GHL
CONSULTANTS LTD

700 W. PENDER STREET, SUITE 800
VANCOUVER, BC V6C 1G8 CANADA

604 689 4449
www.ghl.ca
Holder of AIBC Certificate of Practice

FEASIBILITY STUDY FOR 3-STOREY INFILL ADDITION

For

CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER, BC

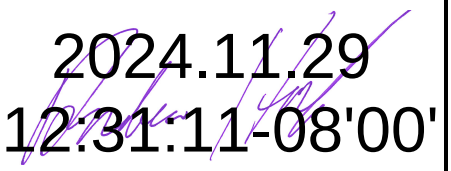
Prepared for

BC Non-Profit Housing Association
220 - 1651 Commercial Drive
Vancouver, BC
V5L 3Y3

September 18, 2024
Revised November 29, 2024

GHL File 9325.00

Revision History			
Revision	**Date**	**Pages Revised**	**Description of the Revision**
R1	November 29, 2024	Multiple	Additional comments provided to address advisory group's questions
Original	September 18, 2024	N/A	Original report

Report Authors / Reviewers		
	Prepared by	**Reviewed by**
Name	Kevin To M Eng, P Eng, ing, CP	Andrew Harmsworth M Eng, P Eng, PE, CP, FEC
Professional Registration	EGBC: 55304	EGBC:17521
Permit to Practice Number	**1002752**	
Signature		
GHL File: 9325.00		

* Limitation of Liability *

This technical report addresses only specific Building Code issues under the GHL/Client agreement for this project and shall in no way be construed as exhaustive or complete. This technical report is issued only to the Authority Having Jurisdiction, the Client, Prime Consultants and Fire Suppression Designer to this project and shall not be relied upon (without prior written authorization from GHL) by any other party.

EXECUTIVE SUMMARY

This report outlines key building fire safety design considerations for the proposed design concept of a 3-storey addition to the existing building, namely Chelsea Manor located at 3640 Victoria Drive in Vancouver, BC, as part of the high-level feasibility study. The new addition construction work will be required to meet the Division B, Part 3 provisions of the VBBL, while the existing lower portion will be subject to upgrade requirement provided under Part 11.

The proposed design concept of a 3-storey addition is based primarily on the building classification of Division B, Article 3.2.2.50 allowing combustible construction up to 6 storeys in building height and 1500m^2 in building area. Both the addition and the existing structure are considered one single building in this concept. The concept of two separate buildings, one on top another subdivided vertically by a horizontal firewall, is not considered a viable or beneficial strategy to avoid upgrading the existing structure.

The proposed design concept is to limit the building height to not more than 6 storeys. It is proposed to achieve this by applying Division A, Sentence 1.3.3.4.(2) with a continuous vertical fire separation between the North and South Wings, due to the sloping site condition.

It is proposed to use mass timber floor assemblies for the added upper portion, which is to be designed structurally independent from the existing loadbearing system underneath. The proposed floor and roof ratings for this design concept are indicated in the report based on the classification of Division B, Article 3.2.2.50. It has also been concluded that full sprinkler protection including the existing building will be required for this addition concept. Another critical design consideration for the proposed concept is to limit the building height within 18m measured up to Level 6 as this may have implications on application of Division B, Article 3.2.2.50 and on high building status should this limit be exceeded.

A number of other potential areas is identified to require alternative solutions. Further review will be required to determine the need for alternative solutions based on confirmation of existing conditions upon further review. Notably, fire department access routes for this site-specific location will need to be reviewed.

For construction, a brief discussion on construction fire safety based on applicable Fire Bylaw concept is provided. A review of construction exposure hazard for a 6-storey combustible building will be requested by the Vancouver Fire Rescue Services (VFRS) as well as detailed approach to construction hazards and fire hazards if the building remains occupied. An approach based on good practice can be developed to address these conditions during construction.

If the building is to remain occupied, it is strongly recommended that the sprinklering of the existing building be prioritized, with temporary water supplies so as to provide sprinkler protection to the existing building during construction. It is a project objective to evaluate the feasibility of maintaining occupancy during construction. This approach is not recommended by GHL considering the extent of construction and upgrade work potentially required.

On this basis, it is our opinion that it is feasible at this point to proceed further to develop a Bylaw compliance approach. A meeting for preliminary discussion with the Chief Building Official's Office (CBOO) on the proposed concept and key alternative solutions/minor relaxations approaches is recommended as a critical next step for the project, Furthermore, future review and study to determine the existing conditions for the areas addressed in this report in order to better defined the scope of work required are also recommended next steps for pursuing this proposed 3-storey infill addition.

TABLE OF CONTENTS

APPENDIX

1.0 INTRODUCTION

This report is an outline approach to compliance with Building Bylaw provisions for a feasibility study carried out by the BC Non-Profit Housing Association (BCNPHA). This study relates to a 3-storey addition to an existing social housing building, Chelsea Manor, located at 3640 Victoria Drive in Vancouver, BC.

The intent of this report is to highlight key fire safety requirements and provide guidance and recommendations for development of a design based on an approach to Building Bylaw compliance. The review carried out by GHL is limited to conceptual design and does not cover review of existing conditions with respect to code compliance.

Our report review is limited to Building Bylaw provisions as discussed in Section 4.0 of this report. Other bylaws and regulations such as those by BC Housing are not covered by this report.

2.0 OBJECTIVES

The objective of our code review is to provide input from a Building Code standpoint on the following:

- Impact of the proposed addition to the existing building.
- Constructability of the proposed addition.
- Identify barriers to implementing the proposed infill construction concept.
- Fire ratings for materials of the proposed construction type.
- Feasibility of design approach to consider separate buildings or a combined building and identify challenges.
- Broad guidance on upgrade provision related to energy performance.

These aspects are discussed under relevant items in the outline approach presented in this report.

Additional comments are provided to address questions by the advisory group.

3.0 DOCUMENTS AND REFERENCES

Our review is based on the information provided as follows:

- Existing drawings provided by BCNPHA.
  - Floor plans and elevation drawings are included in *Appendix A* for reference.
- Preliminary design concept discussed during a meeting on June 25, 2024 with the team.

4.0 APPLICABLE BUILDING CODE

The current applicable Building Code is the Vancouver Building By-law 2019 (VBBL). For the purpose of our review with respect to the architectural concept, this edition of the VBBL was relied upon for the feasibility study.

The next edition of the VBBL is expected to be published in 2025. The official timeline for the publication of the new VBBL is yet to be confirmed by the City.

With respect to the scope of this report, it is not anticipated there will be significant changes in the upcoming VBBL 2025 that would affect the findings of this report given the scope of this project is limited to conceptual design only.

All reference numbers indicated in this report refer to Division B of the VBBL, unless otherwise stated. The Authority Having Jurisdiction (AHJ) for the application of the VBBL is the City of Vancouver.

4.1 New Construction Work

Design and construction of new components will be subject to the edition of the VBBL in force at the time of permit application.

This will be applicable to any new addition involved, i.e., the 3 storeys added and other added components to the building.

4.2 Alteration, Addition, and Renovation

Construction work related to alterations, rehabilitations, additions, expansions, repair, and renovations of the existing building will be subject to Part 11 of the applicable edition of the VBBL. These provisions will need to be taken into consideration for the design. The approach to determining the required upgrade is discussed in Section 6.0 of this report.

Specific key areas which might be impacted by current provisions under Part 11 of the VBBL, where applicable, are discussed in Section 7.0 of this report.

Part 11 of the VBBL does not contemplate non-conventional approaches to building addition such as proposed. Significant dialogue with the CBOO will be required, although cooperation and support for the concept are anticipated.

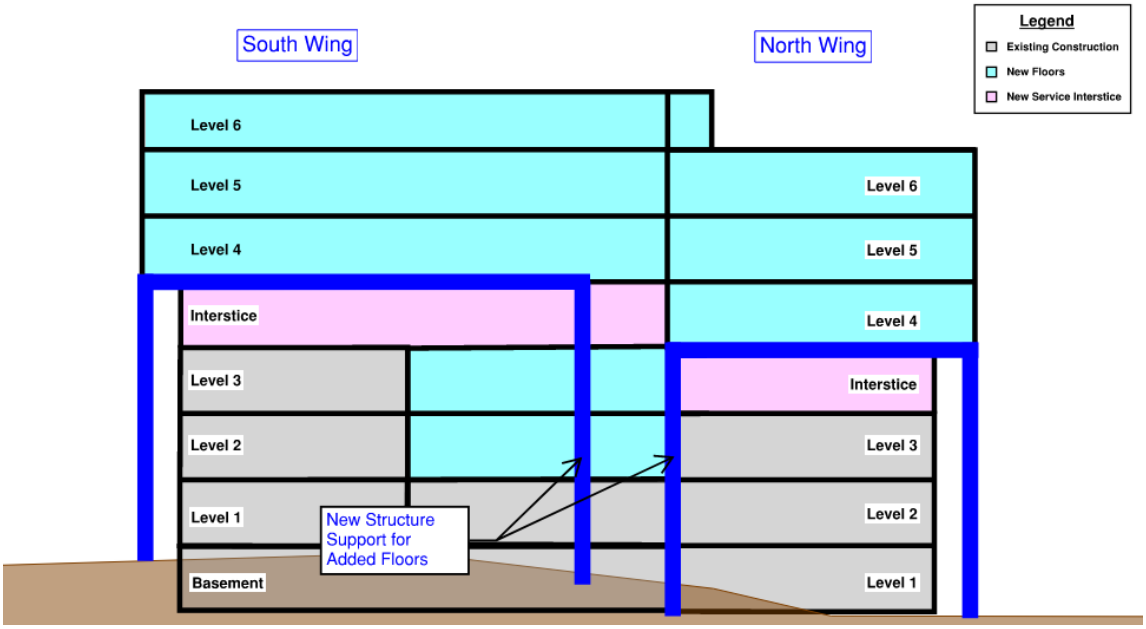
5.0 DESCRIPTION OF PROJECT

It is proposed to design an addition of 3 storeys over the existing residential Chelsea Manor.

Based on the discussion with the design team, the concept under review for this feasibility study involves the following design concept with respect to relevant fire safety Bylaw requirements:

- The new addition will superimpose the existing building, but will not be connected between the North and South Wings.
- The added floor levels (3 storeys) will be of mass timber construction or mass timber floors with light frame walls.
- The added floor levels will be structurally independent of the existing structural system.
- A service interstice will be located above the existing building and underneath the new floors.
- The entire building including the new interstice is expected to be sprinklered throughout.
- Services to run at perimeters of the building.
- The existing building is to remain unchanged as much as possible other than the required upgrade prescribed by the VBBL.
- A new elevator to be installed at the building perimeter.

The following is a schematic diagram illustrating the addition project design concept based on the floor designation noted in the drawing provided. Further discussion on building height in number of storeys is provided in Section 5.3.1 of this report.



In addition to design construction, another important consideration for this project is to limit disruption of the existing occupancy within the lower floors during construction. Discussion on this objective is provided where applicable in the report.

Based on discussion with the structural designer, it is proposed to follow a design concept where the upper portion is to be structurally independent from the existing loadbearing system of the lower portion, which would limit the required upgrade for the existing lower portion. This report does not cover structural design other than the required fire rating for structural elements.

5.1 Structural Design Concept

Based on the information provided by the structural engineer, namely WSP, the design concept is as follows:

- Gravity – Gravity structure for new overbuild is independent to original structure and no reliance on the original building for gravity loads.

- Lateral – Lateral structures for the new overbuild can be either independent from the original building, or strengthened to provide supplementary seismic support to the original building to bring it to current applicable code requirements. The implications of both options are detailed in the structural report.

It is understood that the design concept will be to have the upper system designed to meet 100% of the prescribed design load per the VBBL, while an upgrade will be carried out to the existing lower structure. The specific upgrade requirements are expected to be a subject to discussion with the CBOO based on the existing conditions, should 100% upgrade per VBBL provisions be deemed challenging due to hardship.

This report does not cover structural design other than the required fire rating for structural elements.

5.2 Occupancy During Construction

In addition to design construction, another important consideration for this project is to limit disruption of the existing occupancy within the lower floors during construction. Discussion on this objective is provided where applicable in the report.

5.3 Description of Existing Building

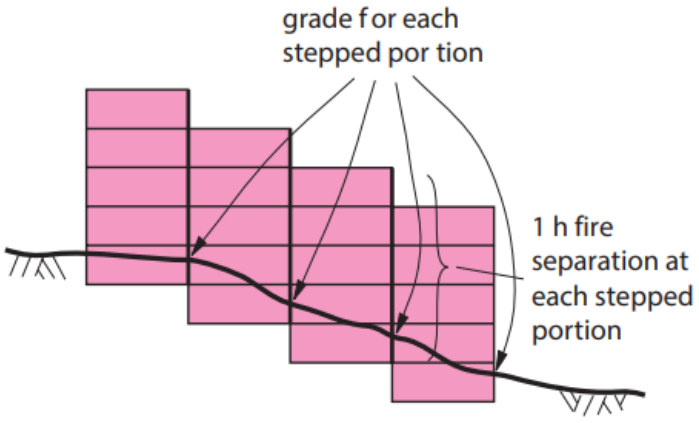
Based on the information provided, the existing building has the following characteristics. For the purpose of the VBBL, both the North and South Wings are considered one single building.

Year of Construction	To be confirmed
Occupancy	Group C residential only
Building Height	3 storeys per Division A, Sentence 1.3.3.4.(2); see Section 5.3.1 of this report
Building Area	960m^2
Construction	Combustible construction with noncombustible basement
Sprinklered	Unsprinklered
Number of Streets	2 (to be confirmed)
High Building	No
Firewalls	None

Changes to these characteristics as a result of the proposed addition are provided in the outline under Section 7.0 of this report.

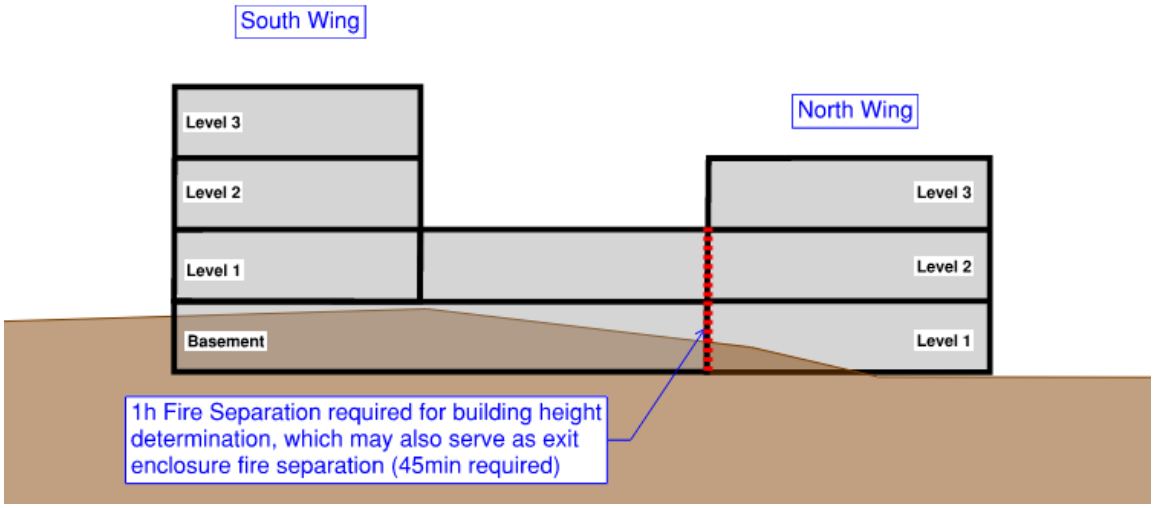
5.3.1 *Existing Building Height*

The North and South Wings are connected by an exit corridor on the floor area designated as Level 1 in the fire alarm drawings provided. Based on this layout, the floor levels in each wing are permitted to be considered separately for the determination of building height based on the concept under Division A, Sentence 1.3.3.4.(2), provided that a 1h fire separation is in place between the two wings. This fire separation is required to be maintained vertically from the lowest to the highest adjoining portions. This concept is illustrated in the following diagram provided in the Note to Part 1 in Division A.



Note that this 1h fire separation is not a firewall as defined in the VBBL. The presence of 1h fire separation will have to be reviewed in the existing conditions in order to confirm whether the existing condition is consistent with this design concept.

The following diagram illustrates the concept per Division A, Sentence 1.3.3.4.(2) for the project building as a 3-storey building in its existing conditions.



For the purpose of our review, the existing building is assumed to be a 3-storey building.

5.3.2 *Number of Streets and Access Route*

While a site plan is not available, the number of streets the existing building is faced will need to be confirmed. Based on the satellite image available on Google Maps, the existing building appears to be served by a private access route considered as 2 streets within 15m of its perimeter. However, initial observations are that this route may not meet width, turning radius, and maximum dead end provisions as further discussed below.

Based on the definition of streets in the current VBBL, a street less than 9m is not considered a street. Although the minimum 9m width criterion for defining a street might not have been introduced at the time of construction. This aspect will have to be reviewed to confirm the number of streets for the purpose of determining building classification under Subsection 3.2.2. It is noted that Victoria Drive is located more than 15m. As such, it cannot be considered a street serving the project building.

Similar to the number of streets for the VBBL application, the characteristic of the existing access route to the building should be reviewed with respect to the provisions of Articles 3.2.5.5 and 3.2.5.6, such as width, turn radius, maximum slope, etc. Based on our preliminary review, this route highlighted in red in the image above might not meet the current provision of the VBBL as a compliant access route. This may have been an existing deficiency for this existing Part 3 building in its current state.

As noted later in this report, the access route issue will need to be revisited in discussions with the CBOO and VFRS.

5.3.3 *Existing Alternative Solutions/Equivalencies*

For the purpose of our review, it is assumed that there are no existing alternative solutions and equivalencies applicable to this building.

While potential deficiencies related to the number of streets and access route have been identified, there was no indication of any alternative solutions that would have a significant impact on the proposed addition with respect to construction requirements, such as construction type, floor rating, and sprinklering.

6.0 APPLICATION OF DIVISION B, PART 11 OF THE VBBL

The provisions of Part 11 address the approach to upgrade of existing buildings for alterations. Depending on the nature of upgrade, specific Design Upgrade Levels as provided in Notes to Part 11 of the VBBL can be determined. These provisions may have an impact on the extent of upgrade required for the existing portion of the project building. Key considerations for upgrades triggered by Part 11 are identified in the following.

6.1 Upgrade Objectives

For alteration to existing buildings, Part 11 prescribes notably the following objectives be satisfied per Sentence 11.2.1.1.(1):

- All existing unsafe conditions must be corrected to an acceptable level.
- All new materials and construction work must comply with the VBBL.
- The building shall be upgraded to an acceptable level of fire, life and health safety, structural safety, non-structural safety, accessibility for persons with disabilities, and water efficiency.
- Any significant extension of the design life of an existing building beyond its original design life shall require upgrading to an acceptable level.
- The level of life safety and building performance shall not be decreased below the existing level.

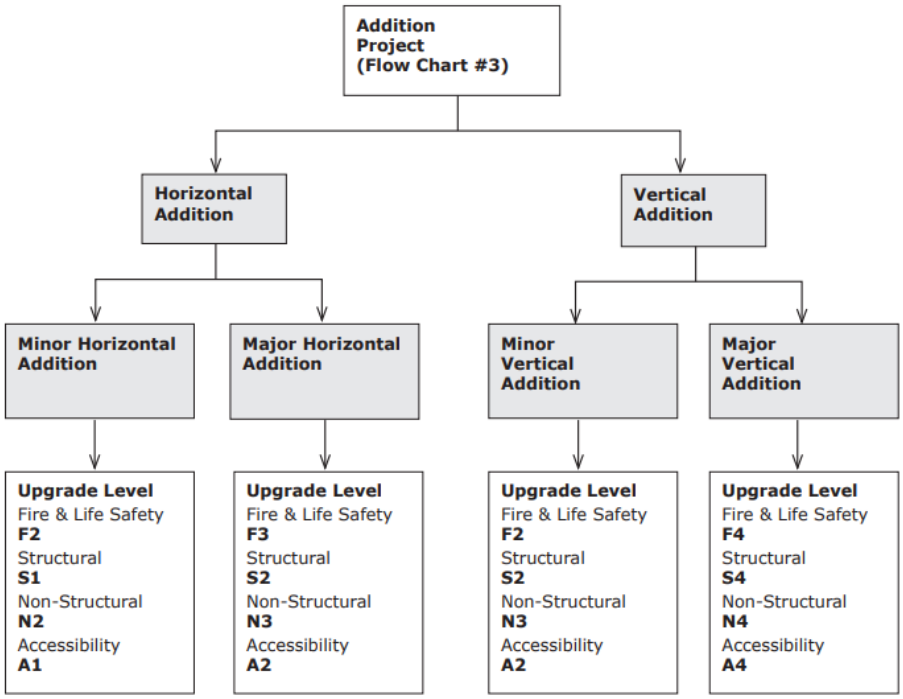
6.2 Upgrade Mechanism Model

Recommended procedures for determining upgrade requirements are detailed under Notes to Part 11, Reference A-11.2.1.2 of the VBBL.

6.2.1 *Major Vertical Addition*

For addition projects, the required update levels are to be determined using Flow Chart No. 3 as shown below.

FLOW CHART NO. 3



Since the aggregate added floor area is expected to exceed 500m^2, the project in this case is considered a Major Vertical Addition and thus Design Level 4 upgrade is required. The following is an excerpt describing Design Level 4 under Notes to Part 11, Reference A-11.2.1.2:

Table A-11.2.1.2.-B (*continued*)
DESIGN UPGRADE LEVELS FOR FIRE, LIFE AND HEALTH SAFETY (F), STRUCTURAL SAFETY(S), NON-STRUCTURAL SAFETY (N), and ACCESSIBILITY (A)

DESIGN LEVEL(1)	OBJECTIVE STATEMENT	ALTERNATIVE ACCEPTABLE SOLUTIONS
F4	Entire building to substantially meet the intent of health, fire and life safety requirements of the VBBL as well as provide protection to adjacent property.	**Entire Building** – Alarms & detectors, emergency lighting, access to exit, exits, exit signs, exit lights, flame spread ratings, firefighting access & water supply, floor assemblies & support, spatial separation, occupancy separation, standpipes & sprinklers, washrooms, high building requirements, lighting levels, sound transmission classifications, ventilation, building envelope review, and radio antenna systems.
S4	The entire building structure shall be brought up to an acceptable level in order to meet seismic requirements of the VBBL.	**Entire Building** – Building to be upgraded to resist 75 percent of the current By-law specified lateral force levels, where the building is evaluated as having less than 60 percent of the current required seismic resistance.
N4	Entire Building and to acceptable open space to be reviewed to ensure safety from overhead falling hazards.	**Entire Building** – Restrain all interior partition walls. Restrain all ceiling supporting frames, T-bars assemblies, ceiling gypsum wall boards, overhead mechanical equipment and services, sprinklers, sprinkler systems, overhead electrical equipment and services. Restrain exterior falling hazards to resist forces due to a seismic event from cladding, veneer, cornices, parapets, canopies, awnings, and ornaments attached to the exterior of the building.
A4	The existing building shall be upgraded in order to provide the minimum accessibility requirements of the VBBL.	**Entire Building** – Building to meet accessibility provisions of the current VBBL.

Notes to Table A-11.2.1.2.-B:

(1) Where there is one or more upgrade level(s) within the same category preceding the design upgrade level in Table A-11.2.1.2.-B, then the design upgrade level shall also include all of the preceding upgrade levels. For example, where the design upgrade level is F3, then all of the upgrade requirements under F2 and F1 also apply.

The acceptable solutions as described in the table above for Design Level F4 form the basis of upgrade requirements for the proposed addition project for consideration by the design team.

6.2.2 *Feasibility of Required Upgrade*

While it may not be practical to develop a design fully satisfying upgrade Design Level F4, it may be necessary to address these conditions by one of the following options:

1. Demonstrate hardship to meet the required upgrade level and propose a suitable upgrade to the satisfaction of the CBOO in virtue of Sentence 11.2.1.2.(2), or
2. Propose minor relaxations for approval by the CBOO.

These two options will likely require prior discussion and negotiation with the CBOO. Design aspects which may require one of these options are identified in the Outline under Section 7.0 of this report.

Information provided in the report is only based on past project experiences with City staff. Negotiation of upgrade requirements with the City is highly dependent on project specific conditions. City policies towards projects with existing conditions may evolve overtime due to societal needs and concerns. It is therefore not possible to confirm upgrade requirements prior to discussion with the CBOO.

7.0 OUTLINE CODE SUMMARY

This section of the report outline key code considerations for the proposed addition project. Discussions on relevant aspects corresponding to the objectives listed under Section 2.0 of this report are provided.

7.1 Building Classification

Building classification in accordance with Subsection 3.2.2 of the VBBL is intended primarily for new construction. As such, there is no direct classification for addition to existing buildings, notably for the existing lower portion. It is therefore proposed to apply the following provisions for this project:

Table 1. Building Classification and Construction Requirements

	Residential	**Storage Garage**
Use / Occupancy	C	F-3
New Building Area (m^2)	≤ 1500 (see Note 1)	≤ 1500 (see Note [1])
New Building Height (storeys)	6	6
Streets Faced	At least 1	At least 1
Sprinklered	Yes	Yes
Construction Article	3.2.2.50 (see Note 2)	3.2.2.81
Building Area Permitted (m^2)	1500	7200
Type of Construction	Combustible permitted (see Note 2)	Noncombustible

	Residential	Storage Garage
Floor Assembly FRR	1h (see Note 5)	1h
Mezzanine FRR	1h	1h
Roof (Occupied/Unoccupied) FRR	1h / 1h	1h / None
Firewall	None required	
High Building	Likely high building - to be determined See discussion in Section 7.9.	

Fire Resistance Rating = FRR

1. Building area (footprint) is expected to increase with the added services and supporting structure but within the permitted limit by the construction article.

2. See Section 7.1.2 of this report regarding 18m height limit per Article 3.2.2.50.

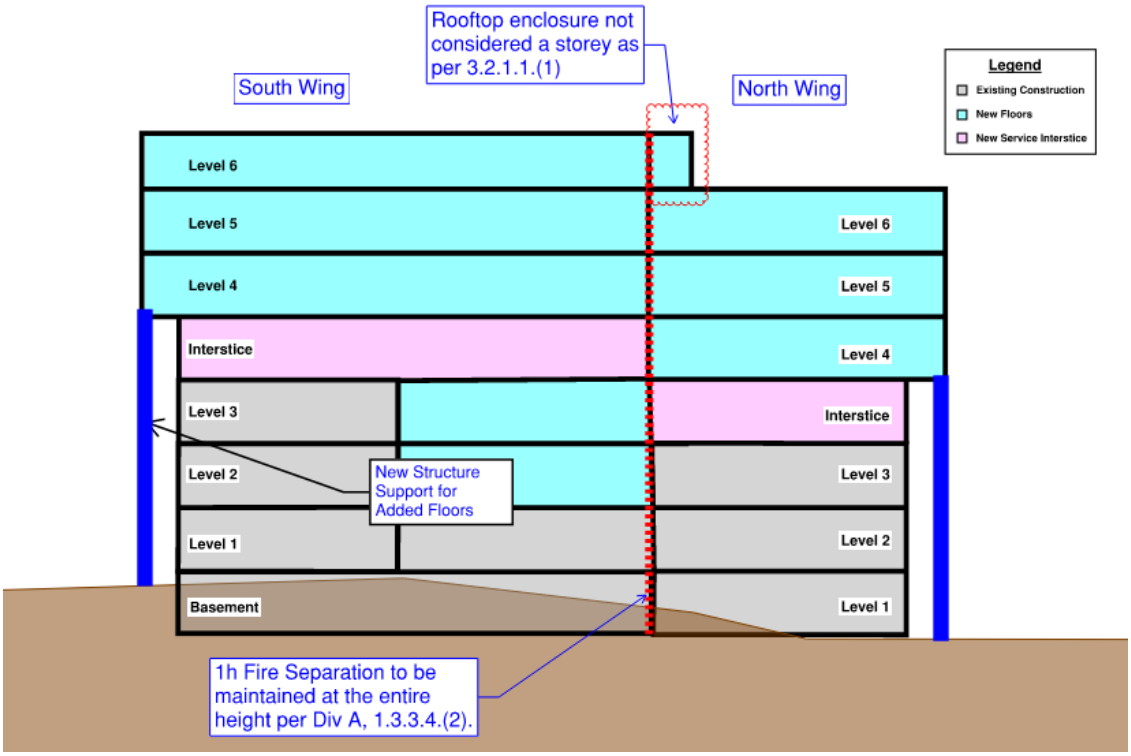
3. Combustible construction including light wood frame, heavy timber construction as defined by the VBBL, and mass timber construction such as CLT products.

4. Additional fire rating considerations for floor assemblies are discussed in Section 7.1.5 of this report.

7.1.1 *Building Height in Number of Storeys*

The proposed building classification is based on the application of Article 3.2.2.50 to allow for combustible construction for a 6-storey building. As the height limit for the application of Article 3.2.2.50 is 6 storeys, the proposed addition will need to be limited to increasing the building height to up to 6 storeys. As discussed under Section 5.3.1 of this report, the concept of building height determination per Division A, Sentence 1.3.3.4.(2) can also be applied with the added storeys taken into consideration. This strategy with respect to determination of building height is recommended in order to limit the building height to 6 storeys for the proposed infill addition, despite the difference in building height/grade between the two wings.

In this case, the required 1h fire separation will need to be maintained at the vertical interface between the North and South Wings. The following is a schematic illustration of this 1h fire separation based on the proposed addition concept.



As illustrated above, the required 1h fire separation is to be located such that the vertical extension and its continuity are maintained. This detail will need to be reviewed on the basement level in particular.

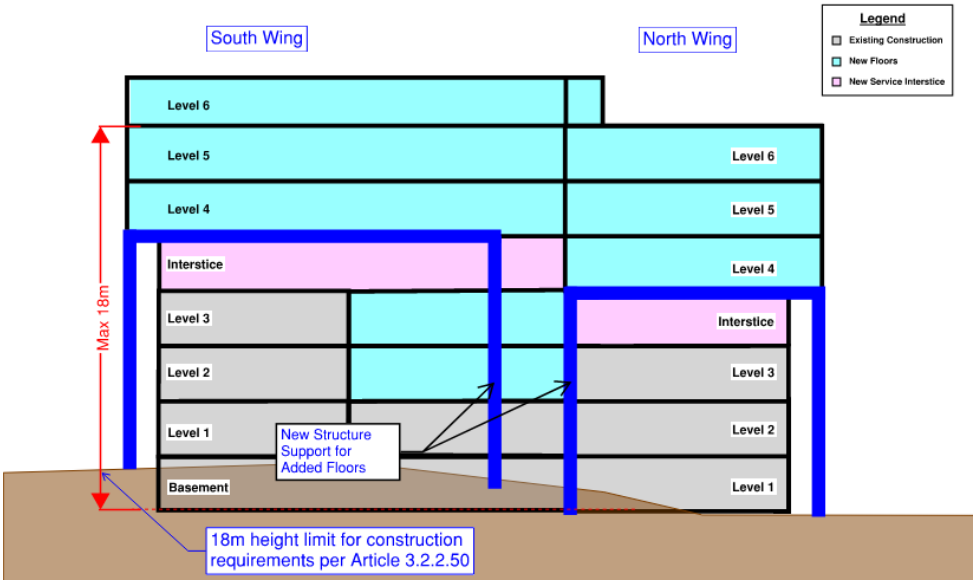
Furthermore, the presence of rooftop enclosure is to be taken into consideration for the determination of building height in storeys. Per Sentence 3.2.1.1.(1), elevator machine rooms, elevator overrun, service rooms, stairways used for no purpose other than for access or egress, elevator lobbies use for access and egress only are permitted to be excluded from building height calculation. Any structure over the roof of Level 6 of the North Wing will need to be limited to these spaces permitted by Sentence 3.2.1.1.(1) in order to meet the 6 storeys limit. If these spaces are provided, the required 1h vertical fire separation per Division A, Sentence 1.3.3.4.(2) will need to be maintained.

See Section 7.2 of this report regarding the added interstitial service spaces.

7.1.2 *18m Height Limit per Article 3.2.2.50*

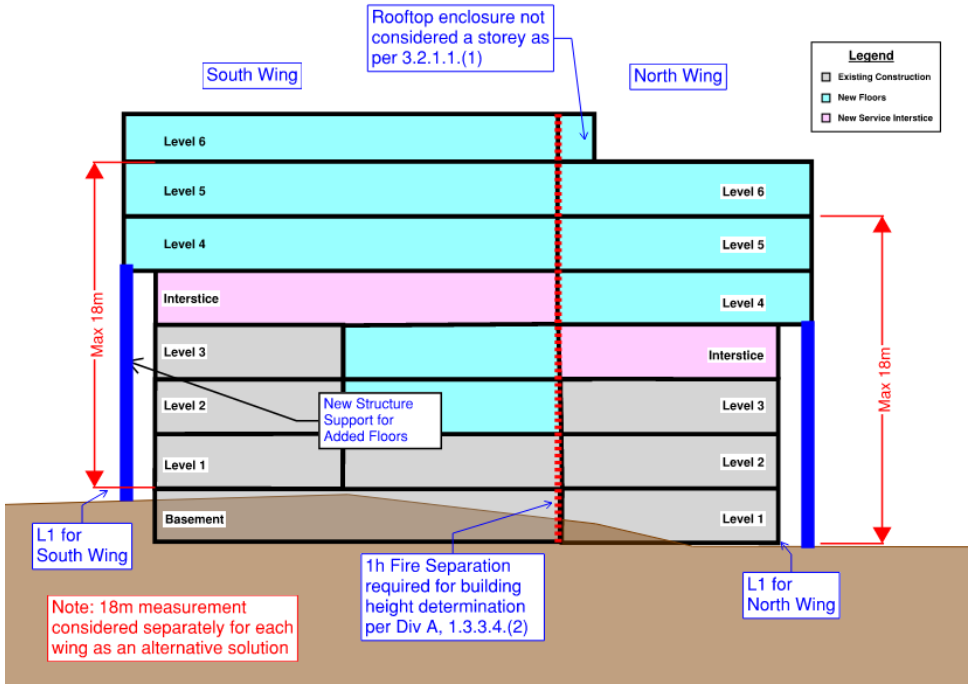
The proposed building classification is based on the application of Article 3.2.2.50 to allow for combustible construction for a 6-storey building. It should be noted that Clause 3.2.2.50.(1)(c) limits the height measured from Levels 1 to 6 to maximum 18m. As such, the design team will need to take this into consideration for when designing the 3-storey addition and the new interstitial service space. See Section 7.2 of this report regarding clear height within the service interstice.

The following schematic illustrates this height limit:



This is a critical consideration for the addition concept as the overall design is based fundamentally on construction Article 3.2.2.50.

Based on the sloping site condition, it may be challenging to develop a design to meet this measurement. In this case, it is proposed to develop an alternative solution allowing to consider both swings separately for this 18m, given the existing conditions, for discussion with the CBOO. This approach is illustrated below.



For this approach, the following fire department access provisions will also have to be taken into consideration for each wing:

- Entry lobby not more than 15m from an access route.
- Minimum 10% perimeter within 15m of a street.
- Level 6 at not more than 20m from access route level.
- Fire department connections and hydrant locations.

See Section 7.3 of this report for further discussion on fire department access and provisions.

Also see Section 7.9 of this report regarding a different 18m height limit for the purpose of determining high building status.

7.1.3 *Building Subdivision by Firewalls*

As a complex building per Part 3 and sprinklered, there is no value to maintaining the existing vertical firewall, since the resulting building is expected to fall within the building area limit under Article 3.2.2.50. It is important to note and distinguish that the vertical fire separation per Division A, Sentence 1.3.3.4.(2) for building height determination is not considered a firewall. This Division A vertical fire separation only addresses building height determination and is not permitted to subdivide a building into smaller buildings.

It is understood that BCNPHA and the design team desire to investigate the potential to develop a concept of subdividing the building by a firewall between the upper and lower structures such that each portion is to be considered a separate building. The purpose of this subdivision concept is to allow for greater flexibility with respect to structural upgrade requirements notably for the lower portion.

Although the concept of "horizontal firewall" is recognized by the VBBL, notably under Article 3.2.1.2, this solution is limited to a basement storage garage. The proposition of horizontal firewall between the existing floors and the new upper addition is not considered a viable option for compliance with the VBBL. It should be noted that this Article 3.2.1.2 horizontal firewall concept for subdivision is only intended for building classification and application of sprinkler standards. The entire structure even subdivided by a horizontal firewall per Article 3.2.1.2 is still considered one single building for other provisions of the VBBL, including Part 11. As such, for the purpose of upgrade requirement determination per Part 11, the concept of subdivision by horizontal firewall does not offer any significant benefit with respect to compliance based on the current Part 11 provisions.

The design concept of subdivision or compartmentation for the purpose of building upgrade can be found, for example, under Article 11.2.1.5 for Self-Contained Volumetric Spaces. However, the provisions under this Article only allow specifically vertical fire separations for determining/limiting the extent of applicable upgrade. Application of the same subdivision concept in a horizontal orientation would not be equivalent as the impact of failure within the lower portion on the upper portion or vice versa cannot be singled out in the same fashion as a vertical subdivision from a fire standpoint and structurally.

On this basis, the approach through applying the notion of individual building separately to both the upper and lower portions does not provide any direct benefits with respect to limiting upgrade for the lower portion based on the current VBBL code framework. The entire structure will need to be treated and reviewed as one building regardless. Rather, a direct approach to address specific upgrade design, such as structural upgrade or fire upgrade, based on the existing conditions is considered for this project without resorting to the technicality with respect to the notion/definition of *Buildings* per the VBBL.

Key areas of upgrade approach including compartmentation, sprinklering, fire alarm, emergency power, accessibility, etc are discussed in the following sections of this report.

7.1.4 *Grade and Building Height (Storeys)*

The concept of building height determination per Division A, Sentence 1.3.3.4.(2) as discussed in Section 5.3.1 of this report as well as the location of grade are expected to remain unchanged for the proposed addition project.

Note that the location grade has an implication of triggering high building status requiring additional fire safety provisions, such as generator, firefighters' elevators, etc. See Section 7.9 of this report regarding high building status and high building provisions.

7.1.5 *Floor Ratings*

7.1.5.1 *New Upper Portion*

In addition to the floor ratings provided in Table 1 above, it is proposed to provide a 2h fire resistance rating for the floor deck location above the service interstice. The supporting structural elements of this 2h floor deck is also required to have 2h fire resistance rating. The 1h fire resistance rating remains applicable to other upper floor levels per Article 3.2.2.50.

The proposed CLT floor can achieve a fire resistance up to at least 2h based on its thickness design.

This design approach will be beneficial to provide additional compartmentation with the building to address the risk of upward fire spread from the existing portion, as well as a fire safety feature for limiting upgrade to existing 45min fire separations and other deficiencies in the existing building.

7.1.5.2 *Existing Lower Portion*

Since the existing building was designed in accordance with Part 9 of the VBBL, the existing floor assemblies are expected to have a 45min fire resistance rating. Since 1h floor rating is required per Article 3.2.2.50, we foresee the following options to address potential floor rating deficiency:

- upgrading based on existing rating shortfall with respect to 1h rating, or
- prepare an alternative solution to maintain the existing 45min rating and Part 9 and out of date firestopping, subject to discussion with AHJ.

We believe that, in conjunction with the 2h separation noted above in Section 7.1.5.1 of this report, and retrofitting sprinklers in the lower portion, an alternative solution can be negotiated with the CBOO to avoid upgrading the suite fire ratings.

It should be noted that the existing floor rating will have to reviewed to confirm whether a 45min fire resistance rating can be justified by the existing floor assemblies.

7.1.6 *Roof Construction and Ratings*

7.1.6.1 *New Upper Portion*

As indicated in Table 1 above, 1h fire resistance rating will be required for the new roof of the new addition.

As per Article 3.2.2.50, where roof assemblies are located above 25m from the first storey floor level, noncombustible construction or fire-retarded-treated wood conforming to Article 3.1.4.5 is required. This aspect will have to be reviewed during the design stage.

7.1.6.2 *Existing Lower Portion*

Existing roof assemblies that are to remain part of the roof, including the parking portion, will need to provide 1h fire resistance rating. Similar to floor assemblies, the existing conditions of these roof assemblies, if any, will have to be reviewed and addressed based on the same approach as discussed above in Section 7.1.5.2 of this report.

Based on the current concept, it is proposed to the existing roof assemblies (to become a floor assembly with the addition) underneath the added service interstice not be provided with a fire resistance rating. It is noted that there are no fire separation requirements between a floor area and a service interstice. Floor separation between Levels 3 and 4 is maintained by the new 2h CLT floor deck.

See Sections 7.1.7 and 7.2 of this report for sprinklering requirements for the service interstice.

7.1.7 *Sprinkler Protection*

Sprinkler protection is required for building designed in conformance with Article 3.2.2.50. For this project, installation of an automatic sprinkler system per NFPA 13 will have to be envisioned. The system coverage will need to be provided throughout the entire building including the existing portion as well as the new service interstice over the existing portion.

Sprinkler protection is considered an effective and critical fire safety measure recognized by the VBBL. Given the potential deficiency in various areas of the existing portion, any design concepts without full sprinkler protection will likely be considered inadequate by the City within the context of discussion for upgrades.

We do not see any options to avoid retrofitting sprinklers in the existing buildings. Effectiveness of sprinklers is dependent on sprinkler activation in a limited area and before a fire has expanded beyond the room of origins. If sprinklers are omitted from the lower portion, a fire in the lower portion would be expected to exceed the capability of the fire department and be essentially uncontrollable.

7.2 Interstitial Service Space (Service Interstice)

The VBBL under Sentence 3.2.1.1.(8) permits interstitial service spaces be excluded from storey count for the determination of building height. It is proposed to consider the service space between the lower and upper protection as an interstitial service such that it does not need to be included as a storey for application of the height limit of 6 storeys per Article 3.2.2.50.

The proposed service interstice is to be designed in accordance with Sentence 3.2.1.1.(8). The following aspects are notably to be taken into consideration:

- Sprinkler protection per Article 3.2.5.14
- Exit signs per Article 3.3.1.24
- Fire alarm components installation per Sentence 3.2.4.18.(10)
- Means of egress and travel distance per Sentences 3.3.1.3.(7) and 3.4.2.4.(3)
- Integrity of exits to be maintained per Sentence 3.4.4.4.(9)

In addition, it is recommended a clear height of 2050mm be maintained within the interstice where possible. Slight localized reduction of clear height to not less than 2000mm should be reviewed on a case-by-case basis.

7.3 Fire Department Provisions

The fire department provisions for the project building will have to reevaluated based on Part 3 provisions and sprinkler protection.

7.3.1 *Access Route*

Since the building with addition is now a Part 3 building, the access route will be required in conformance with Subsection 3.2.5. The following aspects will have to be reviewed based on the site specific conditions:

- Access route located not more than 15m from the entry lobby for fire department access:
  - In the existing condition, we understand the main entrance is located in the west face of the building which may not be served by an access route within 15m. A separate designated fire department access principal entrance within 15m of the access route is to be considered.
- Minimum 6m width for any access route.
- No dead end more than 90m except a turnaround facility is provided for the access route.
- Maximum gradient of not more than 1 in 12.5.
- Centreline turn radius not more than 12m.
- Overhead clear height nor less than 5m.

In addition, since the proposed concept is based on Article 3.2.2.50, the following provisions with respect to the access route will have to be taken into consideration, notably for each wing in the case of Chelsea Manor:

- At least 10% of the building perimeter to be located not more than 15m from a street:
  - It is noted that this prescription may no longer be applicable once the next edition of the VBBL is adopted.

- Access route to be located not more than 20m vertically from the uppermost floor level per Sentence 3.2.5.6.(2).

Deviation will require discussion with the VFRS in order to establish an acceptable approach.

7.3.2 *Fire Department Connections and Hydrants*

Since the building will be provided with a sprinkler system, fire department connection located not more than 5m from the principal entrance per Sentence 3.2.5.15.(1) will be required.

A fire hydrant is required not more than 90m from the principal entrance per Sentence 3.2.5.5.(4). A new fire hydrant may be required to be installed for serving the project building. Based on the images available on Google Maps, there is no hydrant available within 90m of the project site connected to an access route.

These aspects will need to be reviewed during the design stage.

7.4 Fire Separations and Compartmentation

Required fire separations and compartmentation for the addition protection are to be established based on sprinkler protection. The following key fire separations will be subject to requirements for increased minimum fire resistance ratings within the existing portion based on the requirements of Article 3.1.3.1, Sections 3.3, 3.4, Subsections 3.2.6 and 3.6.2 as follows:

Table 2. Increased Fire Resistance Rating of Key Fire Separations

Fire Separation	General Part 9 Provisions	Proposed Addition
Exit Enclosure	45min	1h
Elevator Shaft	45min	1h
Firefighters' Elevator Shaft	N/A	2h (high building only)
Floor Rating	45min	1h
Roof Rating	N/A	1h
Fire Alarm Riser	N/A	2h (high building only)
Dwelling Units	45min	1h
Generator Room	N/A	2h (high building only)
Fire Pump/Sprinkler Rooms	N/A	2h (high building only)

See further discussions on high building status and applicable high building features in Section 7.9 of this report.

7.5 Other Construction Requirements

The following aspects as prescribed by Part 3 are to be considered for the existing portion.

7.5.1 *Exterior Cladding*

For buildings subject to Article 3.2.2.50, Sentence 3.1.4.8.(1) requires that exterior claddings be noncombustible or the exterior wall assemblies meet the CAN/ULC-S134 fire test criteria per Clause 3.1.5.5.(1)(b).

It appears that the existing cladding is combustible on two levels of the South Wing, with noncombustible cladding on the lowest level, while the North Wing has combustible cladding on all three levels.

For the addition project, the cladding provided to the upper floor addition will need to meet this requirement. If it is desired to keep the existing combustible cladding, we anticipate an alternative solution can be negotiated.

If it is decided the existing cladding is to be replaced due to its existing conditions, new cladding will be required to be noncombustible or tested to CAN/ULC-S134 as noted above.

See Section 7.11.2 of this report regarding consideration of upgrade for energy performance.

7.5.2 *Emergency Power for Fire Alarm System*

For buildings subject to Article 3.2.2.50, emergency power will be required for operation of the fire alarm system under full load for 1h.

See Section 7.9.2 of this report regarding additional emergency power requirement for the fire alarm system as well as other specific fire safety services for high buildings if applicable.

7.5.3 *Fire Blocking of Existing Combustible Concealed Spaces*

Fire blocking of construction void space such as within floor and wall assemblies will be required per Subsection 3.1.11 for the existing portion. This aspect will require review and a strategy of compliance based on the existing conditions. Based on the age of the building, existing deficiencies may be present with respect to the fire blocking.

See Section 7.6.1 of this report regarding sprinklering of concealed space per NFPA 13.

7.5.4 *Smoke Dampers Installation*

The installation of smoke dampers is to meet Subsection 3.1.8 on upper new floors. An approach can be established based on the BC Housing Guide to the extent of required smoke dampers within these upper floor areas.

Application of these smoke dampers provisions to the existing portion are to be addressed based on the challenges associated with the existing conditions. Similarly, a strategy may be developed based on the BC Housing Guide to address the need for smoke damper installation that is suitable for the existing condition.

7.6 Automatic Sprinkler System

Based on the proposed addition concept, the project building is expected to be sprinklered throughout including the existing portion.

The design and installation of an automatic sprinkler system will require to meet NFPA 13 per Sentence 3.2.5.12.(1).

See Section 7.1.7 of this report regarding sprinkler coverage.

See Section 7.9.1 of this report regarding sprinkler design for high building measure waiver.

See Section 7.12.1 of this regarding phasing consideration.

7.6.1 *Sprinkler Protection of Combustible Concealed Spaces*

Sprinklering combustible concealed space per NFPA 13 within the existing portion, such as within floor assemblies, is to be reviewed by a sprinkler engineer based on the existing conditions.

This is also applicable to the new upper portion. With CLT floors for the upper portion, the upper floors are expected to have fewer concealed spaces requiring sprinklers.

7.7 Installation of Fire Alarm System

Since the building is expected to be fully sprinklered, installation of a fire alarm system in accordance with Subsection 3.2.4 will be required per Sentence 3.2.4.1.(1).

The fire alarm system will require to be designed and installed in conformance with CAN/ULC-S524.

See Section 7.9 of this report regarding fire alarm conductors and emergency power for the fire alarm system for high buildings if applicable.

See Section 7.12.1 of this report regarding phasing consideration.

7.8 Exit/Egress Systems

Exit and egress systems will need to be provided in accordance with Sections 3.4 and 3.3 with consideration given to sprinklered floor area.

7.8.1 *Exit/Egress Design*

It is noted that exiting for both North and South Wings is to be considered altogether on each level as the same floor area. Doorways within the vertical fire separation per Division A, Sentence 1.3.3.4.(2) as described under Section 7.1.1 of this report are not permitted to be considered a horizontal exit as this vertical fire separation is not a considered a firewall. Regardless of the location of required exits for each floor area, the continuity of the required vertical fire separation between the two wings is to be maintained.

Existing conditions of exit stair designs such as dimensions are to be reviewed to identify deficiencies if any. We understand the upper addition will generally be served by separate exit stairs in the current design concept. A transition between the new upper portion and the existing lower exit stair through an existing rooftop space may be desired for an exit stair. This design will require further review once the concept is developed. An alternative solution approach may be required to address the continuity of protected exit path at the transition.

7.8.2 *Basement Exiting*

Exits serving basement level will have to be reviewed in conjunction with whether the high building status is applicable. For a high building, basement exit stairs are required to be separated from exit stairs serving upper floor. This may require an alternative solution if high building measures are applicable.

See Section 7.9 of this report regarding exit stair smoke control measures for high buildings if applicable.

7.8.3 *Exit Lobby*

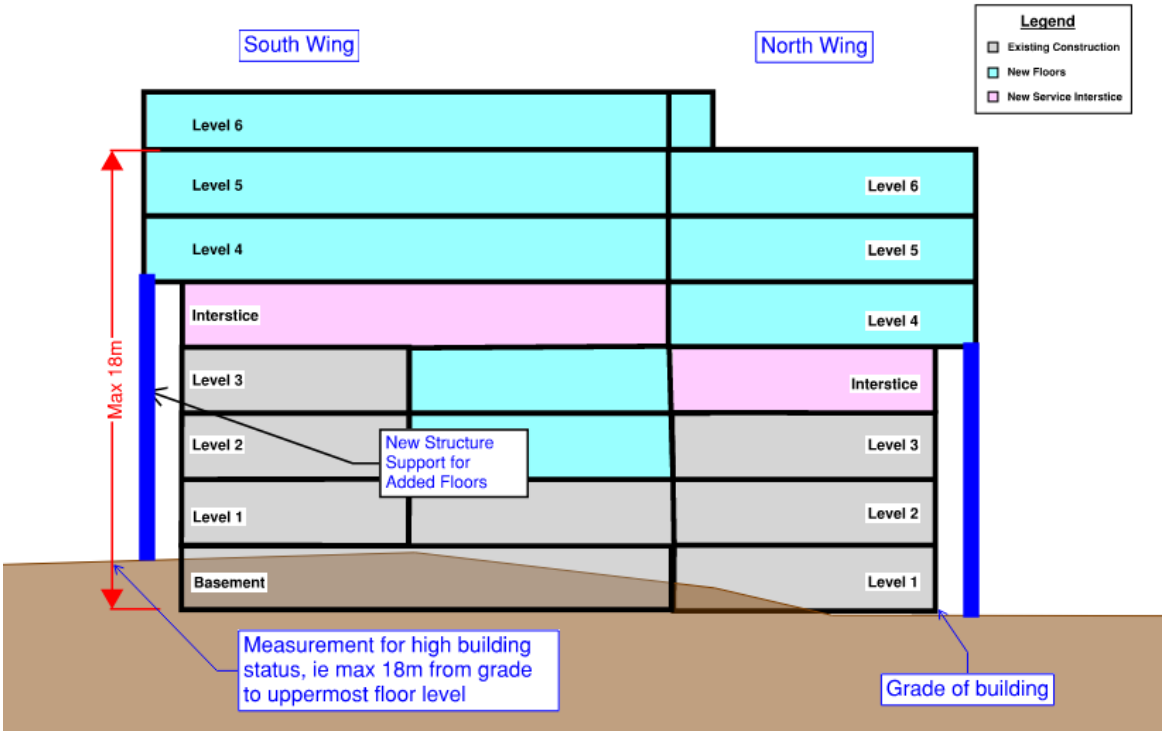
There appears to be an exit lobby at the main entrance on the west end of the building. This design will need to be reviewed during the design stage. We do not believe this has any significant impact on the proposed addition concept from a feasibility standpoint.

7.8.4 *Exit Exposure*

Exit exposure will have to be reviewed for added exit facilities and exit paths in accordance with Article 3.2.3.13. Exit exposure protection by means of sprinkler based solutions as permitted by Sentences 3.2.3.13.(4) and (5) can be provided as compliant solution without alternative solution.

7.9 High Building

The high building provisions, notably those of Articles 3.2.6.2 to 3.2.6.9, would be applicable if the height between the average lowest grade and the uppermost floor level exceeds 18m. This aspect should be taken into consideration during the design stage. With the proposed new service interstice and based on the location of grade at the lower North Wing portion, this height limit may be exceeded. It should be noted that the high building height limit is to be measured from grade near Level 1 of the North Wing to Level 6 in the South Wing as shown below. See Section 7.2 of this report regarding design requirements for the service interstice.



Based on the sloping site condition, it may be challenging to develop a design to meet this measurement similar to the 18m height limit for application of Article 3.2.2.50 as discussed in Section 7.1.2 of this report. In this case, it is proposed to develop an alternative solution allowing to consider both wings separately for this 18m, given the existing conditions, for discussion with the CBOO. The same principle applies to this high building status approach, except the measurement is between grade to Level 6 as opposed to Levels 1 to 6.

In case of over height, the following measures are to be taken into consideration.

7.9.1 *High Building Waiver per Sentence 3.2.6.1.(2)*

The VBBL provides an option for buildings up to 6 storeys that exceed the 18m high building height limit prescribed under Clause 3.2.6.1.(1)(a). If the following conditions of Sentence 3.2.6.2.(2) are met, the building need not be considered a high building designed in conformance with provisions including those of Articles 3.2.6.2 to 3.2.6.9. These requirements are further discussed in Section 7.9.2 of this report.

2) A *building* or that portion of a *building* separated in accordance with Division A, Article 1.3.3.4., need not comply with the requirements of this Subsection, provided

a) the *building* or that portion of a *building* does not exceed 6 *storeys* in *building height*,

b) the *building* or that portion of a *building* does not contain a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or Group B, Division 3 *major occupancy*,

c) the principal entrance for firefighters is located on the *storey* which requires vertical travel to the topmost floor level to be not more than 18 m,

d) except where vestibules designed to limit movement of smoke from a fire in a *floor area* below the lowest *exit storey* into upper *storeys* are provided, stairs and elevators shall not directly connect more than 6 consecutive *storeys* (See Note A-3.2.6.2.(4).),

e) *exit* stair enclosures are provided with not less than a 2 h *fire separation*, and

f) the *building* sprinklers are designed in accordance with NFPA 13 "Installation of Sprinkler Systems", except that the design area of the *floor areas* above the *basement* shall be twice the design area otherwise permitted by NFPA 13 "Installation of Sprinkler Systems" after all reductions in design area have been applied.

(See Note A-3.2.6.1.(2).)

Rev. 12683

This VBBL waiver provision may serve as a viable strategy to avoid items, such as emergency generator, firefighters' elevators, increased fire rating for related fire separations, etc.

It should be noted that these provisions under Sentence 3.2.6.1.(2) may evolve during the next Code change cycle for the VBBL. As such, these provisions will need to be reviewed based on the applicable edition of the VBBL during the design stage.

For this project, the building height in terms of the number of storeys in accordance with the average grade level as previously discussed and the vertical travel of 18m per Clause (c) may require careful design consideration in order to pursue this waiver option.

7.9.2 *High Building Provisions*

In case the waiver per Sentence 3.2.6.1.(2) cannot be met, the high building requirements as summarized are required to be addressed.

Table 3. Summary of Key High Building Provisions

VBBL Reference	VBBL Requirement

Article 3.2.6.2	**Limits to Smoke Movement**
	- Separation of stairs serving above and below the lowest exit level.
	  - *This may be addressed by an alternative solution, subject to review during the design stage.*
	- Bottom venting of other exit stairs serving storeys above the lowest exit level (doors to the exterior).
	- Pressurization of exit stairs below the lowest exit level, and with top venting, and manual fan control at the CACF.
	  - *The exit stair on Gridline B currently serving both basement and upper levels will require further review further to address this condition*.
	- 2h shafts for pressurization ducts serving stairs and exit corridors below the lowest exit level.
	  - *This is not expected to be required for Chelsea Manor, subject to review for exit stair on Gridline B as commented above.*

VBBL Reference	VBBL Requirement
	- Air handling systems serving more than one storey to be designed to prevent the circulation of smoke on a signal from a duct type smoke detector. - Air moving fans in a system that serves more than two storeys to be designed and installed so that they can be stopped by a manually operated switch at the CACF. - Residential corridor pressurization (make-up air) designed to stay on during fire alarm and can be stopped by a manually operated switch at the CACF. - As elevators serve multiple storeys below the lowest exit storey, 2h fire rated vestibules required at elevator openings. - *This is not applicable to Chelsea Manor as there is only one basement level.* - Vertical service spaces other than elevator shafts, which start at the level below the exit storey and continue through the floor above the exit storey shall be provided with a firestop where the exit storey, and storey below exit storey meet. Otherwise, this condition must be vented to outdoors at the top during emergency operable manually, on signal from smoke detector at or near the top of shaft and also requires it is openable by a control device located at the CACF.
Article 3.2.6.4	**Emergency Operation of Elevator** - Automatic and manual emergency recall features for elevators serving storeys above the first storey, including freight elevators. - Automatic emergency recall to be activated by smoke detectors installed in each floor area in front of the elevator or the building fire alarm system. - Where smoke detectors are activated at the recall level, the automatic emergency recall signal to direct recall to an alternate floor level. - Elevator car emergency switches and status indicators. These are in addition to recall and other features required by the Elevator Code. - Electrical conductors are to be protected against exposure for a period no less than 1h per Article 3.2.7.10
Article 3.2.6.5	**Elevator for Use by Firefighters** - At least one elevator to be designed for use by firefighters; minimum useable area of 2.2m^2 and capable of carrying a load of 900kg to every floor above grade that is normally served by an elevator. - *This may require an alternative solution, subject to discussion with VFRS, if a separate firefighters' elevator is provided for different floor level due to existing conditions.* - All elevators should be capable of operating on emergency power. - At least one elevator per building at a time is required to operate on emergency power. - 2h fire rated shaft with closures having 1½h fire protection rating. - Electrical conductors are to be protected against exposure for a period no less than 1h per Article 3.2.7.10.
Article 3.2.6.6	**Venting to Aid Firefighting** - Openable windows uniformly distributed along exterior walls or provision of manually controlled smoke exhaust at rate of six air changes/h. - Exhaust fans for parkade at rate of six air changes/h.
Article 3.2.6.7	**Central Alarm and Control Facility (CACF)** - To be provided at entry lobby served by a Fire Department access route.

VBBL Reference	VBBL Requirement
Article 3.2.6.8	**Voice Communication System** - NOT expected to be required for Chelsea Manor, as its height is not expected to exceed 36m.
Article 3.2.7.4	**Emergency Lighting and Power** - 2h duration under full load.
Article 3.2.7.8	**Fire Alarm Emergency Power** - 2h duration under full load and 24h supervisory power.
Article 3.2.7.9	**Emergency Power for Building Services** - 2h operation for all emergency systems, provided by a generator.
Article 3.2.7.10	**Protection of Electrical and Emergency Conductors** - Electrical conductors which serve fire alarm system, emergency lighting, high building system equipment, fire pumps, or areas of refuge are to be protected. - The intent of conductor protection described in the VBBL is to maintain operation of service equipment for a period of 1h; temperatures within the shaft may affect conductor operation and design of suitable protection may require shafts with a rating of more than 1h. Sentences (7) and (9) describe conditions where conductor protection is not necessary within a single storey.

7.10 Accessibility and Enhanced Accessibility

Based on the current VBBL 2019, Sentence 3.8.2.1.(1) requires access to be provided to all buildings where work functions can reasonably be expected to be performed by persons with disabilities. The VBBL requires access to be provided throughout common areas, from the exterior to the accessible entrance, and from the accessible entrance to all common areas and to parking areas. Common areas include all areas where public access is permitted such as the entry lobby and amenities areas.

Sentence 3.8.2.3.(2) exempts service, janitors', and elevator machine rooms from being accessible.

It should be noted that the current accessibility and enhanced accessibility provisions under Section 3.8 of the VBBL 2019 may evolve during the upcoming Code change cycle of the VBBL 2024/2025.

7.10.1 *Adaptable Unit Requirements*

All new dwelling units will be subject to the adaptable unit requirements of the applicable edition of the VBBL. Current adaptable unit requirements are expected to be updated during the next code change cycle.

For existing dwelling units, it is proposed they remain unchanged in terms of upgrading approach for adaptability, subject to discussion with the CBOO.

7.11 Energy Requirements

Applicable design requirements with respect energy performance should be reviewed and confirmed by an energy consultant for the proposed addition. The VBBL in Part 11 does not contain any specific energy performance related provisions for upgrade upon addition to an existing project.

The following approach should be considered with the energy consultant in order to develop a compliance strategy, notably for the existing portion. Based on our experience, the City will be flexible as long as new equipment conforms to best practices.

7.11.1 *Upper Portion*

The new upper floors as new construction work will be subject to the energy provisions under Part 10 per Division A, Sentence 1.1.1.1.(1) of the VBBL.

7.11.2 *Lower Portion*

As discussed under Section 7.5.1 of this report, should it be permitted for the existing cladding to remain from a fire standpoint for addressing cladding requirement under Sentence 3.1.4.8.(1). Since the exterior walls are unaltered, we do not expect onerous energy upgrade for existing unaltered exterior walls. This aspect will be subject to discussion with the City.

Should cladding be required to be replaced or upgraded to meet Sentence 3.1.4.8.(1), energy upgrade may be required per Sentence 11.2.1.2.(6). In this case, the extent of required upgrade should be discussed with the CBOO based on its existing conditions. The level of improvement from the existing condition measured against the required works for full upgrade can be considered to justify an appropriate scope of upgrade for exterior walls. An approach consistent with Clause 11.2.1.2.(2)(b) for energy upgrade would be an appropriate starting point for the purpose of feasibility review.

7.12 Construction Fire Safety

Construction fire safety is to meet the applicable Fire Bylaw requirements and to be reviewed and prepared by the general contractor (GC).

In our experience, the VFRS requires a review of construction exposure hazard to adjust properties for a 6-storey construction project of combustible construction. Exposure concerns during construction due to light frame or mass timber construction materials can be addressed based on commonly acceptable measures for 6-storey projects.

7.12.1 *Considerations for Phasing Construction Work*

It is our opinion that to maintain a certain level of occupancy of the lower portion during the construction phase will be extremely challenging, both for the construction team and the tenants of the buildings. As such, this project objective is not recommended.

8.0 ALTERNATIVE SOLUTIONS AND MINOR RELAXATIONS

Alternative solutions and Minor Relaxations may be developed and negotiated to address designs providing equivalent, or marginally deficient performance for Bylaw compliance. The following areas with respect to fire safety are identified which may be required development a design on an alternative solution basis due to potential issue with existing conditions:

1. Height exceeding 18m for application of Article 3.2.2.50 and/or high building measures
   - See Section 7.1.2 and 7.9.2 of this report

2. Existing exterior cladding not in direct compliance with Sentence 3.1.4.8.(1)
   - See Section 7.5.1 of this report

3. Existing floor fire resistance rating deficiency within lower portion
   - See Section 7.1.5.2 of this report

4. Fire department access and location of fire department connections
   - See Sections 7.3.1 and 7.3.2 of this report

5. Exit exposure protection with existing windows

Additional alternative solutions and minor relaxations will likely be required once more information is available on the existing conditions in areas discussed in this report.

9.0 CONCLUSION

This report outlines key building fire safety design considerations for the proposed design concept of a 3-storey addition to the existing building, Chelsea Manor, located at 3640 Victoria Drive in Vancouver, BC, as part of the high-level feasibility study. The new addition construction work will be required to meet the Part 3 provisions of the VBBL, while the existing lower portion will be subject to upgrade requirement provided under Part 11.

The proposed concept of a 3-storey addition is in our opinion, feasible; however, it requires significant discussion with the City of Vancouver's CBOO. An approach to Building Bylaw compliance is expected to be based primarily on a building classification per Article 3.2.2.50 allowing combustible construction up to 6 storeys in building height and 1500m^2 in building area. A key consideration for limiting the proposed design to 6 storeys in height is to apply the provision under Division A, Sentence 1.3.3.4.(2) for which a continuity vertical 1h fire separation is required between the North and South Wings. This allows each wing to be considered separately for the overall building height and grade determination. This strategy is recommended to be implemented in order to allow for the proposed design configuration of the addition. The optimal placement of this vertical fire separation is to be reviewed based on the existing conditions.

A number of other potential areas is identified to require alternative solutions for the Building Bylaw compliance approach envisioned to address key fire safety design aspects including upgrade requirements for the existing building. Early discussion with the City will be required to gather consensus on the proposed design approach on an alternative solution/minor relaxation basis as well as the extent of the required upgrade for this specific project building.

Further review of the existing conditions will be required as the next step in order to further develop the compliance approach and alternative solution/minor relaxation concept.

With respect to maintaining occupancy during construction for this 3-storey infill project, this approach is not recommended considering the extent of construction and upgrade work potentially required.

10.0 ADDITIONAL DISCUSSIONS

The following was provided to discuss the advisory group's questions relating to considerations, such as changes to the infill design concept, code/policy changes, recommended research studies, etc.

- *What would need to be changed or added to better support this type of structure (whether it is considered two buildings or one)?*

GHL's review has identified the critical step for the proposed sites is the determination of appropriate upgrade work for the lower existing building, notably in terms of fire protection (including fire rating, sprinklers, fire alarm, fire department access route, firefighting provisions such as hydrant and fire department connections, exterior cladding materials, high building measures), energy/envelop, structural, and accessibility as stipulated in Part 11 of the VBBL. We understand this question relates to what can be changed or added to the current infill concept study. In this context, the design concept of building subdivision by horizontal firewall does not offer any significant benefit for reducing upgrade work for the existing lower structure as upgrade will still need to be considered for the existing structure regardless of division by vertical firewall. As indicated in the report, subdivision of a structure into two distinct buildings by a horizontal firewall for upgrade requirement purposes is not a recognized concept in the VBBL. We do not believe this horizontal firewall subdivision strategy is a suitable or effective means to waiver upgrade work required by Part 11.

It is important to understand that if the lower structure is sprinkler protected, it can be assumed a fire in the lower structure is limited in size. If the lower structure is NOT sprinklered, it must be assumed that fire can rapidly spread to all suites on all three existing levels. Such a fire would be beyond available firefighting resources and firefighting water availability, and it would not be possible for firefighters to protect the upper new building, hence there is no option to avoid upgrading the lower building. Put another way, the heat would be so intense that firefighting water streams would likely evaporate before reaching the fire. Even if a 3h noncombustible or mass timber slab was provided, flames would wrap around the slab to engulf the upper buildings. The slab would have to extend between 6m or more beyond the upper building on all faces to provide any form of protection from flames wrapping around the edge of the slab, and none of the sites are big enough for this.

- *Are there a few policy/code additions we can suggest that would make this concept more feasible?*

Although the current VBBL already has provisions in Part 11 to cover vertical additions, these provisions are intended to be applied in a more general fashion. There are no provisions intended specifically for this unique design concept of 3 level infill of an existing 3-storey residential

building. In theory, additional provisions could be developed to address key upgrade design parameters specific to this type of building. Conceptually, some relaxations in building height limits and smoke control/high building measures could assist. A separate scope will be required in order to review and study specifics for this approach in collaboration with the stakeholders, assuming the City as the AHJ is committed to developing these additional provisions addressing a unique concept.

- *Can you add to the discussion/implications:*

  - *Are there certain Code/policy provisions that could potentially favour this concept over redevelopment or vice versa?*

    In our view, projects involving existing buildings can require multi-dimensional evaluation of competing factors, including cost, practicality, constructability, compliance, etc, while the Code such as the VBBL relates primarily to the compliance factor by setting forth minimum requirements. There are trade offs in term of these factors between infill and redevelopment. Rather than viewing which Code provisions favour which particular design, the stakeholders should evaluate the trade offs between design options. A separate scope can be developed to assist BCNPHA further with evaluating these factors of the infill design against redevelopment.

  - *E.g. are there some Code/policy provisions that might constrain redevelopment at some sites?*

    From our perspective, a compliance approach can be developed for new construction of a 6-storey building. Our review did not cover consideration of redevelopment. We can provide review comments on specific redevelopment designs if required in a separate scope as the next phase. This question should be directed to other consultants/stakeholders such as architect to review other considerations in terms of redevelopment.

  - *Or what changes would be needed to allow a horizontal fire wall to be considered?*

    See comments above. Given the potential size of a fire involving multiple existing storeys and suites, we do not believe installation of horizontal firewalls is a beneficial design approach to focus on for the infill concept. The provision of horizontal firewall does not provide any significant benefits in terms of limiting upgrade requirements, which we understand are key concerns for the feasibility of the proposed infill concept. We do not see other benefits in terms of code compliance to develop a horizontal firewall concept that is not envisioned in the current VBBL.

    This aspect is discussed in a previous section of the report. Essentially, the provision of horizontal firewall does not have any significant impact on upgrade requirements. The determination of Part 11 upgrade requirements will still be subject to discussion with the CBOO.

  - *Do the use of the specific materials in the case studies have any Code implications to make this concept more or less feasible?*

We do not consider material choice for the infill a critical challenge in this concept in general. In terms of construction type for code compliance, the use of mass timber is considered suitable for this concept due to its recognized material properties in terms of fire resistance rating. This offers design flexibility for addressing structural fire safety thereby making the proposed concept more feasible compared to light wood frame construction with respect to permitted building height. Our review is limited to code compliance for fire safety provisions. Feasibility in terms of structural design, architectural design, acoustic rating, cost, impact of construction on occupants should be evaluated by other respective consultants.

- *If the two structures are considered one building, but in the end they decide to redevelop the lower structure (using the upper structure to house tenants rather than relocating them), are there any Code/policy barriers that would come into play?*

  Fire department access including access route, fire department connections, fire hydrants, fire alarm panel, etc and building accessibility to upper structure such as path to entrance, elevators, exits, etc will need to be maintained and available for occupants. Structural fire protection of elements supporting the upper structure will also have to be maintained. This scenario will require further studies to identify more detailed code considerations depending on site specific conditions. This additional study can be carried out under a separate scope.

- *Are there any Code/policy requirement we need to take into consideration if we want tenants to stay in place during the construction of the upper level? (e.g. doing the sprinkler upgrade first before adding new structure)*

  As discussed in the report, construction fire safety is to meet the applicable Fire Bylaw/Fire Code requirements for which the general contractor is responsible. For example, the interface between the construction site and the occupied floor area will need to be constructed as fire separation in conformance with the Bylaw based on the construction site conditions, such as whether sprinkler protection is provided. Fire department access, exiting, and building accessibility as described above will also need to be maintained. These aspects can be reviewed by GHL for assisting the development of a construction plan based on site specific conditions. There are no specific Code requirements in the VBBL for sprinkler installation sequencing for this unique design concept, but we recommend that the sprinkler installation sequence be developed during the design stage and be discussed with the AHJ as part of the upgrade determination dialogue. It is also recommended that the existing lower building be retrofitted with sprinklers prior to the construction of upper structure as good practice for fire safety measure whether the existing structure is vacant or not.

- *If tenants need to be relocated, how long would they need to be relocated to accommodate the construction of the concept?*

  We are not in position to comment. We suggest discussing this with the architect and general contractor based on the expected construction timeline.

- *Is there an opportunity for a site specific code to allow a pilot site to try this concept? If so, what provisions would be needed/removed?*

  We do not believe a site specific Code is necessary for this, as there is significant flexibility permitted in the Code for existing buildings. This issue is the willingness of the local authorities, either City of Vancouver or Provincial, to work through what would be a very complex design exercise. Such authorities will need to be prepared to rely on performance-based engineering and peer review processes. If the lower building is sprinklered, we believe the City of Vancouver, compliance through the existing mechanisms of Part 11, can be achieved. However, if the lower building is not sprinklered, we cannot envision any means of controlling the size of fire to a level that local fire resources can manage, even if we were to ignore the life safety considerations.

- *Are there any future research questions to enhance the feasibility that should be mentioned?*

See comments above. In addition, we suggest the following:

1. While our review and comments are provided within the context of the VBBL, it is also recommended to consider a scenario where the BC Building Code (BCBC) is applicable as opposed to the VBBL. It is noted Part 11 provisions for upgrade is unique to the VBBL and are not applicable in the BCBC. A separate code compliance approach (similar potentially but not identical) can be developed and compared to that for the VBBL.

2. Different height thresholds are applicable to 6-storey residential buildings, which can have an impact on permitted type of construction, high building status, etc. Further study is recommended to review and evaluate the possibility of increasing these thresholds for specific design applications such as the current infill design. A generic alternate approach may be developed to address these design considerations for marginally taller buildings based on the impact of fire safety as well as practicality.

3. We would also suggest obtaining input from a general contractor to comment on constructability of proposed design, identification of challenges from a construction standpoint, impact on occupants, phasing approach, occupant displacement plan, etc.

Enclosure

KT/dh/kl/cye P:\PRJ\93\9325 - BCH 3 Over 3 Mass Timber Residential Infill Feasibility, Vancouver\Report\Chelsea Manor\2024-11-29 Code Report_Chelsea Manor (GHL 9325.00) R1.docx

Attachment 1

Project Drawings

PARKING LEVEL
SCALE: 1/8" = 1' - 0"

KEY PLAN
SCALE: NTS

LEGEND	
FAP	FIRE ALARM PANEL
P	FIRE ALARM PULL STATION
B	FIRE ALARM BELL
	END OF LINE DEVICE
$\otimes_F$	COMBINATION FIXED TEMPERATURE AND RATE-OF-RISE HEAT DETECTOR. F = FIXED TEMPERATURE ONLY
	SMOKE DETECTOR
	ELECTROMAGNETIC DOOR HOLDER
B	FIRE ALARM TROUBLE BUZZER

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpge@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
BASEMENT PARKING LEVEL
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016		2031
DRAWN	FN	SHEET NUMBER	
CHECKED	LPG		E1 of 8

GROUND FLOOR

SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.

CONSULTING ENGINEERS ELECTRICAL

#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpgc@uniserve.com

PROJECT:

CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:

LEVEL 1
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016		2031
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG		E2 of 8

SECOND FLOOR
SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpga@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
SECOND FLOOR
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016	2031	
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG	E3 of 8	

THIRD FLOOR
SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106-3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604-298-0939 F: 604-298-9823
E-MAIL: lpga@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
THIRD FLOOR
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016	2031	
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG	E4 of 8	

PARKING LEVEL
SCALE: 1/8" = 1' - 0"

KEY PLAN
SCALE: NTS

LEGEND	
FAP	FIRE ALARM PANEL
P	FIRE ALARM PULL STATION
B	FIRE ALARM BELL
	END OF LINE DEVICE
$\otimes_F$	COMBINATION FIXED TEMPERATURE AND RATE-OF-RISE HEAT DETECTOR. F = FIXED TEMPERATURE ONLY
	SMOKE DETECTOR
	ELECTROMAGNETIC DOOR HOLDER
B	FIRE ALARM TROUBLE BUZZER

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpge@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
BASEMENT PARKING LEVEL
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016		2031
DRAWN	FN	SHEET NUMBER	
CHECKED	LPG		E1 of 8

GROUND FLOOR

SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.

CONSULTING ENGINEERS ELECTRICAL

#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpgc@uniserve.com

PROJECT:

CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:

LEVEL 1
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016		2031
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG		E2 of 8

SECOND FLOOR
SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106–3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604–298–0939 F: 604–298–9823
E–MAIL: lpga@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
SECOND FLOOR
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016	2031	
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG	E3 of 8	

THIRD FLOOR
SCALE: 1/8" = 1' - 0"

THESE FLOOR PLANS WERE PRODUCED ON CAD BY SCANNING AND OVERLAY TRACING. THIS PROCESS DOES NOT GUARANTEE COMPLETE ACCURACY. WHERE COMPLETE ACCURACY IS REQUIRED FOR ANY PURPOSE, OBTAIN SUCH FROM A SITE VISIT.

NO	REVISIONS	DATE
1	ISSUED FOR BUILDING PERMIT	1/25/2017

L.P. GANDER & ASSOCIATES LTD.
CONSULTING ENGINEERS ELECTRICAL
#106-3855 HENNING DRIVE
BURNABY, BRITISH COLUMBIA, V5C 6N3
T: 604-298-0939 F: 604-298-9823
E-MAIL: lpga@uniserve.com

PROJECT:
CHELSEA MANOR
3640 VICTORIA DRIVE
VANCOUVER BC

FIRE ALARM UPGRADE

SHEET:
THIRD FLOOR
EXISTING FIRE ALARM SYSTEM

SCALE	AS SHOWN	PROJECT NUMBER	
DATE	DEC 31, 2016	2031	
DRAWN	RSC	SHEET NUMBER	
CHECKED	LPG	E4 of 8	