

Home Base Yellowknife Mixed-Use Building Yellowknife, NT



Schematic Design Report

Prepared by: Taylor Architecture Group

Prepared for: Home Base Yellowknife

August 28, 2024

Contents

1	Introduction	5
1.1	Project Team	5
1.2	Visits to Site.....	6
1.3	Documentation Required from Client.....	6
1.4	Documentation Provided by Design Team to Date	6
1.5	Schedule of Work.....	6
2	Project Information.....	7
2.1	Key Design Considerations.....	7
2.2	Meeting with City of Yellowknife Planning Department	7
2.3	Youth Engagement.....	7
2.4	Functional Program.....	9
2.5	Code Review.....	13
2.6	Accessibility.....	13
2.7	Harm Reduction	13
3	Site Considerations	14
3.1	Site Overview	14
3.1.1	Site Servicing	14
3.1.2	Outdoor Activities/Programs	14
4	Architectural Design Narrative.....	16
4.1	Building Overview	16
4.1.1	Ground Floor	16
4.1.2	Second Floor	18
4.1.3	Third Floor	20
4.1.4	Fourth Floor	23
4.1.5	Fifth, Sixth & Seventh Floors	26
4.1.6	Eighth & Ninth Floors.....	29
5	Building Envelope.....	31
5.1	Above Grade Walls.....	31
5.2	Roof.....	31
5.3	Floor	32

5.4	Exposed Floor	32
5.4.1	Green Roof	33
5.5	Exterior Doors and Windows	33
6	Interior Finishes	34
6.1	Home Base Spaces	34
6.2	Market Rental Spaces	37
6.3	Building Service Spaces	37
7	Mechanical Considerations	39
7.1	General	39
7.2	Plumbing	39
7.2.1	Domestic Water Supply:	39
7.2.2	Sanitary And Rainwater Drainage System	40
7.2.3	Domestic Water Distribution:	40
7.2.4	Domestic Hot Water Heating	41
7.2.5	Plumbing Fixtures	41
7.3	Heating and Cooling	42
7.4	Ventilation	43
7.5	Fuel Systems	44
7.6	Fire Protection	44
7.7	Controls	45
7.7.1	Alarms	46
8	Electrical Report	47
8.1	General	47
8.2	Codes and Standards	47
8.3	Load Estimate and Service	48
8.4	Standby Emergency Power	48
8.5	Electrical Service	48
8.6	Power Distribution System	49
8.7	Lighting Systems	50
8.8	Life Safety	52
8.8.1	Fire Alarm System	52

8.8.2	Emergency and Exit Lighting	52
8.9	Building Security System	53
8.9.1	CCTV System	53
8.9.2	Access Control System	53
8.9.3	Panic Alarm System.....	53
8.10	Wiring and Wiring Devices	54
8.11	Communication Systems.....	54
8.11.1	Structured Wiring.....	54
8.12	Motor Control	55
8.13	Energy Conservation Features	55
9	Project Costing	56
9.1	Project Budget.....	56
9.2	Cost Estimates & Pricing Options.....	56
Appendix		57
A	Geotechnical Desktop Study	57
B	Civil Report.....	58
C	Structural Report.....	59
D	Schematic Design Drawings	60
E	Energy Modeling Report	61
F	Outline Specifications	62
G	Mechanical Equipment List.....	63
H	Class B Cost Estimate	64

1 Introduction

1.1 Project Team

Owner

Home Base Yellowknife
Yellowknife, NT

Architect, Prime Consultant

Taylor Architecture Group
3502 Raccine Road
Yellowknife, NT

Structural Engineer

Concentric Engineering
307 - 700 Richmond Street
London, ON

Civil Engineer

Associated Engineering
301 – 4109 4th Avenue
Whitehorse, YT

Mechanical & Electrical Engineers

TAG Engineering
3502 Raccine Road
Yellowknife, NT

Energy Modeler

ReNü Engineering
3506 McDonald Drive
Yellowknife, NT

1.2 Visits to Site

- May 29, 2023 – Visit to existing Home Base Youth Centre, Office, and Apartment Building, and Hope's Haven Dorms & Shelter
- June 11, 2023 – Youth engagement at existing Home Base Youth Centre. Present: Melani Korver and Kamille Manoy (TAG)

1.3 Documentation Required from Client

- TBD pending funding approval.

1.4 Documentation Provided by Design Team to Date

- Pre-Design Report, June 24, 2023
- Site Survey, April 23, 2024
- Client Draft Schematic Design Review Presentation, June 3, 2024
- Youth Engagement Concept Design Presentation, June 11, 2024
- Geotechnical Desktop Study, July 5, 2024
- Energy Modeling Report, August 28, 2024

1.5 Schedule of Work

Milestone	Date
Project Startup	May 1, 2023
Pre-Design Site Visit	May 29, 2023
Pre-Design Report	July 21, 2023
Meeting with the City of Yellowknife Planning Department	May 9, 2024
Client Draft Schematic Design Review	June 3, 2024
Youth Engagement Workshop	June 11, 2024
Schematic Design Submission Draft	July 16, 2024
Client Draft Schematic Design Review	August 2, 2024
Class B Cost Estimate (by Hanscombe)	August 7, 2024
Final Schematic Design Submission	August 28, 2024
Final Supporting Documents for CMHC as Needed	August 28, 2024

2 Project Information

2.1 Key Design Considerations

The Home Base Yellowknife Mixed-Use Building is designed to be a welcoming beacon in the city, with distinctive design features that are intended to foster a sense of pride of place, support the needs of its residents, and be a fun environment for youth. The design allows for opportunities of interaction between different building users while also providing spaces for retreat.

Addressing the unique site condition of facing an intersection, the site access extends 49th Avenue as a covered driveway through the site, dividing the ground floor into an east and west podium. This arrangement places the staff parking on the south end of the site and allows the site to potentially be accessed on the west side of the site from the adjacent City of Yellowknife parking lot. The plaza, undercover recreation area, and combination of the grand staircase in the Youth Centre Event Space and café space facilitate moments where residents and the public can engage with one another. Meanwhile, separate market rental residential entrances ensure residents' privacy.

A connection to nature is emphasized by offering sweeping views to the nearby Frame Lake as well as providing a green roof on the lower, south roof. The building design acknowledges the site's prominent location across from City Hall and the Somba K'e Park. With inviting public spaces, murals, colourful metal cladding, and irregular windows, the design is a light-hearted appeal to its youth residents that will also enhance the public streetscape.

2.2 Meeting with City of Yellowknife Planning Department

On May 9, 2024, TAG met with the City of Yellowknife (CoY) Planning Department to discuss the possibility of accessing the site through the adjacent city parking lot and how garbage can be collected from the site. At this stage in the design process, the CoY cannot guarantee access through the city parking lot and will require a Development Permit Application to enable a full review of the project design. If access through the parking lot is granted, Home Base would enter into a lease agreement with the CoY. TAG's flexible site design can be modified to close off this access if its use is not granted. CoY informally noted the garbage bins can be located on the west side of the site and can be accessed by garbage trucks via the parking lot, however this approach will require input from the Public Works Department.

2.3 Youth Engagement

A youth engagement session was held in the Home Base Youth Centre on June 11. The session focused on information sharing and included the presentation of building design, site drawings, and precedent projects.

TAG prepared questions for the youth to help understand ways the design can incorporate the youths' needs and interests. The questions and some select responses are as follows:

What does a safe home/place mean to you?

- Being Alone/Privacy
- Ability to Be Myself
- Lock on My Door
- Fire Alarms
- Staff

What events would you like in the event space?

- Movies
- Concerts
- Art Show/Exhibits
- Dance Party
- Birthdays
- Fashion Show
- Beauty Party (Hair/Makeup)
- Career Fair
- Youth Centre Hair Salon

What would you like to see in your dormitory/space?

- Giant Whiteboard Wall
- TV
- Desk
- PC
- LED Lights

What is your daily routine in summer and winter?

- Coffee
- Work
- Sports
- Gaming
- Gym
- Cooking/Cook outs
- Basic Hygiene

What activities do you like to do?

- Sports (Volleyball, Basketball, Softball, Soccer, Football, Badminton, Ping Pong, Pool)
- Fitness/Gym Classes
- Camping
- Beading
- Sewing
- Making Earrings/Crafts/Jewellery
- Traditional Games
- Hair and Makeup

One of the priorities of this project is to provide safe, inclusive spaces for all users. TAG has designed spaces that are accessible and allow for appropriate levels of supervision and refuge. Noting the suggestions of the youth, TAG will be looking at ways to support the production of art shows, fashion shows, movies, and concerts in the Youth Centre Event Space. TAG has also provided a multi-purpose space that can be used for craft making and hosting hair salons.



Youth engagement session.



Youth responding to engagement questions.

2.4 Functional Program

The following is a summary of the program areas of the project as of schematic design.

Space	Number Required	Room Area (m2)	Cumulative Area (m2)	Floor	Equipment/Furn/Millwork	CCTV	Notes
Home Base Entry							
Lobby (Youth Centre Event Space)	1	7	7	1		Yes	
Youth Centre Event Space	1	100	100	1-3	Wood-clad staircase w/ integrated seating	Yes	
Washroom (BF)	2	5.5	11	1			
Café	1	35	35	1	Tables and chairs	Yes	
Lobby (Home Base)	1	26	26	1	Elevator	yes	
Subtotal			179				
Subtotal with Structure and Circulation Factors			227				
Youth Centre							
Intake Room	1	9	9	3	Desk, task chairs, sink, toilet	yes	Barrier-free
Staff Washroom	1	3	3	3	Sink, toilet		
Reception	1	11	11	3	iPad for youth check-in	yes	Barrier-free
Meeting Room/Interview Room	2	6.5	13	3	Desk and task chairs	yes	
Sobering Room	1	23.5	23.5	3	5 single cots, sink, toilet, shower	yes	

Space	Number Required	Room Area (m2)	Cumulative Area (m2)	Floor	Equipment/Furn/Millwork	CCTV	Notes
Manager’s Office	1	8	8	3	L-shaped desk, upper cabinets, task chairs		
Youth Centre Office	1	23	23	3	Millwork desk, task chairs, storage	yes	CCTV monitor station TBD
Lounge	1	68	68	3	TV, couches, arm chairs, gaming setup, projection, pool table	yes	Barrier-free
Classroom/Computer Room	1	31	31	3	table, chair, computer, shelves	yes	Barrier-free 6-8 computer stations; enclosed room
Dining Space	1	52	52	3	table, chair	yes	Barrier-free, 40 people
Washroom & Shower	3	4	12	3	shower, sink, toilet		
Washroom & Shower (BF)	2	6	12	3	shower, shower seat, sink, toilet, grab bars		Barrier-free
Sensory Room	1	20	20	3	Projector, tables and chairs, storage	yes	Barrier-free
Kitchen	1	32	32	3	Range, commercial dishwasher, sinks		Quantity and quality of appliances to be confirmed, contains Kitchen pantry
Laundry	1	9	9	3	1 stacked washer/dryer, 1 front-loading washer, 1 front-loading dryer	yes	Barrier-free
Pantry/Food Rescue	1	7	7	3	Freezer, millwork shelves		Barrier-free, open access, store donated food
Subtotal	333.5						
Subtotal with Structure and Circulation Factors	423.5						
Gym/Overnight Shelter	1	109	109	3	basketball (half size), floor hockey (TBD), drop-down curtain partition, lockers	yes	Barrier-free, 20 people (5m2/ person) access-controlled
Equipment Storage	1	16	16	3	Gym equipment		
Cot Storage	1	16	16	3			
Subtotal	141						
Subtotal with Structure and Circulation Factors	179						
Home Base Residential							
Communal Kitchen	1	23	23	4	cupboard (lockable), fridge, stove, kitchen island, microwave and dishwasher, sink	yes	limited access
Lounge	1	36	36	4	TV, couches, arm chairs	yes	Barrier-free
Dining Room	1	24	24	4	dining tables and chairs	yes	Barrier-free
Washroom & Shower	4	5.5	22	4	Shower, sink, toilet		
Washroom & Shower (BF)	2	8	16	4	Shower, shower seat, sink, toilet, grab bars		Barrier-free

Space	Number Required	Room Area (m2)	Cumulative Area (m2)	Floor	Equipment/Furn/Millwork	CCTV	Notes
Shared Laundry (for 1-br and dorm single)	1	17	17	4	6 sets of washer/dryer, sink	yes	Barrier-free, serves both dorm rooms and 1-bed suites
Outdoor Terrace	1	24	24	4			Barrier-free
Subtotal (HB Communal)	162						
Subtotal with Structure and Circulation Factors	206						
Dormitory (Single)	9	9.5	85.5	4	Built-in bed, under-bed storage, built-in desk and closet, chair		
Dormitory (BF)	3	18.5	55.5	4	Bed, desk, closet		
1-Bedroom	13	37	481	5-7	Bed, closet, coat closet		Private washroom with bathtub, private kitchen
1-Bedroom (BF)	4	40	160	5-7	Bed, millwork closet		Barrier-free, Private washroom with roll-in shower, private kitchen with barrier-free counter and appliances
2-Bedroom	3	57.5	172.5	7	Bed, closet, coat closet		Private laundry, private washroom with bathtub, private kitchen
2-Bedroom (BF)	1	58	58	7	Bed, closet, coat closet		Barrier-free, Private laundry, private washroom with roll-in shower, private kitchen with barrier-free counter and appliances
Subtotal	1012.5						
Subtotal with Structure and Circulation Factors	1286						
Home Base Administration							
Executive Director	1	16.5	16.5	4	L-shaped desk, task chairs, 2-person meeting table, filing cabinets		
Assistant Director	1	9.5	9.5	4	L-shaped desk, task chairs, filing cabinets		
Dorms Manager	1	9.5	9.5	4	L-shaped desk, task chairs, filing cabinets		
Human Resources	1	9.5	9.5	4	L-shaped desk, task chairs, filing cabinets		
Training Coordinator	1	15	15	4	Built-in desk, task chair		
Office (extra)	1	27	27	4	Millwork desk, task chair, filing cabinets millwork storage		
Reception	1	12	12	4	Built-in desk, task chair		
Boardroom	1	26	26	4	Table, task chairs, millwork storage		Barrier-free

Space	Number Required	Room Area (m2)	Cumulative Area (m2)	Floor	Equipment/Furn/Millwork	CCTV	Notes
Waiting Area	1	6	6	4	seating benches/ chair		Barrier-free
Storage Room	1	7	7	4	shelves, printer		
Coffee Station	1	11	11	4	Under-cabinet fridge, microwave, under-mount sink, lockers, upper cabinets		
Washroom	1	2	2	4	Sink, toilet		
Washroom (BF)	1	4	4	4	Sink, toilet, grab bars		Barrier-free
Youth Workers Office	1	11	11	4	Millwork desk, task chairs		In Dorms Rooms
Housing Manager	1	11	11	5	L-shaped desk, task chairs, filing cabinets		
Navigators	1	28	28	5	Millwork desk, task chairs, filing cabinets, round meeting table		Kitchenette, Washroom with sink and toilet
Subtotal	205						
Subtotal with Structure and Circulation Factors	260						
Market Rental							
Lobby (Market Rental)	1	27.0	27	1	Mailbox	Yes	Barrier-free
Market Rental (FL 2)	1	34	34	2		Yes	
Market Rental (FL 3)	1	58	58	3		yes	
Subtotal	119						
Subtotal with Structure and Circulation Factors	151						
Market Rental Housing							
1-Bedroom	4	48	192	8	Bathtub and shower liner, Stacked washer/dryer, millwork storage		Private laundry, private washroom with bathtub, private kitchen
1-Bedroom (BF)	2	77	154	9	Shower liner, Front- loading washer, front- loading dryer		Barrier-free, Private laundry, private washroom with roll-in shower, private kitchen with barrier-free counter and appliances
2-Bedroom	2	57	114	8	Bathtub and shower liner, Stacked washer/dryer		Private laundry, private washroom with bathtub, private kitchen
2-Bedroom (BF)	2	78	156	9	Shower liner, Front- loading washer, front- loading dryer		Barrier-free, Private laundry, washroom with roll- in shower, private kitchen with barrier- free counter and appliances
Subtotal	616						
Subtotal with Structure and Circulation Factors	782						

Space	Number Required	Room Area (m2)	Cumulative Area (m2)	Floor	Equipment/Furn/Millwork	CCTV	Notes
Storage and Service							
Storage/Loading Area	1	28.0	28.0	1			
Storage (Youth Centre Event Space)	1	20	20	1-2			
Janitor	1	20	20	1,3,4	mop sink, shelving		
Electrical Room	1	25	25	1			
Generator Room	1	22.5	22.5	1			
Mechanical Room	1	197	197	1-2, Roof			
Electrical Panel Room	7	1.7	12	3-9			
Subtotal			324.5				
Subtotal with Structure and Circulation Factors			412				
Functional Program Total			2,930.5				
GROSS FLOOR AREA TOTAL			3,722				

2.5 Code Review

Please find the complete code review in the Appendix.

Design team will re-visit the code review as the design progresses. Since this building has complicated occupancy types, it will trigger stricter building code requirements. A code review consultant may need to be retained to provide a thorough code review.

2.6 Accessibility

The Home Base Yellowknife Mixed-Use Building is designed according to the barrier-free guidelines in Part 3 of NBC 2020 and additional accessibility requirements per the CMHC Affordable Housing Fund that includes designing a minimum 20% of dwelling units to meet stipulated accessibility standards and all common areas to be barrier-free. Some of the accessibility requirements of the CMHC Affordable Housing Fund are considered above and beyond the barrier-free standards of Part 3 of NBC 2020. The biggest impact of these additional requirements is to the floor area and related costs, chiefly increased floor areas for circulation in accessible dwelling units, washrooms, and common areas. The client has advised that they would like to proceed with 25% of dwelling units being accessible. This project contains 43 dwelling units including single-bed dormitories, one-bedroom apartments, and two-bedroom apartments, of which 12 are accessible for a total of 28% accessible dwelling units.

2.7 Harm Reduction

At the draft schematic design review with the client, TAG was given direction that anti-ligature fixtures were not needed by operations. TAG's design proceeds with this directive, but the inclusion of anti-ligature fixtures can be reconsidered at a future phase.

3 Site Considerations

3.1 Site Overview

The site plan provides a two-way driveway that aligns with 49th Avenue located at the center of the site, allowing vehicles to enter the site easily. This plan creates a thoroughfare at the south end of the site that has the potential to be accessed through the adjacent City of Yellowknife parking lot, west of the site. The City of Yellowknife is unable to approve site access through this parking lot without reviewing the project through a development permit application, which will not be submitted until a later design phase. Therefore, the site plan and building have been designed to accommodate the possibility that access through the City parking lot is not granted in the future. A barrier can be erected at this location if access is not granted.

The main floor of the building is divided into two structures, each with its own lobby. The west lobby will be dedicated to the public programs and the Youth Centre Event Space. On the other hand, the east lobby will be allocated for market rental tenants. In this layout, the Home Base and Market Rental entrances are easily identifiable from the front street. Moreover, it creates a clear separation between the Home Base users and rental users. A private entrance, on the west side of the building, facing the park, is dedicated to the Youth Centre users.

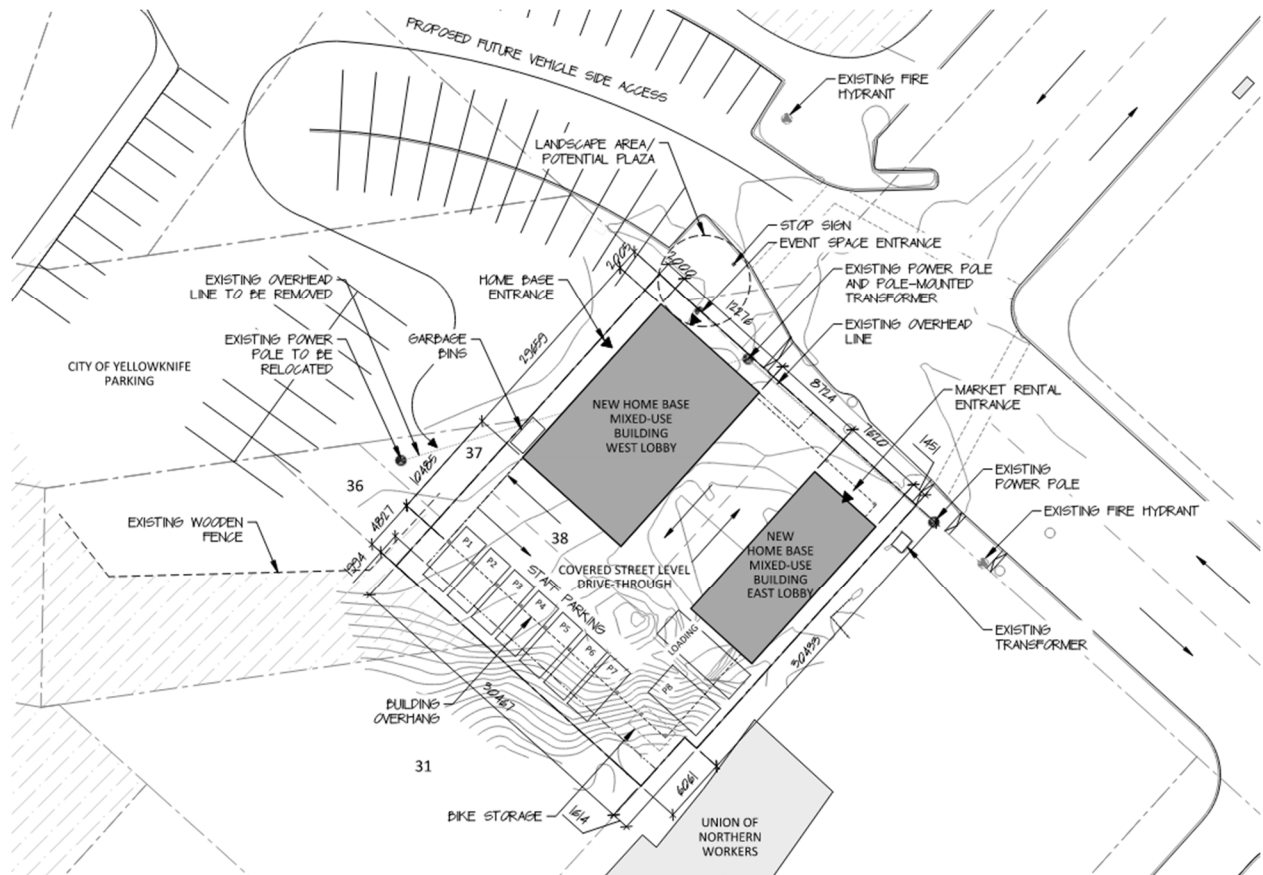
3.1.1 Site Servicing

There are 8 parking stalls and an enclosed bike storage area located on the south end of the site. The loading zone is in the southeast while the garbage bins are located on the west side of the site, adjacent to the parking stalls, which are to be accessed by waste collection via the City parking lot.

3.1.2 Outdoor Activities/Programs

A gate at the entrance of the driveway can close off the undercover area to traffic, allowing the north-south oriented driveway to be used as an outdoor event space for recreation, such as floor hockey, or community events, for example, popup shops or exhibitions.

The 2.5m area in front of the west lobby and the east lobby will be landscaped with native trees and shrubs and furnished with outdoor seating to comply with City of Yellowknife Zoning Bylaw requirements. As the sidewalk extends further out at the northwest corner of the site, the area in front of the west lobby can become a public plaza with the addition of street furniture, creating a public destination for meetings or events.



Proposed site plan.

4 Architectural Design Narrative

4.1 Building Overview

The building consists of nine storeys with the first four floors containing a mix of public spaces, youth centre and shelter, offices, and market rentals. The upper five floors contain a mixture of one-bedroom and two-bedroom residential apartments with the top two floors consisting of market rental apartments. The building contains two circulation cores in the east and west side of the building designated for market rental tenants and Home Base respectively. Floor access will be controlled via fob-access.

4.1.1 Ground Floor

Event Space

The building consists of nine storeys with a three-storey-height lobby and Event Space on the ground floor. A large staircase leads to the Home Base Youth Centre and Shelter on the third floor. The grand staircase is a combination of stair and seating that can be utilized for viewing the ground floor, which can be transformed into a stage for events. Large windows will be used in the lobby and Event Space to highlight the stair and improve the connection between the Youth Centre and the public. The Event Space can open up to the Youth Centre on the third floor and can also be closed off for private functions.

Café (Rental Space)

The Café (Rental Space) is located across from the event space on the ground floor and can be open to the public or reserved for the building occupants. The Café is designed as a kiosk which can be shuttered when closed while surrounding seating can be moved and stored in the building storage rooms.

Home Base Entrance

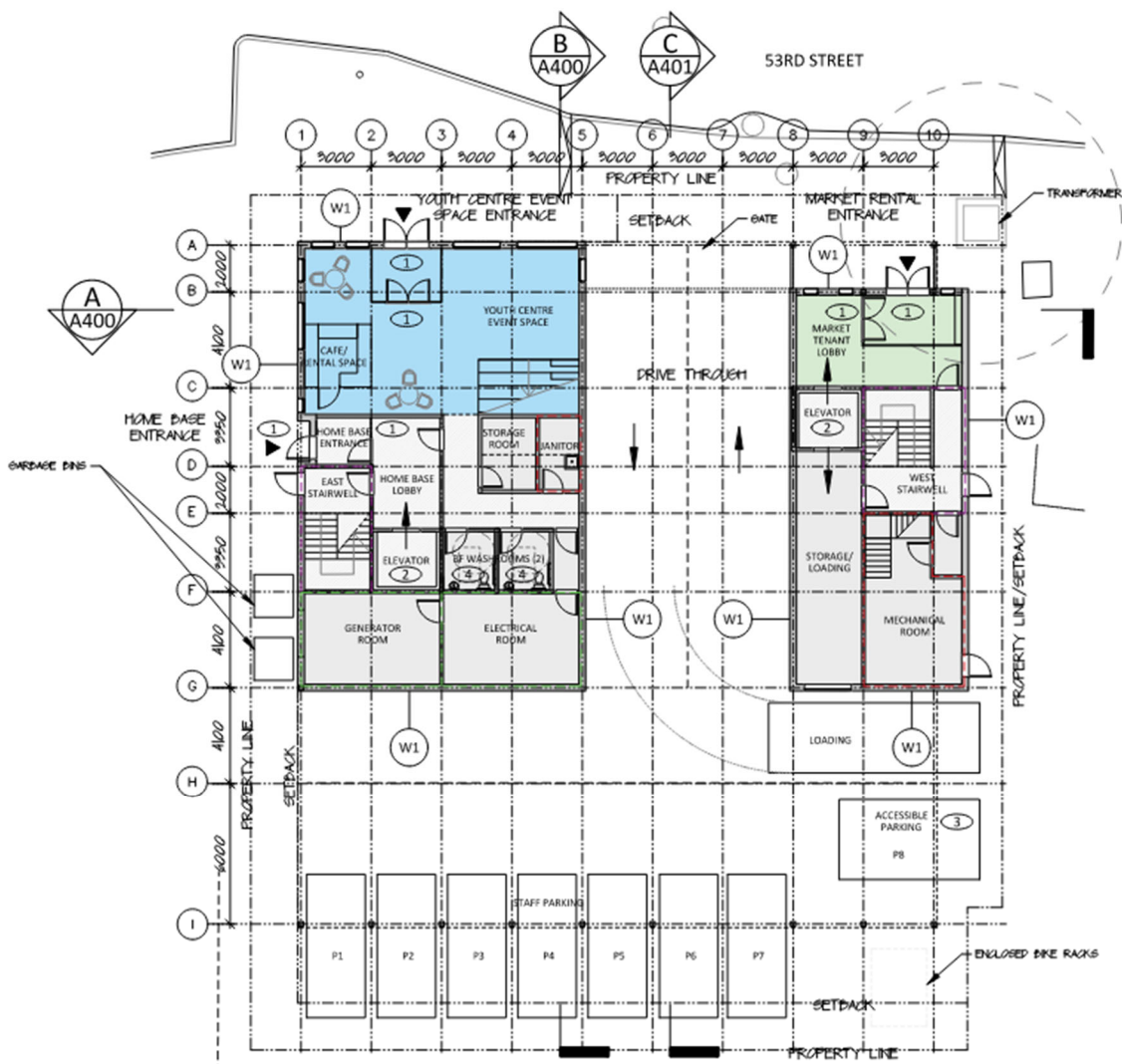
The Home Base Entrance is located on the west face of the building. This private entrance provides a separate, direct access to the Home Base Youth Centre and Shelter and allows the Event Space to be closed off for private functions.

Market Rental Lobby

The Market Rental Lobby is located on the east side of the ground floor and provides a direct, private entrance to the market rental floors. A slatted screen provides additional privacy between the street and the front entrance while also filtering the abundant natural light through the lobby's large windows.

Building Services

The Electrical Room is located on the south side of the building's west lobby while the Loading/Storage Room and Mechanical Room are located on the south side of the building's east lobby.



Ground floor plan.

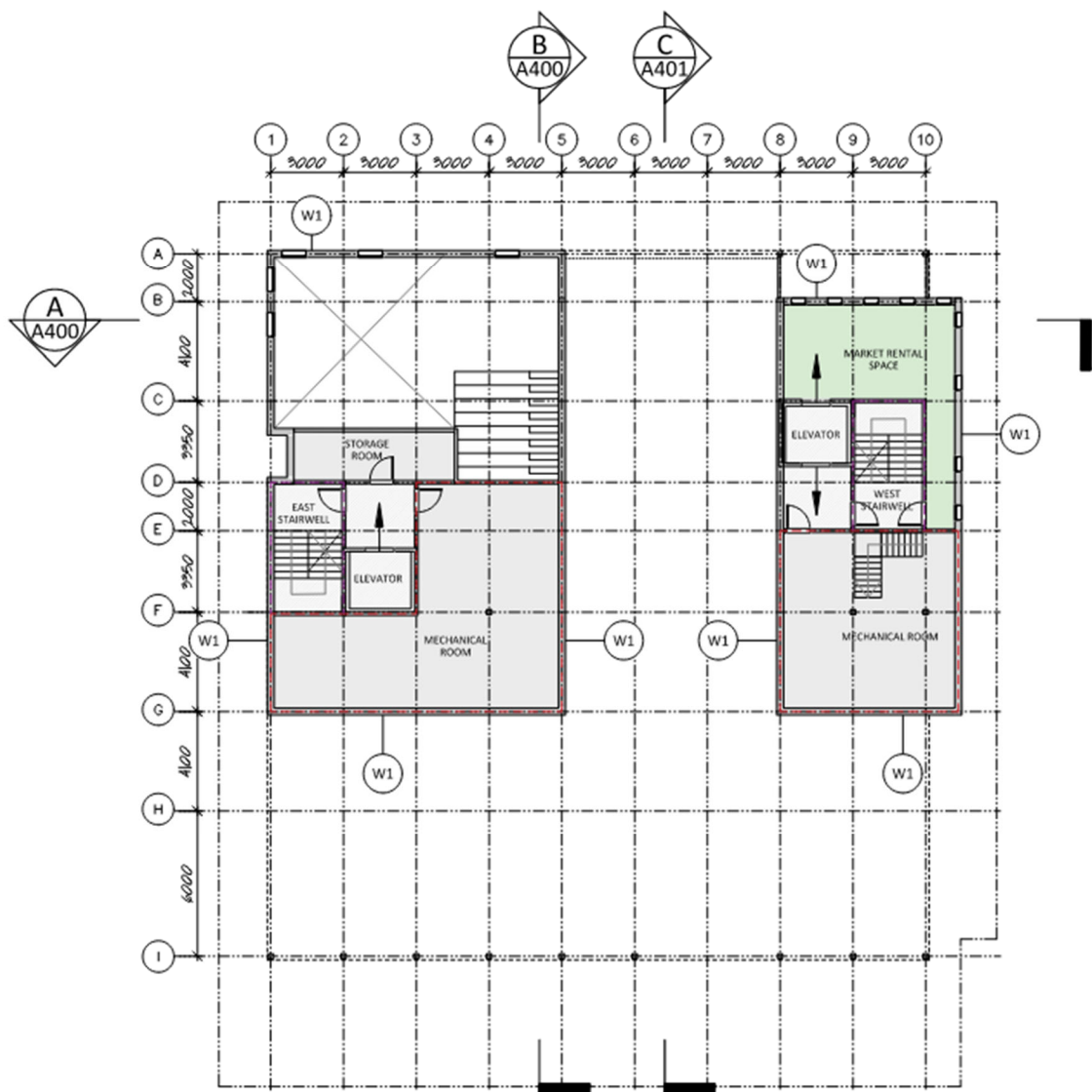
4.1.2 Second Floor

Building Services

A mechanical room and additional storage space occupies the second floor of the west wing. This floor will be restricted to building maintenance staff only.

Commercial Market Rental Space

A small market rental unit is located in the east wing, accessed via the east elevator.



Second floor plan.

4.1.3 Third Floor

Home Base Youth Centre and Shelter

Reception, Office

The Home Base Youth Centre and Shelter occupies the third floor of the building and can be reached from the Home Base Entrance or via the grand staircase in the Event Space. Access to the Youth Centre is controlled through the Reception where staff can screen visitors and assess youth in the Intake Room. The Office is connected to a Sobering Room with space for five cots and an attached washroom with shower, where intoxicated youth can rest before entering the Youth Centre. The Office has workstations for two staff, with direct line of site to the Youth Centre. The Manager Office is located centrally in the Office and has direct line of site to the Youth Centre. Staff can access the Interview and Meeting Rooms opposite the office which are also directly accessible from the Youth Centre.

Lounge, Dining Room, Kitchen

From the Reception, visitors enter the Youth Centre Lounge. The Lounge can be closed off on two ends to create a separate room via sliding glazed partitions. Alternatively, the Lounge can be expanded to the Event Space by opening the partition between these spaces. The option to close off the Lounge from the rest of the Youth Centre allows staff to further control access to the building, particularly at night when the Youth Centre is not in use and youth will only access the Overnight Shelter. The Lounge contains a variety of seating, a television, an electric fireplace, and a pool table.

The Dining Room is connected to the Lounge on the south side of the Youth Centre and contains multiple tables that can be combined into a large, family-style dining table. A high-top table is provided along the south wall of the Dining Room to allow youth to dine separately from larger groups. The Dining Room is situated next to a servery counter off the Kitchen, with a roll-down gate that can be shut when the Kitchen is closed, as well as a handwashing sink. A mobile pan rack for food trays can be located next to the servery while waste bins can be located below the servery counter.

Classroom/Computer Room

The Classroom/Computer Room, located in the middle of the Youth Centre floor, is enclosed with half-glazed walls, allowing line of sight from the Office through the room and to the rest of the floor beyond. The Classroom/Computer Room contains several workstations and computers for youth and contains a projector and projector screen for use with lessons.

Sensory Room

The Sensory Room is a multi-functional space that can be used as a quiet, private space for youth to retreat and de-stress. This space contains variable LED lighting and a projector to create different sensorial experiences. The room can also be furnished with tables and used for activities like crafts and jewellery making with materials stored in millwork cabinets.

Pantry/Food Rescue Room, Laundry Room

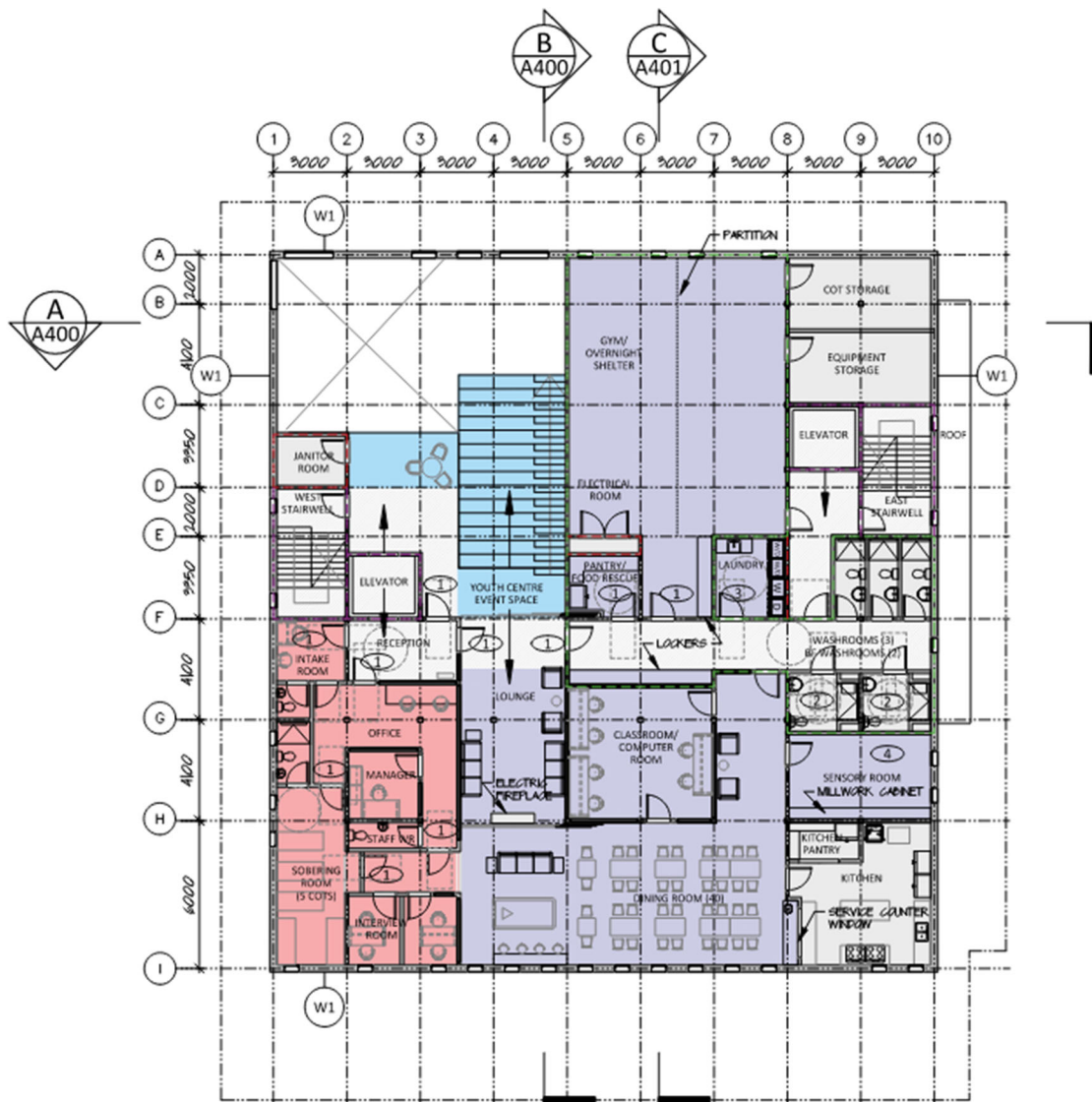
The Pantry/Food Rescue Room and Laundry Room are located in the north side of the Youth Centre, accessible through a corridor off the Lounge. The Pantry/Food Rescue Room will be accessible while the Youth Centre is open and contains freezers and shelves for non-perishable food donations. The Laundry Room will be accessible to users of the Youth Centre and will contain accessible front-loading washers and dryers and stacked washers/dryers.

Washrooms>Showers

Five washrooms with showers, of which two are barrier-free, are located on the east side of the Youth Centre. These will be accessible to all users of the Youth Centre and Shelter.

Gym/Overnight Shelter

The Gym consists of a half-court basketball court which can be divided in two by a fold-up curtain divider. The Gym becomes a shelter in the evening and cots can be moved into the space from the storage rooms located off the Gym. Stacking lockers for overnight use are located inside the Gym's entrance while day-use lockers are located in the corridor outside of the Gym.



Third floor plan.

4.1.4 Fourth Floor

Home Base Office

The Home Base Office contains offices for the Executive Director, Assistant Director, Human Resources, Dorms Manager, and Training Coordinator with additional touch-down workstations for staff and a boardroom for meetings. Additional office spaces include a small Coffee Station next to staff lockers, two washrooms and a storage room.

Dormitories

Lounge, Dining Room, Communal Kitchen

The main entrance to the dormitory floor opens to the Lounge and Dining Room, located on the west side of the floor. The location of the main entrance across from the Home Base Office and next to the Communal Kitchen allows staff to monitor youth coming and going through the space. The Lounge and Dining Room feature large windows to view Frame Lake. The Dining Room is situated next to a servery counter off the Communal Kitchen, with a roll-down gate that can be shut when the Communal Kitchen is closed. The servery counter can become a snack bar when the Communal Kitchen is closed. A mobile pan rack for food trays can be located next to the servery while waste bins can be located below the servery counter.

Single-Bed Dormitory

Nine single-bed dormitories are located on the south side of this floor while three single-bed barrier-free dormitories are located on the east side, providing each dormitory with an exterior view. The nine dormitories contain a built-in twin-XL bed with under-bed storage, a built-in desk and closet. The barrier-free dormitories will be furnished with a twin-XL bed, desk and closet. The dormitories feature variable LED lighting and walls with integrated dry-erase panels.

Washroom

Six washrooms, of which two are barrier-free, are located in the service core of the dormitory floor. Providing six washrooms allows just two individuals to share one washroom.

Youth Worker Office

The Youth Worker office is located within the dormitory floor and contains a built-in desk for three dormitory workers. Its location at an access to the dormitory floor allows staff to monitor youth coming and going through that access point.

Laundry Room

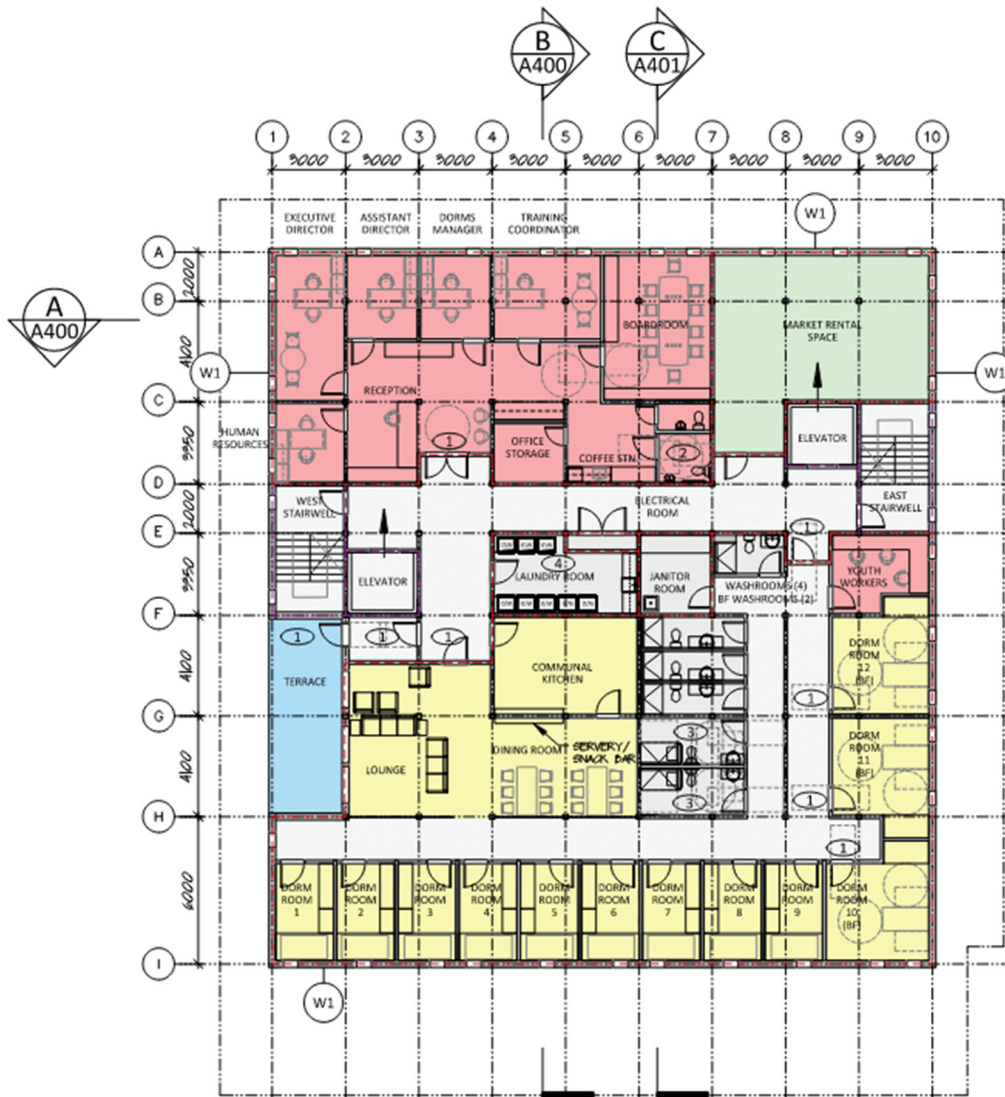
The Laundry Room serves the dormitories and the Home Base One-Bedroom apartments. It contains six stacked washer/dryers and an accessible front-loading washer and dryer.

Outdoor Terrace

Located on the west side of the building, the Outdoor Terrace overlooks Frame Lake and allows further connection to nature for Home Base users. The Outdoor Terrace features a full-height porous screen that provides users with a view out while also ensuring the safety of users in this space.

Market Rental Space

The Commercial Market Rental Space is located on the northeast side of the floor and is accessed via the east elevator and has an exit door that opens out to the main circulation corridor. The space can be configured to suit the tenant.



Fourth floor plan.

4.1.5 Fifth, Sixth & Seventh Floors

Housing Manager Office

The Housing Manager Office is located in a unit on the fifth floor and contains a separate office for the Housing Manager, a built-in desk for four Navigators, kitchenette, and washroom. Maintenance access to the green roof is also available through the Housing Manager Office.

Green Roof

The Green Roof is located on the south side of the building, above the fourth floor. The Green Roof will feature sedum plants that are native to the north, adding another visual connection to nature for residents. This area of the roof will be accessible to building maintenance workers only.

Home Base Apartments

One-Bedroom, One-Bedroom Barrier-Free

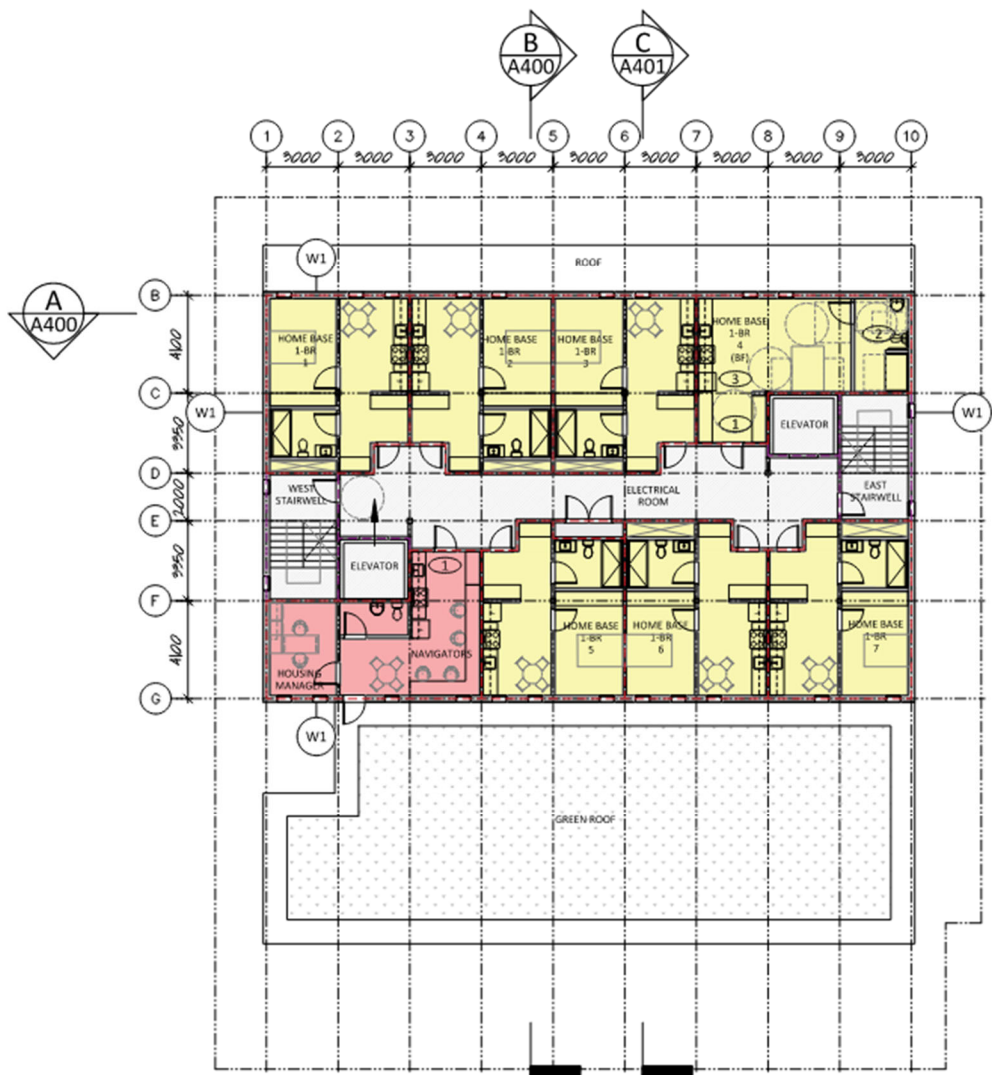
Thirteen Home Base One-Bedroom apartments contain a full bathroom, kitchen, dining area, and bedroom with closet and double bed. Four Home Base One-Bedroom Barrier-Free apartments contain a full bathroom with barrier-free fixtures, kitchen with barrier-free counters and appliances, extended closet space and double bed. As these apartments do not contain laundry units, residents can utilize the Laundry Room on the building's fourth floor. All barrier-free apartments feature an accessible door operator at their entrance.

Two-Bedroom, Two-Bedroom Barrier-Free

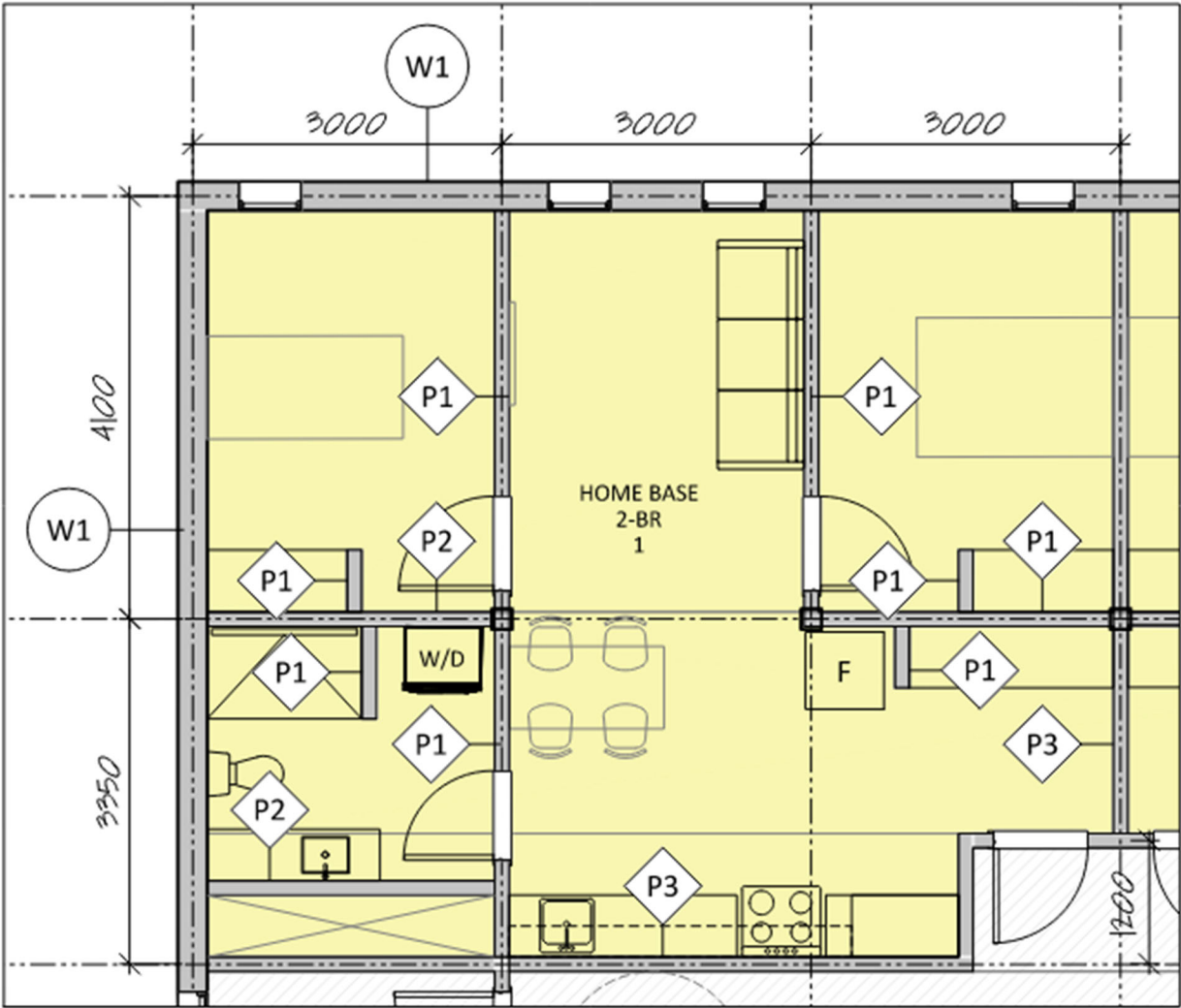
Three Home Base Two-Bedroom apartments contain a primary and secondary bedroom, kitchen, dining area, living area, and full bathroom with a stacked washer/dryer unit. One Home Base Two-Bedroom Barrier-Free apartment contains a barrier-free primary bedroom, a secondary bedroom, a kitchen with barrier-free counters and appliances, a barrier-free kitchen peninsula that can function as a dining table, living area, and a full bathroom with barrier-free fixtures and accessible, front-loading washer and dryer units.

Building Services

A separate garbage room with an access-restricted garbage chute can be provided on each floor above the ground floor to allow residents to deposit garbage without the need to leave the building to access the garbage bins outside. The garbage can be collected in a room on the ground floor and then removed to the garbage bins for disposal. Alternatively, there can be a single garbage room on the main floor that residents where residents can deposit garbage, with building maintenance regularly moving the garbage bins for disposal. These options are to be coordinated in the next phase of design.



Fifth floor plan.



Home Base two-bedroom apartment plan.

4.1.6 Eighth & Ninth Floors

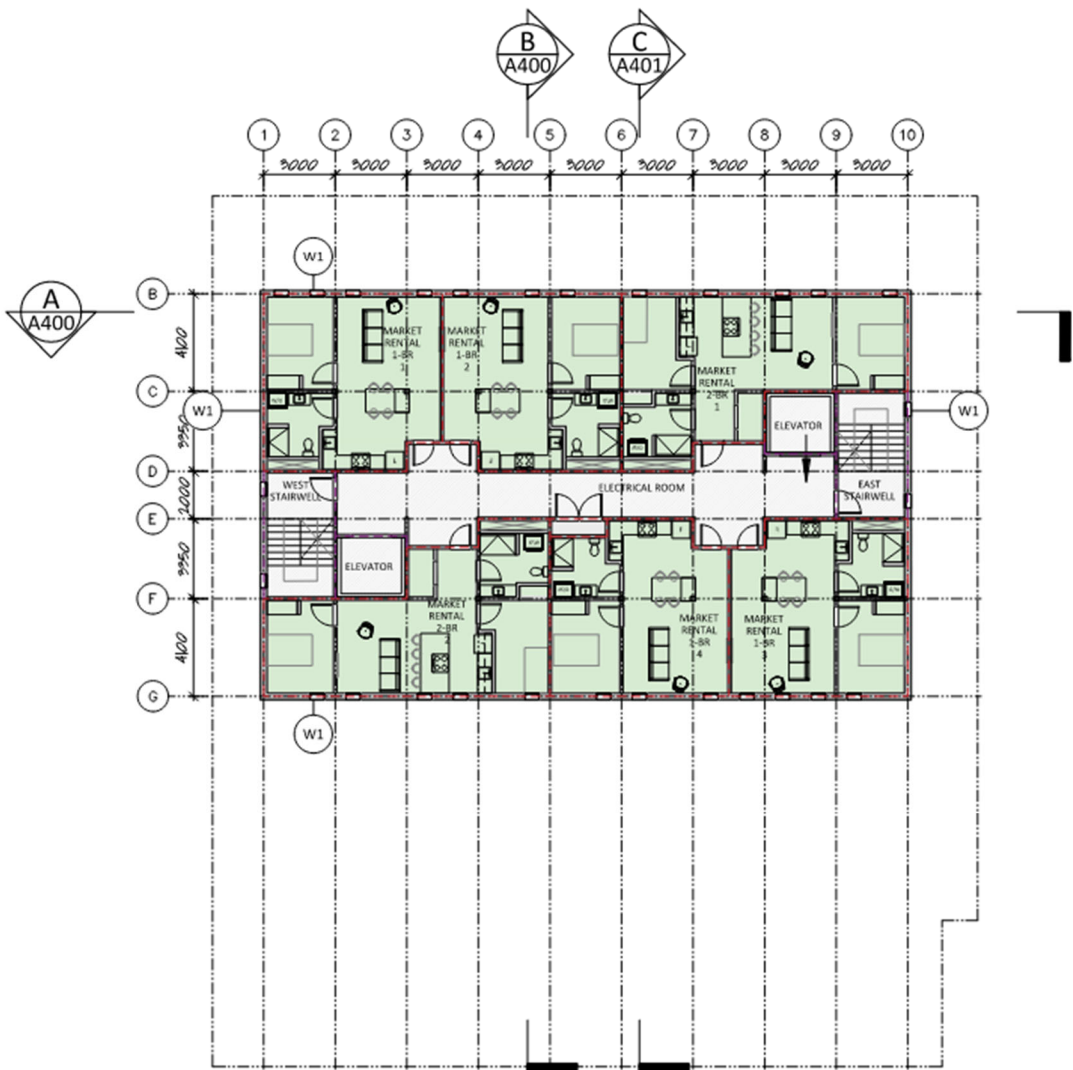
Market Rental Apartments

One-Bedroom, One-Bedroom Barrier-Free

Four Market Rental One-Bedroom apartments contain a full bathroom with a stacked washer/dryer unit, kitchen, dining area, living area, and bedroom with closet and double bed. Two Market Rental One-Bedroom Barrier-Free apartments contain a full bathroom, accessible front-loading washer and dryer units, kitchen with barrier-free counters and appliances, dining area, living area, and barrier-free bedroom.

Two-Bedroom, Two-Bedroom Barrier-Free

Two Market Rental Two-Bedroom apartments contain a primary and secondary bedroom, kitchen, dining area, living area, and full bathroom with a stacked washer/dryer unit. Two Market Rental Barrier-Free apartments contain a barrier-free primary bedroom, a secondary bedroom, kitchen with barrier-free counters and appliances, dining area, living area, in suite laundry with accessible front-loading washer and dryer units, and full bathroom with barrier-free fixtures.



Eighth floor plan.

5 Building Envelope

The following details are proposed assemblies and will be coordinated in the next design phase. The Energy Modeling was conducted with the following assemblies (see Appendix E for the Energy Modeling Report).

5.1 Above Grade Walls

W1 Metal Cladding Rigid Mineral Wool Insulation Exterior Wall

Proposed Insulation Value R-37 Nominal, R-37 Effective

VARIES	22 GA. METAL CLADDING
22 MM	HAT CHANNEL @ 400MM O.C.
	WEATHER BARRIER MEMBRANE
228 MM	RIGID MINERAL WOOL INSULATION BOARDS ATTACHED TO STRUCTURE WITH ACS THERMAL CLIPS @ 400MM O.C.
	PEEL AND STICK AIR AND VAPOUR BARRIER MEMBRANE
16 MM	EXTERIOR GRADE GYPSUM BOARD
140 MM	20 GA. STEEL STUDS @ 400 MM O.C.
16 MM	TYPE-X GWB

5.2 Roof

R1 Mineral Wool Insulation Vented Roof Assembly

Proposed Insulation Value R-56 Nominal

4 MM	MBM GRANULAR CAP SHEET MEMBRANE (TORCH INSTALL)
2.5 MM	BASE SHEET MEMBRANE (MECHANICALLY FASTENED TO GWB, PER MFR.)
16 MM	EXTERIOR GRADE CEMENT BOARD SHEATHING FASTENED TO GIRTS BELOW
76 MM	18 GA. GALVANIZED STEEL GIRTS @ 600 MM O.C.
	VAPOUR OPEN ROOFING MEMBRANE
356 MM	RIGID MINERAL WOOL INSULATION BOARD WITH 76 MM 18 GA. Z-GIRT @ 600 MM O.C. (PERPENDICULAR TO Z-GIRTS ABOVE). Z-GIRTS SCREWED TO DECK WITH #15 SCREWS (DELEGATED DESIGN)
2.5 MMM	SELF-ADHERED AIR AND VAPOUR BARRIER
16 MM	CEMENT BOARD SHEATHING
38 MM	22 GA. ROOF DECK
450 MM	OPEN WEB STEEL JOISTS @ 1500MM O.C.
13 MM	RESILIENT CHANNEL
16 MM	TYPE-X GWB

R2 Mineral Wool Insulation Green Roof Assembly

Proposed Insulation Value R-56 Nominal

100 MM	TOUNDRA BOX GREEN ROOF MODULE
0.8 MM	ROOT BARRIER MEMBRANE
4 MM	SOPRALENE FLAM 250 GR MBM GRNULAR CAP SHEET (TORCH INSTALL)
2.5 MM	BASE SHEET MEMBRANE (MECHANICALLY FASTENED TO SHEATHING, PER MFR.)
16 MM	CEMENT BOARD SHEATHING
354 MM	RIGID MINERAL WOOL INSULATION BOARD WITH 76 MM 18 GA. Z-GIRT @ 600 MM O.C. (PERPENDICULAR TO Z-GIRTS ABOVE). Z-GIRTS SCREWED TO DECK WITH #15 SCREWS (DELEGATED DESIGN)
2.5 MM	SELF-ADHERED AIR AND VAPOUR BARRIER
38 MM	22 GA. ROOF DECK
750 MM	OPEN WEB STEEL JOISTS @ 1200 MM O.C.
13 MM	RESILIENT CHANNEL
16 MM	TYPE-X GWB

5.3 Floor

F1 Slab on Grade

Proposed Insulation Value R-30 Nominal R-30 Effective

100 MM	CONCRETE FLOOR
	AVB MEMBRANE
150 MM	XPS INSULATION

5.4 Exposed Floor

EF-1 Third Floor Level Assembly: Exposed Insulation

Proposed Insulation Value R-47 Nominal

4 MM	FINISH FLOORING
10 MM	G1S PLYWOOD UNDERLAY
100 MM	COMPOSITE CONCRETE FLOOR (64 MM CONCRETE ON 38 MM 22GA COMPOSITE METAL DECK)
600 MM	OPEN WEB STEEL JOISTS @ 1000 MM O.C. WITH 76 MM SPRAY FOAM INSULATION
19 MM	HAT CHANNEL @ 400 MM O.C.
16 MM	CEMENT BOARD SHEATHING
2.5 MM	SELF-ADHERED AIR AND VAPOUR BARRIER

178 MM	RIGID MINERAL WOOL BETWEEN PERPENDICULAR LAYERS 102MM 18 GA. ARMATHERM Z-GIRTS @ 600 MM O.C. SCREWED TO SHEATHING (DELEGATED DESIGN)
	WEATHER BARRIER MEMBRANE
19 MM	HAT CHANNEL
VARIES	20 GA. METAL SOFFIT

5.4.1 Green Roof

TAG recommends installing a green roof on the lower south roof to provide residents with an additional visual connection to nature and enhancing the views from these apartments. Installing a green roof can also reduce building energy use by its added insulation, provides additional health benefits by absorbing pollutants, and cools the area above the roof surface.

5.5 Exterior Doors and Windows

Window shading for the summer months will be considered in the design. Windows will be triple paned, low e-argon gas filled with insulated frames.

6 Interior Finishes

The following are proposed finishes and will be coordinated in the next design phase.

6.1 Home Base Spaces

Youth Centre Event Space

- **Flooring**
 - Concrete
 - Wood clad staircase
- **Wall Finishes**
 - Painted gypsum board

Administrative Spaces and Youth Centre Living Spaces

- **Flooring**
 - Carpet tile (Offices)
 - Marmoleum (Youth Centre Spaces, Reception)
- **Wall Finishes**
 - Painted gypsum board
 - Tempered safety glazing
 - Wood liner below 2134mm (Youth Centre Spaces)
- **Ceiling**
 - Acoustic tile
- **Millwork**
 - Laminate desks (Offices)
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish
 - Stainless steel pulls

Washrooms

- **Flooring**
 - Marmoleum
- **Wall Finishes**
 - Painted moisture-resistant gypsum board
- **Ceiling**
 - Painted moisture-resistant gypsum board
- **Millwork**
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish
 - Solid surface countertops
 - Stainless steel pulls

- **Fixtures**
 - Stainless steel undermount sinks
 - Shower liners (where required)
 - Stainless steel faucets and shower fixtures (where required)

Youth Centre Kitchen/Communal Kitchen

- **Flooring**
 - Safety vinyl flooring
- **Wall Finishes**
 - Painted moisture-resistant gypsum board
- **Ceiling**
 - Painted moisture-resistant gypsum board
- **Millwork**
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish
 - Stainless steel pulls
 - Solid surface countertop
 - Stainless steel countertop (Serving)
- **Fixtures**
 - Stainless steel undermount sinks

Gym/Overnight Shelter

- **Flooring**
 - Multi-sport gym flooring
- **Wall finishes**
 - Painted gypsum board
 - Wood liner below 2134mm

Laundry/Pantry

- **Flooring**
 - Marmoleum
- **Wall finishes**
 - Painted moisture-resistant gypsum board
- **Millwork**
 - Melamine shelving w/ PVC edge finish (Pantry)
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish (Laundry)
 - Stainless steel pulls (Laundry)
 - Solid surface countertop (Laundry)
- **Ceiling**
 - Painted moisture-resistant gypsum board

- **Fixtures**
 - Stainless steel undermount sink (Laundry)

Bedrooms/Dormitories/Washrooms

- **Flooring**
 - LVT
- **Wall finishes**
 - Painted gypsum board
 - Dry-erase wall paneling (in Dormitories)
 - Painted moisture-resistant gypsum board (Washrooms)
- **Ceiling**
 - Painted gypsum board
 - Painted moisture-resistant gypsum board (Washrooms)
- **Millwork**
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish
 - Laminate desks
 - Solid surface countertops (Washrooms)
 - Stainless steel pulls
- **Fixtures**
 - Stainless steel undermount sinks
 - Shower liners
 - Stainless steel faucets and shower fixtures

Apartment Living Spaces (Kitchen/Living Room)

- **Flooring**
 - LVT
- **Wall finishes**
 - Painted gypsum board
- **Millwork**
 - Particle board casework with melamine interiors, laminate doors and drawer faces w/ PVC edge finish
 - Solid surface countertops
 - Stainless steel pulls
- **Fixtures**
 - Stainless steel undermount sinks
 - Stainless steel faucets and shower fixtures

6.2 Market Rental Spaces

Lobby

- **Flooring**
 - Concrete
- **Wall Finishes**
 - Painted gypsum board

Fourth Floor Rental Space

- **Flooring**
 - Marmoleum
- **Wall Finishes**
 - Painted gypsum board

Bedrooms

- **Flooring**
 - LVT
- **Wall finishes**
 - Painted gypsum board

Washrooms

- **Flooring**
 - Ceramic tile
- **Wall finishes**
 - Painted moisture-resistant gypsum board
 - Ceramic tile

Living Spaces (Kitchen/Living Room)

- **Flooring**
 - LVT
- **Wall finishes**
 - Painted gypsum board

6.3 Building Service Spaces

Corridors

- **Flooring**
 - Marmoleum
- **Wall finishes**
 - Painted gypsum board
- **Ceiling**
 - Acoustic tile

Mechanical/Electrical Rooms/Janitor Rooms

- **Flooring**
 - Marmoleum
- **Wall finishes**
 - Painted gypsum board
- **Ceiling**
 - Painted gypsum board

Stairwells

- **Flooring**
 - Concrete
- **Wall finishes**
 - Painted gypsum board
- **Ceiling**
 - Painted gypsum board
- **Stair**
 - Concrete

7 Mechanical Considerations

7.1 General

Mechanical systems for the new building shall provide a comfortable and safe environment for the building occupants, while operating in an efficient and reliable manner. The building life shall be assumed to be fifty (50) years. Building energy efficiency, water efficiency, and indoor environmental quality shall be maximized while meeting project requirements.

Mechanical systems and equipment will be designed in accordance with the latest adopted versions of all applicable codes and standards, including:

- National Building Code of Canada
- National Plumbing Code of Canada, 2020
- National Fire Code
- CSA B139:19 Installation Code for Oil Burning Equipment
- CSA 149:19 Natural Gas and Propane Code of Canada
- CSA B52:18 – Mechanical Refrigeration Code
- ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality
- ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
- ASHRAE Handbooks
- Good building Practices for Northern Facilities, Edition 4
- NFPA 10 Portable Fire Extinguishers
- NFPA 13 Standard for the installation of Sprinkler Systems
- NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- The National Energy Code of Canada for Buildings
- Local Municipal By-Laws, City of Yellowknife
- SMACNA HVAC Duct Construction Standards – 4th Edition

The focus on an advanced level of energy efficiency will increase the complexity of the mechanical controls and systems monitoring, however not beyond the maintenance and servicing capabilities available within the City of Yellowknife. The design will be as simple as possible while still meeting the owner's design parameters for efficiency. Building Energy Modeling will be performed to help inform key decisions on mechanical systems, as well as to demonstrate compliance with energy performance requirements.

7.2 Plumbing

All plumbing and drainage systems shall meet the requirements of the National Plumbing Code of Canada and applicable ASPE standards, together with the additional requirements of Good Building Practice for Northern Facilities.

7.2.1 Domestic Water Supply:

The site has access to the City's municipal underground water system in the street in front of the site. The municipal water system in this area consists of high- and low-pressure mains. Confirmation with the City

of Yellowknife on configuration of recirculation piping, either pumped re-circulation or orifice plate with a connection to low pressure main will be completed during detailed design.

A 100 mm to 150 mm diameter water service pipe is anticipated to meet the requirements of the wet pipe sprinkler system and domestic cold-water system. Sizing to be confirmed based on the hydraulic requirements of the sprinkler system and capacity of the city domestic cold water main, which can be obtained in coordination with the City of Yellowknife, through a hydrant test. The builder will be responsible for administering a hydrant test, and collecting the flow and pressure data.

The domestic water recirculation line is to be connected upstream of the reduced pressure back flow preventer (RPBFP) and water meter. The RPBFP will serve the fire water piping and the water meter will serve the building potable water systems.

An RPBFP and a water meter with a bypass isolation valve will be provided, along with drains for RPBFP for maintenance for the domestic water line serving the fire water supply.

7.2.2 Sanitary And Rainwater Drainage System

The building will use a gravity sanitary drainage system throughout, with individual sanitary stacks running down plumbing shafts from the top units to the individual podiums. Below the building, a single sanitary main will connect to the city's sanitary main in the street in front of the building. Due to the split nature of the vertical drainage lines, a central wastewater heat recovery system is not anticipated for this building. Depending on final layouts, it may make sense to utilize multiple smaller vertical drain water heat recovery units to preheat cold water serving showers/tubs on the upper floors. This will be evaluated during energy modeling.

A grease interceptor will be provided at the floor level of the commercial kitchen and piped into the sanitary system.

Rainwater will be drained from the roof with distributed roof drains, into two internal rainwater leaders down the building, and into the main floor. From here the water will be sent to either site planting or other green spaces away from the building. Consideration for rainwater holding barrels can be given if gardening is a priority, otherwise gravity drainage diverting toward the city's stormwater system will be provided.

Floor drains will be provided in the commercial kitchen, mechanical rooms, in washrooms outside of barrier-free shower stalls, and where required by code. Floor drains in service/mechanical rooms will be provided with trap guards, and in other spaces with trap primers.

7.2.3 Domestic Water Distribution:

Potable water shall be provided throughout the building to all fixtures and equipment service points. Domestic water mains shall be rigid copper piping from the mechanical room to each floor. All domestic hot water re-circulation shall also be piped copper from all spaces.

Water distribution in each residential unit shall be manifold based. Manifolds to be connected directly to the mains and shall be provided with isolation valves. Branch lines from each manifold shall be continuous cross-linked polyethylene (PEX) with no joints, terminating in quarter-turn ball valve stops, with braided

PEX-core supplies to each fixture. One manifold per unit is to be used, with only supply to that unit from each manifold to make it easy to isolate a single unit for repairs and maintenance.

All materials that are in contact with domestic water are to be NSF/ANSI/CAN 61 certified.

7.2.4 Domestic Hot Water Heating

All domestic hot water heating (DHW) to be generated through two commercial propane-fired condensing water heaters. See overall Heating and Cooling Plant Description in Heating section below.

The domestic hot water system shall distribute service water at a single temperature of 60°C.

To provide scald protection on the 60°C domestic hot water system, all lavatories and all showers are to be provided with point of use scald guard mixing faucets or local thermostatic temperature and pressure-compensating mixing valves. Output from all valves shall be no more than 43°C when measured at the fixture.

Domestic hot water recirculation piping shall be provided, complete with balancing valves, where hot water supply piping exceeds 15 m in total length. The length of branch piping from a fixture to a recirculation main shall not exceed 8 m. The domestic hot water recirculation system shall be fitted with only 45° elbows and shall be hydraulically balanced to eliminate concerns over pinhole failures of fittings. Duplex DHWR pumps will be provided, configured in a main-stand-by configuration and on a time-of-day schedule, to minimize waste heat during the night.

7.2.5 Plumbing Fixtures

Plumbing fixtures are to be vitreous china or other aesthetically appealing materials rather than stainless steel in lower traffic areas where practical to provide a more residential feel. Stainless steel may be required for durability in some locations, such as kitchen spaces, laundry rooms and in the service rooms. Barrier-free fixtures to be used in barrier-free washrooms as required.

Faucets and flush valves are to be lever operated, and plumbing fixtures throughout the building will be low or ultra low water usage fixtures to minimize domestic water consumption.

Plumbing fixtures shall meet the following requirements: All plumbing fixtures shall be commercial quality, low water usage (ultra low flow) fixtures. All water closets and lavatory faucets throughout are to be Barrier Free compliant, regardless of barrier free designation of the space.

Standard residences are to have standard oval lavatories at countertops and standard bathtubs complete with faucets and shower fittings. Barrier-free residences are to have wall-mounted ADA compliant lavatories and ADA compliant rollover shower stalls and fixtures.

Kitchen sinks are to be stainless steel with single handle faucets in both residential and commercial areas. Barrier free compliant kitchen sink installations to be included where barrier-free fixtures are indicated by architectural.

Lavatory sinks are to be countertop, vitreous china sinks (residence units), stainless Steel (commercial and public spaces) or wall mounted barrier free sinks (where barrier-free requirements exist, consult architectural).

Floor mounted Janitor sinks (terrazzo or stainless steel) with manually controlled supply fittings, hose attachment, wall brace and mop hanger shall be provided. Stainless steel wall protection to be provided. A utility sink with floor mounted tub on enamel legs to be provided in Laundry Room.

Key-operated, non-freeze hose bibs shall be provided on building exterior, one on each of two opposite sides of building, serving building perimeter.

Fixture-mounted vacuum breakers shall be provided at all hose bibbs and service sinks, and backflow prevention on makeup water to all mechanical systems.

Insulation on all circulating water lines shall be provided to the requirements of NECB 2020 (minimum 25mm thick) with paintable vapour barrier in order to maintain water temperature, minimize heat loss and to prevent condensation.

All exposed piping to be complete with a PVC or canvas jacket over insulation, and colour coded for function.

Piping identification labels and flow arrows are to be provided as per Good Building Practice.

7.3 Heating and Cooling

The primary heating source will be propane boilers, which will be sized to handle the peak building heating load, with additional heat pumps to be operated when climactic conditions allow. There will be 3 boilers, sized to cover 110% of the anticipated maximum heating load. The propane boilers will supply a 40% glycol/water mixture, and be connected to a buffer tank that provides extra fluid volume in the system to reduce short cycling of the heat pumps and the boilers.

The boilers will each have a primary pump which will run when the boiler is firing. A series of secondary pumps will move fluid through the building through a full reverse-return system from the main floor to the roof-mounted heat pump. Every floor will have a supply and return main from the vertical heating supply and return piping. The piping on each floor will deliver the heating/cooling fluid to fan coil units in each space.

Heating of the main occupied spaces will be by concealed or exposed fan coil units, with a single hydronic coil for both heating and cooling. There will be one fan coil per residential unit, and multiple fan coils spread around the offices and other spaces to cover the heating and cooling loads. Fan coil units will have a ducted supply delivering to each space where heating & cooling is required, with return air via transfer openings or ducted where required for acoustic or fire/smoke separation purposes. Special care will be used around any spaces with multiple exposures or large window areas to minimize cold spots.

Cabinet unit heaters will be used in the vestibules to provide quick heat recovery to any spaces that open to the outside, like vestibules, or mechanical rooms, or any loading spaces/exit stair wells. Baseboard heater may also be used to provide some additional heating if losses are very high, or for primary heating in non public facing areas, such as storage rooms or other auxiliary spaces that may not need direct cooling.

To cover the shoulder season heating and the summer cooling loads; while also reducing the dependence on fossil fuels, an air-source heat pump will be included to provide heating above -8°C outdoor air temperature (OAT), and will provide cooling for the summer months. A thermal buffer tank is anticipated, depending on the volume of hydronic fluid in the building. A 6000 L tank (or series of tanks with total volume of 6000 L) should be included in the design at this stage but may be removed/reduced as the design progresses.

The final heat pump heating cut off may be adjusted from -12°C up to -5°C (OAT), depending on the final heat pumps selected. The heat pumps will also provide cooling both the offices and the residential units.

The heat pumps and boilers will both run on a warm weather setback, providing a reduced heating water temperature when OAT is above -25°C and continually decreasing the heating water temperature as the outdoor temperature rises. This will allow the heat pump to operate at a lower delivered water temperature during warmer days, where it can operate at a higher efficiency / coefficient of performance (COP). This overall setback strategy will also allow the building to be more comfortable during the shoulder seasons since heating and cooling system will more closely match the building load, reducing overheating and helping with comfort all summer.

A dedicated split A/C unit will be provided for cooling of the LAN/network room.

7.4 Ventilation

A single large Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) will be provided in the mechanical penthouse on the rooftop of the building and ducted down through the whole building, providing ventilation to all residential spaces, as well as all offices, to meet the ASHRAE 62.1 code requirements for ventilation air. This ERV unit will provide both fresh air and exhaust for all spaces, besides the commercial kitchens.

The lower floors could be provided with a secondary ERV/HRV, which could operate to match the times the spaces are in use, or times that the space is occupied to ensure energy is not used to ventilate when spaces are unoccupied. This ERV/ HRV can be located in the main floor, providing fresh air and exhaust to all of the spaces on the first two floors.

As mentioned above, there is a possibility to be able to reduce, or shut down altogether, the air flow to the spaces which are not occupied in the evenings, saving money on heating and cooling these spaces. This could be done with two units, or by using variable air volume boxes to shut down section (or run them at a much-reduced airflow) in the off hours. This option will be explored further during design development and will be based in part on the results of energy modeling.

Small smoke evacuation fans may be required in the stairwells, which would only be activated in case of fire. These will need to be coordinated with the fire protection system.

Residential hoods above each kitchen range will be provided in the residences. Depending on the layout of the building, it may be easier to provide recirculating hoods with a dedicated exhaust to the HRV/ERV located in the kitchen space, rather than exhausting the hoods directly to the exterior.

Both the commercial kitchen for the youth center and the commercial kitchen for the dormitory will have an in-line or centrifugal blower fan for the grease hood which will be ducted out the south wall of the building and in accordance with NFPA 96, as well as a hydronically-heated make up air unit for each kitchen to prevent depressurization. There may be a chance to combine the make up air systems for the dormitory commercial kitchen, the youth center commercial kitchen, and the laundry to reduce the total number of mechanical systems and aid with reduced maintenance.

Where required, mechanical & electrical service rooms will be cooled through direct outside air ventilation, utilizing an exhaust fan and passive intake opening. The generator will be prevented from overheating by direct exhaust of the radiator airflow to the outdoors and a passive intake opening.

7.5 Fuel Systems

A propane tank will be located on the property to supply both hydronic heating water and domestic hot water. This tank will either require a vaporizer or tank heater to provide sufficient propane flow during the winter. Supply piping from the propane tank to the building will be buried below grade.

Additionally, a small fuel oil day tank will be required for the generator, to provide a minimum of 24 hours of run time for the fire pump. This tank will be installed inside the building and will be filled from the back or the side of the building.

7.6 Fire Protection

A wet pipe sprinkler system designed to NFPA 13 is to be provided throughout the building, unless in areas required by code or that have the possibility of freezing. Vestibules may be served by a wet system with a dry head, or a fully dry pipe system, to prevent freezing of the head. All sprinkler piping is to comply with NFPA 13, with the sprinkler tree in the main floor fire pump room, or other suitable space.

The sprinkler heads will be upright style in open exposed ceiling spaces and service spaces, and pendant style heads in any spaces with dropped T-bar or drywall ceilings and side wall where possible in residential spaces. Guards are to be provided for all sprinkler heads in service rooms and as required. High temperature sprinkler heads will be required above the heating boilers and heating system. Vestibules and exist corridors may have dry heads to provide protection from any temperature dips in these spaces. The space between the podiums, under the second floor of the building, will be protected by a dry system complete with its own zone valve and compressor.

A packaged electric fire pump system, with jockey pump and all associated controls shall be provided, located in the fire pump room in accordance with NFPA 20. Coordinate with electrical all required cable ratings, transfer switches and electrical equipment required to supply power to the fire pump.

Fire Department connection to be provided in accordance with City of Yellowknife and consultation with the City's Fire Department.

The builder will be required to engage a sprinkler design engineer to provide a detailed sprinkler design, with full stamped hydraulic calculations for the building wet and dry pipe sprinkler system.

Fire extinguishers are to be provided throughout the building as required, installed in cabinets in all public and commercial office spaces and mounted on wall brackets in service spaces, sized and located to meet NFPA 10. In addition, small fire extinguishers are to be provided in each residence kitchen.

All mechanical systems to include fire dampers and fire-stopping systems to ensure continued integrity of any fire ratings of partitions shown in the architectural drawings.

The commercial kitchens will both need to have a NFPA 96 hood tied into the fire protection system, with automatic shut off to the cooking equipment energy supply with manual reset, all built into the local hood control systems.

7.7 Controls

In the residences, the controls will be kept to a minimum, with a stand-alone thermostat to control the fan coil units in the space. The thermostats will work with the associated fan coils to control the fan speed and the zone valve for the heating/cooling coil to maintain room temperatures.

For all common spaces, and for all larger mechanical equipment, a Building Management System (BMS) using DDC will be provided, with a computer workstation in the mechanical room for on site maintenance and control, as well as remote connection for maintainers to log in to the system over the internet.

A web-based BACnet compliant direct digital control (DDC) system, with appliance solid-state controllers, shall be provided. Full remote access shall be incorporated into the control system. Controls contractor will require two dedicated data outlets, one for the operator workstation and one for the control system. Controls contractor is to allow provision of coordination, testing and verification of full controls system.

The following capabilities are to be included in the design of the DDC:

1. Control of primary energy consuming equipment;
2. Developing of an optimum start and stop time for equipment and systems that do not operate 24 hours a day;
3. Resetting of air and heating water supply temperatures using feedback from occupied space demand;
4. Using air system to preheat, pre-cool or purge the space, to reach space temperature at the start of occupancy;
5. Control of zone temperatures by way of user-adjustable thermostats with high and low temperature limits set by the DDC and with low room temperatures readings alarming to autodialler.
6. Control of zone temperatures by way of temperature sensors, with all limits set by the DDC system operators.
7. Control of the heat pumps for space conditioning, including hand-off of primary heat to biomass boiler system at an adjustable set point.

All DDC components shall be BACnet compliant, be capable of standalone operation and shall communicate using BACnet protocols for TCP/IP communications over a peerless Ethernet and Token Ring for communication and data transfer. A new web server PC shall operate both as the system server and

as a web-based Internet server that will allow control functions, report functions, all data base generation and modification functions as described for typical DDC workstations to be completed via the Internet from any remote site with Internet access from a 3rd party maintainer if desired.

7.7.1 Alarms

The BMS will be configured to send alarm notifications to service staff and/or activate exterior alarm indicator lights based on critical conditions which include:

- Building low temperature or humidity
- Failure alarms from any HVAC devices, including boilers, pumps, fans, terminal units, motorized dampers, etc.
- Failure alarms from any plumbing devices, including pumps, water heaters, etc.
- Low fuel level in generator tank

8 Electrical Report

TAG Engineering

8.1 General

Electrical installation and systems for the Yellowknife Homebase Residential mixed-use building will be designed with functionality, comfort, and safety of building occupants in mind. Equipment selection will be based on previous experiences on similar projects and proven functionality and maintenance records. In addition, each system will be designed to match the overall aesthetics of the building and individual spaces, while adhering to the latest codes and standards.

The electrical systems and services described within this report include:

- Load Estimate and Service
- Electrical Service for Power and Communication Systems
- Power Distribution System
- Lighting System
- Emergency & Exit Lighting System
- Wiring Devices
- Fire Alarm System
- Building Security Systems
- Communications Systems
- Motor Control
- Stand-by Power Generation

8.2 Codes and Standards

All Electrical systems will meet the requirements of the latest editions of all applicable codes and may include but are not necessarily limited to:

- National Building Code of Canada, (latest edition)
- Canadian Electrical Code, (2021 edition)
- CAN/ULC-S524 Standard for the Installation of Fire Alarm Systems, (latest edition)
- CAN/ULC-S537 Standard for the Verification of the Fire Alarm Systems, (latest edition)
- ANSI/TIA 586A, Commercial Building Telecommunications, Canadian Building Standard, (latest edition)
- CAN/CSA-T529, Design Guidelines for Telecommunications Wiring in Commercial Buildings (latest edition)
- Illuminating Engineering Society (IES) The Lighting Handbook
- Government of Northwest Territories Good Building Practice for Norther Facilities (Fourth Edition, March 2021)

- Special requirements of the national and local inspection authorities having jurisdiction.

8.3 Load Estimate and Service

The proposed facility will be a new mixed-use building, and as such, there are no historical demand records available from the local utility company. Based on that new building power demand will be calculated using watts per square meter method as per CEC 8-210 and the demand load for heater receptacles for vehicles powered by flammable or combustible fuels as per CEC 8-400.

This building will have two usage/occupancy cases:

- Residential Rental (the 2 uppermost floors)
- Commercial Rental and Community Centre

Power utility metering will be as per the client's preferences, as well as the requirements of the local power utility provider (Naka Power). Based on building usage/occupancy based on the options for service entrance(s) as follows:

Service Entrance:

The configuration of the main power feed to the building is dependent on the estimated or calculated maximum total demand. If the maximum total demand is lower than the highest allowable transformer capacity for pole-mounted applications, then the main transformers can be pole-mounted (as opposed to pad-mounted on the ground level), thus saving property space.

Based on the occupancy classification of the building as per the National Building Code of Canada and service load calculations guidelines provided in Section 8 of the Canadian Electrical Code, the anticipated demand for the Yellowknife Homebase Residential mixed-use building is estimated at 244 kW; this includes 10% spare capacity. To provide the simplest power distribution system, the system voltage and configuration of the building is recommended to be a 120/208V 3-phase, 4-wire system.

Based on the above load estimate and the selected system voltage, the calculated size of the main service circuit breaker would be 931 A. It is proposed to provide a 1,200 A circuit breaker.

8.4 Standby Emergency Power

The required genset capacity for standby or emergency power is expected to be approximately 200 kW. At the 208V operating voltage, this results in an emergency load panel of 800 A

Note that this load estimate is preliminary, and the service size will be recalculated throughout the design process as necessary, with a final estimate produced prior to completing construction documents. This depends on whether the client requires this genset for stand-by or emergency purposes.

8.5 Electrical Service

Based on the recent coordination with the local electrical utility provider, Naka Power, it is now required that any electrical services of 400 A and above will be required to be installed and routed underground from the nearest utility pole. As such, It is therefore expected that electrical service cabling for this building will be installed underground from the utility pole to the electrical room located inside the building. Conduit will enter the building inside the Mechanical/Electrical Room located on the main floor. From there, power will be distributed with service wiring routed inside suitably sized rigid steel conduit in a riser configuration to the branch Central Distribution Panel (CDP) located in the hallway on each floor.

8.6 Power Distribution System

As part of the new electrical installation, a Central Distribution Panel (CDP) will be provided inside the Mechanical/Electrical Room located on each main floor of the building. The CPD will include the main service-rated circuit breaker, utility CT section, surge protection device (SPD), customer metering, and distribution panel section.

In addition to the Central Distribution Panel number of electrical sub-panels will be located throughout the facility to feed local loads. Panels will be located away from public access and where possible in close proximity to loads that they will feed. Typically, these panels are located in electrical closets on each floor to distribute power throughout the floor.

All new distribution and branch circuit breakers will be automatic, molded-case type. Uniformity of the manufacturer will be maintained for all breaker panels and breakers. Bolt-on breaker-type panel boards with tin-plated aluminum bussing will be utilized.

It is the intent of the design to specify systems and equipment so as to eliminate the need for power factor correction capacitors on the distribution system. This includes high efficiency, high power factor motors, LED lighting drivers, and any inherently inductive equipment.

Communication Services

It is expected that telecommunication wiring including internet, telephone, cable TV, and fiber optic services will generally follow the routing of the electrical service. Two conduits of appropriate size will be provided from the utility pole location to the location of the telecommunication backboard which will be used as a service demarcation point.

Telephone System

There appears to be discrepancy in Design Brief document in relation to phone system requirements. At the start of the section related to the communication system, the key requirements indicate that an Avaya VoIP phone system will be supplied and installed by the GNWT TSC. Later in the same section of the document under Telephone/Data, it is indicated that the phone system shall be included as part of the construction contract.

GNWT shall clarify the final requirements and confirm if phone system shall be included as part of the design or will it be provided by the GNWT TSC.

Cable TV System

A cable TV distribution system will be designed for this facility. CATV system will consist of signal splitters, signal amplifiers, and wall receptacles and will be interconnected using RG6-type cables. Wiring will be distributed from main telecommunication demarcation point to CATV outlets where indicated in room data sheets. Cables will be routed using cable tray baskets and conduits where required.

System will be designed to allow separate signals and billing capabilities for staff living in apartments on the second floor of the building.

System Grounding

Grounding for the new electrical power system will be achieved by an artificial ground electrode formed by copper-clad ground rods interconnected by copper conductors. It is proposed to provide a minimum of three (3) ground rods spaced no less than 3 meters apart as part of the system.

Copper conductors will be run back to the location of the main grounding bus bar. In addition to the main grounding bus bar, additional grounding will be provided for telecommunication services located inside the proposed Network Room.

8.7 Lighting Systems

The lighting systems will be designed based on the recommended practice of the Illuminating Engineering Society of North America (IES). Specific requirements will also be considered based on information provided inside RFP documents and conversations with project stakeholders.

Interior Lighting

The use of energy-efficient LED sources will be used throughout all areas of the facility. The colour temperature will be between 3500K and 4000K, with high colour rendering indices (CRI) in order to provide a good colour rendering of tissue.

In general office and admin areas direct/indirect recessed fixtures will be provided. In storage rooms and service areas wall mounted or suspended strip LED light fixtures will be provided complete with a protective wire cage. In public washrooms a vandal-resistant, wet listed wall mounted fixture will be utilized. Luminaire choice for remaining areas will be discussed with building staff during the initial design stages. This will allow for a better understanding of their requirements to assure the safety of both workers and tenants.

Typical illumination levels will be as follows:

Area	Average maintained Lux as per code and standards.
------	---

Office and Admin Areas	500
Corridors and Circulation	100
Washrooms	200
Mechanical/Electrical rooms	300
Telecommunication, server rooms	300
Sleeping Rooms	300-500

Low harmonic, high power factor and dimmable electronic drivers will be utilized inside LED light fixtures within the facility.

Where building staff will be working on specific tasks, appropriate task lighting will be provided as close as possible to the working surface. For workstations that are not permanently fixed receptacles will be provided in close proximity to allow for connection of portable task lighting. Such lighting will be provided by building owner and would not form part of the design unless specifically asked for.

Exterior Lighting

For the safety of the occupants and public as well as the security of the building exterior LED lighting design will be provided for the building perimeter. Light fixtures will utilize cut-off lenses to avoid sky lighting pollution and lighting trespass to other buildings located in close proximity of the proposed new Homebase Residential mixed-use building.

The general illumination of the perimeter of the building and the parking lot will be designed to a target level of 25Lux considering 20Lux as the minimum.

Lighting at entrances and exits will be designed so as to provide a minimum illumination of 50Lux, but not more than 200Lux. Exterior lighting shall be building-mounted only unless otherwise directed by the client.

Lighting Controls

Lighting control system will be based on use of line voltage type switches throughout the facility. At this time low voltage control system is not being considered for this project.

It is proposed that dimmable switches will be provided in areas where light adjustment might be required to perform specific tasks or where there is enough daylight coming into the space to justify the use of a daylight dimming system. Those spaces might include but not be limited to offices, meeting rooms, community halls, and seating areas.

It is not expected that dimming switches will be required inside service spaces, storage, or utility rooms.

Occupancy/vacancy line voltage switches will be utilized where practicable. This typically includes office spaces, washrooms, storage rooms, or any other spaces where staff or occupants might only be present for short periods.

Exterior-mounted luminaires will be controlled via a combination of an exterior-mounted photocell and a Hand/Off/Auto control panel.

8.8 Life Safety

8.8.1 Fire Alarm System

The facility will be provided with an addressable, single-stage fire alarm system with a battery-based emergency power supply. The main fire alarm control panel will be located in the electrical room with an annunciator located in the main entrance to the facility and any other entrance deemed as a fire-fighting entrance.

All fire alarm detection and addressable loop wiring will be Class-A and all output devices will be Class-B. Horn-strobe devices will be provided throughout the building.

Intelligent type smoke and heat detectors will be provided wherever smoke detection is required by the National Building Code and CAN/ULC-S524. Manual, addressable pull stations will be installed within 3m of all exits and provided with protective covers.

Smoke detectors should be avoided in spaces where cold outside air could enter due to an opened door or window since the condensing air can cause false alarms.

Intelligent, duct-type smoke detectors will be installed in air handling systems where required by NBC. Air handling equipment is to be designed to shut down upon activation of its dedicated duct detector or the fire alarm system.

The fire alarm system will be connected to a remote fire alarm communicator that meets the requirements of CAN/ULC for remote reporting of fire alarm systems as well as being approved by the NWT Fire Marshal. The fire alarm communicator will be connected to the telephone line and internet for reporting with the understanding that the owner will create an account with an approved central monitoring service.

All fire alarm wiring will be in conduit and will not share conduit with other cables for other systems.

8.8.2 Emergency and Exit Lighting

All emergency lighting in the building will be accomplished by using battery packs and double remote heads with low-voltage LED lamps. The battery packs will also supply DC power to the exit lights for illumination under the condition of normal power failure.

Where there is a potential for emergency lighting to be damaged or vandalized, appropriate vandal-resistant light fixtures with the most appropriate impact rating will be specified.

AC light emitting diode (LED) type exit lights, that conform to CAN/CSA-C860 will be used to provide energy efficiency and to meet the proposed CSA/NBCC standard.

The exit signs specified will meet the National Building Code requirement that exit signs consist of a green pictogram and a white graphical symbol, commonly referred to as the “running man”.

8.9 Building Security System

8.9.1 CCTV System

Video Surveillance System (CCTV System) will consist of interior and exterior mounted cameras, centrally located recording equipment, and viewing screens that can be installed in a location designated by the client. As a minimum cameras will provide coverage of the entrance vestibule, all exterior doors, and staff parking. Exact locations and coverage will be discussed in detail with project stakeholders during the detailed design stage.

Cameras would be wired using CAT6-type data cables in a star topology. This means that each camera is wired directly from its location to the location of the network recorder.

All interior and exterior cameras will have rugged, high-impact, vandal-resistant body construction with an impact resistance rating of IK10. In addition, exterior-mounted cameras will be provided with integral heaters to allow for the operation of the equipment in temperatures as low as -40°C.

The network recorder will be located inside the Network Room with direct wiring to the location of the monitoring screens. The system will be capable of displaying multiple camera views on the monitor at one time.

8.9.2 Access Control System

An access control system will be provided and integrated with the door hardware. The system will provide for each staff member or authorized guest to have a unique identifier associated with an access card or other device. The system will allow each individual their unique authorization for selected areas of the facility. The system will consist of access door controllers, card readers, proximity cards and/or fobs, and other associated equipment to provide a fully functional system as per requirements of GNWT Department of Health & Social Services.

Device readers will be located at all doors identified by the client. Final quantities and locations will be confirmed with the building end user.

The building's access control system will be linked with a fire alarm system to release locks upon activation and alarm. The system will also be integrated with a barrier-free door system where applicable to avoid damaging door opener motors while doors are closed by the card system.

The system will be specified to meet the existing access control system already utilized by GNWT Department of Health & Social Services.

8.9.3 Panic Alarm System

A panic alarm system will consist of a main control panel, central annunciator, push buttons, dome lights, and audio alarm devices. Panic buttons will be located in strategic places to provide best protection for staff from aggressive clients or intruders. The final locations of all related devices will be confirmed during the design stage in coordination with the building end user and staff.

The system will be connected to the fire alarm DACT and monitored for alarm by a certified monitoring station such as Arctic Alarm Ltd.

8.10 Wiring and Wiring Devices

Wiring devices will be designed so as to provide the required functionality while retaining the safety and security required by the area they are used in.

All wiring shall be RW90-XLPE, routed through conduit or AC90 (BX) cable. NMD 90 cable will be considered where the use of conduit or AC90 cable proves impractical. Where exposed, all cables will be run in conduit.

Main electrical service feeders and feeders for the branch circuit panels will be copper type. All branch wiring will be copper.

In office spaces no more than four (4) receptacles will be wired for same circuit breaker. Printers and other similar equipment will be provided with receptacles connected to dedicated circuit breakers.

In other areas where general-use receptacles will be provided, no more than eight (8) receptacles will be wired from the same circuit breaker.

Exterior receptacles will be provided with CEC-approved weatherproof 'while-in-use' covers. Intelligent Parking Lot Controller (IPLC) receptacles will be utilized as parking receptacles where required.

8.11 Communication Systems

8.11.1 Structured Wiring

A structured wiring system will be provided throughout the facility to support the communication needs of the building.

Wiring will be of Category 6 type and will be distributed using a star topology with individual cables being home run from the wall receptacles back to the patch panels located in the communication room. Wires will be distributed using a combination of basket-type cable tray and suitably-sized conduit. Cable tray will be provided in accessible ceiling space along the main corridors and they distributed to individual wall outlets inside EMT conduit.

Category 6 cabling, patch panels, and outlet jacks will be of the same manufacturer to provide a complete and certified system. All wires will be tested and results will be provided as part of the O&M Manual.

Each structured wiring outlet will be provided with four (4) jacks.

Patch panels and communication racks will be located inside centrally located communication equipment room which will ensure that maximum horizontal distance to outlets will not exceed 50 meters.

Design for structured wiring system will meet requirements of CAN/CSA-T529 “Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings”, ANSI/TIA-568 “Commercial Building Telecommunications Cabling Standard” as well as the GNWT Good Building Practice for Norther Facilities.

8.12 Motor Control

In general, all motorized equipment with motors rated 0.37 kW and smaller will be single phase, 120V, and motors larger than 0.37kW will be three phase. There may be occasional exceptions to this rule based on the availability of motors on selected pieces of mechanical equipment.

Single-phase motors that are 1hp or less will be controlled using motor protection switches and contactors. Connections to mechanical systems will be supplied as required by the mechanical equipment installed.

All disconnects, motor protection switches, starters, and load-rated relays will be provided under the electrical divisions. All combination starters will include adjustable electronic trip units with instantaneous and time-delayed over-current protection, single-phase and voltage protection, breaker-type disconnects, and LED service lights. All three-phase starters will be equipped with auxiliary contacts for interlocking as required. All starters shall be sized to NEMA standards.

Motors that are to be speed-controlled via variable frequency drives (VFDs) will be specified to be compliant with NEMA 31, a standard specifically tailored to address the high transient voltage conditions associated with VFD’s. Variable frequency drives for all mechanical equipment will be specified under the Mechanical Division 23 and 25.

8.13 Energy Conservation Features

To minimize and control energy consumption and to provide a sustainable, efficient, and functional system for the facility, it is proposed that the following special features be incorporated into the electrical systems of the centre:

- Energy-efficient dimmable lighting fixtures with:
 - Dimmer controls.
 - Building Management Control System (BMCS) for lighting.
 - Occupancy or schedule control of lighting in all areas

9 Project Costing

9.1 Project Budget

TAG understands the client is using different funding streams to finance this project. It will be important that the client ensures that the overall budget approved by the funders is adjusted after schematic design, so that the design can proceed with a measure of certainty that impactful design changes will not be required. While certain elements can be removed during later stages of design, a fundamental design approach such as a green roof is not easily removed and would result in a schedule delay and additional design fees if it were to be removed following schematic design approval.

9.2 Cost Estimates & Pricing Options

Hanscomb has completed a Class B cost estimate of the design presented here. The estimate is **\$47.1m**, including the construction allowance.

The following summary is taken from page 12 of the Hanscomb report. Please see Appendix G for the full cost estimate.

CONSTRUCTION COST ESTIMATE SUMMARY

Description	Quantity	Rate	Amount
New Construction	4,431 m2	5,995.06	\$26,564,100
Site Development	1 Sum		\$705,600
Sub-total	4,431 m2	6,154.30	\$27,269,700
General Requirements & Fee	26.0%		\$7,090,100
Fee	10.0%		\$3,436,000
Sub-total	4,431 m2	8,529.86	\$37,795,800
Design & Pricing Allowance	10.0%		\$3,779,600
Escalation Allowance	8.0%		\$3,326,000
Total Construction Cost	4,431 m2	10,133.47	\$44,901,400
Construction Allowance	5.0%		\$2,245,100
Total + Construction Allowance	4,431 m2	10,640.15	\$47,146,500

Appendix

A Geotechnical Desktop Study

Desktop Geotechnical Evaluation for New Homebase Multistorey Residential Project, Yellowknife, NT



PRESENTED TO
Taylor Architecture Group

AUGUST 7, 2024
ISSUED FOR USE
FILE: ENG.YARC03622-01

This page intentionally left blank.

1.0	INTRODUCTION	1
2.0	PROJECT DETAILS	1
3.0	SCOPE OF WORK AND METHODS.....	1
3.1	General	1
3.2	Desktop Study.....	1
4.0	SITE DESCRIPTION	2
4.1	Location	2
4.2	Climate.....	2
4.3	Geological Setting.....	2
4.4	Anticipated Surface Conditions.....	3
4.5	Anticipated Subsurface Conditions.....	3
4.5.1	Overburden.....	3
4.5.2	Bedrock.....	4
4.6	Anticipated Permafrost Conditions	5
4.7	Anticipated Groundwater Conditions	5
5.0	RECOMMENDATIONS AND CONSIDERATIONS.....	5
5.1	General	5
5.2	Climate Change Considerations	6
5.3	Rock-Socketed Steel Pipe Piles	6
5.3.1	General	6
5.3.2	Conventional Rock-Socketed Steel Pipe Piles	7
5.4	Shallow Foundations	8
5.5	Frost Protection.....	9
5.6	Construction Excavation and Dewatering.....	9
5.7	Site Grading and Drainage	9
5.8	Cement / Concrete Type.....	10
5.9	Seismic Site Classification and Seismic Hazard	10
6.0	DESIGN AND CONSTRUCTION GUIDELINES	10
7.0	REVIEW OF DESIGN AND CONSTRUCTION.....	11
8.0	CLOSURE.....	12
	REFERENCES	13

LIST OF TABLES IN TEXT

Table 4-1: Groundwater Level	5
------------------------------------	---

APPENDIX SECTIONS

FIGURES

- Figure 1 Site Location Plan
- Figure 2 Rock-Socketed Steel Pipe Pile Detail (Unslotted and Slotted)
- Figure 3 Generic Perimeter Insulation Details for Shallow Foundations

APPENDICES

- Appendix A Tetra Tech's Limitations on the Use of this Document
- Appendix B Construction Guidelines

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Taylor Architecture Group and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Taylor Architecture Group, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) conducted a desktop geotechnical site evaluation on behalf of Taylor Architecture Group (TAG) to support the design of the new homebase residential apartment units in Yellowknife, NT.

The objective of this desktop evaluation was to develop recommendations for the geotechnical engineering aspects of design and the construction of the new building based on a review of existing geotechnical information available from nearby developments in Yellowknife.

Authorization to proceed with this work was provided by TAG, via a services agreement dated April 23, 2024.

2.0 PROJECT DETAILS

Tetra Tech understands that TAG requires engineering support for the construction of the new residential apartment units. Based on the Pre-Design Report (2023-07-24), Home Base Yellowknife has acquired a lot (Lot 38, Block 27, Plan 4703), referred to as “subject site” in this report, at 4906 53rd Street in downtown Yellowknife. It is understood that the building may be as tall as eight stories. It is further understood that a basement is not currently being considered. The site location is shown in Figure 1.

3.0 SCOPE OF WORK AND METHODS

3.1 General

Based on the requirement of National Standards of Canada CAN/BNQ 500/2017, the scope of work for this desktop study was understood to consist of the following:

- Conduct a review of available information for the site, including nearby geotechnical investigation reports, borehole or testpit logs, surficial geology maps, bedrock geology maps, aerial photography, satellite imagery, historical climate records and any other relevant documents.
- Prepare an evaluation report that describes the findings from the desktop review and provides associated foundation recommendations.

3.2 Desktop Study

Tetra Tech reviewed the following available information for the proposed site in Yellowknife: aerial photographs, satellite imagery, surficial geology maps, bedrock geology maps, topographic maps, and previous geotechnical reports from nearby investigations. A complete list of information sources is included in the references section of this report. The locations of geotechnical site investigations and geotechnical studies are shown in Figure 1.

It should be noted that Tetra Tech has neither conducted a site investigation nor conducted a detailed inspection of the proposed sites. All descriptions and recommendations presented in this report are based upon the sources listed in the references.

4.0 SITE DESCRIPTION

4.1 Location

Yellowknife is the capital city of the Northwest Territories and is located in the North Slave Region, at approximately latitude 62° 27' North and longitude 114° 22' West.

The subject Site is located in the city center on the east Frame Lake shore. This lot is bounded to the southeast by an existing building, to the northeast by 53rd Street, to the northwest by a parking lot and to the southwest by vacant land. The subject site is shown in Figure 1.

4.2 Climate

Climate data for Yellowknife is available from 1942 to the present (Environment and Natural Resource, 2024). The mean annual air temperature (MAAT) for the period of record is -4.7°C.

The annual air temperature has been gradually increasing in Yellowknife. The temperature warming trend was analyzed using linear interpolation of the average annual temperature data between 1994 and 2023. The average rate of increase has been about 0.003°C per year in recent 30 years. The MAAT has averaged -3.8°C over the last 30 years (1994-2023).

The annual freezing and thawing indices have averaged about 3,183 Celsius degree-days and 1,845 Celsius degree-days, respectively, for the period of 1994 to 2023.

The mean annual total precipitation for Yellowknife over the period from 1994 to 2023 is about 275 mm, approximately 40% of which falls as snow. Total precipitation has increased over the period of record, with a 2% increase from the 1963-1992 interval to the 1994-2023 interval.

4.3 Geological Setting

Yellowknife lies within the Canadian Shield and is underlain by Archean meta-volcanic and meta-sedimentary rock of the Yellowknife Supergroup intruded by younger granitoid rocks. The most recent glaciation has resulted in widespread bedrock exposure.

Geological mapping indicates that the subject site is underlain by mafic volcanic (mainly basalt) rocks of the Kam Formation (Henderson, 1985).

Retreat of the continental glaciers occurred about 8,000 to 10,000 years ago (Prest, 1969). Deglaciation generally resulted in deposition of glaciofluvial sediment consisting of outwash sand and gravel, followed by deposition of glaciolacustrine sediment in glacial Lake McConnell, which covered the area.

Based on a surficial geology map of the Yellowknife area, glaciofluvial sediments comprising sand and gravel to cobbles of variable thickness, are mapped overlying the Archean bedrock in the area of the subject site (Wolfe and Kerr, 2014).

4.4 Anticipated Surface Conditions

Based on a brief site visit, the east quarter portion of the subject site is developed and occupied by an apartment building; the western portion is undisturbed and covered by trees; and the north quarter portion is not developed but covered by a layer of sand and gravel (fill), possibly extending from the adjacent parking lot. There are also some trees at the north corner of the site. A large bedrock outcrop ridge encroaches onto the south portion of the site.

Surface drainage is expected to be towards northwest toward Frame Lake.

Available elevation contours for the area (ATLAS, 2024) indicate that the most of site is generally flat while the natural ground slopes down gently towards Frame Lake located to the northwest, with an elevation of about 191 m to 192 m above mean sea level (masl), except the south corner of the site, where large rock outcrops, slope towards the north.

4.5 Anticipated Subsurface Conditions

Subsurface conditions at the proposed sites are characterized based on interpretation of satellite imagery, surficial geology maps, as well as subsurface data obtained during previous investigations in close vicinity to the subject site.

Subsurface investigations completed within about 400 m of subject site include the Library and Civic Plaza site (EBA, 2008), the New Mixed Use Building site (Tetra Tech, 2023), the Lot 19 & 20 site (Thurber, 1994), and the Nunasi Boarding Home Site (EBA, 2009). In addition, observations of subsurface conditions were also made for the Gerry Murphy Arena site (EBA, 2002) which is immediately adjacent to the northwest of the subject site.

Findings from the above-noted subsurface investigations give some indication of the general subsurface conditions in the area. Since these observations cannot be directly applied to the site in question, the following discussion presents anticipated conditions at the subject site. Actual conditions encountered may differ from those described below.

4.5.1 Overburden

Fill

A layer of fill, extends from the adjacent parking lot located northwest of the subject site, is found on the north portion of the site. The fill was encountered in all boreholes and averaged 0.7 m at the Gerry Murphy site including the parking lot (EBA, 2002).

Organics / Peat

A layer of organics and/or peat is anticipated to be encountered at the undisturbed ground surface on the subject site.

A thin layer of peat with an averaged thickness of 0.2 m was encountered below the fill in two boreholes at the Library and Civic Plaza site (EBA, 2008) and the peat was described as consisting of rootlets, wood chips, twigs, leaves and other organic material with occasional inclusions of mineral soil. Similarly, topsoil consisted of vegetation, organics and roots was encountered with thickness ranging from 0.4 m to 1.3 m and averaged 0.6 m in all boreholes at the Lot 19 & 20 site (Thurber, 1994).

Sand

Sand is the prevalent near-surface natural soil in close vicinity to the subject site and is anticipated below the fill or topsoil. Sand was encountered in most of the boreholes reviewed for this project (EBA, 2002; EBA, 2008; EBA, 2009; Thurber, 1994 and Tetra Tech, 2023). In nearby sites, the gradation of the layers varied from sand to sand with some gravel, trace of silt (EBA, 2002) to silty (Tetra Tech, 2023), and appeared well graded (EBA, 2008).

The consistency of the sand measured by SPT testing was observed to range from loose to dense (EBA, 2002 and EBA, 2008), although one sample collected in EBA 2008 BH-06 had an SPT-N value of 3, indicating a very loose sand at that location (EBA, 2008). In addition, SPT testing showed the sand was compact between depths of about 2 to 3 m below ground surface, and generally dense to very dense with increasing depths below 3 m (Tetra Tech, 2023).

Moisture contents ranged from 3% to 21% and averaged 9% at the arena site (EBA, 2002); and ranged from 5% to 22% and averaged 16% the Library and Civic Plaza site (EBA, 2008). Where it could be discerned, the thickness of the sand layer ranged from about 1.0 m to about 4.0 m (EBA, 2002 and EBA, 2008). Most recently, findings from the geotechnical investigation at the New Mixed Use Building site indicated that sand was damp to very wet, with natural moisture content ranging from 5% to 8%, and averaging 6% above the groundwater table; and ranging from 17% to 24%, and averaging 20% below the groundwater table (Tetra Tech, 2023).

Clay / Silt

A layer of clay/silt may be observed to be interbedded with sand or below the sand at the subject site.

Geotechnical data from an investigation of the Gerry Murphy site, indicated encountered clay/silt in five of six boreholes (EBA, 2002). At the sites, the clay/silt was encountered at depths ranged from 2.1 m to 5.5 m and averaged 3.1 m below grade. Moisture contents ranged from 14% to 26% and averaged 20% (EBA, 2002).

Similarly, clay/silt was encountered at the Library and Civic Plaza site (EBA, 2008). It's described as firm to stiff and low plastic. The fines content ranged from 57% to 75% (EBA, 2008). The clay/silt is generally found directly on top of bedrock.

4.5.2 Bedrock

Based on the review of aerial imagery (Google Earth, 2024) and a site visit, a large bedrock outcrop is located southwest of the subject site and encroaches into the southwest portion of the site.

Bedrock was found in five of eight boreholes drilled at the Gerry Murphy site (EBA, 2002). Where encountered, depth to bedrock ranged from 0.9 m to 14 m below ground surface. The bedrock depths indicates that the bedrock below the site slopes down steeply from south to north (EBA, 2002).

Bedrock was encountered in only one of seven boreholes at the investigation depths during the geotechnical investigation for the Library and Civic Plaza site (EBA, 2008). Similarly, only one of six borehole was refused due to bedrock at the New Mixed Use Building site (Tetra Tech, 2023). However, bedrock was encountered in all boreholes at the depths ranging from 0.8 m to 5.8 m at the Lot 19 and 20 site (Thurber, 1994) and the Nunasi Boarding Home Site (EBA, 2009).

Based on the information above, bedrock is anticipated to be about 10 m deep, though it may be deeper in some areas particularly near 53rd Street, and shallower at the back of the lot.

4.6 Anticipated Permafrost Conditions

Based on a ground ice map of Canada (O'Neill et al., 2020), Yellowknife is located within the discontinuous permafrost zone.

Permafrost was not encountered in any of the boreholes advanced during previous investigations in close vicinity to the subject site (EBA, 2002; EBA, 2008; EBA, 2009 and Tetra Tech, 2023). Furthermore, ground temperatures of +3.3°C and +3.0°C were measured in EBA's 2002 BH-04 at depths of 5.5 m and 9.0 m below grade, respectively (EBA, 2002). Considering this it is unlikely that permafrost underlies the site.

The near ground surface was found to be seasonally frozen when drilling the EBA 2002 boreholes in mid-November. The near surface ground was also observed to be frozen between depths of 0.9 m and 1.5 m in one of EBA's 2008 boreholes at the end of May, as a result of seasonal frost penetration. Consequently, seasonal frost was encountered in most boreholes and the maximum frost depth was up to 3.3 m below grade (EBA, 2009).

4.7 Anticipated Groundwater Conditions

Groundwater depths were measured in standpipes installed in three boreholes during the investigation at the Gerry Murphy site (EBA, 2002), in two boreholes at the Library and Civic Plaza site (EBA, 2008), in one borehole at the Nunasi Boarding Home Site (EBA, 2009), and in three boreholes at the New Mixed Use Building site (Tetra Tech, 2023). The readings are presented in Table 4-1 below:

Table 4-1: Groundwater Level

Borehole Number	Water Below Grade (m)
EBA 2002 BH-01	3.30
EBA 2002 BH-02	4.45
EBA 2002 BH-08	5.40
EBA 2008 BH-02	1.95
EBA 2008 BH-06	0.63
EBA 2009 BH-04	2.60
Tetra Tech 2023 BH 03	2.88
Tetra Tech 2023 BH 04	3.22
Tetra Tech 2023 BH 05	2.98

Groundwater level at the site may be expected to fluctuate seasonally and in response to precipitation, especially during the spring freshet and after heavy rains.

5.0 RECOMMENDATIONS AND CONSIDERATIONS

5.1 General

The review of available information suggests that the site is acceptable for the proposed development, from a geotechnical perspective. The following foundation types have been considered:

Rock-Socketed Steel Pipe Piles: Exposed or shallow bedrock is found locally in the city, and other structures have been founded upon rock-socketed steel pipe piles. Based on the review of satellite imagery and boreholes drilled

in the vicinity of the subject site, bedrock is anticipated to be at drillable depths, therefore, rock-socketed steel pipe piles are considered feasible and are recommended for this development. This foundation type is considered to be less susceptible to the effects of seasonal frost action. Recommendations for rock-socketed steel pipe piles are provided in Section 5.3.

Shallow Foundations: Shallow foundations consisting of concrete footings cast directly on bedrock are discussed in Section 5.4.

5.2 Climate Change Considerations

The impacts of potential climate change should be considered in the design of the new structures at the proposed site. The Canadian Standards Association (CSA, 2019) provides guidance for screening the vulnerability of a development to climate change. The sensitivity of the site to climate change is governed by the characteristics of permafrost at the site. The site is located in an area of discontinuous permafrost; however, as permafrost is not anticipated at the site, climate change is not expected to have any impacts on the geotechnical conditions at the site or the performance of the new building foundations.

5.3 Rock-Socketed Steel Pipe Piles

5.3.1 General

It is generally feasible to install rock-socketed steel pipe piles using an air track drill. Conventional rock-socketed pile installation involves drilling a hole to a specified depth in the bedrock, filling the rock socket with grout and lowering the steel pile into the grouted rock socket. A temporary casing can also be installed to prevent overburden soils from sloughing into the pile holes, or to control potential seepage, should water be encountered during construction.

This method may be feasible if bedrock is very shallow (potentially in the western and southwestern portions of the site). However, in areas of the site where overburden is thicker and wet sandy/silty soils are present beneath the sand, temporary casing may not be sufficient to effectively overcome the water and sloughing issues, but a specialized drilling system such as a “ring bit” system could be used. This system, which allows for pile advancement through difficult ground conditions into bedrock, has been successfully used in Yellowknife on several previous projects. The “ring bit” system advances casing at the same time as the drill bit, seating the casing into bedrock to create a tight seal. A smaller diameter rock socket is then drilled beyond the end of the casing, and a grouted anchor bar, extending from the socket base into the casing, is installed.

General recommendations for the design and installation of rock-socketed steel pipe piles are provided below, while specific recommendations are presented in sub-section 5.3.2.

- Piles should be spaced a minimum of three pile diameters apart, centre-to-centre. For rock-socketed piles, the pile diameter is considered to be the diameter of the drilled hole. Group effects may govern over single pile behavior, depending upon the actual pile spacing used.
- A high early strength, non-shrink grout should be used. Tetra Tech should be retained to review the contractor's proposed grout mix. If a non-standard product is proposed, it is recommended that the adequacy of the proposed grout mix be verified by trial batches in advance of construction. The mixing water should be warmed so that the temperature of the grout mix will be approximately 20°C to 25°C when placed. The grout should be prepared and placed with an integral mechanical mixer/pump with a shearing type action. Ground temperatures should be recorded during the pile installation. If permafrost is not encountered, a normal non-shrink grout may be used. If pile installation occurs in the winter or spring, a permafrost grout (or non-permafrost grout with cold temperature admixture) should be used.

- For the purpose of structural design, the piles can be assumed to be laterally restrained from the bottom of the grouted rock-socket to the top of the weathered bedrock. If further lateral capacity is required, cross-bracing, battered piles, concrete-filled piles, or additional grout on the outside of the pile through the overburden can be considered.

The pile design should be developed and/or reviewed by a qualified geotechnical engineer once the building design is underway, to confirm that the recommendations provided in this report are reflected in the design and to provide additional recommendations if required.

It is recommended that a qualified geotechnical engineer or technologist monitor pile installations to ensure that the piles are installed to the correct depth and properly seated at the bottom of the rock socket, to record ground temperatures, to test the grout to verify that the mix is performing acceptably, and to document the pile installations.

5.3.2 Conventional Rock-Socketed Steel Pipe Piles

A typical rock-socketed pile configuration is shown in Figure 2. In addition to the recommendations provided in the above sub-section, conventional rock-socketed steel pipe piles should be designed and constructed in accordance with the following recommendations:

- For the high strength bedrock anticipated to underlie the site, it is assumed that the pile capacity is governed by the grout-to-pipe bond, and the grout-to-pile bond strength is related to the compressive strength of the grout backfill. An ultimate, unfactored grout-to-steel bond of 1200 kPa may be assumed if the unconfined compressive strength of the grout is at least 20 MPa. Higher bond strength is achievable with higher strength grout. Geotechnical resistance factors of 0.4 and 0.3 can be used to determine the factored foundation resistance in compression and uplift, respectively.
- Piles should be designed to resist uplift forces caused by potential frost heave in the overburden soil surrounding the pile shaft, which is known as frost jacking. Frost jacking should be assumed to act on the pile shaft from ground surface to a depth equal to the seasonal frost depth, which is assumed to be about 3 m, or the depth to competent bedrock, whichever is less. The frost jacking force should be considered in combination with any permanent structural uplift loads but is non-additive to short term or instantaneous loads. An estimated minimum rock socket length of 1.3 m in competent bedrock should be used to resist frost jacking. The top of bedrock may be weathered. The thickness of weathered bedrock at each pile location should be confirmed at the time of construction, and the necessary bond length calculated from the top of competent bedrock.
- The diameter of the drilled hole should be at least 50 mm larger than the outside diameter of the pipe, so that the grout can completely surround the pile and develop a strong, uniform bond.
- After drilling, the pile hole should be flushed free of water, mud, drill cuttings, slough and any other deleterious materials prior to installation of the pile and grout. For piles installed where overburden is present, particularly if installation takes place during the thaw season, it may be necessary for the contractor to use casing to reduce seepage and sloughing into the rock socket. If persistent seepage or similarly wet conditions are present in the pile holes, grout should be tremied to displace water from the bottom of the hole.
- Loose material, preservatives, oil and grease should be completely cleaned off the bond length of the pile immediately before installation. Grout slots measuring 50 mm by 100 mm should be cut at 500 mm spacing in the bonded length of the pile, on alternating sides of the pile shaft. The pipe pile should be installed and backfilled with grout as soon as possible following completion of the pile hole drilling. These procedures are important for obtaining a good bond between the grout and the pile, and between the grout and the rock.
- Once the pile and grout have been placed, it should be vibrated with the drill to develop a good seat on the rock at the base and to consolidate the grout. The pile should be supported centrally within the hole using bracing at ground surface and downhole centralizers (e.g., short pieces of 20M rebar tacked to the outside of the bond length). Bracing should remain in place for at least 24 hours to allow setting of the grout.

- After the grout has been allowed to set, the remainder of the pile annulus should be backfilled with clean, dry sand or fine gravel. The inside of the pile can be left empty, filled with sand or gravel, or filled with grout.

5.4 Shallow Foundations

Shallow foundations consisting of concrete spread and strip footings cast directly on competent bedrock are feasible where bedrock can be reached with an excavator and is reasonably shallow (around 2 m). If ground water or deeper than expected bedrock, or other problematic conditions are encountered it may not be possible to use shallow foundations on bedrock.

To avoid potential problems associated with winter construction, such as cold weather concrete placement and frozen bedrock/backfill, Tetra Tech recommends that construction occur during spring or summer months when air temperatures are above freezing.

The design and construction of shallow foundations on bedrock should be undertaken in accordance with the following recommendations:

- An unfactored geotechnical bearing resistance of 5.0 MPa may be assumed for foundations bearing on competent, unfractured bedrock. If excavation reveals fractured or weathered bedrock, this bearing resistance may need to be reduced to compensate for the reduced rock strength. A geotechnical resistance factor of 0.5 should be applied to this value.
- Footings should be cast on a clean and (ideally) horizontal rock surface. Any loose, disturbed, frozen, or other deleterious material should be removed before construction of the footing or foundation wall. If blasting is required for levelling, loose or fractured material resulting from the blast must be removed.
- For sloped rock surfaces steeper than 6H:1V (horizontal: vertical), the rock surface should be chipped level, or steel dowels should be drilled and grouted into the rock surface to connect the concrete footing to the sloping rock surface.
- Backfill material used around the footings and piers should be frost-stable fill. Frost-stable fill consists of various fractions of gravel and sand with a maximum of 10% fines content (silt and clay-sized particles passing a 0.08 mm sieve, by weight). Although the use of frost-stable fill will reduce the transmission of frost heave uplift forces to the foundation column, the connection between the footing and footing column should be designed to resist tensile heave force. Guidelines for the placement and compaction of backfill are presented in Appendix B.
- Foundation components located below final grade may be subject to an uplift force due to frost jacking unless measures are taken to prevent the foundation from freezing. A design uplift pressure of 150 kPa should be applied to the surface area of foundation components subject to adfreeze bonding with surrounding frost-susceptible backfill or native material. Such components would include vertical foundation walls or columns passing through the local, native soil. The design and placement of horizontal perimeter insulation is discussed in Section 5.5.
- Grouted rock anchors may be required to resist uplift or lateral forces on the foundation. Tetra Tech recommends that rock anchors comprise deformed steel bars grouted into bedrock. Depth of embedment recommendations can be provided once the design uplift or lateral force is determined. The choice of grout should take into account the time of construction. If freezing temperatures are expected in the rock, a high early strength, non-shrink cold weather grout formulation should be used. Tetra Tech should be given opportunity to review the contractor's grout mix design prior to construction.

Additional general recommendations regarding shallow foundations are given in Appendix B.

5.5 Frost Protection

The native soils at the site may be frost susceptible. The seasonal frost depth is anticipated to be about 2.5 m below grade. During the design phase of the project, samples should be collected from the site to determine if the soils are indeed frost susceptible. If they are, horizontal perimeter insulation should be installed to limit the depth of seasonal frost penetration around the new building and reduce the potential for frost heaving beneath the building foundations.

The insulation should consist of rigid, extruded polystyrene insulation with R-value at least 0.88, compressive strength at least 275 kPa and maximum water absorption less than 0.6% by volume. The insulation should be at least 100 mm thick and should extend at least 1.8 m out from the perimeter of the building. The insulation thickness should be doubled to 200 mm around entrances, overhead doors, and at corners. A minimum burial depth of 300 mm is recommended to protect the insulation from damage. Figure 3 shows the recommended configuration.

The insulation should be sandwiched between two layers of bedding sand and sloped away from the structure at 4%. The bedding sand should be non-frost susceptible and compacted to at least 98% of SPMDD.

External appurtenances to the building, such as tanks, stairs or ramps, if not supported on footings that are insulated, should be independent from the building and allowed to move freely from the foundation. Connections between external appurtenances and the building should be flexible to accommodate some differential movement.

5.6 Construction Excavation and Dewatering

The Government of the Northwest Territories Safety Act and Regulations and standard good practice should be followed for all trenches/excavations. Excavations deeper than 1.5 m should have sloped sidewalls. If dewatering is employed to lower the groundwater table, a slope of 1 horizontal to 1 vertical (1H:1V) is the recommended slope for temporary excavations below 1.5 m. Localized instability (seepage/sloughing/flowing soil) in trench/excavation walls may still occur. In these cases, side slopes would need to be made flatter, under the direction of a qualified geotechnical engineer.

Assuming that the site surface is reasonably dry at the time of construction, seepage into excavations should be minimal. However, the contractor should be ready to dewater the excavation if necessary. If seepage is encountered, pumps should be sufficient for drainage of seepage.

Further general recommendations regarding construction excavations are given in Appendix B.

5.7 Site Grading and Drainage

Final site grading should direct water away from the new building to reduce the potential for physical erosion and mitigate seasonal frost. Improper drainage and ponding of water near or under the structure could initiate foundation settlement.

Tetra Tech typically recommends final grades within 3 m of the new buildings be sloped at least 4% away from the buildings. It is recommended that gravel-surfaced or landscaped areas beyond 3 m have a minimum grade of 2%. This should provide positive drainage without causing erosion problems. Future and existing development should also be taken into consideration when directing drainage, so flow is not directed into adjacent developments.

Runoff from the roof and downspouts should be directed onto splash pads and away from the building.

5.8 Cement / Concrete Type

Tetra Tech recommends that all concrete be designed, mixed, placed, and tested in accordance with the most recent edition of the Canadian Standards Associations (CSA) standards CAN/CSA-A23.1 and A23.2. According to these standards, concrete should be designed to satisfy at least the minimum durability requirements as defined by exposure class.

The exposure class of the concrete is dependent on the presence or lack of chlorides, sulphates, freezing and thawing conditions and soil saturation. If used for pad footings at the sites, concrete will be exposed to cycles of freezing and thawing. It is therefore recommended that all concrete foundation elements be specified in accordance with CSA A23.1 Exposure Class F-2 (*concrete in an unsaturated condition exposed to freezing and thawing, but not to chlorides*). With F-2 exposure class concrete in a northern environment, 30 MPa concrete with 4% - 7% entrained air is considered appropriate. Additionally, soils in contact with the foundation elements in situ and/or granular backfill should be tested to determine water soluble sulphate content. Dependent upon test results, the exposure class may have to be changed to S-1 or S-2 to reflect the use of sulphate resistant cement (or a blended cement that will provide equivalent mitigation levels); lower water/cement ratios; and higher specified strength requirements (as directed by the structural design team).

5.9 Seismic Site Classification and Seismic Hazard

The seismic site designation for seismic design can be assigned according to Table 4.1.8.4.A of the 2020 Edition of the National Building Code of Canada (NBCC), published by the National Research Council of Canada (NRCC, 2020). The seismic site designation is based on the shear stiffness of the upper 30 m of the soil profile at the site, as described on Table 4.1.8.4.A of the building code. Shear stiffness is typically determined using the averaged shear wave velocity (V_{s30}). The upper 30 m below the ground surface at the subject site is anticipated to consist of up to ten metres of overburden soil over bedrock. Based on the available SPT data collected from boreholes located in the vicinity of the subject site, Tetra Tech recommends that the site be considered as Site Class "D" for seismic design, per Table 4.1.8.4.A of the NBCC. (Table 4.1.8.4.A, NRCC 2020).

Natural Resources Canada (NRC) provides interpolated seismic hazard values for use with the 2020 NBCC. The peak ground acceleration for Yellowknife is 0.0615 g for the design earthquake event with a 2% probability of exceedance in 50 years (NRC, 2024).

6.0 DESIGN AND CONSTRUCTION GUIDELINES

Recommended general design and construction guidelines for backfill materials and compaction are provided in Appendix B.

These guidelines are generic and are intended to present standards of good practice. They have been developed largely from Tetra Tech's southern practice. We have attempted to address specific local requirements in the main text of this report. The guidelines are supplemental to the main text of this report. In the event of any discrepancy between the main text of this report and Appendix B, the main text should govern. The design and construction guidelines are not intended to represent detailed specifications for the works, although they may prove useful in the preparation of such specifications.

7.0 REVIEW OF DESIGN AND CONSTRUCTION

It is recommended that Tetra Tech be given the opportunity to review the details of the final design related to the geotechnical aspects of the project prior to construction.

All foundation design recommendations presented in this report are based on the assumption that an adequate level of monitoring will be provided during construction and that all construction will be carried out by a suitably qualified contractor, experienced in foundation construction in the north. For this project, it is recommended that construction monitoring include the following:

- For earthworks, particle size analysis on “non-frost-susceptible” or “frost-stable” fill, observations of the site conditions prior to placing fill, and full-time monitoring and compaction testing during fill placement;
- Testing (air, slump, compressive strength) completed on samples of any cast-in-place concrete placed during construction; and
- For rock-socketed piles, full-time observation and design review during construction, and materials testing on samples of grout collected during pile installation.

All such quality assurance monitoring should be carried out by suitably qualified persons, on behalf of the owner, independent of the contractor. If the contractor also carries out testing for quality control, all parties should be made aware of this. One of the purposes of providing an adequate level of foundation monitoring is to check that the provided recommendations are valid. Tetra Tech can provide these services upon request. Failure to provide an adequate level of foundation monitoring may contravene Building Code Requirements.

8.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

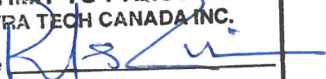
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01

REGISTERED PROFESSIONAL ENGINEER
2024-08-07
R.S. GIRVAN
NWT/NU
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01
FILE: ENG.YARC03622-01

Prepared by:
Zezhong Zhang, Ph.D., E.I.T.
Geotechnical Engineer-in-Training, Arctic Region
Direct Line: 867.675.0259
Zezhong.Zhang@tetrattech.com

Reviewed by:
Rob Girvan, P.Eng.
Manager, Yellowknife Arctic Group
Direct Line: 867.675.0252
Rob.Girvan@tetrattech.com

/kla

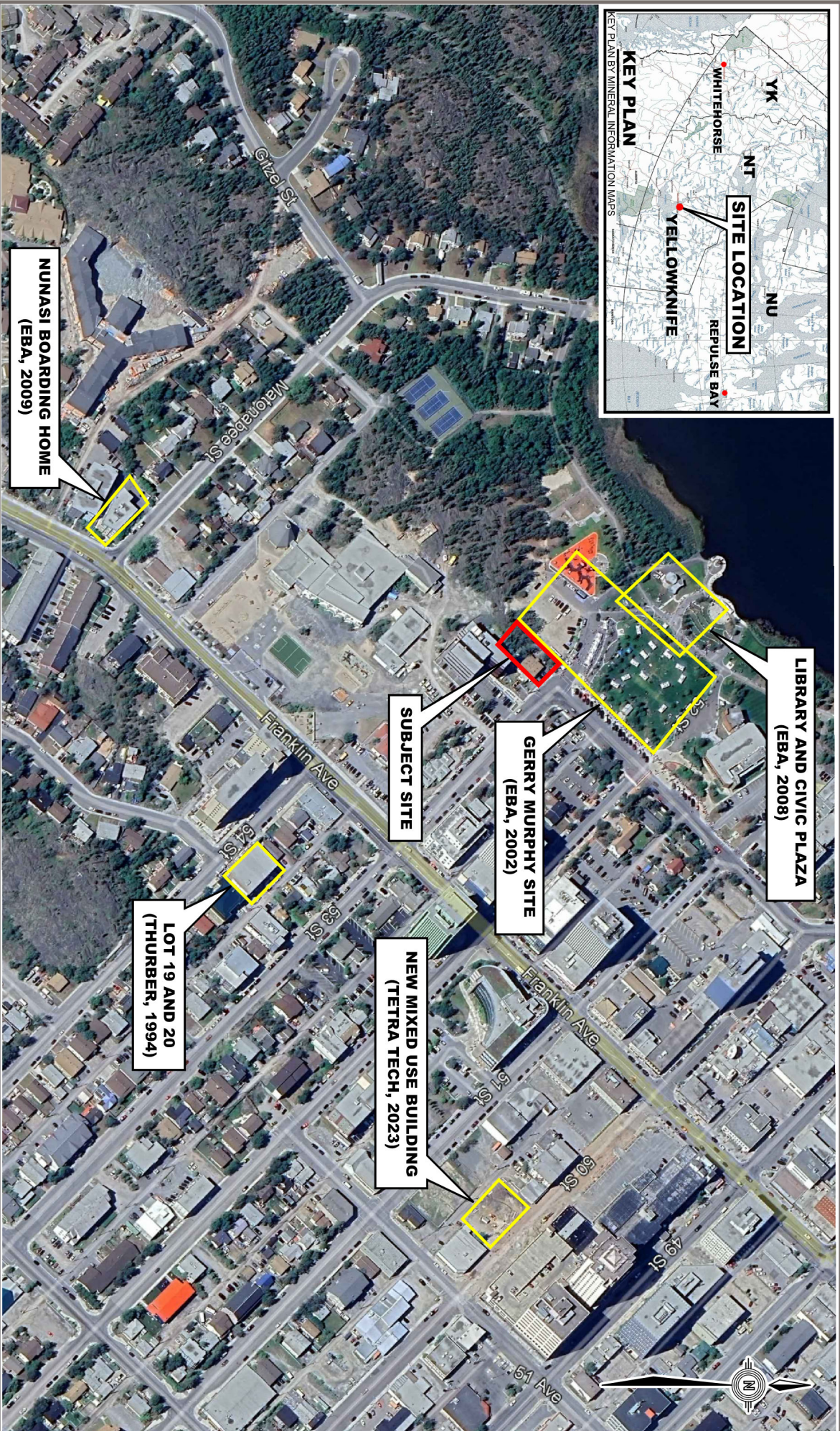
PERMIT TO PRACTICE
TETRA TECH CANADA INC.
Signature 
Date 2024-08-07
PERMIT NUMBER: P 018
NT/NU Association of Professional
Engineers and Geoscientists

REFERENCES

- ATLAS. 2004. https://www.maps.geomatics.gov.nt.ca/HTML5Viewer_Prod/index.html?viewer=ATLAS.
- Canadian Standards Association (CSA), 2019. Technical Guide Infrastructure in Permafrost, a Guideline for Climate Change Adaptation. CSA Reference Number: Plus 4011-19.
- EBA Engineering Consultants Ltd. (EBA), 2002. Geotechnical Evaluation for Gerry Murphy Site, Yellowknife, NT. Report submitted to Government of the Northwest Territories, Department of Public Works and Services. EBA File No. 1700049.
- EBA Engineering Consultants Ltd. (EBA), 2008. Geotechnical Evaluation Library and Civic Plaza, Yellowknife, NT. Report submitted to Nadji Architects. EBA File No. Y14101017.
- EBA Engineering Consultants Ltd. (EBA), 2009. Geotechnical Evaluation Nunasi Boarding Home Yellowknife, NT. Report submitted to Clark Builders. EBA File No. Y14101155.
- Environment Canada 2024. National Climate Data and Information Archive, Climate Normals and Averages. Retrieved from: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html.
- Google Earth, 2024. Imagery for Lutsel K'e, NT.
- Henderson, J.B., 1985. Geology, Yellowknife - Hearne Lake, District of Mackenzie, Northwest Territories. Geological Survey of Canada, Map 1601A, scale 1:250 000.
- National Research Council of Canada (NRCC), 2020. National Building Code of Canada, 15th Edition. Issued by the Canadian Commission on Building and Fire Codes, National Research Council of Canada.
- Natural Resources Canada (NRC), 2024. National Building Code of Canada seismic hazard values. Interactive website at <https://earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php>.
- O'Neill, H.B., Wolfe, S.A., and Duchesne, C., 2020. Ground ice map of Canada; Geological Survey of Canada, Open File 8713 (version 1), 1.zip file. <https://doi.org/10.4095/326885>.
- Prest, V.K. 1969. Retreat of Wisconsin and Recent ice in North America. Geological Survey of Canada Map, 1257A.
- Tetra Tech Canada Inc. (Tetra Tech), 2023. Geotechnical Evaluation for Mixed Use Building, Yellowknife, NT. Report submitted to Northwest Territories Housing Corporation. Tetra Tech File: ENG.YARC03573-01.
- Thurber Consultants Ltd. (Thurber), 1994. Lots 19 and 20, Block 34, Foundation Conditions, Yellowknife, NT. Report submitted to Mr. Jim Murphy. Thurber file: 19-1911-0.
- Wolfe, S.A. and Kerr, D.E. 2014. Surficial Geology, Yellowknife Area, Northwest Territories, parts of NTS 85-J/7, NTS 85-J/8, NTS 85-J/9 and NTS 85-J/10; Geological Survey of Canada, Canadian Geoscience Map 183 (preliminary), scale 1:25 000. doi: 10.4095/293725.

FIGURES

- | | |
|----------|--|
| Figure 1 | Site Location Plan |
| Figure 2 | Rock-Socketed Steel Pipe Pile Detail (Unslotted and Slotted) |
| Figure 3 | Generic Perimeter Insulation Details for Shallow Foundations |



Taylor Architecture Group

SITE PLAN

**DESKTOP GEOTECHNICAL EVALUATION FOR NEW HOMEBASE
MULTISTOREY RESIDENTIAL PROJECT, YELLOWKNIFE, NT**

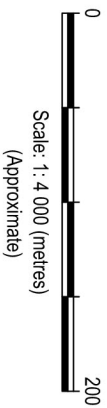


TETRA TECH

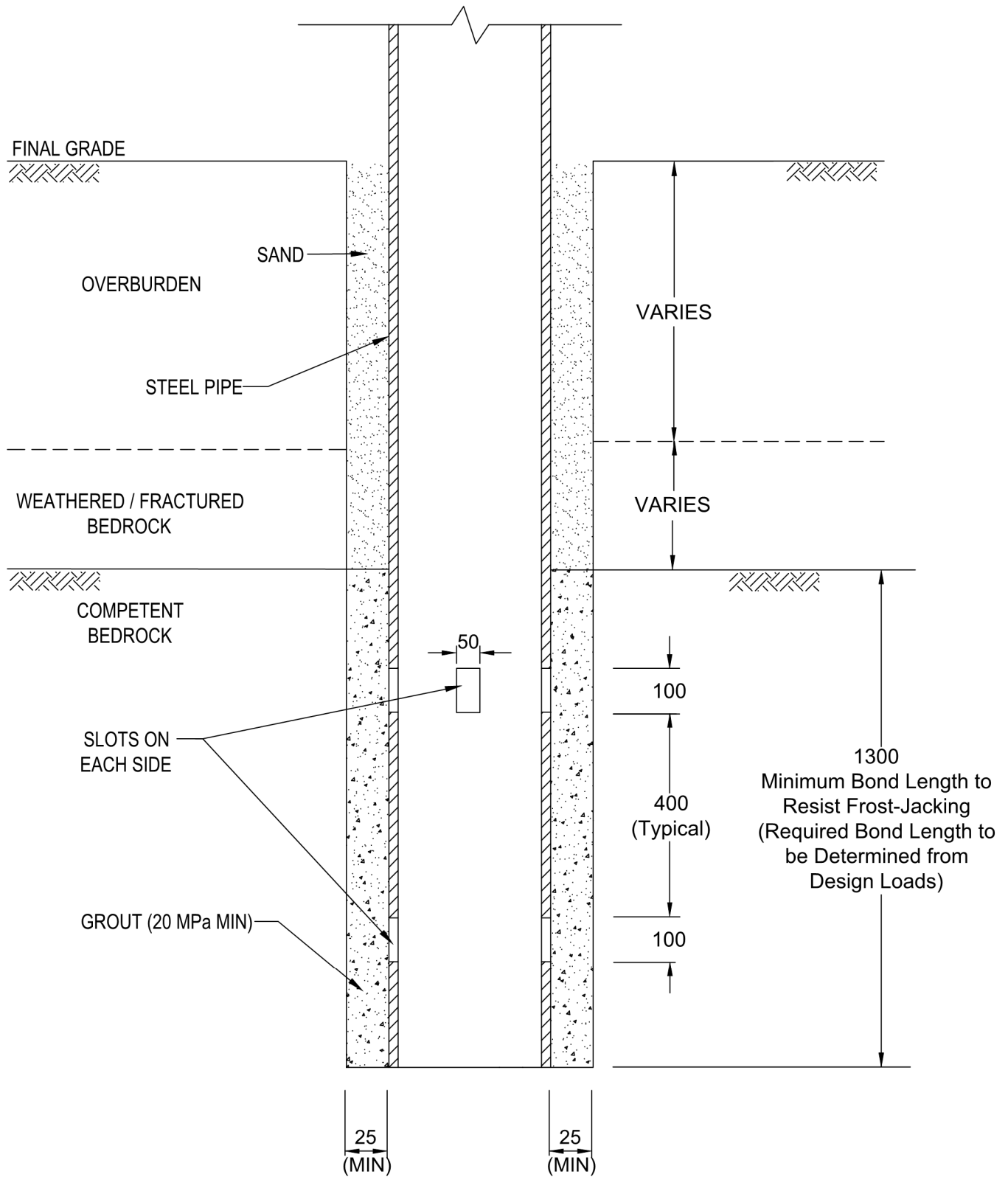
PROJECT NO.	DMN	CKD	REV
ENG. YARC03622-01	DBD	ZZ	0
OFFICE	DATE		
EDM	June 2024		

Figure 1

NOTE:
BASE IMAGE OBTAINED FROM GOOGLE EARTH
IMAGERY DATE: JUNE 2023



Q:\Edmonton\Drafting\PROJECTS\704-ENG-YARC\ENG-YARC03612-01_Fort Resolution_NT\03_Acad\ENG-YARC03612-01_Figure 2.dwg [FIGURE 2] June 11, 2024 - 2:02:37 pm (BY: DAS, DEBASHIS)



NOTES:

- 1) ALL DIMENSIONS IN mm
- 2) DRAWING NOT TO SCALE

CLIENT

Taylor Architectural Group



TETRA TECH

DESKTOP GEOTECHNICAL EVALUATION FOR NEW
HOMEBASE MULTISTOREY RESIDENTIAL PROJECT,
YELLOWKNIFE, NT

**TYPICAL ROCK SOCKET
STEEL PIPE PILE DETAIL**

PROJECT NO.
ENG.YARC03622-01

DWN
DBD

CKD
RG

REV
0

OFFICE
EDM

DATE
June 2024

Figure 2

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

CONSTRUCTION GUIDELINES

CONSTRUCTION GUIDELINES

Revision No: 03 | Last Revised: February 24, 2022

BACKFILL MATERIALS AND COMPACTION (GENERAL)

1.0 DEFINITIONS

“Landscape fill” is typically used in areas such as berms and grassed areas where settlement of the fill and noticeable surface subsidence can be tolerated. “Landscape fill” may comprise soils without regard to engineering quality.

“General engineered fill” is typically used in areas where a moderate potential for subgrade movement is tolerable, such as asphalt (i.e., flexible) pavement areas. “General engineered fill” should comprise clean, granular or clay soils.

“Select engineered fill” is typically used below slabs-on-grade or where high volumetric stability is desired, such as within the footprint of a building. “Select engineered fill” should comprise clean, well-graded granular soils or inorganic low to medium plastic clay soils.

“Structural engineered fill” is used for supporting structural loads in conjunction with shallow foundations. “Structural engineered fill” should comprise clean, well-graded granular soils.

“Lean-mix concrete” is typically used to protect a subgrade from weather effects including excessive drying or wetting. “Lean-mix concrete” can also be used to provide a stable working platform over weak subgrades. “Lean-mix concrete” should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

Standard Proctor Density (SPD) as used herein means Standard Proctor Maximum Dry Density (ASTM Test Method D698). Optimum moisture content is defined in ASTM Test Method D698.

2.0 GENERAL BACKFILL AND COMPACTION RECOMMENDATIONS

Exterior backfill adjacent to abutment walls, basement walls, grade beams, pile caps and above footings, and below highway, street, or parking lot pavement sections should comprise “general engineered fill” materials as defined above.

Exterior backfill adjacent to footings, foundation walls, grade beams and pile caps and within 600 mm of final grade should comprise inorganic, cohesive “general engineered fill”. Such backfill should provide a relatively impervious surficial zone to reduce seepage into the subsoil against the structure.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflections are apparent, the compactive effort should be reduced accordingly.

In order to reduce potential compaction induced stresses, only hand-held compaction equipment should be used in the compaction of fill within 1 m of retaining walls or basement walls. If compacted fill is to be placed on both sides of the wall, they should be filled together so that the level on either side is within 0.5 m of each other.

All lumps of materials should be broken down during placement. Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade.

Where the maximum-sized particles in any backfill material exceed 50% of the minimum dimension of the cross-section to be backfilled (e.g., lift thickness), such particles should be removed and placed at other more suitable locations on site or screened off prior to delivery to site.

Excavation and construction operations expose materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration of performance. Unless otherwise specifically indicated in this report, the walls and floors of excavations, and stockpiles, must be protected from the elements, particularly moisture, desiccation, frost, and construction activities. Should desiccation occur, bonding should be provided between backfill lifts. For fine-grained materials the previous lift should be scarified to the base of the desiccated layer, moisture-conditioned, and recompacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture-conditioning and recompaction.

3.0 COMPACTION AND MOISTURE CONDITIONING

“Landscape fill” material should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90% of SPD unless a higher percentage is specified by the jurisdiction.

“General engineered fill” and “select engineered fill” materials should be placed in layers of 150 mm compacted thickness and should be compacted to not less than 98% of SPD. Note that the contract may specify higher compaction levels within 300 mm of the design elevation. Cohesive materials placed as “general engineered fill” or “select engineered fill” should be compacted at 0 to 2% above the optimum moisture content. Note that there are some silty soils which can become quite unstable when compacted above optimum moisture content. Granular materials placed as “general engineered fill” or “select engineered fill” should be compacted at slightly below (0 to 2%) the optimum moisture content.

“Structural engineered fill” material should be placed in compacted lifts not exceeding 150 mm in thickness and compacted to not less than 100% of SPD at slightly below (0 to 2%) the optimum moisture content.

4.0 “GENERAL ENGINEERED FILL”

Cohesive or granular soils are considered acceptable for use as “general engineered fill,” providing the soils are inorganic and free of deleterious materials.

5.0 “SELECT ENGINEERED FILL”

Low to medium plastic clay with the following range of plasticity properties is generally considered suitable for use as “select engineered fill”:

Liquid Limit	= 20 to 40%
Plastic Limit	= 10 to 20%
Plasticity Index	= 10 to 30%

Test results should be considered on a case-by-case basis.

“Pit-run gravel” and “fill sand” are generally considered acceptable for use as “select engineered fill.” See exact project or jurisdiction for specifications.

The “pit-run gravel” should be free of any form of coating and any gravel or sand containing clay, loam or other deleterious materials should be rejected. No material oversize of the specified maximum sieve size should be tolerated. This material would typically have a fines content of less than 10%.

The materials above are also suitable for use as “general engineered fill.”

6.0 “STRUCTURAL ENGINEERED FILL”

Crushed gravel used as “structural engineered fill” should be hard, clean, well graded, crushed aggregate, free of organics, coal, clay lumps, coatings of clay, silt, and other deleterious materials. The aggregates should conform to the requirement when tested in accordance with ASTM C136 and C117. See exact project or jurisdiction for specifications. This material would typically have a fines content of less than 10%.

In addition to the above, further specification criteria identified below should be met:

“Structural Engineered Fill” – Additional Material Properties

Material Type	Percentage of Material Retained on 5 mm Sieve having Two or More Fractured Faces	Plasticity Index (<400 µm)	L.A. Abrasion Loss (percent Mass)
Various sized Crushed Gravels	See exact project or jurisdiction for specifications	See exact project or jurisdiction for specifications	See exact project or jurisdiction for specifications

Materials that meet the grading limits and material property criteria are also suitable for use as “select engineered fill.”

7.0 DRAINAGE MATERIALS

“Coarse gravel” for drainage or weeping tile bedding should be free draining. Free-draining gravel or crushed rock generally containing no more than 5% fine-grained soil (particles passing No. 200 sieve) based on the fraction passing the 3/4-inch sieve or material with sand equivalent of at least 30.

“Coarse sand” for drainage should conform to the following grading limits:

“Coarse Sand” Drainage Material – Percent Passing by Weight

Sieve Size	Coarse Sand*
10 mm	100
5 mm	95 – 100
2.5 mm	80 – 100
1.25 mm	50 – 90
630 µm	25 – 65
315 µm	10 – 35
160 µm	2 – 10
80 µm	0 – 3

* From CSA A23.1-09, Table 10, “Grading Limits for Fine Aggregate”, Class FA1

Note that the “coarse sand” above is also suitable for use as pipe bedding material. See exact project or jurisdiction for specifications.

8.0 BEDDING MATERIALS

The “Coarse Sand” gradation presented above in Section 7.0 is suitable for use as pipe bedding and as backfill within the pipe embedment zone, however, see exact project or jurisdiction for specifications.

CONSTRUCTION GUIDELINES

Revision No: 01 | Last Revised: March 31, 2016

SHALLOW FOUNDATIONS

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term 'shallow foundations' includes strip and spread footings, mat slab, and raft foundations.

Minimum footing dimensions in plan should be in accordance with the applicable design code of the local jurisdiction.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations. Hand cleaning should be undertaken to prepare an acceptable bearing surface.

Foundation excavations and bearing surfaces should be protected from rain, snow, freezing temperatures, excessive drying, and the ingress of free water before, during, and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil against inclement weather and provide a working surface for construction.

All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to check that the recommendations contained in this report have been followed.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined below:

- "Structural engineered fill" should comprise clean, well-graded granular soils.
- "Lean-mix concrete" should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

CONSTRUCTION GUIDELINES

Revision No: 00 | Last Revised: October 1, 2014

CONSTRUCTION EXCAVATIONS

Construction should be in accordance with good practice and comply with the requirements of the responsible regulatory agencies.

All excavations greater than 1.5 m deep should be sloped or shored for worker protection.

Shallow excavations up to about 3 m depth may use temporary sideslopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3 m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to Tetra Tech for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in situ conditions and the movement of the system. If anchors are used, they should be load tested. Tetra Tech can provide further information on monitoring and testing procedures if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down, at 45 degrees from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

B Civil Report



Issue Date:	July 12, 2024	File No.:	AERIS
To:	Kamille Manoy	Previous Issue Date:	N/A
From:	Evan Latos, P.Eng.	Project No.:	2024-2023.00
Client:	Taylor Architecture Group		
Project Name:	Home Base Youth Centre		
Subject:	Civil Site Development		

1 INTRODUCTION

Taylor Architecture Group retained Associated Engineering (AE) to complete the civil schematic design for a new youth centre located in Yellowknife, Northwest Territories. The proposed site is located in the downtown core on Lot 38 of Block 27, at the corner of 53rd Street and 49th Avenue. The purpose of this memo is to provide a high-level description of the civil site development including surface development, drainage, and site servicing.

2 SURFICIAL DEVELOPMENT AND DRAINAGE

The existing site relies entirely on overland drainage as there is no underground storm sewer located adjacent to the property. The existing grading regime splits drainage to the adjacent City of Yellowknife (CoY) parking lot to the north-west and to 53rd Street to the northeast. Once off site, stormwater generally flows overland to the north-west, towards Frame Lake. A bedrock outcrop is located in the south corner of property.

Site drainage is proposed to generally match the existing conditions. Drainage will remain overland with the building's rear parking lot graded to direct water away from the building towards the adjacent parking lot to the north-west and the building frontage draining towards 53rd Street to the northeast. Positive drainage away from the building should be provided in all areas. The drawing attached to this memo shows a conceptual drainage plan for the site. A drainage easement will likely be required to continue to discharge to the adjacent CoY parking lot. It is understood that preliminary discussion with the City of Yellowknife have begun regarding access and easements through the parking lot.

Pedestrian paths, parking and loading areas are anticipated to be hard surfaced, either concrete or asphalt pavement, and tie-into the existing gravel parking lot and sidewalk bordering the north-west and north-east sides of the property respectively. All hard surfaces will have a minimum of 1% grade; all other locations shall have a minimum of 2% grade. Bedrock outcrops within the rear parking lot will need to be removed to facilitate grading and parking. The depth of removal and extents will be determined during detailed design based on the final grading plan and the geotechnical consultant's recommended parking lot structure. It is anticipated that bedrock removal may be required within the adjacent properties based on the site layout, which would require an agreement with the parcel owners. Surfaces will be designed following the latest edition of the City of Yellowknife Design Standards Manual (COYDSM), geotechnical report recommendations, applicable bylaws requirements, and Government of Northwest Territories' Good Building Practice for Northern Facilities.

Memo To: Kamille Manoy, Taylor Architecture Group
July 12, 2024
Page 2

3 SITE SERVICING

The site will be serviced from the existing water and sewer mains located in 53rd Street fronting the property. The services will be extended from the existing mains into the mechanical room, located in the east building podium/lobby. Design and installation will follow the latest edition of the COYDSM, City of Yellowknife Water and Sewer Bylaw and the Government of Northwest Territories' Good Engineering Practice for Northern Water and Sewer System Guidelines. The services should be located away from permanent structures such as electrical transformers, power poles, or other structure to allow for future replacement or repair. The attached drawing to this memo shows the conceptual servicing for the site. Further details regarding the sanitary sewer and water servicing are provided in the sections below.

3.1 Sanitary

A 200 mm sanitary sewer exists along 53rd Street and 49th Avenue. Based on available record information, the sewer is insulated, has approximately 2.5 m of cover, and the material type is unknown. This section of sewer is located at the boundary of the collection system, with only the adjacent North Star Building contributing upstream. It is anticipated that this main and downstream infrastructure will have enough capacity, as it currently services the existing Park Place apartments that would be replaced by the Home Base Youth Centre, however a system analysis would be required to confirm.

The sanitary sewer service will be designed and installed as per COYDSM standards and is therefore assumed to have the following features at a minimum:

- Minimum Cover at Property Line: 1.5 m (No Basement)
- Pipe Material: Insulated Ductile Iron Pipe
- Minimum Pipe Grade: 2%
- Minimum Pipe Diameter: 150 mm
- Maximum Cumulative Bends: 180 Degrees

It is anticipated the sanitary service will be installed perpendicular to the building face and tie directly in to the sanitary sewer main, without the need of any horizontal elbows. The exact alignment and building penetration location for the sanitary service would be determined during detailed design.

Record information indicates an existing sanitary sewer main, and manhole may be located within the proposed building footprint. It is recommended that a field investigation and further liaising with the City is completed to confirm its existence, if any services actively feed into it, and if it can be removed. If this sewer and manhole exist, it would need to be removed and disposed of due to its location.



Memo To: Kamille Manoy, Taylor Architecture Group

July 12, 2024

Page 3

3.2 Water

A single 300 mm watermain exists along 53rd Street and 49th Avenue. Based on available record information, the watermain only has approximately 1.5 m of cover and the material type is unknown. It is anticipated the watermain will have enough fire flow capacity to service the facility however a more detailed review will be required to confirm.

The water service is anticipated to be a minimum diameter of 150 mm due to building sprinkler requirements and include a 38 mm re-circulation line for freeze protection; the exact sizing would be determined during detailed design based on building demand and fire flow requirements. Because only a single main exists, an orifice system for recirculation, common to the downtown core, will not be possible and a recirculation pump will be required. The water service lines are anticipated to be installed in a common trench with the sanitary sewer which will govern the alignment and tie-in location. The water service will be designed and installed as per COYDSM standards and is therefore assumed to have the following features at a minimum:

- Minimum Cover at Property Line: 1.5 m
- Pipe Material: Insulated Type K (50 mm diameter or less) or Insulated Ductile Iron
- Valving Access: Water Service Manhole

There are two existing hydrants located in close proximity to the property as shown in the attached drawing. The distance between the hydrants and the proposed main entryways are less than 45 m. It is anticipated that the two hydrants will be sufficient to service the building however during detailed design when the required fire flow is determined, the Fire Underwriters Survey's Water Supply for Public Fire Protection should be reviewed.

Memo To: Kamille Manoy, Taylor Architecture Group

July 12, 2024

Page 4

4 CLOSURE

This memo was prepared for the Taylor Architecture Group to provide a description of the civil site development for the proposed Home Base Youth Centre located in the City of Yellowknife. The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Prepared by:

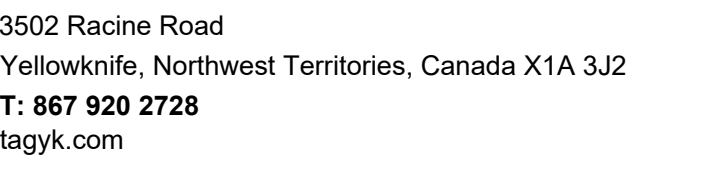


Evan S. Latos, P.Eng.
Project Engineer
EL/SB

Reviewed by:



Steven Bartsch, P.Eng
Area Manager, Yukon & NWT

[illegible]

NO.	DATE	DESCRIPTION
-----	------	-------------

4904 53rd Street
Yellowknife, Northwest Territories
Canada X1A 0A5

PROJECT NO: 2024-2023-00
SCALE: AS SHOWN
DRAWN BY: J. ELLINGSON
REVIEWED BY: E. LATOS

C-101



C Structural Report

Homebase Youth Centre Design Brief

Structural Requirements

Codes and Regulations

- National Building Code of Canada 2020 (NBCC).
- Government of Northwest Territories Good Building Practices for Northern Facilities, Fourth Edition, March 2021.
- Northwest Territories Engineering and Geoscience Professions Act.
- Northwest Territories Occupational Health & Safety Regulations.
- The structure will be classified as a Normal Importance building.
- All structural drawings and specifications will be sealed by a Professional Engineer licensed to practice in the Northwest Territories.

Design Criteria

The structural design will consider NBCC Part 4 design criteria and site-specific climatic data for Yellowknife, NT:

- | | |
|-------------------------------------|---|
| • 1-in-50-year ground Snow Load | $S_s = 2.20 \text{ kPa}$ |
| • 1-in-50-year associated Rain Load | $S_r = 0.10 \text{ kPa}$ |
| • Reference velocity pressure | $q_{50} = 0.47 \text{ kPa}$ |
| • Seismic site properties | $S_a(0.2, X_D) = 0.103$ |
| • | $S_a(0.5, X_D) = 0.0928$ |
| • | $S_a(1.0, X_D) = 0.0516$ |
| • | $S_a(2.0, X_D) = 0.0251$ |
| • | $PGA(X_D) = 0.0615$ |
| • | Site Class 'D' |
| • Roof Snow Load | $1.86 \text{ kPa} + \text{snow drifts}$ |
| • Floor Occupancy Load | 2.40 kPa |
| • Mechanical Rooms | 3.60 kPa |
| • Corridors, Stairs, and Landings | 4.80 kPa |
| • Mezzanine | 4.80 kPa |
| • Allowable deflections | $1/360\text{th of the span}$ |

Foundations

A geotechnical desktop investigation was completed by Tetra Tech. The report did not detect the presence of permafrost, but did find the seasonal frost depth to be approximately 2.0 to 2.5 m below grade. The report also identified that bedrock was found ranging from 0.8 to 14.0 metres below grade (mbg) at surrounding sites. The report anticipates bedrock at the site to be approximately 10.0 mbg and makes initial recommendations for a foundation system consisting of rock socket steel pipe piles.

Rock socketed steel pile foundations will result in a grid pattern of strategically located piles which will accommodate the strength and serviceability requirements of the superstructure. The steel piles and pile groups will be installed into pre-drilled sockets in the bedrock and grouted in place. The bond between the steel piles, the grout, and the bedrock will provide the load bearing system to transfer the building loads to the ground. Use of void forms under grade beams is required to reduce the effects on the structure due to frost heave.

Rock socketed steel pipe piles are the preferred approach for the foundations, but where bored holes can slough during drilling, a steel casing would be required. For very deep piles a steel casing alone may not be sufficient to overcome groundwater and sloughing issues, so a “ring bit” system would be used to advance the piles through the difficult ground conditions.

Superstructure

The superstructure will be capable of supporting the dead and live loads as prescribed in the NBCC as well as the applicable environmental loads for Yellowknife. The design will take into consideration both strength and serviceability requirements, as well as constructability considerations including availability of materials and skilled labour, transportation costs, and a limited construction season. The superstructure and its associated components will be of non-combustible construction. Joist and beam spans will be up to 7.5m to locate columns at the corridors and exterior walls, leaving residential units free of structural supports wherever possible.

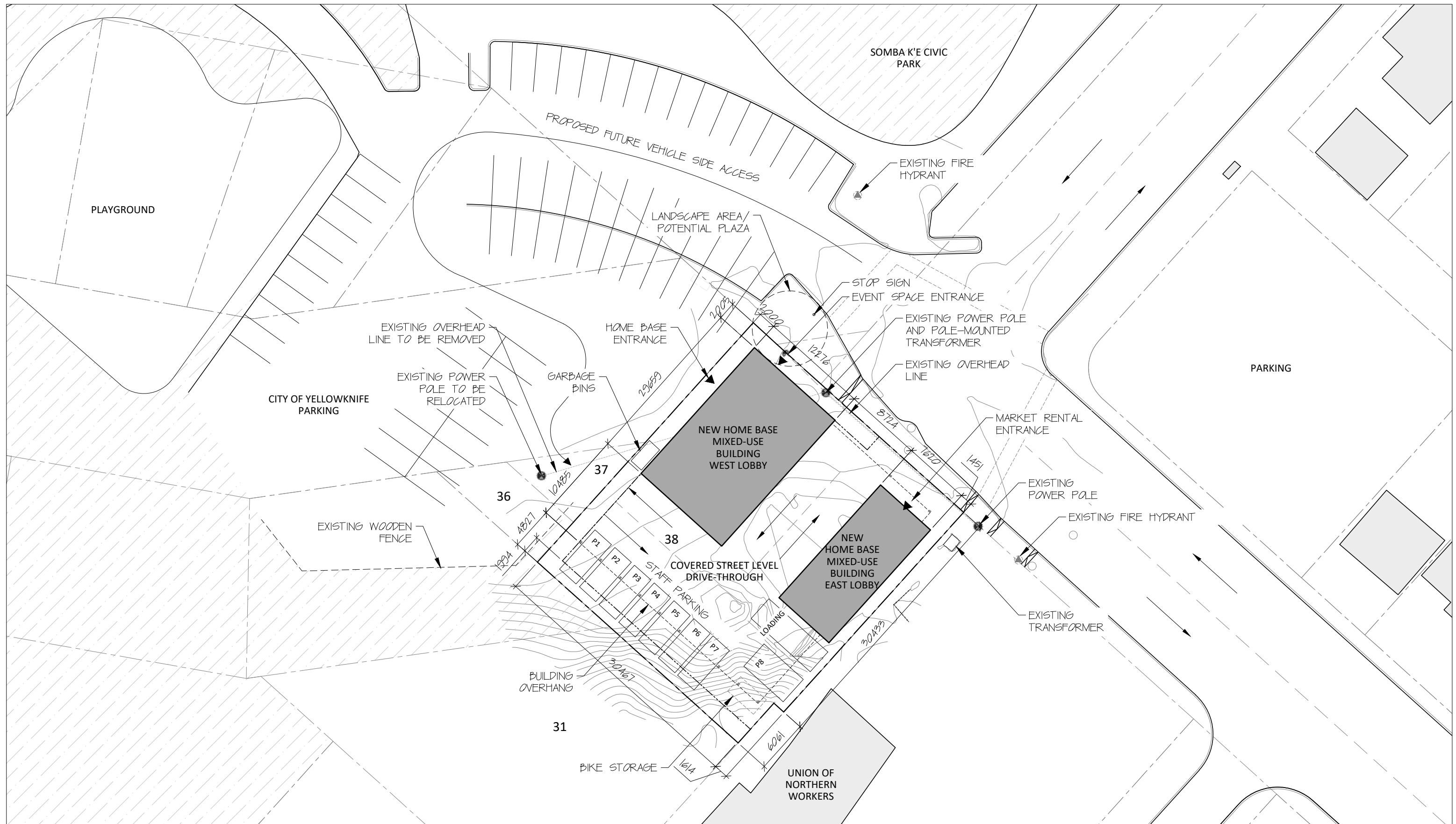
Structural System

Given the requirements outlined above, the recommended structural system for this building would be as follows:

- Typical Roof construction – 38 mm roof deck, minimum 22 gauge, supported on 450mm deep open web steel joists at +/- 1500mm on centre, bearing on steel beams.
- Green Roof construction, fourth floor – 38 mm roof deck, minimum 20 gauge, supported on 750mm deep open web steel joists at +/- 1200mm on centre, bearing on steel beams.
- Floor construction, third to ninth floors – 100mm composite concrete floor (64mm concrete on 38mm composite metal deck, minimum 22 gauge) supported on 600mm to 750mm deep open web steel joists at +/- 1500mm on centre, bearing on steel beams.
- Floor construction, mechanical rooms – 100mm composite concrete floor (64mm concrete on 38mm composite metal deck, minimum 22 gauge) supported on 600mm deep open web steel joists at +/- 1200mm on centre, bearing on steel beams.

- Floor construction, mezzanine – 100mm composite concrete floor (64mm concrete on 38mm composite metal deck, minimum 22 gauge) supported on 600mm deep open web steel joists at +/- 1000mm on centre, bearing on steel beams.
- Main load supporting members will be clear span steel beam and perimeter steel beams with interior and exterior steel columns, respectively, full height from the roof to the ground floor. Beams vary from W360x45 to W610x101.
- Building columns will be steel hollow structural sections (HSS) full height, varying from HSS 8x8 at the roof to the largest being HSS 12x12 at the ground level.
- The lateral force resisting system (LFRS) would be comprised of perimeter steel moment frames and steel cross bracing in coordination with opening and curtain wall arrangements.
- The entire building will be supported on rock socketed steel pipe piles. Piles will vary from single piles to battered piles to pile groups of two or four piles, depending on the column loads at that location. Exterior walls will be reinforced concrete grade beams spanning between piles, with void forms below to resist the effects of frost heave.s

D Schematic Design Drawings



SITE PLAN

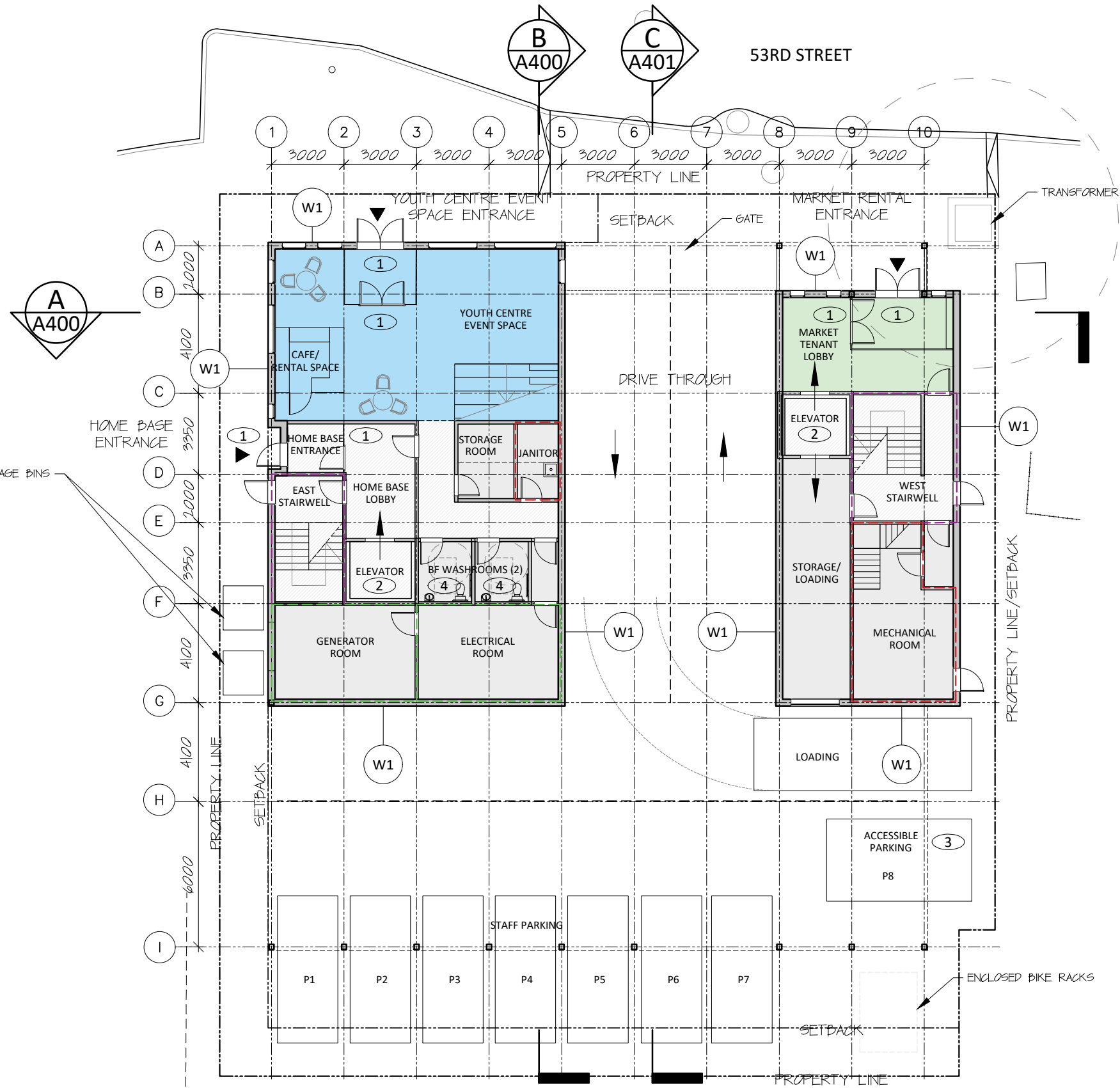


Home Base Mixed-Use Building Yellowknife, NT
 August 19, 2024 Home Base Yellowknife
 Schematic Design



A100

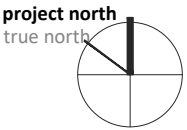
1:400



- LEGEND:**
- 1 POWER DOOR OPERATORS
 - 2 ACCESSIBLE LIFT
 - 3 ACCESSIBLE ELECTRIFIED PARKING STALL
 - 4 BF WASHROOM: TOILET WITH BARRIER-FREE GRAB BARS, POWER DOOR OPERATOR, ACCESSIBLE LAVATORY
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - 2-HOUR FIRE RATING
 - HOME BASE
 - MARKET RENTAL
 - SERVICE
 - CIRCULATION

FLOOR 1

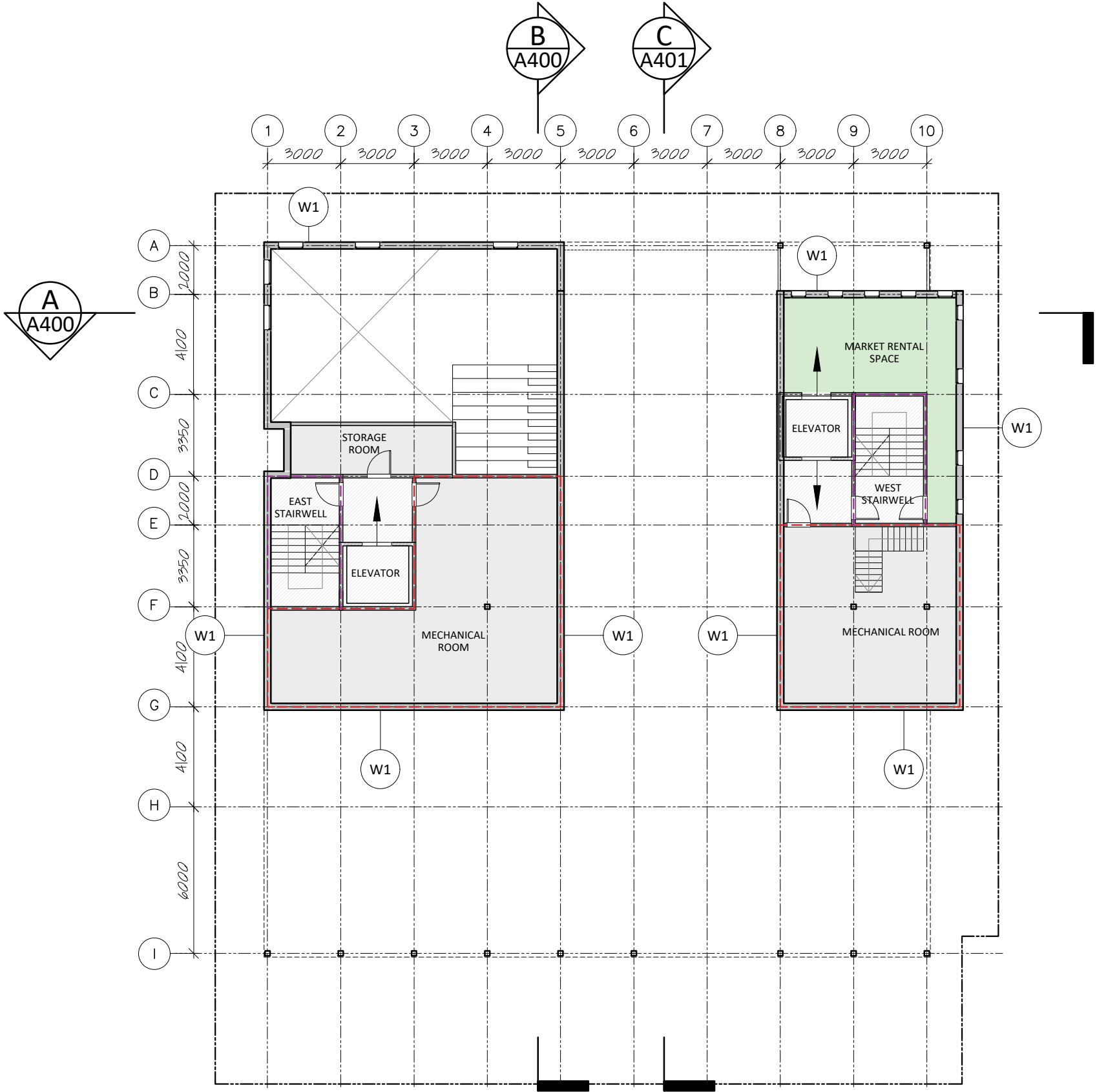
Home Base Mixed-Use Building Yellowknife, NT
August 19, 2024 Home Base Yellowknife
Schematic Design

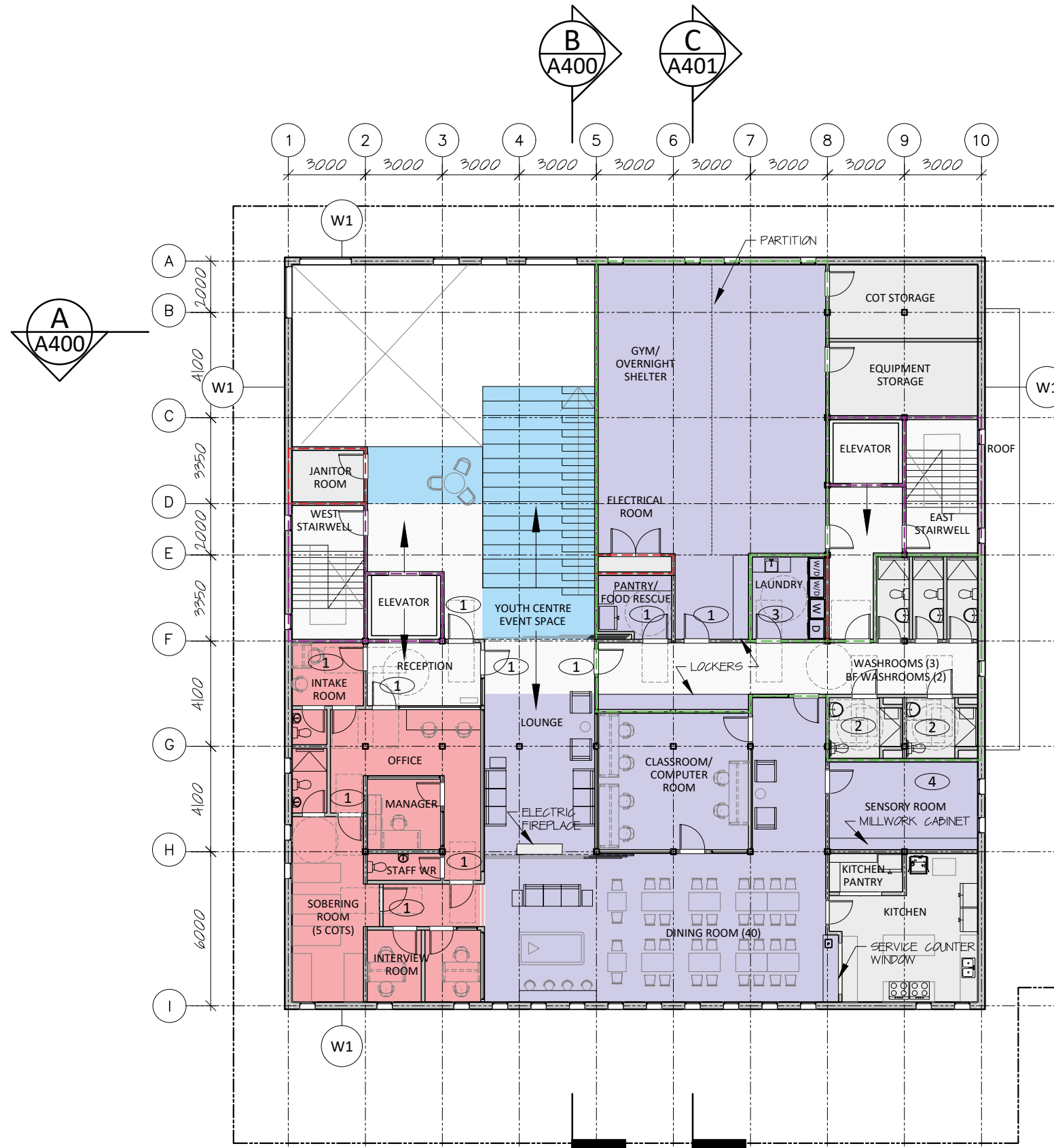


A101
1:200



- LEGEND:
- 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - MARKET RENTAL
 - SERVICE SPACE
 - CIRCULATION

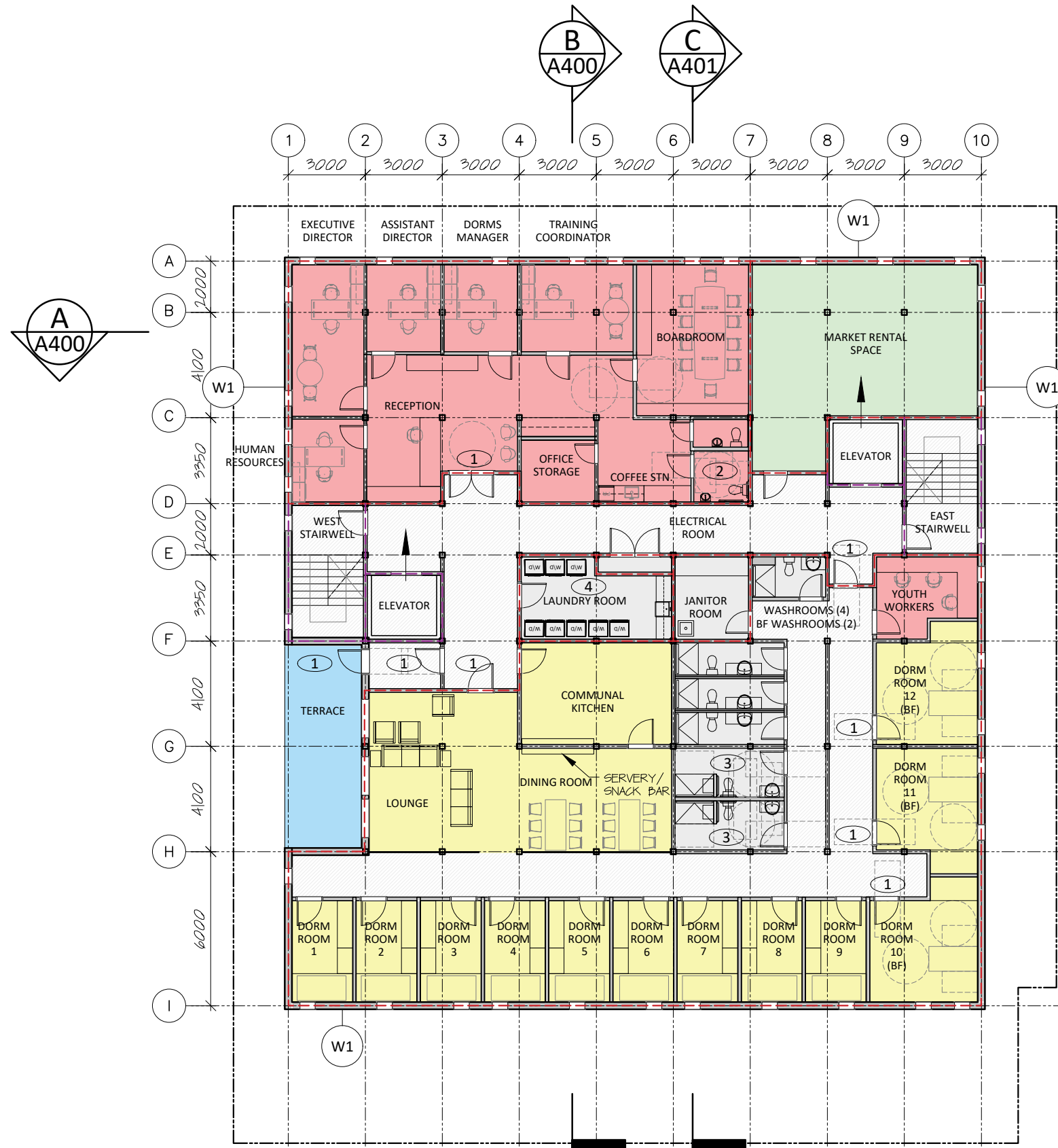




- LEGEND:**
- 1 POWER DOOR OPERATORS
 - 2 BF WASHROOM: TOILET WITH BARRIER-FREE GRAB BARS, POWER DOOR OPERATOR, ACCESSIBLE LAVATORY
 - 3 ACCESSIBLE LAUNDRY: POWER DOOR OPERATOR, ACCESSIBLE COUNTER WITH SINK, (1) ACCESSIBLE FRONT-LOADING WASHER, (1) ACCESSIBLE FRONT-LOADING DRYER
 - 4 MULTI-SENSORY ROOM
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - 2-HOUR FIRE RATING
 - YOUTH CENTRE EVENT SPACE
 - YOUTH CENTRE/SHELTER
 - YOUTH CENTRE OFFICE
 - SERVICE
 - CIRCULATION

FLOOR 3

Home Base Mixed-Use Building Yellowknife, NT
 August 19, 2024 Home Base Yellowknife
 Schematic Design



- LEGEND:**
- 1 POWER DOOR OPERATORS
 - 2 BF WASHROOM: TOILET WITH BARRIER-FREE GRAB BARS, POWER DOOR OPERATOR, ACCESSIBLE LAVATORY
 - 3 BF WASHROOM & SHOWER: TOILET WITH BARRIER-FREE GRAB BARS, ROLL-IN SHOWER WITH GRAB BARS, ACCESSIBLE SHOWER FIXTURES, BARRIER-FREE SHOWER SEAT, POWER DOOR OPERATOR, ACCESSIBLE LAVATORY
 - 4 ACCESSIBLE LAUNDRY: POWER DOOR OPERATOR, ACCESSIBLE COUNTER WITH SINK, (1) ACCESSIBLE FRONT-LOADING WASHER, (1) ACCESSIBLE FRONT-LOADING DRYER
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - 2-HOUR FIRE RATING
 - HOME BASE OUTDOOR TERRACE
 - HOME BASE OFFICES
 - DORMITORY SPACES
 - MARKET RENTAL
 - SERVICE
 - CIRCULATION

FLOOR 4

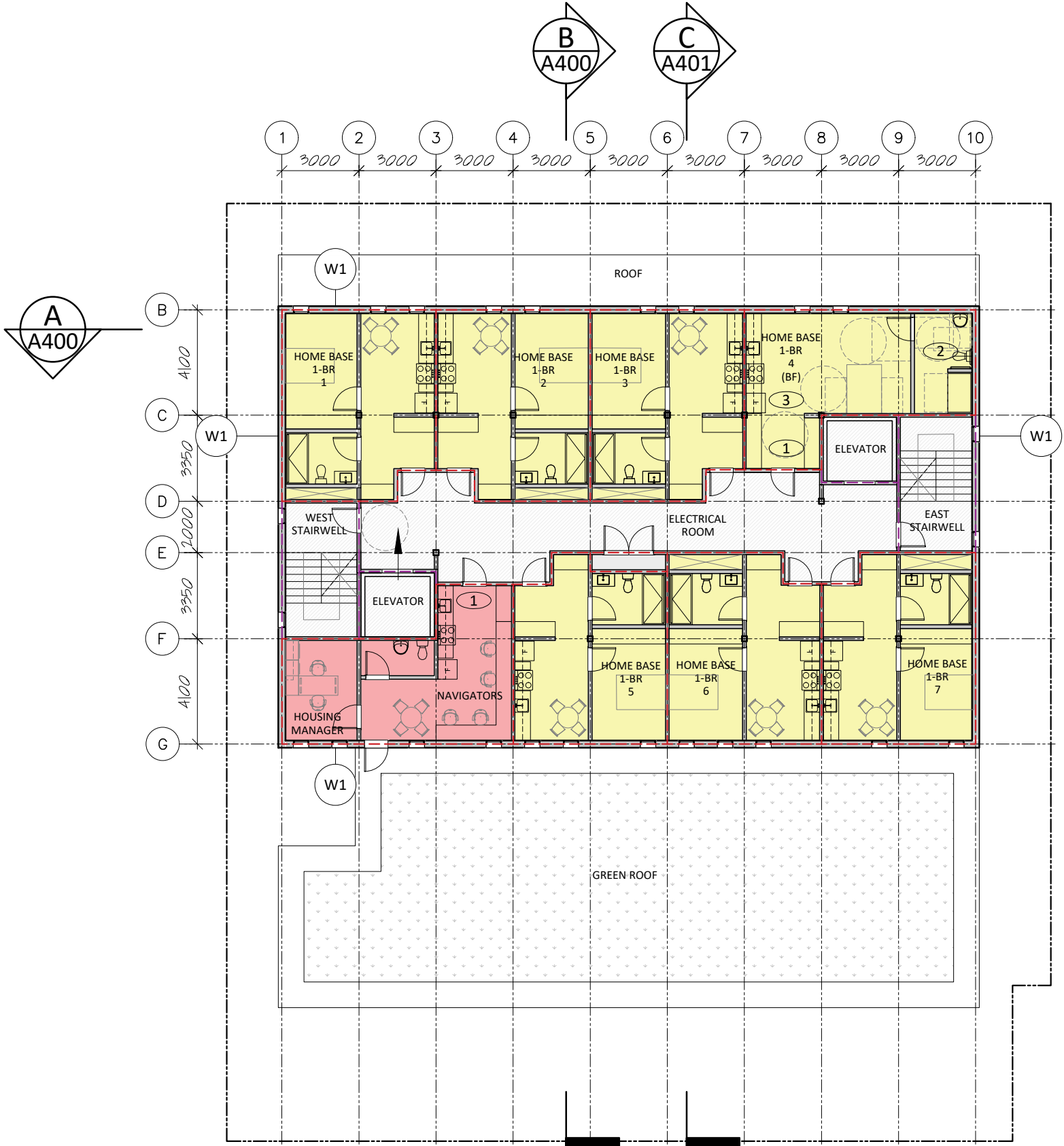
Home Base Mixed-Use Building Yellowknife, NT
August 19, 2024 Home Base Yellowknife
Schematic Design



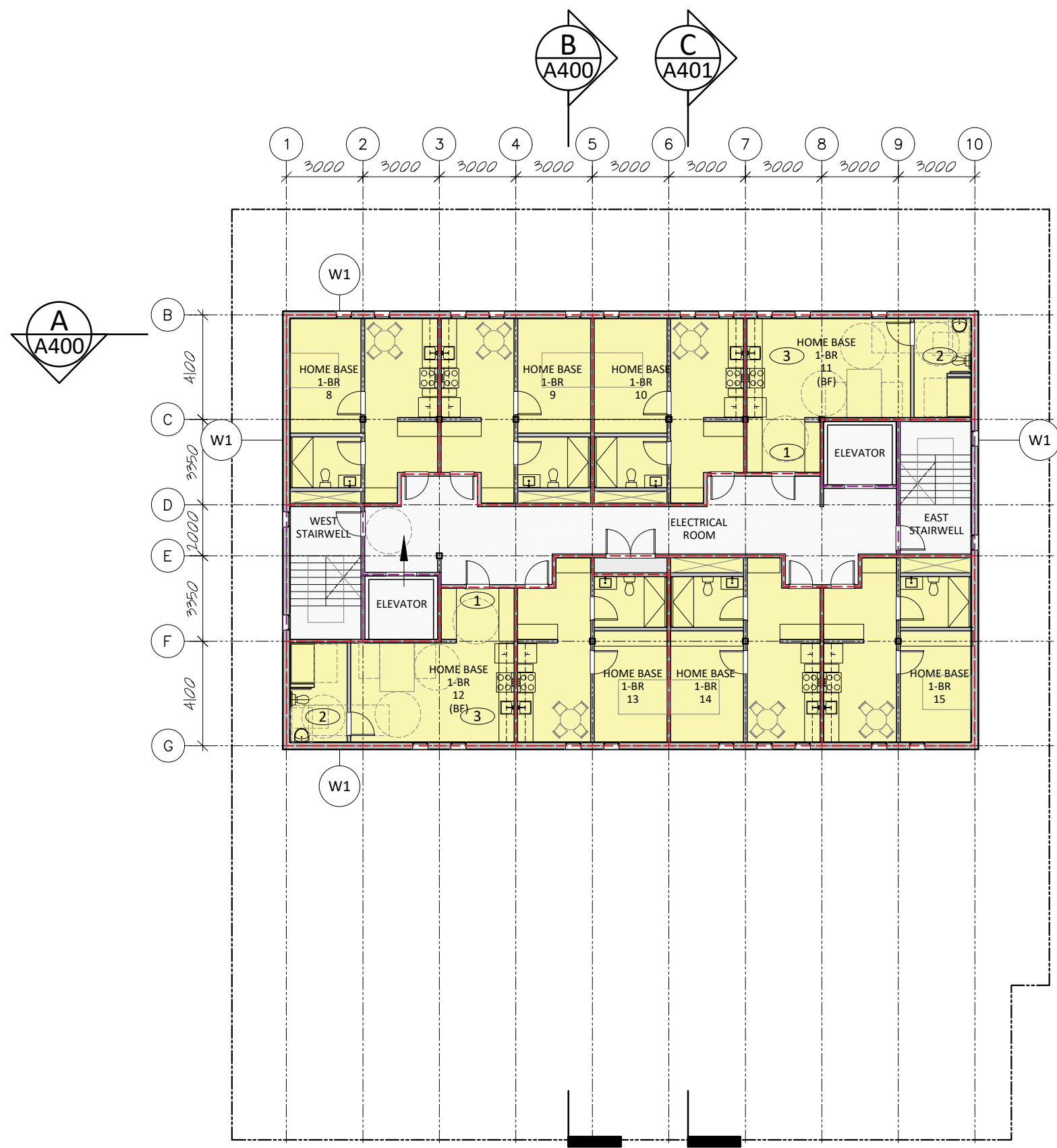
A104

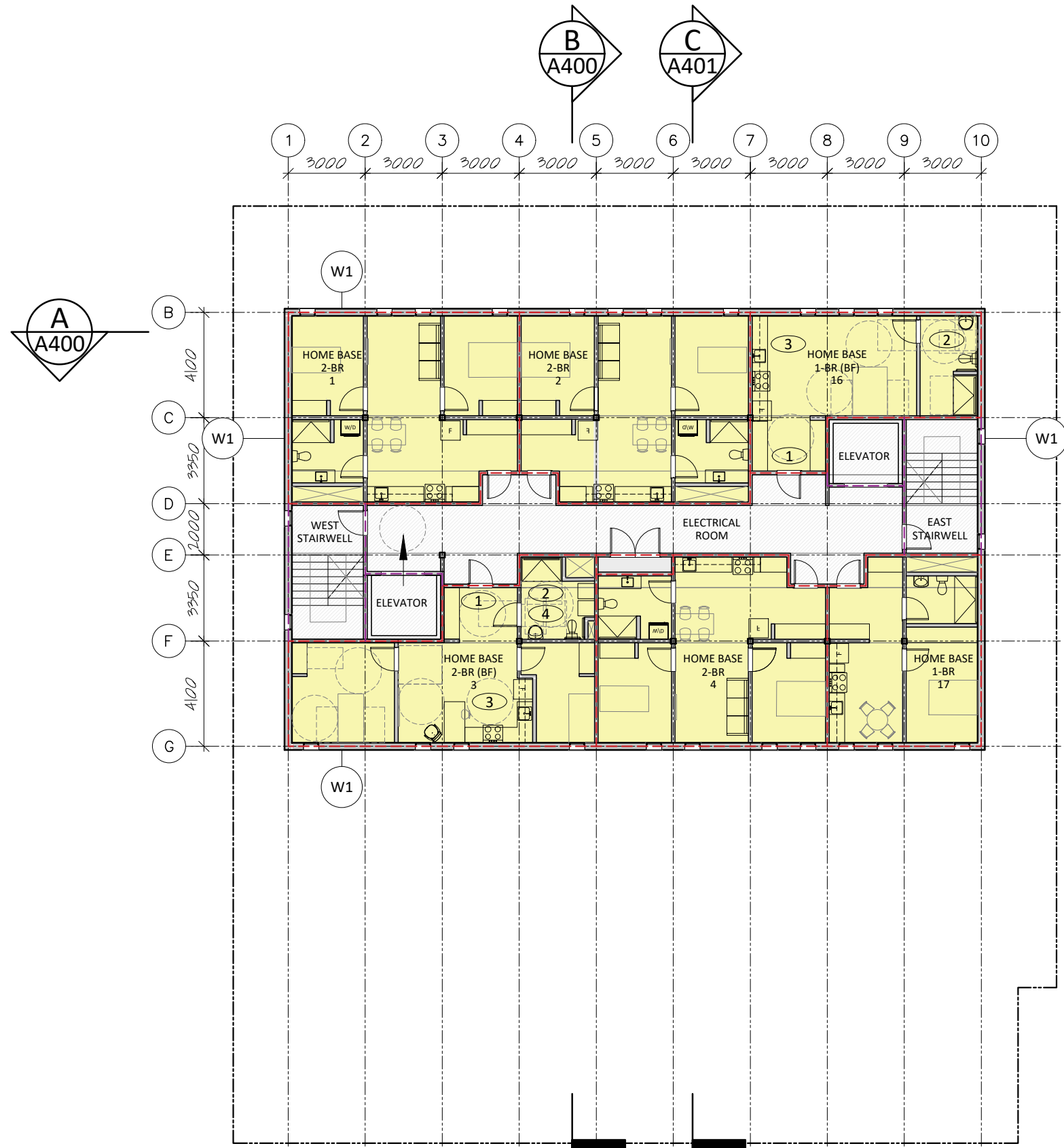
1:200

- LEGEND:**
- 1 POWER DOOR OPERATORS
 - 2 BF WASHROOM & SHOWER: TOILET WITH BARRIER-FREE GRAB BARS, ROLL-IN SHOWER WITH GRAB BARS, ACCESSIBLE SHOWER FIXTURES, BARRIER-FREE SHOWER SEAT, ACCESSIBLE LAVATORY
 - 3 BF KITCHEN: ACCESSIBLE COUNTERTOP, ACCESSIBLE RANGE, ACCESSIBLE UNDERMOUNT SINK
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - HOME BASE APARTMENTS
 - HOME BASE OFFICE
 - SERVICE
 - CIRCULATION



- LEGEND:**
- 1 POWER DOOR OPERATORS
 - 2 BF WASHROOM & SHOWER: TOILET WITH BARRIER-FREE GRAB BARS, ROLL-IN SHOWER WITH GRAB BARS, ACCESSIBLE SHOWER FIXTURES, BARRIER-FREE SHOWER SEAT, ACCESSIBLE LAVATORY,
 - 3 BF KITCHEN: ACCESSIBLE COUNTERTOP, ACCESSIBLE RANGE, ACCESSIBLE UNDERMOUNT SINK
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - HOME BASE APARTMENTS
 - SERVICE
 - CIRCULATION

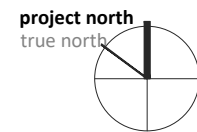




- LEGEND:**
- ① POWER DOOR OPERATORS
 - ② BF WASHROOM & SHOWER: TOILET WITH BARRIER-FREE GRAB BARS, ROLL-IN SHOWER WITH GRAB BARS, ACCESSIBLE SHOWER FIXTURES, BARRIER-FREE SHOWER SEAT, ACCESSIBLE LAVATORY, ACCESSIBLE FRONT-LOADING WASHER, ACCESSIBLE FRONT-LOADING DRYER
 - ③ BF KITCHEN: ACCESSIBLE COUNTERTOP, ACCESSIBLE RANGE, ACCESSIBLE UNDERMOUNT SINK
 - ④ ACCESSIBLE FRONT-LOADING WASHER, ACCESSIBLE FRONT-LOADING DRYER
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - HOME BASE APARTMENTS
 - SERVICE
 - CIRCULATION

FLOOR 7

Home Base Mixed-Use Building Yellowknife, NT
August 19, 2024 Home Base Yellowknife
Schematic Design



- LEGEND:**
- 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - MARKET RENTAL APARTMENTS
 - SERVICE
 - CIRCULATION

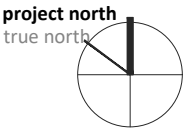


- LEGEND:
- 1 POWER DOOR OPERATORS
 - 2 BF WASHROOM & SHOWER: TOILET WITH BARRIER-FREE GRAB BARS, ROLL-IN SHOWER WITH GRAB BARS, ACCESSIBLE SHOWER FIXTURES, BARRIER-FREE SHOWER SEAT, ACCESSIBLE LAVATORY
 - 3 BF KITCHEN: ACCESSIBLE COUNTERTOP, ACCESSIBLE RANGE, ACCESSIBLE UNDERMOUNT SINK
 - 4 ACCESSIBLE FRONT-LOADING WASHER, ACCESSIBLE FRONT-LOADING DRYER
 - 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - MARKET RENTAL APARTMENTS
 - SERVICE
 - CIRCULATION

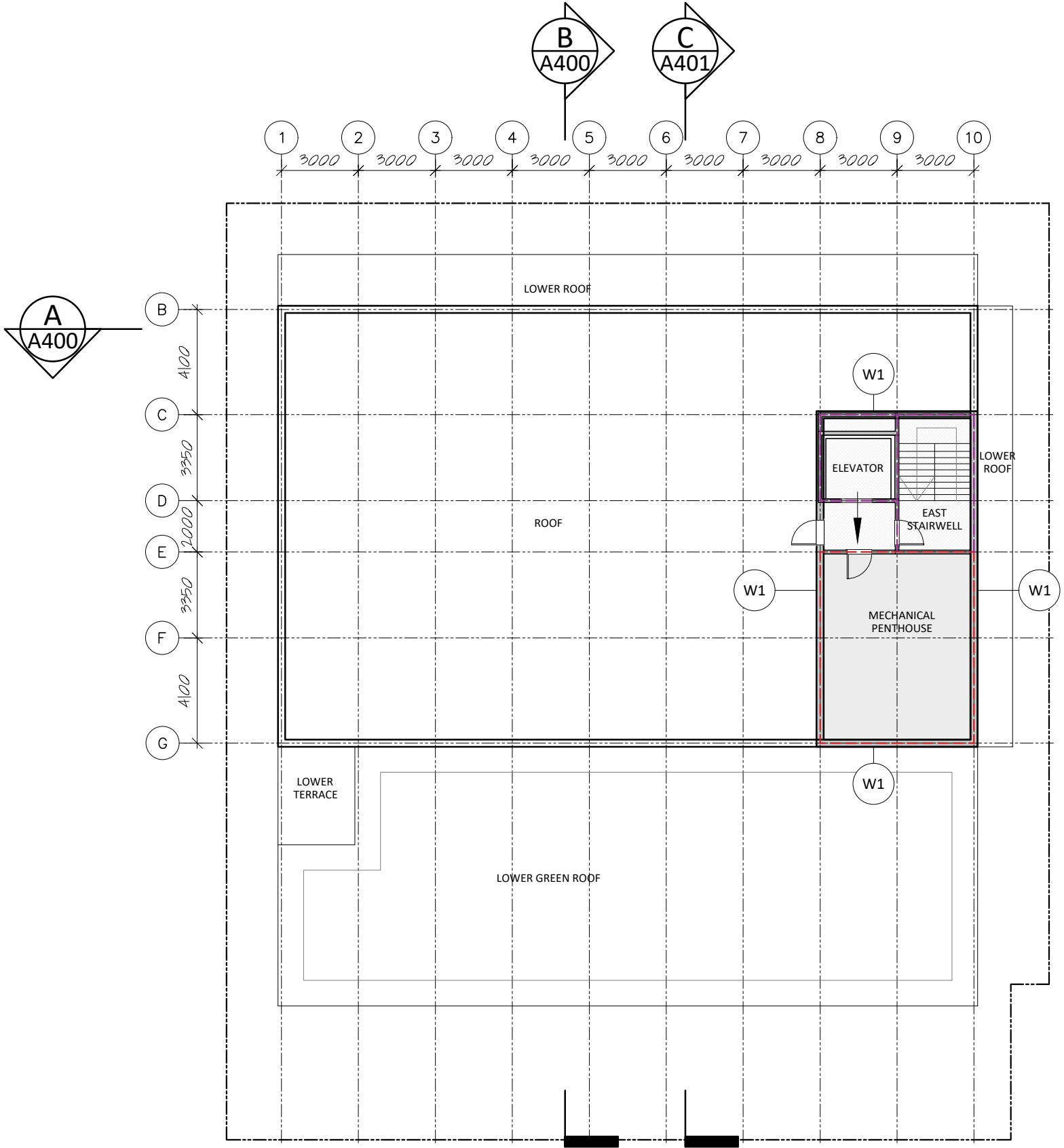


FLOOR 9

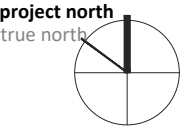
Home Base Mixed-Use Building Yellowknife, NT
August 19, 2024 Home Base Yellowknife
Schematic Design



- LEGEND:
- 45-MIN FIRE RATING
 - 1-HOUR FIRE RATING
 - SERVICE
 - CIRCULATION

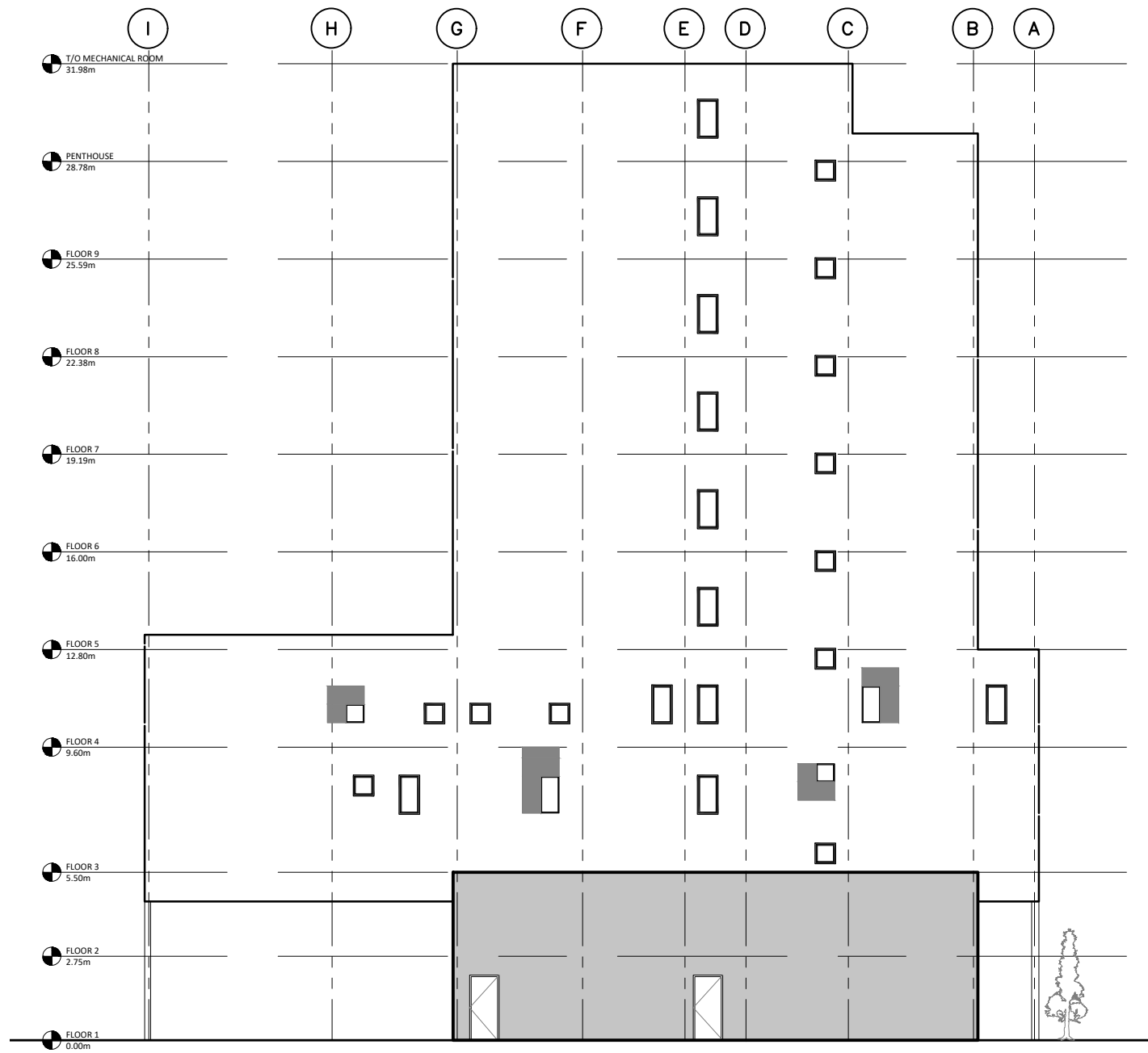


ROOF

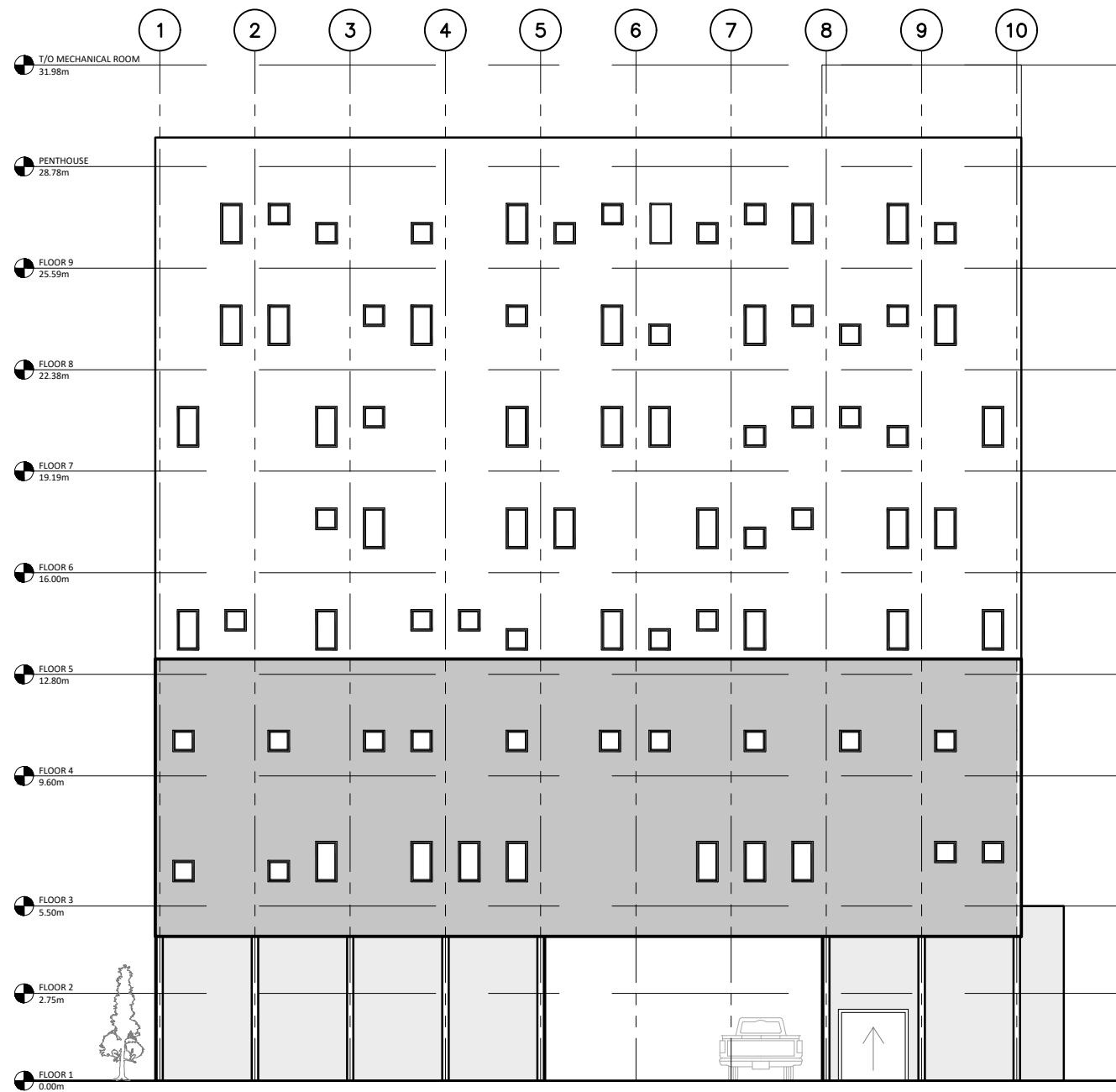




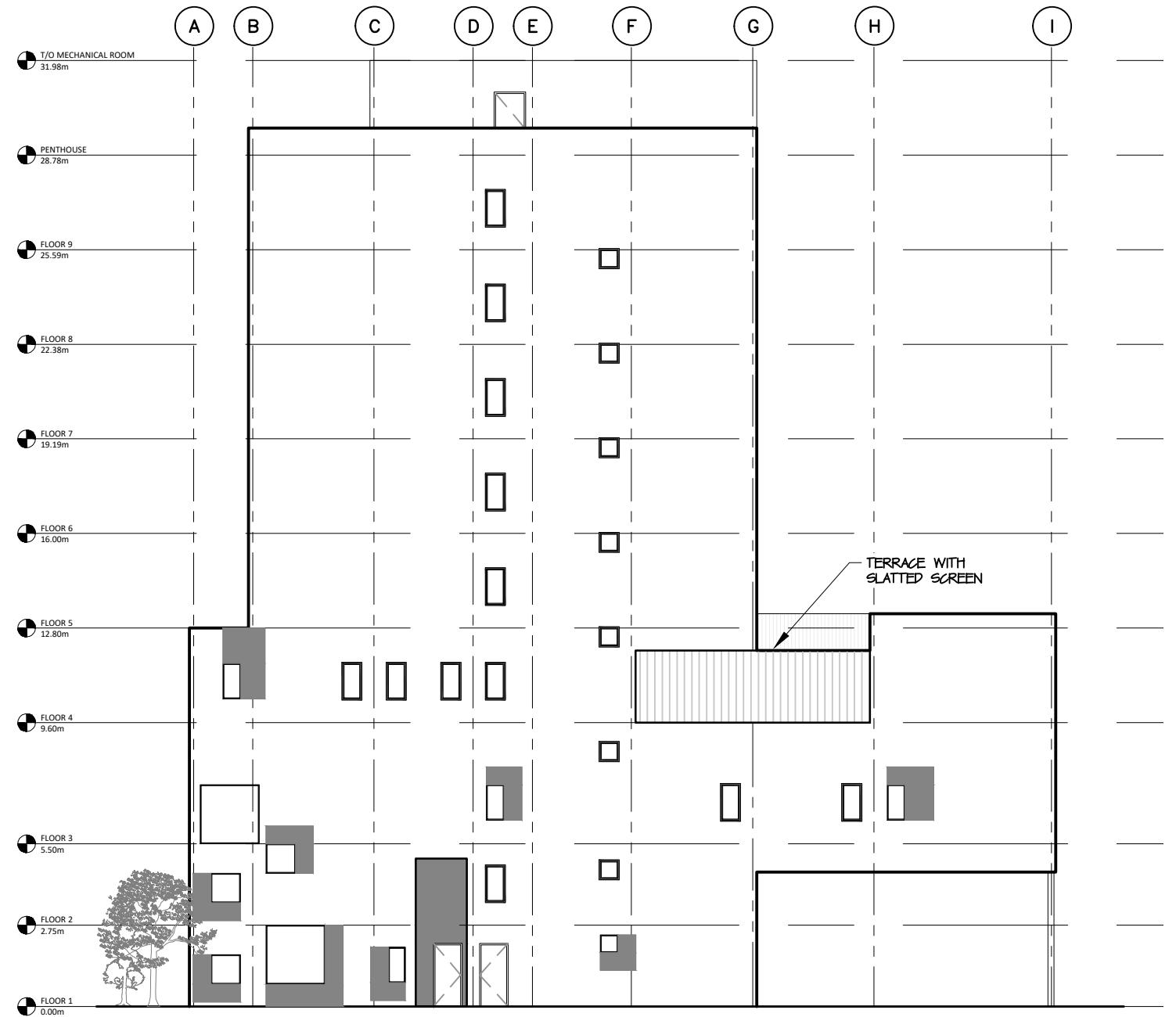
1 NORTH ELEVATION
A200 scale 1:200



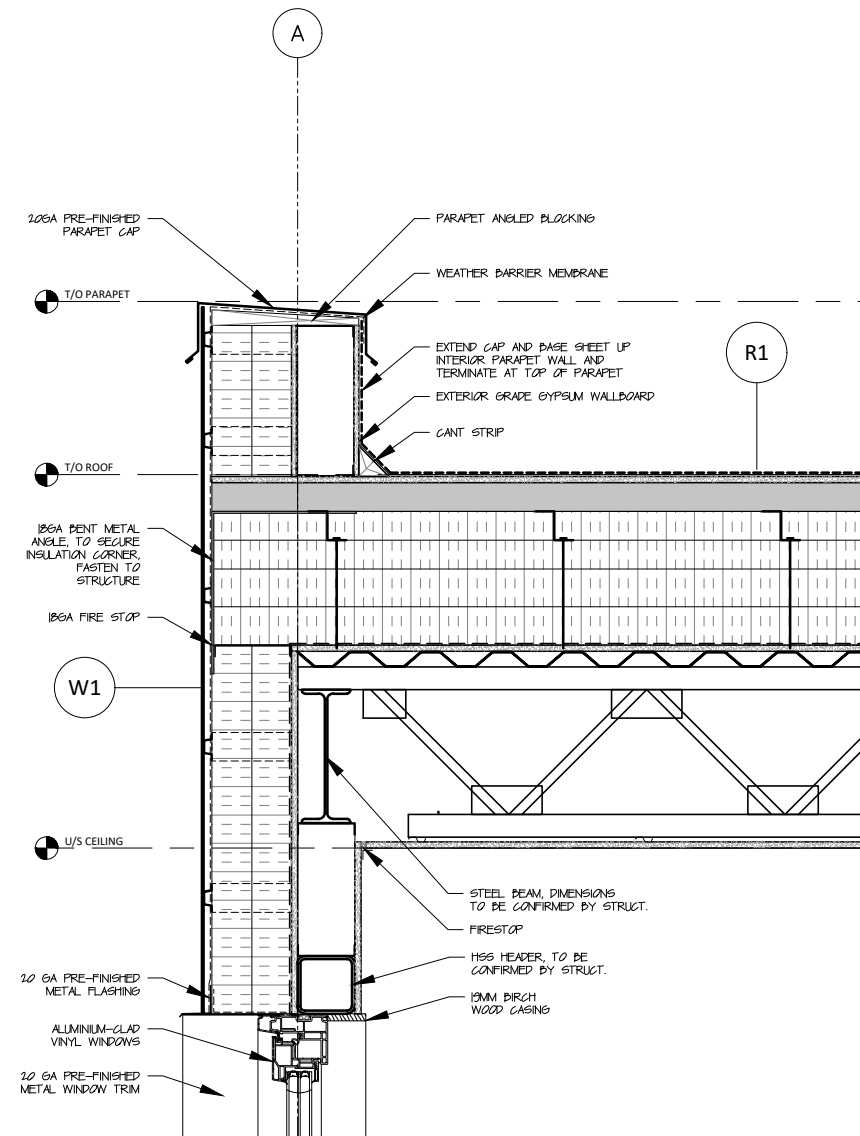
2 EAST ELEVATION
A200 scale 1:200



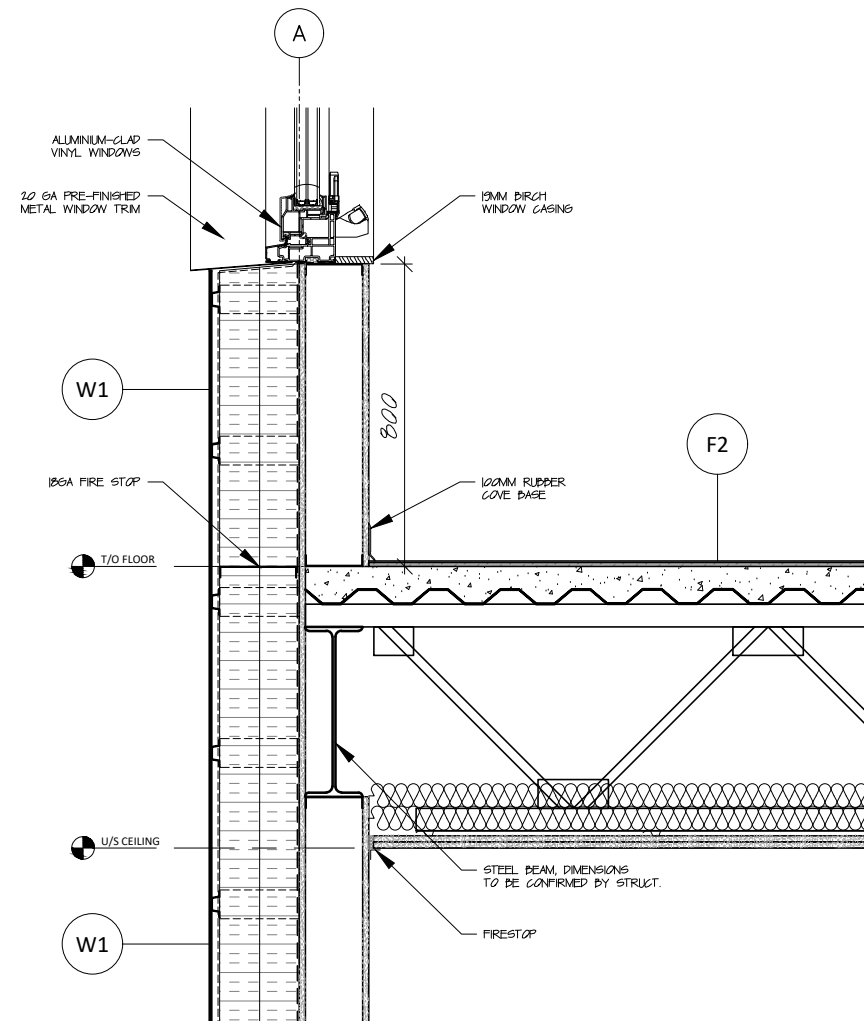
1 SOUTH ELEVATION
A201 scale 1:200



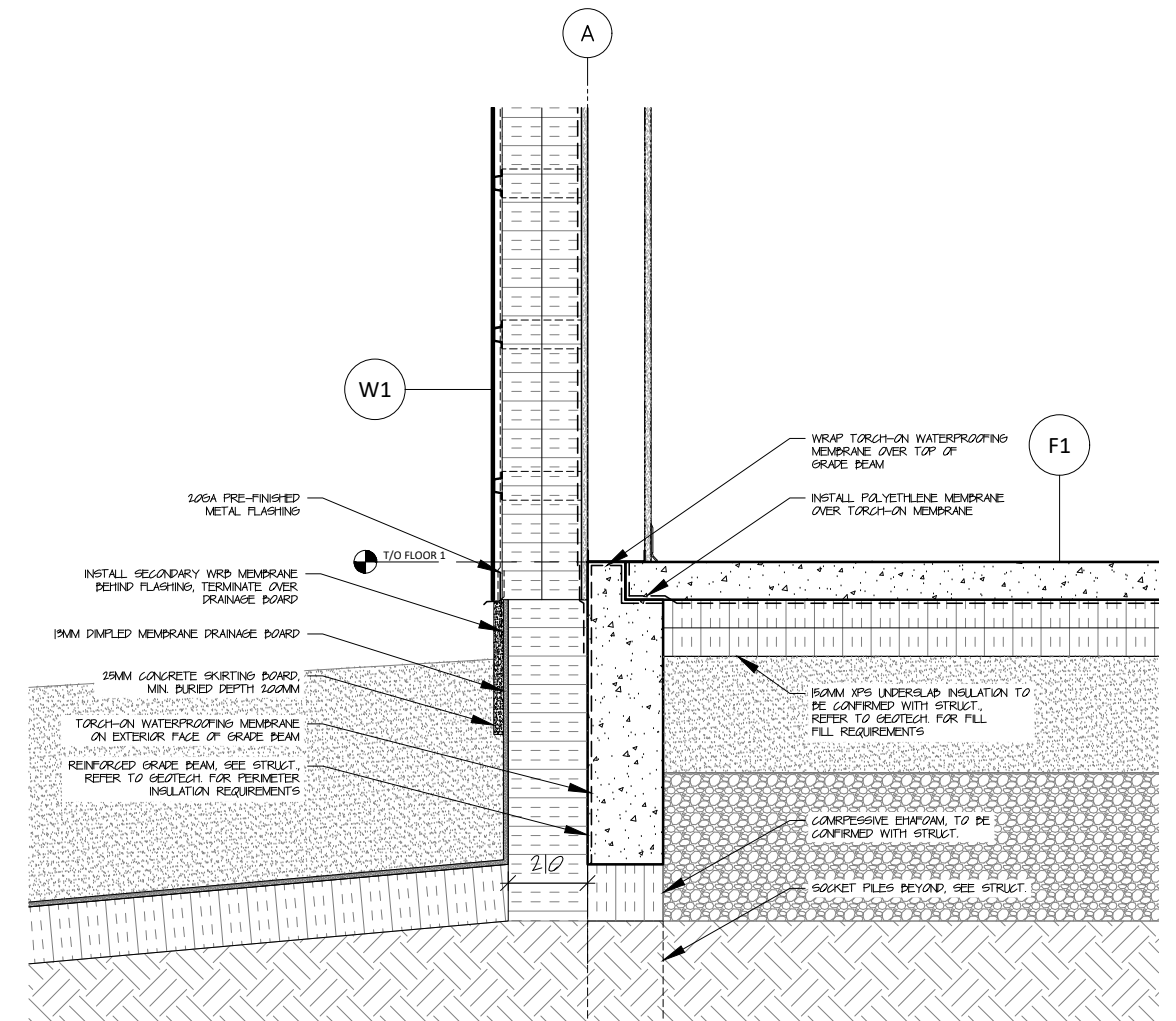
2 WEST ELEVATION
A201 scale 1:200



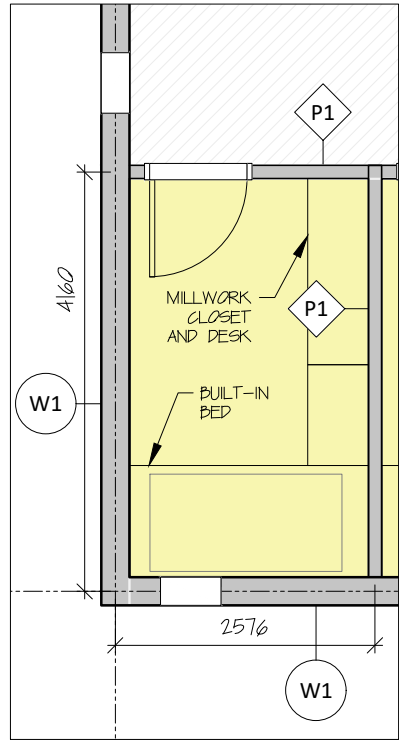
1 Parapet Detail
A500 scale 1:20



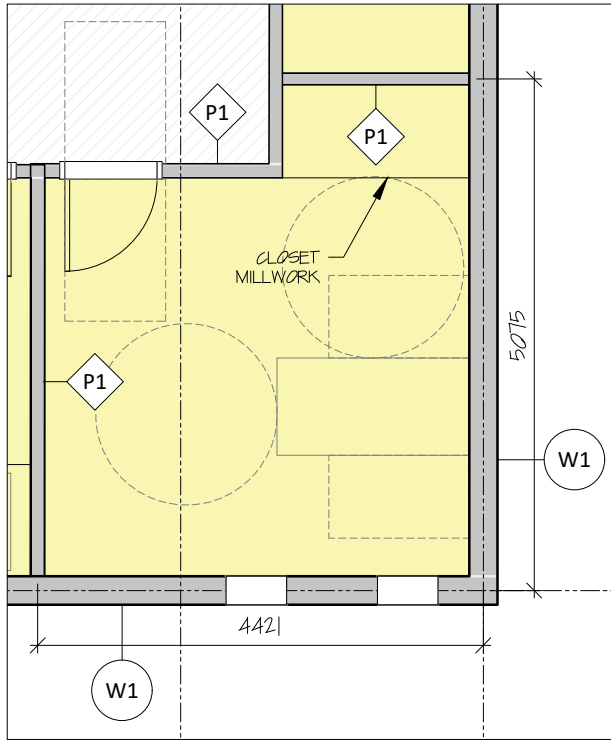
2 Wall to Wall Section Detail
A500 scale 1:20



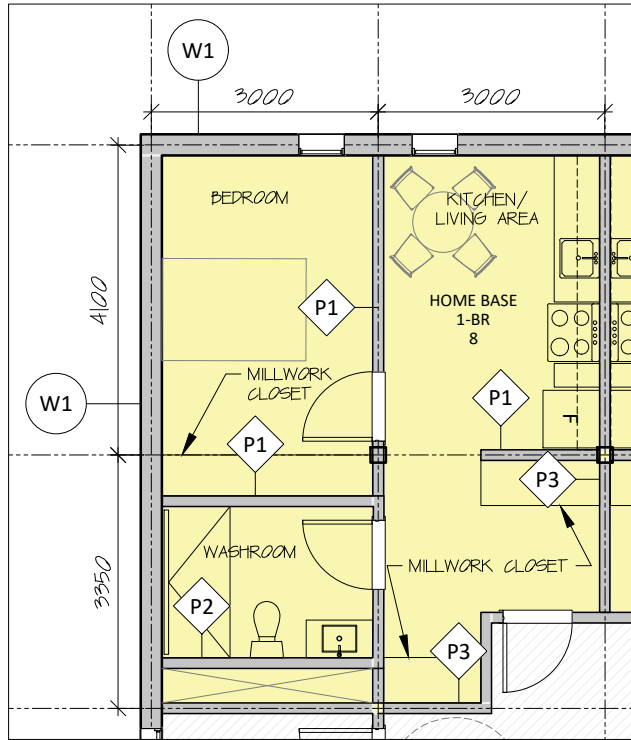
3 Wall to Foundation Detail
A500 scale 1:20



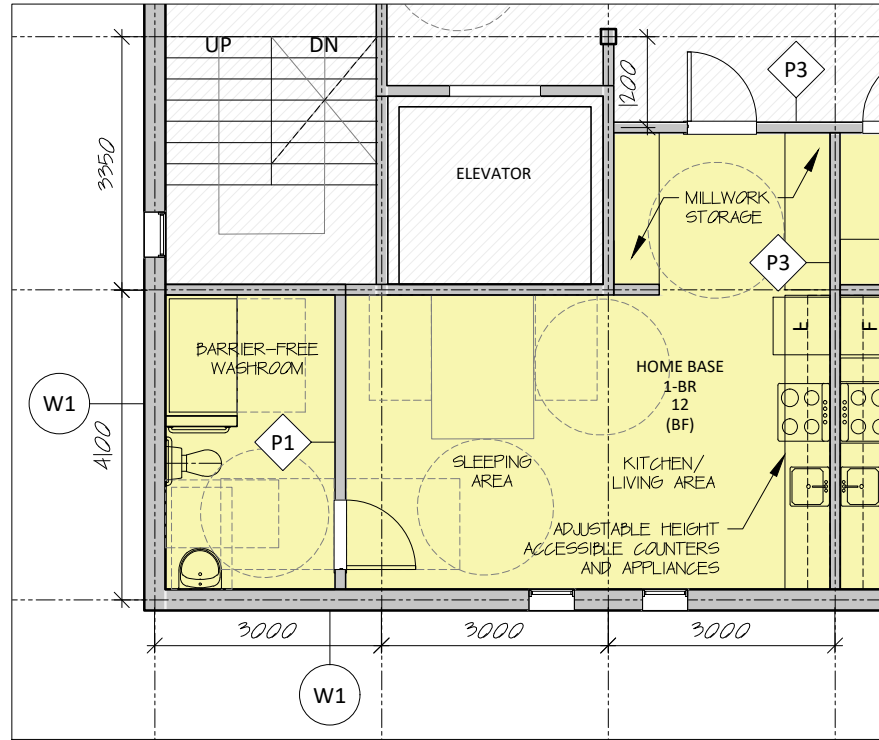
1 Dormitory
A700 scale 1:75



2 Dormitory BF
A700 scale 1:75

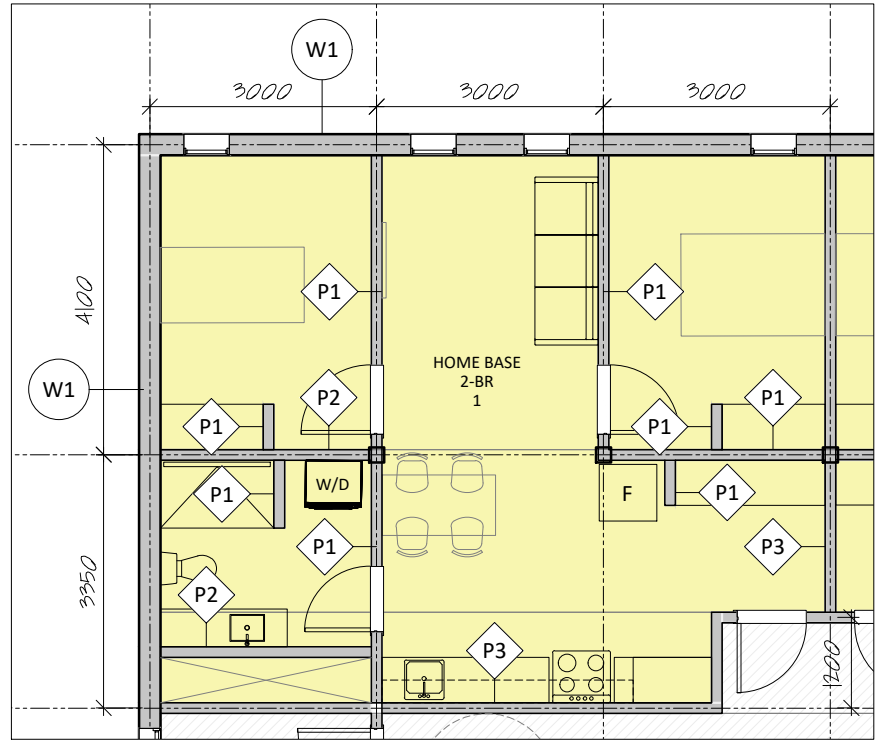


3 Home Base 1-Bedroom Apartment
A700 scale 1:100

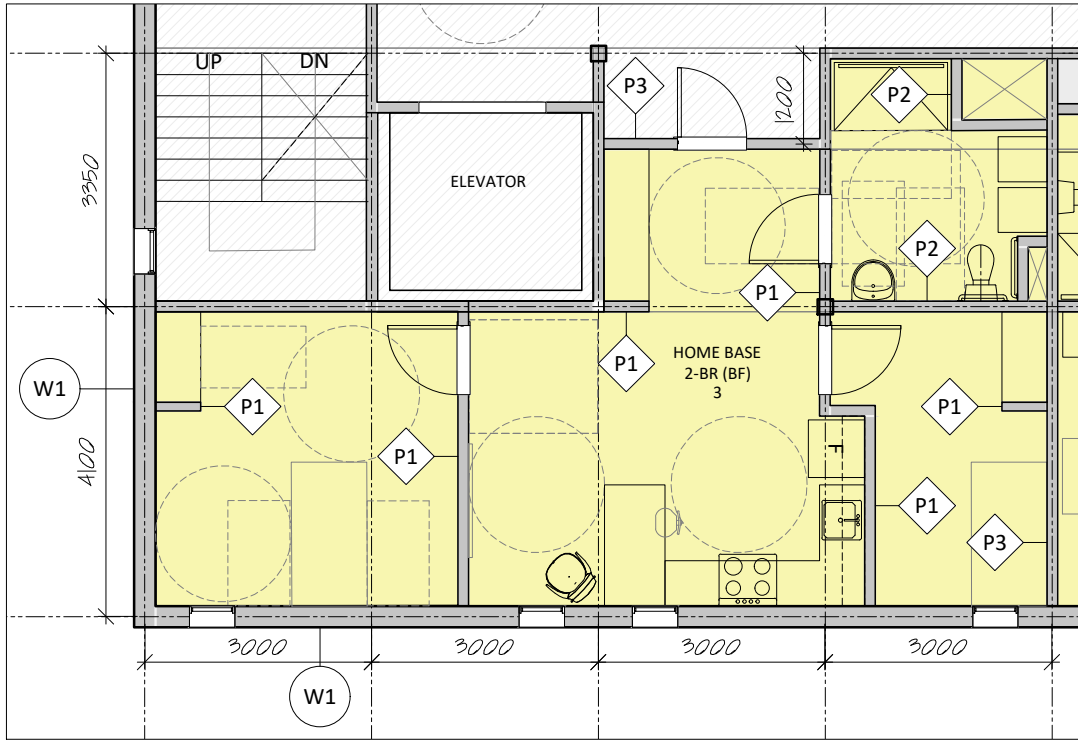


4 Home Base 1-Bedroom BF Apartment
A700 scale 1:100

- LEGEND:**
- PARTITION**
16mm TYPE-X GWB
92mm STEEL STUD W/ ACOUSTIC BATT INSULATION
16mm TYPE-X GWB
 - PARTITION (PLUMBING WALL)**
16mm TYPE-X GWB
150mm STEEL STUD W/ ACOUSTIC BATT INSULATION
16mm TYPE-X GWB
 - PARTITION (1HR FRR)**
16mm TYPE-X GWB
92mm STEEL STUD W/ ACOUSTIC BATT INSULATION
(2) 16mm TYPE-X GWB



5 Home Base 2-Bedroom Apartment
A700 scale 1:100



6 Home Base 2-Bedroom Apartment
A700 scale 1:100

HOME BASE APARTMENTS





RENDERED PERSPECTIVE

Home Base Mixed-Use Building Yellowknife, NT
 August 2024
 Schematic Design



RENDERED PERSPECTIVE

Home Base Mixed-Use Building Yellowknife, NT
August 2024
Schematic Design



RENDERED PERSPECTIVE

Home Base Mixed-Use Building Yellowknife, NT
August 2024
Schematic Design

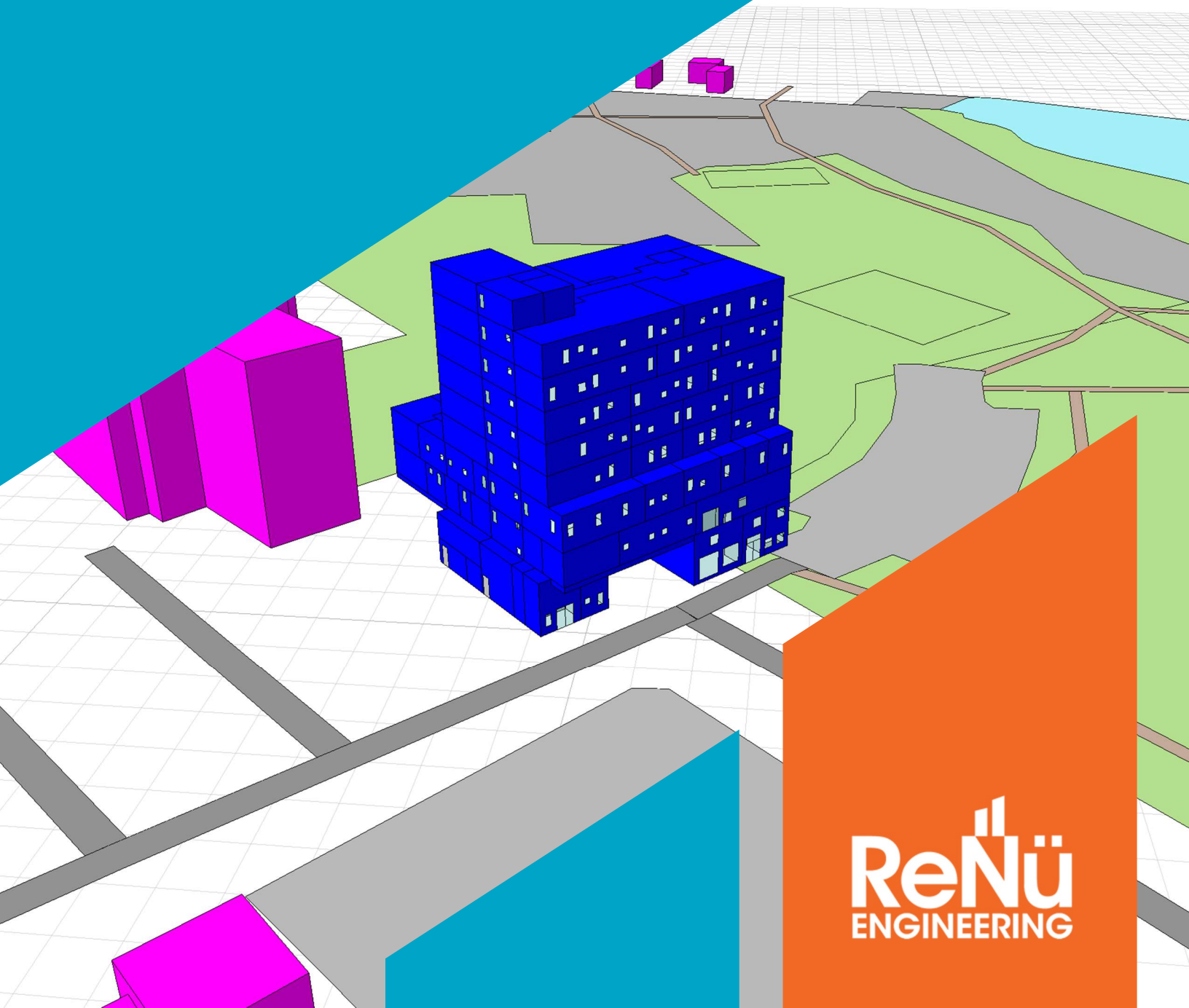
E Energy Modeling Report

NECB 2017 Energy Modeling Report

Home Base Mixed Use

Project No.: C22-1135

Issued: August 28, 2024



ReNü
ENGINEERING

Home Base Mixed Use

NECB 2017 Energy Modeling Report

Energy Modeler

ReNü Engineering Inc.
3506 McDonald Drive
Yellowknife NT
X1A 2H1

Analysis & Report By

Mike Otto, P.Eng., CEM
motto@renu.engineering

Client

Taylor Architecture Group
3502 Raccine Road
Yellowknife NT
X1A 3J2

Client Contact

Kamille Manoy
Kamille@tagyk.com

Revision	Notes	Date
0	Issued for client use	August 28, 2024

1 Executive Summary

ReNü Engineering was requested by Taylor Architecture Group (TAG) to perform a National Energy Code of Canada for Buildings (NECB) 2017 performance path (Part 8) compliance analysis on a proposed mixed-use residential and social services building to be constructed in Yellowknife, NT.

The energy consumption of the building is 16% less than the NECB 2017 reference building.

Additionally, a number of energy conservation measures were analyzed to further reduce the building's energy consumption:

- ECM-1: Improved Airtightness
- ECM-2: Biomass Boiler
- ECM-3: Dual-core ERV
- ECM-4: Recirculating Range Hoods & Heat Pump Dryers
- ECM-5: Domestic Hot Water Heat Recovery
- ECM-6: R-47 Wall Assembly
- ECM-7: Upgraded Overhead Door

These upgrades combined would save \$50,170 per year and reduce annual greenhouse gas emissions by 115.3 tCO₂e.

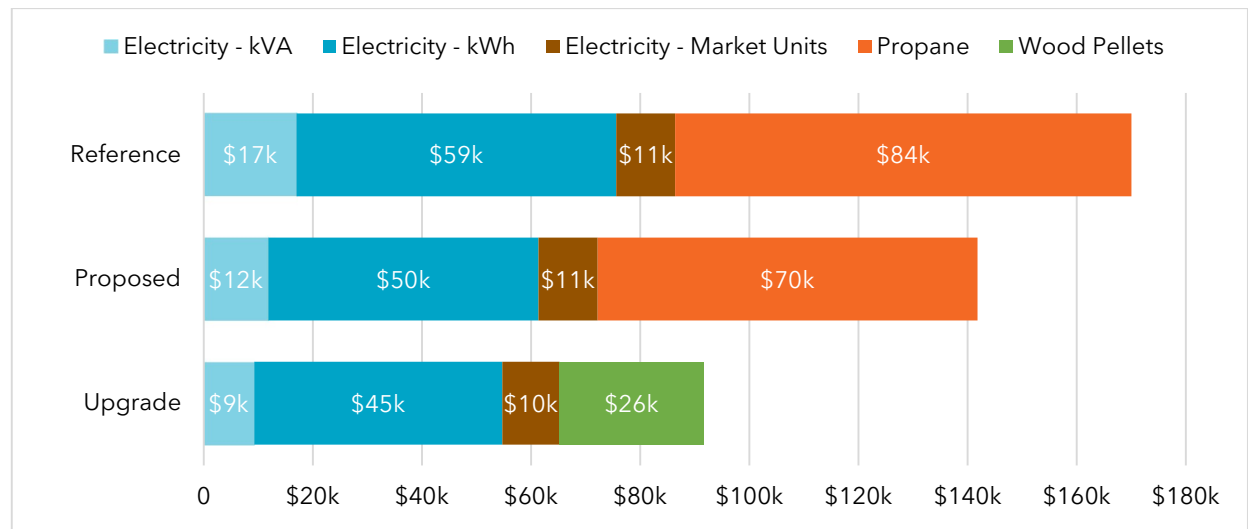


Figure 1: Projected annual energy costs

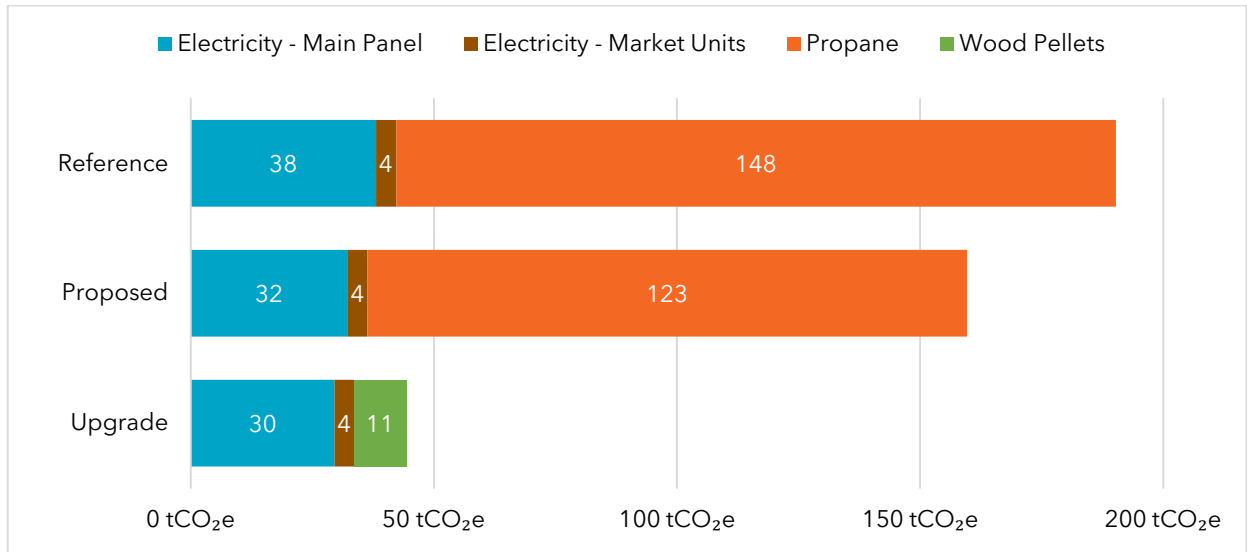


Figure 2: Projected annual GHG emissions

Table of Contents

1	Executive Summary	3
2	Introduction	6
2.1	Scope of Analysis.....	6
2.2	Information Provided	6
2.3	Analysis Method	6
3	Energy Modeling.....	7
3.1	Site and Climate Data	7
3.2	Building Geometry	7
3.3	Building Envelope	8
3.4	Lighting.....	12
3.5	Heating, Ventilation, and Air-Conditioning	14
3.6	Domestic Hot Water.....	14
3.7	Other Equipment.....	14
3.8	Operating Schedules	15
4	Results.....	16
4.1	Energy Use	16
4.2	Energy Costs	18
4.3	Greenhouse Gas Emissions.....	19
5	Energy Conservation Measures	20
5.1	ECM-1: Improved Airtightness.....	20
5.2	ECM-2: Biomass Boiler.....	21
5.3	ECM-3: Dual-core ERV	22
5.4	ECM-4: Recirculating Range Hoods & Heat Pump Dryers	23
5.5	ECM-5: Domestic Hot Water Heat Recovery	24
5.6	ECM-6: R-47 Wall Assembly.....	25
5.7	ECM-7: Upgraded Overhead Door	26
6	Upgrades Summary	27
6.1	Recommended ECMs	27
6.2	Projected Annual Energy Consumption, Cost, and GHG Emissions	28

2 Introduction

2.1 Scope of Analysis

ReNü Engineering was requested by Taylor Architecture Group (TAG) to perform a National Energy Code of Canada for Buildings (NECB) 2017 performance path (Part 8) compliance analysis on a proposed mixed-use residential and social services building to be constructed in Yellowknife, NT.

2.2 Information Provided

We have been provided with the following documentation:

- Architectural schematic design drawings by TAG dated June 28, 2024
- Draft schematic design report by TAG received on June 28, 2024

2.3 Analysis Method

IES VE 2023 energy modeling software was used to perform the energy modeling analysis. IES VE allows for calculation of building parameters such as space heating, space cooling, fans, pumps, lighting, hot water, plug loads, and human occupants in intervals of an hour or less and meets the requirements of ASHRAE 140 as required by NECB.

To perform the comparative analysis, an energy model of the proposed building is created. This model is then adjusted to meet the requirements of NECB, referred to as the reference building. If the energy consumption of the proposed building is less than or equal to the reference building, then the proposed design is in compliance with Part 8 of NECB.

The site and climate data, building geometry, building envelope assemblies, mechanical systems, and space use assignments used in both energy models are as shown in section 3. At this early stage of design heating & ventilation equipment was automatically sized using IES VE for the purposes of running the model.

3 Energy Modeling

3.1 Site and Climate Data

The data used for energy simulation and determination of the reference building's prescriptive insulation values and allowable window to wall ratio is shown below.

Table 1: IES and ASHRAE location and climate information

IES VE	Location	Yellowknife, NT
	Weather File	2020 CAN_NT_YELLOWKNIFE-A_2204101_CWEC.epw
ASHRAE	Heating Load Temp	-40.0°C
	Cooling Load Temp	28.2°C DB / 17.2°C WB
NECB 2017	Location	Yellowknife
	Heating Degree Days (HDD)	8170
	Climate Zone	8

3.2 Building Geometry

The building's allowable window & door to wall area ratio is based on the HDD of the location and calculated per Sentence 3.2.1.4.(1). The reference building may have up to 2% skylight area per Sentence 3.2.1.4.(2).

Table 2: Building geometry summary

	Reference	Proposed
Floor Area	4364 m ²	
Wall Area	2900 m ²	
Window & Door Area	580 m ²	159 m ²
Window to Wall Ratio	20.0%	5.5%
Roof Area	835 m ²	
Skylight Area	17 m ²	0 m ²
Skylight to Roof Ratio	2.0%	0.0%

3.3 Building Envelope

3.3.1 Assemblies

The modeled envelope assemblies and resulting thermal transmittance values are summarized below. TAG will design assemblies to meet the targeted U-values. Windows and doors have been selected to represent components that are commonly available on the market.

The assignment of assemblies to the energy model is shown in Figure 3.

Table 3: Modeled envelope U-values

Assembly		Reference	Proposed
Wall	All	U-value: 0.183 (R-31.0)	Steel-framed wall assembly with 2" mineral wool, 4" polyiso, 16x24" clip spacing U-value: 0.172 ^A (R-33.0)
Roof	R1 R2	U-value: 0.121 (R-46.9)	16 mm cement board 356 mm mineral wool w/perpendicular layered z-girts (estimated reduction in insulating value of 40%) 16 mm cement board Air cavity w/steel joists 16 mm drywall U-value: 0.147 (R-38.5)
Exposed Floor	All	U-value: 0.142 (R-40.0)	Metal soffit 204 mm mineral wool w/perpendicular layered Armatherm fiberglass z-girts (estimated reduction in insulating value of 20%) 16 mm cement board 102 mm mineral wool w/steel joists (estimated reduction in insulating value of 50%) 100 mm concrete 10 mm plywood underlay U-value: 0.151 (R-37.6)
Ground-contact Floor	North	R-15 under full slab area ISO 13370 U-value: 0.148	R-30 under full slab area ISO 13370 U-value: 0.105
	South	R-15 under full slab area ISO 13370 U-value: 0.144	R-30 under full slab area ISO 13370 U-value: 0.103
Window	Fiberglass Fixed	U-value: 1.4 SHGC same as proposed	Triple, 2x low-e (272/272), argon fill, vinyl frame in Duxton 458 frame Overall U-value: 0.85, SHGC: 0.35

^A Effective insulation value calculated by Soprema in memo dated July 18, 2024.

Assembly		Reference	Proposed
	Fiberglass Operable		Triple, 2x low-e (272/272), argon fill, vinyl frame in Duxton 458 frame Overall U-value: 0.97, SHGC: 0.35
	Curtainwall Fixed		Triple, 2x low-e, argon fill glazing Glass U-value: 0.74, SHGC: 0.35 Alumicor Thermawall T2600 framing, non-metallic spacer Overall U-value: 1.10
Skylight	All	U-value: 1.4	N/A
Door	Curtainwall Glazed	U-value: 1.4	Double, low-e, argon fill glazing Glass U-value: 1.42, SHGC: 0.40 Alumicor ThermaPorte 7700 T400A door, non-metallic spacer Overall U-value: 2.82
	Opaque		Insulated metal door in metal frame U-value: 2.10
	Overhead		Richards-Wilcox T175 U-value: 1.19

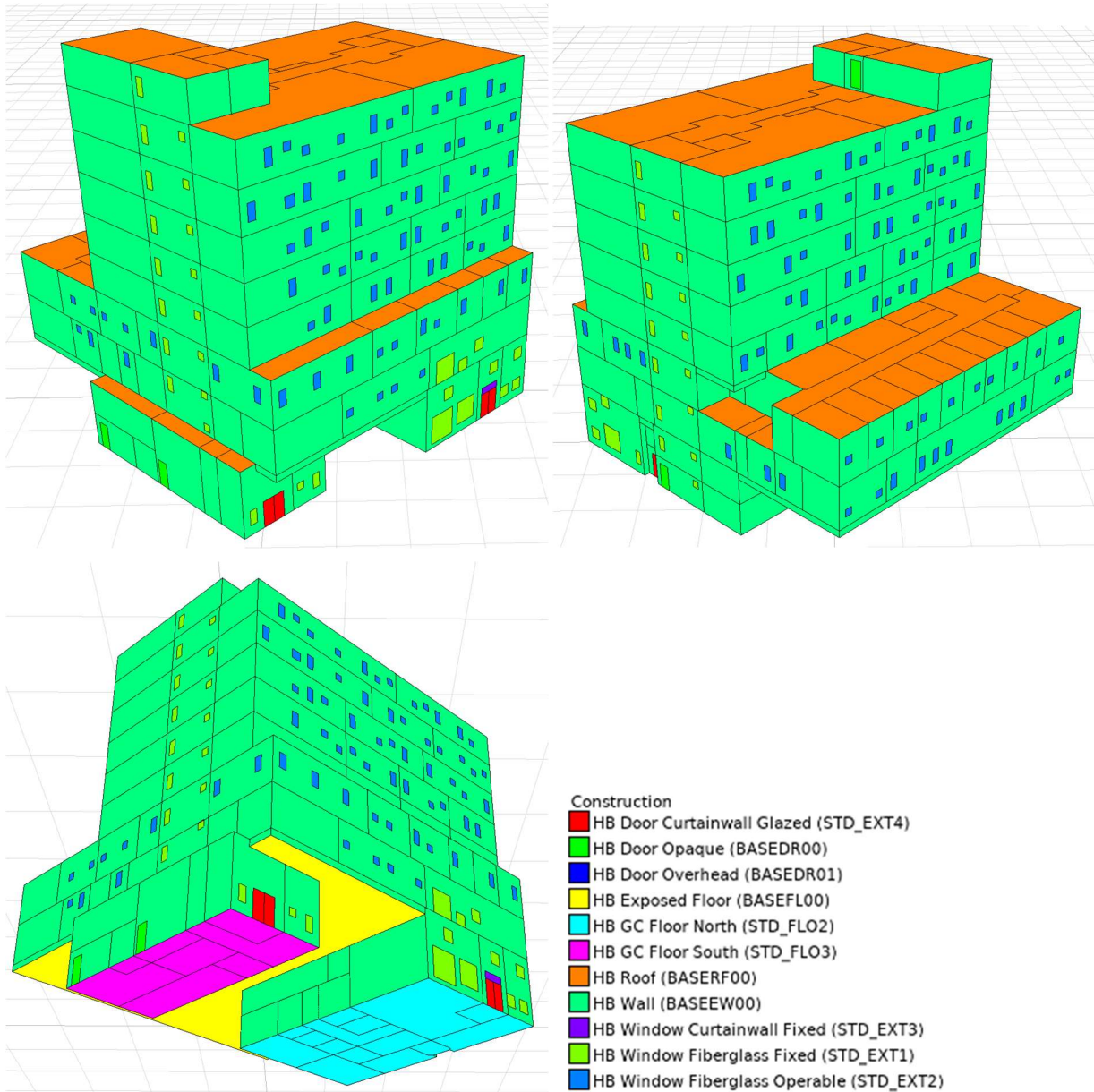


Figure 3: Building energy model showing proposed building assemblies.

3.3.2 Air Infiltration

NECB 2017 specifies a default infiltration rate to be used in the reference model, this has been used for the reference and proposed models. A higher level of airtightness is analyzed in ECM-1: Improved Airtightness.

Table 4: Modeled envelope air infiltration

Assembly	Reference	Proposed
Wall, Roof	0.25 L/s·m ² gross wall and roof area Equates to 0.322 L/s·m ² wall area @ 5 Pa 934 L/s	

3.4 Lighting

3.4.1 Interior Lighting

Determination of the reference building's allowable interior lighting power was performed using the space-by-space method, with space types selected as shown in Table 5 below.

The lighting power density for the proposed building is set to match the reference building lighting power density. Lighting power for the dwelling units is set to 5.0 W/m² in the reference and proposed models per NECB Sentences 8.4.3.4.(1) and 8.4.4.5.(2).

Table 5: Summary of space types and calculated lighting power densities

Space Type	Reference			Proposed		
	Base LPD (W/m ²)	Control	Adjusted LPD (W/m ²)	Base LPD (W/m ²)	Control	Adjusted LPD (W/m ²)
Classroom/lecture hall/training, other	7.6	2	4.8	7.6	2	4.8
Conference/meeting/multi-purpose	10.5	2	6.6	10.5	2	6.6
Corridor/transition, other	4.4	2	4.4	4.4	2	4.4
Dining area, cafeteria/fast food dining	4.3	2	4.3	4.3	2	4.3
Electrical/mechanical	4.6	4	4.2	4.6	4	4.2
Food preparation area	11.7	2	11.7	11.7	2	11.7
Laundry/washing area	5.7	2	5.7	5.7	2	5.7
Lounge/break, other	6.3	2	6.3	6.3	2	6.3
Office, enclosed, ≤25m ²	8.0	2	5.6	8.0	2	5.6
Office, open plan	6.6	2	5.0	6.6	2	5.0
Stairwell	5.3	2	5.3	5.3	2	5.3
Storage room, <5m ²	5.5	2	3.0	5.5	2	3.0
Washroom, other	6.8	2	4.3	6.8	2	4.3
Dormitory - living quarters	5.4	4	5.4	5.4	4	5.4
Dwelling units, general	5.0	-	5.0	5.0	-	5.0
Healthcare facility, exam/treatment	15.1	2	11.7	15.1	2	11.7

The assignment of space types in the energy model is shown in Figure 4.

Table 6: Listing of lighting control types (adapted from NECB Table 4.3.2.10.-B)

No.	On Mode	Off Mode
1	Auto full on	Auto full off
2	Manual on or Auto partial on	Auto full off
3	Manual on	Auto partial off
4	Manual on	Manual off
5	No local switches	No local switches

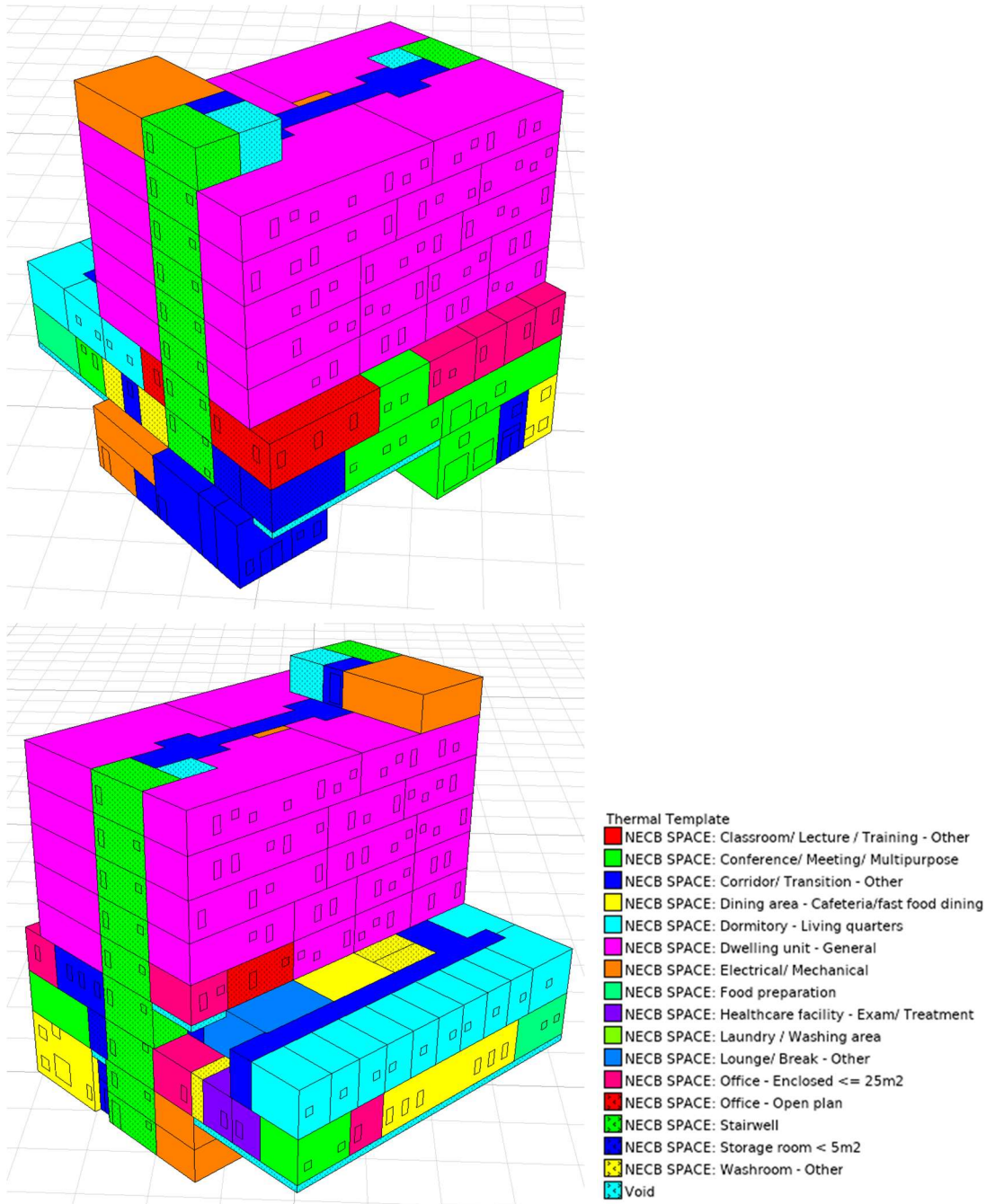


Figure 4: View of the energy model showing assigned space types.

3.4.2 Exterior Lighting

Exterior lighting has not been designed so an assumed lighting load of 500 W is included in the reference and proposed models. The exterior lighting will be controlled by a photocell.

3.5 Heating, Ventilation, and Air-Conditioning

Table 7: HVAC systems summary

Spaces	Reference	Proposed
All	Heating by fan-coil units supplied by air-source heat pump ^B when outdoor air temperature is above -10°C and 90% efficient propane-fired boilers when it is colder Same ventilation as proposed with 50% sensible effective HRV Cooling by EER 9.8 heat pump	Heating by fan-coil units supplied by air-source heat pump ^C when outdoor air temperature is above -8°C and 95% efficient propane-fired boilers when it is colder Ventilation by 60% sensible effective HRV with hydronic preheat to -10°C, outdoor air rate based on ASHRAE 62.1 (2218 L/s total) Assumed 50 L/s per dryer (common dryers 1h/day, apartment dryers 1h/week) and 100 L/s per kitchen range hood (1h/day) Cooling by EER 9.8 heat pump

3.6 Domestic Hot Water

Table 8: Hot water heating systems summary

System	Reference	Proposed
All	90% efficient propane-fired tank heaters	95% efficient propane-fired tank heaters

3.7 Other Equipment

A load of 3 kW per elevator using NECB Occupancy Schedule C has been assumed as specified in City of Vancouver Energy Modeling Guidelines v2.0.

^B ASHP is modeled with NECB reference building curve which varies from COP 2.05 at -8.3°C to COP 3.2 at 8.3°C.

^C ASHP is modeled as a Mitsubishi NX-N, COP varies from 2.3 at -15°C to 4.3 at 15°C.

3.8 Operating Schedules

Each space is assigned peak occupancy, plug loads, and DHW loads as shown below.

Table 9: Space occupancy and loads

Space Type	Peak Occupancy (m ² /person)	Peak Plug Load (W/m ²)	Peak DHW Load (W/person)	Peak DHW Load (L/h)	NECB Schedule
Classroom/lecture hall/training, other	7.5	7.5	65	4	C
Conference/meeting/multi-purpose	5	1	45	42	C
Corridor/transition, other	100	0	0	0	C
Dining area, cafeteria/fast food dining	10	1	120	28	C
Electrical/mechanical	200	1	0	0	C
Food preparation area	20	10	120	6	C
Laundry/washing area	20	20	60	1	C
Lounge/break, other	10	1	60	7	C
Office, enclosed, ≤25m ²	20	7.5	90	9	C
Office, open plan	20	7.5	90	7	C
Stairwell	200	0	0	0	C
Storage room, <5m ²	100	0	0	0	C
Washroom, other	30	1	0	0	C
Dormitory - living quarters	25	2.5	500	50	G
Dwelling units, general	25	5	375	407	G
Healthcare facility, exam/treatment	20	10	90	1	C

The values specified in section 3.4.1 for lighting power densities and above for occupancy, plug loads, and DHW use are peak values that are multiplied by a value from 0-1 that varies hourly based on the building's operating schedule.

4 Results

4.1 Energy Use

The projected annual energy use for the reference buildings and proposed building is shown below.

Table 10: Projected annual energy use summary (MWh)

Energy Source	End Use	Reference		Proposed		Savings
Electricity - Common Panel	Space Heating	59.7	223.6	34.3	189.2	43%
	Space Cooling	10.9		3.0		72%
	Fans	26.1		25.2		3%
	Pumps	1.9		1.6		16%
	Interior Lighting	61.5		61.5		0%
	Exterior Lighting	3.2		3.2		0%
	Plug Loads	36.3		36.3		0%
	Elevators	24.1		24.1		0%
Electricity - Market Units	Subpanels	24.3	24.3	24.3	24.3	0%
Propane	Space Heating	573.5	680.9	465.4	567.1	19%
	Domestic Hot Water	107.4		101.7		5%
Total		928.8		780.6		16%

The energy consumption of the building is 16% less than the NECB 2017 reference building.

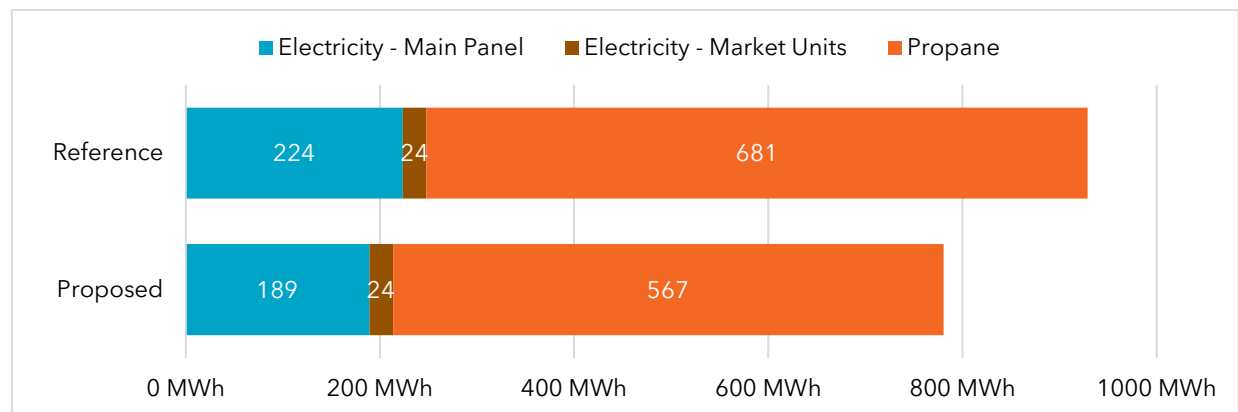


Figure 5: Projected annual energy consumption

The figure below shows the relative proportion of energy consumption by end use, with space heating split out into conduction, infiltration (air leakage through the envelope), and ventilation (fresh air) heating.



Figure 6: Energy end use diagram

4.2 Energy Costs

Table 11: Projected annual energy costs

	Electrical Demand	Electricity - Common Panel	Electricity - Market Units	Propane	Total
Reference	\$17,055	\$58,554	\$10,811	\$83,626	\$170,045
Proposed	\$11,845	\$49,532	\$10,811	\$69,652	\$141,841

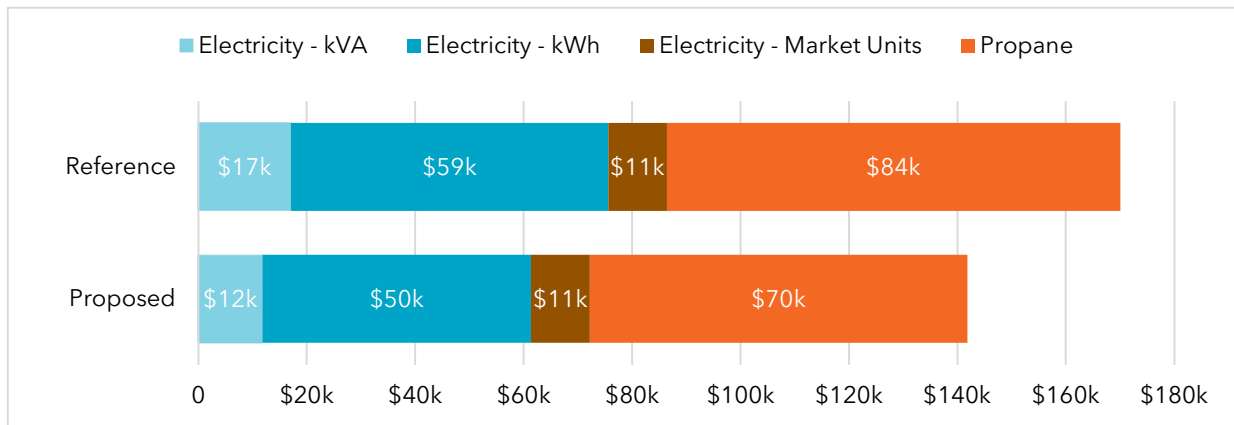


Figure 7: Projected annual energy costs

Costs for energy consumption are based on the rates below.

Table 12: Energy content and cost for energy sources

Energy Source	Rate	Unit	Energy Content	Note
Electricity	\$15.32	kVA	-	Arctic Energy Alliance fuel cost library
	\$0.2618	kWh	0.001 MWh/kWh	
Propane	\$0.87	L	0.007 MWh/L	

4.3 Greenhouse Gas Emissions

Table 13: Projected annual greenhouse gas emissions

	Electricity - Common Panel	Electricity - Market Units	Propane	Total
Reference	38.1	4.1	148.0	190.3
Proposed	32.2	4.1	123.3	159.7

The proposed building's GHG emissions are 16% less than the NECB 2017 reference building.

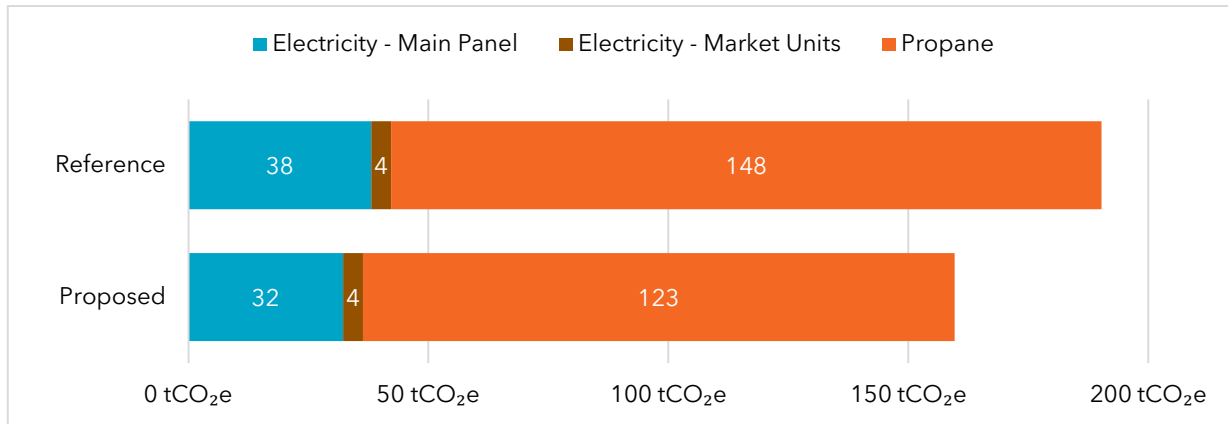


Figure 8: Projected annual greenhouse gas emissions

Table 14: Greenhouse gas emissions for energy sources

Energy Source	GHG Emissions	Note
Electricity	0.170 tCO ₂ e/MWh	Based on Environment and Climate Change Canada National Inventory Report 2022
Propane	0.217 tCO ₂ e/MWh	

5 Energy Conservation Measures

5.1 ECM-1: Improved Airtightness

5.1.1 Description

NECB 2017 states a default air leakage value of 0.25 L/s·m² wall and roof area. This results in a calculated air leakage through the envelope of 934 L/s at an operating pressure differential of 5 Pa.

Passive House Institute US (PHIUS) Core certification requires a maximum air leakage of 0.08 cfm/ft² at 75 Pa, or 0.41 L/s·m². This equates to an air leakage of 336 L/s. This level of airtightness is achieved through architectural detailing, good construction, and blower door testing during and after construction to confirm compliance with the targeted air leakage value.

We have run a variation of the model assuming an air leakage that is double that allowed by PHIUS Core, or 673 L/s. This level of airtightness should be achievable for this project.

5.1.2 Energy Analysis

Table 15: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L
ECM Energy Use	726 MWh	183851 kWh	73111.8 L
Energy Savings	55 MWh	5340 kWh	6948.3 L
Energy Cost Savings	\$8,156	\$2,111	\$6,045
GHG Reduction	11.6 tCO ₂ e	0.9 tCO ₂ e	10.7 tCO ₂ e

5.2 ECM-2: Biomass Boiler

5.2.1 Description

The mechanical systems could be modified to use biomass (wood pellet) boilers for space and water heating instead of propane, which will reduce fuel costs and greenhouse gas emissions.

5.2.2 Energy Analysis

Table 16: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane	Wood Pellets
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L	0 t
ECM Energy Use	847 MWh	189191 kWh	0 L	176.1 t
Energy Savings	-67 MWh	0 kWh	80060.1 L	-176.1 t
Energy Cost Savings	\$12,918	\$0	\$69,652	-\$56,735
GHG Reduction	100.2 tCO ₂ e	0 tCO ₂ e	123.3 tCO ₂ e	-23.1 tCO ₂ e

5.3 ECM-3: Dual-core ERV

5.3.1 Description

The schematic design report does not state what type of HRV is intended to be used for the building. As a baseline we have assumed a 60% sensible effective conventional HRV that requires air preheating to -10°C to prevent freeze-up.

As an alternative, a dual-core ERV (Tempeff or Price RegenCore) would have a heat recovery effectiveness better than 85% sensible/70% latent (which will help in keeping humidity levels reasonable in the winter) and does not require air preheating.

5.3.2 Energy Analysis

Table 17: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L
ECM Energy Use	613 MWh	182848 kWh	57301.4 L
Energy Savings	168 MWh	6343 kWh	22758.7 L
Energy Cost Savings	\$22,424	\$2,624	\$19,800
GHG Reduction	36.1 tCO ₂ e	1.1 tCO ₂ e	35 tCO ₂ e

5.4 ECM-4: Recirculating Range Hoods & Heat Pump Dryers

5.4.1 Description

For the baseline model we have assumed conventional kitchen range hoods in the apartments that exhaust to the outdoors, and conventional electric clothes dryers that also exhaust to the exterior.

As an alternative, recirculating range hoods could be used (with general kitchen exhaust provided by the central ERV) and heat pump clothes dryers that don't need an external vent could be installed. This is assumed to be the case for the apartments only; the staff area and café kitchens would still be externally vented as would the central common laundry rooms.

The savings below do not take into account the overall improvement to airtightness of the building that will occur with the elimination of many exterior vent hoods from these appliances.

5.4.2 Energy Analysis

Table 18: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Electricity - Market Units	Propane
Baseline Energy Use	781 MWh	189191 kWh	24325 kWh	80060.1 L
ECM Energy Use	769 MWh	186871 kWh	23413 kWh	78940.2 L
Energy Savings	11 MWh	2320 kWh	912 kWh	1120 L
Energy Cost Savings	\$2,447	\$1,160	\$312	\$974
GHG Reduction	2.3 tCO ₂ e	0.4 tCO ₂ e	0.2 tCO ₂ e	1.7 tCO ₂ e

5.5 ECM-5: Domestic Hot Water Heat Recovery

5.5.1 Description

Drain water heat recovery heat exchangers could be added to the plumbing stacks to preheat cold water before going to the water heaters. We have assumed 40% effective heat exchanger units in the analysis below.

5.5.2 Energy Analysis

Table 19: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L
ECM Energy Use	725 MWh	189191 kWh	72178.2 L
Energy Savings	56 MWh	0 kWh	7881.9 L
Energy Cost Savings	\$6,857	\$0	\$6,857
GHG Reduction	12.1 tCO ₂ e	0 tCO ₂ e	12.1 tCO ₂ e

5.6 ECM-6: R-47 Wall Assembly

5.6.1 Description

The baseline wall assembly has an effective insulating value of R-33.0. The analysis below assumes an effective insulating value of R-47.0.

5.6.2 Energy Analysis

Table 20: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L
ECM Energy Use	758 MWh	186889 kWh	77163.4 L
Energy Savings	23 MWh	2302 kWh	2896.7 L
Energy Cost Savings	\$3,439	\$919	\$2,520
GHG Reduction	4.9 tCO ₂ e	0.4 tCO ₂ e	4.5 tCO ₂ e

5.7 ECM-7: Upgraded Overhead Door

5.7.1 Description

The baseline model assumes a 1-3/4" overhead door, this could be upgraded to a 3" thick model.

5.7.2 Energy Analysis

Table 21: Annual fuel, energy, and GHG emission reductions

	Total	Electricity	Propane
Baseline Energy Use	781 MWh	189191 kWh	80060.1 L
ECM Energy Use	780 MWh	189165 kWh	80033.2 L
Energy Savings	0 MWh	26 kWh	27 L
Energy Cost Savings	\$26	\$3	\$23
GHG Reduction	0 tCO ₂ e	0 tCO ₂ e	0 tCO ₂ e

6 Upgrades Summary

In the previous sections, a number of ECMs were analyzed, with estimated reductions in fuel use, operating cost, and greenhouse gas emissions calculated for each. If ECMs are implemented at the same time, they interact in ways that either diminish or enhance each other's effects. This section takes all of the ECMs and calculates what the combined effect would be if they were implemented together.

6.1 Recommended ECMs

This upgrade summary includes all the ECMs analyzed previously:

- ECM-1: Improved Airtightness
- ECM-2: Biomass Boiler
- ECM-3: Dual-core ERV
- ECM-4: Recirculating Range Hoods & Heat Pump Dryers
- ECM-5: Domestic Hot Water Heat Recovery
- ECM-6: R-47 Wall Assembly
- ECM-7: Upgraded Overhead Door

The figures on the following pages represent the projected energy savings if all ECMs are implemented at the same time and take into account the interactive effects between the different ECMs using the whole-building energy model.

6.1.1 Energy Analysis

Table 22: Annual fuel, energy, and GHG emission reductions

	Total	Electricity - Common Panel	Electricity - Market Units	Propane	Wood Pellets
Baseline Energy Use	781 MWh	189191 kWh	24325 kWh	80060.1 L	0 t
ECM Energy Use	492 MWh	173625 kWh	23413 kWh	0 L	82.1 t
Energy Savings	288 MWh	15566 kWh	912 kWh	80060.1 L	-82.1 t
Energy Cost Savings	\$50,170	\$6,653	\$312	\$69,652	-\$26,448
GHG Reduction	115.3 tCO ₂ e	2.7 tCO ₂ e	0.2 tCO ₂ e	123.3 tCO ₂ e	-10.8 tCO ₂ e

6.2 Projected Annual Energy Consumption, Cost, and GHG Emissions

The graphs below show the expected annual energy use, operating cost, and GHG emissions for the proposed building if no changes were made and with the upgrade case outlined in section 6.1.

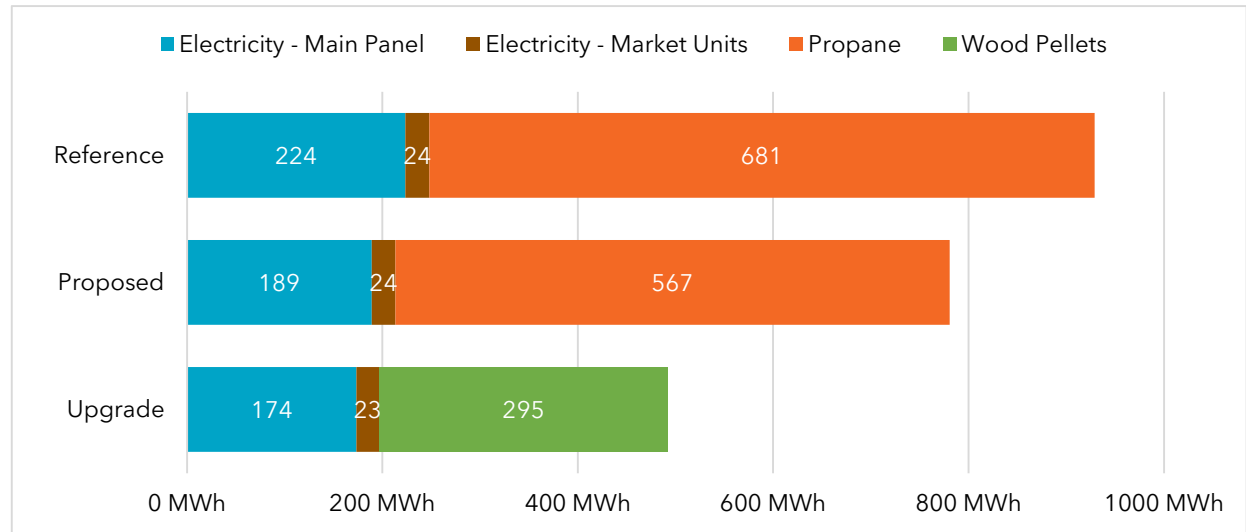


Figure 9: Projected annual energy use

Total energy consumption will be reduced from 781 MWh to 493 MWh, a reduction of 37%.

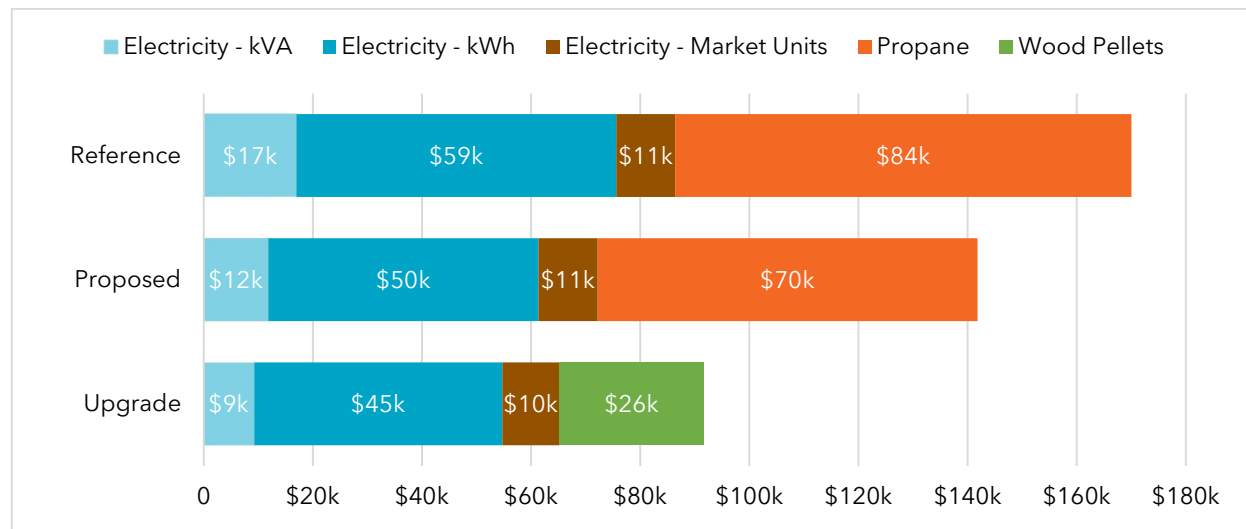


Figure 10: Projected annual energy costs

The building's energy costs would be reduced from \$142k annually to \$92k, a reduction of 35%.

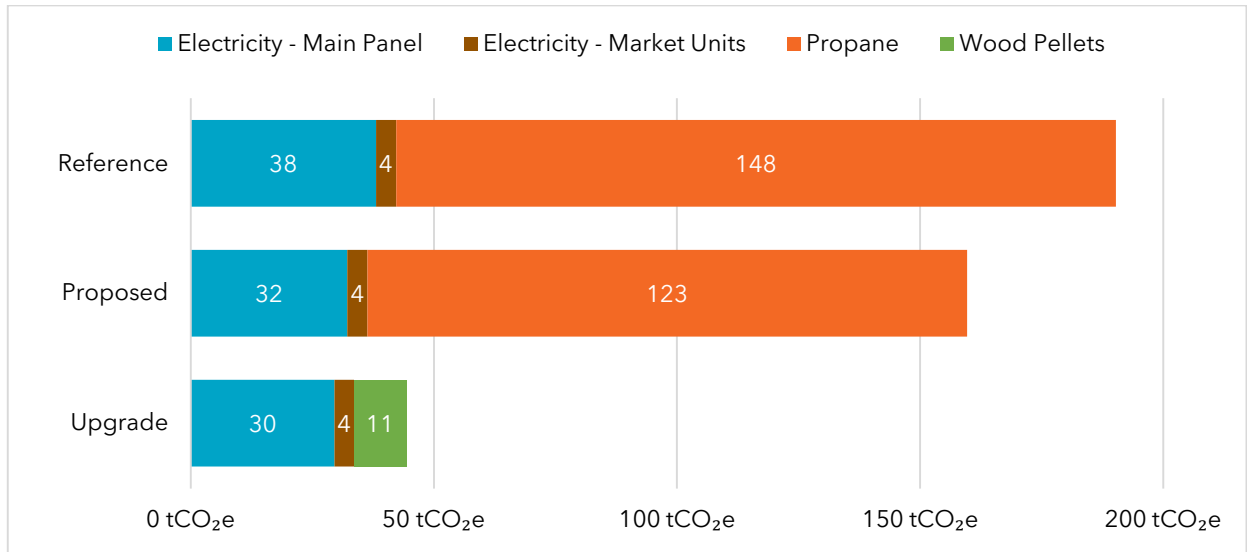


Figure 11: Projected annual GHG emissions

Greenhouse gas emissions would be reduced from 160 tCO₂e to 44 tCO₂e, which is a 72% reduction.

F Outline Specifications

ARCHITECTURAL OUTLINE SPECIFICATIONS & SUBMITTAL REQUIREMENTS																		
Spec #	Division	Manufacturer (basis of design)	Product / Description	Dimensions	Finish Code	Finish	Design Samples	Location	Power Requirement	Sample	Sample Received by TAG	Sample Approved by Client	Site Mock-up/Test Report	Shop Drawings submitted by Manufacturer	P.Eng	Product Data	O&M Manuals	Notes
ARCHITECTURAL/ STRUCTURAL																		
03 00 00	CONCRETE																	
03 41 00	Precast Structural Concrete		Per structural (TBD)			per structural								•	•	•		Shop drawings for structure to be stamped by a P.Eng
03 45 00	Precast Architectural Concrete		Custom concrete bollards, custom downspout splashpads				Bollards: in parking areas Splashpads: exterior perimeter of building at downspouts						•	•				
05 00 00	METAL																	
05 12 23	Structural Steel for Buildings		Per Structural (TBD)	Per structural requirements														
05 21 19	Open Web Steel Joist Framing		Per structural (TBD)	Per structural requirements										•	•	•		Shop drawings for structure to be stamped by a P.Eng
05 31 00	Steel Decking		Per structural (TBD)	Per structural requirements										•	•	•		Shop drawings for stairs, ramps and guards to be stamped by a P.Eng
05 41 00	Structural Metal Stud Framing		Per structural (TBD)	Per structural requirements														
05 50 00	Metal Fabrications		Gutters, downspouts, flashings, etc.			Galvanized								•				
05 50 00a	Metal Fabrications - Structural		Per structural (TBD)	Per structural requirements		per structural								•	•			Shop drawings for structure to stamped by a P.Eng
05 51 00	Guards and Handrails		Steel pipe/section guards, vertical balusters and rails			Stainless steel or powder-coated	East and West Stairwell, handrail for Youth Centre stair and mezzanine							•	•			Shop drawings for stairs, ramps and guards to stamped by a P.Eng
05 59 00	Metal Specialities													•	•			Shop drawings for structure to stamped by a P.Eng
05 75 00	Decorative Formed Metal		• Perforated metal screen			pre-painted or galvanized	4th Floor Terrace							•				
06 00 00	WOODS, PLASTICS AND COMPOSITES																	
06 16 26	Underlayment		Plywood subflooring				Floors 2-9							•				
06 20 00	Finish Carpentry		Wood baseboard, window & door casing (fj pine, casing thicker than 1/2" baseboard)				Apartment floors 5-9											
06 40 00	Architectural Woodwork	Millwork	Casework top/bottoms: melamine on 19mm particle board •Casework backs: melamine on 13mm particle board •Drawer boxes, melamine on 13mm particle board •Shelves within a cabinet: Melamine on 19mm medium-density fibreboard w/ PVC edging •Toe kicks: melamine on 19mm particle board •Countertops: 19mm solid surface (Corian)				See drawings			•				•				
06 40 00	Architectural Woodwork		•Stairs: solid birch treads for staircase in Youth Centre Event Space			clear finish												
06 40 23.13	Plastic Laminate Finishing for Interior Architectural Woodwork	Millwork	•Doors and drawer fronts, exposed cabinet sides: Laminate on 19mm medium-density fibreboard w/ PVC edging, SS pulls •Desktops: Laminate on 19mm medium-density fibreboard w/ PVC edging				See drawings											
06 41 93	Cabinet and Miscellaneous Hardware		European hinges; full extension drawer slides; soft close drawers and doors, Stainless steel pulls											•		•	•	
07 00 00	THERMAL AND MOISTURE PROTECTION																	
0713 52	Modified Bituminous Sheet Waterproofing	Soprema, Dorken	Waterproof membrane: Soprema Colphene Torch'N Stick. Membrane Primer: Soprema Elastocol 500 Drainage membrane: Dorken Delta-Drain 2000 HI-X				Foundation grade beams									•	•	
07 21 13	Board Insulation	Rockwool	•Rockwool Comfortbatt 80				W1, R1, R2							•		•	•	
07 21 29	Sprayed Insulation	BaseF	Walltite v.3 Spray Foam insulation	51mm min to achieve vapour barrier			As needed in interior cavity of W1at AVB penetrations									•		
07 26 00	Vapour Retarders	Soprema	Sopraseal Stick 1100T & primer (walls) - vapour and air barrier				W1									•		
07 27 00	Weather Barrier Membranes	Prosoco, Tyvek	Fluid applied WRB •Cat 5 for the field •Fastflash at windows •Joint & Seam around penetrations * Prosoco/Contractor to confirm if this product is compatable with wood fibre board spec Tyvek WRB where fluid applied is not possible													•		
07 27 00	Air Barriers	Stego	15 mil poly Stego Wrap (under slab)													•		
07 52 00	Modified Bituminous Membrane Roofing	Soprema	Cap sheet: Sopraply Traffic Cap Base sheet composite board: Sopralene Flam 180 Roof parapet/verticle membrane flashing: Sopraply Flam Stick				R1, R2						•	•		•	•	
07 55 64	Green Roof Components	Soprema	•Toundra Box •Root barrier membrane: Soprema Soprabarrier 30				R2							•		•	•	

ARCHITECTURAL OUTLINE SPECIFICATIONS & SUBMITTAL REQUIREMENTS																	
Spec #	Division	Manufacturer (basis of design)	Product / Description	Dimensions	Finish Code	Finish	Design Samples	Location	Power Requirement	Sample	Sample Recived by TAG	Sample Approved by Client	Site Mock-up/Test Report	Shop Drawings overseeing construction	P.Eng	Product Data O&M Manuals	Notes
07 62 00	Sheet Metal Flashing & Trim		Includes prefinished flashing and counter-flashings, galvanized steel formerd scuppers and downspouts											•		•	
07 84 00	Firestopping and Smoke seals	Richelieu	Fire stopping and smoke seals products and systems required at top and bottom of, and penetrations of, fire rated assemblies. Provide fireproofing (via intumescent paint, spray on fireproofing, gypsum board assemblies, etc.) to protect fire-rated assemblies and structure required to be fire-rated. Install firestopping and smoke seals as required											•		•	•
07 92 00	Joint Sealants	BASF, Chemtron Manufacturing Ltd, Dow Corning Canada, GE Silicones Ltd, Sika Chemical of Canada Ltd, Tremco Ltd	Caulking and sealants at doors and window frames, thresholds, and wall system penetrations (exterior) Caulking and sealants at doors and window frames, countertops and walss, WC's and floors lavatories and counter walls, acoustical isolation application (interior) Includes elastomeric and rigid joint sealants, and related accessories such as joint fillers and backer rod. Non-sag, pourable, mildew-resistant, sanitary, acrylic, bituminous, latex, polysulfide, polyurethane, PVC, rubber, silicone, synthetic urethane joint sealants.										•			•	•
08 00 00	OPENINGS																
08 11 13	Metal Doors and Frames		Interior service doors: hollow metal door with pressed steel frames, 16 ga welded (interior). • Exterior entrance doors: center glazing			Primer with 2 finished coats of paint		interior service doors, exterior service doors					•	•		•	•
08 14 00	Wood Doors (interior)		• Interior doors: solid core wood with wood frames			clear maple or birch finish		interior doors						•		•	
08 14 73	Sliding Wood and Plastic Doors	3Form	Custom sliding resin door & partition walls: 3form Varia Ecoresin 4x10 panels					Sliding doors between Youth Centre Event Space and Youth Centre Lounge		•				•		•	•
08 32 13	Sliding Aluminium-Framed Glass Doors	NanaWall	Custom sliding aluminium framed glass door					sliding doors separating north half and south half of Youth Centre Lounge									
08 51 13	Windows	Plygem	•Aluminum clad, thermally broken wood frames, awning •Glass: Triple glazed, argon filled •Clip on insect screens •Extruded window sills			Frame Finish: Pre-finished		All exterior windows					•	•		•	•
08 71 00	Door Hardware	Sargent or Shlage	Heavy duty institutional grade, keyed locking system Hardware for operation of doors including hanging, latching, locking, controlling and automatic operation. Hinges, pivots hardware, latches, locks, cylinders, etic devices, closers, holders, self-closing hinges, push plates, kick plates, other door trim, weaather stripping, seals, gaskets, and thresholds. Fire rated as required and to meet BF requirements											•		•	•
08 81 26	Interior Glass Glazing		• Partition glazing between 900 and 2134mm: 10mm laminated tempered safety glass, glass sitffeners every 1500mm •Aluminum frames •All clear glazing					Youth Centre Office									
08 90 00	Louvres and Vents		TBD											•		•	•
09 00 00	FINISHES																
09 21 16	Gypsum Board		16mm type-x gypsum board. Use moisture and mold resistant GWB (w/ mesh tape) for all interior wet walls (DensArmor Plus)													•	•
09 30 13	Ceramic Tiling	TBD	Wall and floor; commercial grade porcelain tile					Apartment washroom floors, walls, kitchen backsplash		•						•	•
09 51 13	Acoustic Panel Ceilings	TBD						As indicated in SD report interior finishes									
09 65 13	Resilient Base	Forbo	Wall base					All walls from floors 1-4									
09 65 16	Resilient Sheet Flooring	Forbo	Forbo Marmoleum with Topshield 2					As indicated in SD report interior finishes		•				•		•	•
09 65 16 (anti-slip)	Resilient Sheet Flooring - Anti-Slip	Forbo	Step Safety Vinyl					As indicated in SD report interior finishes (Youth Centre washrooms, Dormitory floor washrooms)		•				•		•	•
09 65 66	Indoor Resilient Athletic Surfacing	Tarkett	Omnisports Multi-Use					Gym flooring									
09 68 13	Tile Carpeting	FLOR	TBD					As indicated in SD report interior finishes									
09 80 00	Acoustic Treatment	TBD	TBD					Acoustic panels possible in the following locations: classroom, east and west stairwells, sensory room, gym									
09 81 16	Acoustic Blanket Insulation	Rockwool	Safe'n'Sound					See architectural drawings									
09 91 23	Interior Painting	Benjamin Moore	Walls (GWB): Benjamin Moore; Zero VOC, Zero Emissions, Certified Asthma and Allergy friendly Paint finish generally to be satin, unless otherwise noted Stains: TBD					Walls and ceilings, doors and door frames as noted on finish schedule		•				•		•	•

ARCHITECTURAL OUTLINE SPECIFICATIONS & SUBMITTAL REQUIREMENTS																		
Spec #	Division	Manufacturer (basis of design)	Product / Description	Dimensions	Finish Code	Finish	Design Samples	Location	Power Requirement	Sample	Sample Recived by TAG	Sample Approved by Client	Site Mock-up/Test Report	Shop Drawings undergoing review	P.Eng	Product Data	O&M Manuals	Notes
09 91 13	Exterior Painting		●Site applied paint finishes to exterior surfaces, includes site painting of shop-primed surfaces. ●Exterior painting of structural steel: Steel (incl. heat exchangers, pipes, flues, stacks, etc.), Aluminum (including flashing, sashes, downpipes, etc.) , bituminous coated surfaces and other exterior items requiring paint/finish: to match envelope finish (colour to be selected/confirmed by architect)							●				●		●	●	
10 00 00	SPECIALTIES																	
10 11 16.13	Fixed Markerboards	3M	Di-Noc Whiteboard film					Dormitory bedroom walls										
10 14 00	Signage		TBD if required (coordinate w/ client)							●			●	●		●	●	
10 14 53	Traffic Signage		TBD if required (coordinate w/ client)										●	●		●	●	
10 26 00	Wall and Door Protection		S.S. Wall and corner guards. Manufactured protective devices for walls and doors made of stainless steel, finish materials. Wall guards, bumpers guards on wall corner, door guards, column guards and other similar, door kick plate					At corner of GWB partitions						●		●	●	
10 28 00	Toilet and Bath Accessories	Richelieu	Grab bars, towel dispensers, soap dispensers, napkin/tampon disposal units, toilet paper dispensers, waste disposal units, hooks, framed mirrors, paper dispensers and other toilet accessories. Stainless steel finish; surface mounted; BF free Showers: Shower bars, hooks and curtains. Clothes hook. Grab bars as required for BF shower areas, along with collapsable seat. add baby change table to ground floor accessible washrooms					Washrooms								●	●	
10 51 23	Plastic-Laminate-Clad Lockers	Hollman	3-tier lockers, 60 lockers total															
10 57 00	Coat Hooks	Richelieu	5 1/2" Heavy Duty Coat Hook - 2375SCV or 2375FBV (colour TBC)					All washroom doors, office, bedrooms, dormitories										
11 00 00	EQUIPMENT																	
11 30 00	Appliances/Equipment		(To be coordinated with client) Kitchen: commercial grade 42" stainless steel refrigerator, 6-burner induction cooktop w/ oven below, ceiling mounted hoodfan, 2x s.s. dishwashers, stainless steel microwave Pantry: 32" stainless steel upright freezer Laundry: washer and dryers					see drawings						●		●	●	
11 81 29	Facility Fall Protection		Roof anchors with life line (to be coordinated with Structural)					R1, R2 Roof						●	●	●	●	designed/stamped by roof anchor designer
12 00 00	FURNISHINGS																	
12 24 13	Roller Window Shades	Phifer Sheerweave	Sunshading (5% openness) roller shades for all exterior windows - ShearWeave 2000 Dual shades (5% openness and 0% blackout) for bedroom windows - - ShearWeave 2000 / Shearweave 7100							●				●		●	●	
12 48 13	Entrance Floor Mats	Forbo	Forbo Coral Brush, 3721 Hurricane Grey															
12 50 00	Furniture & AV equipment		Ceiling mtd. Projector, projector screen (classroom), LED projector (sensory room)							●				●		●		
	Metal Shelving		Adjustable metal shelving (in storage rooms)															
14 00 00	CONVEYING EQUIPMENT																	
14 20 06	Passenger Elevators	Otis	Gen2							●				●		●	●	

G Mechanical Equipment List

Mechanical Equipment Schedule

Project: Home Base
Design stage: SD

Project #: 23-005

Date updated:

July 15, 2024

item tag	QTY	Location	Model	Description	Capacity	Weight	Electrical Requirements
HEATING EQUIPMENT							
B-1 A/B/C	3	MECH ROOM	Evergreen Pro EVG-399	PROPANE BOILER	97.6 kW output		250 W, 208/1/60
HP-1 A/B	2	OUTDOORS - Roof	Airstack APR015XN11A1AL-AASEN134a	A2W HEAT PUMP	53 kW heat	710 kg (each)	81.4 RLA , 208/3/60
DHW-1 A/B	2	MECH ROOM	LOCHINVAR AWH0400NPM	PROPANE DHWH (near instantaneous)	479 gal/h recovery		115/1/60 1/2HP
FC-1,2,3 etc.	55	Through out Building	PRICE FDCLP2 DOAS	CONCEALED 2-PIPE HYDRONIC FAN COIL UNIT	21L/s - 377L/s		1/3 HP, 4.9 FLA, 120/1/60
UH-1 A/B/...	5	MECH ROOM, GENERATOR ROOM, ROOFTOP FAN ROOM, SHAFT ROOM	ROSEMEX H-26	UNIT HEATER			150 W, 120/1/60
CUH-1 A/B/C...	6	VESTIBULES/LOBBY/STAIRS		CABINET UNIT HEATER			100 W, 120/1/60
HC-1	1	LAUNDRY ROOM?		DRYER MAKEUP AIR COIL(S)			n/a
VENTILATION EQUIPMENT							
HRV-1	1	MECH ROOM		ERV FOR MAIN FLOOR YOUTH CENTER	225 L/s	500 kg	FLA ~12 A, 208/3/60
HRV-2	1	FAN ROOM - ROOF	TEMPEFF - RGN4000	ERV FOR THE RESIDENCES	2000 L/S	1390 kG	2.68 kW
MAU-1	1	MECH ROOM		MECH ROOM			3/4 HP, 120/1/60
EF-1	2	MECH ROOM		MECH ROOM COOLING FAN			1/2 HP, 120/1/60
EF-2/3	2	TOP OF ELEVATOR SHAFT		ELEVATOR SHAFT COOLING FAN		15kg	300 W, 120/1/60
RH-1	43	KITCHEN		RESIDENTIAL KITCHEN RANGE HOOD		25 kg	2.5 A, 120/1/60
COOLING EQUIPMENT							
CU-1	1	OUTDOORS		SERVER ROOM CONDENSING UNIT	1500 W cooling capacity		MOCP 28 A, 208/1/60
CU-2	1	OUTDOORS		RESIDENTIAL SERVER ROOM CU	1000 W cooling capacity		MOCP 28 A, 208/1/60
AC-1	1	SERVER ROOM		SERVER ROOM A/C UNIT	1500 W cooling capacity		included in CU-1
AC-2	1	SERVER ROOM		SERVER ROOM A/C UNIT	1500 W cooling capacity		included in CU-2
TANKS							
TK-1 A/B	4	MECH ROOM		THERMAL BUFFER TANK(S)	1500 L (400 GAL)		N/A
TK-2	1	MECH ROOM	Amtrol AX-260V	HEATING EXPANSION TANK	200L (55.7 G)		N/A
TK-3	1	MECH ROOM	Amtrol ST-30VC-DD	DHW EXPANSION TANK			N/A
TK-4	1	MECH ROOM	Amtrol WX-203	DCW PRESSURE TANK			
TK-5	1	MECH ROOM	AXIOM SF100-L	GLYCOL FILL TANK			
OTK-1	1	GENERATOR ROOM		GENERATOR DAY TANK			N/A
PUMPS							
P-1 A/B/C	3	MECH ROOM	Grundfos Magna3 32-0120	PROPANE BOILER PUMP		34.69	250 W, 115/1/60
P-2 A/B/C	3	MECH ROOM	Armstrong 4380 DEMP	HEAT PUMP CIRCULATOR		43.36	5hp 208/3/60
P-3	1	MECH ROOM	Grundfos UP 15-18 B5	DHW RECIRC. PUMP		3	85 W, 115/1/60
P-4	2	Roof Top Penthouse		ERV REHEAT COIL PUMP			
P-5	1	FIRE PUMP ROOM	ARMSTRONG INLINE	FIRE PUMP		500	50 HP, 208/3/60
P-6 A/B	2	MECH ROOM	Grundfos CMBE Twin 5-62	DOMESTIC WATER PUMP	60 PSI - 50 GPM		2.78 kW 240/1/60
P-7	1	MECH ROOM	AXIOM	GLYCOL FILL PUMP			120/1/60 15 MCOP

H Class B Cost Estimate

CLASS B ESTIMATE

HOME BASE YELLOWKNIFE
MIXED-USE BUILDING
YELLOWKNIFE, NT

Prepared for:
Taylor Architecture Group

August 07, 2024

Harscomb
QUANTITY SURVEYORS

August 07, 2024

Ref # OTT6213



Taylor Architecture Group
3502 Raccine Road
Yellowknife, NT X1A 3J2
T: (867) 920-2728
E: jeremy@tagyk.com

Attn: Jeremy Flatt

Re: Home Base Yellowknife, Mixed-Use Building, Yellowknife, NT

Dear J. Flatt:

Please find attached our Class B Estimate for the Home Base Yellowknife, Mixed-Use Building in Yellowknife, NT.

This Class B Estimate is intended to provide a realistic allocation of direct construction costs and is a determination of fair market value. Pricing shown reflects probable construction costs obtainable in the Yellowknife, NT area on the effective date of this report and is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the work.

Hanscomb has prepared this estimate(s) in accordance with generally accepted principles and practices. Our general assumptions are included in Section 3 of this report and any exclusions are identified in Section 1.6. For quality assurance, this estimate has been reviewed by the designated Team Lead as signed below. Hanscomb staff are available and pleased to discuss the contents of this report with any interested party.

Requests for modifications of any apparent errors or omissions to this document must be made to Hanscomb within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

We trust our estimate is complete and comprehensive and provides the necessary information to allow for informed capital decisions for moving this project forward. Please do not hesitate to contact us if you have any questions or require additional information.

Yours truly,

Hanscomb Limited
Team Lead

A handwritten signature in blue ink, appearing to read "Jeff Ho Yeung Cheung".

Jeff Ho Yeung Cheung
MRICS, PQS, MHKIS
Quantity Surveyor

Hanscomb Limited
Principal / Estimate Reviewer

A handwritten signature in blue ink, appearing to read "Dale Stratton".

Dale Stratton
PQS
Manager, Arctic Region

Hanscomb Limited
1830 - 130 Albert St.
Ottawa, Ontario
T: (613) 234-8089
ottawa@hanscomb.com
www.hanscomb.com

EXECUTIVE SUMMARY

This Class B Estimate is intended to provide a realistic allocation of direct construction costs for the Home Base Yellowknife, Mixed-Use Building, located in Yellowknife, NT. Hanscomb recommends that the Owner and design team carefully review this document, including line-item descriptions, unit prices, exclusions, inclusions, assumptions, contingencies, escalation, and mark-ups. If the project is over budget or has unresolved budgeting issues, alternatives should be evaluated before proceeding to the next design phase.

The following are the highlights of this Class B Estimate:

Project Cost Highlights:

Gross Floor Area (GFA)	4,431 m2
Unit (count, linear measure, etc.)	N/A
Total Construction Cost	\$44,901,400
Cost per GFA	\$10,133.47/m2
Unit Cost	N/A



- Allowances** included in the estimate:
- **10.0%** design & pricing contingency
 - **8.0%** escalation from August 2024 to the anticipated Fall 2025 tender date
 - **5.0%** construction contingency (excluded in the above construction cost and provided separately as an Owner's contingency on the summary page)



The Degree of Accuracy expected for this Class B Estimate is **+/- 10-15%**. In other words, bid results might vary by this amount if the construction budget were set at this milestone estimate. In today's market, projects are trending to the higher end of the plus range.

Base Assumptions:

All costs are estimated on the basis of **competitive bids** (a minimum of at least 3 general contractor bids and at least 3 subcontractor bids for each trade) being received in Yellowknife, NT in **August 2024** based on a **stipulated sum** form of contract. If these conditions are not met, bids received could be expected to exceed this estimate.

The details of this estimate are provided in the subsequent pages of this report for your review, comment and acceptance.

Exclusions

- Cost of contaminated soil removal
- Cost of hazardous material (e.g. asbestos, lead, PCB, etc.) removal
- Soft Costs (e.g. professional fees, building permit, development charges, owner's staff and management, relocation costs, etc.)
- Financing costs
- Special audio, visual, security equipment or installation other than provision of empty conduit systems carried in electrical division
- In-contract equipment and ICAT beyond that identified in this estimate
- Loose furniture, other than items included in B31 & B32, equipment and ICAT
- Escalation contingency beyond that identified in this estimate
- Value-added tax (e.g. Harmonized Sales Tax, Goods and Services Tax, or other)
- Unexpected labour unavailability and productivity disruptions leading to delays and added costs
- Supply chain disruptions leading to delays and added costs

TABLE OF CONTENTS

Executive Summary	1
Table of Contents	2
1. Introduction	3
1.1 Purpose	3
1.2 Description	3
1.3 Methodology	3
1.4 Specifications	3
1.5 Estimate Classification and Cost Predictability	3
1.6 Exclusions	5
2. Documentation	6
3. Cost Considerations	7
3.1 Cost Base	7
3.2 Unit Rates	7
3.3 General Requirements and Fee	7
3.4 Design and Pricing Allowance	7
3.5 Escalation Allowance	7
3.6 Construction Allowance	8
3.7 Cash Allowance	8
3.8 Taxes	8
3.9 Schedule	8
3.10 Statement of Probable Costs	8
3.11 Ongoing Cost Control	9
3.12 Covid-19 Class A Estimate Statement, If Applicable	9
3.13 Other Current Risks to construction escalation, If Applicable	10
4. Gross Floor and Site Developed Areas	11
5. Cost Estimate Summary	12
6. Understanding the Elemental Estimate Summary	13

Appendices

Estimates:

A - Detailed Elemental Estimate

A 1 - 22

Documents and Drawings:

AA - Documents and Drawings List

AB - Representative Drawings

1. INTRODUCTION

1.1 PURPOSE

This Class B Estimate is intended to provide a realistic allocation of direct construction costs for the Home Base Yellowknife, Mixed-Use Building, located in Yellowknife, NT, with the exception of the items listed in 1.6 Exclusions.

1.2 DESCRIPTION

The Home Base Yellowknife, Mixed-Use Building located in Yellowknife, NT is comprised of the following key elements:

The project includes 4,431 m2 of 10- storey mixed-use building. The scope of work includes but is not limited to pile and shallow foundation, structure, entrances and windows, projections, interior partitions, doors and finishes, fittings and fixtures, equipment, elevators, mechanical and electrical installation, and site development. No specific LEED designation is targeted but the project will meet all applicable codes and standards.

1.3 METHODOLOGY

Hanscomb has prepared this estimate(s) in accordance with generally accepted principles and practices. Hanscomb staff are available to discuss its contents with any interested party.

From the documentation and information provided, quantities of all major elements were assessed or measured where possible and priced at rates considered competitive for a project of this type under a stipulated sum form of contract in Yellowknife, NT.

Pricing shown reflects probable construction costs obtainable in the Yellowknife, NT area on the effective date of this report. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the work.

1.4 SPECIFICATIONS

For building components and systems where specifications and design details are not available, quality standards have been established based on discussions with the design team.

1. INTRODUCTION

1.5 ESTIMATE CLASSIFICATION AND COST PREDICTABILITY

Estimates are defined and classified based on the stage of a project's development and the level of information available at the time of the milestone estimate.

This Class B Estimate is considered to have an expected degree of accuracy of +/- 10-15%. In other words, bid results might vary by this amount if the construction budget were set at this milestone estimate. Under stable market conditions, fierce competition and scope reduction might result in costs coming in under the milestone estimate. However, in today's market, projects are trending to the higher end of the plus range.

At the initial stages of a contemplated project, the cost accuracy of the estimate is low as there may be little or no information available to inform a first high-level concept estimate or order of magnitude estimate. As a project nears design completion and is ready to be released to market for tender, the level of accuracy of the estimate is high as the detail is generally extensive and typically represents the information on which contractors will bid.

Milestone cost estimates or "checks" are recommended as the project design develops to keep track of scope and budget. Early detection of potential budget overruns will allow for remedial action before design and scope are locked in. The number of milestone estimates will depend on a project's size and schedule and cost predictability will improve as the design advances.

According to the Canadian Joint Federal Government/Industry Cost Predictability Taskforce, industry standards for estimate classification and cost estimate accuracy may be summarized as follows:

COST ESTIMATE CLASSIFICATIONS						
GOC	OME	D	C	← B	→ A	
DND		Indicative		Substantive		
	ROME	D	C	← B	→ A	
AACE	5		4	3		
RAIC			Sketch Design	Design Development		Contract Documents Tender Documents
↓	↓	↓	↓		↓	↓
Design Documentation % Complete			12.5%	25%		95.0% 100%
Cost Estimate Accuracy (+/-%)		+/-30%	+/-20% <30%	+/-15% <20%		+/-10% <15% +/-5% <10%

Legend

GOC	Government of Canada
DND	Department of National Defence
AACE	Association for the Advancement of Cost Engineering
RAIC	Royal Architectural Institute of Canada
OME	Order of Magnitude Estimate
ROME	Rough Order of Magnitude Estimate

While the classification categories differ from one authority to the next, the overarching principle for cost predictability remains the same – as the level of detail and design development increases, so does the level of accuracy of the estimate.

1. INTRODUCTION

1.6 EXCLUSIONS

This Class B Estimate does not provide for the following, if required:

- Cost of contaminated soil removal
- Cost of hazardous material (e.g. asbestos, lead, PCB, etc.) removal
- Soft Costs (e.g. professional fees, building permit, development charges, owner's staff and management, relocation costs, etc.)
- Financing costs
- Special audio, visual, security equipment or installation other than provision of empty conduit systems carried in electrical division
- In-contract equipment and ICAT beyond that identified in this estimate
- Loose furniture, other than items included in B31 & B32, equipment and ICAT
- Escalation contingency beyond that identified in this estimate
- Value-added tax (e.g. Harmonized Sales Tax, Goods and Services Tax, or other)
- Unexpected labour unavailability and productivity disruptions leading to delays and added costs
- Supply chain disruptions leading to delays and added costs

2. DOCUMENTATION

This Class B Estimate has been prepared from the documentation included in Appendix AA of this report.

All of the above documentation was received from Taylor Architecture Group and was supplemented with information gathered in meeting(s) and telephone conversations with the design team, as applicable.

Design changes and/or additions made subsequent to this issuance of the documentation noted above have not been incorporated in this report.

3. COST CONSIDERATIONS

3.1 COST BASE

All costs are estimated on the basis of competitive bids (a minimum of at least 3 general contractor bids and at least 3 subcontractor bids for each trade) being received in August 2024 from general contractors and all major subcontractors and suppliers based on a stipulated sum form of contract. If these conditions are not met, bids received could be expected to exceed this estimate.

3.2 UNIT RATES

The unit rates in the preparation of this Class B Estimate include labour and material, equipment, subcontractor's overheads and profit. Union contractors are assumed to perform the work with the fair wage policy in effect.

3.3 GENERAL REQUIREMENTS AND FEE

General Requirements and Fee cover the General Contractor's indirect costs which may include but not be limited to supervision, site set up, temporary utilities, equipment, utilities, clean up, etc. as covered in Division 1 General Conditions of the Contract Documents. It also includes the contractor's fees and should not be confused with Design or Consultant fees which are excluded from the Construction Costs and carried separately in the Owner's Total Project Costs.

3.4 DESIGN AND PRICING ALLOWANCE

An allowance of 10.0% has been included to cover design and pricing unknowns. This allowance is not intended to cover any program space modifications but rather to provide some flexibility for the designers and cost planners during the remaining contract document stages.

It is expected that this allowance amount will be absorbed into the base construction costs as the design advances. The amount by which this allowance is reduced corresponds to an increase in accuracy and detailed design information. Hanscomb recommends that careful consideration be made at each milestone estimate to maintain adequate contingency for this allowance.

As a project nears completion of design, Hanscomb recommends retaining some contingency for this allowance for the final coordination of documents.

3.5 ESCALATION ALLOWANCE

All costs are based on August 2024 dollars with 8.0% construction cost escalation included to cover increases that may occur between August 2024 and the anticipated Fall 2025 tender date for the project.

The budgeted amount will typically decline as the time to award nears. If escalation is taken to the start of construction, escalation during construction is included in the unit rates. If escalation is taken to the midpoint of construction, it is because the market is volatile, or the project is considerably large with a construction duration of more than 2-3 years making it difficult to secure firm pricing at tender.

Forecasting escalation requires careful assessment of a continually changing construction market which at best is difficult to predict. The escalation rate should be monitored.

3. COST CONSIDERATIONS

3.6 CONSTRUCTION ALLOWANCE

An allowance of 5.0% has been made to cover construction (post contract) unknowns. This allowance, also known as the Post Contract Contingency (PCC), is intended to cover costs for change orders during construction that are not foreseeable. It is not intended to cover scope changes to the contract. The amount carried in a budget for this allowance is typically set at the initial planning stage and should be based on the complexity of the project and the probability of unknowns and retained risks.

3.7 CASH ALLOWANCE

Cash allowances are intended to allow the contractor to include in the bid price the cost for work that is difficult to fully scope at the time of tendering based on factors that are beyond the Owner and Prime Consultant's control. Cash allowances attempt to reduce the risks by dedicating a set amount for use against a certain cost that cannot yet be detailed. The Contractor is obligated to work as best as possible within the limitations of the Cash Allowance.

Examples of Cash Allowances include hardware, inspection and testing, site conditions, replacement of existing elements during demolition for renovation, hazardous materials abatement, signage, etc.

Any Cash Allowances if applicable are included either in the details of this estimate under the appropriate discipline or at the summary level.

3.8 TAXES

No provision has been made for the Harmonized Sales Tax. It is recommended that the owner make separate provision for HST in the project budget.

3.9 SCHEDULE

Pricing assumes a standard schedule of work appropriate to the size and scope of this project. Premiums for off-hour work, working in an operational facility, accelerated schedule, etc., if applicable, are identified separately in the body of the estimate.

3.10 STATEMENT OF PROBABLE COSTS

Hanscomb has no control over the cost of labour and materials, the contractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made on the basis of experience, qualifications and best judgment of the professional consultant familiar with the construction industry. Hanscomb cannot and does not guarantee that proposals, bids or actual construction costs will not vary from this or subsequent cost estimates.

3. COST CONSIDERATIONS

3.11 ONGOING COST CONTROL

Hanscomb recommends that the Owner and design team carefully review this document, including line item description, unit prices, clarifications, exclusions, inclusions and assumptions, contingencies, escalation, and mark-ups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the next design phase.

It is recommended that a final updated estimate at the end of the design stage be produced by Hanscomb using Bid Documents to determine overall cost changes which may have occurred since the preparation of this estimate. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. Hanscomb cannot reconcile bid results to any estimate not produced from bid documents, including all addenda.

This estimate does not constitute an offer to undertake the work, nor is any guarantee given that an offer to undertake the work at the estimate(s) price will subsequently be submitted by a construction contractor. Unless explicitly stated otherwise, it is assumed that competitive bids will be sought when tender documents have been completed. Any significant deviation between bids received and a pre-tender estimate prepared by Hanscomb from the same tender documents should be evaluated to establish the possible cause(s).

3.12 COVID-19 STATEMENT

Though the World Health Organization has determined that COVID-19 is now an established and ongoing health issue that no longer constitutes a public health emergency of international concern, the impact that this pandemic inflicted on the world economy continues to be felt. Such impact includes:

- Labour shortages due to recent career changes resulting from the pandemic and other reasons
- Resultant delays in the delivery of materials and equipment to the site
- Unavailability of materials due to past factory closures or shipping interruptions that created a massive backlog

The above factors are bound to impact not only the cost but also the completion date for the project, as has been witnessed in the current market. Understanding that contractors, subtrades and suppliers must assume these factors as part of their bid, these potential cost impacts have been considered and captured to the best of our ability in the rates and general requirements included in this estimate.

In the event of a catastrophic global event, all costs will be subject to review.

3. COST CONSIDERATIONS

3.13 OTHER CURRENT RISKS TO CONSTRUCTION ESCALATION

THE IMPACT OF THE RUSSIA / UKRAINE WAR:

The impact of the Russia / Ukraine war on the Western economy continues to cause inflationary pressure within the Western economy. Many countries have laid siege to Russia in the form of severe sanctions on most transactions of goods and services that originate from Russia. The impact of these sanctions has reduced normal trade of goods and services within the global economy, affecting construction activity in various ways, including:

- Increases in the cost of oil and natural gas
- Restrictions on the trade of base metal materials (nickel, palladium, iron, zinc, aluminum etc.)
- Continued constraints on the supply of oil-based chemicals and other materials
- Shortages of fertilizers (potash and products made from oil & gas)
- Shortages of wheat and sunflower-based products

The current situation continues to cause inflationary pressure on Western Countries and is fueling higher wages.

THE STATUS OF THE CANADIAN CONSTRUCTION MARKET:

The construction market is relatively heated across the country. Because of the significant volume of activity, Hanscomb has observed that with recent tender closings, the normal number of general contractors and sub-trades bidding on projects has been reduced. Less competition during tendering often results in elevated project pricing. We expect this trend to continue for the following reasons:

- The volume of work exceeds the capacity of available resources
- An aging workforce contributes pressure through the ever-increasing retirement of trade workers
- All members within the construction community are actively looking for new personnel and are having trouble finding new qualified candidates
- Contractors are generally competing for the same tradespeople, offering higher than normal salaries and benefits, translating into higher operating costs, which get transferred to the construction projects

The above risks may be amplified under the following conditions:

- Remote or less densely populated areas where materials and labour cannot be sourced locally and transportation, accommodation and incentives impact schedule and cost

Where any of the above may be a factor, Hanscomb highly recommends conducting appropriate risk analyses, including market sounding. Hanscomb can assist; however, this level of risk assessment is outside the scope of this estimate.

4. GROSS FLOOR AND SITE DEVELOPED AREAS

The following areas have been measured in accordance with the Canadian Institute of Quantity Surveyors' Measurement of Buildings by Area and Volume.

4.1 GROSS FLOOR AREA (GFA)

Description	Area (m2)
Ground Floor	366
Second Floor	238
Third Floor	694
Fourth Floor	766
Fifth Floor	458
Sixth Floor	458
Seventh Floor	458
Eighth Floor	458
Ninth Floor	458
Penthouse	77
Total GFA	4,431

4.2 SITE DEVELOPED AREA

Description	Area (m2)
Site	1,159
Building Footprint	366
Total Site Developed Area	793

Site Developed Area is the area of the site less the foot-print area of the building.

5. CONSTRUCTION COST ESTIMATE SUMMARY

Description	Quantity	Rate	Amount
New Construction	4,431 m2	5,995.06	\$26,564,100
Site Development	1 Sum		\$705,600
Sub-total	4,431 m2	6,154.30	\$27,269,700
General Requirements & Fee	26.0%		\$7,090,100
Fee	10.0%		\$3,436,000
Sub-total	4,431 m2	8,529.86	\$37,795,800
Design & Pricing Allowance	10.0%		\$3,779,600
Escalation Allowance	8.0%		\$3,326,000
Total Construction Cost	4,431 m2	10,133.47	\$44,901,400
Construction Allowance	5.0%		\$2,245,100
Total + Construction Allowance	4,431 m2	10,640.15	\$47,146,500

6. UNDERSTANDING THE ELEMENTAL COST SUMMARY

Cost information prepared and presented by Quantity Surveyors is often organized in a form referred to as the 'Elemental Cost Summary'. In this format, the more 'intuitive' building elements (e.g. foundations, exterior cladding, plumbing, etc.) are evaluated rather than materials or trades. Quantity Surveyors track this information consistently from project to project to benchmark not just the overall building unit rate but also rates and ratios for key elements. Below are some key features of the Elementary Cost Summary.

Building components are summarized as elements 'A2 Structure' and then sub-elements 'A23 Roof Construction'. This allows review of Roof Construction costs whether it is steel, concrete or wood - something difficult with a trade summary.

Ratio to GFA evaluates design efficiency and highlights outliers. It is arrived at by dividing the parametric quantity of a sub-element (i.e. overall exterior wall area) by the building gross floor area (GFA). A ratio greater than 0.600 for 'A32 Walls Above Grade' is considered high and may be due to articulation, courtyard design or high floor to floor heights.

The 'Unit Rate' is the blended rate of a sub-element's costs divided by its parametric quantity and allows a review of its reasonableness relative to benchmarks. A rate of \$559/m2 indicates a good quality exterior wall cladding.

The last column expresses the cost of each element as a percentage of total construction cost. At 18.7% of total construction costs, mechanical and electrical systems are considered basic.

The 'Rate per SF' (m²) column converts costs for each element or sub-element to a \$/SF (m²) of GFA for comparison to benchmark rates. A rate of \$217/m² indicates basic electrical design.

General Requirements & Fee cover General Contractor's overheads (site set up, supervision, etc.) and contractor's expenses. Fee is not for Consultants.

Allowances are critical for estimates. Design & pricing compensates for a lack of detail early in design; escalation considers changes to labour & material; construction allowance is for unforeseen conditions; and, cash allowances offer flexibility for items difficult to detail at bid.

Project : Location : Owner : Consultant :				SAMPLE ELEMENTAL SUMMARY				Report date : 19 Jul 2017 Page No. : A - 1 Bidg Type : 420 C.T. Index : 0.0 GFA : 1,582 m2			
Element	Ratio to GFA	Quantity	Unit Rate	Elemental Cost	Elemental Amount	Rate per m2					
A SHELL		1,582 m2			1,829,900				1,156.70	35.6	
A1 SUBSTRUCTURE					250,000				158.03	4.9	
A11 Foundations	1.000	1,582 m2	158.03	250,000		158.03					
A12 Basement Excavation	0.001	1 Nil	0.00	0		0.00					
A13 Special Conditions	0.001	1 Nil	0.00	0		0.00					
A2 STRUCTURE					468,800				296.33	9.1	
A21 Lowest Floor Construction	1.000	1,582 m2	64.92	102,700		64.92					
A23 Roof Construction					0						
A23 Roof Construction	1.013	1,602 m2	228.53	366,100		231.42					
A3 EXTERIOR ENCLOSURE					1,111,100				702.34	21.6	
A31 Walls Below Grade	0.001	1 Nil	0.00	0		0.00					
A32 Walls Above Grade					612,900				387.42		
A32 Walls Above Grade	1.096	1,096 m2	559.22	612,900		559.22					
A33 Windows & Entrances	0.003	4 Lvs	3,275.00	13,100		8.28					
A34 Roof Coverings	1.013	1,602 m2	220.22	352,800		223.01					
A35 Projections	1.000	1,582 m2	83.63	132,300		83.63					
B INTERIORS		1,582 m2			1,033,400				653.22	20.1	
B1 PARTITIONS & DOORS					382,900				242.04	7.4	
B11 Partitions	1.504	2,380 m2	105.29	250,600		158.41					
B12 Doors	0.038	60 Lvs	2,205.00	132,300		83.63					
B2 FINISHES					398,400				251.83	7.7	
B21 Floor Finishes	1.000	1,582 m2	75.35	119,200		75.35					
B22 Ceiling Finishes	1.000	1,582 m2	91.28	144,400		91.28					
B23 Wall Finishes	2.314	3,660 m2	36.83	134,800		85.21					
B3 FITTINGS & EQUIPMENT					252,100				159.36	4.9	
B31 Fittings & Fixtures	1.000	1,582 m2	159.36	252,100		159.36					
B32 Equipment	1.000	1,582 m2	0.00	0		0.00					
B33 Elevators	0.001	1 Nil	0.00	0		0.00					
B34 Escalators	0.001	1 Nil	0.00	0		0.00					
C SERVICES		1,582 m2			964,400				609.61	18.7	
C1 MECHANICAL					621,100				392.60	12.1	
C11 Plumbing & Drainage	1.000	1,582 m2	145.26	229,800		145.26					
C12 Fire Protection	1.000	1,582 m2	31.04	49,100		31.04					
C13 HVAC	1.000	1,582 m2	170.35	269,500		170.35					
C14 Controls	1.000	1,582 m2	45.95	72,700		45.95					
C2 ELECTRICAL					343,300				217.00	6.7	
C21 Service & Distribution	1.000	1,582 m2	42.54	67,300		42.54					
C22 Lighting, Devices & Heating	1.000	1,582 m2	116.81	184,800		116.81					
C23 Systems & Ancillaries	1.000	1,582 m2	57.65	91,200		57.65					
NET BUILDING COST - EXCLUDING SITE					\$ 3,827,700				2,419.53	74.4	
D SITE & ANCILLARY WORK		1,582 m2			799,800				505.56	15.5	
D1 SITE WORK					799,800				505.56	15.5	
D11 Site Development	6.541	10,348 m2	48.71	504,100		318.85					
D12 Mechanical Site Services	0.001	1 Sum	167,400.00	167,400		105.82					
D13 Electrical Site Services	0.001	1 Sum	128,300.00	128,300		81.10					
D2 ANCILLARY WORK					0				0.00	0.0	
D21 Demolitions	0.001	1 Nil	0.00	0		0.00					
D22 Alterations	0.001	1 Nil	0.00	0		0.00					
NET BUILDING COST - INCLUDING SITE					\$ 4,627,500				2,925.09	89.9	
Z1 GENERAL REQUIREMENTS & FEE					520,100				328.76	10.1	
Z11 General Requirements			8.0%	370,200		234.01					
Z12 Fee			3.0%	149,900		94.75					
TOTAL CONSTRUCTION ESTIMATE - EXCLUDING ALLOWANCES					\$ 5,147,600				3,253.86	100.0	
Z2 ALLOWANCES					930,500				588.18		
Z21 Design & Pricing Allowance			10.0%	514,800		325.41					
Z22 Escalation Allowance			2.5%	141,600		89.51					
Z23 Construction Allowance			3.0%	174,100		110.06					
Z24 Cash Allowances			1 Sum	100,000.00		63.21					
TOTAL CONSTRUCTION ESTIMATE - INCLUDING ALLOWANCES					\$ 6,078,100				3,842.04		
VALUE ADDED TAX (GST/HST)					0				0.00		
- Value Added Tax (GST/HST)				0.0 %	0				0.00		
TOTAL CONSTRUCTION ESTIMATE					\$ 6,078,100				3,842.04		

By using this format consistently across all projects, Quantity Surveyors can compare projects and better understand why the 'roof covering' element may be more on this project if it's fulfilling the same function as a similar project.

Note: The above sample is based on the CIQS Elemental format. The fundamental principles of reading the information are the same for summaries reported based on UNIFORMAT.

**Appendix
A - Detailed Elemental Estimate**

Project : Home Base Yellowknife					Report date : 7 Aug 2024				
Location : Mixed-Use Building					Page No. : A - 1				
Location : Yellowknife, NT					ELEMENTAL COST SUMMARY				
Owner : Home Base Yellowknife					Bldg Type : 810				
Consultant : Taylor Architecture Group					C.T. Index : 0.0				
					GFA : 4,431 m2				
Element	Ratio to GFA	Elemental Cost		Elemental Amount		Rate per m2		%	
		Quantity	Unit rate	Sub-Total	Total	Sub-Total	Total		
A SHELL		4,431 m2			12,578,600		2,838.77	33.3	
A1 SUBSTRUCTURE					1,783,600		402.53	4.7	
A11 Foundations	0.186	823 m2	2,152.60	1,771,600		399.82			
A12 Basement Excavation				0		0.00			
A13 Special Conditions	0.000	1 Sum	12,000.00	12,000		2.71			
A2 STRUCTURE					6,794,100		1,533.31	18.0	
A21 Lowest Floor Construction	0.083	366 m2	3,512.30	1,285,500		290.12			
A22 Upper Floor Construction	0.847	3,753 m2	1,212.80	4,551,500		1,027.19			
A23 Roof Construction	0.189	839 m2	1,140.80	957,100		216.00			
A3 EXTERIOR ENCLOSURE					4,000,900		902.93	10.6	
A31 Walls Below Grade				0		0.00			
A32 Walls Above Grade	0.643	2,850 m2	855.30	2,437,600		550.12			
A33 Windows & Entrances	0.039	172 m2	2,826.70	486,200		109.73			
A34 Roof Coverings	0.189	839 m2	901.80	756,600		170.75			
A35 Projections	0.000	1 Sum	320,500.00	320,500		72.33			
B INTERIORS		4,431 m2			7,114,000		1,605.51	18.8	
B1 PARTITIONS & DOORS					2,824,400		637.42	7.5	
B11 Partitions	1.032	4,573 m2	348.00	1,591,600		359.20			
B12 Doors	0.050	221 No	5,578.30	1,232,800		278.22			
B2 FINISHES					2,092,400		472.22	5.5	
B21 Floor Finishes	0.843	3,737 m2	161.00	601,800		135.82			
B22 Ceiling Finishes	0.928	4,113 m2	219.20	901,400		203.43			
B23 Wall Finishes	2.238	9,917 m2	59.40	589,200		132.97			
B3 FITTINGS & EQUIPMENT					2,197,200		495.87	5.8	
B31 Fittings & Fixtures	1.000	4,431 m2	177.70	787,500		177.73			
B32 Equipment	1.000	4,431 m2	67.60	299,700		67.64			
B33 Elevators	0.000	2 No	555,000.00	1,110,000		250.51			
B34 Escalators				0		0.00			
C SERVICES		4,431 m2			6,871,500		1,550.78	18.2	
C1 MECHANICAL					4,576,400		1,032.81	12.1	
C11 Plumbing & Drainage	1.000	4,431 m2	335.50	1,486,500		335.48			
C12 Fire Protection	1.000	4,431 m2	83.80	371,100		83.75			
C13 HVAC	1.000	4,431 m2	550.80	2,440,400		550.76			
C14 Controls	1.000	4,431 m2	62.80	278,400		62.83			
C2 ELECTRICAL					2,295,100		517.96	6.1	
C21 Service & Distribution	1.000	4,431 m2	156.10	691,700		156.10			
C22 Lighting, Devices & Heating	1.000	4,431 m2	224.50	994,900		224.53			
C23 Systems & Ancillaries	1.000	4,431 m2	137.30	608,500		137.33			
NET BUILDING COST - EXCLUDING SITE					\$	26,564,100		5,995.06	70.3
D SITE & ANCILLARY WORK		4,431 m2			705,600		159.24	1.9	
D1 SITE WORK					705,600		159.24	1.9	
D11 Site Development	0.179	793 m2	550.10	436,200		98.44			
D12 Mechanical Site Services	0.000	1 m	214,400.00	214,400		48.39			
D13 Electrical Site Services	0.000	1 Sum	55,000.00	55,000		12.41			
D2 ANCILLARY WORK					0		0.00	0.0	
D21 Demolitions				0		0.00			
D22 Alterations				0		0.00			
NET BUILDING COST - INCLUDING SITE					\$	27,269,700		6,154.30	72.2
Z1 GENERAL REQUIREMENTS & FEE					10,526,100		2,375.56	27.8	
Z11 General Requirements		26.0 %		7,090,100		1,600.11			
Z12 Fee		10.0 %		3,436,000		775.45			
TOTAL CONSTRUCTION ESTIMATE - EXCLUDING ALLOWANCES					\$	37,795,800		8,529.86	100.0
Z2 ALLOWANCES					9,350,700		2,110.29		
Z21 Design & Pricing Allowance		10.0 %		3,779,600		852.99			
Z22 Escalation Allowance		8.0 %		3,326,000		750.62			
Z23 Construction Allowance		5.0 %		2,245,100		506.68			
TOTAL CONSTRUCTION ESTIMATE - INCLUDING ALLOWANCES					\$	47,146,500		10,640.15	
- VALUE ADDED TAX (GST/HST)					0		0.00		
Value Added Tax (GST/HST)		0.0 %		0		0.00			
TOTAL CONSTRUCTION ESTIMATE					\$	47,146,500	\$	10,640.15	

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 2

A1 SUBSTRUCTURE		Quantity	Unit rate	Amount
A11 Foundations				
1	Rock socket steel pipe pile	160 no.	6,500.00	1,040,000
2	Allowance for pile caps	70 no.	600.00	42,000
3	Excavation and backfill	1,832 m3	362.60	664,350
	- Excavation	1,832 m3	200.00	366,400
	- Backfill	1,472 m3	150.00	220,800
	- Clearing & grubbing	823 m2	50.00	41,150
	- Cart away	360 m3	100.00	36,000
4	Excavation and backfill for working space	72 m3	350.00	25,200
	- Excavation	72 m3	200.00	14,400
	- Backfill	72 m3	150.00	10,800
A11 Foundations TOTAL : \$		823 m2	2,152.61	1,771,600
A13 Special Conditions				
1	Allowance for dewatering		allow	12,000
A13 Special Conditions TOTAL : \$		1 Sum	12,000.00	12,000

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 3

A2 STRUCTURE		Quantity	Unit rate	Amount
A21 Lowest Floor Construction				
1	Slab on grade, overall 150mm thick	366 m2	375.80	137,530
	- Concrete supply	37 m3	490.00	18,130
	- Concrete placement	37 m3	165.00	6,105
	- Rebar, 95kg/m3	5,216 kg	8.50	44,336
	- Formwork	11 m2	280.00	3,080
	- Air vapour barrier membrane	366 m2	40.00	14,640
	- XPS insulation, 150mm thick	366 m2	140.00	51,240
2	Grade beam with void form below, assume 300mm x 2000mm	461 m	2,468.50	1,138,000
	- Concrete supply	277 m3	490.00	135,730
	- Concrete placement	277 m3	165.00	45,705
	- Rebar, 45kg/m3	12,447 kg	8.50	105,800
	- Formwork	1,844 m2	280.00	516,320
	- Air vapour barrier membrane	1,844 m2	40.00	73,760
	- XPS insulation, 150mm thick	1,844 m2	140.00	258,160
	- Void form, 300mm x 150mm	21 m3	120.00	2,520
3	Allowance for housekeeping pad		allow	10,000
A21 Lowest Floor Construction TOTAL : \$		366 m2	3,512.30	1,285,500
A22 Upper Floor Construction				
1	2nd floor assembly	179 m2	379.30	67,900
	- Concrete supply	18 m3	490.00	8,820
	- Concrete placement	18 m2	165.00	2,970
	- Rebar, 10kg/m2	1,790 kg	8.50	15,215
	- L100x100x6mm to perimeter	154 m	190.00	29,260
	- 38mm 22ga. composite metal deck	179 m2	65.00	11,635
2	Typical floor assembly	3,095 m2	287.20	889,030
	- Concrete supply	310 m3	490.00	151,900
	- Concrete placement	310 m2	165.00	51,150
	- Rebar, 10kg/m2	30,950 kg	8.50	263,075
	- L100x100x6mm to perimeter	1,167 m	190.00	221,730
	- 38mm 22ga. composite metal deck	3,095 m2	65.00	201,175
3	3rd floor level assembly (EF-1)	479 m2	220.20	105,460
	- Concrete supply	48 m3	490.00	23,520
	- Concrete placement	48 m3	165.00	7,920
(Continued)				
Carried Forward :				1,062,390

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 4

A2 STRUCTURE		Quantity	Unit rate	Amount
A22 Upper Floor Construction (Continued)			Brought Forward :	1,062,390
3 3rd floor level assembly (EF-1) (Continued)				
- Rebar, 95kg/m3		4,551 kg	8.50	38,684
- Formwork		15 m2	280.00	4,200
- 38mm 22ga. composite metal deck		479 m2	65.00	31,135
4 Structural support to above		3,226 m2	993.00	3,203,420
- Allowance for OWSJ, beams, columns, etc.		193,560 kg	15.00	2,903,400
- Miscellaneous metals, connections		19,356 kg	15.50	300,018
5 Beam to elevator shaft		161 m	476.40	76,700
- Concrete supply		24 m3	490.00	11,760
- Concrete placement		24 m3	165.00	3,960
- Rebar, 45kg/m3		1,080 kg	8.50	9,180
- Formwork		185 m2	280.00	51,800
6 Concrete stair in stairwell		17 flight	10,500.00	178,500
7 Concrete stair in mechanical room		1 flight	10,500.00	10,500
8 Wood clad staircase, 15 risers		1 flight	15,000.00	15,000
9 Allowance for housekeeping pad			allow	5,000
A22 Upper Floor Construction TOTAL : \$		3,753 m2	1,212.76	4,551,500
A23 Roof Construction				
1 Roof construction, type R1		573 m2	65.00	37,250
- 38mm 22ga. metal roof deck		573 m2	65.00	37,245
2 Roof construction, type R2		266 m2	65.00	17,290
- 38mm 22ga. metal roof deck		266 m2	65.00	17,290
3 Structural support to above		839 m2	1,075.80	902,560
- Allowance for OWSJ, beams, columns, etc.		54,535 kg	15.00	818,025
- Miscellaneous metals, connections		5,454 kg	15.50	84,537
A23 Roof Construction TOTAL : \$		839 m2	1,140.76	957,100

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 5

A3 EXTERIOR ENCLOSURE		Quantity	Unit rate	Amount
A32 Walls Above Grade				
1	Exterior wall finishes (W1)	2,850 m2	435.00	1,239,750
	- 22ga. metal cladding	2,850 m2	300.00	855,000
	- Allowance 20% for premium cladding	570 m2	250.00	142,500
	- Hat channel	2,850 m2	35.00	99,750
	- Weather barrier membrane	2,850 m2	50.00	142,500
2	Extra over wall assembly to above exterior wall finishes (W1)	2,364 m2	450.00	1,063,800
	- Rigid mineral wool insulation board attached to structure w/ ACS thermal clips	2,364 m2	85.00	200,940
	- Peel and stick air and vapour barrier membrane	2,364 m2	50.00	118,200
	- Exterior grade gypsum board, 16mm thick	2,364 m2	100.00	236,400
	- 20ga. steel studs, 140mm thick	2,364 m2	150.00	354,600
	- Type 'X' gypsum board, 16mm thick	2,364 m2	65.00	153,660
3	Allowance for opening for snowhood/louvre/air intake		allow	20,000
4	Allowance for sealants, foamed in place insulation exterior painting	2,850 m2	40.00	114,000
A32 Walls Above Grade TOTAL : \$		2,850 m2	855.30	2,437,600
A33 Windows & Entrances				
1	Hollow metal doors c/w pressed steel frame and standard hardware	11 no.	5,927.30	65,200
	- Single	7 no.	5,900.00	41,300
	- Double	2 pr.	11,200.00	22,400
	- Glazing above the door, triple glazed	1 m2	1,500.00	1,500
2	Allow for hardware upgrade		allow	5,500
3	Push button door operator	3 no.	5,500.00	16,500
4	Fiberglass windows, triple glazed and argon filled	145 m2	2,510.00	363,950
Carried Forward :				451,150

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 6

A3 EXTERIOR ENCLOSURE		Quantity	Unit rate	Amount
A33 Windows & Entrances (Continued)			Brought Forward :	451,150
5	Garage door c/w frame, standard hardware and operators, 2250mm x 2250mm (assume)	1 no.	15,000.00	15,000
6	Allowance for exterior louvre		allow	20,000
A33 Windows & Entrances TOTAL : \$		172 m2	2,826.74	486,200
A34 Roof Coverings				
1	Mineral wool insulation vented roof assembly (R1)	573 m2	710.00	406,830
	- MBM granular cap sheet membrane, torch install, 4mm thick	573 m2	240.00	137,520
	- Base sheet membrane, 2.5mm thick	573 m2	125.00	71,625
	- Exterior grade cement board sheathing fastened to girts below	573 m2	50.00	28,650
	- Rigid mineral wool insulation board with 76mm 18 ga. z-girt, 356mm thick	573 m2	180.00	103,140
	- Self-adhered air and vapour barrier	573 m2	30.00	17,190
	- Cement board sheathing, 16mm thick	573 m2	85.00	48,705
2	Mineral wool insulation green roof assembly (R2)	266 m2	1,315.00	349,790
	- Toundra box green roof module, 100mm thick	266 m2	600.00	159,600
	- Root barrier membrane	266 m2	50.00	13,300
	- Sorpalene flam 250 GR MBM granular cap sheet, torch install, 4mm thick	266 m2	280.00	74,480
	- Base sheet membrane	266 m2	125.00	33,250
	- Cement board sheathing, 16mm thick	266 m2	50.00	13,300
	- Rigid mineral wool insulation board with 76mm 18ga. z-girt, 354mm thick	266 m2	180.00	47,880
	- Self-adhered air and vapour barrier	266 m2	30.00	7,980
A34 Roof Coverings TOTAL : \$		839 m2	901.79	756,600

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 7

A3 EXTERIOR ENCLOSURE		Quantity	Unit rate	Amount
A35 Projections				
1	Underside of 3rd floor	479 m2	445.00	213,160
	- 19mm hat channel	479 m2	35.00	16,765
	- Cement board sheathing, 16mm thick	479 m2	85.00	40,715
	- self-adhered air and vapour barrier	479 m2	50.00	23,950
	- Rigid mineral wool weather barrier membrane, 178mm thick	479 m2	100.00	47,900
	- 19mm hat channel	479 m2	35.00	16,765
	- 20ga. metal soffit	479 m2	140.00	67,060
2	Rigid mineral wool insulation parapet wall	62 m2	883.40	54,770
	- 22ga. metal cladding	62 m2	300.00	18,600
	- Allowance 20% for premium cladding	12 m2	250.00	3,000
	- Hat channel	62 m2	35.00	2,170
	- Weather barrier membrane	62 m2	50.00	3,100
	- Rigid mineral wool insulation baord attached to structure w/ ACS thermal clips	62 m2	85.00	5,270
	- Peel and stick air and vapour barrier membrane	62 m2	50.00	3,100
	- Exterior grade gypsum board, 16mm thick	62 m2	100.00	6,200
	- 20ga. steel studs, 140mm thick	62 m2	150.00	9,300
	- Type 'X' gypsum board, 16mm thick	62 m2	65.00	4,030
3	20ga. pre-finished parapet cap	35 m2	250.00	8,750
4	Slatted screen	47 m2	550.00	25,850
5	Stone to terrace floor	24 m2	750.00	18,000
A35 Projections		TOTAL : \$	1 Sum	320,500.00
				320,500

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 8

B1 PARTITIONS & DOORS		Quantity	Unit rate	Amount
B11 Partitions				
1	Partition, P1	1,117 m2	275.00	307,180
	- Type 'X' gypsum board, 16mm thick	1,117 m2	65.00	72,605
	- 92mm steel stud	1,117 m2	95.00	106,115
	- Acoustic batt insulation	1,117 m2	50.00	55,850
	- Type 'X' gypsum board, 16mm thick	1,117 m2	65.00	72,605
2	Partition, P2	277 m2	290.00	80,330
	- Type 'X' gypsum board, 16mm thick	277 m2	65.00	18,005
	- 150mm steel stud	277 m2	110.00	30,470
	- Acoustic batt insulation	277 m2	50.00	13,850
	- Type 'X' gypsum board, 16mm thick	277 m2	65.00	18,005
3	Partition, P3	903 m2	340.00	307,020
	- Type 'X' gypsum board, 16mm thick	903 m2	65.00	58,695
	- 92mm steel stud	903 m2	95.00	85,785
	- Acoustic batt insulation	903 m2	50.00	45,150
	- Type 'X' gypsum board, 16mm thick	903 m2	65.00	58,695
	- Type 'X' gypsum board, 16mm thick	903 m2	65.00	58,695
4	Non fire-rated partition, assume similar to P1	806 m2	275.00	221,650
	- Type 'X' gypsum board, 16mm thick	806 m2	65.00	52,390
	- 92mm steel stud	806 m2	95.00	76,570
	- Acoustic batt insulation	806 m2	50.00	40,300
	- Type 'X' gypsum board, 16mm thick	806 m2	65.00	52,390
5	45min. fire-rated partition, assume similar to P3	477 m2	340.00	162,180
	- Type 'X' gypsum board, 16mm thick	477 m2	65.00	31,005
	- 92mm steel stud	477 m2	95.00	45,315
	- Acoustic batt insulation	477 m2	50.00	23,850
	- Type 'X' gypsum board, 16mm thick	477 m2	65.00	31,005
	- Type 'X' gypsum board, 16mm thick	477 m2	65.00	31,005
6	1 hr. fire-rated partition, assume similar to P3	659 m2	340.00	224,060
	- Type 'X' gypsum board, 16mm thick	659 m2	65.00	42,835
	- 92mm steel stud	659 m2	95.00	62,605
	- Acoustic batt insulation	659 m2	50.00	32,950
	- Type 'X' gypsum board, 16mm thick	659 m2	65.00	42,835
	- Type 'X' gypsum board, 16mm thick	659 m2	65.00	42,835
Carried Forward :				1,302,420

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 9

B1 PARTITIONS & DOORS		Quantity	Unit rate	Amount
B11 Partitions	(Continued)		Brought Forward :	1,302,420
7	2 hr. fire-rated partition (assumed)	252 m2	470.00	118,440
	- Type 'X' gypsum board, 16mm thick	252 m2	65.00	16,380
	- Type 'X' gypsum board, 16mm thick	252 m2	65.00	16,380
	- 92mm steel stud	252 m2	95.00	23,940
	- Acoustic batt insulation	252 m2	50.00	12,600
	- Type 'X' gypsum board, 16mm thick	252 m2	65.00	16,380
	- Type 'X' gypsum board, 16mm thick	252 m2	65.00	16,380
	- Type 'X' gypsum board, 16mm thick	252 m2	65.00	16,380
8	Partition glazing, 10mm laminated tempered safety glass, glass stiffeners every 1500mm c/w aluminum frames and all clear glazing	82 m2	1,350.00	110,700
9	Allowance for rough carpentry, wood blocking and backing	1 sum	30,000.00	30,000
10	Allowance for firestopping, sealing and caulking	1 sum	15,000.00	15,000
11	Allowance for opening for interior louvre	1 sum	15,000.00	15,000
B11 Partitions	TOTAL : \$	4,573 m2	348.04	1,591,600
B12 Doors				
1	Hollow metal door c/w pressed steel frames and standard hardware	27 no.	4,347.80	117,390
	- Single	11 no.	4,410.00	48,510
	- Double	8 pr.	8,610.00	68,880
2	Solid core wood door c/w wood frames and standard hardware	188 no.	3,643.10	684,900
	- Single	184 no.	3,650.00	671,600
	- Double	2 pr.	6,650.00	13,300
3	Allow for hardware upgrade	215 no.	500.00	107,500
4	Push button door operators	44 no.	5,500.00	242,000
			Carried Forward :	1,151,790

Page No. : A - 10

[illegible]

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 11

B2 FINISHES		Quantity	Unit rate	Amount
B21 Floor Finishes				
1	Carpet tile c/w base	191 m2	150.00	28,650
2	Ceramic tile c/w base	64 m2	200.00	12,800
3	Luxury vinyl flooring c/w base	1,515 m2	150.00	227,250
4	Marmoleum c/w base	1,395 m2	175.00	244,130
5	Multi-sports gym flooring c/w base	108 m2	165.00	17,820
6	Safety vinyl flooring c/w base	54 m2	165.00	8,910
7	Seal concrete c/w base	410 m2	35.00	14,350
8	G1S plywood underlay, 10mm thick	479 m2	100.00	47,900
B21 Floor Finishes TOTAL : \$		3,737 m2	161.04	601,800
B22 Ceiling Finishes				
1	Ceiling assembly 1	573 m2	150.00	85,950
	- Resilient channel, 13mm thick	573 m2	85.00	48,705
	- Type 'X' gypsum board, 16mm thick	573 m2	65.00	37,245
2	Ceiling assembly 2	266 m2	150.00	39,900
	- Resilient channel, 13mm thick	266 m2	85.00	22,610
	- Type 'X' gypsum board, 16mm thick	266 m2	65.00	17,290
3	Ceiling assembly 3	179 m2	151.70	27,150
	- Rigid mineral wool, 134mm thick	179 m2	50.00	8,950
	- Gypsum board, 16mm thick	169 m2	50.00	8,450
	- Gypsum board, 16mm thick	169 m2	50.00	8,450
	- Type 'X' gypsum board, 16mm thick	10 m2	65.00	650
	- Type 'X' gypsum board, 16mm thick	10 m2	65.00	650
4	Ceiling assembly 4	3,095 m2	153.30	474,570
	- Rigid mineral wool, 134mm thick	3,095 m2	50.00	154,750
	- Gypsum board, 16mm thick	2,751 m2	50.00	137,550
	- Gypsum board, 16mm thick	2,751 m2	50.00	137,550
	- Type 'X' gypsum board, 16mm thick	344 m2	65.00	22,360
	- Type 'X' gypsum board, 16mm thick	344 m2	65.00	22,360
Carried Forward :				627,570

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 12

B2 FINISHES		Quantity	Unit rate	Amount
B22 Ceiling Finishes	(Continued)		Brought Forward :	627,570
5	Extra over to above for paint finish	4,113 m2	40.00	164,520
6	Acoustic tile c/w suspended T-bar grid	1,151 m2	85.00	97,840
7	Extra over for 16mm type 'X' gypsum board bulkhead	1 sum	11,500.00	11,500
B22 Ceiling Finishes	TOTAL : \$	4,113 m2	219.16	901,400
B23 Wall Finishes				
1	Paints	8,920 m2	35.00	312,200
2	Ceramic tiles	308 m2	185.00	56,980
3	Dry erase wall panel	407 m2	350.00	142,450
4	Wood liner	282 m2	275.00	77,550
B23 Wall Finishes	TOTAL : \$	9,917 m2	59.41	589,200

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 13

B3 FITTINGS & EQUIPMENT		Quantity	Unit rate	Amount
B31 Fittings & Fixtures				
1	Washroom accessories	48 no.	2,163.30	103,840
	- Mirror	48 no.	650.00	31,200
	- Washroom grab bar set	16 no.	750.00	12,000
	- Paper towel dispenser	17 no.	350.00	5,950
	- Soap dispenser	17 no.	260.00	4,420
	- Waste receptacle	17 no.	400.00	6,800
	- Foldable shower seat	13 no.	930.00	12,090
	- Shower grab bar set	13 no.	750.00	9,750
	- Curtain rod	35 no.	275.00	9,625
	- Toilet paper dispenser	48 no.	250.00	12,000
2	Janitor room accessories	3 no.	3,000.00	9,000
3	Locker	7 m	2,000.00	14,000
4	Glass balustrade, assume 1070mm	5 m2	1,350.00	6,750
5	Millwork	1 sum	598,950.00	598,950
	- Built-in bed	22 m	1,350.00	29,700
	- Laminate desk with particle board casework	48 m	1,350.00	64,800
	- Melamine shelving w/ PVC edge finish	6 m	1,000.00	6,000
	- Millwork cabinet	13 m	1,350.00	17,550
	- Millwork closet	152 m	1,250.00	190,000
	- Particle board casework	18 m	800.00	14,400
	- Solid surface countertop	152 m	1,500.00	228,000
	- Solid surface kitchen island	12 m	3,000.00	36,000
	- Stainless steel countertop	5 m	2,500.00	12,500
6	Indoor kiosk	1 no.	30,000.00	30,000
7	Allowance for interior signage, wayfinding and building directory	1 sum	25,000.00	25,000
B31 Fittings & Fixtures		TOTAL : \$	4,431 m2	177.73
				787,500

Page No. : A - 14

B3 FITTINGS & EQUIPMENT		Quantity	Unit rate	Amount
B32 Equipment				
1	Laundry appliances	11 no.	9,881.80	108,700
	- Washer/dryer	19 no.	5,500.00	104,500
	- Dryer	1 no.	2,100.00	2,100
	- Washer	1 no.	2,100.00	2,100
2	Kitchen appliances	32 no.	5,968.80	191,000
	- Range	34 no.	2,500.00	85,000
	- 1-door refrigerator	32 no.	2,500.00	80,000
	- 2-door refrigerator	4 no.	6,500.00	26,000
B32 Equipment TOTAL : \$		4,431 m2	67.64	299,700
B33 Elevators				
1	Elevator, 9 stops	1 no.	525,000.00	525,000
2	Elevator, 10 stops	1 no.	585,000.00	585,000
B33 Elevators TOTAL : \$		2 No	555,000.00	1,110,000

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 15

C1 MECHANICAL	Quantity	Unit rate	Amount
C11 Plumbing & Drainage			
1 Plumbing fixture	1 sum	643,800.00	643,800
- Water closet c/w flush tank b/f	14 no.	2,800.00	39,200
- Water closet c/w flush tank	34 no.	2,550.00	86,700
- Lavatory, c/w faucet b/f	14 no.	2,500.00	35,000
- Lavatory, c/w faucet	35 no.	2,200.00	77,000
- Shower c/w mixing valve b/f	13 no.	2,000.00	26,000
- Shower c/w mixing valve	29 no.	3,000.00	87,000
- Kitchen sink	34 no.	2,400.00	81,600
- Janitor sink	2 no.	2,400.00	4,800
- Laundry sink	2 no.	2,700.00	5,400
- Public sink	1 no.	2,200.00	2,200
- Washer connection	43 no.	900.00	38,700
- Fixture rough-ins	178 no.	900.00	160,200
2 Domestic water	1 sum	368,900.00	368,900
- DCW entrance assembly c/w RPBFPF	1 sum	14,500.00	14,500
- L-copper piping c/w insulation	1 sum	204,000.00	204,000
- PEX piping	32 no.	1,100.00	35,200
- DHW-1 A/B hot water tanks	1 sum	73,600.00	73,600
- P-3, P-6 A/B Pumps	1 sum	32,000.00	32,000
- TK-3 expansion tank	1 sum	4,800.00	4,800
- TK-4 pressure tank	1 sum	4,800.00	4,800
3 Sanitary drainage	1 sum	328,000.00	328,000
- SAN piping	1 sum	144,000.00	144,000
- In suite SAN piping	1 sum	93,000.00	93,000
- Cleanout, floor drain	1 sum	36,000.00	36,000
- Vent pipe	1 sum	36,000.00	36,000
- Grease interceptor	1 sum	19,000.00	19,000
4 Storm drainage	1 sum	81,400.00	81,400
- Pumps	1 sum	11,200.00	11,200
- STM piping	1 sum	43,000.00	43,000
- RD roof drain	1 sum	3,200.00	3,200
- Rainwater tank	1 sum	24,000.00	24,000
5 Propane gas	1 sum	26,400.00	26,400
- Incoming connection	1 sum	5,600.00	5,600
- Gas piping	1 sum	16,800.00	16,800
- Gas connection	1 sum	4,000.00	4,000
Carried Forward :			1,448,500

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 16

C1 MECHANICAL		Quantity	Unit rate	Amount
C11 Plumbing & Drainage	(Continued)		Brought Forward :	1,448,500
6 Fuel system		1 sum	8,000.00	8,000
- OTK-1 tank		1 sum	6,400.00	6,400
- Piping		1 sum	1,600.00	1,600
7 P&D miscellaneous such as start-up, cleaning, drawings, manuals, tagging, identifications etc.		1 sum	30,000.00	30,000
C11 Plumbing & Drainage	TOTAL : \$	4,431 m2	335.48	1,486,500
C12 Fire Protection				
1 Fire water main entrance assembly c/w BFP		1 sum	11,200.00	11,200
2 P-5 fire pump c/w jockey pump		1 sum	48,000.00	48,000
3 Header		1 sum	4,800.00	4,800
4 Main piping		1 sum	24,000.00	24,000
5 Wet pipe sprinkler system		4,431 m2	42.00	186,100
6 Dry sprinkler system c/w compressor, zone valves, etc		1 sum	24,000.00	24,000
7 Fire extinguisher in public areas		15 no.	960.00	14,400
8 Fire extinguisher in residential areas		16 no.	560.00	8,960
9 Kitchen fire protection system		1 sum	12,800.00	12,800
10 Fire department connection		1 sum	4,800.00	4,800
11 FP miscellaneous such as start-up, cleaning, drawings, manuals, tagging, identifications etc.		1 sum	32,000.00	32,000
C12 Fire Protection	TOTAL : \$	4,431 m2	83.75	371,100

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 17

C1 MECHANICAL	Quantity	Unit rate	Amount
C13 HVAC			
1 Heating, and cooling	1 sum	612,800.00	612,800
- B-1 A/B/C boilers	3 no.	32,000.00	96,000
- HP-1 A/B heat pumps c/w buffer tank and all associated items	1 sum	350,000.00	350,000
- Air separator	1 sum	24,000.00	24,000
- Heat exchanger	1 sum	50,000.00	50,000
- P-1 A/B/C pumps	3 no.	6,400.00	19,200
- P-2 A/B/C pumps	3 no.	4,800.00	14,400
- P-4 pump	1 no.	3,200.00	3,200
- P-7 and TK-5 glycol fill station c/w pump and tank	1 sum	8,000.00	8,000
- TK-1 A/B buffer tank	2 no.	16,000.00	32,000
- TK-2 expansion tank	1 no.	16,000.00	16,000
2 Ventilation	1 sum	1,365,200.00	1,365,200
- HRV-1	1 sum	24,000.00	24,000
- HRV-2 2000 l/s	1 sum	160,000.00	160,000
- Ductwork c/w insulation	1 sum	640,000.00	640,000
- Condensate line	1 sum	54,000.00	54,000
- FCU fan coil units	55 no.	5,600.00	308,000
- Baseboard heater system	1 sum	8,000.00	8,000
- CHU-1 A/B/C/D/E/F cabinet unit heater	6 no.	1,500.00	9,000
- UH-1 A/B/C/D/E unit heater	5 no.	960.00	4,800
- Diffusers, grilles, louvers	1 sum	107,000.00	107,000
- Dampers	1 sum	36,000.00	36,000
- AC split system AC-1 c/w CU-1	1 sum	6,400.00	6,400
- AC split system AC-2 c/w CU-2	1 sum	8,000.00	8,000
3 Exhaust system	1 sum	191,360.00	191,360
- RH-1 kitchen range hood	43 no.	1,920.00	82,560
- Commercial range hood	1 sum	9,600.00	9,600
- MAU-1 & HC-1 makeup air unit c/w heating coil	1 sum	48,000.00	48,000
- EF-1,2,3 fans	4 no.	12,800.00	51,200
4 Hydronic piping	1 sum	185,000.00	185,000
5 Allow for testing, adjusting and balancing	1 sum	38,000.00	38,000
6 HVAC miscellaneous such as start-up cleaning, drawings, manuals, tagging, identifications etc.	1 sum	48,000.00	48,000
C13 HVAC	TOTAL : \$ 4,431 m2	550.76	2,440,400

C1 MECHANICAL	Quantity	Unit rate	Amount
C14 Controls			
1 Controls	1 sum	278,400.00	278,400
- Heating boiler	3 no.	8,000.00	24,000
- Pumps	13 no.	4,000.00	52,000
- Heat pump	2 no.	24,000.00	48,000
- Fans	4 no.	2,400.00	9,600
- Heaters	11 no.	2,400.00	26,400
- T-stat c/w LV wiring	1 sum	80,000.00	80,000
- Fire protection system	1 sum	8,000.00	8,000
- MAU	1 sum	8,000.00	8,000
- ERV	2 no.	11,200.00	22,400
C14 Controls	TOTAL : \$ 4,431 m2	62.83	278,400

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 19

C2 ELECTRICAL		Quantity	Unit rate	Amount
C21 Service & Distribution				
1	Service & distribution	4,431 m2	120.00	531,720
2	Electrical misc.	1 sum	30,000.00	30,000
	- Testing/commissioning	1 sum	5,000.00	5,000
	- Permits, fees & inspection	1 sum	5,000.00	5,000
	- Drawings & manuals	1 sum	5,000.00	5,000
	- Sealing & firestopping	1 sum	2,500.00	2,500
	- Tagging & identification	1 sum	2,500.00	2,500
	- Mobilization	1 sum	10,000.00	10,000
3	200KW 208V genset	1 sum	130,000.00	130,000
C21 Service & Distribution TOTAL : \$		4,431 m2	156.10	691,700
C22 Lighting, Devices & Heating				
1	Supply, install & wire light fixtures	4,431 m2	129.20	572,620
	- Dorm room	9 unit	1,500.00	13,500
	- Dorm room, BF	3 unit	2,000.00	6,000
	- Home base room, 1BR	17 unit	4,000.00	68,000
	- Home base room, 2BR	4 unit	5,000.00	20,000
	- Market rental, 1BR	6 unit	4,000.00	24,000
	- Market rental, 2BR	4 unit	5,000.00	20,000
	- Other areas	2,632 m2	160.00	421,120
2	Exit & emergency lighting	4,431 m2	12.00	53,170
3	Lighting controls	4,431 m2	23.10	102,440
	- Dorm room	9 unit	400.00	3,600
	- Dorm room, BF	3 unit	400.00	1,200
	- Home base room, 1BR	17 unit	1,400.00	23,800
	- Home base room, 2BR	4 unit	1,600.00	6,400
	- Market rental, 1BR	6 unit	1,400.00	8,400
	- Market rental, 2BR	4 unit	1,600.00	6,400
	- Other areas	2,632 m2	20.00	52,640
4	Power outlets, devices & connections	4,431 m2	48.90	216,620
	- Dorm room	9 unit	1,000.00	9,000
	- Dorm room, BF	3 unit	1,000.00	3,000
	- Home base room, 1BR	17 unit	3,500.00	59,500
	- Home base room, 2BR	4 unit	4,000.00	16,000
(Continued)				
Carried Forward :				944,850

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 20

C2 ELECTRICAL		Quantity	Unit rate	Amount
C22 Lighting, Devices & Heating	(Continued)		Brought Forward :	944,850
4 Power outlets, devices & connections	(Continued)			
- Market rental, 1BR	6 unit	3,500.00	21,000	
- Market rental, 2BR	4 unit	4,000.00	16,000	
- Other areas	2,632 m2	35.00	92,120	
5 Connections to mech. equipment	1 sum	50,000.00	50,000	
- Boiler	3 no.	800.00	2,400	
- Heat pump	2 no.	800.00	1,600	
- DHW	2 no.	800.00	1,600	
- Fan coil, FC	3 no.	800.00	2,400	
- Unit heater	4 no.	800.00	3,200	
- Makeup air coil	1 no.	800.00	800	
- HRV	2 no.	800.00	1,600	
- MAU	1 no.	800.00	800	
- Exhaust fan	3 no.	800.00	2,400	
- Range hood	1 no.	800.00	800	
- Condensing unit, CU	2 no.	800.00	1,600	
- A/C unit, AC	2 no.	800.00	1,600	
- Pump	12 no.	800.00	9,600	
- Misc. connection to mech. equipment	1 sum	19,600.00	19,600	
C22 Lighting, Devices & Heating	TOTAL : \$	4,431 m2	224.53	994,900
C23 Systems & Ancillaries				
1 Fire alarm system	4,431 m2	47.80	211,940	
- Dorm room	9 unit	1,000.00	9,000	
- Dorm room, BF	3 unit	1,000.00	3,000	
- Home base room, 1BR	17 unit	2,500.00	42,500	
- Home base room, 2BR	4 unit	3,000.00	12,000	
- Market rental, 1BR	6 unit	2,500.00	15,000	
- Market rental, 2BR	4 unit	3,000.00	12,000	
- Other areas	2,632 m2	45.00	118,440	
2 Communication system	4,431 m2	37.70	166,840	
- Dorm room	9 unit	600.00	5,400	
- Dorm room, BF	3 unit	600.00	1,800	
- Home base room, 1BR	17 unit	1,200.00	20,400	
- Home base room, 2BR	4 unit	1,800.00	7,200	
- Market rental, 1BR	6 unit	1,200.00	7,200	
	(Continued)			
			Carried Forward :	378,780

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 21

C2 ELECTRICAL		Quantity	Unit rate	Amount
C23	Systems & Ancillaries (Continued)		Brought Forward :	378,780
2	Communication system (Continued)			
	- Market rental, 2BR	4 unit	1,600.00	6,400
	- Other areas	2,632 m2	45.00	118,440
3	Cable TV system	4,431 m2	19.10	84,680
	- Dorm room	9 unit	600.00	5,400
	- Dorm room, BF	3 unit	600.00	1,800
	- Home base room, 1BR	17 unit	1,200.00	20,400
	- Home base room, 2BR	4 unit	1,800.00	7,200
	- Market rental, 1BR	6 unit	1,200.00	7,200
	- Market rental, 2BR	2 unit	1,600.00	3,200
	- Other areas	2,632 m2	15.00	39,480
4	Security - access controls system	1 sum	40,000.00	40,000
5	CCTV system	1 sum	80,000.00	80,000
6	Panic alarm system	1 sum	25,000.00	25,000
C23 Systems & Ancillaries		TOTAL : \$	4,431 m2 137.33	608,500

**Home Base Yellowknife
Mixed-Use Building
Yellowknife, NT**

Report date : August 2024

Page No. : A - 22

D1 SITE WORK	Quantity	Unit rate	Amount
D11 Site Development			
1 Allowance for site development	793 m2	550.00	436,150
D11 Site Development TOTAL : \$	793 m2	550.06	436,200
D12 Mechanical Site Services			
1 Watermain	1 sum	110,400.00	110,400
- Watermain c/w recirculation line	1 sum	80,000.00	80,000
- Valves	1 sum	24,000.00	24,000
- Connections	1 sum	6,400.00	6,400
2 Sanitary services	1 sum	40,000.00	40,000
- Piping	1 sum	32,000.00	32,000
- Connections	1 sum	4,800.00	4,800
- Allow remove existing manhole	1 no.	3,200.00	3,200
3 Storm water disposal		nil	
4 Fuel system	1 sum	64,000.00	64,000
- Propane tank	1 sum	56,000.00	56,000
- U/G gas piping	1 sum	8,000.00	8,000
D12 Mechanical Site Services TOTAL : \$	1 m	214,400.00	214,400
D13 Electrical Site Services			
1 Site power services	1 sum	30,000.00	30,000
2 Site communication services	1 sum	15,000.00	15,000
3 EV charging system, allow	5 no.	2,000.00	10,000
D13 Electrical Site Services TOTAL : \$	1 Sum	55,000.00	55,000

**Appendix AA
Documents and Drawings List**

DOCUMENTS AND DRAWING LIST

DOCUMENTS

Number	Title	Dated	Received
N/A	Home Base Yellowknife Mixed-Use Building Yellowknife, NT Schematic Design Report – Draft for Cost Estimating	Jul. 16/24	Jul. 17/24

ARCHITECTURAL DRAWINGS

Number	Title	Dated	Received
A1-1	Not Applicable	N/A	N/A

STRUCTURAL DRAWINGS

Number	Title	Dated	Received
N/A	Not Applicable	N/A	N/A

MECHANICAL DRAWINGS

Number	Title	Dated	Received
N/A	Not Applicable	N/A	N/A

ELECTRICAL DRAWINGS

Number	Title	Dated	Received
N/A	Not Applicable	N/A	N/A

CIVIL DRAWINGS

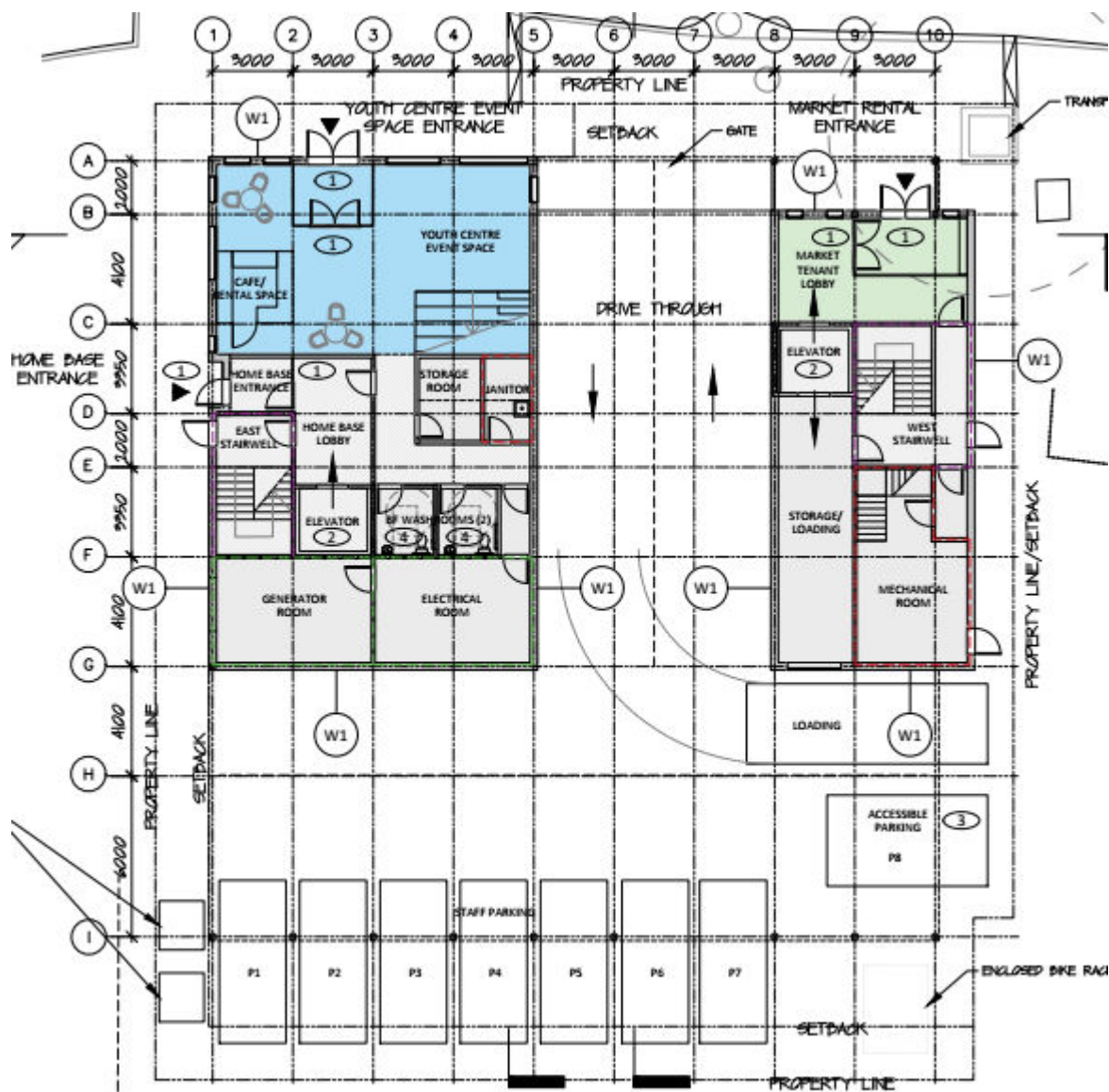
Number	Title	Dated	Received
N/A	Not Applicable	N/A	N/A

LANDSCAPE DRAWINGS

Number	Title	Dated	Received
N/A	Not Applicable	N/A	N/A

**Appendix AB
Representative Drawings**





HANSCOMB: Providing Cost Excellence in the Construction Industry Since 1957

As trusted independent cost advisors, our value extends beyond estimates:

Cost Planning & Control

- Master plan costing
- Construction cost estimates
- Change order evaluation

Project Loan Monitoring

Value Management

Financial Analysis

- Life cycle costing
- Operations and maintenance
- Cost/benefit analysis
- Feasibility studies

Applied Research

- Construction price indexing
- Risk and gap analysis
- Cost publications

Scheduling

Litigation Support

Our numbers at a glance:

- 85+ dynamic and inclusive team members
- 65+ years of expert costing
- 9 offices, and more coming
- 1 Manager of Canada's Arctic Region



From west to east, our leadership team is here to serve you. We collaborate on many projects nationally and internationally and are available to assist. For information, please contact us.

VANCOUVER, BC

650 - 409 Granville St.
604-685-1241, vancouver@hanscomb.com
Ken King, Manager, Business Development
Indu Elapatha, Manager
Albert Antolin, Technical Manager
Adrian Secu, Technical Manager

EDMONTON, AB

503 - 10080 Jasper Ave.
780-426-7980, edmonton@hanscomb.com
Dominic Kiema, Manager
Joshua Akom, Technical Manager

REGINA, SK

PO Box 37060
306-201-9107, regina@hanscomb.com
Ayo Abiola, Manager

WINNIPEG, MB

218 - 1460 Chevrier Blvd
204-775-3389, winnipeg@hanscomb.com
Isaac Gwendo, Executive Vice President
Irene Malang, Manager
Afolabi Ajayi, Technical Manager
Colin Elliot, Technical Manager

LONDON, ON

PO Box 60010
226-378-4920, london@hanscomb.com
Bob Picken, Director
Nadine Kralj, Technical Manager

HAMILTON, ON

602 - 25 Main St. W.
905-525-5777, hamilton@hanscomb.com
Craig Bye, Executive Vice President
Melissa Trautmann, Director
Lauren Mainprize, Technical Manager

TORONTO, ON

900 - 40 Holly St.
416-487-3811, toronto@hanscomb.com
Susan Neil, President
Dale Panday, Executive Vice President
Sean Davis, Director of Marketing
Nathan Thinagaripillai, Manager
Murugan Thambiayah, Manager M&E
Richard AQUI, Technical Manager
Muhundan Appudurai, Technical Manager
Alex Paul, Technical Manager

OTTAWA, ON

1830 - 130 Albert St.
613-234-8089, ottawa@hanscomb.com
Art Maw, Chief Executive Officer
Tracy Slattery, Director
Brian McBurney, Director of IT
Nicolas Serge, Manager
Dale Stratton, Manager, Arctic
Erwin Raymundo, Technical Manager
Chinthana Peiris, Technical Manager
Jeyakaran Nadarasa, Technical Manager

HALIFAX, NS

4002 - 7071 Bayers Rd
902-422-3620, halifax@hanscomb.com
Raymond Murray, Executive Vice President
Erin Brownlow, Director
Ryan Duncan, Technical Manager
JoAnne Murray, Temp Technical Manager
Michelle Ernst, Business Manager

HEAD OFFICE, TORONTO, ON

900 - 40 Holly St.
416-487-3811, info@hanscomb.com
Tyler Keizer, Director of Finance