The following Motions and Documents were considered by the GFC Facilities Development Committee at its Thursday, September 27, 2018 meeting:

Agenda Title: **South Campus Community Ice Arena - Schematic Design Report**

CARRIED MOTION:
THAT the GFC Facilities Development Committee approve, with delegated authority from the Board of Governors, and on the recommendation of Planning and Project Delivery, the proposed South Campus Community Ice Arena Schematic Design Report as the basis for further design development.

Final Item: 5

OUTLINE OF ISSUE
Action Item

Agenda Title: **South Campus Community Ice Arena – Schematic Design Report**

Motion: THAT the GFC Facilities Development Committee approve, with delegated authority from the Board of Governors, and on the recommendation of Planning and Project Delivery, the proposed South Campus Community Ice Arena Schematic Design Report as the basis for further design development.

Item

Action Requested	☒Approval ☐Recommendation
Proposed by	Pat Jansen, AVP – (Facilities and Operations, Planning and Project Delivery)
Presenter	Cheryl Harwardt, Director Campus and Community Recreation, Faculty of Kinesiology, Sport, and Recreation Peter Osborne, Architect, GEC Architecture

Details

Responsibility	Vice-President (Facilities and Operations)
The Purpose of the Proposal is (please be specific)	To provide a joint-use ice arena to support University of Alberta's varsity sports program, campus and community recreation programs, high-performance athlete training, and research centre.
The Impact of the Proposal is	To benefit the Faculty of Kinesiology, Sport, and Recreation academic, athletics and recreation programs, campus life while adding valuable recreation infrastructure to support local, provincial, and national sports organizations.
Replaces/Revises (eg, policies, resolutions)	N/A
Timeline/Implementation Date	N/A
Estimated Cost and funding source	N/A
Next Steps (ie.: Communications Plan, Implementation plans)	Design development stage
Supplementary Notes and context	N/A

Engagement and Routing (Include meeting dates)

Participation: (parties who have seen the proposal and in what capacity) <For further information see the link posted on the Governance Toolkit section Student Participation Protocol>	*Those who have been **informed**:* • Community Relations • University Relations
	*Those who have been **consulted**:* • Dean, Faculty of Kinesiology, Sport, and Recreation • Vice-President, Facilities and Operations • City of Edmonton
	*Those who are actively **participating**:* • Director Campus and Community Recreation, Faculty of Kinesiology, Sport, and Recreation • Office of the University Architect, Planning and Project Delivery • Director, Project Management Office, Planning and Project

	Delivery • Associate Vice-President, Planning and Project Delivery • The City of Edmonton
Approval Route (Governance) (including meeting dates)	GFC Facilities and Development Committee – September 27, 2018
Final Approver	GFC Facilities and Development Committee

Alignment/Compliance

Alignment with Guiding Documents	**Comprehensive Institutional Plan** **Institutional Strategic Plan - *For the Public Good*** **BUILD...** 5. OBJECTIVE: Build and strengthen trust, connection, and a sense of belonging among all members of the university community through a focus on shared values. i. Strategy: Support and enhance activities, initiatives, and traditions that bond alumni, students, staff, faculty, and professors emeriti to the university vi. Strategy: Encourage and support institution-wide initiatives, services, and programs, such as arts and cultural activities, intramurals, student groups, volunteering, clubs, and centres, which bring students from all faculties into community with each other. 6. OBJECTIVE: Build and support an integrated, cross-institutional strategy to demonstrate and enhance the University of Alberta's local, national, and international story, so that it is shared, understood, and valued by the full University of Alberta community and our many stakeholders. ii. Strategy: Engage and advocate strategically with all levels and orders of government and other key stakeholders, and identify and demonstrate how university activities intersect with their goals and strategies. iii. Strategy: Communicate, using both quantitative and qualitative evidence, how the University of Alberta serves as a cornerstone of the community bringing widespread economic and societal benefits to all Albertans, as well as to national and international partners and stakeholders. **EXPERIENCE...** 8. OBJECTIVE: Create and facilitate co-curricular and extracurricular learning experiences for undergraduate and graduate students that enable their self-discovery and give them the skills to use their talents, creativity, and curiosity to contribute as future citizens and leaders. v. Strategy: Continue to support and enhance a student-athlete-centred university sport environment that facilitates

the academic, athletic, and personal development of students.

EXCEL...

13. OBJECTIVE: Enable University of Alberta researchers to succeed and excel.

v. Strategy: Participate fully in matching programs and maintain and pursue memberships in relevant funding organizations to expand and leverage funding opportunities for the university and to increase our researchers' reach, influence, and impact.

ENGAGE...

16. OBJECTIVE: Enhance, increase, and sustain reciprocal, mutually beneficial community relations, community engagement, and community-engaged research and scholarship that will extend the reach, effectiveness, benefit, and value of our university-community connections.

i. Strategy: Identify and embrace opportunities to build, strengthen, and extend the University of Alberta's connections to and engagement with external stakeholders, including the general public, neighbouring communities, ethnic and cultural communities, and other communities of practice.

iv. Strategy: Continue to build mutually beneficial, authentic relationships with alumni and donors.

v. Strategy: Welcome increased community access, participation, and engagement at all University of Alberta sites, such as our downtown campus at Enterprise Square and our sports facilities at South Campus.

18. OBJECTIVE: Seek, build, strengthen, and sustain partnerships with local, national, or international research agencies, governments, government ministries and agencies, universities, Indigenous communities, libraries, not-for-profits, industry, business, and community organizations.

iii. Strategy: Encourage municipal, provincial, national, and international collaborations, partnerships, and MOUs at the institutional, faculty, department, unit, and individual levels.

SUSTAIN...

20. OBJECTIVE: Continue to build and support an integrated approach to social, economic, and environmental sustainability that incorporates teaching and learning, research, outreach, capacity building, and the operations that support them.

ii. Strategy: Embed social, economic, and environmental

	sustainability into the development and care of the university's natural and built environments. iii. Strategy: Enhance awareness of, and engagement with, the university's environmental sustainability features, practices, and resources across University of Alberta campuses and external communities. 22. OBJECTIVE: Secure and steward financial resources to sustain, enhance, promote, and facilitate the university's core mission and strategic goals. i. Strategy: Seek and secure resources needed to achieve and support our strategic goals. 23. OBJECTIVE: Ensure that the University of Alberta's campuses, facilities, utility, and information technology infrastructure can continue to meet the needs and strategic goals of the university. i. Strategy: Secure and sustain funding to plan, operate, expand, renew, and optimize the use of campus infrastructure to meet evolving teaching and research priorities. iv. Strategy: Engage and strategically partner with stakeholders to explore and develop joint-use projects.
Compliance with Legislation, Policy and/or Procedure Relevant to the Proposal (please quote legislation and include identifying section numbers)	***Post-Secondary Learning Act* (*PSLA*):** The *PSLA* gives GFC responsibility, subject to the authority of the Board of Governors, over academic affairs (Section 26(1)) and provides that GFC may make recommendations to the Board of Governors on a building program and related matters (Section 26(1) (o)). Section 18(1) of the PSLA give the Board of Governors the authority to make any bylaws "appropriate for the management, government and control of the university buildings and land." Section 19 of the *Act* requires that the Board "consider the recommendations of the general faculties council, if any, on matters of academic import prior to providing for (a) the support and maintenance of the university, (b) the betterment of existing buildings, (c) the construction of any new buildings the board considers necessary for the purposes of the university [and] (d) the furnishing and equipping of the existing and newly erected buildings [.] […]" Section 67(1) of the *Act* governs the terms under which university land may be leased. **GFC Facilities Development Committee Terms of Reference** **3. MANDATE OF THE COMMITTEE** 2. Delegation of Authority Notwithstanding anything to the contrary in the terms of reference

	above, the Board of Governors and General Faculties Council have delegated to the Facilities Development Committee the following powers and authority: A. Facilities 1. To approve proposed General Space Programmes for academic units. 2 (i) To approve proposals concerning the design and use of all new facilities and the repurposing of existing facilities and to routinely report these decisions for information to the Board of Governors. (ii) In considering such proposals, GFC FDC may provide advice, upon request, to the Provost and Vice-President (Academic), Vice-President (Facilities and Operations), and/or the University Architect (or their respective delegates) on the siting of such faculties. B. Other Matters The Chair of FDC will bring forward to FDC items where the Office of the Provost and Vice-President (Academic) and/or the Office of the Vice-President (Facilities and Operations), in consultation with other units or officers of the University, is seeking the advice of the Committee. **UAPPOL** Space Management Policy and Space Management Procedure The respective roles of GFC FDC and the Vice-President (Facilities and Operations) with regard to institutional space management are set out in the Board-approved Policy and attendant Procedure.

1. Briefing Note (2 pages)
2. South Campus Community Ice Arena – Schematic Design Report (125 pages)

Prepared by:

Ben Louie
Director
University Architect
Facilities and Operations
Email: ben.louie@ualberta.ca

UNIVERSITY OF ALBERTA

Briefing Note

(GFC) Facilities Development Committee – September 27, 2018
Planning and Project Delivery
Facilities and Operations

South Campus Community Ice Arena Schematic Design Report

Background

In 2014 the University of Alberta approached the City of Edmonton as a potential partner for the development of a community arena that would be part of the South Campus development. This led to a memorandum of understanding being signed 2015. In April 2016 the University of Alberta presented to City Council a proposal for the South Campus Community Ice Arena (SCCIA).

The South Campus Long Range Development Plan - Land Use Plan establishes the site for the SCCIA within the recreation zone of Sector 12. The SCCIA will be located at the centre of the south campus, northwest of a future plaza, and south of a planned parkade. Pedestrian routes will connect the plaza to the existing LRT on 115th Street and to other future facilities on campus.

The goals for this project are:

- Expanded provision of indoor ice for user groups of all activities, ages, and abilities (1.25 ice sheets of prime time for both sheets will be available for community use).
- Enabling the current supply of indoor ice arenas to be sustained and expanded amidst the pressures of aging infrastructure.
- Enabling affiliated stakeholders such as the City of Edmonton and Government of Alberta to further meet strategic goals (e.g. City of Edmonton Recreation Facility Master Plan, Province of Alberta Active Alberta Policy, etc.)
- Enabling local, provincial, and national sport organizations to better meet program goals (Edmonton hockey and ringette groups, Skate Canada, Hockey Canada, etc.).

The Project

Program Part I: The development of a new twin arena, which will include a high-performance sport complex, will complement the university's existing athletic facilities and provide "home ice" for the Pandas and Golden Bears hockey teams training facilities for the university's combative sports teams. A 3,000 seat room varsity arena and a 400 seat community area will also provide recreation ice for the benefit of the entire community.

The gross floor area of the proposed schematic design (exclusive of the high performance component) is as follows:

- Participant level 86,585 ft^2 (8,044 m^2)
- Spectator level 44,100 ft^2 (4,097 m^2)
- Upper suite level 9,644 ft^2 (896 m^2)
- Total 140,329 ft^2 (13,037 m^2)

This compares to the proposed pre-design space drogram of 136,521 ft^2 gross floor area and the feasibility study estimate of 159,654 ft^2 gross floor area exclusive of the high performance component.

The increase of 3,809 ft^2 over the proposed pre-design program relates to accommodating a community / participant lobby and additional spaces added in the varsity dressing rooms and support spaces.

Program Part II: The High Performance Athlete Training and Research Centre (HPTRC) allows the Faculty of Kinesiology, Sport, and Recreation to offer training and research in high performance sport. The HPTRC allows students to engage with renowned academic staff and Canada's most successful inter-university athletic programs. Students are provided practical, hands-on learning experiences in sport conditioning while developing an understanding of sport science research.

The HPTRC includes a large open floor training space, a multi-purpose room for combative sports training, a 150' sprint track for biomechanics training and research, and laboratories for sport medicine research, body composition, and as well as a wet lab. The HPTRC also includes classrooms and office spaces as well as change rooms and support spaces for its programs. The project is designed to allow the HPTRC to be built in the future when funding is available – once built, the HPTRC will be integrated into the overall design and operation of the SCCIA.

Operations: The building will operate in two modes; as a community and practice arena and as an event facility. For example, during major events spectators need to be separated from the participants. The arenas require a service entrance to an exterior service yard accessing the "back of house" functions.

Recommendation

The GFC Facilities Development Committee approve the proposed South Campus Community Arena schematic design report.

UNIVERSITY OF ALBERTA

SOUTH CAMPUS COMMUNITY ICE ARENA

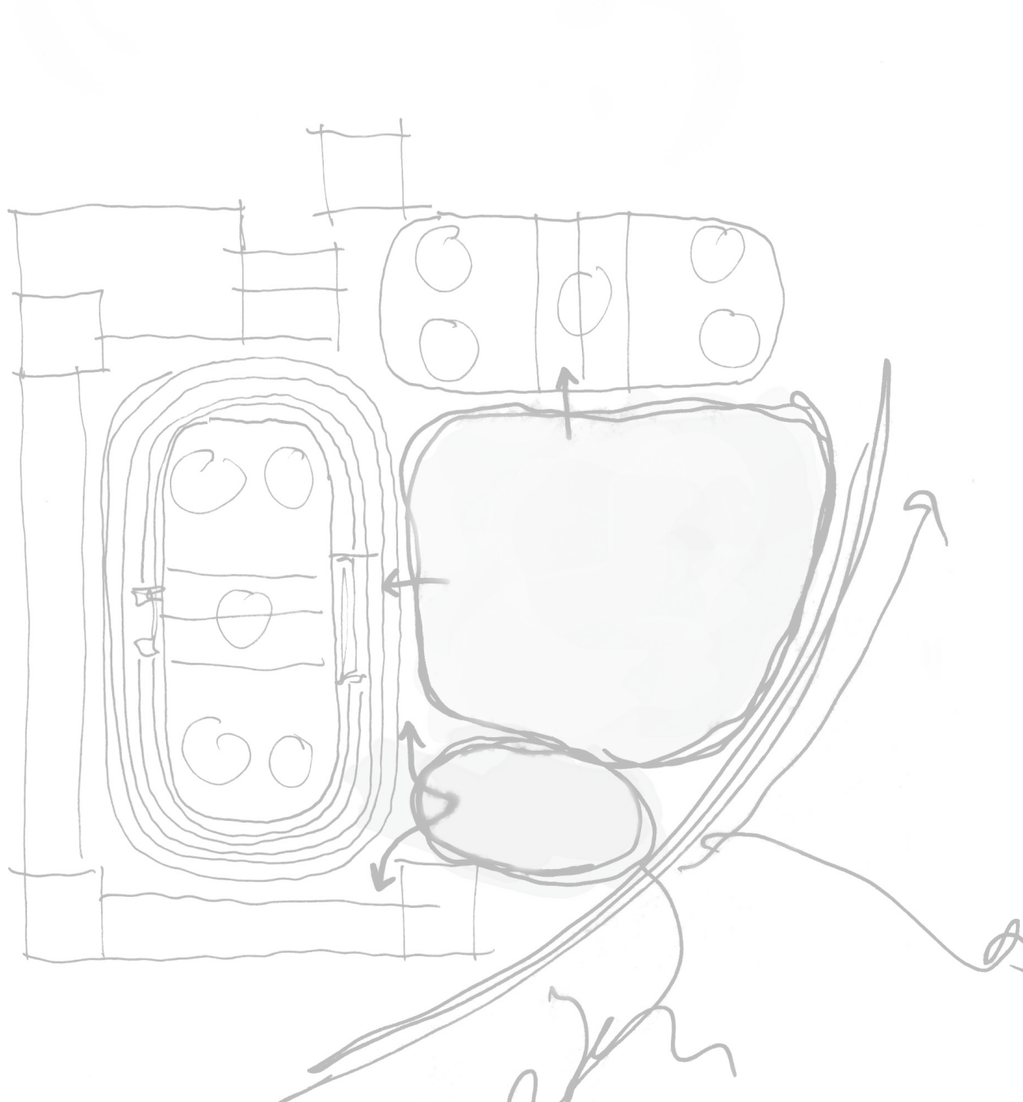
SCHEMATIC DESIGN REPORT

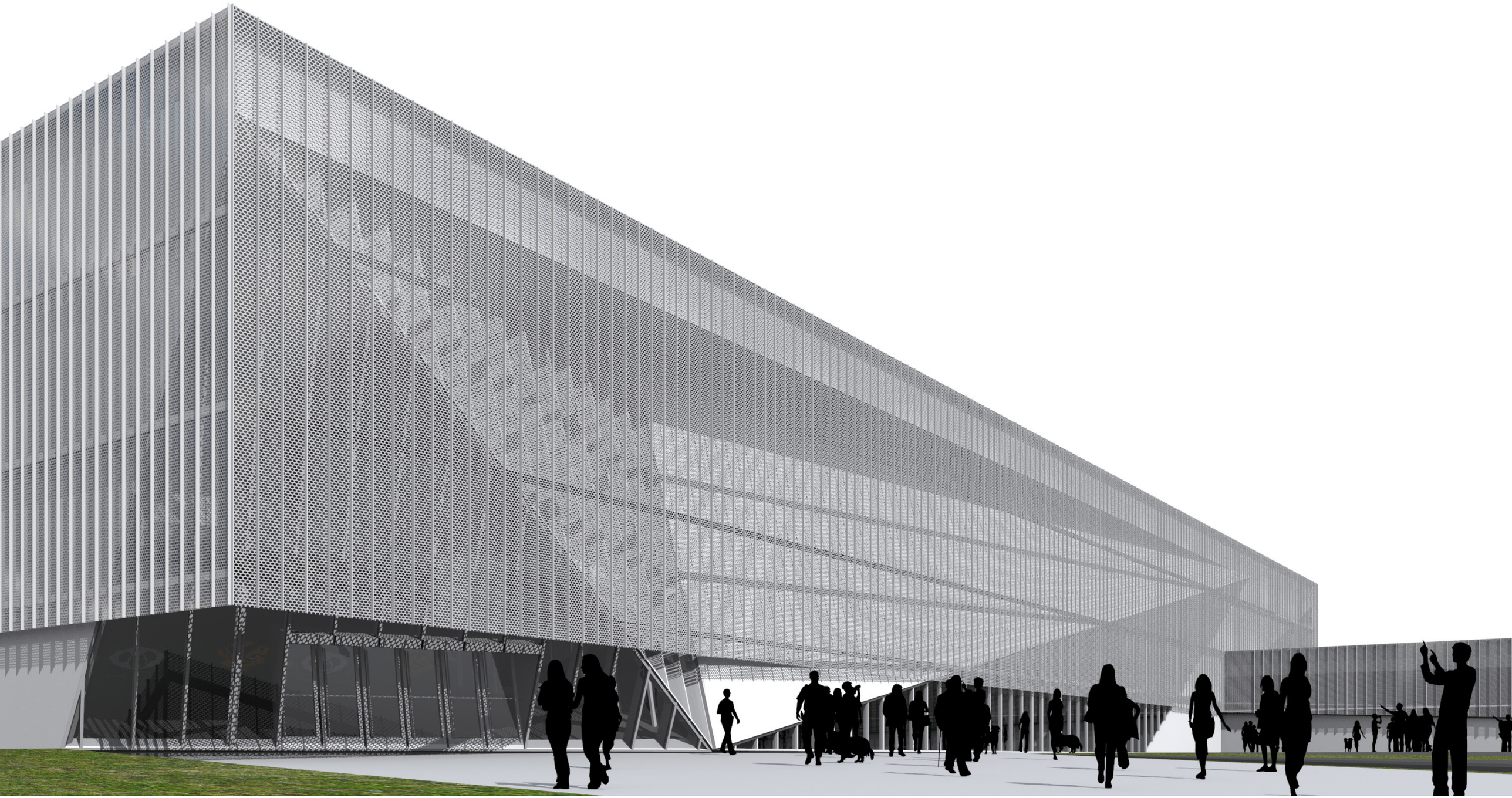
GEC ARCHITECTURE

FINAL SUBMISSION AUGUST 30, 2018

Contents

Appendices





Spectator Entrance

Executive Summary

Project Background

In 2014 the University of Alberta approached the City of Edmonton as a potential partner for the development of a Community Arena that would be part of the South Campus development. A Memorandum of Understanding (MOU) between the partners was signed in 2015. The University of Alberta and City of Edmonton have established an executive steering committee and a project steering committee to guide the development and planning of the Arena project. In April of 2016 the University of Alberta met with City of Edmonton City Council to present a proposal for a South Campus Community Ice Arena (SCCIA).

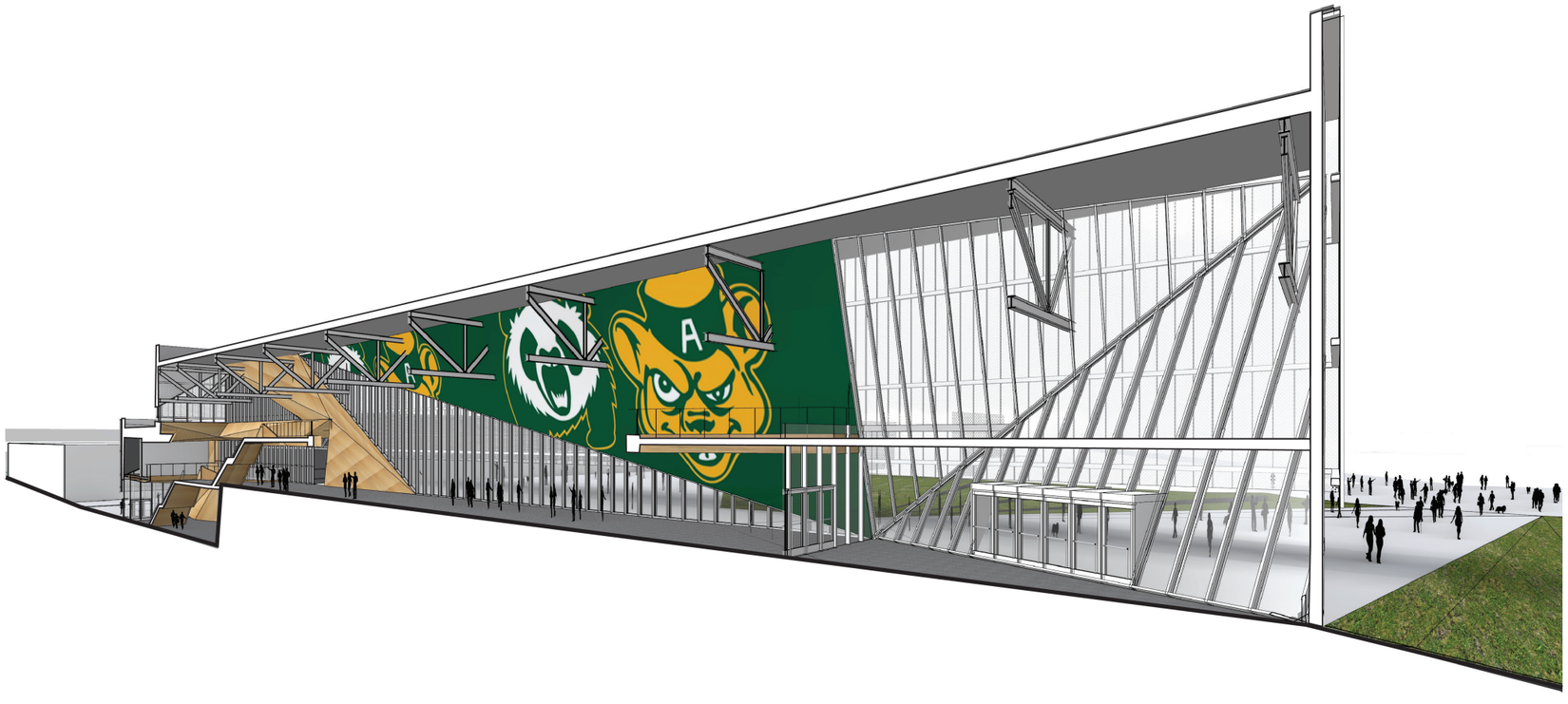
Benefits

Benefits to the broader Edmonton community, region, and beyond include:

- Expanded provision of indoor ice for user groups of all activities, ages and abilities (1.25 ice sheets of prime time for both sheets will be available for community use).
- Enabling the current supply of indoor ice arenas to be sustained and expanded amidst the pressures of aging infrastructure
- Enabling affiliated stakeholders such as the City of Edmonton and Province of Alberta to further meet strategic goals (City of Edmonton Recreation Facility Master Plan, Province of Alberta Active Alberta Policy, etc.)
- Enabling local, Provincial and National sport organizations to better meet program goals (Edmonton hockey and ringette groups, Skate Canada, Hockey Canada, etc.).

South Campus Long Range Development Plan (SCLRDP)

The SCLRDP Land Use Plan establishes the Site for the South Campus Community Ice Arena within the Recreation Zone of Sector 12. The Land Use Plan envisions a future Campus that prioritizes pedestrian and bicycle circulation. The South Campus Community Ice Arena will be at the heart of the South Campus, North West of a future pedestrian plaza and South of a planned parkade that will serve the Campus. Pedestrian routes will connect the plaza to the existing LRT on 115th Street and to other future facilities on Campus.



Program Analysis & Reconciliation

The University of Alberta prepared a Business Case in November 2016 that identified Community and University program needs. This initial Preliminary Facility Program served as a point of departure for reconciling the current needs of the University and resulted in a new Schematic Design Program used for the basis of our schematic design development.

The development of a new twin arena, and a future high performance sport complex, on the South Campus, will complement the existing athletic facilities and provide "home ice" for the University of Alberta Pandas and Golden Bears Hockey teams training facilities for the UofA Combative Sports teams and for combative sports. A 3000 seat + 300 standing room Varsity Arena and a 400 seat community area will provide recreation ice for the City of Edmonton and University Students, Faculty and Staff.

The Gross Floor Area (GFA) of the Proposed Schematic Design (Exclusive of the High Performance component) is as follows:

Participant Level	86,585 sqft (8,044 sqm)
Spectator Level	44,100 sqft (4,097 sqm)
Upper Suite Level	9,644 sqft (896 sqm)
Total	140,329 sqft (13,037 sqm)

This compares to the Proposed Schematic Design Space Program of 136,521 sq ft Gross Floor Area (GFA) and the feasibility study estimate of 159,654 sq ft Gross Floor Area (GFA) exclusive of the High Performance component.

The increase of 3,809 sq ft over the Proposed Schematic Design Program can be attributed to increased area to accommodate a community/participant lobby and additional area added in the Varsity dressing rooms and support spaces.

Image Credit: Don Voaklander

Schematic Design Approach

The design concept is informed by the siting, contextual and functional relationships. There are a number of relationship drivers and siting challenges that have determined the design including the following:

- The building will operate in two modes, as a community and practice arena and as an event facility. Participants, including Varsity athletes, community users and parents of children need reasonably direct access to the dressing rooms so as to minimize the hauling distance of hockey bags etc. Spectators, particularly ticketed spectators, need to arrive through a controlled entrance and need space to allow for movement and access.
- During a major event, spectators need to be separated from the participants. The ideal separation is achieved if spectators enter at a top loaded seating bowl and participants enter at the lower ice level. This approach eliminates the need for vomitories and improves site lines.
- The arenas require a service entrance to an exterior service yard accessing the "back of house" functions. Ice resurfacing equipment and event equipment and staging will need to be unloaded into the building. The exterior service yard will house the cooling tower for the refrigeration equipment, mechanical equipment, and provide for team buses, media and broadcast vehicles, temporary storage and service vehicles.

To achieve a best fit solution to the siting and circulation challenges, a number of options were examined during the concept design phase. Each of the options anticipated an upper level concourse with suites and meeting spaces and organizes the building on three levels. GEC examined options that provided for different spectator entrance points from the North and South and options that placed the participant (ice) level below and at grade.

The design concept stems from these siting and contextual relationships. A simple massing arrangement places the community and Varsity rinks in a L shaped configuration and creates the space for the future High Performance element. The Community Arena is lowered and mostly below grade and very much a secondary structure. The arrangement allows the higher and larger Varsity Arena to have its own identity and presence.

Given the parking to the North and the planned pedestrian plaza to the South Esat, the service yard has been placed to the North and the spectator entrance to the South. A community/athletes entrance at ice level is provided at the North adjacent the planned parkade.

As the site becomes more pedestrian oriented in the future, the South spectator entrance will address the central plaza. A drop off along the South boundary of the site will provide vehicle access for spectators. This arrangement allows the public face of the building to address the "main Street" of the Campus and connect to the High Performance component in the future.

Hockey is a winter sport and the Pandas and Golden Bears are a winter City Team. For much of the season spectators will arrive in the early evening in the dark of winter. The Varsity Arena will be clad in a back-lit perforated metal screen to create a festive lantern that can be seen from all points on the Campus. The screen and its lighting soften the largely solid mass of the Arena give it the appearance of floating above the entries and surrounding landscape.

The simple box shapes of the arenas have been carved and faceted with large glazed areas behind the screen. These elements identify the spectator and community entrances and provide visual interest at key locations of the building. The faceting on the South West corner provides a focal point along the West entry to the Campus.

Varsity Arena Seating Bowl

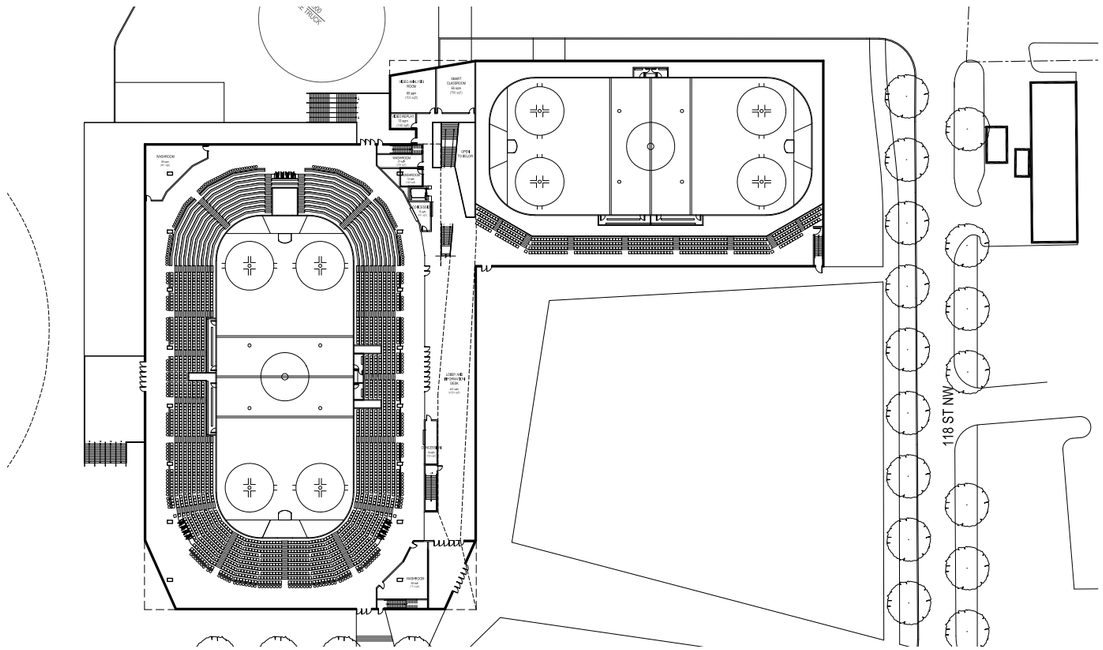
The existing Clare Drake Arena has approximately 2600 bench seats in a horse shoe arrangement. Typical of small arenas at the time, the rise of the seating bowl is rather high while the run is quite short. This creates, a steep bowl with good site lines and most importantly a sense of intimacy and a degree of intimidation which contributes to a home team advantage.

Reproducing this environment in the new building is important and has driven the bowl design and seating rake. The U of A has proposed that a certain percentage of the seats need not have backs and that a "student zone" can be designed that reproduces the Clare Drake experience with more densely packed spectators on benches.

Participant Level Plan - High Performance

The High Performance Athlete Training and Research Centre (HPTRC) allows the Faculty of Kinesiology, Sport, and Recreation to offer training and research in high performance sport. The HPTRC allows students to engage with renowned academic staff and Canada's most successful inter-university athletic programs. Students are provided practical, hands-on learning experiences in sport conditioning while developing an understanding of sport science research.

The program for the HPTRC includes a large open floor training space, a multi-purpose room for combative sports training, a 150' sprint track for biomechanics training and research, and laboratories for sport medicine research, body composition, and as well as a wet lab. The HPTRC includes classrooms and office spaces, as well as change rooms and support spaces for its programs. The project is designed to allow the HPTRC to be built in the future when funding is available – once built, the HPTRC will be integrated into the overall design and operation of the SCCIA.



Estimated Project Cost

GEC Architecture, PCL Construction, and CostPlan Management are currently working together to develop the estimated probable cost of construction.

Refer to Section 11.0 (page. 61) for Cost Estimate.

1.0 Project Background

Introduction

The City of Edmonton and the University of Alberta have entered into a Memorandum of Understanding to explore a potential partnership for the development of the South Campus Community Ice Arena Project.

The City of Edmonton and the University of Alberta recognize the significance of public recreation facilities and the strength of partnerships. An alignment of common objectives between municipal entities and educational institutions can provide important and relevant recreation opportunities.

Given this shared vision, the University of Alberta approached the City of Edmonton as a potential partner for the development of a Community Arena that would be part of the South Campus development. After the development of an MOU – signed in 2015 – the two partners began discussions on an implementation phase for a Community Arena. The University of Alberta and City of Edmonton have established an executive steering committee and a project steering committee to guide the development and planning of the arena project. After months of discussion and Business Case development, the University of Alberta met with City of Edmonton City Council to present a proposal for a South Campus Community Ice Arena in April 2016. The proposal outlined how a new South Campus Community Ice Arena would strategically align to the:

- City of Edmonton Recreation Facility Master Plan
- 10 Year Arena Capital Development Strategy
- Facility use and services that promote healthy living for Edmontonians
- Enhance the City of Edmonton as a sport tourism destination and further capitalize on existing infrastructure supported by public investment
- Effective resource stewardship with affirmed budget and schedule alignment

Public engagement is an important part of project development. The University of Alberta and the City of Edmonton through their consultative mandates have held the first of two open house an gathered valuable feedback. This feedback was taken inconsideration and will be formalized at the Design Development stage of the project.

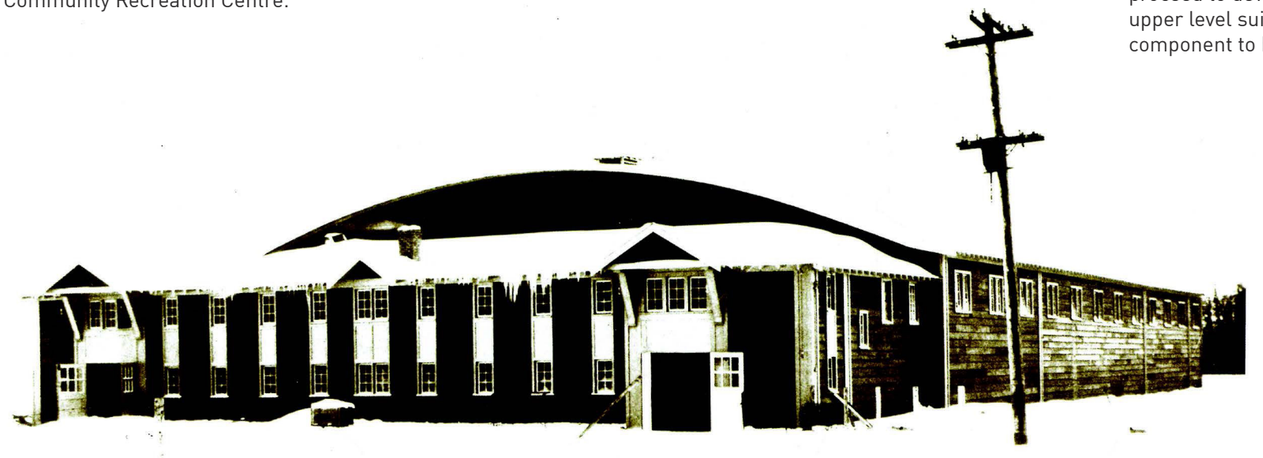
University Of Alberta Academic Needs, Goals, Objectives For The Partnership/Project

The South Campus Community Ice Arena project will help the University of Alberta achieve the following goals:

- academic achievement
- student outcomes and retention
- High Performance sports development
- leadership & team development
- research development
- overall fitness and well being
- mental health
- culture importance
- community engagement

City Of Edmonton Strategic Alignment Of Partnership Project

- The City's 10-Year Arena Capital Development Strategy (2009-2019) indicates that the City will need 34 public ice arenas by 2019 to meet demand. Currently, there are 31 ice arenas available.
- The Strategy indicates the need to replace six existing ice sheets in the short to medium term.
- The South Campus Community Ice Arena would be considered a replacement ice sheet for Coronation Arena during the construction of the Coronation Community Recreation Centre.



Varsity Arena, 1927. U of A Archives 69-97-693.

Benefits

Benefits to the broader Edmonton community, region, and beyond include:

- Expanded provision of indoor ice for user groups of all activities, ages and abilities (1.25 ice sheets of prime time for both sheets will be available for community use).
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- Enabling local, Provincial and National sport organizations to better meet program goals (Edmonton hockey and ringette groups, Skate Canada, Hockey Canada, etc.).

Budget Objectives

The U of A established a construction budget for the Arena complex (excluding parkade) for three (3) preliminary design options based on the following estimated hard construction budget scenarios:

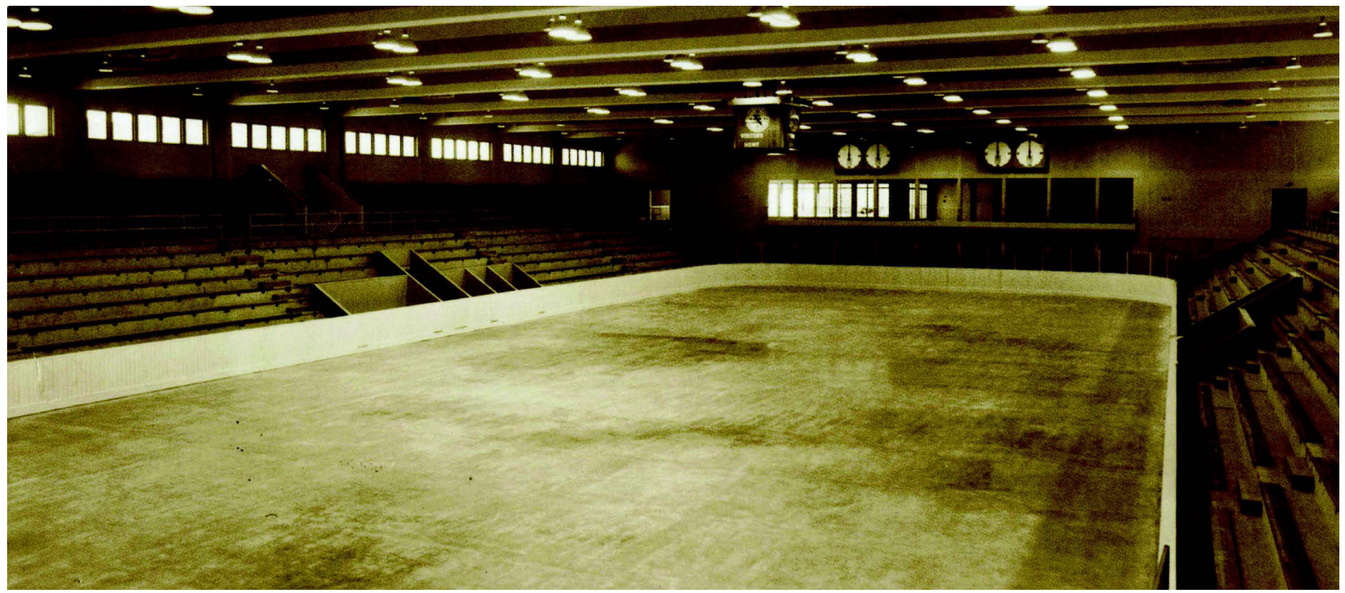
Option 1: Up to $52 million for the Arena complex as well as landscaping and civil work (site servicing, site grading, storm management etc.) including new access road;

Option 2: Up to $45 million for the Arena complex as well as landscaping and civil work (site servicing, site grading, storm management etc.) including new access road;

Option 3: Up to $38 million for the Arena complex as well as landscaping and civil work (site servicing, site grading, storm management etc.) including new access road.

Following the concept design phase and based upon preliminary estimates of the probable cost of construction, GEC determined that the full program with the two Arenas and the High Performance Sport Component, **(Option 1)** could be constructed for approximately $54 million. Construction of the Arena program without the High Performance Component **(Option 2)**, was estimated at $44 million. Removal of the High Performance component and the upper level suites **(Option 3)** resulted in an estimated construction cost of approximately $40 million.

Based upon these estimates the U of A instructed GEC to proceed to develop a Schematic Design that retains the upper level suites and allows the High Performance component to be constructed at a future time.



Above - Varsity Arena, 1940. U of A Archives 69-95-270.
Bottom Left - 1946-47 Golden Bears, U of A Archives 72-58-2038
Bottom Right - Existing Clare Drake Arena, 1957.

2.0 Site

Context

The University of Alberta's South Campus was purchased in the 1920s. Initially, it comprised 379 acres of land, approximately a mile and one-half South of the Main Campus (now known as the North Campus). This area runs from 60 Avenue North to Fox Drive, and from 122 Street Esat to approximately 115 Street. The South Campus also includes lands known as the West 240, purchased in the 1930s and located South of 62 Avenue to 52 Avenue and Esat of 122 Street to the edge of the Whitemud Creek Ravine. In total the South Campus now encompasses 620 acres.

The South Campus is surrounded by residential neighbourhoods and is accessible to the North Campus and the region by a LRT Line located on 114 Street to the West. The proposed site is South West from the existing Saville Community Sports Centre. The Saville Community Sports Centre is a joint-use University/Community facility.

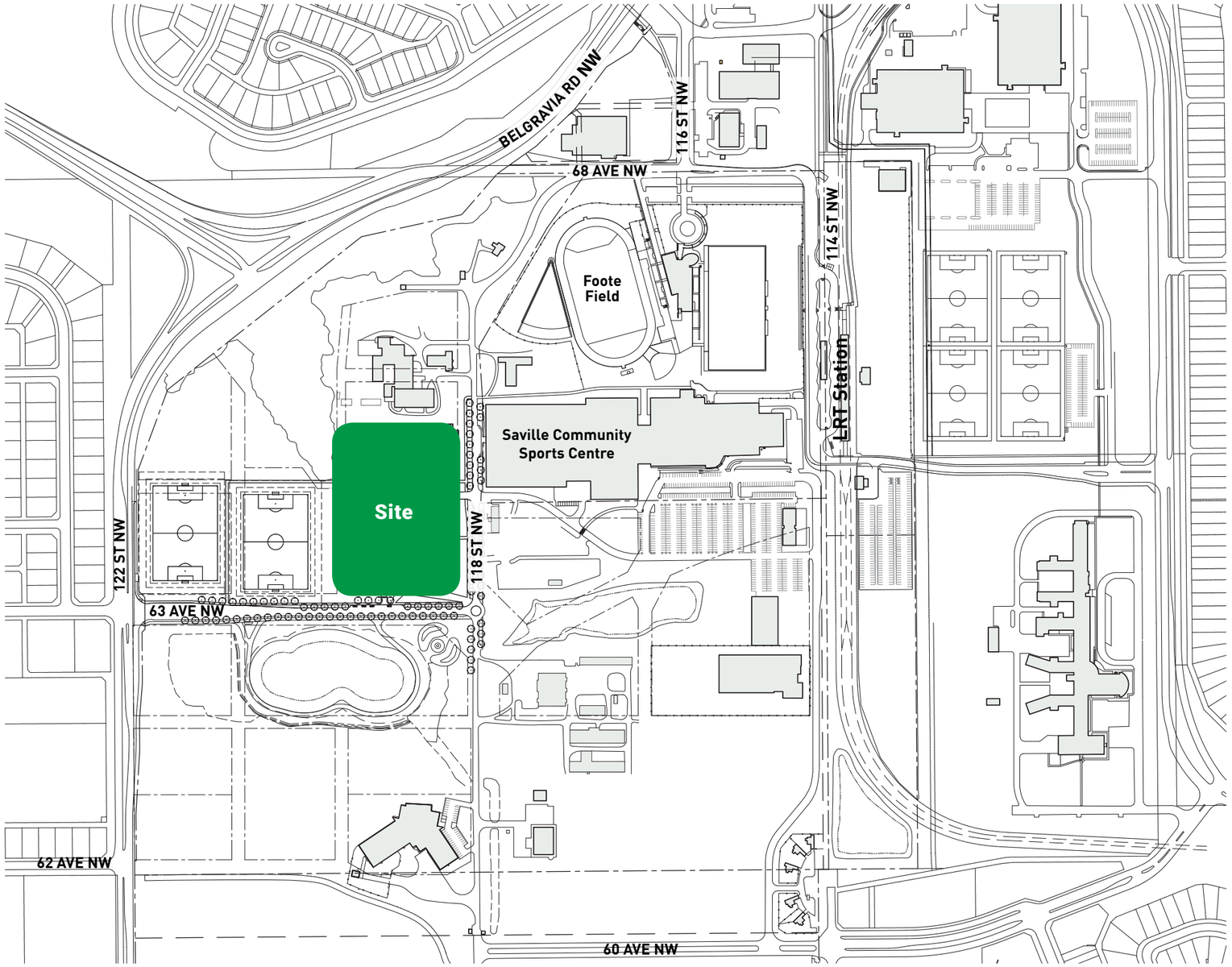
South Campus is divided into a number of sectors – the Arena site is located in Sector 12.

The Long Range Development Plan for South Campus identifies that it will accommodate much of the growth of the University of Alberta for the next thirty years. Over time, it may accommodate faculties and other activities from North Campus as well as new faculties and new areas of teaching, research and development.

South Campus may grow initially as a specialty Campus and home of the Centres of Excellence and Achievement and independent Faculties. The Faculties of Physical Education and Recreation (PER) and Agriculture, Life and Environmental Sciences (ALES) are anticipated to be the first occupants of Sector 12, where the Arena is located.

This academic/research sector of South Campus, with its attractive physical character, evolved reputation, modern facilities, and easy access may become the University's new location of choice for many programs.

The addition of a new twin arena, and in the future a High Performance sport complex, will complement the existing athletic facilities and provide "home ice" for the University of Alberta Pandas and Golden Bears Hockey team and facilities for combative sports. A 3000 seat Varsity Arena and a 400 seat community area will provide recreation ice for the City of Edmonton and University students, faculty and staff.



University of Alberta - South Campus Site Plan

View Looking North Esat (Campus Entry)

View Looking Esat

View Looking West

Site Requirements and Planning

The South Campus Community Ice Arena Project is a development within Sector 12 of the South Campus Long Range Development Plan (SCLRDP): a Campus dedicated to academics and research in a park-like setting. Amendment was issued on the website for this document on June 2013.

South Campus Long Range Development Plan

The SCLRDP is a part of the U of A global Long Range Development Plan (LRDP) that identifies a set of Strategic Planning Principles that form the basis for achievements of the goals, objectives and strategies expressed in the Academic, Research and the Business Plans. It identifies how the University lands and facilities should be developed in response to these plans, and it outlines the operational planning initiatives and guidelines that will direct development. The LRDP is the overall organizing framework for development and is approved by the Board of Governors as the guiding document for physical planning.

The LRDP embodies the following principals:

Smart Growth Principles

- Maintain a healthy, sustainable Campus
- Realize operational, academic and social benefits to the university and surrounding communities
- Develop stronger connections and communication with surrounding communities
- Create lasting, meaningful and accessible spaces
- Maintain barrier-free access and service availability to university facilities by creating a pedestrian-focused Campus
- Develop the Campus in phases

Sustainability Pillars

- Energy efficiency
- Water and wastewater management
- Water and stormwater management
- Ecology and the environment
- Transportation
- Healthy and complete communities
- Built Environment

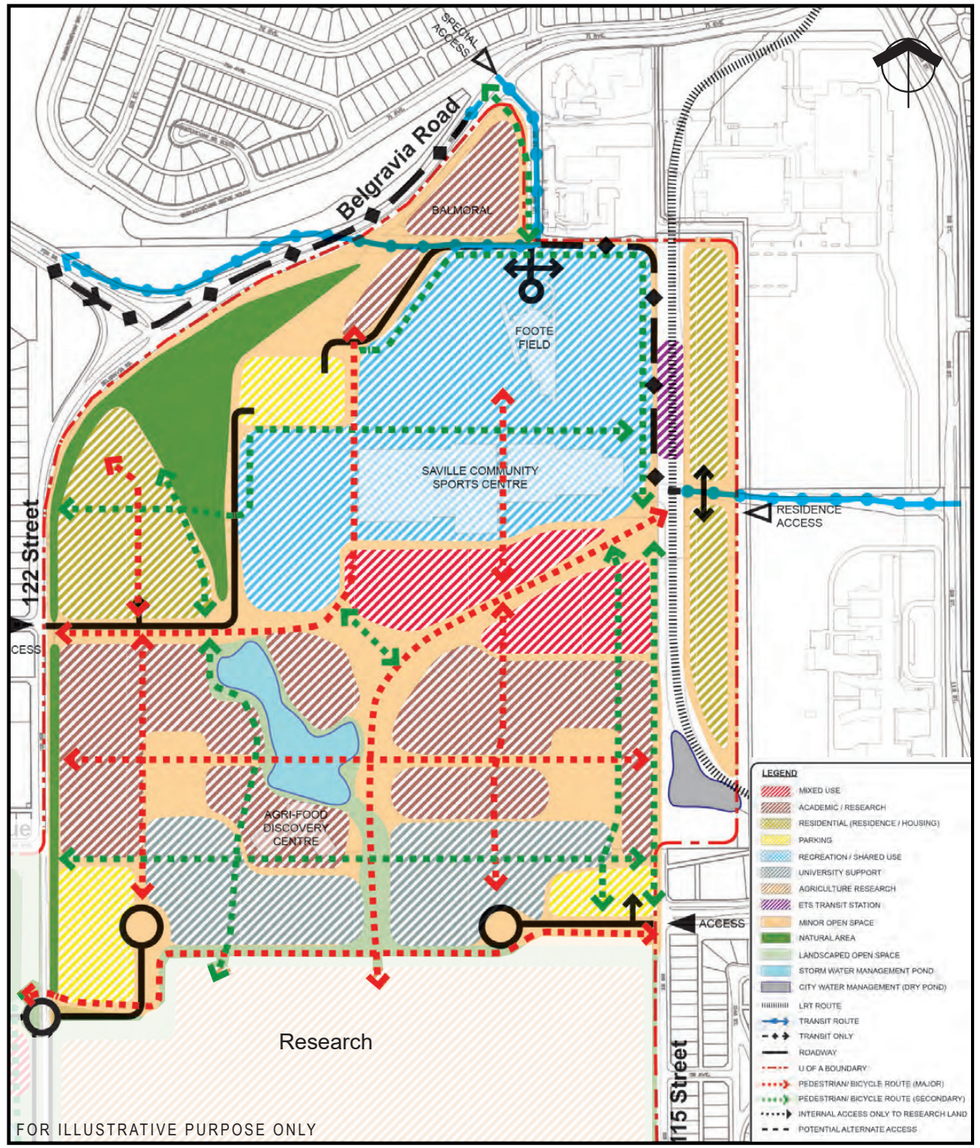
Healthy Communities Principles

- Continually improve sustainability and resource stewardship by balancing social, economic and environmental sustainability
- Create an academic and residential environment that fosters new ideas and creates a unique sense of place
- Promote Campus as a Living Lab opportunities
- Develop strong relationships with neighbouring communities, sharing amenities and services
- Support and advance the university in its goal to become one of the world's top public educational institutions
- Optimize budgetary resources and partnership funding
- Develop a walkable Campus and support various modes of transportation

Sector 12 Land Use Plan

The Sector 12 Land Use Plan establishes the site for the South Campus Community Ice Arena within a Recreation/ Shared Use Zone. The Arena will be at the heart of the South Campus supporting the goals and principals outlined within the Sector 12 plans including but not limited to:

- Open elements such as a future pedestrian quad for gathering and activities which connects to future pedestrian routes to the existing LRT on 115th Street and to other future facilities on Campus;
- Preservation of the natural environment such as the NorthWest ravine;
- On-site parking through a planned parkade;
- Prioritization of pedestrian and bicycle linkages throughout the site connecting developments to the South Campus and the broader neighboring communities; and
- Access of recreation facilities to the surrounding community.



Appendix XIX: South Campus Long Range Development Plan (SCLRDP), Amendment June 2013, Sector 12: Land Use Plan

The Sector 12 Land Use Pattern follows five central strategies:

1. Faculty-specific sectors will be accommodated to the extent practical;
2. A higher density main Street will be developed connecting the LRT station in the North Esat corner of the site with an improved gateway feeding to the centre of the sector. The main Street will integrate a mix of land uses including teaching and researching space, student residence, university support services and Campus commercial and retail spaces;
3. Lower density uses will be located towards the periphery of the site to reduce the impact on surrounding neighbours and provide a more welcoming and interconnected boundary between adjacent land owners;
4. The Campus will be pedestrian-orientated with distributed formal points of access from vehicles with sufficient parking on the periphery; and
5. Creation of a University support area in the Southern portion of Sector 12 with direct vehicular access from 60th Avenue. In the near-term, the snow dump and vehicle pool will remain in their existing locations near the West and Esat edges of Sector 12, respectively.

Access to South Campus Community Ice Arena

South Campus - Transportation Goals

- The development of South Campus is intended to take advantage of the enormous potential of the City of Edmonton's LRT system to efficiently move people.
- South Campus offers a real opportunity to grow the University in an effective, integrated, and quality manner. It also allows the University to do so in a manner that utilizes the transportation infrastructure of the City of Edmonton effectively and with minimal impact on communities.
- A sustainable campus is characterized by a mixture

of transport modes, with a strong emphasis on sustainable modes in order to shrink the energy and land consumptive characteristics of existing and future transportation features to and within the site.

Road Access

Road access to Sector 12 (South Campus) will be from 122 Street at 63 Avenue and from 60 Avenue at 115 Street; additional access points will be from 116 Street via Belgravia Road and from 65 Avenue via 113 Street in the longer term.

Pedestrian & Bicycle Circulation

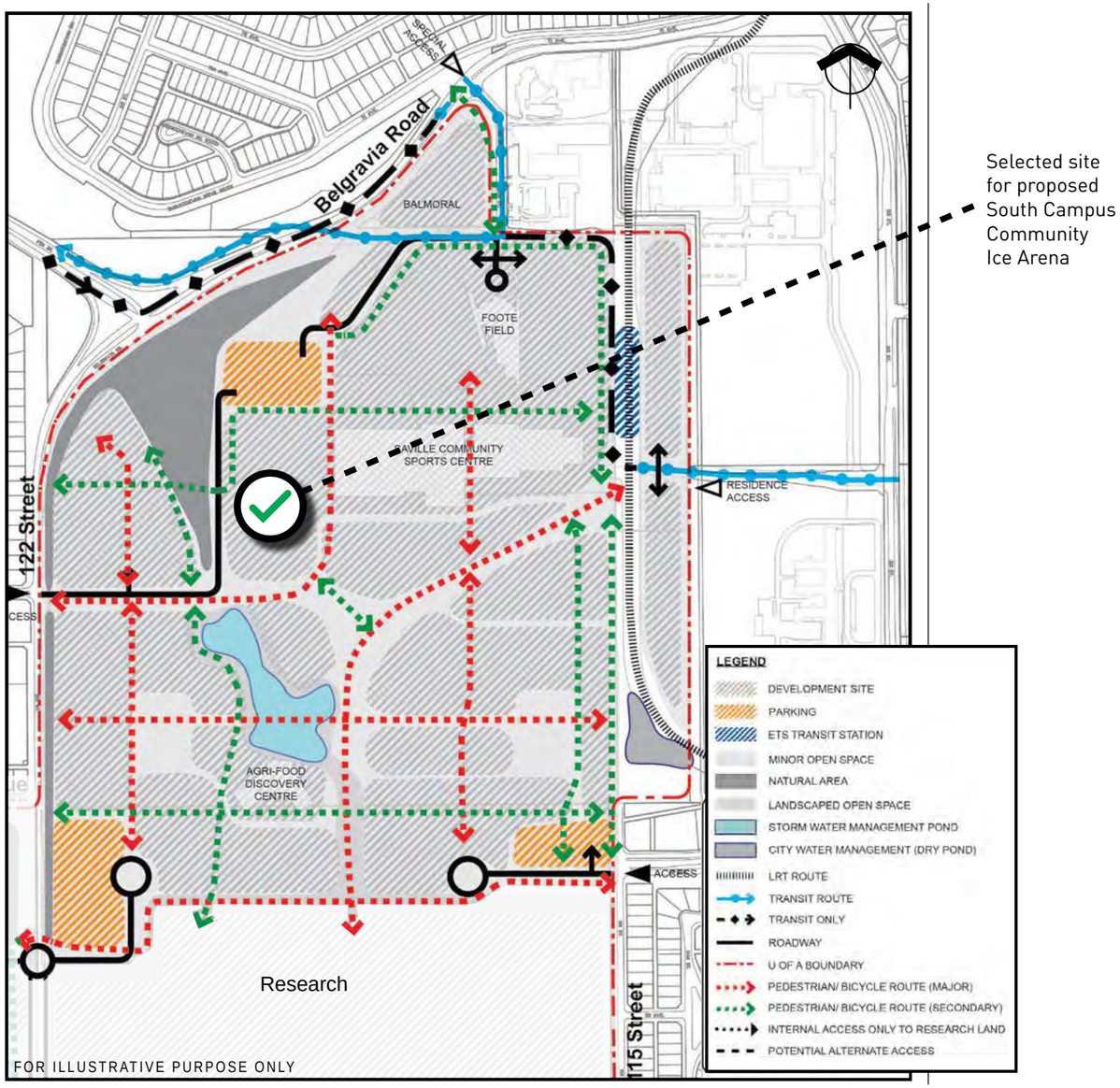
The campus street will be the major intra-campus spine for pedestrian and bicycle traffic.

Parking (Transitional Plan)

Parking will be accommodated on-site through a combination of surface and structured parking facilities located at the entrances to the campus. Initially, parking is provided as surface lots. As development progresses and land is required, parking will be designed in structured facilities.

Overall Development Strategy

- Create an integrated transportation system that encourages non-vehicular movement and public transportation
- Develop an on-campus resident population to reduce travel demand
- Continue to implement TDM (Transportation Demand Management) initiatives



Selected site for proposed South Campus Community Ice Arena

- Maximize the utilization of internal service roadways to multiple destinations on campus (i.e. one roadway serves several areas, limiting the extent of the service roadway network)
- Apply minimal roadway cross sections/widths that meet the intended use(s) of the roads
- Avoid the bisection of South Campus by limiting public vehicular access to parking areas at the periphery of the campus and necessary access to Recreation/Shared Use facilities
- Cluster parking facilities including structured parking to reduce pedestrian walking distances and to create more attractive pedestrian environments

Proposed South Campus Community Ice Arena Parking

- A Car Park will be constructed as part of the South Campus Community Ice Arena project development.
- Future parking development will be located as defined in the South Campus LRDP and Sector Planning documents.
- Traffic Impacts studies will be updated from the bases of design Traffic Impact Assessment (TIA) conducted in conjunction with the City of Edmonton in the fall of 2016.
- The University receives no support for the capital funding or operational aspects of any of its parking infrastructure initiatives.
- Challenges are recognized by the partners in parking garage use and pressures to adjacent communities.
- The proposed South Campus Community Arena parking garage is not to be considered part of any support infrastructure for LRT parking.
- Operational considerations and cost recovery models are still in review, options may include; collective development levy, parking entry payment and other considerations as determined in the consultative processes.

Site Specific Development Guidelines (D1-#6)

- Recreational/Shared Use
- Plan D1-#6: 3.14 ha (31,400 m2)
- Floor Area Ratio (FAR): 0.4 to 0.8
- Site Coverage 80%
- Building Height: 1 Storey, 8 metres
- Setbacks

  East: 10.0m (max)

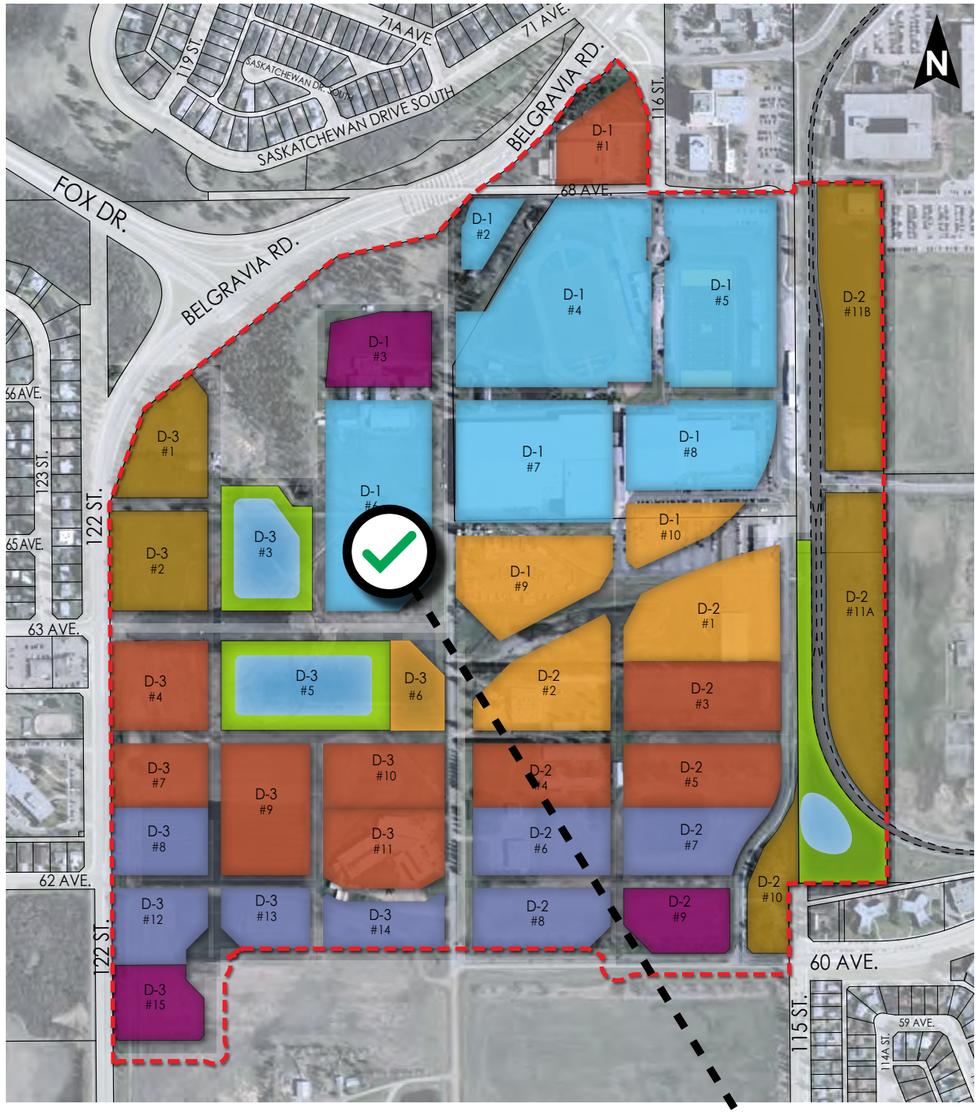
  North: not applicable

  South: 10.0m (max)

  West: not applicable

Major Campus Movement & View Corridors

The campus movement corridors are based on the hierarchy of paths established. The LRT station is an important asset to the South Campus, especially as many faculty and students use this as a major transportation corridor. The 63 Avenue entrance to the west is also an important asset as it will act as a gateway to the campus from the west. Therefore linking these two major assets was logical and was designated as the main east-west route through the campus. Additionally, the existing 118 Street alignment acts as a north-south route between Sector 12 and Sector 13 and therefore has also been designated as an important corridor. These main routes have been labeled Campus Way and are the widest corridors on campus featuring high quality landscaping, areas designed as gathering places particularly at the intersections of major routes, and multi-modal movement infrastructure for pedestrians, cyclists, service and emergency access, and public vehicular access along the 63 Avenue alignment.



LEGEND

- Mixed Use
- Academic/Research
- Recreation/Shared Use
- Residential (Residence/Housing)
- University Support
- Parking
- Stormwater Management Facility
- Sector 12 Boundary

Figure 1:
Proposed Land Uses

Campus Planning and Design Guidelines for Implementation

Major Campus Gathering Places

The Major Campus Gathering Places are informed by the intersection of the Major Movement corridors. The Campus Way paths join at the heart of the Sector, creating an important node for campus activity and events, and playing an essential placemaking role within the campus.

While these movement corridors inform the locations of major gathering places, it is their node, landmark, and edge characteristics that will help support these spaces as major gathering places for activity. These nodes will feature high quality landscaping and material, and animated open spaces for users to inhabit. Landmarks in the form of public art, enhanced landscaping, and other varieties will further establish these nodes as gathering places. The edges of the buildings that front onto these gathering places will also offer further support through enhanced building treatment and programming. Since the two major campus gathering places are anchored on either end of the Mixed Use section of Campus Way, this section will act as a pedestrian-oriented mall and essentially be a long linear urban park lined with active ground-floor uses. Together, these gathering places and pedestrian mall will act as the centre of activity for the entire Sector.

Parcel Planning Guidelines

Floor Area Ratio (FAR) and Site Coverage

The LRDP and South Campus Sectors Plan currently establish a maximum Floor Area Ratio (FAR) of 1.0 across Sectors 12, 13 and 14. As such, in order to achieve typical program requirements for different land uses, and meet urban design goals for campus open spaces, FAR ranges and maximum site coverages have been established for each development parcel.

Building Heights

Maximum building heights are determined by a number of factors, including typical program requirements for different land uses, urban design considerations, location within the Sector, and adjacency considerations regarding adjoining communities and the interplay of site coverage and FAR maximums.

Building Design Guidelines

The University of Alberta updated the Campus Planning and Design Guidelines in April 2016. These design guidelines were taken into consideration in the development of the following building design guidelines.

Authenticity and Context

The design of buildings or landscape elements in Sector 12 should strive to achieve an authenticity of locale and design purpose. Massing, Scale, and Articulation The massing of all buildings should adhere to the following principles:

- Buildings should support the creation of a comfortable pedestrian environment along adjacent campus paths
- Massing should reduce microclimatic impacts and provide an appropriate human scale and visual relationship between the building and adjacent campus paths
- Upper storeys should enhance and complement the surrounding campus or neighbourhood skyline through their articulation and massing. Unique architectural/ sculptural forms, as well as various materials and lighting should be utilized to screen HVAC and other building systems/services
- Materials and detailing should be articulated to distinguish upper storeys from the lower storeys
- Large flat walls and incompatible materials are to be avoided

Materials

Buildings and landscape materials should:

- Be chosen for their character, durability and connection to the University's history and place in the Western Canadian urban landscape
- Acknowledge and harmonize with overall campus use of materials that narrows the palette instead of continuously expanding it. They should be chosen to weather well, maintaining or improving their appearance over time
- Follow winter city design guidelines and utilize glass and transparency to help brighten the long winter nights

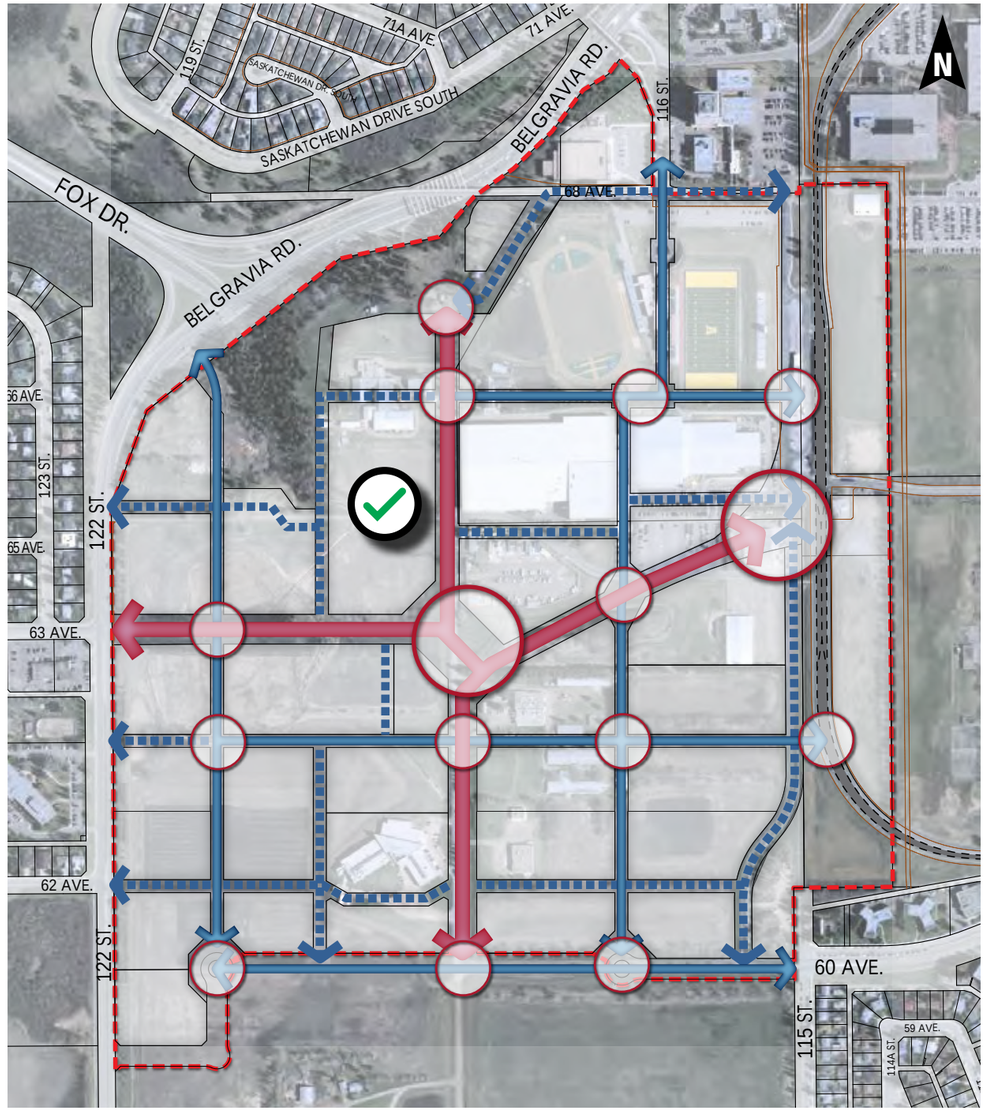


Figure 2:
Proposed Paths and Nodes

Campus Planning and Design Guidelines for Implementation

Internal & External Relationships

Buildings should address adjacent campus open space, and vice versa, through the following design considerations:

- Building corners should address and enhance Path and Node intersection development • The ground level of buildings should be designed to create the feeling of extending the outdoors indoor, and vice versa
- Existing mature trees should be integrated with new tree plantings wherever possible • A seamless transition between pathways and building edge should be provided
- Exterior lighting should be pedestrian scaled, whether mounted on poles or on building facades
- Bicycle storage should be accommodated at each building. The location of bicycle racks should be in a safe and secure location, without conflicting with movement around key building entrances. Bicycle storage should be aesthetic, practical, and integrated with the architecture of the building
- Winter city design guidelines to promote year round usability and utilizing transparency to provide visual interest and illumination

Arrival & Entry

Building entrances:

- Should be clearly visible to create a sense of arrival, occupancy, activity, and gathering to the adjacent campus pathway, and should be accessible
- Should be highlighted and defined through the use of architectural and landscape devices (e.g. lighting, benches, planting, etc.)
- Should be visible, safe, and inviting
- Should incorporate canopies, arcades, colonnades, awnings, pergolas, porticos, etc. to create a comfortable and seasonal pedestrian environment in any season

Edge Guidelines

- Buildings fronting this type of edge should build to the edge for at least 75% of their frontage
- No portion of the building should be a distance greater than 10 m from the parcel boundary
- Position building entry and orientation on Primary Edges
- When part of the programming of a building, the following types of spaces should be located adjacent to Primary Edges
- Retail, commercial, and food service
- Student gathering
- Student study
- Assembly
- Building facades facing Primary Edges should have a high degree of transparency to the exterior, particularly at ground level

Node Guidelines

Nodes are locations where campus movement corridors come together to create opportunities for students, staff, faculty, and campus visitors to meet and recreate.

Development guidelines for buildings adjacent to Major Nodes are as follows:

- Position uses adjacent to Major Nodes that consist of:
  - Building entry and orientation
  - Retail, commercial, and food service
  - Student gathering
  - Student study
  - Assembly
- Buildings should be built to the parcel edge for at least 75% of their length adjacent to Major Nodes.
- The building edge should be highly transparent at ground level.

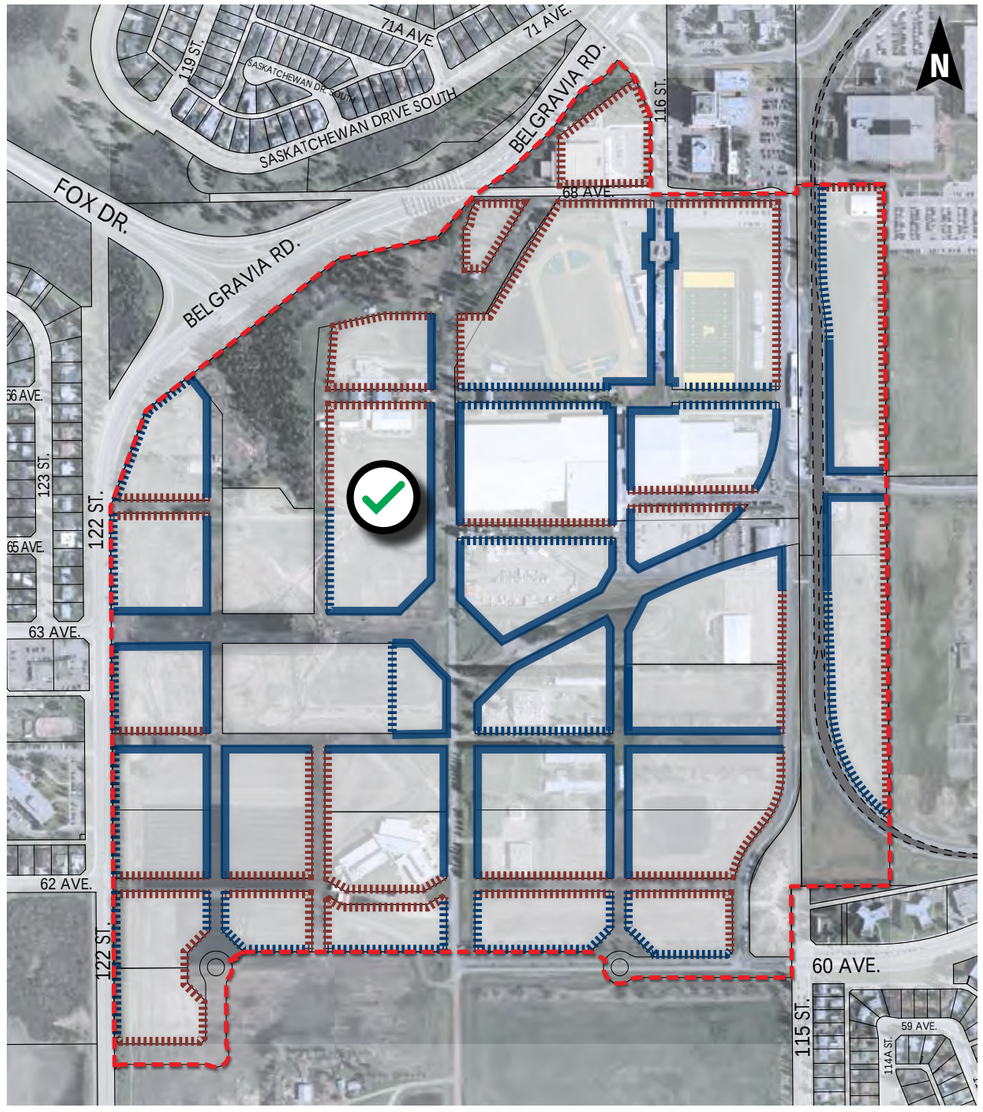


Figure 3:
Proposed Edges

Campus Planning and Design
Guidelines for Implementation

3.0 Program Analysis & Reconciliation

The University of Alberta prepared a Business Case in November 2016, prior to the preparation of this Schematic Design report. A program was developed during this stage and served as a starting point for this report.

The Schematic Design program has evolved from the preliminary facility program and reflects:

- Clarifications, minor additions, and modifications requested by the U of A stakeholder and user groups. In particular, space has been added to accommodate a community entrance, the Varsity change rooms have been further developed and an additional ice resurfacing room has been added.
- Modifications and adjustments to space sizes to allow for planning efficiency's. In particular, the community dressing rooms have been standardized in size and layout.
- Changes to the circulation calculations to reflect a more compact and efficient plan. This has resulted in significant area reduction and therefore cost reductions from the feasibility stage.
- The proposed program includes the area requirements for the High Performance Athletic Training and Research Centre (HPTRC) as part of a future Phase 2 addition to the twin arena.

PRELIMINARY FACILITY PROGRAM FROM BUSINESS CASE (2016)			APPROVED SCHEMATIC DESIGN PROGRAM (MARCH 03 2018)			CURRENT SD DESIGN NET AREA			
Type and Quantity of Programmed Space	**Intended Activity**	**Required Area (ft_2)**	**Units**	**NFA Per Unit**	**NFA Total**	**# of Rooms**	**NFA Per Room**	**NFA Total**	**DELTA (SF)**
Varsity Ice Arena		**50,900**	**Varsity Ice Arena**		**60,200**	**Varsity Ice Arena**		**48,771**	**-11,429**
Arena bowl	3,000 seats, 200'x85' ice	41,700	3,000		46,000	3,000		46,824	824
Public Washrooms	men and women, 3,000 spectators	3,400	3,000	1.13	3,400	2	(861 + 732)	1,593	-1,807
Ticketing Area	spectator event support (small area should be ok)	1,000			300	MOVED TO GROSS AREA		0	-300
Lobby and Information Desk	spectator event support	3,200			4,000	MOVED TO GROSS AREA		0	-4,000
Concession	spectator event support, food and beverage, secured, with dry storage and garbage areas	600			500	2	(193 + 161)	354	-146
Merchandise Storefront	spectator event support	1,000			1,000			0	-1,000
Stairs					5,000	MOVED TO GROSS AREA		0	-5,000
Arena Support- Upper Suite Level		**2,535**	**Arena Support- Upper Suite Level**		**5,533**	**Arena Support- Upper Suite Level**		**6,532**	**1,000**
Multipurpose Room	100 people, viewing to rink-preferably between the 2 rinks	1,025			1,000			775	-225
Servery					100	2	(140 + 97)	237	137
Suites	4 suites, 20 seats each, 2 per side, convertible to classroom space	1,350	4	600	2,400	4	(592 + 592 + 592 + 818)	2,594	194
Areana Spectator Seating (on Upper Suite Level)					0			1,162	1,162
Lounge/Club Area	program area included in multipurpose room			1,500	1,500			936	-564
Public Washrooms			250	1.13	283	2	(323+215)	538	256
Press Box	media production, 8 – 10 people plus equipment	160	10	25	250			290	40
Arena Support - Participant Level		**16,365**	**Arena Support - Participant Level**		**16,185**	**Arena Support - Participant Level**		**20,818**	**4,633**
Workshop (skate sharpening, stick taping repair etc)	arena support (2 sheets)	200			200			505	305
Mechanical Room	arena support (2 sheets)	4,900						0	0
Refrigeration Room					1,000			1,033	33
Ice Resurfacer shared	arena support (2 sheets)	1,150			1,000	2	(893+484)	1,377	377
Storage	arena support (2 sheets), loading dock	400				4	(785 + 409 + 721 + 312)	2,227	2,227
Back of House Storage/Event Logistics	Event support, rink protection storage,				1,500	2	(333 + 613)	946	-554
Kitchen/Storage					1,500			796	-704
Skate Sharpening	kiosk/small shop	80						130	130
Arena Manager/First Aid Office	office/first aid multipurpose	110			220	2	215 + 150	365	145
Video Replay/Production Room		125			125			140	15
Video Analysis Room		150			700			700	0
Community and Visitor Dressing Rooms	2 @ 30 stalls, (24 stalls x 4 rooms - 2018.06.01)	1675	4	900	3,600	4	958	3,832	232
Community and Visitor Dressing Rooms	2 @ 22 stalls	1675						0	0
Flexible Dressing Rooms	2 off gender dressing rooms, 6 stalls, (13 stalls x 2 rooms - 2018.06.01)	600	2	300	600	2	678	1,356	756
Officials Rooms	2 officials dressing rooms, 4 – 6 people per room	600	12	20	240			280	40
Varsity Dressing Rooms	2 dressing rooms (Bears and Pandas), 30 stalls each	2,000	2	1,500	3,000	2	1,689	3,378	378
Varsity Dressing Rooms - Dry Change + Sink Area					0	2	377	754	754
Varsity Equipment Rooms	2 equipment rooms (Bears and Pandas)(300 ft2 each)	600			600	2	322	644	44
Athletes Lounge	sufficient for 4 teams	600			800	2	484	968	168
Athletic Therapy Rooms	1 room, 2 – 4 athletes at a time and 2 whirlpool tubs	800			800			915	115
Male Hockey Coaches Dressing Room	6 coaches	400	6	25	150			236	86
Female Coaches Dressing Room		300	6	25	150			236	86
Event Level Public Washrooms					0			0	
Event Level Concessions				150	0			0	0

Ancillary		**2,740**	**Ancillary**		**1,740**	**Ancillary**		**1,776**	**36**
General Office	support staff, mail, photocopy, event management, and reception	800			800			818	18
Staff Offices/ Assistant Coaches	hockey 3, wrestling 1	440			440	3	(108 + 108+226)	442	2
Staff Washrooms/Locker Rooms	2 @ 500', 12/room	1,000		25	0	2	60	0	0
Team Support	laundry, storage, equipment	500			500			516	16
Community Arena		**27,500**	**Community Arena**		**26,500**	**Community Arena**		**31,064**	**4,564**
User Ice Sheet	rentals/practice, ~400 seats, 200'x85'	24,000			22,000			23,336	1,336
Community Arena Spectator Level Seating		0			0			2,486	2,486
User Dressing Rooms	4 dressing rooms for user groups, 20 stalls per room (2 dressing rooms should be "accessible" to ice— i.e. for sledge hockey), (19 stalls x 4 rooms - 2018.06.01	2,600	4	900	3,600	4	904	3,616	16
Auxilliary / Flex Dressing Rooms	2 auxilliary dressing rooms, 6 stalls, (8 stalls x 2 rooms - 2018.06.01)	600			600	2	527	1,054	454
Public Washrooms	at Spectator Level				0	2	(226+140)	336	336
Officials Rooms	1 officials dressing room, 4 – 6 people per room or 1 room for 10 people	300			300	10	24	236	-64
NET PROGRAM AREA		**100,040**			**110,158**			**108,961**	**-1,197**
Building Services + Circulation		**45,100**	**Building Services + Circulation**		**9,200**	**Building Services + Circulation**		**2,367**	**-6,833**
IT/Communications Room		200	2	100	200			0	-200
Electrical and contoll room			1	1,000	1,000	1	861	861	-139
Ground Level		20,000			0				0
Concourse Level		18,900			0				0
Plus 15 Connector		6,000			0				0
Air Handling Room Arena 1					2,500			0	-2,500
Air Handling Room Arena 2					1,500			0	-1,500
Air Handling Room High Performance					2,000			0	-2,000
Central Boiler Plant					2,000			1,506	-494
SUB-TOTAL OF NET AREA W/ CIRC. AND BUILDING SERVICES		**145,140**			**119,358**			**111,328**	
GROSS BUILDING AREA								**140,329**	
Participant Level								86,585	
Spectator Level								44,100	
Upper Suite Level (3rd Floor)								9,644	
Gross Up Factor (includes exterior walls and exterior		**1.1**			**1.14**		**1.26**		****Refer to Note**
TOTAL BUILDING GROSS AREA		**159,654**			**136,521**			**140,329**	**3,809**

* *Gross Factor includes the following programs:
Ticketing Area
Lobby + Information Desk
Warm Up Areas
Stairs + Circulation
Wall Area

Actual Gross Area of the Proposed Schematic Design.

(Exclusive of the High Performance component) are as follows:

Participant Level **8,044 sqm (86,585 sqft)**

Spectator Level **4,097 sqm (44,100 sqft)**

Upper Suite Level **896 sqm (9,644 sqft)**

Total **13,037 sqm (140,329 sqft)**

This compares to the Proposed Schematic Design Program of 136,521 sq ft GFA and the Feasibility Study estimate of 159,654 sq ft GFA exclusive of the High Performance component.

The increase of 3,809 sq ft over the Proposed Schematic Design Program can be attributed to increased area to accommodate a community/participant lobby and additional area added in the Varsity dressing rooms and support spaces.

AREA SUMMARY INCLUDING HIGH PERFORMANCE

High Performance Athlete Training and Research Centre (HPTRC) * Academic		**25,160**	**HPTRC * Academic**		**22,960**	**HPTRC * Academic**		**25,522**	**2,562**
Reception		200			200			205	5
Open Floor Training Space		10,000	200	40	8,000	200	47	9,460	1,460
Combative Sports Washrooms	2 for 25 athletes @ 800'	1,600	2	800	1,600	2	764	1,528	-72
Combative Sports Room	wrestling	3,600			3,600			3,600	0
Biomechanics Research and Training Space	artificial turf track surface: 12' x 150'	1,800			1,800			1,800	0
Sport Medicine Health Research and Assessment Space		3,000			3,000			3,056	56
Body Composition Laboratory		600			600			624	24
Wet Lab		600							
Smart Classroom	70 –80 Students	700			700	2	(721+700)	1,421	721
Research Offices	3 @ 110'	330			330	3	(129+107+107)	343	13
Staff Offices	3 @ 110'	330			330	3	107	321	-9
Seminar/Meeting Rooms	1 @ 200	200			200			205	5
Maintenance/Storage Room		400			400	3	258+140+183)	581	181
Locker Rooms/Washrooms	2 @ 800': 40 persons	1,600	100	20	2,000			2,152	152
Staff Room		200			200			226	26
SUB-TOTAL OF NET AREA W/ CIRC. AND BUILDING SERVICES		**170,300**			**142,318**			**136,850**	
GROSS BUILDING AREA								**172,578**	
Participant Level								108,974	
Spectator Level								53,572	
Upper Suite Level (3rd Floor)								10,032	
Gross Up Factor (includes exterior walls and exterior entry plaza)		**1.1**			**1.17**		**1.26**		***Refer to Note**
TOTAL BUILDING GROSS AREA WITH HIGH PERFORMANCE		**187,330**			**166,549**			**172,578**	**6,030**

* *Gross Factor includes the following programs:
Ticketing Area
Lobby + Information Desk
Warm Up Areas
Stairs + Circulation
Wall Area

4.0 Schematic Design Approach

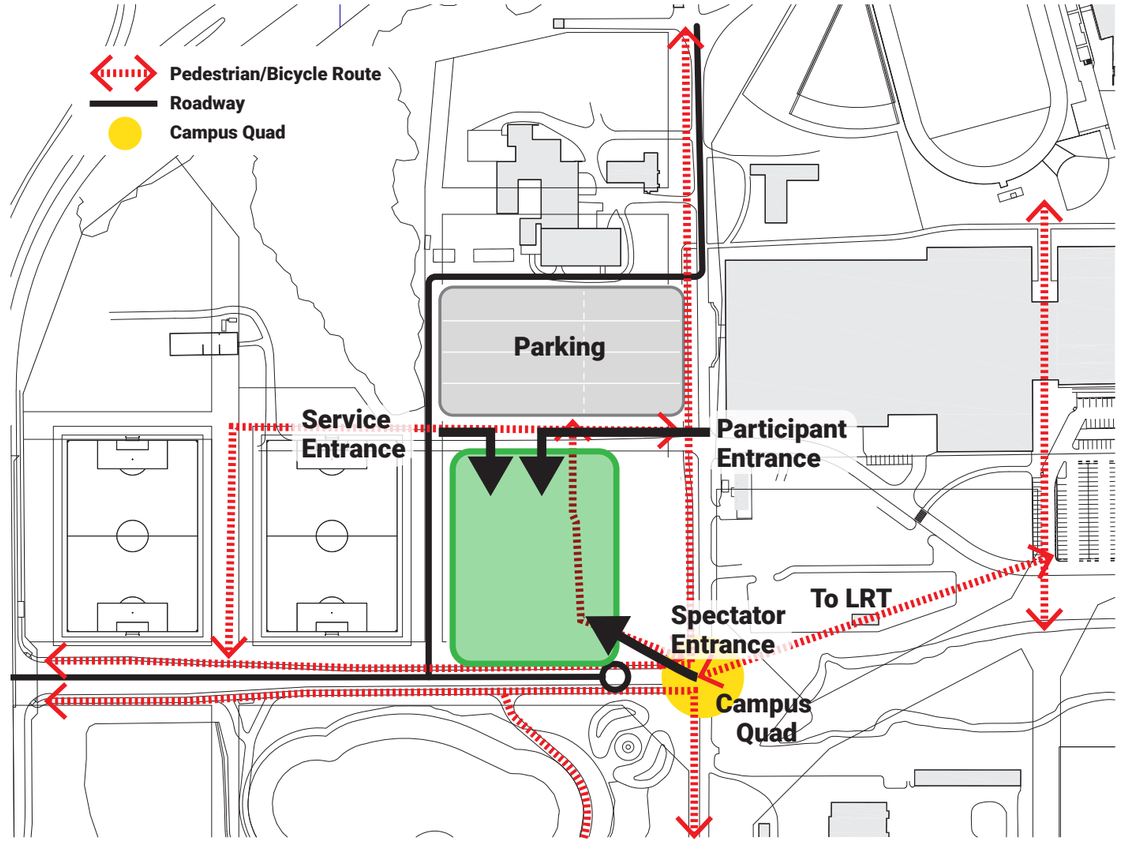
Siting and Functional Relationship Challenges

The design concept is informed by the siting, contextual and functional relationships. There are a number of relationship drivers and siting challenges that have determined the design including the following:

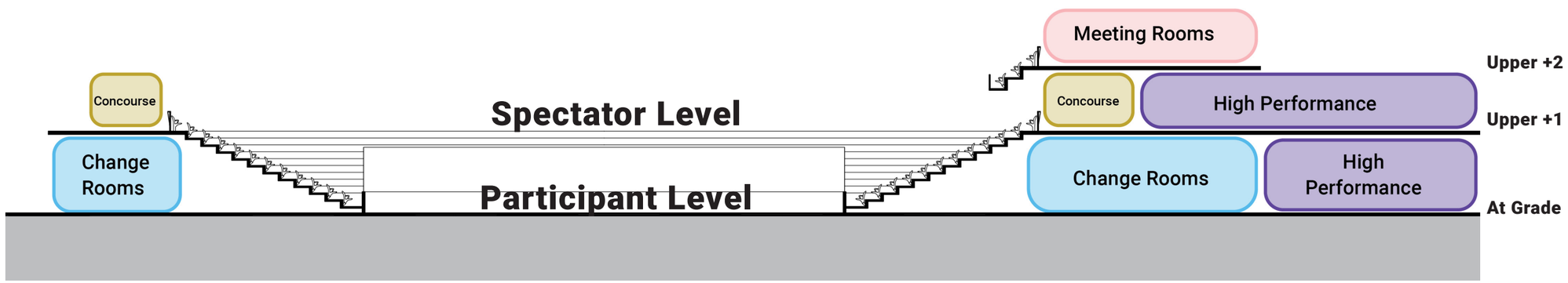
- The building will operate in two modes, as a community and practice arena and as an event facility. The occupant load of the building during community use will typically be less than 500 persons, while during a major event the load could be more than 3500 persons. Participants, including Varsity athletes, community users and parents of children need reasonably direct access to the dressing rooms to minimize the distance of hauling hockey bags. Spectators, particularly ticketed spectators need to arrive through a controlled entrance and need space to allow for movement and access.
- During a major event, spectators need to be separated from the participants. The ideal separation is achieved if spectators enter at a top loaded seating bowl and participants enter at the lower ice level. This approach eliminates the need for vomitories' and improves site lines. The resulting upper concourse provides for standing room behind the seats and access to concessions, washrooms and other amenities. Most importantly the separation of spectators and participants allows the community rink to operate uninterrupted during a major event in the Varsity Arena.

See Sections on Opposite Page

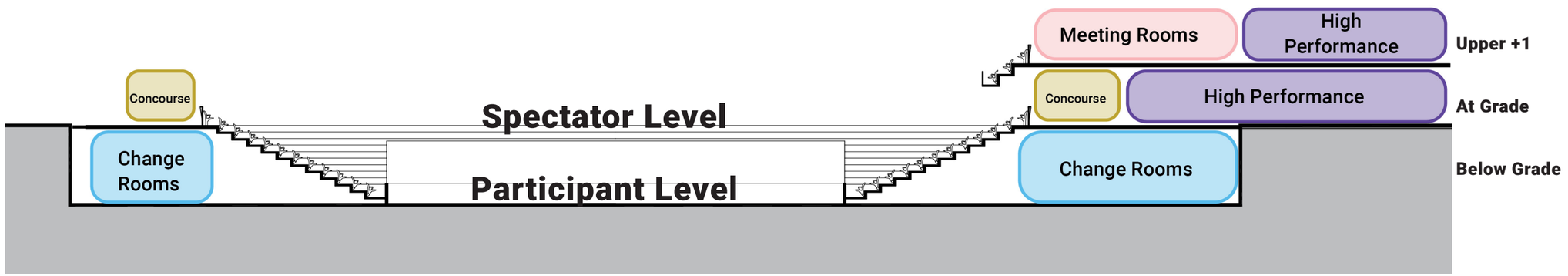
- The arenas require a service entrance to an exterior service yard accessing the "back of house" functions. Ice resurfacing equipment and event equipment and staging will need to be unloaded into the building. The exterior service yard will house the cooling tower for the refrigeration equipment, mechanical equipment, and provide space for team buses, media and broadcast vehicles, temporary storage and service vehicles.
- Assuming the recommended low charge ammonia system is used, the ice plant must be housed in a class T mechanical room. The class T mechanical room must have direct access to the outside, ideally to the service yard. Other mechanical spaces can benefit from outside access to the service yard as well.
- The soil conditions include an upper layer of 1.5m of unsuitable material, underlain by clays that are highly susceptible to swelling in response to moisture content. Significant excavation will be required to remove unsuitable material. Furthermore, the clay layer becomes more consistent as the depth increases and moisture levels become more stable. Lowering the building half way in the ground works best for the soil conditions and vertically separates the spectator and participant entrances.
- The Sector Plan anticipates that structured parking will be located North of the complex. It also plans for a future pedestrian-oriented Campus Quad to the South Esat that becomes an important movement node for the Campus. In the future, this quad will be connected to the LRT station at 114th Street by a pedestrian route.
- While funding for the High Performance component of the project is in the future, area to accommodate the program has been identified at this time.



Section Options



Event Floor at Grade Section

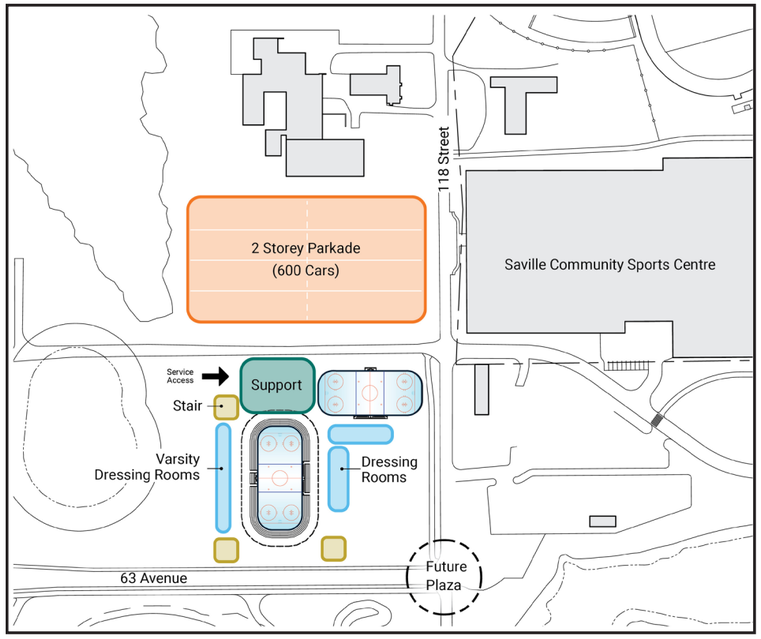


Event Floor Below Grade Section

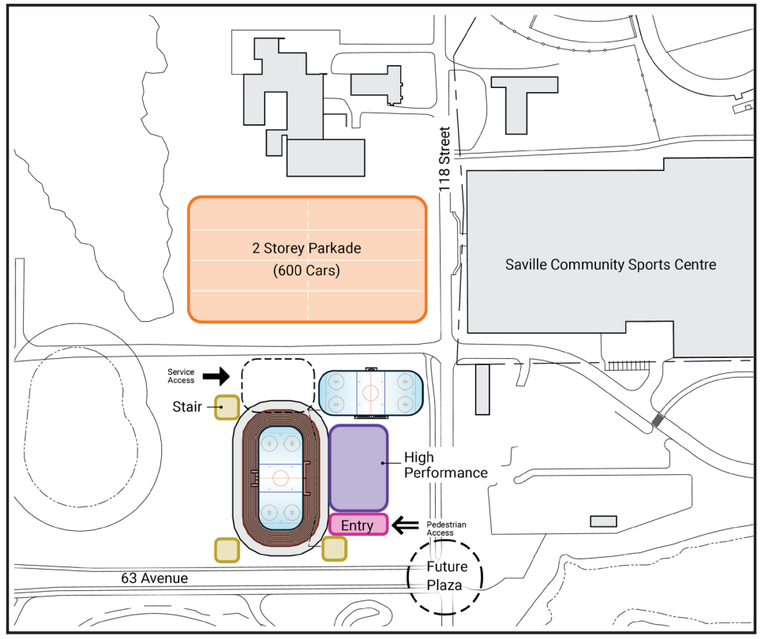
Options Examined

To achieve a best fit solution to the siting challenges, six (6) options were examined during the concept design phase. Each of the options anticipates an upper level concourse with suites and meeting spaces and organizes the building on three levels. Each option considered different spectator entrance points from the North or South and placement of the participant (Ice) Level either below or at-grade. Of the six options prepared, Option 1 was preferred and formed the basis of design for the Schmatic Design phase.

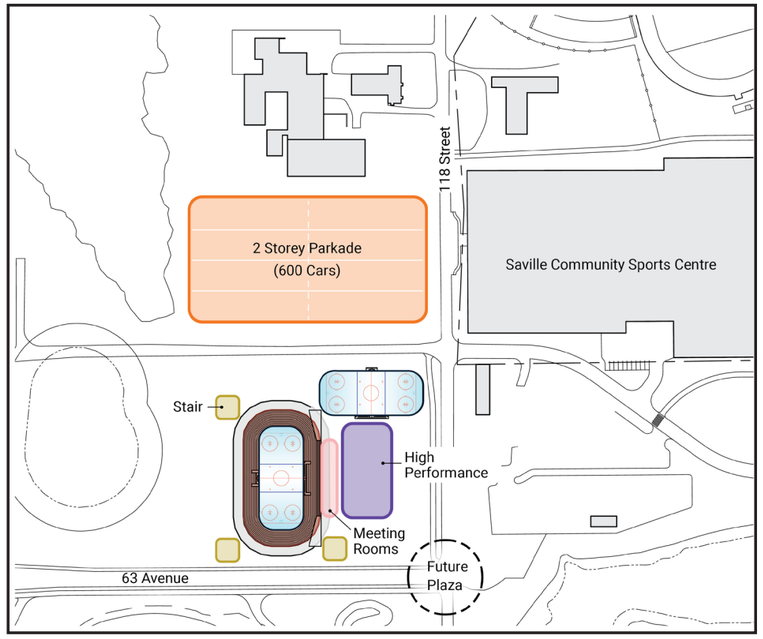
Below Grade



At Grade



Upper +1



Option One

Option 1 places the two rinks at right angles to each other with the High Performance to the East. The rink support spaces are placed in the intersection of the two rinks. The plan separates the participant level from the spectator level vertically. Option 1 forms the basis of design for the Schmatic Design phase.

Pros

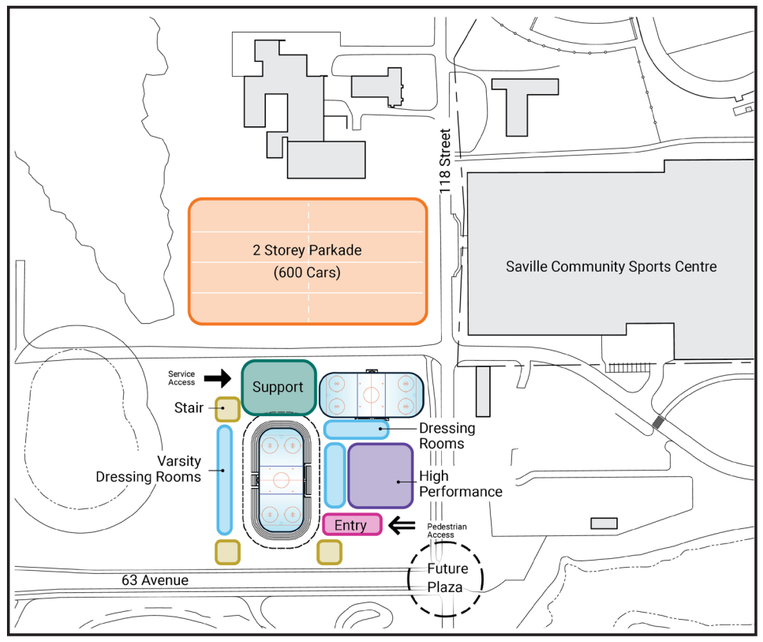
- HPTRC faces the future Campus Quad
- Service yard is hidden from 63rd Avenue and from the entrance to the Campus
- Spectator entrance faces the Campus Quad
- Spectators enter the seating bowl from the top
- The back of house and change rooms are entered from the lower level, separate from the spectator entrance
- Most compact “back of house”
- Concourse at the plaza level reduces the stairs required to exit spectators in an emergency; exit stairs can be inexpensive exterior stairs.

Cons

- Service yard at low elevation does not drain to Campus’ storm water system and therefore requires separate flow control.

Options Examined (Continued)

At Grade



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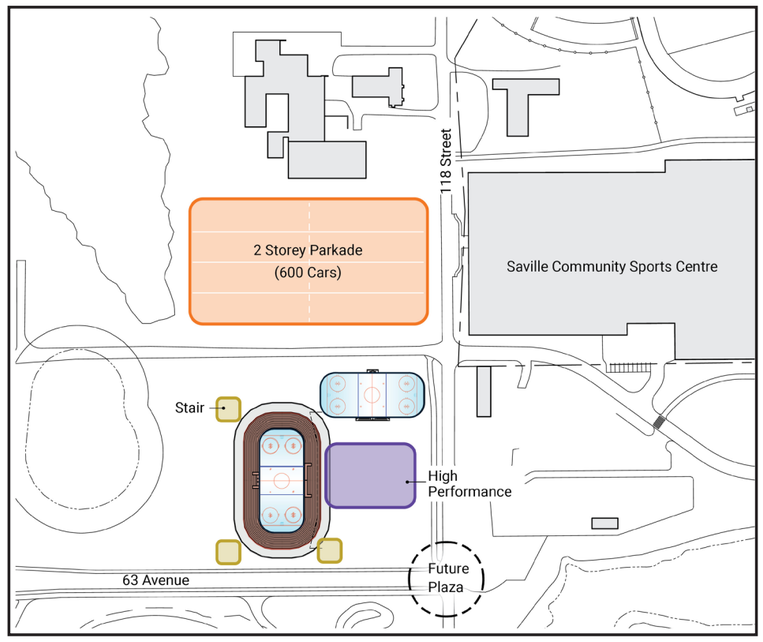
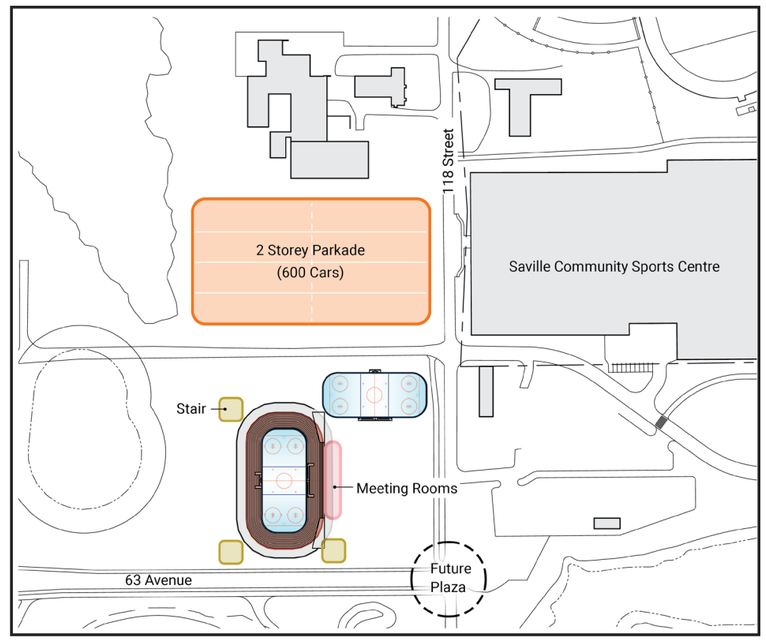


Upper +2



Option Two

Option 2 is organized similar to Option 1; however, the building is organized on two levels with all rink support and spectator services on one level. This approach creates circulation conflicts throughout and was deemed to be undesirable.

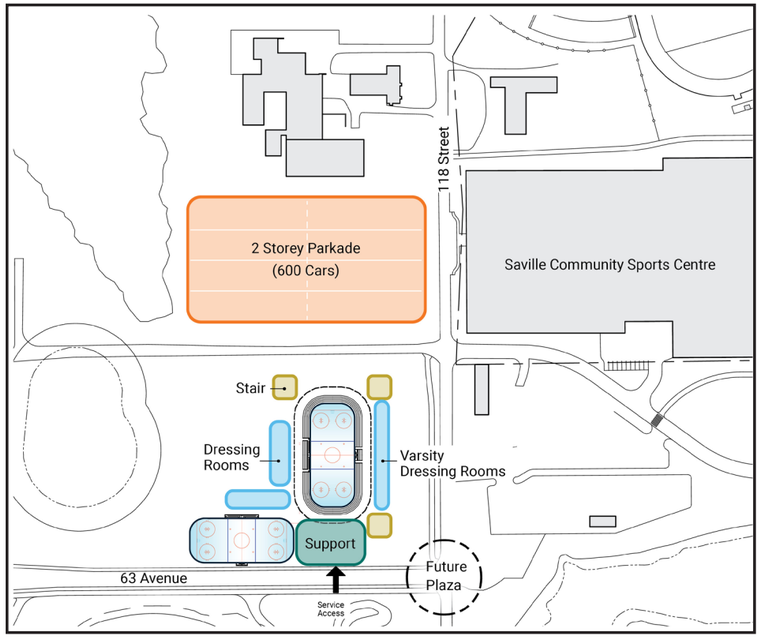
Pros

- HPTRC faces the future Campus Quad
- Service yard is hidden from 63rd Avenue and from the entrance to the Campus
- Spectator entrance faces the Campus Quad
- Spectators enter the seating bowl from the top
- The back of house and change rooms are entered from the lower level, separate from the spectator entrance
- Most compact "back of house"
- Concourse at the plaza level reduces the stairs required to exit spectators in an emergency; exit stairs can be inexpensive exterior stairs.

Cons

- Service yard at low elevation does not drain to Campus' storm water system and therefore requires separate flow control
- Raising the seating bowl above grade requires interior stair cores to bring spectators up to the concourse

Below Grade



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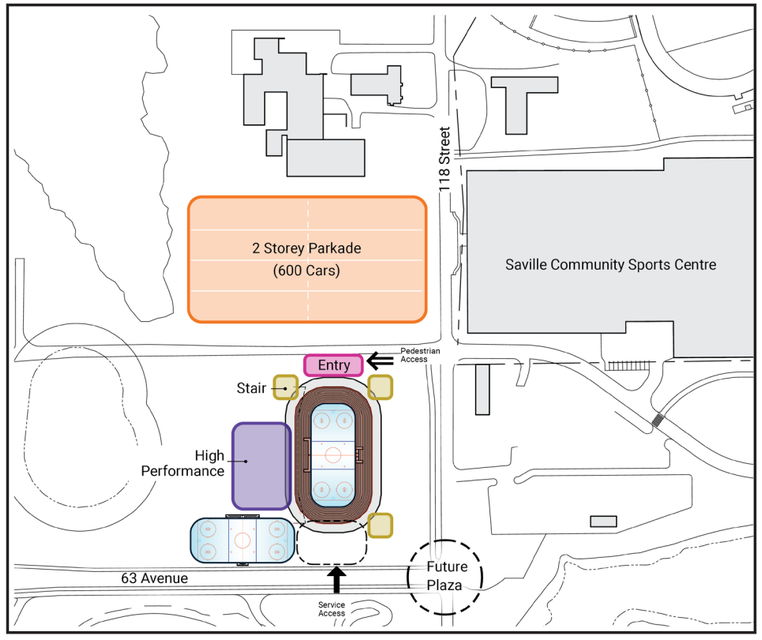
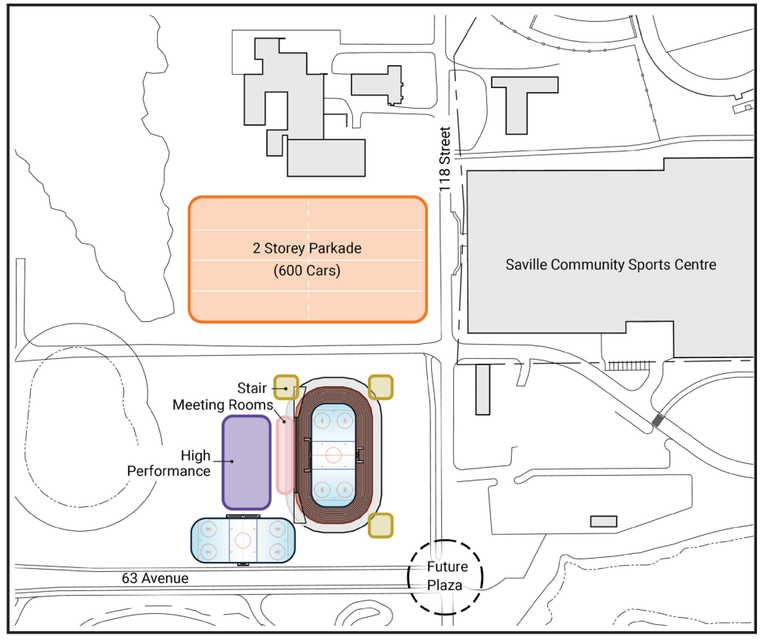


Upper +1



Option Three

Option 3 explored placing the High Performance component to the West and the spectator entry to the North. The service zone would be placed to the South. This option works in the short term, however it does not address the future Campus Quad and places a service yard in the future heart of the Campus.

Pros

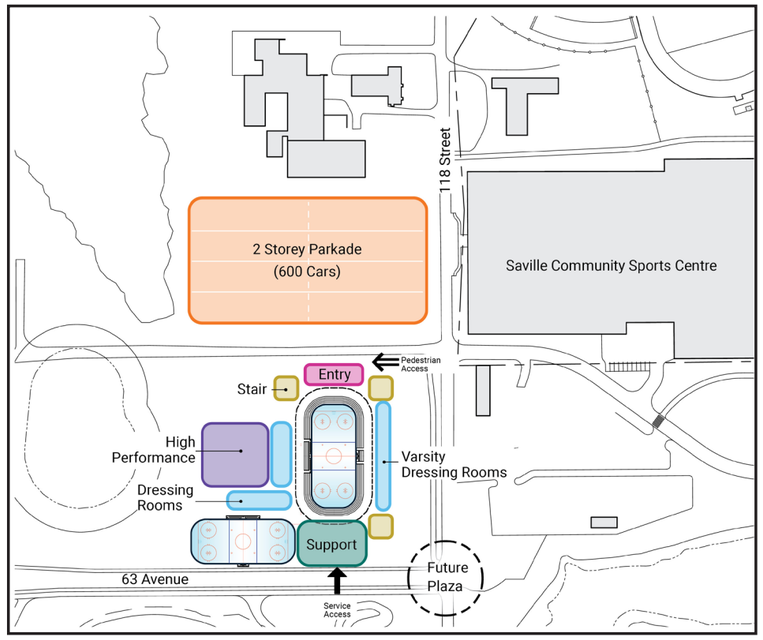
- Spectators enter the seating bowl from the top
- The back of house and change rooms are entered from the lower level, separate from the spectator entrance
- Most compact "back of house"
- Concourse at the plaza level reduces the stairs required to exit spectators in an emergency; exit stairs can be inexpensive exterior stairs.
- Entry faces parking lot and is the most direct route from Saville Centre
- HPTRC faces entrance to Campus
- Service yard elevation allows drainage into the campus system

Cons

- HPTRC does not face into Campus
- Spectators, participants, and Community Arena users all use the same entrance
- Service yard faces Campus Quad

Options Examined (Continued)

At Grade



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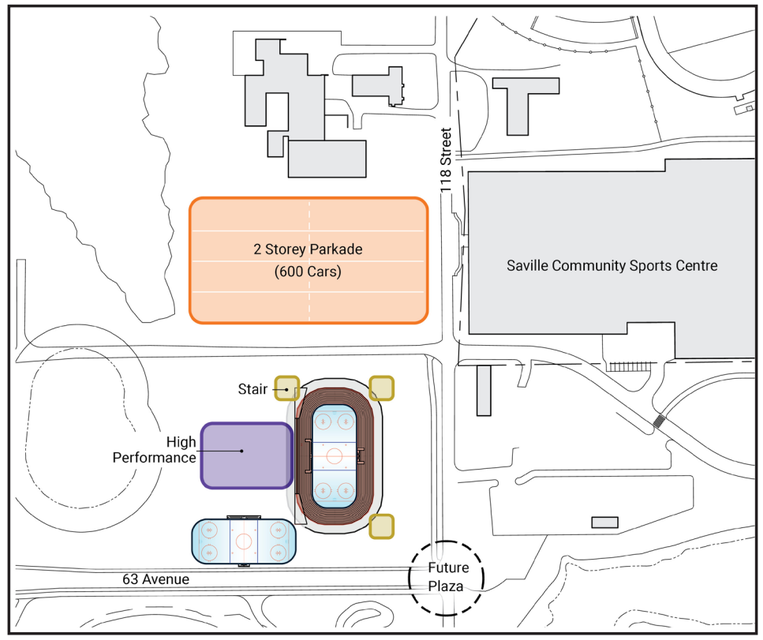

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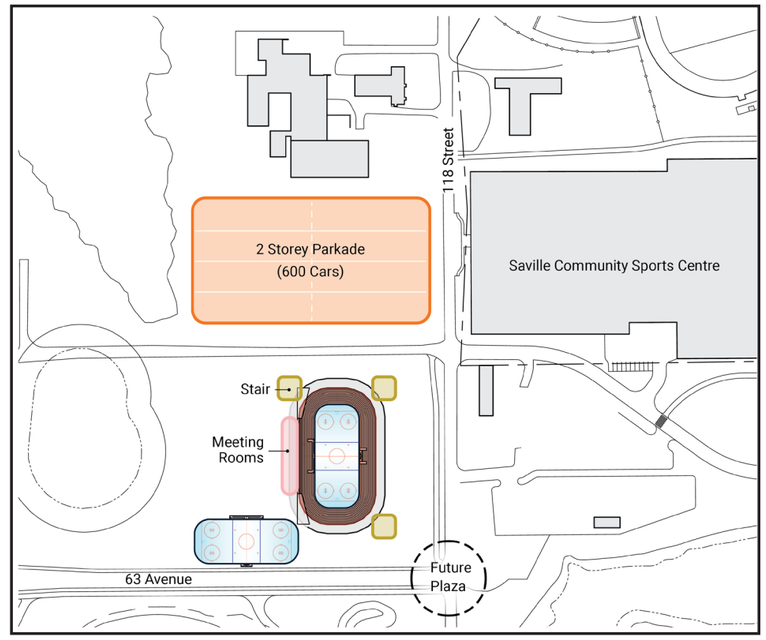


Option Four

Option 4 is similar to Option 3, however organized on two levels.

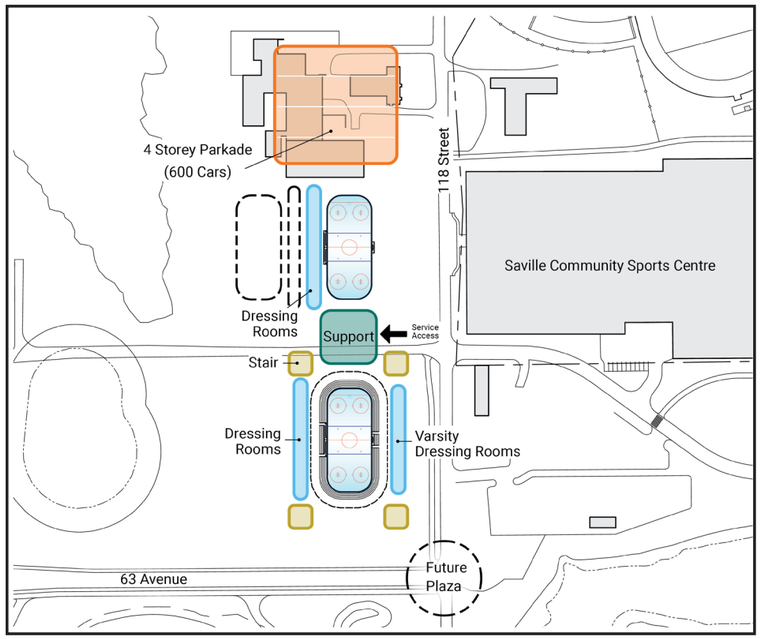
Pros

- Concourse at the plaza level reduces the stairs required to exit spectators in an emergency; exit stairs can be inexpensive exterior stairs. Entry faces parking lot and most direct route from Saville Centre
- Entry faces parking lot and is the most direct route from Saville Centre
- HPTRC faces entrance to Campus

Cons

- HPTRC does not face into Campus
- Spectators, participants, and Community Arena users all use the same entrance
- Service yard faces Campus Quad HPTRC does not face into Campus
- Raising seating bowl above grade requires interior stair cores to bring spectators up to the concourse

Below Grade



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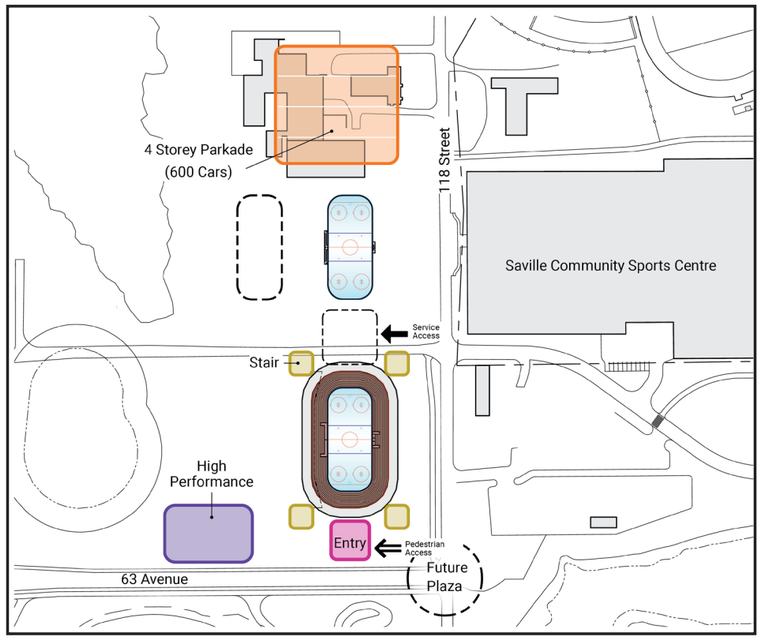

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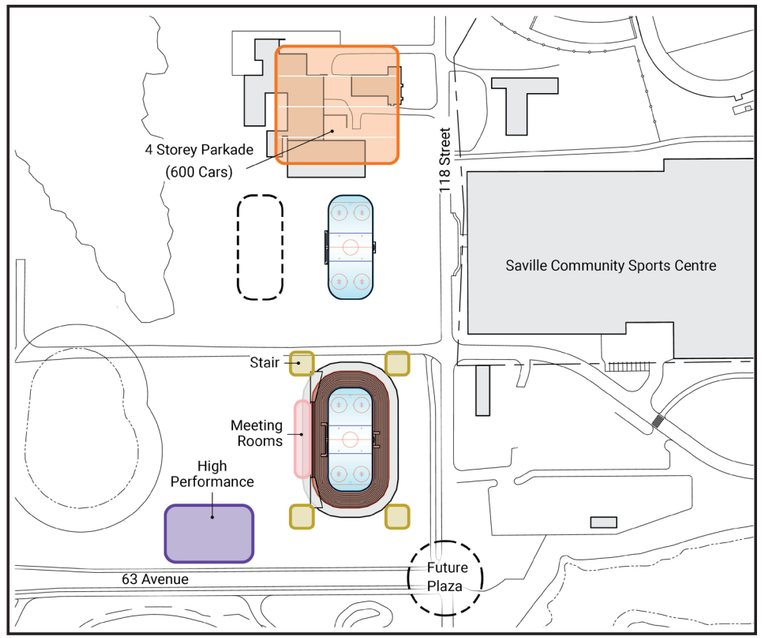


Option Five

Option 5 places the rinks end to end with the rink service areas between. The High Performance component is placed to the West and could be developed as a stand alone element. This option is only in the long term when the buildings to the North are removed to accommodate parking.

Pros

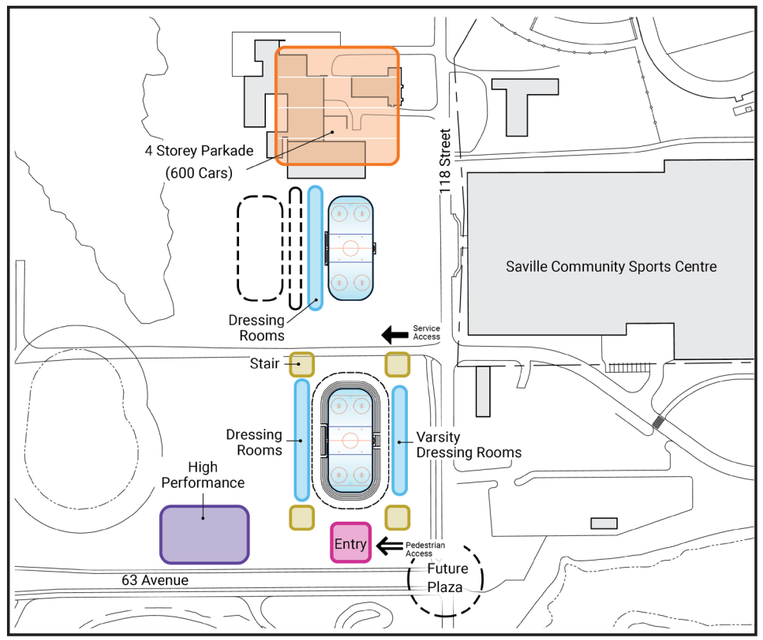
- Minimizes back of house space
- Straightforward twinning of the Community Arena in the future
- Multiple building phases can be accomodated easily since the Varsity Arena, Community Arena, and HPTRC are not integrated.

Cons

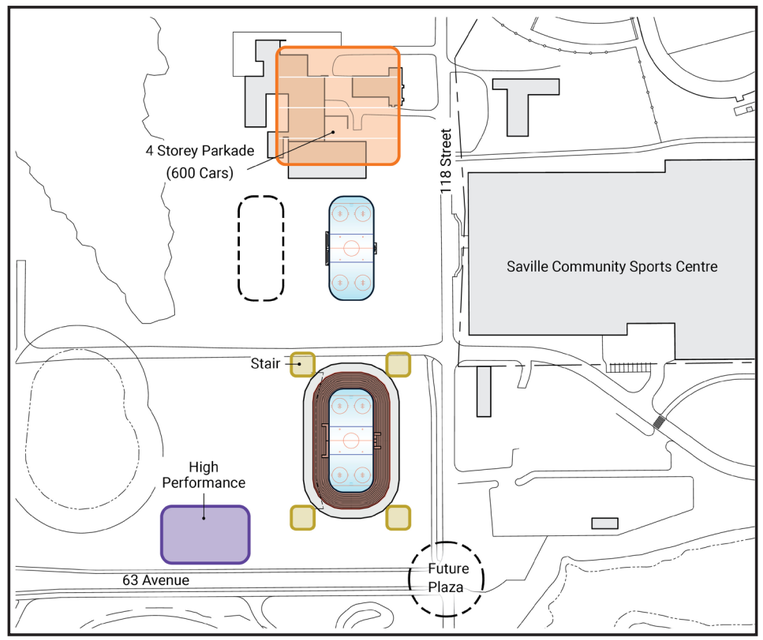
- Does not fit on site - Lair McElroy Environment and Metabolism Research Centre will need to be demolished.
- The three components (Varsity Arena, Community Arena, and HPTRC) are not integrated.

Options Examined (Continued)

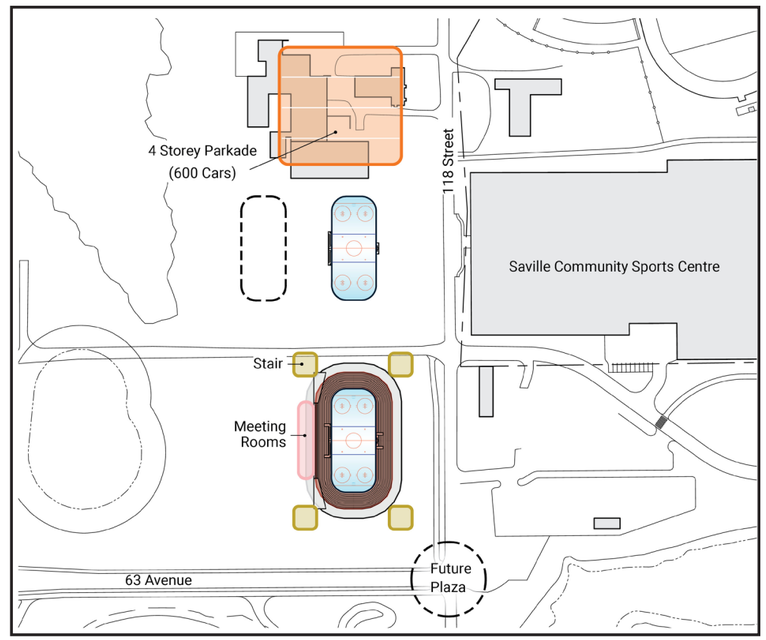
At Grade



Upper +1



Upper +2



Option Six

Option 6 is similar to Option 5, however organized on two levels.

Pros

- Minimizes back of house space
- Straightforward twinning of the Community Arena in the future
- Multiple building phases can be accomodated easily since the Varsity Arena, Community Arena, and HPTRC are not integrated. Minimizes back of house space

Cons

- Does not fit on site - Lair McElroy Environment and Metabolism Research Centre will need to be demolished.
- The three components (Varsity Arena, Community Arena, and HPTRC) are not integrated. Does not fit on site - Lair McElroy Environment and Metabolism Research Centre will need to be demolished.
- The three components (Varsity Arena, Community Arena and HPTRC) are not integrated.
- Raising seating bowl above grade requires interior stair cores to bring spectators up to the concourse.
- Support area has not been addressed in this option.

Option 1 Development

Based on the 6 options examined, and in consideration of the challenges and future opportunities, it was determined that a modified version of Option 1 would best fit the project requirements. In moving forward with Option 1, it was also determined that the high performance program component would be relocated to the lower participant level to better integrate High Performance functions into the facility.

With parking planned to the North and the future Campus Quad to the South East, this option places the service yard to the North and the spectator entrance to the South. As the site becomes more pedestrian oriented, the spectator entrance will address the Campus Quad and 118th Street to the East . A drop off along the South boundary of the site will provide vehicle access for spectators. This arrangement allows the public face of the building to address the “main Street” of the Campus and connect to the High Performance component in the future.

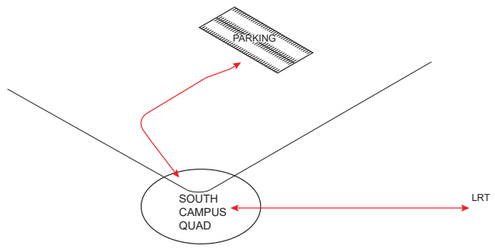
Separation of the spectators from participants is accomplished by grade-separating of their respective entrances. Spectators will enter the building from the South on the second level at the top of the seating bowl. Whereas, the community/athletes entrance at ice level, is provided at the North end of the building adjacent to the planned parking area.

To accommodate the two different entrance levels the building is designed such that the service yard is depressed and the South entrance slightly elevated taking advantage of the natural slope of the site. As noted earlier, this approach is complementary to the soil conditions, in that removal of the unsuitable material does not require replacement with expensive fill.

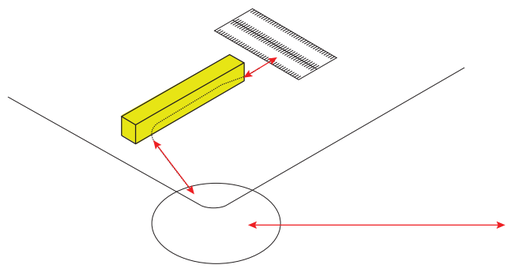
The North entrance will be an important access point for spectators and will remain an important access point for athletes and community users. As well, consequently, the lower level community entrance and the upper level spectator lobby have been aligned in plan and vertically connected with a feature stair in an open atrium. The stair connects the participant level with the spectator level and continues up to the third level suites and meeting rooms.

The proximity of the north entry to the service end of the building makes the use of a single ice resurfacing machine problematic. Any arrangement that provides access to both rinks (a necessity) results in a cross over condition where the machine must cross a public corridor. For this reason a second ice resurfacer and room is proposed to eliminate the crossover.

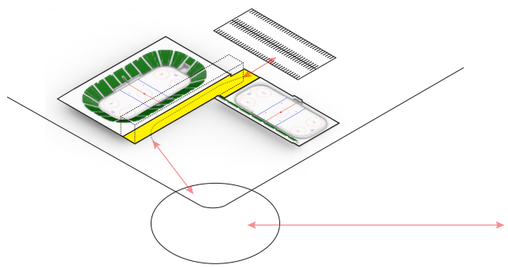
CAMPUS ELEMENTS



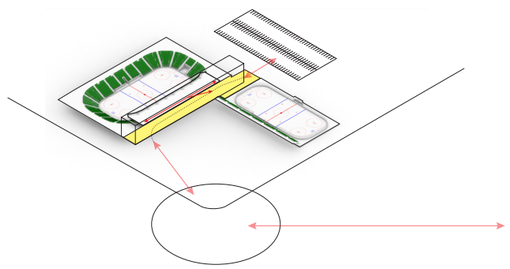
CIRCULATION SPINE



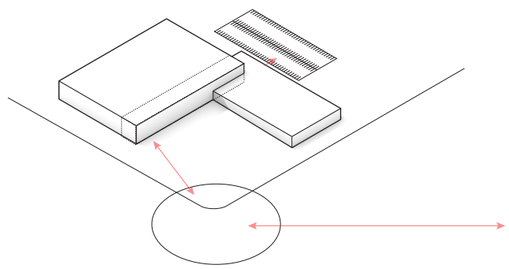
ARENAS



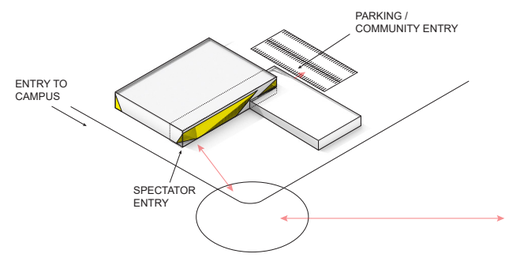
VARSITY ARENAS SUITES



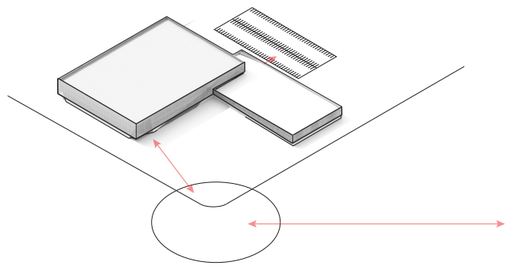
BUILDING MASSING



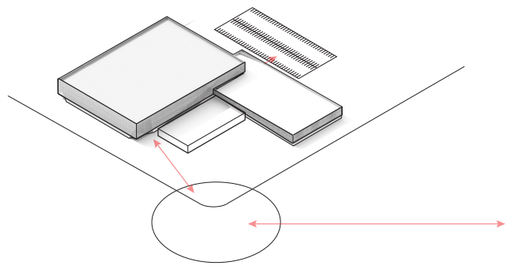
RESPONSE TO Campus

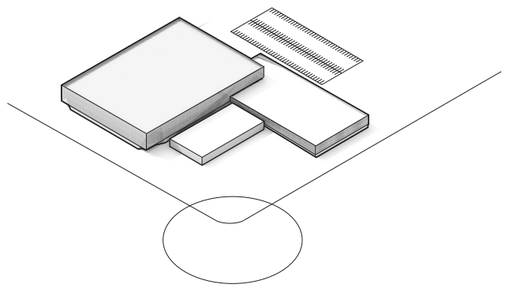


LANTERN



High Performance

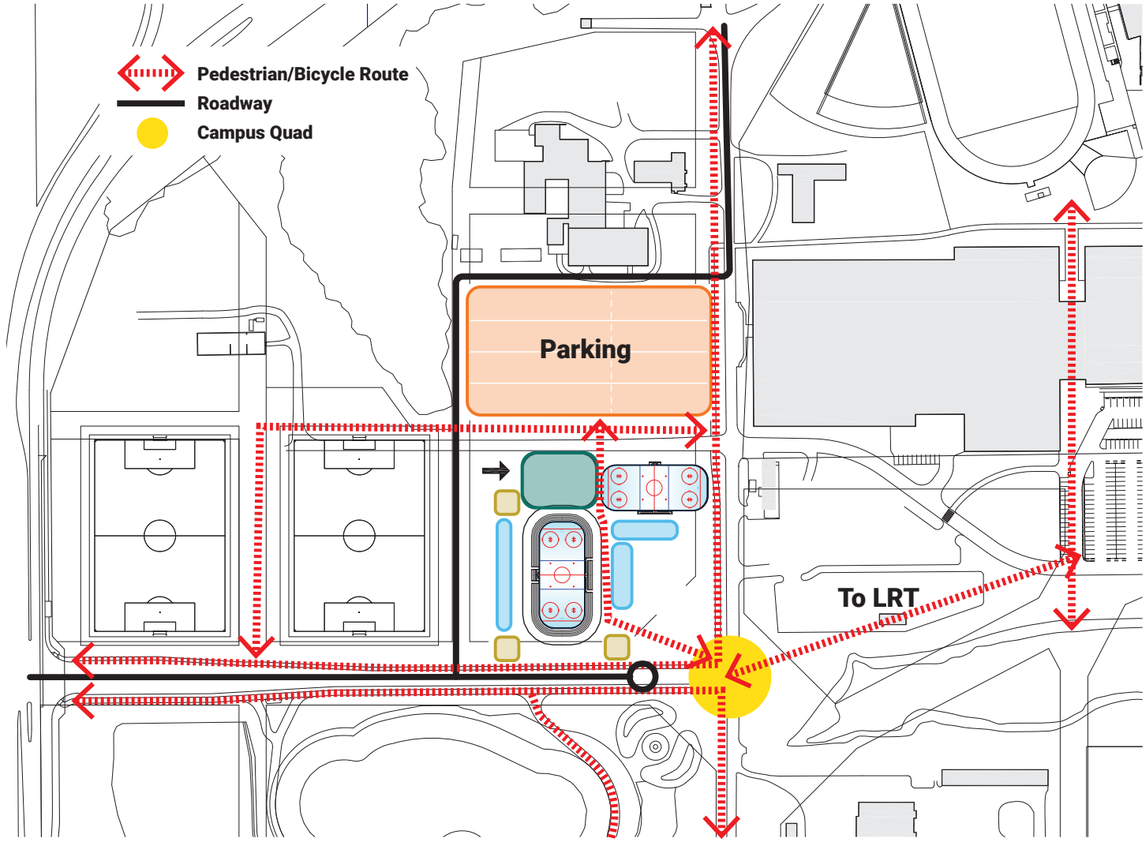




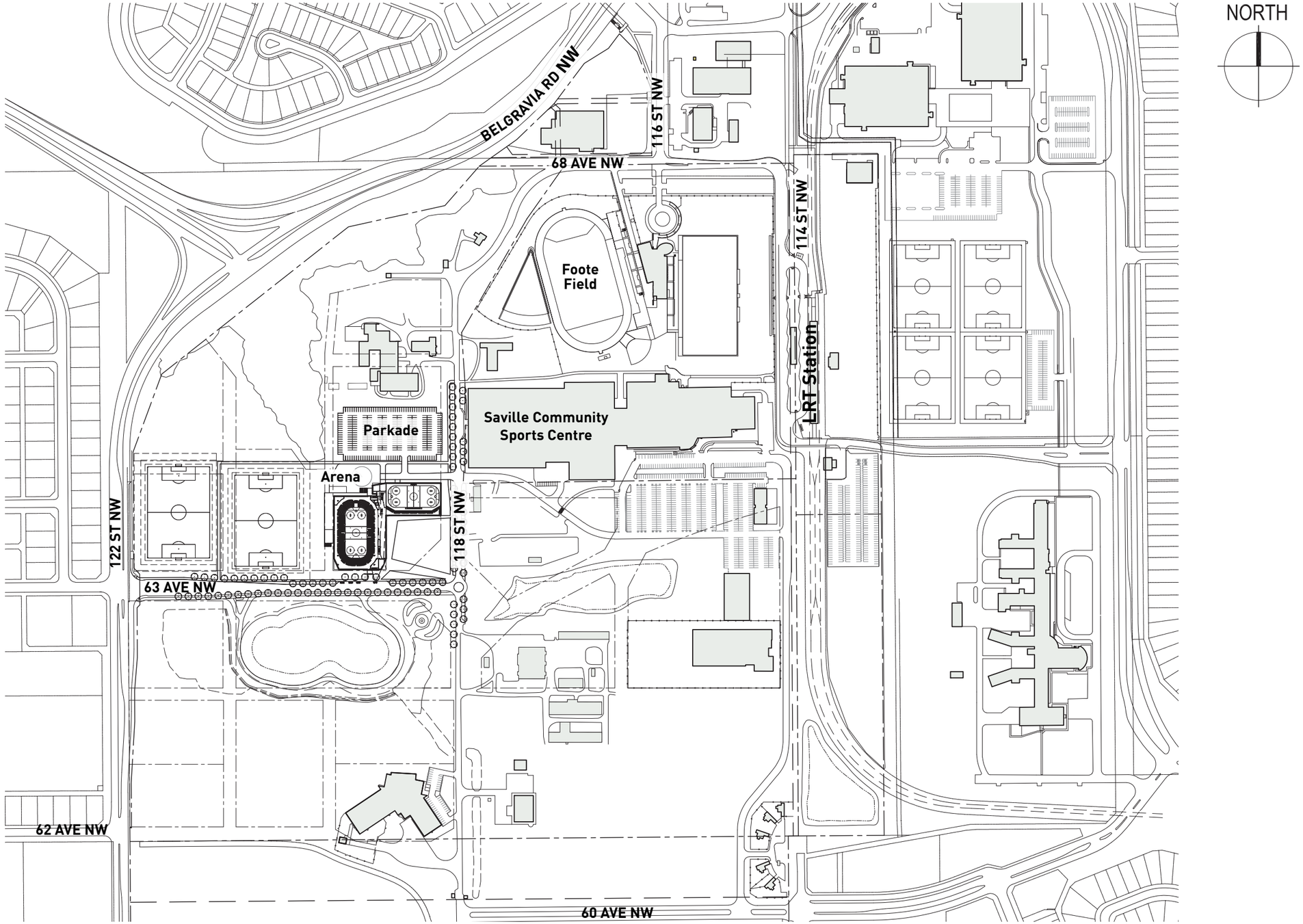
Siting and Plan Arrangement

There are several drivers to the siting and arrangement of the SCCIA that have determined the proposed arrangement. These include:

- The Arenas require a service entrance to an exterior service yard. Ice resurfacing equipment, and event equipment and staging will need to be unloaded into the building. The exterior service yard will house the cooling tower for the refrigeration equipment, mechanical equipment, and provide space for team buses, media and broadcast vehicles, temporary storage and service vehicles.
- Assuming the recommended low charge ammonia system is used, the ice plant must be housed in a class T mechanical room. The class T mechanical room must have direct access to the outside, ideally to the service yard. Other mechanical spaces will benefit from outside access to the service yard as well.
- Participants, including Varsity athletes, community users and parents of children need reasonably direct access to the dressing rooms so as to minimize the hauling distance of hockey bags etc.
- Spectators, particularly ticketed spectators, need to be separated from the participants. Ticketed spectators need to arrive through a controlled entrance.
- A top loaded seating bowl, i.e. access from an upper concourse, eliminates the need for vomitories and improves site lines. The upper concourse provides for standing room behind the seats and access to concessions washrooms and other amenities.
- While funding for the High Performance component of the project is in the future, area to accommodate the program must be identified at this time.
- The soil conditions include an upper layer of 1.5m of unsuitable material, underlain by clays that are highly susceptible to swelling in response to moisture content. Significant excavation will be required to remove unsuitable material. Furthermore the clay layer becomes more consistent as the depth increases and moisture levels become more stable.
- The structured parking is located North of the twin arena and immediately West of the Saville Community Sports Centre.



Site Movements



Site Context Plan

Architectural Treatment

A simple massing arrangement places the community and Varsity rinks in a L shaped configuration. This configuration places the service yard adjacent the back of house for both rinks, and creates the space for the future High Performance element. Most importantly the massing allows the higher and larger Varsity Arena to have its own identity and presence. The Community Arena is lowered and mostly below grade and very much a secondary structure.

Hockey is a winter sport and the Pandas and Golden Bears are a winter city team. For much of the season spectators will arrive in the early evening in the dark of winter. The Varsity Arena will be clad in a back lit perforated metal screen to create a festive lantern than can be seen from all points on the Campus. The screen and its lighting soften the largely solid mass of the Arena and allow it visually float above the entries and surrounding landscape.

The simple box shapes of the Arenas have been carved and faceted with large glazed areas behind the screen. These elements identify the spectator and community entrances and provide visual interest at key locations of the building. The faceting on the South West corner provides a focal point along the West entry to the Campus.

Precedents

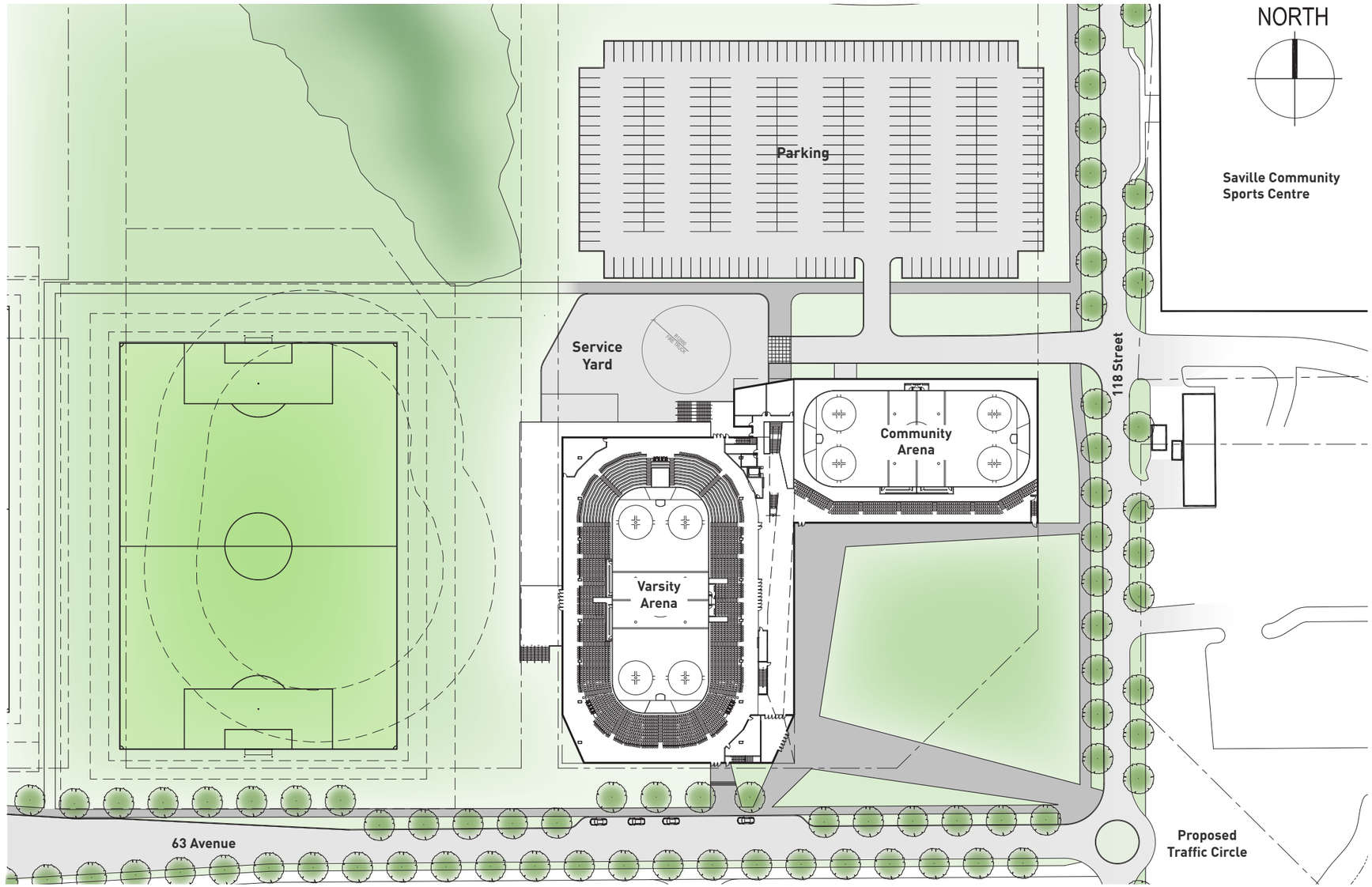
Proposed Site Plan

The South Campus Community Ice Arena has two main entrances; one located at the North and one located at the South. The North entry will be used as a community and athlete entrance bringing participants into the building at the lower level. Located West of this entry is a service yard and entrance housing mechanical, refrigeration, and electrical equipment. Oversize vehicle access into the facility will be provided here through the ice resurfacer room overhead door.

Patron parking will be provided by a gravel lot North of the community entrance. Access to this parking lot will be provided from 118th Street.

The South entry will be used for spectators bringing them into the facility at the concourse level. A drop off zone located South of the building on 63rd Avenue provides an area for vehicles to safely pull in and drop off spectators.

A proposed traffic circle will be located at the intersection of 118th Street and 63rd Avenue providing traffic calming measures and orientating vehicles properly towards the drop off area.



LEGEND

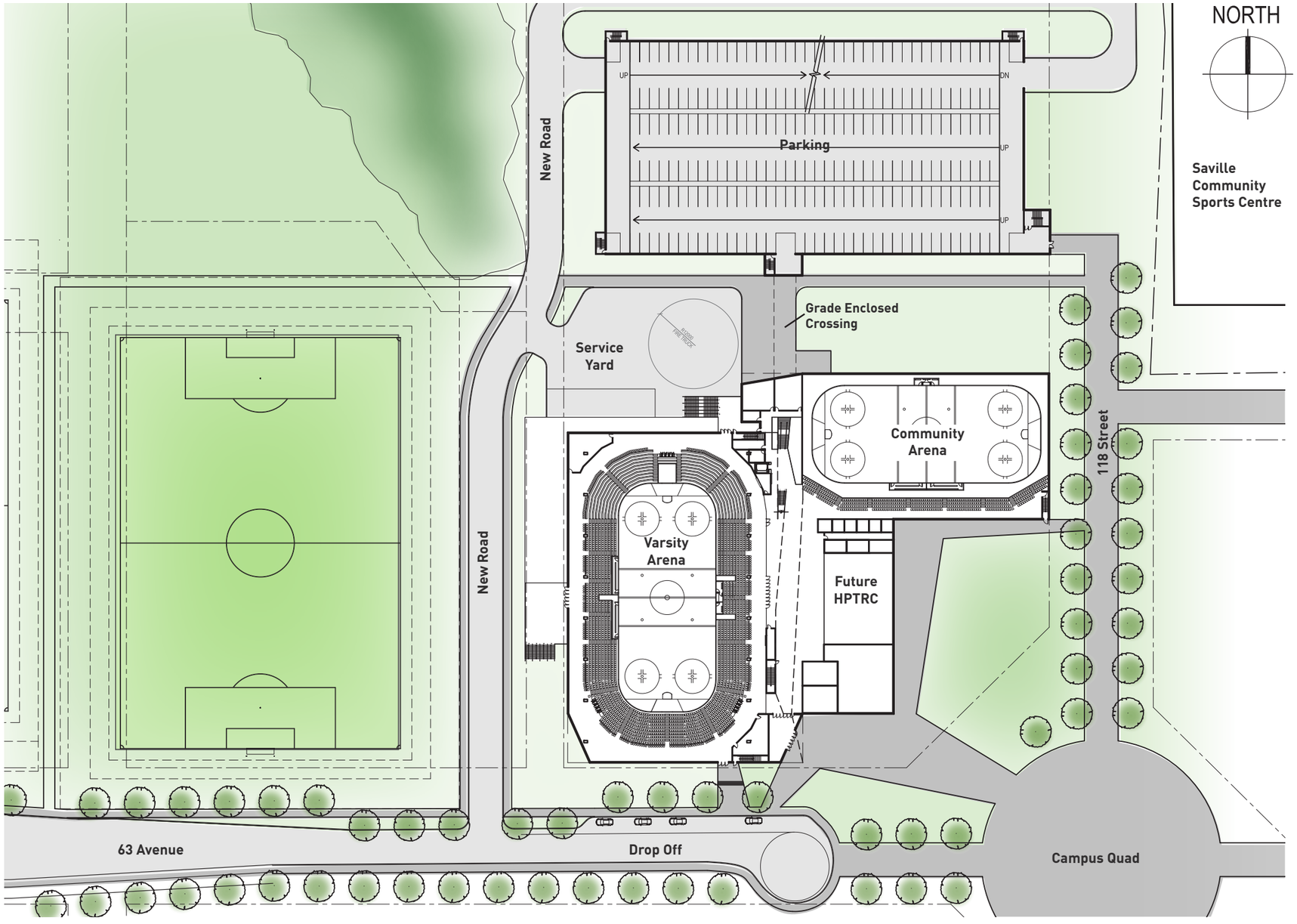
- Pedestrian Areas
- Roads

Future Site Plan

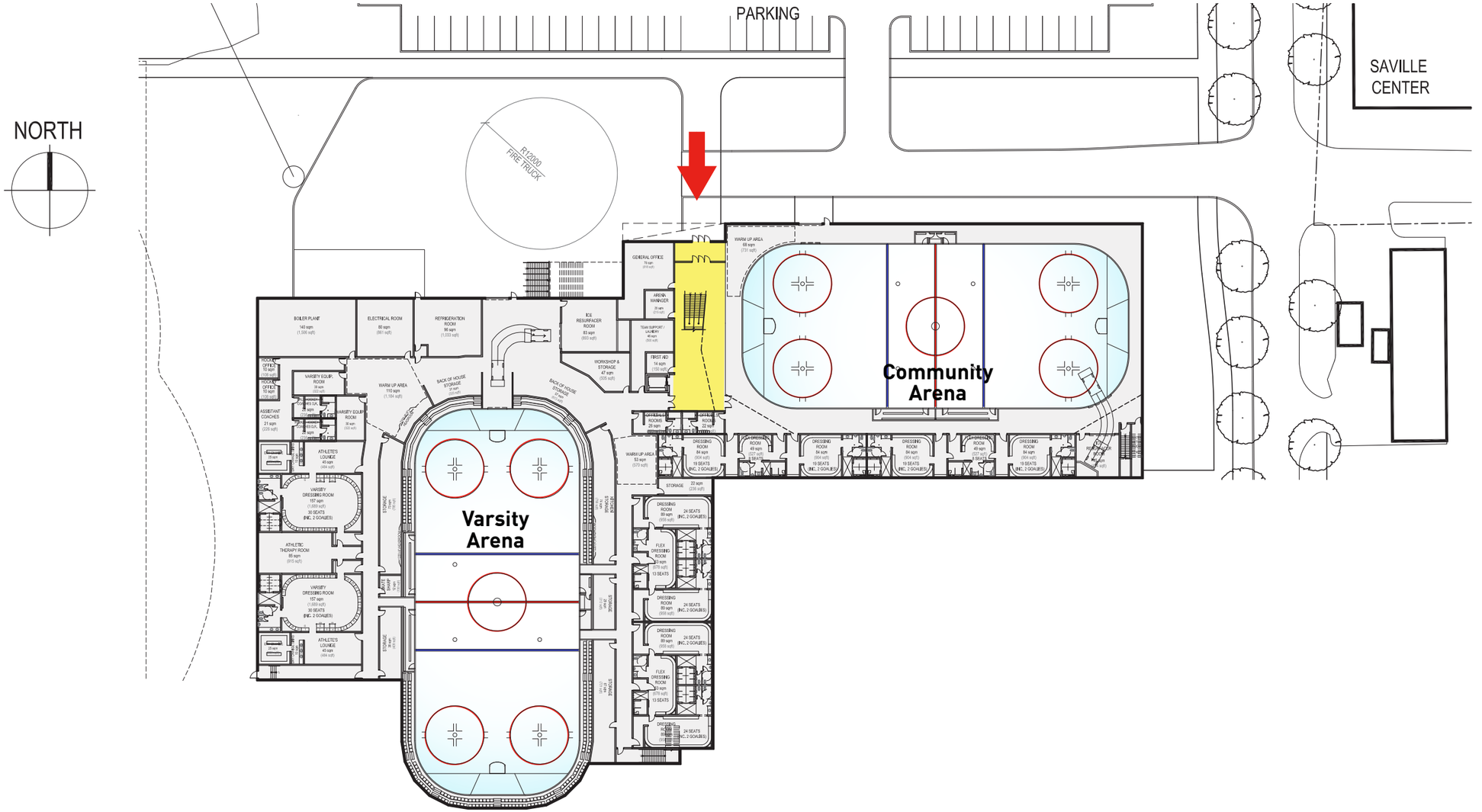
This site plan responds to the addition of the High Performance Athletic Training and Research Centre (HPTRC) program and the pedestrianized principals outlined in the South Campus Long Range Development Plan (SCLRDP).

The HPTRC addition will be located on the Esat side of the building adjacent to the Varsity Arena. This addition does not affect the facility's North and South entrances or service yard; they will remain as originally designed. Patron parking will now be provided by a parkade. Access will be through a new road located off of 63rd Avenue and West of the building. Pedestrians will connect from this parkade to the South Campus Community Ice Arena through sidewalks to the community entrance or through a future potential above grade enclosed connection.

The SCLRDP pedestrianizes the Campus by closing a number of roads to vehicular traffic one of which being 118th Street. The future pedestrian thoroughfare will feed directly into the new Campus Quad replacing the proposed traffic circle at the intersection of 118th Street and 63rd Avenue. A new traffic circle will be provided West of the Campus Quad continuing to orient vehicles properly towards the drop off area.



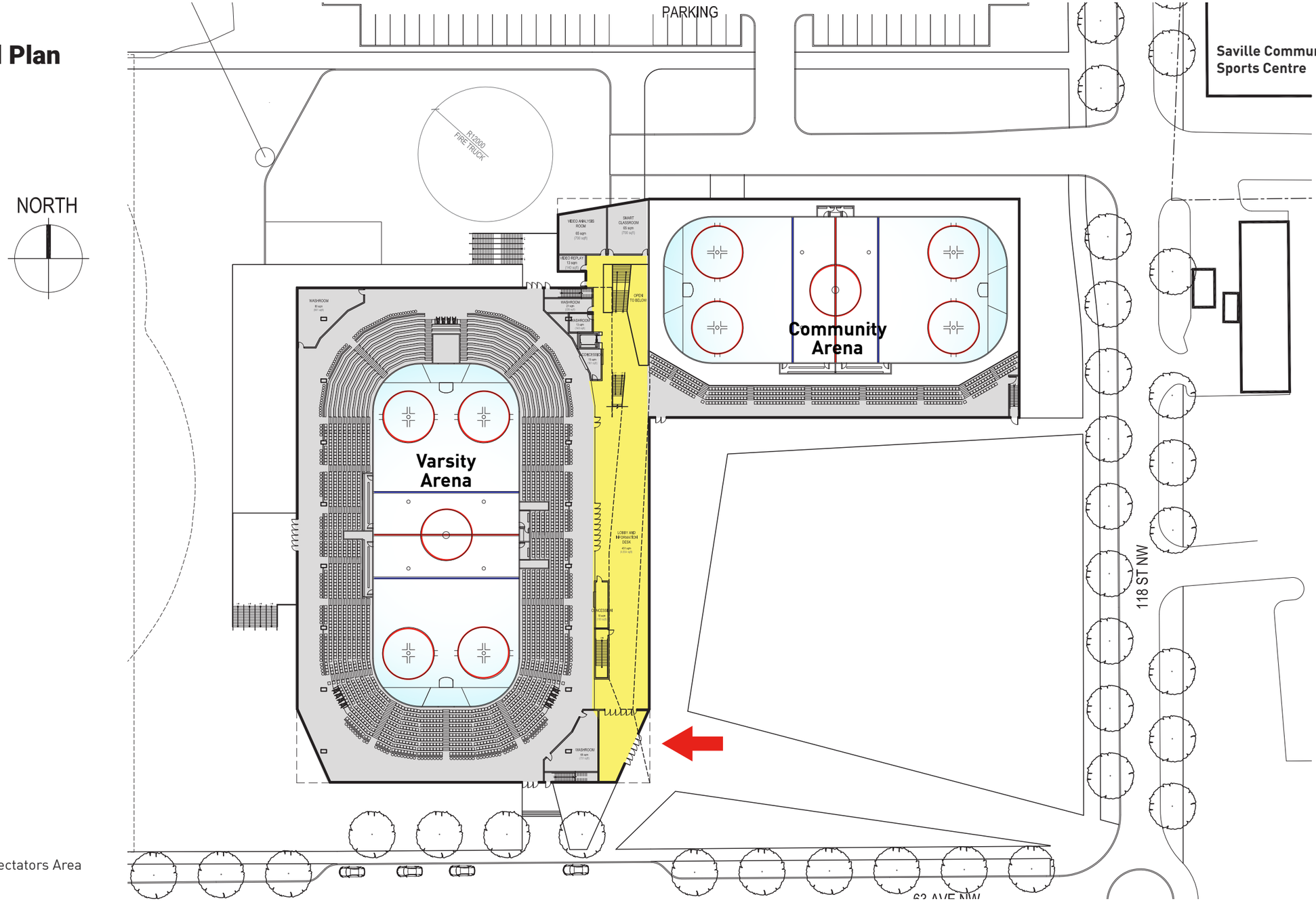
Participant Level Plan



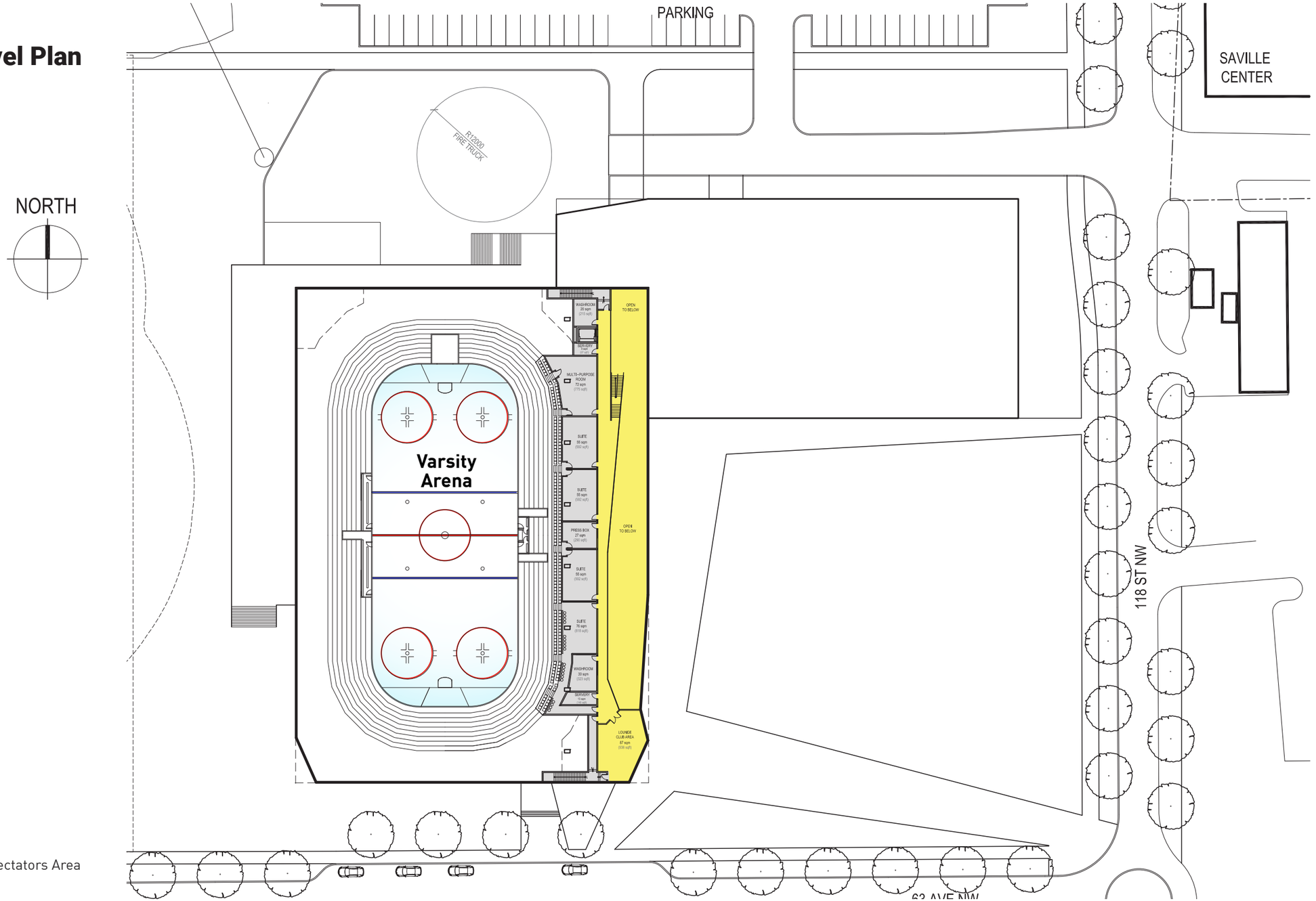
LEGEND

Spectators Area

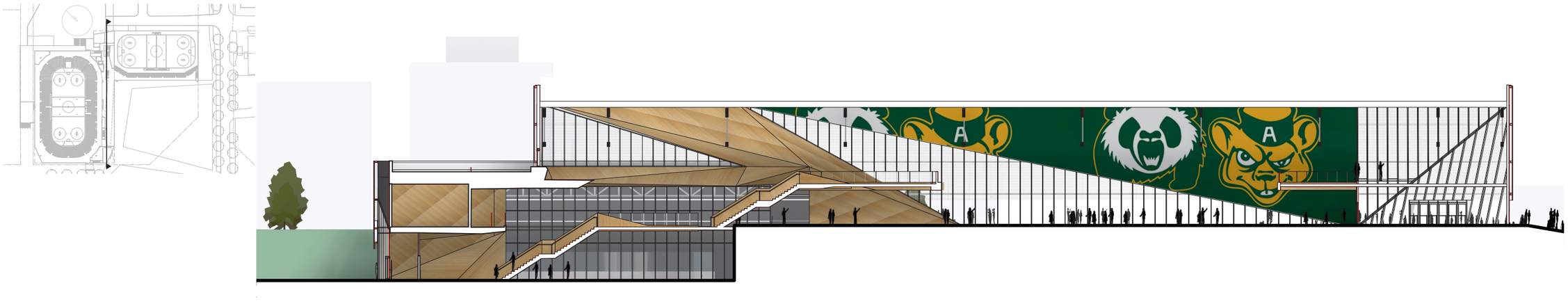
Spectator Level Plan



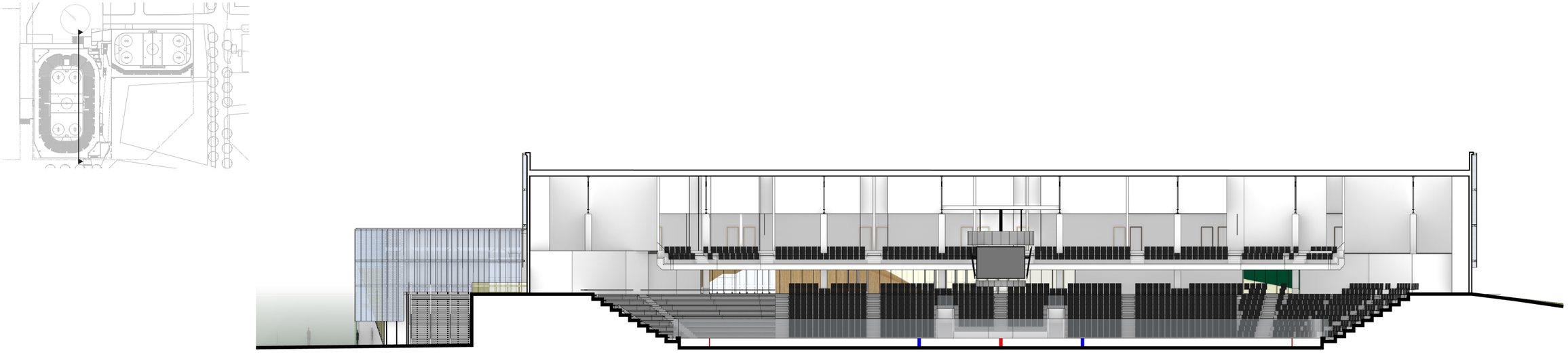
Upper Suite Level Plan



Building Sections

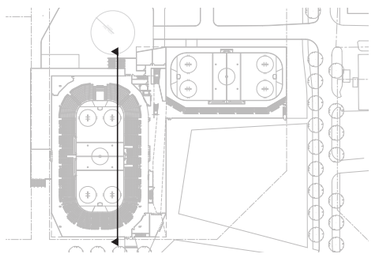


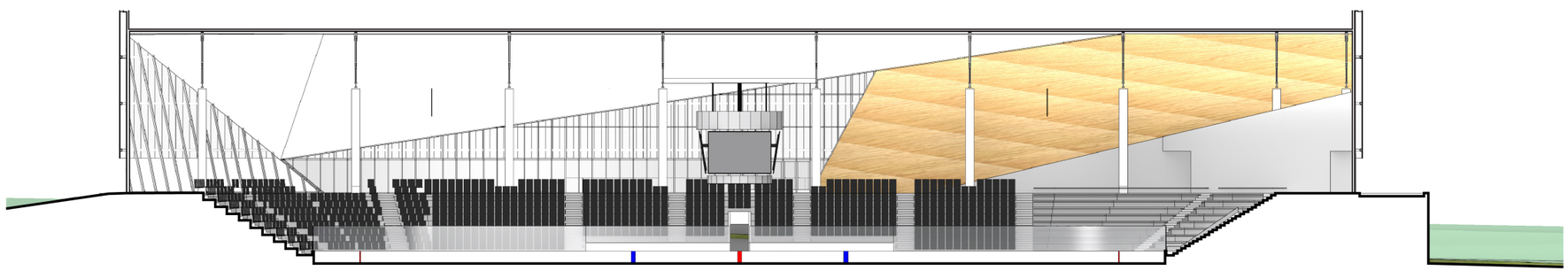
Entry Concourse Looking Esat



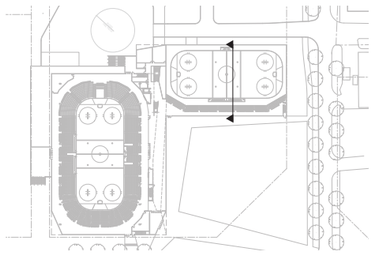
Varsity Arena Looking Esat

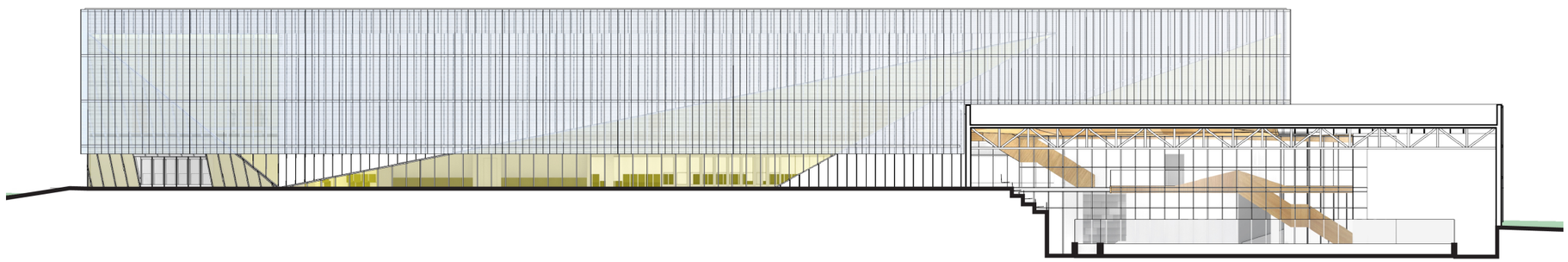
Arena Sections





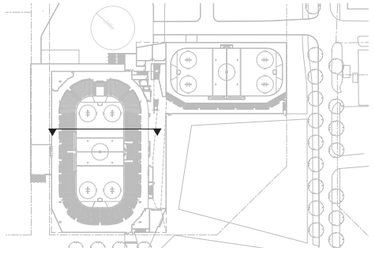
Varsity Arena Looking West

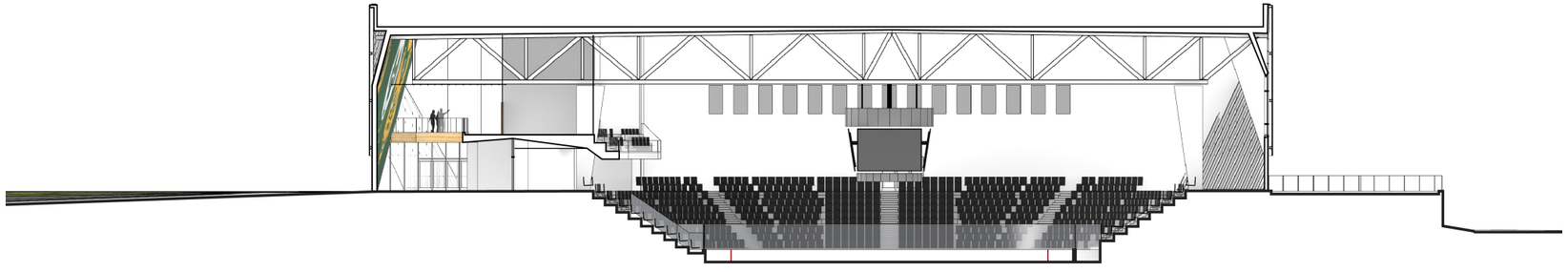




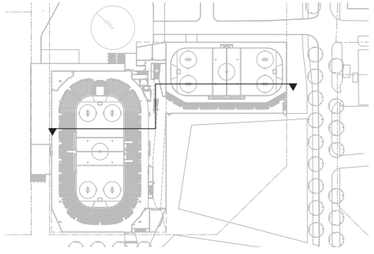
Community Arena Looking West

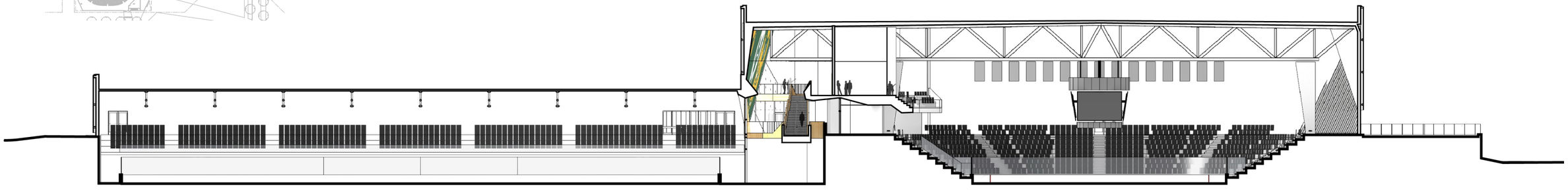
Arena Sections





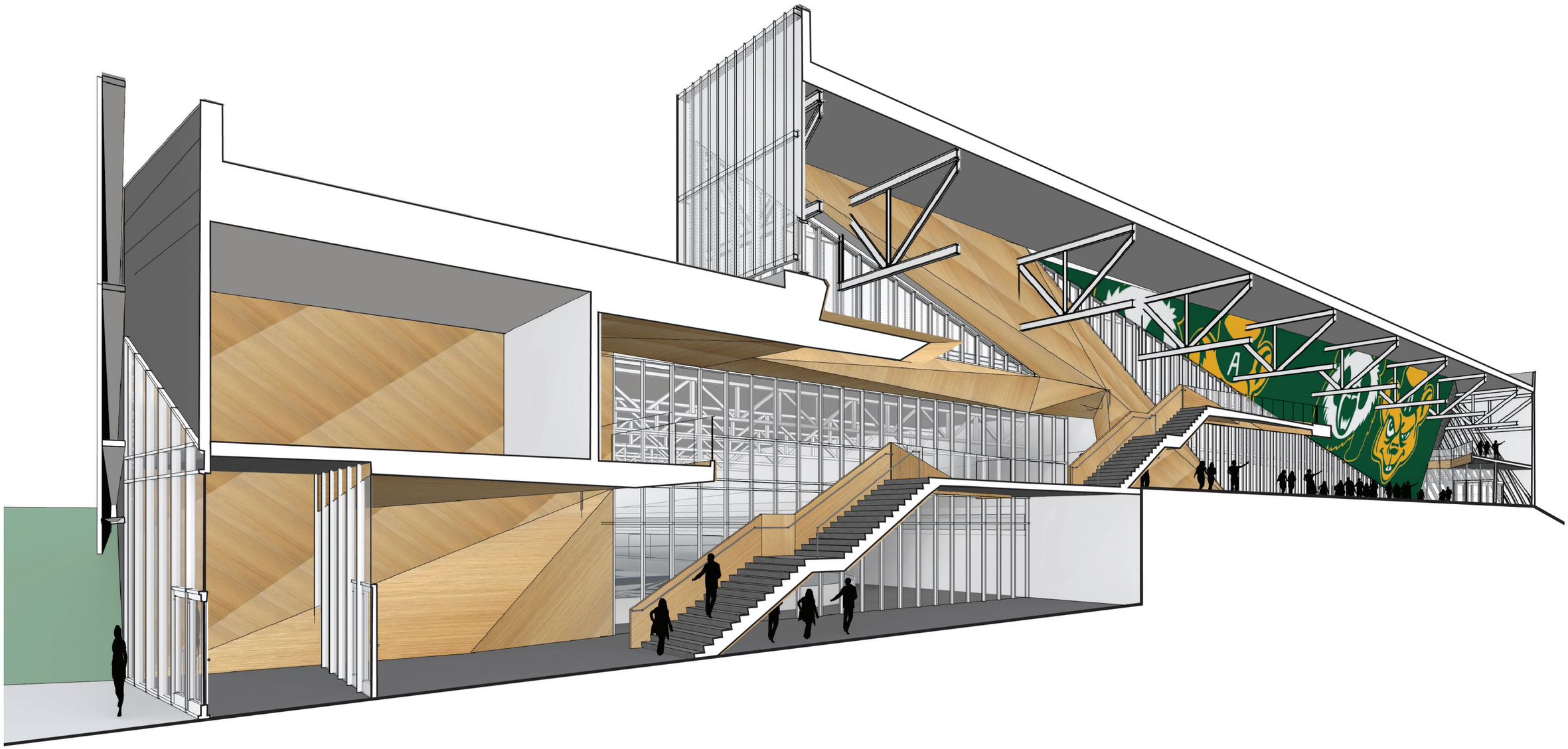
Varsity Arena Looking South





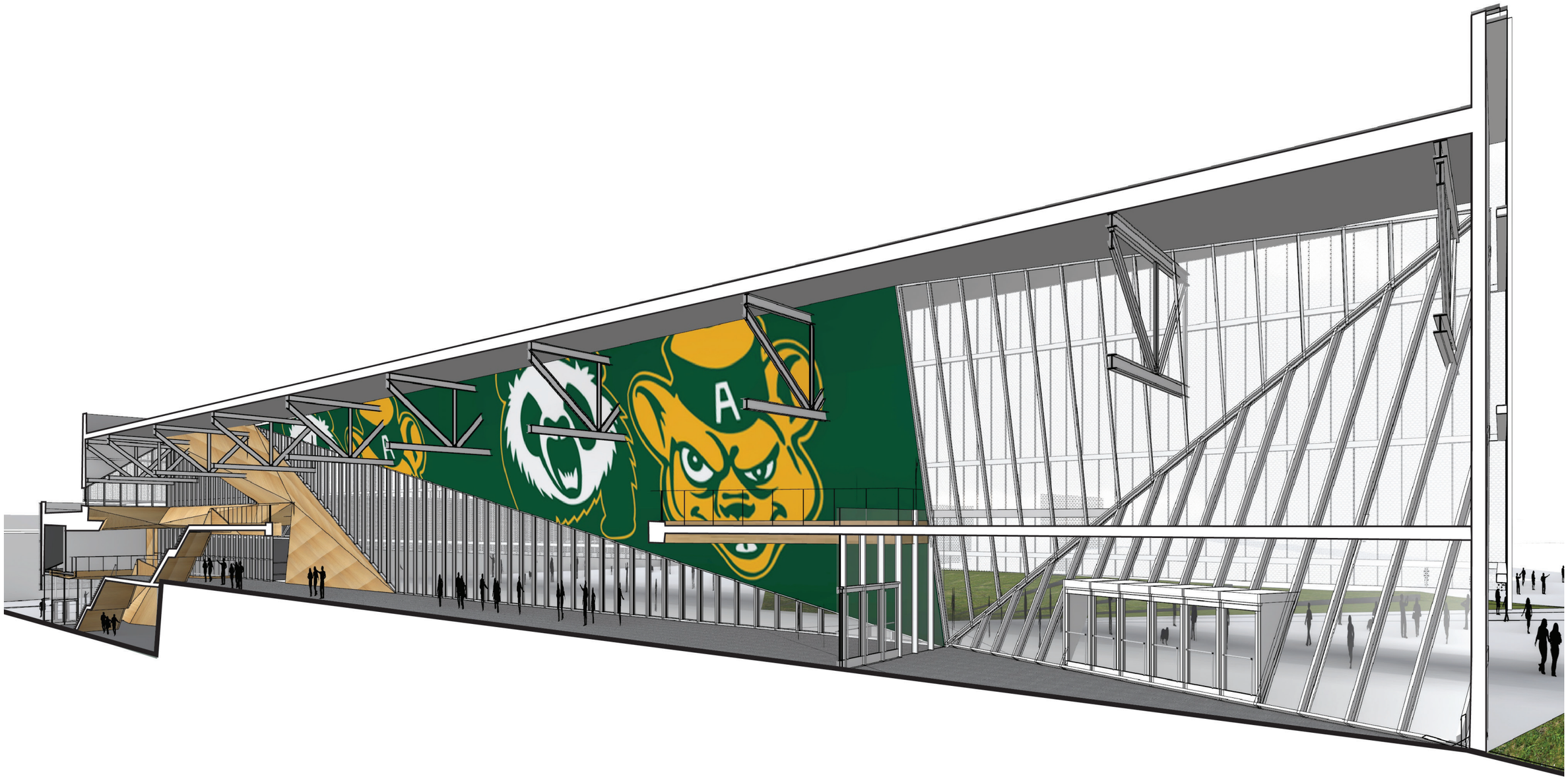
Varsity and Community Arena Looking South

Entry Concourse Section



Community Entry

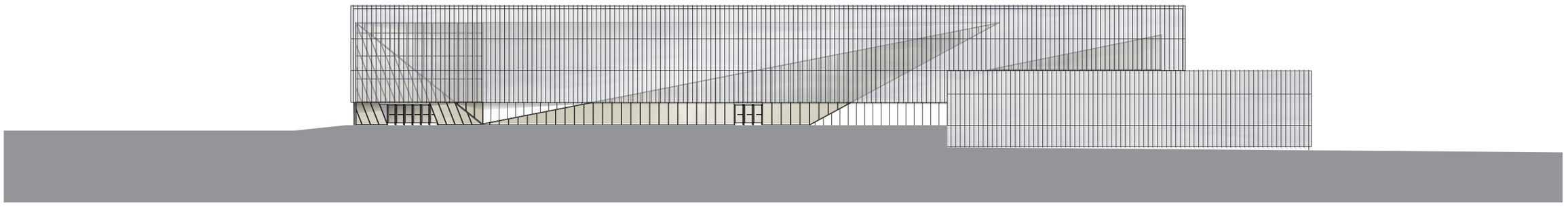
Entry Concourse Section



Spectator Entry

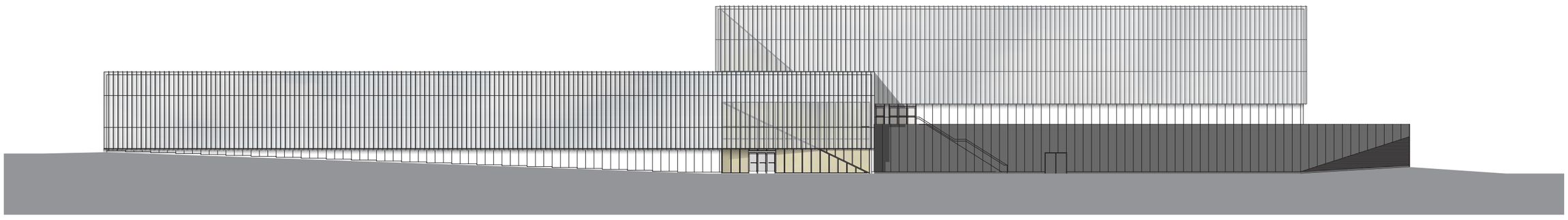
Elevations

South Elevation

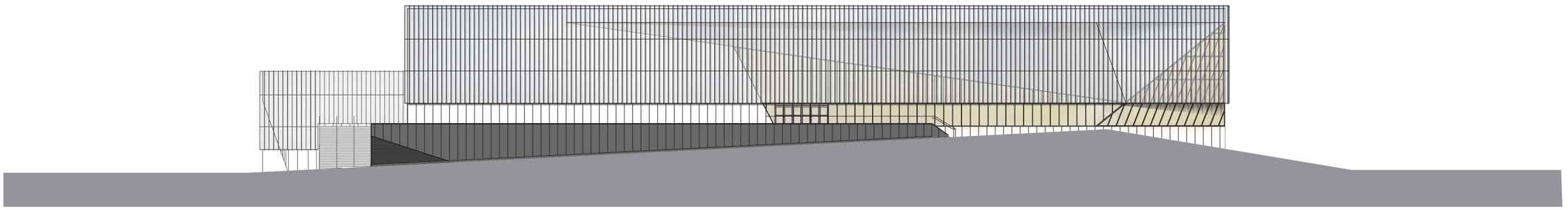


Esat Elevation

Elevations



North Elevation



West Elevation

Varsity Seating Bowl

The existing Clare Drake Arena has approximately 2600 bench seats in a horse shoe arrangement. Typical of small arenas at the time, the rise of the seating bowl is rather high while the run is quite short. This creates a steep bowl with good site lines and most importantly a sense of intimacy and a degree of intimidation contributing to a home team advantage. The partisan crowd is in the opposition's face, so to speak.

Reproducing this environment in the new building is important and has driven the bowl design and seating rake. Initially GEC had proposed an 11 row bowl, entirely fitted with 3000 seats with backs. Cost and geometry limitations constrain the distance from concourse to ice to 5 metres therefore determining the height of each riser.

The U of A has proposed that a certain percentage of the seats do not need backs and that a "student zone" can be designed that reproduces the Clare Drake experience with more densely packed spectators on benches. This approach allows for a 10 row bowl having approximately 1,850 seats with backs and approximately 930 bench seats. Given the same 5 metre height of bowl this results in a steeper, tighter (and more cost effective) bowl with approximately the same number of seats. Roughly 10 barrier free seats will be provided around the concourse and while 180 seats will remain at the upper suites.

The building program calls for several meeting rooms, suites and a press box all of which require or can benefit from a view of the ice. An upper level concourse provides access to these upper level rooms and their related seating. These spaces will serve University and user needs and will also serve as rental spaces and event viewing spaces. They will generate revenue and provide viewing for VIPs, Alumni, Donors, press and special events.

Seating Types	
Backed Seats	1850
Bench Seats	930
Upper Level	180
Barrier Free Seats	10
Total	2970

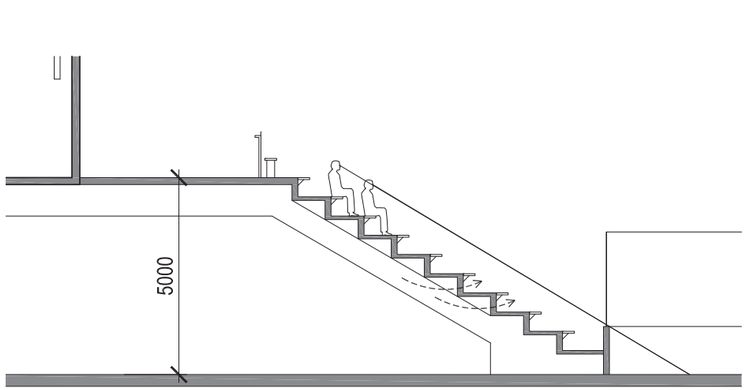


Figure 1
Varsity Bowl Bleacher Section

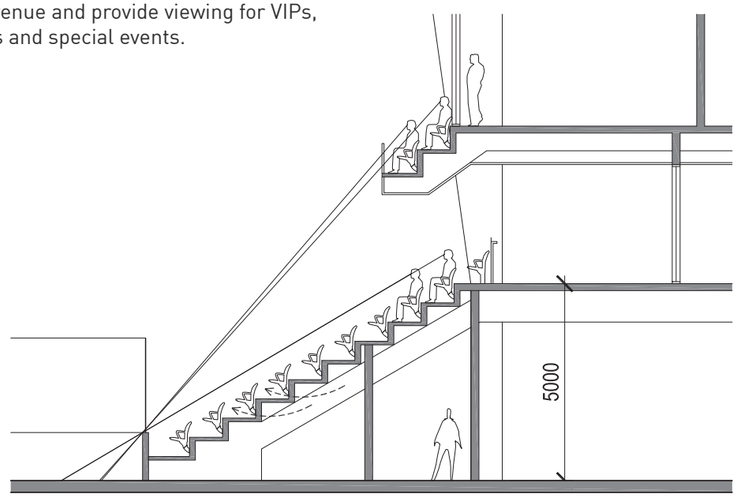
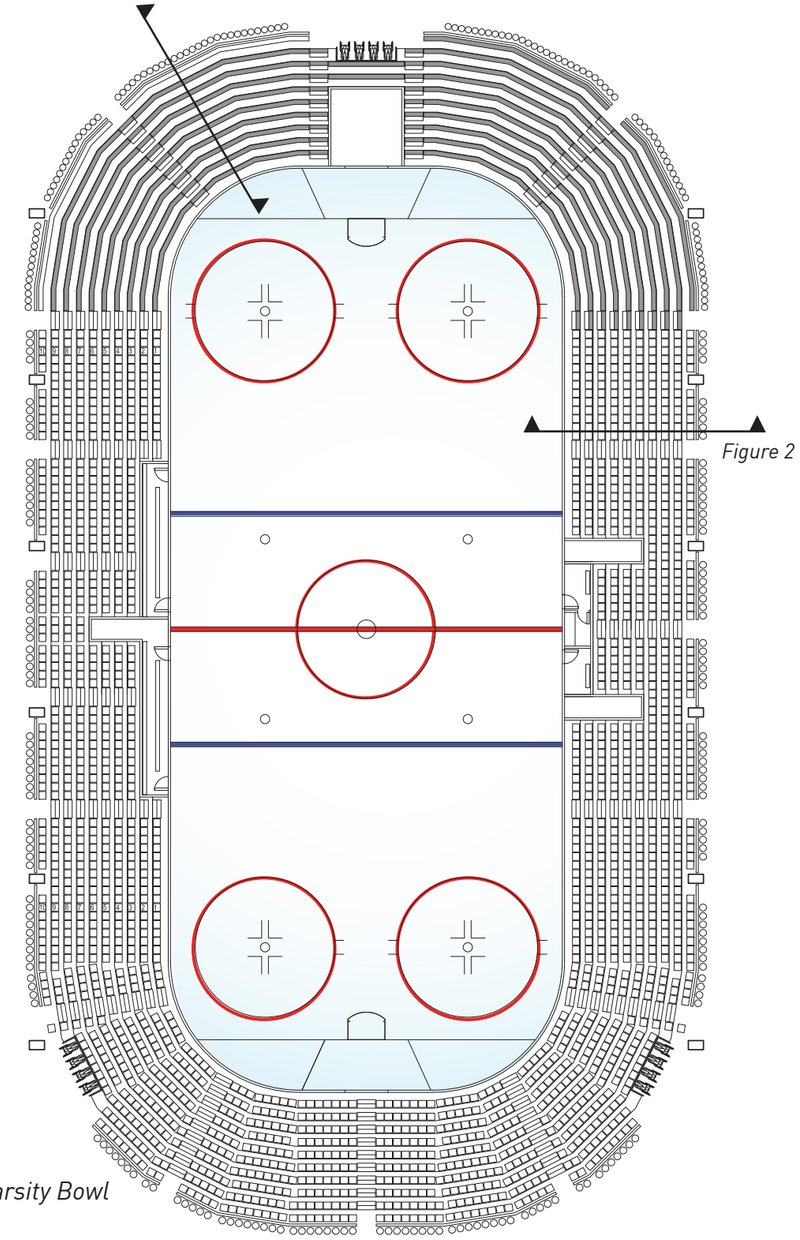


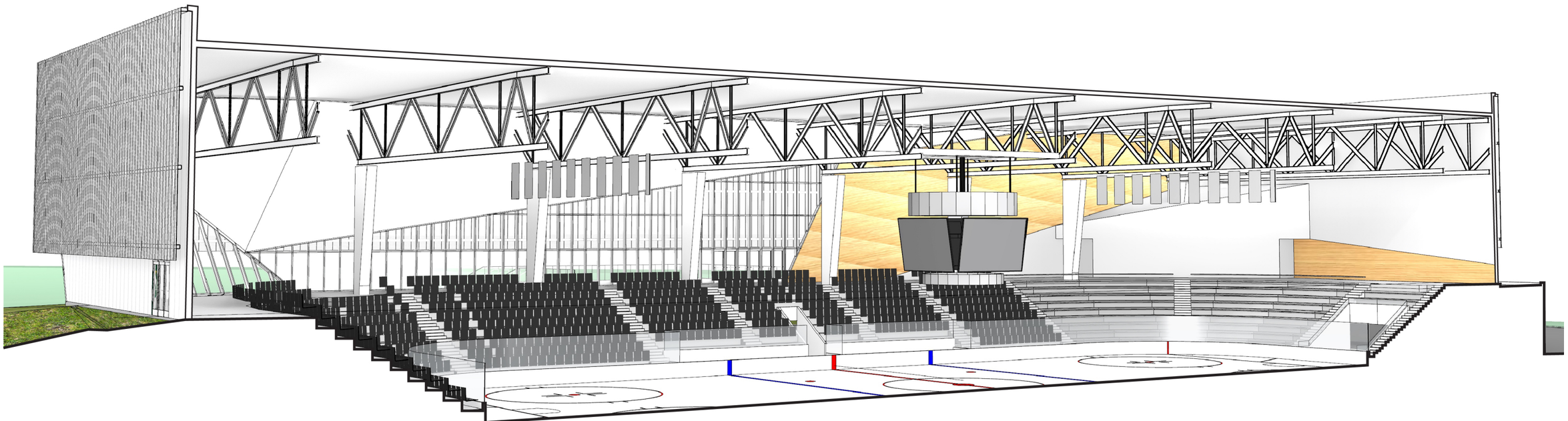
Figure 2
Varsity Bowl Seat Section

Figure 1

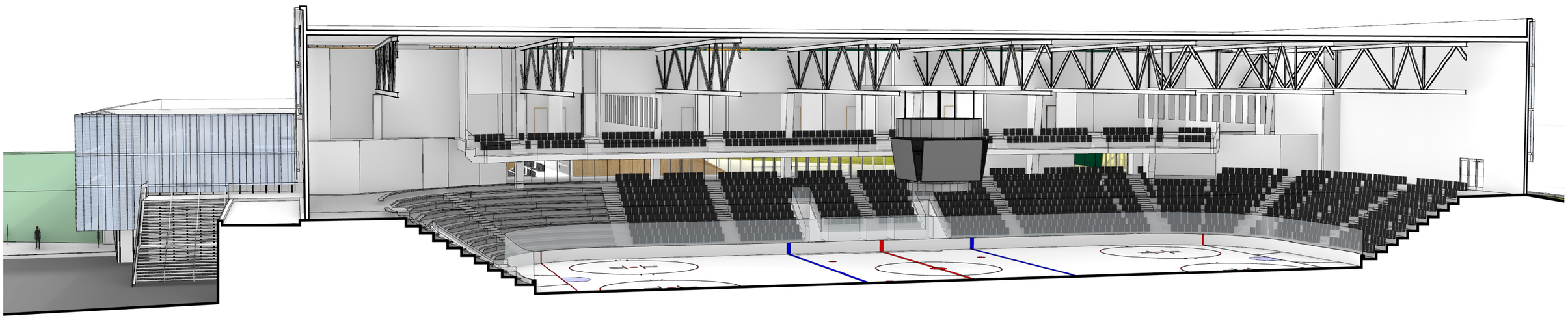
Figure 2



Varsity Bowl



Varsity Bowl Looking North West

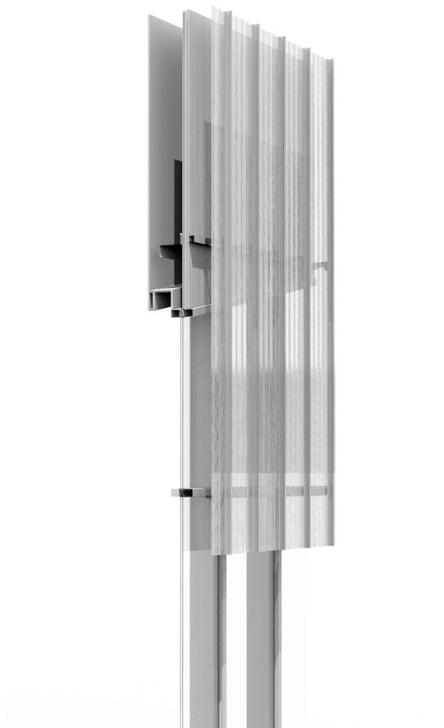


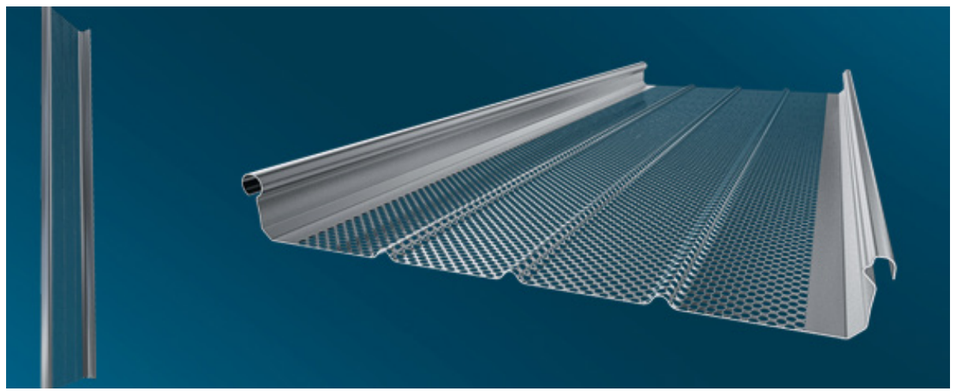
Varsity Bowl Looking Esat

Building Envelope

The exterior skin of the building will consist of prefinished, insulated metal panels at all locations above grade except where there is glazing. These panels provide both the interior and exterior finished surface and have good insulating properties without significant thermal bridging. They are one of the loWest cost exterior cladding systems available.

A perforated metal screen will be placed outboard over the metal panels. This screen is proposed to be Kal Zip or one of several identical products that can be obtained in the Canadian market. The system incorporates a deep rib that provides visual interest and can span approximately 2.5 m without intermediate support.





Exterior Screen Details

High Performance Participant Level Plan

The High Performance Athlete Training and Research Centre (HPTRC) allows the Faculty of Kinesiology, Sport, and Recreation to offer training and research in High Performance sport. The HPTRC allows students to engage with renowned academic staff and Canada's most successful inter-university athletic programs. Students are provided practical, hands-on learning experiences in sport conditioning while developing an understanding of sport science research.

HPTRC user groups include:

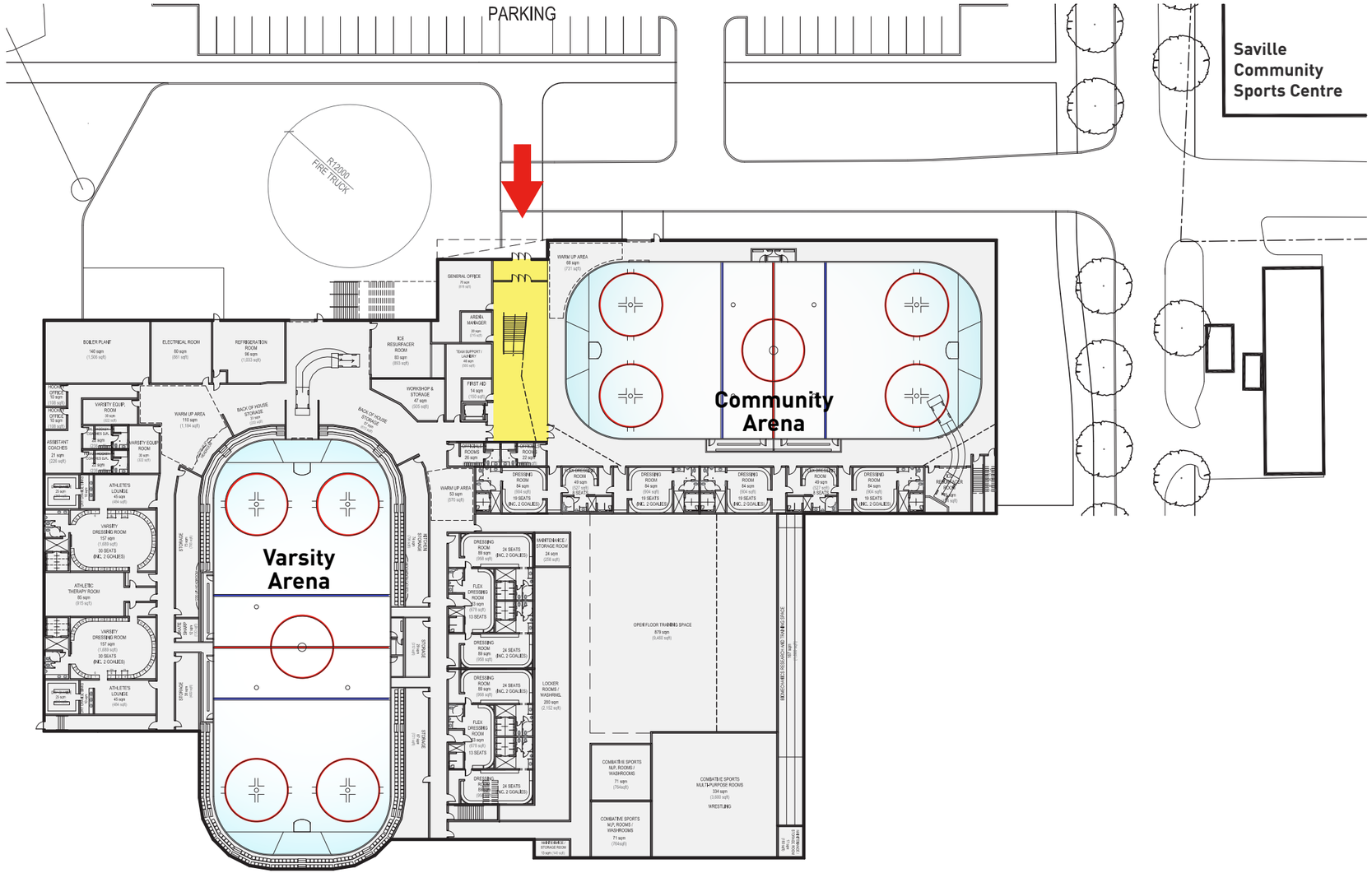
- University of Alberta Athletics - Golden Bears and Pandas Varsity student-athletes and affiliated programs
- Alberta Sport Development Centre *
- Professional sport teams
- Provincial, National and International competitive athletes *

*Identified or carded athletes

The program for the HPTRC includes a large open floor training space, a multi-purpose room for combative sports training, a 150' sprint track for biomechanics training and research, and laboratories for sport medicine research, and body composition. The HPTRC includes classrooms and office spaces, as well as change rooms and support spaces for its programs. A detailed program is included in Section 3.0.

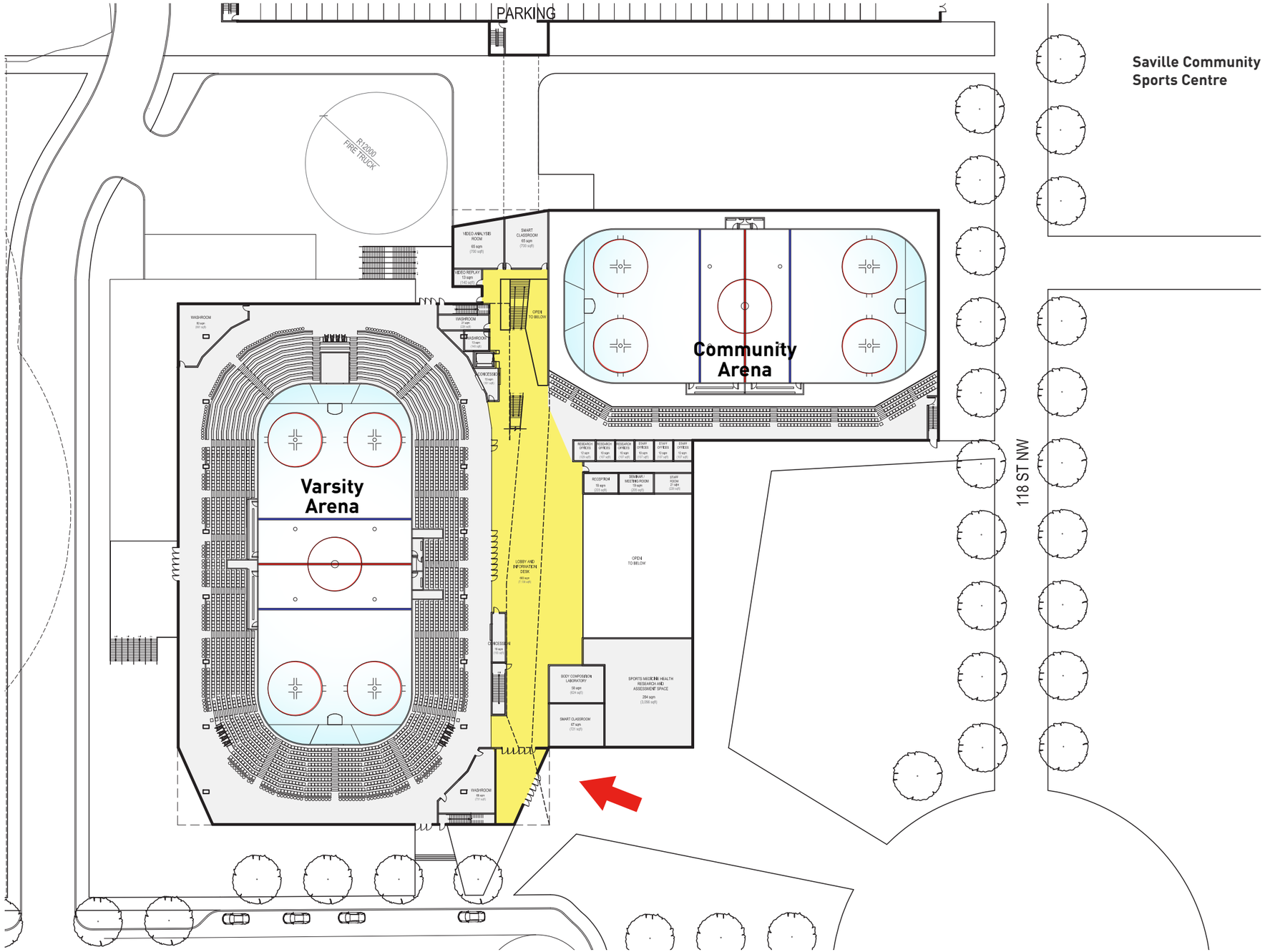
Today, the HPTRC is located in the Saville Centre on South Campus. The South Campus Community Ice Arena will include a new, purpose-built facility. The project is designed to allow the HPTRC to be built in the future when funding is available – once built, the HPTRC will be integrated into the overall design and operation of the SCCIA.

The HPTRC is designed to be on two floors with the training spaces at the event level of the Arena and the offices and laboratories on the concourse level. This allows the integration of shared uses between the training areas of HPTRC and the Varsity hockey program which is located adjacent to the Bears and Pandas hockey change rooms on the event level. The classrooms, offices and laboratories are located on the entrance level adjacent to the public concourses of the Arenas where they will be easily accessed by students from other faculties and the public.



High Performance Spectator Level Plan

NORTH

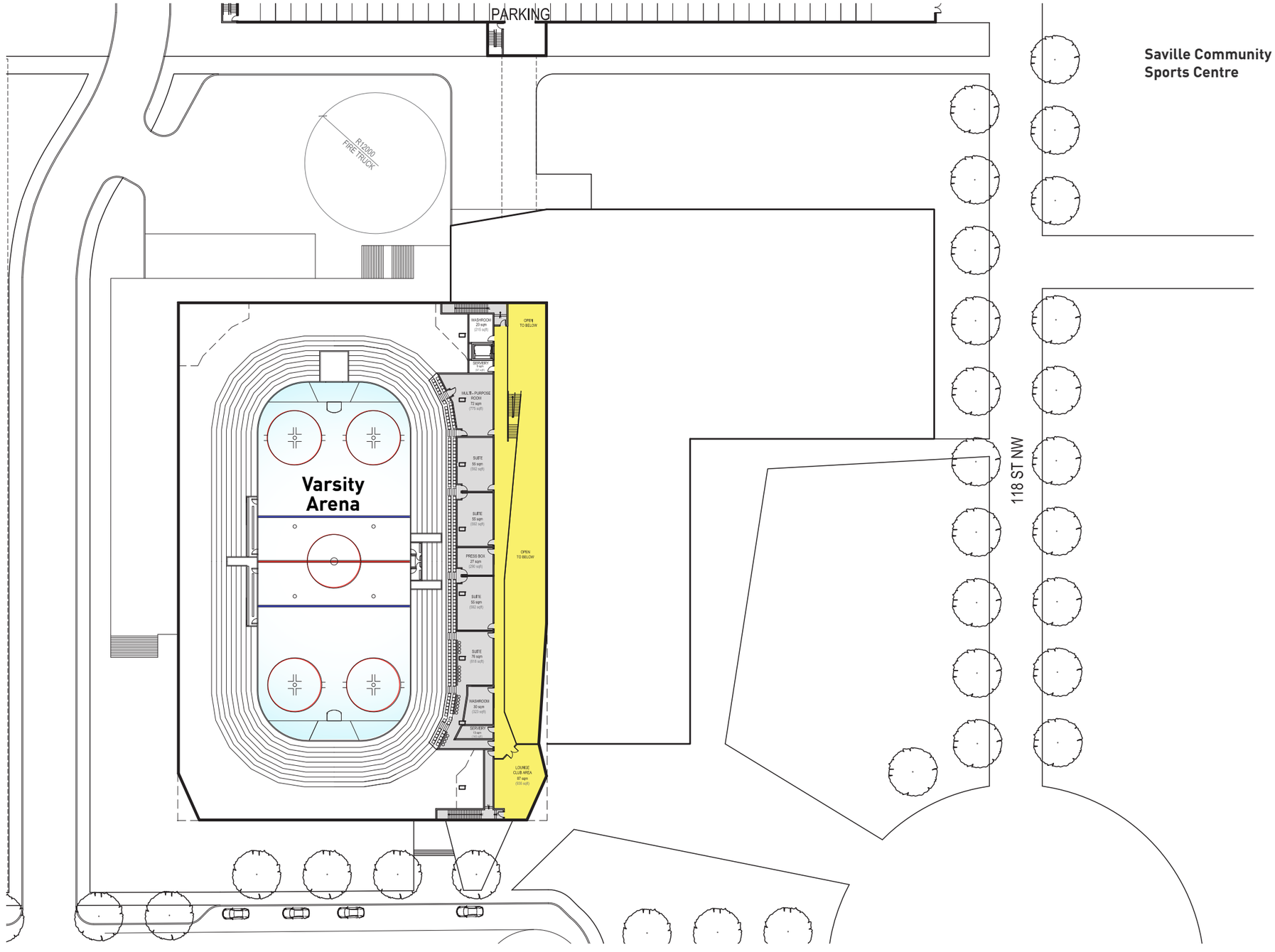


LEGEND

Spectators Area

High Performance Upper Suite Level Plan

NORTH



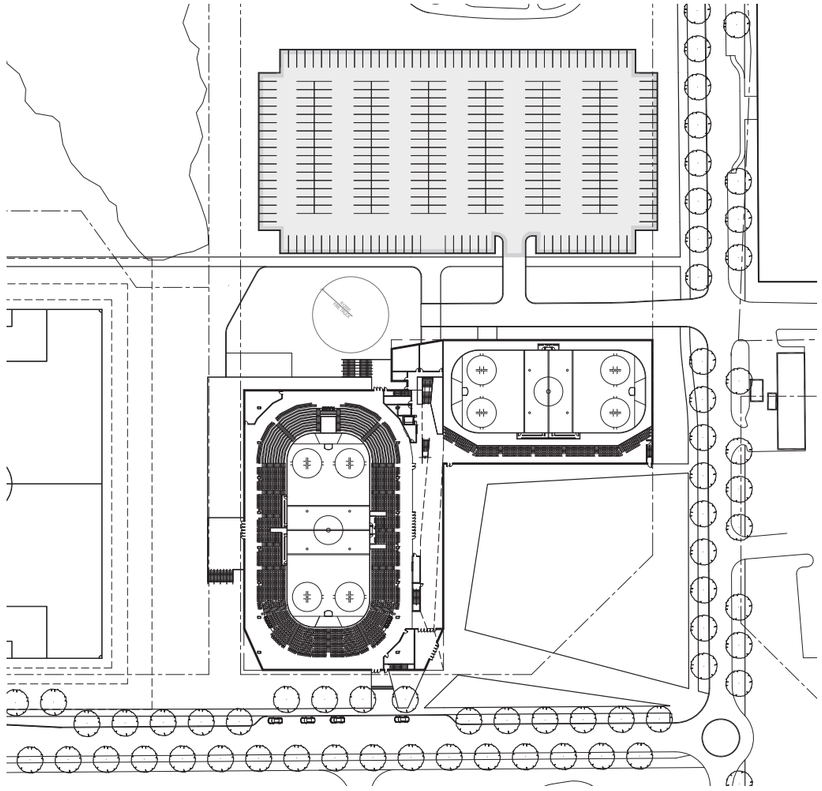
LEGEND

Spectators Area

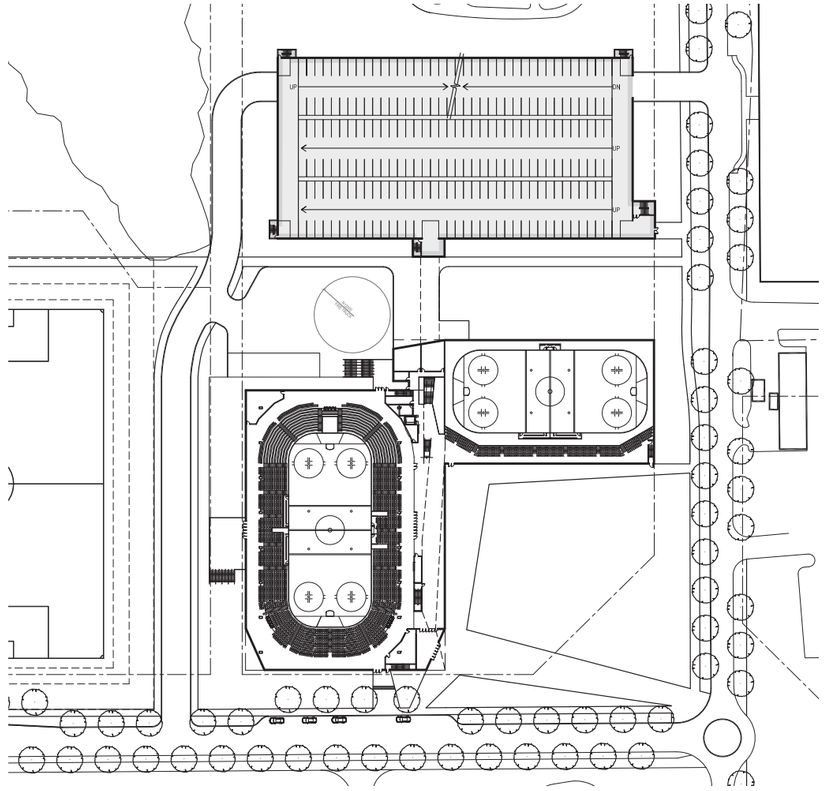
Parking Options

Two options have been explored to accommodate parking on site:

- A temporary gravel parking lot located directly North of the building site and South of the Laird W McElroy Environmental & Metabolism Research Centre, can be provided to accommodate 300 stalls. Access to this lot will be from an existing road running Esat-West from the Saville Community Sports Centre to 118th Street and beyond. Pedestrians will connect from this gravel parking lot to the South Campus Community Ice Arena through sidewalks to the community entrance.
- A three storey, open air, precast parkade located directly North of the building site and South of the Laird W McElroy Environmental & Metabolism Research Centre, can be provided to accommodate 600 stalls. Access to this parkade will be from the Esat side from 118th Street, and from a new access road on the West side of the Arena. The site's grading does not allow these two entrance points to be at the same level of the parkade; the East entrance will access the middle floor while the West entrance will access the lower floor. Pedestrians will connect from this parkade to the South Campus Community Ice Arena through sidewalks to the community entrance or through an above grade enclosed connection.



Gravel Parking Lot
300 Stalls



Three Level Parkade
600 Stalls

Spectator Entrance

Spectator Entrance at Night

Spectator Entrance

Community Entrance

South West Building Approach

South Esat Building Approach from Quad

5.0 Architectural

Building Description

The University of Alberta updated the Campus Planning and Design Guidelines in April 2016. These design guidelines were taken into consideration in the development of the following building design guidelines.

The U of A South Campus Community Ice Arena will be a slab on grade, steel framed structure on concrete pile foundations.

Prefinished insulated metal panels and a High Performance double glazed aluminum curtain wall system will enclose the building. Attached through a system of girts, embossed perforated aluminum panels will form a screen in front of the building enclosure around the entire facility perimeter. Both arenas will have a flat roof and SBS roofing membrane.

Interior partitions at the participant level will be durable and mainly comprised of concrete block with a higher degree of finishes in the Varsity dressing room areas. The spectator and upper suite levels will combine steel stud and gypsum partitions with glazed aluminum curtain wall in most areas. Additional acoustic measures will be taken when required to ensure an appropriate sound transmission class (STC) rating is achieved.

Materials

Specific building materials and finishes have been selected which build on the design intent outlined throughout Section 4.0. Both the interior and exterior materials have been specified for their durability, low maintenance and overall energy performance. The final building assemblies will be determined in conjunction with energy model testing to ensure the project's sustainability targets are met. These include but are not limited to the following assemblies:

Glazing Assemblies

Aluminum Curtain Wall

- High Performance double glazed sealed units, with low-E coating, structural silicon joints, in an aluminum thermally broken framing system

Exterior Wall Assemblies

Insulated Metal Wall Panel

- 1mm stucco embossed mill finished aluminum perforated standing seam panels w/ 65mm high ribs on thermal clips
- Galvanized steel structure
- 100mm micro rib fire rated insulated metal wall panels with paint coating

Roof Assemblies

SBS Roof

- 2 ply low albedo SBS granular cap sheet over 2 layers SBS base sheet
- 13mm fiberglass mat gypsum roof covered board
- Sloped insulation
- 2 layers – 51mm polyisocyanurate insulation
- 51mm non-combustible semi-rigid mineral fibre insulation R-32
- Self-adhering flexible membrane air/ vapour barrier applied directly to steel roof deck

Interior Partitions

Interior Partition

- 16mm gypsum board
- 152mm steel stud framing
- 16mm gypsum board

Interior Partition w/ Acoustic Rating

- 3 layers – 16mm gypsum board
- 92mm steel stud framing
- 25mm air space
- 92mm steel stud framing
- 2 layers – 16mm gypsum board

Block Partition

- 190mm concrete block

Fire Rated Partition

- 16mm fire rated gypsum board
- 152mm steel stud framing
- 16mm fire rated gypsum board

Ceilings

- Featured ceilings are proposed in the Varsity dressing rooms and central spine
- Gypsum board finished ceilings are proposed in all public spaces and suites
- Suspended acoustic ceiling tiles in offices and food preparation spaces
- Exposed ceilings in all dressing rooms, Varsity Arena bowl, service, back-of-house and storage rooms
- Low-e ceiling in the Community Arena

Flooring

Refer to the appendix for floor finish plans indicating types and extents of proposed flooring.

Site Servicing and Grading

Site Servicing

The South Campus Community Ice Arena design is coordinated with the grading and utility designs for South Campus. The Campus grading and storm water management design is currently being completed by Stantec, under separate contract to the University.

Grading

The grading around the Arena is designed to meet the following requirements:

- The arena site is tied into the proposed grading and storm water management strategy for South Campus
- The South spectator entrance is set at a geodetic elevation relative to the future plaza at the intersection of 63rd Avenue and 118th Street that is easily accessible by pedestrians: a slope up to the doors of about 4%. The South entrance brings spectators into the building at the concourse floor level.
- The North participant entrance and service entrance bring users into the building at the event level, to avoid having to carry hockey equipment bags up or down stairs, and to allow the ice resurfacer to drive into the building without a ramp. The event floor is 5.0m below the concourse floor.
- To minimize capital costs related to earthwork, the amount of earth excavated for the building is intended to balance with the amount of fill required for the plaza at the future High Performance Training Centre. Due to the expanding clay soils on this site, setting the event floor at lEsat 1.5 m below the existing grades where the moisture content of the clay is more stable provides a more stable base for construction.

Storm Water

The existing grades of the Arena site slope downwards from the South-East corner of the site (the intersection of 63rd Avenue and 118 Street), to the ravine at the North-West corner of the site. The storm water management plan for South Campus reverses this pattern, to direct storm water to the existing storm water retention pond South of 63rd Avenue.

A new underground storm water pipe will be installed along 118th Street to collect storm water and convey it to the existing storm water pond South of 63rd Avenue. This pond discharges into the ravine through an underground pipe along the West side of the Arena site. The soccer field proposed to the West of the Arena site is a surge pond connected to the existing retention pond. The discharge of storm water into the ravine is controlled for volume and rate.

In the Arena design, storm water from the roof of the building, parkade, and the East and South sides of the site will be directed to the new underground pipe along 118 Street. The parkade will be connected to the storm main by a new 380mm line, and the building will be connected by a new 460mm line. Storm water from the service yard at the North entrance of the Arena, and the West side of the Arena site, will be directed to the outfall in the ravine. Because the Campus's control structure for volume and rate is upstream of this part of the site, the service yard's storm water drainage system will need to include its own underground storage facility to provide volume and rate control. This is proposed to be an oversized pipe that ties into Man Hole #1. The storm water design is currently being coordinated with the University's overall design for the Campus. If the grade of the proposed pipe along 118 Street allow, the service yard could be tied into the overall drainage system.

Domestic Water

Domestic water will be provided from 118th Street through a new 150mm service. A water meter will be located in the ice resurfacer room of the Community Arena, at the Esat side of the building.

A new fire hydrant will be required for the Arena. This is proposed to be located near the North entrance, which will be considered the Principal Entrance for fire fighting purposes.

Sanitary

The building and parkade will be tied into the Sanitary utility along 118th Street each with their own 150mm service connection.

Natural Gas

Gas will be accessed from 118th Street. A gas meter will be located on the exterior of the building in the service yard.

Power

Power for the building will be tied into the existing 15kV vault through a 600V, 3 phase, 4 wire service, on 118th Street at the driveway of the Saville Centre. The transformer will be located in the service yard. The parkade will have its own power connection to this 15kV vault and will not be fed from the Arena.

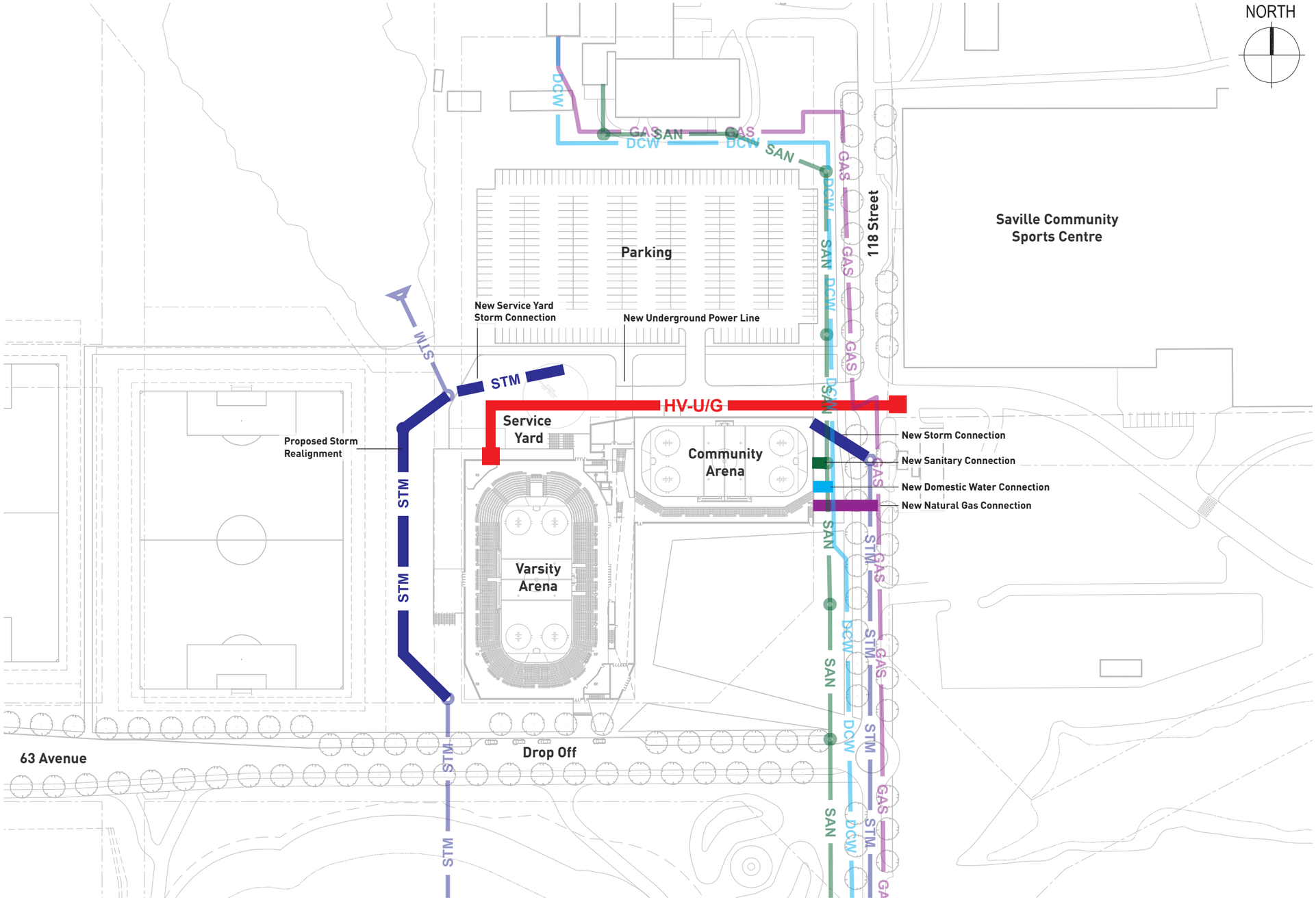
Communications

Communications infrastructure is located along 118th Street.

Abandoned services

The University has confirmed that the existing high voltage service and telephone service running Esat-West through the Arena's service yard can be abandoned and should not be connected to for the Arena development.

Site Servicing Plan



Building Code Analysis

Applicable Code

- Alberta Building Code 2014 - Division B, part 3

Classification & Construction Requirements

- table 3.1.2.1.
- major occupancy classification - A2
- article 3.2.2.24. - group a, division 2, up to 6 storeys, any area, sprinklered

1) except as permitted by sentences 3.2.2.7.(3) and (4), a building classified as group a, division 2, this is not limited by building area, is permitted to conform to sentence (2) provided

a) except as permitted by sentences 3.2.2.7.(1) and 3.2.2.18. (2) the building is sprinklered throughout, and

b) it is not more than 6 storeys in building height

2) except as permitted by article 3.2.2.16., the building referred to in sentence (1) shall be of noncombustible construction, and

a) floor assemblies shall be fire separations with a fire-resistance rating not less than 1hr.

b) mezzanines shall have a fire-resistance rating not less than 1hr, and

c) loadbearing walls, columns and arches shall have a fire-resistance rating not less than that required for the supported assembly.

Building area - 10,090 sq.m

Rating of bleacher Rakers

- bleacher rakers do not need to be fire rated - refer to detail 4/a002
- per article 3.3.2.2. - fire separations

3) if usable space exists under tiers of seats in arena-type buildings, a fire separation with a fire-resistance rating not less than 45 min shall be provided between the space and the seats or the space shall be sprinklered.

Fire alarm & Detection Systems

- per 3.2.4.8. an annunciator shall be installed in close proximity to a building entrance that faces an access route for fire department vehicles and complies with 3.2.5.5.(1)

Fire Separations & fire resistance ratings

- ice plant - 1 hour fire separation including additional requirements for class "t"machinery room per mechanical refrigeration code can/csa-b52
- ice resurfacing machine room Assuming the use of an electric machine, no fire separation should be required as machine is not a "motor vehicle"
- storage rooms in assembly occupancies are to have a 1 hour fire separation per 3.3.1.26.
- stairs and exits to maintain a 1 hour fire separation and fire resistance rating per article 3.4.4.1 and 3.4.4.2.
- janitor room - per article 3.3.1.21 (3) require no fire resistance rating
- fuel fired appliance service rooms - per article 3.6.2.1 (1) a fire separation with a 1-hour fire resistance rating is required
- electrical service rooms - per article 3.6.2.1 (6) require a 1-hour fire resistance rating is required

Firefighting Access

Access is proposed through the service yard.

- per 3.2.2.5. access route is required to the principal entrance and must be between 3 - 15m
- per article 3.2.5.6. access route required to be 6m wide, overhead clearance of 5m and gradient not more than 1:12.5 over 15m
- per article 3.2.5.15 (3) fire department connection is required to be between 3 - 15m from the principal entrance
- per article 3.2.2.15 (1) hydrant is required to be less than 45m

Proposed Maximum Occupant Loads

Varsity Arena Event Level =	800
Varsity Arena Bowl =	Maximum 3400
Suite Level Varsity Arena =	Maximum 300
Community Arena =	Maximum 400

Exiting & Means of Egress

- egress doorways & numbers of exits:
- per 3.3.1.5 (1) & 3.4.2.1 (1): two doorways are required from a room or suite where:
- occupant load is more than 60; or
- the travel distance to an egress door exceeds 25m; or
- area of room or suite is greater than 200 sq.m.
- travel distance & distance between exits:
- per 3.3.1.6 & 3.4.2.5 (1)c: maximum 45m travel distance to an exit from within a room or floor area.
- per 3.4.2.3.: lEsat distance between 2 required exits from a floor area shall be 1/2 of maximum floor area diagonal, but not less than 9m.
- corridors:
  - per 3.3.1.9.(1): the minimum width of a public corridor shall be 1100mm.
  - exit width & capacity:
  - per 3.4.3.2.(8)(d): 900mm minimum ramp or stair with required.
  - per 3.4.3.2.(8)(g): 800mm minimum doorway width required.
  - per 3.4.3.2.(1): 6.1mm per person for 1:8 sloped ramps, doorways, corridors, & passages, & 8.0mm per person for a stair consisting of maximum rise of 180mm & run of minimum 280mm.
  - exits through lobbies:
  - per 3.4.4.2.(2)(e)(iii) not more than one exit from a floor area is permitted to lead through a lobby

Barrier Free Requirements

- applicable to 50% of building entrances per 3.8.1.2
- applicable to washrooms per 3.8.2.3, 3.8.3.8, 3.8.3.9, 3.8.3.10, 3.8.3.11, & 3.8.3.12
- applicable to access doorways per 3.8.3.3
- applicable to public counters per 3.8.3.14
- applicable to elevators per 3.8.3.5
- applicable to ramps per 3.8.3.4

Flame Spread Ratings

- applicable to walls and ceiling finishes per 3.1.13.2
- exits - maximum 25 including floors per 3.1.13.8 and lobby exits per 3.1.13.2
- all other rooms and spaces - maximum 150

Sustainability

We understand that the South Campus Community Ice Arena will target LEED Silver accreditation to measure sustainability. Arenas consist of a number of specialized systems that have a significant impact on energy use, water consumption, and user comfort. The design of these systems is critical to achieving a sustainable end product.

Displacement Ventilation

Displacement ventilation is becoming the norm in most large assembly buildings. The Arena design incorporates a displacement ventilation system for the spectator Arena. Ventilation air is delivered at low velocity behind each seating row through adjustable supply air outlets. This approach eliminates overhead duct work and greatly improves user comfort.

Refrigeration

The refrigeration plant is a major source of electrical demand and the rinks a major user of water. Waste heat from the refrigeration plant will be captured and used for domestic hot water preheat, underfloor heating below ice surfaces, and the snow melt pits. It can also be used for dehumidification; however, this is a significant capital cost and is not included in the design at this time.

The refrigeration system will be a low-charge ammonia system.

Low-charge systems can eliminate up to 90% of the ammonia required, use up to 80% less cooling water when combined with adiabatic coolers, and reduce the number of pumps in the system. Recent experience suggests that low-charge systems are more efficient and produce less waste heat than traditional ammonia plants.

During the Design Development phase, we can explore the use of a CO2 refrigeration system. CO2 is beginning to be used for both primary and secondary refrigerants. It is natural, non-toxic, non-flammable with no net greenhouse effect. Liquid CO2 is circulated at a constant pressure and temperature under the slab which creates a more consistent ice surface; however, a CO2 plant is significantly less energy efficient than ammonia.

Refrigeration plant energy use is a function of the wet bulb temperature (humidity and temperature) of the Arena space and the radiant heat load on the ice. These loads can be significantly reduced through dehumidification and Low Emissivity (low-E) ceiling materials.

Comfortable temperatures can be maintained in an arena space without excessive refrigeration loads provided the air is kept dry. While stand-alone electric dehumidifiers can be used, gas fired desiccant wheel systems have proven superior and is what will be specified for this project. Desiccant wheel systems dehumidify, provide ventilation air, and sensible heat while using economical natural gas.

Solar radiation is absorbed by ceiling material and radiated to the refrigerated surface. This radiation can represent up to 25% of the load on a refrigeration system. A low-E ceiling can significantly reduce the load and run hours of a system. This is an appropriate application in the community rink and is included in the design for that rink, but due to the amount of structure, ducts and others systems suspended below the Varsity rink roof, this is not included in the design for the Varsity Arena.

Water Use

A consistent source of reclaimed water in the arenas are the snow melt pits. A typical twin arena will provide 10 m^3 (2600 US gal) of re-usable water daily from the ice melt pit. This is considered grey water and is therefore filtered and chlorinated in the same manner as rain water recovery systems and can be used for toilet flushing. This cost and feasibility of this system will be evaluated during the Design Development phase.

Ice resurfacing flood water is typically heated to eliminate gases in the water that raise its freezing temperature and reduces ice quality. Heating the flood water is a significant energy cost. "REAL ICE" is a flood water treatment technology which degases the water without heating. This allows the flood water to be applied at a much lower temperature than traditional hot water systems (60°F, vs 140-160°F). This technology can be explored in the Design Development phase of the project.

Ventilation

When spectators are not present, much of the ventilation load in the arenas is related to removing the exhaust from the ice resurfacing equipment. Electric ice resurfacing equipment is rapidly replacing Liquified Petroleum Gas and Natural Gas units. Electric machines are zero emission and significantly reduce the ventilation loads on the arena spaces. Our ventilation design is based on using electric ice resurfacers.

Occupancy loads in arenas are highly variable. Spectators will not be present most of the time, and change rooms and activity spaces are intermittently used. It will be important that fresh air quantities be controlled with CO2 and occupancy sensors.

Photovoltaics

The large expanse of the building roof is conducive to photovoltaics. The cost of photovoltaic panels is coming down and their efficiency and life span has been increasing. While the design does not include for their installation, the roof structure can be prepared to accommodate their future installation.

LEED Summary

The South Campus Community Ice Arena project is to meet and achieve ambitious levels of sustainable design and construction. Leadership in Energy & Environmental Design (LEED) certification, an independent, third-party verification for green buildings, is being pursued under its version 4 Building, Design + Construction: New Construction rating system. The project is aiming to achieve LEED Silver (50-59 points).

The design team brings considerable expertise and experience relating to arena projects and sustainable building design. LEED is a complementary framework that will ensure design takes a holistic approach and an integrative process which will support high performance and cost-effective project outcomes.

Due to the project's location, it is well suited to take advantage of existing infrastructure – public transit, street networks, pedestrian paths, bicycle networks, services and amenities, and existing utilities. As such, the project will maximize its proximity to the South Campus Fort Edmonton Transit Centre and nearby surrounding amenities.

To enrich the site's sustainable qualities the design team is exploring ways to incorporate open space, use low-impact development and green infrastructure, reduce heat island effects, and mimic natural water flow patterns to manage rainwater runoff. This exploration phase will continue into Design Development. Also, the project will reduce construction activity pollution and light pollution.

Arena projects, such as this one, offer a unique opportunity for water conservation. The project will be taking an "efficiency first" approach and will then recognize the use of nonpotable and alternative sources of water. The project will be aiming to reduce water consumption by approximately 40% through the use of water efficient fixtures and fittings and low adiabatic cooling in cooling towers. Furthermore, re-use of snow and ice from the arena to makeup water supply for toilets, urinals, etc. will have a significant impact on water use reduction. Finally, outdoor water use will be reduced through native and adaptive vegetation while an efficient irrigation system may be used, however, further investigation is needed to best align with the University's landscape maintenance operations on South Campus.

Energy on this project first begins with a design that focuses on reducing overall energy needs, then using highly efficient and performing systems and finally exploring renewable energy generation opportunities. Glazing selection, choice of climate-appropriate materials, high-efficiency HVAC systems partnered with smart controls will reduce the building's energy use. Building-level energy metering is included in the design; however, further analysis is needed to determine the cost benefit to advanced sub-metering. From an air quality standpoint, no chlorofluorocarbon (CFC-)-based refrigerants in HVAC systems will be used and ammonia, a naturally occurring refrigerant, with low ozone depleting and global warming potential will be used for the refrigeration plant. Consideration is being given to a photovoltaic system on the roof that could represent approximately 5% of the building's total energy needs.

From a materials and resources perspective, the project is prioritizing storage and collection of recyclables and construction waste management. It will aim to meet the University-wide waste diversion goal of 75%. Additional discussion is needed regarding conducting a whole-building life-cycle assessment. Finally, due to the particular nature of the building, material selection may be restricted making it especially difficult to meet the necessary thresholds for many of LEED's Building Product Disclosure and Optimization credits.

Indoor environmental quality protects the health and comfort of building occupants which is especially important in a sports and recreation facility. Various strategies are being examined to enhance the indoor environmental quality of the building such as prohibiting smoking near entries, outdoor air intakes and operable windows, as well as, examining the feasibility of operating entryway systems in a manner that does not pose problems to maintenance services. Furthermore, low-emitting materials will be selected, an indoor air quality management plan during construction will be created and implemented, and an indoor air quality assessment (building flush-out or air testing) will be conducted. Daylight, quality views and acoustic performance sustainable building strategies will be more closely examined in Design Development.

To conclude, the LEED Scorecard and associated points fluctuate as design and construction progress. At this snapshot in time, early in design, the preliminary LEED score is 48 YES 40 MAYBE 22 NO which positions the project within the LEED Certified threshold (40-49 points). 'Maybe' credits still need much more investigation from the project team which will lead to a more defined LEED score – where more points will move to the 'Yes' and 'No'. As such, it is extremely likely that the score will move into the LEED Silver (50-59) threshold, which is the project's sustainable design and construction goal.

LEED Summary provided by EcoAmmo

Refer to Appendix I for the LEED Scorecard

6.0 Structural

The scope of this project is to allow for the construction of a new 3,000 seat NHL size arena (Varsity Arena), a new 400 seat NHL size arena (Community Arena), and a new three level 600 stall parkade. The report provided summarizes the primary structural systems for the structures noted above, with the primary purpose of estimating each of their construction values at a Schematic Design level. Below summarizes the primary structural systems for each project component.

Varsity Arena - Superstructure

The suspended spectator and upper levels will be comprised of steel deck with concrete topping, supported by structural steel beams and columns. The roof structure will be comprised of 3m deep flat steel trusses spanning the width of the arena at an assumed spacing of 11m on centre. The trusses support steel beams and roof deck. As part of our report alternate framing options are provided for the spectator level and roof.

Community Arena - Superstructure

The suspended spectator level will be comprised of steel deck with concrete topping, supported by structural steel beams and columns. The roof structure will be comprised of roof deck and 2.2m deep open web steel joists (OWSJ) at 1.8m on centre spanning the width of the arena. The OWSJ are supported on steel beams and steel columns at 9m on centre. As part of our report an alternate framing option is provided for the roof framing assembly.

Varsity and Community Arena – Substructure

The lower programming space (pre-cast bleachers and ice level) are situated 5m below finished grade and entry/ spectator level.

The slabs on grade for both arenas require a relatively high level of slab performance with minimal slab movement. Due to the high plastic clay found on site, measures were taken to prevent future slab movement of both arenas: present design assumes a 220mm structural cast-in-place concrete reinforced slab on grade (complete with 100mm of void form) for both the ice level slab system and grade supported spectator level

The ice slab assembly for both arenas will consist of a 150mm reinforced cast-in-place cold slab, poly slip-sheets, rigid insulation, a leveling sand layer, and a 250mm reinforced concrete hot structural slab on grade.

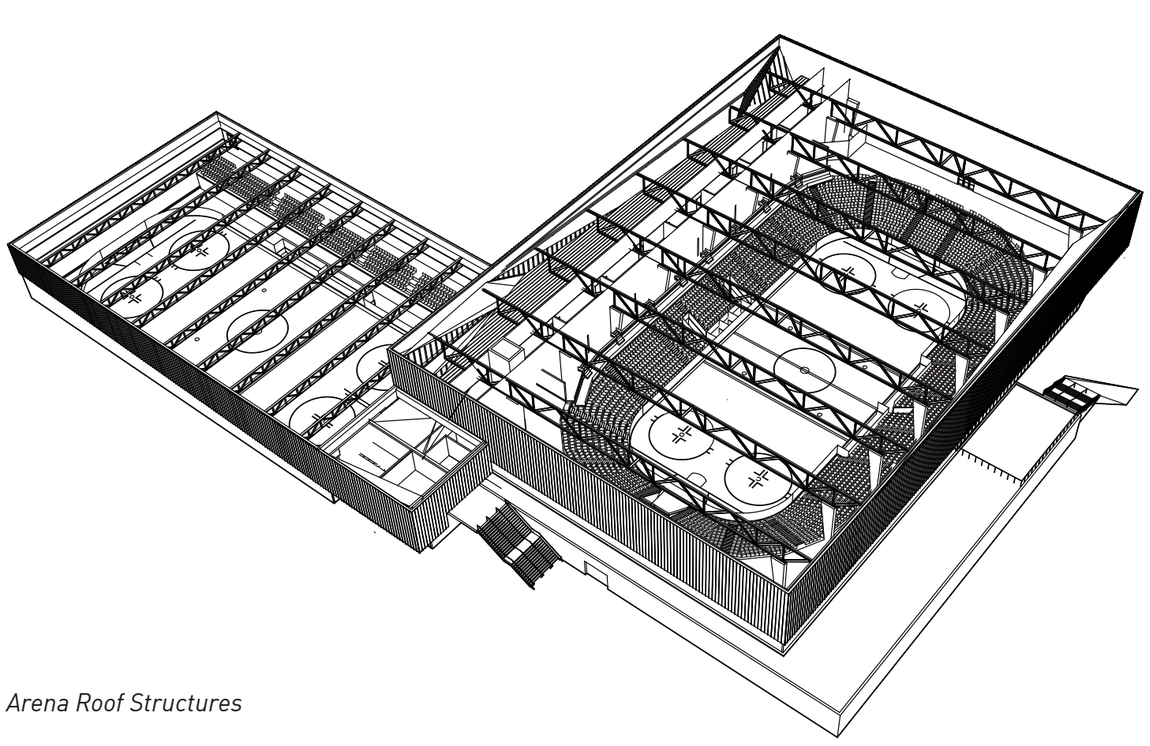
For both arenas the superstructure, perimeter grade beams, bleachers, ice slab assembly, and structural slab-on-grade will be supported on cast-in-place concrete belled piles, founded in the very stiff clay till.

Parkade

The primary structure of the upper parkade levels consists of precast double tees spanning over two stalls and the drive aisle (18 metres). The interior double tees are supported on the pre-cast beams and a vista wall, whereas the exterior double tees are supported on load bearing pre-cast spandrel panels. The parkade superstructure will be supported on cast-in-place concrete belled piles, founded in the very stiff clay till.

The ground floor level of parkade will consist of either a 125mm cast-in-place reinforced concrete slab on grade or asphalt paving.

The structural Schematic Design report should be considered in conjunction with the drawings and sketches provided herein. In addition, the report outlines further items that should be given consideration when developing a schematic estimated budget.



Arena Roof Structures

7.0 Mechanical

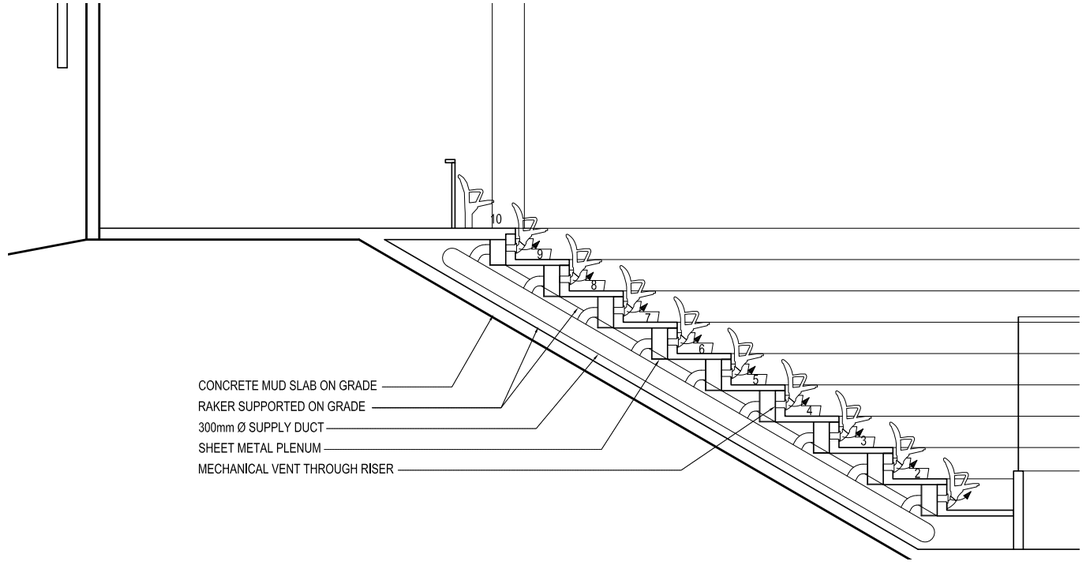
The Mechanical Design Concept for the proposed University of Alberta South Campus Community Ice Arena and system have been selected to:

- Provide a safe and comfortable indoor environment for all students and visitors
- Provide exceptional indoor air quality for an enhanced user experience.
- Provide systems designed for longevity that are accommodating to maintenance and renewal
- Be cost effective in design and energy efficient in operation
- Provide appropriate levels of humidity control for the variety of different space types (e.g., Arenas)
- Utilize a pragmatic design philosophy with well-tested and robust system and equipment choices

The primary focus of any building mechanical system is to provide thermal comfort and acceptable indoor air quality, the two of which are critical elements that contribute to a facility occupant's well-being. Indoor environmental conditions such as air temperature, humidity levels, presence of drafts, and other design considerations such as mechanical system aesthetics, sound levels and energy efficiency all contribute to the promotion of well-being.

The mechanical design shall comply with the most current version of the following codes and industry standards:

- Alberta Building Code
- Model National Energy Code Building (MNECB), Canada
- Plumbing Code of Canada 2010
- Alberta Fire Code 2006
- CAN/CSA B149.1 Natural Gas Installation Codes
- National Fire Protection Association (NFPA) Standards
- Canadian Standards Association (CSA)
- CSA B52-99 – Mechanical Refrigeration Code
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- ASHRAE 55-2010 Thermal Environmental Conditions for Human Occupancy
- ASHRAE 62.1-2001 Ventilation for Acceptable Indoor Air Quality
- ASHRAE 90.1-2010 Energy Standard for Buildings
- University of Alberta Design and Construction Standard and Guidelines



Displacement Ventilation Seat Section

8.0 Refrigeration

Executive Summary

The University of Alberta plans to construct a new twin arena facility with seating capacities of 3000 and 400 respectively. A central refrigeration system located in a dedicated refrigeration mechanical room will provide cooling for the two NHL sized ice surfaces. The proposed refrigeration system is a low charge ammonia system sized with 250 TR capacity, with calcium chloride brine or ethylene glycol as the secondary refrigerant circulated under the refrigerated slabs. The proposed system has the required capacity to allow both arenas to operate year-round, and provide optimal ice conditions in high load conditions such as a Golden Bears hockey game in high outside ambient conditions.

A low charge ammonia system can reduce the mass of ammonia in a system to as low as 0.5 lbs/TR, compared to existing ammonia systems servicing twin arenas which may have as much as 10-12 lbs/TR. Low charge systems allow the entire ammonia system including the relief system to be enclosed within the class T mechanical room. The proposed system will use energy efficient compressors, exchangers, fluid cooler, VFDs and controls to maximize the efficiency of the system.

The system includes the following components:

- PLC Control system including required transmitters, with MCC to house all starters
- Three Mycom MII series compressors with VFDs to provide redundancy, efficiency and long maintenance intervals
- Plate and frame condenser to minimize piping volumes and refrigerant charge
- An adiabatic fluid cooler to reduce the water usage by up to 80%, and remove water treatment requirements when compared to a traditional system
- Two direct expansion, plate and frame chillers for redundancy, efficiency and to minimize piping volume and refrigerant charge
- VFD control of secondary refrigerant pumps to maximize efficiency
- Heat reclaim for underslab heating, snow melt pit, and domestic water preheat
- A deluge tank for the relief system discharge to keep all ammonia within the Class T mechanical room envelope
- Calcium chloride or ethylene glycol secondary refrigerant to be circulated under the refrigerated slabs
- Secondary refrigerant distribution system to provide cooling the refrigerated slabs for each arena.

Ammonia is up to 25% more efficient that alternative refrigerants, is a natural refrigerant with no ozone depleting or green house gas effects, and is easily detectable by smell (self alarming) at low concentrations.

Ice Slab Refrigeration Lines

9.0 Electrical

Design Criteria

The electrical systems will comply with the current Electrical Safety Code, all local and provincial laws having jurisdiction and the University of Alberta design standards. The project will be designed to meet the needs of an active sports and entertainment facility, with the following criteria adopted as a basis for design and future development of the systems:

- Reliability, flexibility and simplicity of operation
- Standardization of equipment
- Maintainability of major systems components with negligible downtime
- Space for future
- Sustainability
- Interfacing with the University of Alberta systems.

Power Distribution

The main electrical system will be via underground feeders in a concrete ductbank from the existing 15kV substation located to the East of the Arena on 118th Street. The parking garage will be serviced from a separate incoming service from the 15kV substation. The University of Alberta Varsity Arena will be serviced from a pad mount switch cubicle feeding a 1500 kVA/600/347V delta/wye transformer to a 2000A switchboard in the main electrical room. A central battery system consisting of two 20 kW inverters is to be provided for all emergency lighting and exit signs in the Arena. A 5kW inverter will be provided in the parking garage.

Note: *For additional event power loads, the transformer will be 2000kVA and the main switchboard will be 2500A. Additional distribution equipment for events includes panels, breakers, conduit, wiring and connectors for broadcast shore power, show power, show lighting and concessions. A transfer switch to accommodate provisions for a temporary generator which would be used for special events requiring no interruption during power failures. The temporary generator would be located outside of the main electrical room.*

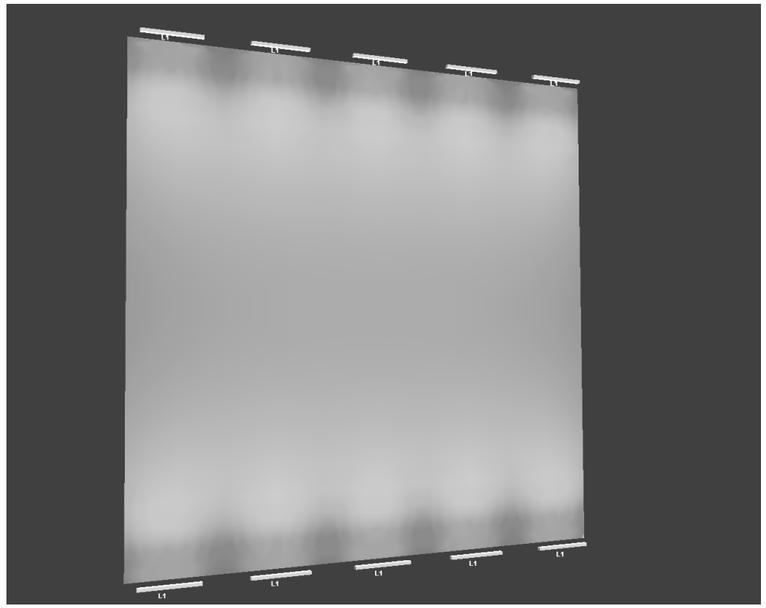
Lighting

LED luminaires will be used throughout the facility in all interior and exterior areas. Site and parking areas will maintain safe light levels with a full cut-off and glare control to avoid off site lighting spill and night sky pollution. Rink areas will utilize suspended, high output linear sport LED luminaires controlled by on-off switches. Lighting throughout is to be controlled by a low voltage control system, photo cells, motion sensors and daylight sensors. Envelope lighting will be provided around the perimeter of the building.

Note: *For additional event lighting control, dimmers are to be provided for lighting requirements in the rink areas.*

Systems

The Arena facility will be provided with an addressable two stage fire alarm system with a main annunciator and remote annunciator panels. Speakers and strobes will be provided throughout the building. The speakers are to be integrated with the public address system. A fire alarm system for the garage is not required by code and will not be provided. Power and communications will be provided for main and auxiliary scoreboards, game clocks, coaching boxes and benches, instant replay and video systems, televisions and signage. Security and communications wiring and devices will be provided. A lighting protection system is not required by code and will not be provided. A wireless system will be provided to meet the needs of the U of A staff and hockey team.



Exterior Screen Lighting Strategy

10.0 Parkade

The program for the parkade is to accommodate 600 parking stalls. Based on the size of the site, a three-level structure will be needed to achieve this count.

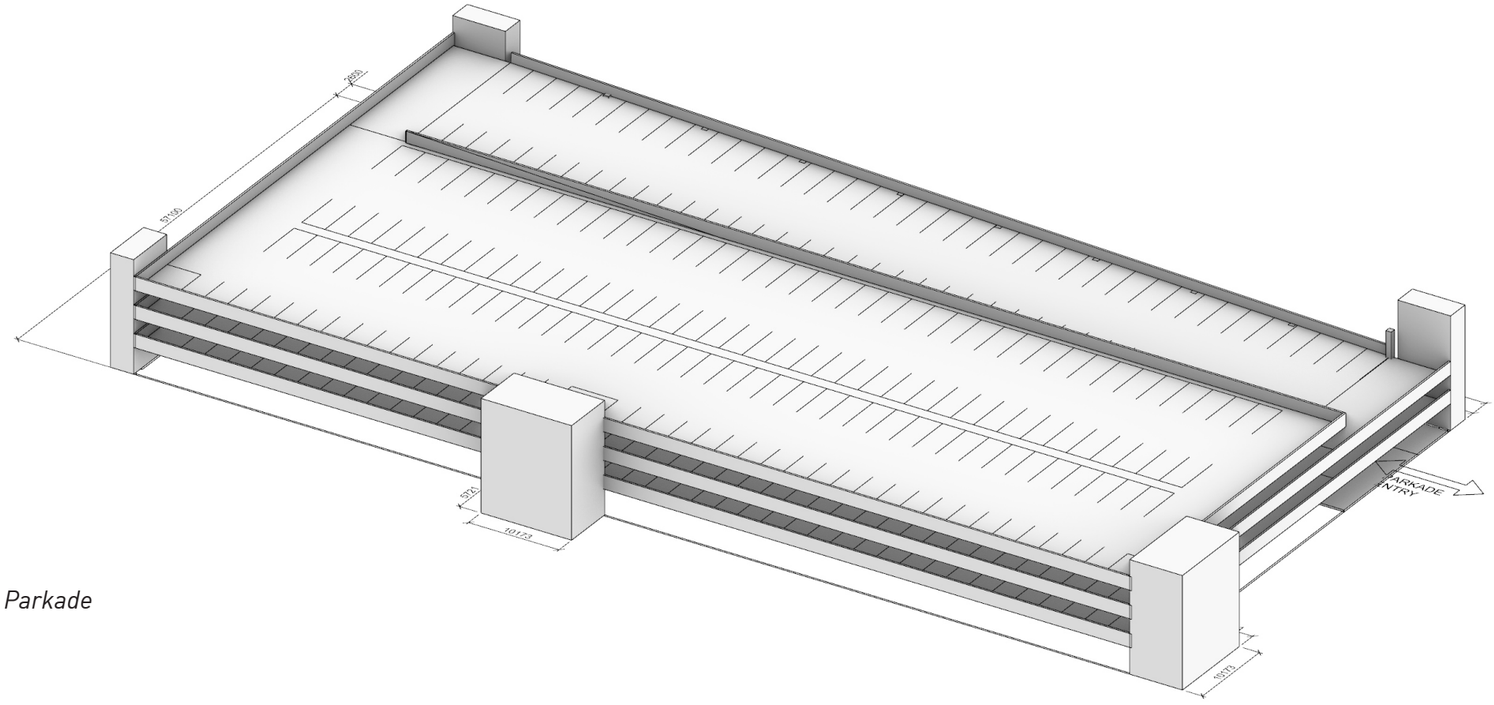
The parkade will have two vehicle entrances: one from 118th Street to the Esat, and one from the new access road on the West side of the Arena. Because of the slope of the site, these entrances are not to the same level: the Esat entrance will access the middle floor of the parkade, and the West entrance will access the lower floor. This staggered entrance gives flexibility in how parking stalls are assigned. For example, during an event the lower floor can be used for participants, and the upper floors used for spectators.

The parkade layout consists of three double-loaded drive aisles, with two-way traffic in each aisle. Two of these aisles will have a flat floor, and the third aisle will be sloped to ramp between floors.

The payment system used by the University is a pay-and-display system. Therefore, no gates or stacking is required in the layout.

There will be an open-air stair at each corner of the parkade for emergency exiting and general access by users. In the centre of the South side facing the Arena will be a future bridge connection to the Arena: an outdoor bridge can be built from the second floor of the parkade to the concourse level of the Arena. This bridge will provide a direct connection for spectators from parking to the entrance of an event without going through the community rink entrance, which may be operating as a community rink during an event in the Varsity Arena.

The parkade will be an open-air structure. Therefore, it does not require ventilation, sprinklering or a fire alarm system. The parkade will be built as a pre-cast concrete structure, with double tees spanning 18m. In other words, there will not be columns between the parking stalls and drive aisles – this aids in the quick entrance and exit of vehicles before and after an event. The loWest floor of the parkade will be a concrete slab-on-grade. The parkade will have be connected to services in 118th Street for power, sanitary, and storm water. The services will be separate from the Arena and not sub-metered.



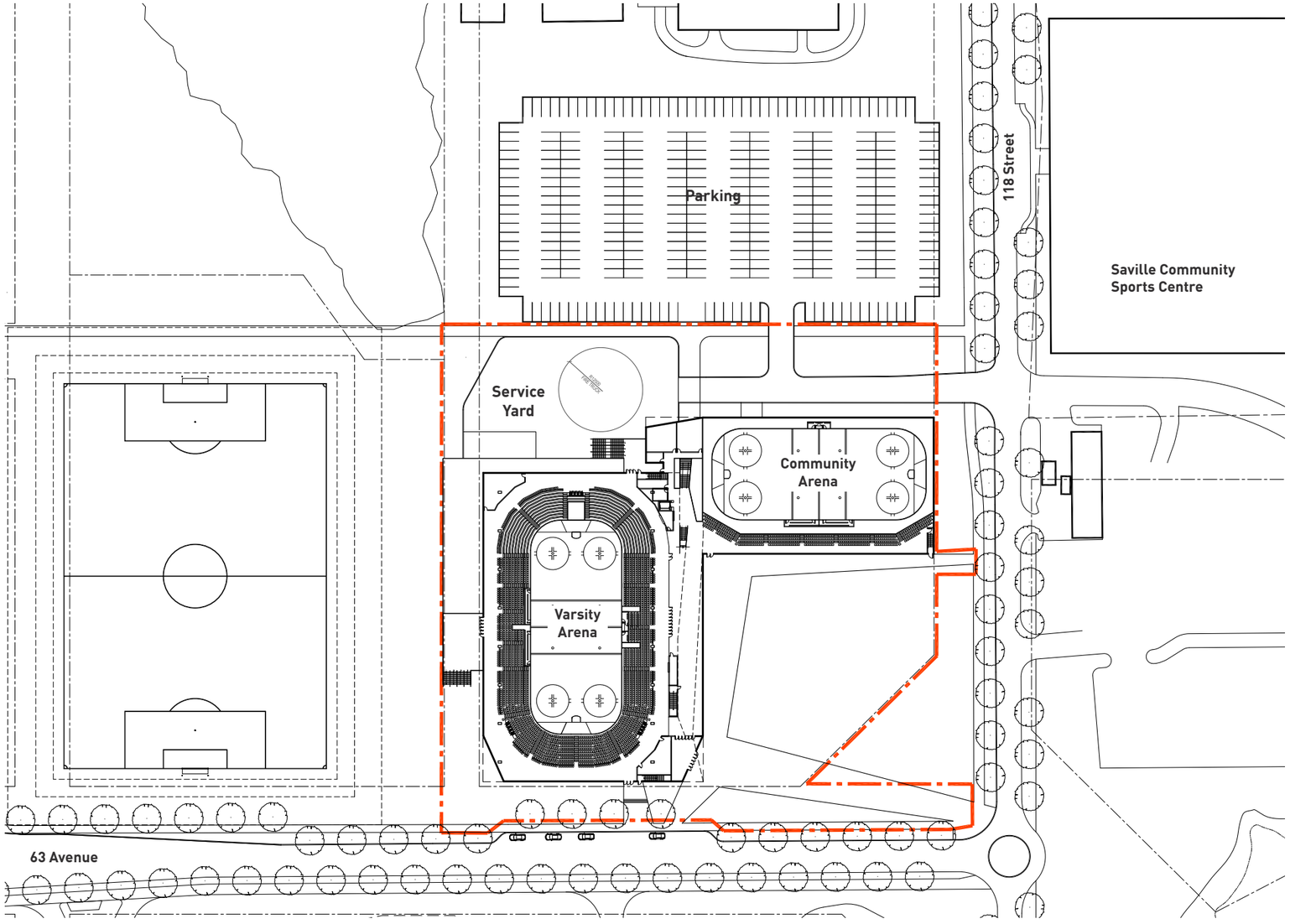
Parkade

11.0 Probable Cost of Construction

The South Campus Community Ice Arena project scope extends to the sector boundary on the Esat including a new sidewalk connection, 63rd Avenue at the South, the building extent to the West, and the parking lot edge at the North as depicted in "Project Scope Boundary" diagram.

GEC Architecture, PCL Construction, and CostPlan Management are currently working together to develop the estimated probable cost of construction.

Refer to Appendix G for a detailed cost estimate provided by Costplan. Value Engineering in Appendix H options are also included for considerations.



Project Scope Boundary

12.0 Schedule

At this time the design and construction schedule have not been determined. We expect that the schedule will be dependent upon funding, the approach to construction procurement and other University requirements.

Schematic Design Report Sign-Off Sheet

GEC Architecture

Peter Osborne, Design Project Leader

Signature Date

David Edmunds, Lead Design Architect

Signature Date

University of Alberta

Kerry Mummery, Dean,Faculty of Kinesiology,
Sport, and Recreation, Faculty Affairs

Signature Date

Cheryl Harwardt, Director
Campus & Community Recreation

Signature Date

Andrew Sharman, Vice-President
Facilities & Operations

Signature Date

Pat Jansen, Associate Vice-President
Facilities & Operations - Planning & Project Delivery

Signature Date

Ben Louie, University Architect
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Todd Werre, Director
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UNIVERSITY OF ALBERTA

SOUTH CAMPUS COMMUNITY ICE ARENA
APPENDICES TO THE SCHEMATIC DESIGN REPORT

GEC ARCHITECTURE AUGUST 30 2018

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Appendices

APPENDIX A
ARCHITECTURAL

PROJECT: University of Alberta Varsity Twin Arena
PROJECT NO.: 5594
ORIGINAL DATE: 2018-06-01

SECTION 00 00 01
OUTLINE SPECIFICATIONS

This Outline Specification is based on the CSC/CSI UniFormat for Building Construction. Proposed assemblies and systems are presented in this manner to assist the Owner, Construction Manager/Cost Consultant, the Prime Consultant and their Consultants determine appropriate methods of construction and confirm budget pricing.

Information from this outline specification will be used during Detail Design and preparation of the Project Manual (based on MasterFormat 04). It will also be used as a coordination tool for the Construction Manager and other Consultants.

General Requirements

The General Contractor shall provide and be responsible for the following general requirements:

1. Coordination of all construction and related items.
2. Project meetings including start-up meeting and regularly scheduled progress meetings.
3. Submittals including shop drawings, project data, samples and mock-ups including, but not limited to mockups of exterior aluminum curtain wall, glazing, metal cladding and the like.
4. Critical path construction schedule, including phasing of the work.
5. Quality control including all testing and inspections paid for by The Owner and cooperation with testing agencies selected by the Consultant, and inspections by authorities having jurisdiction.
6. Temporary facilities including secure temporary 2.4 m high chain link site hoarding, security, site lighting, temporary offices, sanitary facilities, temporary heating and temporary power and all other temporary facilities as required to facilitate construction of this project.
7. Construction safety precautions as required including fire safety precautions and W.H.M.I.S requirements.
8. Conformance to all applicable codes and regulations, including the Alberta Building Code 2014, National Fire Code of Canada and Occupational Health and Safety Act requirements.
9. Systems demonstrations.
10. Testing adjusting and balancing of systems including mechanical and electrical systems.
11. Project record documents including operation and maintenance manuals, record drawings.
12. Project clean-up.
13. Spare parts and maintenance materials.
14. Warranties and bonds, including 50% Performance Bond and 50% Labour and Materials Payment Bond.
15. Project close-out.

	ELEMENT	DESCRIPTION	MASTER FORMAT
A	**FOUNDATIONS**		
A.1	**Foundations**		
A.1.1	Wall Foundations (Standard Foundations)	Standard excavation (minor shoring may be required on east and west walls.), formwork, and steel reinforcements for cast in place strip footings for foundation walls.	03 11 00 03 20 00 03 31 00
		Compacted backfill, formwork, keyway, perimeter insulation, weeping tile, sump pits for drainage and at each elevator (1).	31 23 00 07 21 00

U of A Varsity Twin Arena
Outline Specifications

		Rigid polystyrene insulation on outside of foundation Self adhered waterproofing membrane	07 13 00
A.1.2	Dewatering	Geotechnical report noted groundwater encountered at depths of 6.0 m or more; groundwater levels should be monitored periodically until construction.	31 23 19
A.1.3	Structural Slab-on Grade	Compacted fill, under slab insulation, vapour retarder, reinforcing, expansion joints, control joints. Sloped to floor drains, finish.	03 11 00 03 20 00 03 31 00 03 35 00
A.1.5	Foundation Drainage	Weeping tile system under foundation including excavation, compacted backfill, drainage cloth, perforated weeping tile.	32 11 23 33 05 33
A.1.6	Foundations	Rigid polystyrene insulation on outside of foundation Self adhered waterproofing membrane	07 21 00 07 13 00
A.1.7	Mousture Protection	Waterproofing on the foundation wall beneath the exterior perimeter insulation Rigid polystyrene insulation on outside of foundation Self adhered waterproofing membrane	 07 21 00 07 13 00
B	**SHELL**		
B.1	**Superstructure**		
B.1.1	Floor Construction	Concrete topping on metal deck	03 30 00 05 30 00
B.1.2	Floor Construction	Light weight concrete topping	03 30 00
B.1.3	Roofing Decks and Slabs (Roof Construction)	Structural and Miscellaneous Steel – See Structural Metal Decking c/w gypsum sheathing and semi rigid insulation (R30) – See Structural	05 10 00 07 20 00
B.1.4	SBS Roofing Membrane	2 ply low albedo SBS granular cap sheet over 2 layers SBS base sheet 13mm fiberglass mat gypsum roof cover board (DensDeck Prime Roof Board or sim.) Sloped insulation to drain 2 layers 51mm polyisocyanurate insulation over 1 layer 51mm non-combustible semi-rigid mineral fiber insulation R-32 Self adhering flexible membrane air/vapour barrier applied directly to steel roof deck (Sopravap'R)	07 52 00 09 21 16 07 21 00 07 27 27
B.1.4	Roof Pavers	600 x 600 x 50 precast concrete roof pavers installed level on adjustable pedestal system. Pedistals installed on 25mm thick extruded polystyrene insulation pads on SBS roofing as described above	07 52 00 07 60 13
B.1.6	Fire Proofing		07 81 00
B.2	**Exterior Walls**		
B.2.1	Exterior Cladding w/ Screen	Minimum 1mm thick Stucco embossed mill finished aluminum perforated standing seam panels with 65mm high ribs spaced at 500mm o.c. on thermal clips (Kalzip, Bemo, or approved alternate)	07 41 13 07 21 00 07 42 13

		Galvanized steel structure support 100mm Micro rib fire rated insulated metal wall panels arranged vertically (R14) with Mica Fluropon Classic II PVDF paint coating. Horizontal framing to suit. (Kingspan, Vicwest, or approve alternate)	09 91 10
B.2.2	Exterior Cladding	100mm Micro rib fire rated insulated metal wall panels arranged vertically (R14) with Mica Fluropon Classic II PVDF paint coating. Horizontal framing to suit. (Kingspan, Vicwest, or approve alternate)	07 21 00 07 42 13 09 91 10

B.3 Exterior Protection Devices

B.3.1	Flashings and Trims	Roof, top of wall, through wall, jambs and heads of doors and windows, and other flashings required for project and complete building envelope shall be prefinished galvanized steel, 0.607 mm thickness. Aluminum curtainwall and window sections shall have extruded aluminum sill flashings installed by window installer with custom finish to match frames.	07 60 00 07 90 00

B.4 Exterior Windows

B.4.1	Curtain Wall Glazing System	High performance aluminum curtain wall framing for double glazed curtain wall system. Using manufacturer's standard components, including glass reinforced nylon thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements. Vent and pressure equalize glazing pockets and drain to the exterior. Provide 75mm snap caps to vertical and horizontal mullions. Acceptable Products: - Kawneer 1600 UT System 1 - Alumicor ThermaWall 2600 Series - Engineered Aluminum Products Series 130 HP Framing - Clear anodized aluminum finish. Low thermal conductivity thermal separators either inert polymerized material or soft PVC. Anti-rotational channels: PVC channels, minimum 2.1mm wall thickness, of size to suit glazing rabbet to curtain wall framing, one length piece per location. Provide sealed insulating glass units meeting the requirements of CAN/CGSB-12.8-97 and ASTM E2190, comprised of two panes of glass factory sealed and separated by dehydrated air space. Thickness of glass for each pane determined by window size, snow loads and wind/suction loads but minimum glass thickness 6mm each pane; 25 mm total thickness for double glazed units. Manufacture sealed insulating glass units using warm edge black spacers without edge channels, that is, with bare edges. Use two stage seal method of Manufacture. Double glazed sealed units, Gold Eclipse 6mm over Solarban 60 (#3) 6mm Clear, c/w low-e coating Guardian Sunguard Superneutral 68 on surface #2, on 6mm clear glazing. Provide argon gas fill to sealed units.	08 80 50

B.4.3	Aluminum Windows	High performance aluminum framing for double glazed punched windows (similar to Kawneer)	08 51 00

B.5 Exterior Doors

B.5.1	Exterior Steel Doors and Frames Glazing	Exterior thermally broken frames consisting of galvanized steel, nominal 1.9 mm core metal thickness, 150 mm nominal depth with 50 mm face width and having the following features: - Fully welded frames reinforced as required to suit door opening requirements. - Fill frames with polyurethane, low expansion foam-in-place insulation. - Connect to building air/vapour retarder membrane. Doors consisting of zinc wipe coated steel, nominal 1.5 mm metal core thickness, primed ready for painting and having the following features: - Fabricated full flush seamless, pan type with vertical and any other visible edges having seams continuously welded, filled and ground smooth. - Polyurethane insulated core bonded to door skins having insulating value of nominal RSI 1.5.	08 11 00 08 71 00
B.5.2	Aluminium Doors	Exterior clear annodized aluminum framed entrance system with double glazed sealed units to match exterior glazing: Kawneer Insulclad 360	08 44 00
B.5.2	Overhead Coiling Doors		08 33 00
B.5.3	Overhead Sectional Doors		08 36 13

B.6 Soffits

B.6.1	Prefinished Metal Soffit	Sheet steel: minimum 0.61 mm thick base metal, Z275 galvanized sheet steel conforming to ASTM A653M, SS Grade 33, or AZM165 Galvalume, sheet steel conforming to ASTM A792M SS Grade 33. Soffit Profile: Design based on AD300 as manufactured by Vicwest Membranes as per 07 25 00. Soffit vents: 100mm diameter, PVC ventilation plugs, insect proof, with vent area determined in accordance with CAN 3-A93-M82..	07 42 13

C INTERIORS

C.1 Non-Rated and Rated Interior Partitions

C.1.1	Interior Partition	190mm concrete block Stack bound, painted	04 04 25 09 91 10
C.1.2	Typical Interior Partition	1 layer 16mm gypsum board on each side of 152mm studs to be spaced at 600mm o.c. taped and sanded to AWCB Level 4, all surfaces finished with a minimum 3 coats of paint including primer.	09 21 16 09 91 10
C.1.3	Acoustic Partition	3 layers 16mm gypsum board on one side of 92mm studs to be spaced at 400mm o.c., 25mm air space, 92mm studs to be spaced 400mm o.c. with	09 21 16 09 91 10

		2 layers 16mm gypsum board taped and sanded to AWCB Level 4, all surfaces finished with a minimum 3 coats of paint including primer.	
C.1.4	Rated Interior Partition (1 hour)	1 layer of 16mm fire rated gypsum board on each side of 152mm studs taped and sanded to AWCB Level 4, all surfaces finished with a minimum 3 coats of paint including primer. Steel studs to be spaced at 600mm o.c. Partition to extend to underside of slab or roof deck and have bottom of track sealed with fire stopping	07 90 00 09 21 16 09 91 10
C.1.5	Rated Shaft Wall	Components required for a complete ULC fire resistance rated shaft wall assembly with proprietary components forming a system consisting of: Commercial steel framing system, Gypsum shaft wall liner panels, Gypsum board facer panels, screws, tape, joint compound and all other accessories required for a non-load bearing shaft wall partition.	07 90 00 09 21 16 09 21 40 09 91 10

C.2 Interior Doors

C.2.1	Hollow Metal Doors and Frames	Standard and fire-rated types with flush faces Frames shall be fully welded and reinforced as required to suit door opening requirements. Glass lite provided in certain hollow metal doors	08 11 00 08 70 00
C.2.2.	Aluminum Framed Entrances	Interior doors to be thermally broken medium syle type (similar to 350 series by Kawneer) with double glazed clear glazing.	08 41 00
C.2.3.	Wood Doors	Architectural grade, premium doors, having structural laminated wood stiles and blocking, solid particleboard core, hot glued and having wood veneer finish. Wood doors shall be set in hollow metal frames.	08 11 00 08 14 00 08 70 00

C.3 Interior Glazing

C.3.1	Aluminum Framed Entrances and Storefronts	Interior system to be high performance non-thermal, double glazed, concealed fasteners, silicon joints (similar to Trifab VG 450 series by Kawneer).	08 41 00 08 80 00

C.4 Stair Construction

C.4.1	Feature Stair Construction	Stair to be constructed of 144mm concrete slab on 6mm Thick Steel Plate or bent Steel Plate. Architecturally exposed steel welds require a higher degree of workmanship and finishing than standard exposed structural steel or metal fabrication components. All metal fabrication required AESS4 for the feature stair and to comply to all reference standard specified in Section 05 10 00, 05 50 00 and 09 90 00. Ensure that all architecturally exposed steel conforms to the requirements of the following standards unless otherwise required by the specification. • Canadian Welding Bureau (CWB) • Canadian Institute of Steel Construction (CICS)	05 05 19 05 10 00 05 51 00 09 21 16 09 91 10

• Master Painter's Institute (MPI)

Steel types and requirements: as specified in Section 05 10 00 and 05 50 00 except that where metal fabrications are exposed to view in the completed work must have smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, manufacturer's stamps or roughness. Use architectural quality steel to all handrail and guard rail support framing.

C.4.2	Feature Stair Finishes	1. Guard Rail a. Provide 19mm wood veneer panels to all inside / outside surfaces of the guardrail and undersides of stairs as indicated on the drawings. Include all necessary sub-framing such as Z girts and the like. The panel panel dimensions and joint locations as indicated on the drawings. b. All wood veneer panels shall have a matte hardwax-oil finish. c. Fabricate all panels for concealed fastenings. d. Rift-cut white oak wood vaneer panels, no patches permitted in face veneer. 2. Handrail a. Continuous, 40 mm round staineless steel handrail mounted on stainless steel mounting braket as indicated on the drawings. b. Stainless steel: ASTM A167, Type 304 3. Treads a. Polished Concrete with mechanically fastened aluminum safety stair nosing with hard-wearing grit insert.	05 51 00 05 52 00 08 80 00 09 21 16 09 91 10
C.4.3	Roof Access Stair Construction	Roof access stair, steel with concrete treads	05 51 00
C.4.4	Interior Railings	Fire stairs include the following items: Steel railings including handrails and railings attached to stairs, steel pickets in guards, handrails attached to walls adjacent to stairs. All other guards are to be frameless glass railing system.. Assembly: 1. Glazing: two panes of 6mm clear tempered florat glass with 0.75 thick polyvinyl butyral interlay free of foreign substances and air or flass pockets. 2. Railing Cap: 11 ga. polished stainless steel railing cap 3. Shoe base: Stainless steel clad aluminium base shoe	05 51 00 08 80 00
C.4.5	Exit Stairs	Structural steel stringers with concrete filled metal pan: includes steel stair stringers that will be considered as structural steel components; requirements for certification and record keeping for steel stairs shall be the same for structural steel framing. Mechanically fastened aluminum safety stair nosing with hard-wearing grit insert.	05 51 00 03 30 00 03 35 00

C.5 Interior Specialties

C.5.1	Toilet Partitions	Solid phenolic, ceiling mounted toilet partitions, anti-graffiti finish, stainless steel and cast aluminum hardware, barrier-free accessible (similar to Bobrick Duraline 1088 series)	10 21 00
C.5.2	Toilet and Bath Accessories	– Coat hooks: satin finished stainless steel, square profiled robe hook with concealed mounting, provide one per bathroom stall and two per individual washroom. – Grab Bars: Horizontal 1.27mm; 1067 mm and 915 mm long x 38 mm in diameter. Vertical 1.27 mm; 915 mm long x 38 mm in diameter. Straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws. – Garbage Container: Recessed mounted, 0.80 mm stainless steel, satin finished seamless construction to exposed face, complete with heavy duty reusable, removable vinyl liner having a 45L capacity. – Mop Strip: stainless steel mop and broom holder with non-slip handle restraints, designed to hold three handles 19 mm to 30 mm in diameter. – Feminine Napkin Disposal: Surface mounted, stainless steel, concealed fastening, self-closing disposal opening with leak-proof plastic receptacle. – Hand Dryer: Dyson AirBlade V series – Toilet tissue dispenser: Double roll, surface mounted tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles. – Mirrors: polished stainless steel in all dressing rooms; standard mirrors in public washrooms	10 28 00 08 83 00
C.5.3	Corner Guards and Wall Protection	50mm x 50mm stainless steel corner guards in high traffic areas at event level	10 26 00
C.5.4	White Boards	Located in all dressing rooms	10 11 00
C.5.5	Metal Lockers	Locker body should be made of not less than 0.61mm (24 ga.) thich steel with backs flanged with locked seams and formed and flanged with stiffner ribs; 5 knuckle hinges; louvered openings at top and bottom of each locker; pad lock hardware; sloped tops	10 51 13
C.5.6	HDPE Benches	In all dressing rooms; 13mm thick HDPE bench on steel stringers and steel angles	13 18 16

C.6 Interior Floor Finishes

C.6.1	Rubber Floor	Mondo USA Contract Flooring 3mm roll width 1.9mm with Johnsonite 100mm rubber base	09 68 00
C.6.2	Tile	Similar to mosaic porcelain floor tile by Daltile, 50mm x 50mm mosaic with abraisive content and 7.5% grit for shower and dry off areas; grout to be Mapei Porcelain floor tile exceeding the requirements of CAN/CGSB 75.1 and ANSI A137.1, impervious, fully fired porcelain floor tile having slip resistance where required installed in accordance with ASTM C627 Extra Heavy Duty Setting material and epoxy grout.	09 30 00

		Edge and control joints shall be formed using clear anodized aluminum, purpose made for application. Schluter Systems.	
C.6.3	Safety Flooring	In concession. Similar to Altro Stronghold 30 3mm, 2m wide roll with integral cove base	09 65 00
C.6.4	Skate Flooring	Mondo USA Ramflex 10mm roll width 1.86m skate floor; flush transition	09 65 00
C.6.5	Sport Flooring	Mondo USA Advance 6mm roll width 1.86m sports floor; flush transition	09 65 00
C.6.6	Carpet	Roll (not tile)	09 68 00
C.6.7	Polished Concrete	Ground Coloured Concrete Mix Design: Interstar powered concrete coloured admixture, or preapproved product, to produce dark grey coloured concrete. Concrete floor sealer/hardener for polished concrete interior locations: a clear, highly penetrating sealer to seal, densify, harden and waterproof concrete floors. Sealer is to intensify colour of polished aggregates and not discolour or amber. Apply densifier/sealer to provide a slip resistant finish to meet all Alberta Building Code 2014 requirements.	03 35 40
C.6.8	Artificial Ice		
C.6.9	Epoxy Coating	Suitable for capturing spills; located in boiler room and refrigeration room	09 67 00
C.6.10	Dry Shake Non-oxidizing Metallic Aggrrgate Hardener	In ice resurfacer room and ice resurfacer's path of travel	

C.7 Interior Wall Finishes

C.7.1	Paint	Paint on gypsum board, block, or concrete. Similar to C2 or Sico brand. Expoxy paint in wet areas.	09 90 00
C.7.2	Tile	Similar to wall tile by Daltile, Elevare 101.7mm x 406.9mm biscuit; grout to be Mapei for washroom wall tile. Similar to wall tile by Daltile semi-gloss & matte glazed, 150mmx 150mm; grout to be Mapei for wet area wall tile Similar to wall tile by Daltile, 102mm x 304mm; grout to be Mapei for backsplash tile.	09 30 00
C.7.	Intumescent Paint		09 96 46
C.7.4	Wood Panelling	19mm thick Rift Cut White Oak paneling; no patches permitted in face veneer. All wood veneer panels shall have a matte hardwax-oil finish.	06 20 00

C.8 Interior Ceiling Finishes

C.8.1	Gypsum Board Ceiling Finishes	Acrylic premium grade paint having low or no VOC's applied to a minimum of one coat primer with two coats of finish in accordance with MPI manual. Additional coats shall be applied where coverage shows defects in paint finishes at distance of 1500 mm at 60 degrees from wall surface. Moisture resistant gypsum board or fire rated moisture resistant gypsum board to be used in wet environments Impact resistant gypsum board to be used in high traffic areas	09 21 00 09 90 00
C.8.2	Acoustic Ceiling Treatment	Acoustic Ceiling panels in a suspended ceiling grid. Similar to Armstrong, School Zone Fine Fissured 15/16" Mylar faced acoustical ceiling tiles to be used in food handling areas	09 51 00
C.8.3	Arena Ceiling Membrane	Low e ceiling	07 21 16
C.8.4	Feature Ceiling	Feature ceiling system. Similar to Armstrong WOODWORKS Grille.	

D SERVICES

D.1 Vertical Transportation

D.1.1	Elevator	3500lbs, hydraulic, service provider to be local.	14 24 00

E EQUIPMENT AND FURNISHINGS

E.1 Furnishings

E.1.1	Finishing Carpentry	Interior standing and running trims, flush wood panelling, site applied interior ornamental woodwork, and frames and jambs. Millwork to be factory finished, delivered to the jobsite. Hardware forming a part of cabinets by this Section All millwork to be shop and site inspected and meet AWMAC 2009 Standards. AWMAC GIS required.	06 20 00 06 40 00
E.1.2	Finish Millwork	Flush overlay cabinets with clear lacquered wood veneer exteriors and plastic laminate interiors. AWMAC Premium Grade in accordance with Section 300 of "The Manual". Refer to specification section 09 99 99 Materials List for species.	06 40 00
E.1.3	Countertops	Solid surface countertops. Similar to Porcelanosa Krion, Royal + Lux Solid surface lavatories in all dressing rooms. Similar to Bradley, Terreon Solid Surface	06 61 00

E.2 Window Treatments

E.1.1	Roller Shades		12 24 13

E.3 Kitchen Equipment

E.3.1	Kitchen Equipment		11 40 00

E.4 Equipment

E.4.1	Fall Arrest & Restraint		11 24 23
E.4.2	Scoreboards	Centre hung (FFE)	11 66 43
E.4.3	Arena Dasher Boards System	Must be sledge hockey compliant including flooring in all boxes	13 18 16
E.4.4	Protective Netting		13 28 16

F SPECIAL CONSTRUCTION & DEMOLITION

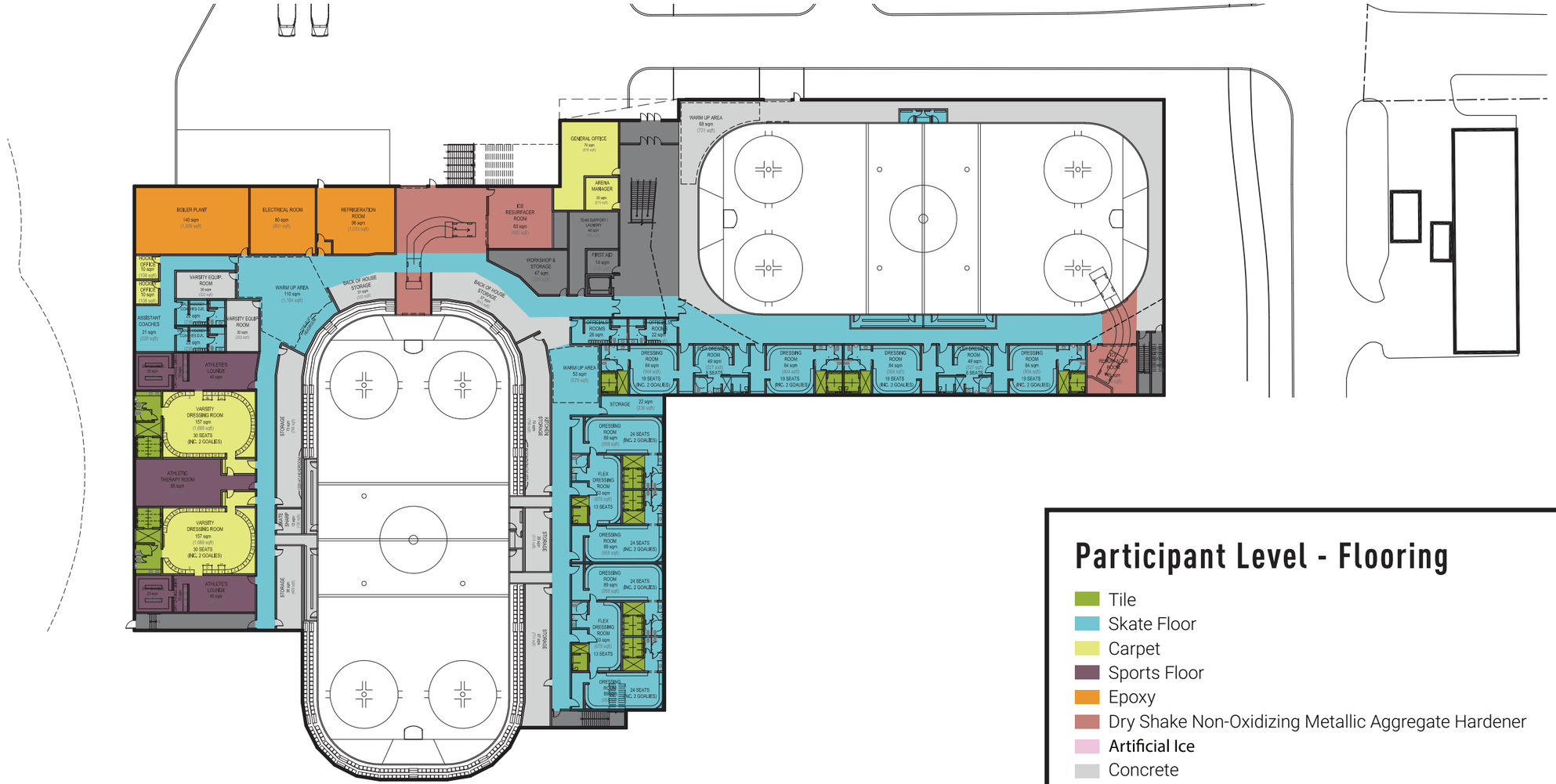
F.1 Selective Building Demolition

G BUILDING SITEWORK

G.1 Site Preparation

G.1.1	Site Earthwork	Granular compacted fill under slab-on-grade	31 00 00
G.1.2	Landscape Maintenance		32 01 31
G.1.3	Concrete Walks, Curbs, & Gutters		32 13 13
G.1.4	Concrete Unit Pavers		32 14 13
G.1.5	Pavement Markings		32 17 23
G.1.7	Topsoil Placement & Fine Grading		32 91 21
G.1.8	Sod		32 92 23
G.1.9	Trees, Shrubs & Groundcovers		32 93 10

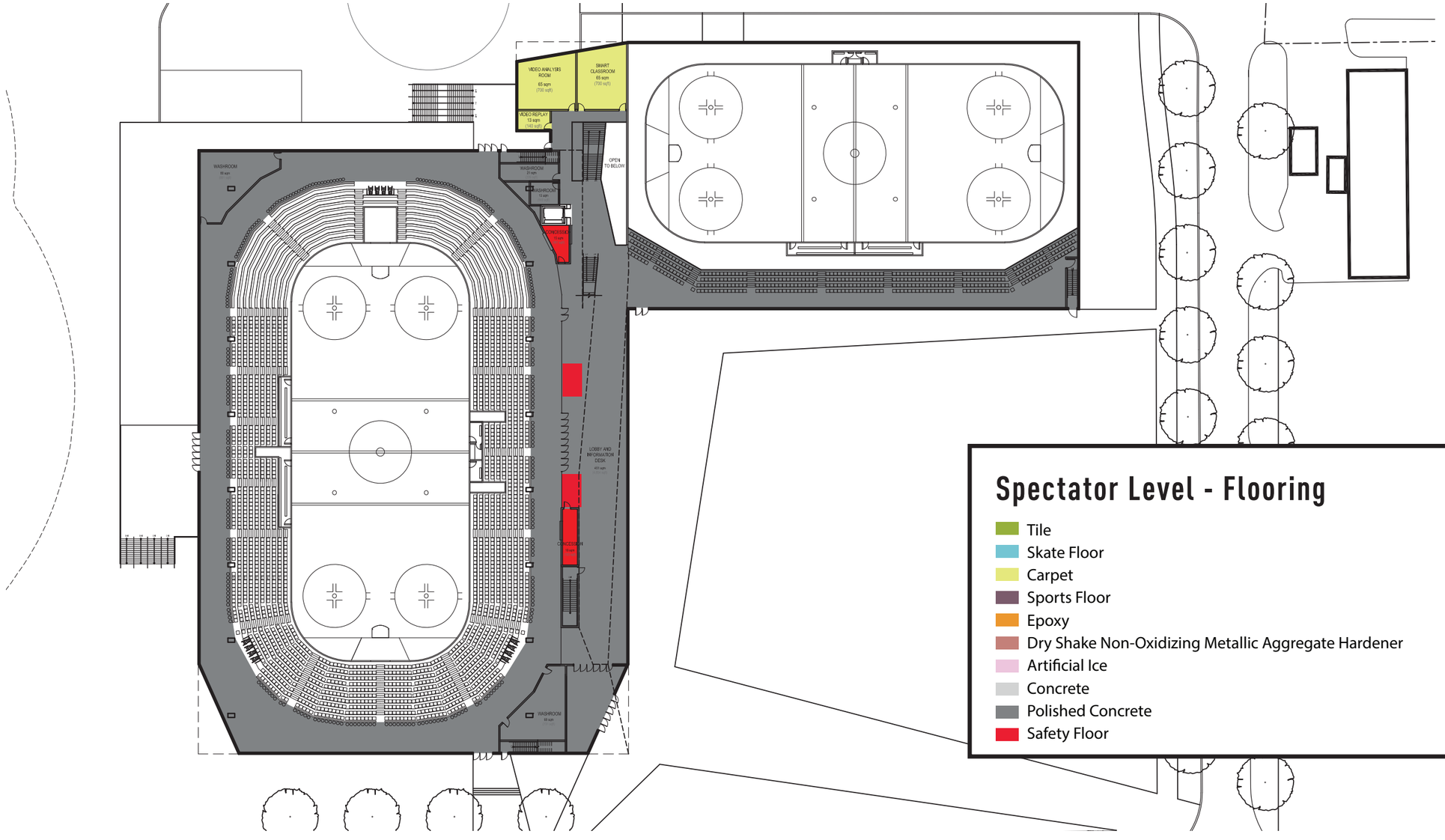
Participant Level Floor Finish Plan



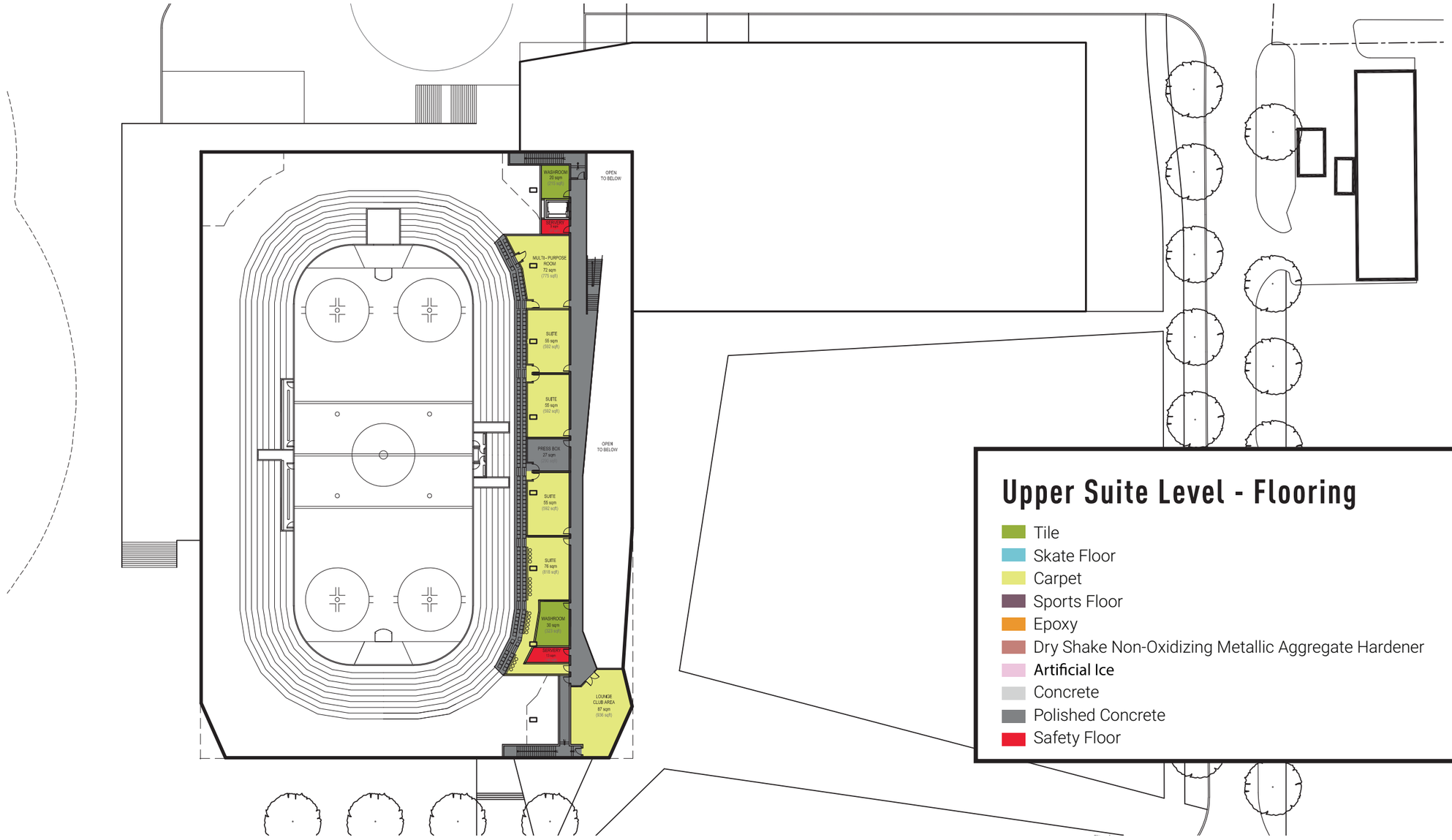
Participant Level - Flooring

- Tile
- Skate Floor
- Carpet
- Sports Floor
- Epoxy
- Dry Shake Non-Oxidizing Metallic Aggregate Hardener
- Artificial Ice
- Concrete
- Polished Concrete
- Safety Floor

Spectator Level Floor Finish Plan



Upper Suite Level Floor Finish Plan



APPENDIX B
STRUCTURAL

University of Alberta South Campus

Varsity and Community Arenas Project

Structural Schematic Design Brief

Date: June 21, 2018
RJC Project Number. CAL.118882.0002

Prepared for:
GEC Architecture
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Prepared by:
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1.0 INTRODUCTION

Read Jones Christoffersen Ltd. (RJC) has been engaged to provide the structural schematic design for the proposed Varsity and Community Arenas located on the University of Alberta's South Campus. The primary purpose of the Varsity Arena is for collegiate use, while the primary purpose of the Community Arena is for public use.

2.0 DESCRIPTION OF STRUCTURAL WORK

The scope of this project is to allow for the construction of the following components:

.1 A new 3,000 seat NHL size arena (*Varsity Arena*)

.2 A new 400 seat NHL size arena (*Community Arena*)

To provide schematic design for both arenas we reviewed the comments and recommendations from the geotechnical report prepared by Thurber Engineering Ltd., dated May 6, 2016 (File: 11712).

3.0 STRUCTURAL CONSIDERATIONS

The sections below summarize the primary structural systems for both the Varsity and Community Arenas, with the primary purpose of estimating each of their construction values at a schematic design level. The structural schematic design narrative should be read in conjunction with the schematic sketches listed in Appendix B.

3.1 Foundations

For both arenas the superstructure will be supported on cast-in-place concrete belled piles, founded in the very stiff clay till. It should be noted temporary pile casings will be required to advance the piles through the overlying sandy layers, where encountered above the clay layer.

Typical pile loads for the Varsity arena are shown on sketch SK-02. Typical pile loads for the Community arena are shown on sketches SK-03.

3.2 Substructure

The slabs on grade for both arenas require a relatively high level of slab performance with minimal slab movement. Both slabs on grade will be founded on high plastic clays with moisture contents close to their plastic limits. Therefore the clay has a high potential for soil swelling. To mitigate potential future slab movement of both arenas, the design assumes a 220mm structural cast-in-place concrete reinforced slab on grade (complete with 100mm of void form) for both the ice level slab system and grade supported spectator level, refer to sketch SK-01. Refer to Section 3.6 for ice slab assembly.

A continuous 600mm x 800mm deep grade beam, supported on piles, will follow the perimeter of the ice level and portions of the spectator level supported on grade. A pile supported 450mm x 700mm deep grade beam will be below all basement concrete walls and masonry interior walls.

The 350mm cast-in-place reinforced concrete foundation wall between the spectator entry and ice levels will be designed in accordance with the recommendations of the soils report, refer to sketch SK-01.

3.3 Superstructure

.1 Spectator Level (Varsity Arena)

The suspended Varsity Arena spectator level will be comprised of 90mm concrete topping on 76mm composite steel deck, supported by W360 to W840 beams on structural steel columns (beam depths and weights vary depending on span, and are shown on sketch SK-01).

.2 Spectator Level (Community Arena)

The suspended Varsity Arena spectator level will be comprised of 90mm concrete topping on 76mm composite steel deck, supported by W250 and W690 beams on structural steel W250 and HSS 102x102 columns (beam depths and weights vary depending on span, and are shown on sketch SK-03).

.3 Upper Level (Varsity Arena)

The upper level suspended slab will be comprised of 90mm concrete topping on 76mm composite steel deck, supported by W410 to W610 beams on structural steel columns (beam depths and weights vary depending on span), and are shown on sketch SK-01.

.4 Bleachers (Varsity and Community Arenas)

The bleacher system for both the Varsity and Community Arenas will be pre-cast concrete supported on W610 x 140 raker beams, supported on piles. Refer to architectural drawings for dimensions of the bleacher.

3.4 Varsity Arena Roof

The Varsity Arena Roof structure will be comprised of a steel truss spanning the width of the arena at an assumed spacing of 11 meters on centre (column spacing). The steel trusses vary in depth across the span, from 3300mm (at the support) to 3600mm (at the mid-span). The trusses support W460 purlins which support 76mm roof deck. Refer to sketch SK-01.

3.5 Community Arena Roof

The Community Arena roof will be comprised of 2200mm deep OWSJ at 3 meters on centre supporting 76mm roof deck. The trusses are supported on W690 edge beams spanning between HSS columns spaced at 9m on centre. Refer to sketch SK-03.

3.6 Ice Slab Assembly

The ice slab assembly for both the Varsity and Community arenas will consist of a 150mm reinforced cast-in-place cold slab, a layer of poly slip-sheet, 2 layers of rigid insulation, a second layer of poly slip-sheet, a leveling sand layer, and a 250mm reinforced concrete hot structural slab on grade.

3.7 Varsity Arena Secondary Exterior Cladding Structure

The varsity arena cladding system consists of two assemblies. Assembly one, a multi-facet glass veneer frame with an offset exterior perforated standing seam screen; and assembly two, a vertical insulated metal panel with an offset exterior perforated standing seam screen. To estimate the construction value of the secondary support steel for the two cladding assemblies, use an estimated steel tonnage of 780 kg per linear horizontal metre length of wall.

3.8 Lateral Load Resisting System

The lateral load resisting system for both the Varsity and Community arena will be comprised of steel braced frames. The locations (bays) of the braced frames will be developed during the next stage of the project.

4.0 NON STRUCTURAL CONSIDERATIONS

This Schematic Design Report is intended to describe the structural systems and summarize the primary structural design criteria for the purposes of schematic design costing. The structural schematic design report should be considered in conjunction with the drawings and sketches provided. In addition, the following items should be given consideration when developing a schematic estimated budget.

Allowances must be made for secondary structure, special structures and atypical elements consistent with this building type. Examples of such elements are as follows.

- Secondary framing for the support of cladding, louvers, screens and glazing.
- Secondary framing for mechanical equipment and at electrical rooms.
- Secondary framing for floor and roof openings as well as sleeves for floor penetrations. Refer also to Architectural and mechanical drawings.
- Skylights, catwalks and other miscellaneous structural steel indicated on the architectural drawings.
- Parapets and roof projections.
- Support for hanging partitions.
- Housekeeping pads, ramps, and curbs.
- Stairs, stair landings, and framing for elevators between floors.
- Exterior structures such as retaining walls, planters, walkways, curbing and the like.
- Window washing and fall arrest requirements.

5.0 EXCAVATION SUPPORT SYSTEM AND GROUND WATER CONTROL

As noted on Architectural drawings, portions of the facility will have one level of basement (ice level), with an expected excavation depth of 3m below existing grade. It is anticipated the basement will project through the stiff to very stiff plastic clay. As the short term groundwater measurements (provide in the geotechnical report) were at relatively large depths, ground water seepage is not anticipated at this excavation depth.

Temporary excavation slopes through the stiff to very stiff clay for basement excavation should be sloped no steeper than 1H to 1.5V. The ground surface outside the excavation should be sloped away from the building to prevent surface water flowing into the open excavation.

6.0 ASSUMPTIONS

The following assumptions have been made with respect to the structural schematic design:

- Construction loads will not exceed the design loads noted in this document. Adequate shoring will be provided during construction to ensure typical floor areas and non-typical areas will be adequately shored. Temporary work is provided for structural work adjacent to existing structures. Provide shoring to accommodate demolition as required.

- Except where specifically noted otherwise, construction tolerances are as described in CSA A23.1/A23.2 for concrete construction and as per CSA S16.1 for steel construction.
- Assumed design criteria and material properties and described in **Appendix A** and **Appendix C**, respectively.

7.0 RISK ASSESSMENT

The following is a list of items in the design process or inherent in this particular project which may create risk to the Owner and should be reviewed in more detail to mitigate this risk. This list will be refined as the design progresses.

- The project design is not yet complete. Structural design continues to evolve in parallel with the design by other consultants and through an evolution of the program requirements. We recommend a Design Contingency be carried to reflect the preliminary nature of the available information.
- Based on our experience, we recommend a Construction Contingency be carried to cover the effect of unforeseen site conditions and unexpected construction process items, such as varying founding conditions, construction sequencing, the need for temporary bracing or shoring, etc.
- We also recommend an Escalation Contingency be carried to cover the effects of the escalation in construction costs from the time the cost estimate is prepared to the start of construction.

APPENDIX A – SUMMARY OF DESIGN CRITERIA

Unless otherwise noted, the design criteria for this project are summarized as follows:

A.1 DESIGN CODES AND STANDARDS

- Alberta Building Code (ABC), 2014 or National Building Code of Canada (NBC), 2010
- CSA CAN-S16– "Limit States Design of Steel Structures"
- CSA A23.3– "Design of Concrete Structures"
- CSA A23.1/A23.2 "Concrete Materials and Methods of Concrete Construction/Methods of Testing for Concrete"
- CSA S304.1– "Design of Masonry Structures"
- CSA O86.1 – "Engineering Design in Wood"
- AISC Design Guideline #11, Steel Design Guide Series – Floor Vibrations Due to Human Activity

A.2 DESIGN LOADS – GENERAL

Design loads adhere to code requirements and are based on the intended building uses, building finishes and proposed building equipment. The importance factor for load types is based on the importance category. The building is classified as NBCC Importance category "Normal" based on its use. The resulting Importance Factors are summarized below in ***Table A1***:

	Importance Factor	
Load Type	**Ultimate Limit States (ULS)**	**Serviceability Limit States (SLS)**
Snow & Rain	1	0.9
Wind	1	0.75
Earthquake	Normal	N/A

Table A1: Building Importance Factor

A.2.1 DESIGN SUPER-IMPOSED DEAD LOADS

Design super-imposed dead loads (self-weight not included) are based on the assumed roof and floor assemblies noted on the architectural drawings at the time of schematic design. The following loads were assumed:

Typical Ceiling, Mechanical and Electrical (C, M, &E) ..... 0.25-0.5 kPa

C, M & E in Mechanical Penthouses ..... 1.0-1.5 kPa

Floor leveling corrective measures 10mm thick ..... 0.24 kPa

Tile and other heavy floor finishes ..... 0.75-1.75 kPa

Basic Partition Allowance ..... 1.0 kPa

Block Wall Partition Allowance (determined by layout) ..... +/- 3.0 kPa

Typical Parking Levels ..... 0.5 kPa

A.2.2 DESIGN LIVE LOADS

Specified uniform live loads used for design are below. Live load reduction factors are utilized to the extent as outlined by the code.

Ice level ..... 4.8 kPa

Spectator level ..... 4.8 kPa

Upper level ..... 4.8 kPa

Mechanical areas ..... 7.2 kPa

Roof levels, basic uniform ground snow load plus rain load ..... 1.7 kPa + 0.1 kPa

Parking ..... 2.4 kPa

Specified concentrated roof loads (no rigging loads) ..... 1.3 kN

Specified concentrated floor loads ..... 12.0 kN

A.2.3 DESIGN WIND LOADS

Design wind loads are calculated as per the Alberta Building Code (ABC), using a 1 in 50 year return wind reference velocity pressure using the climatic data for the city in which the building will be located. For this project in the City of Edmonton q(1/50) = 0.45 kPa.

A.2.4 DESIGN SEISMIC LOADS

Seismic design loads are calculated as per ABC based on a 2% probability of exceedance in 50 years using design data for the city in which the building will be located. For this project in the City of Edmonton: Sa(0.2) = 0.10, Sa(0.5) = 0.06, Sa(1.0) = 0.03, Sa(2.0) = 0.01 and PGA = 0.04.

The seismic force resisting system (SFRS) will be conventional steel braced frames. R_d=1.5 and R_o=1.3 as per ABC.

A.3 DEFLECTION CRITERIA

The structure shall be designed to minimize the effects of deflections including the effects of long-term creep in concrete. The limitations are as per CSA S16, Limit State Design of Steel Structure, for steel structures and CSA A23.3, Design of Concrete Structures, Concrete Structures.

Deflection Criteria Summary (Live Load)

Typical concourse and activity floor Span/480

Typical roof Span/240

Maximum Wind Storey Drift Height/400

Seismic Storey Drift Height/40

APPENDIX B – LIST OF STRUCTURAL SKETCHES

Base Building

SK-01 ..... Varsity Arena – Rink Section
SK-02 ..... Varsity Arena – Pile Loads at Mid-Grid & Column Grid
SK-03 ..... Community Arena – Rink Section

Value Engineering – Separate Estimated Cost Required for Evaluation

SK-04 ..... Value Engineering – Alternate Slab-On-Grade Ice Slab Level
SK-05 ..... Varsity Arena – Value Engineering Roof Framing, Flat Steel Truss with OWSJ

Alternate Explored Framing Concepts – Not Part of Base Building, For Information Only

SK-06 ..... Varsity Arena – Alternate Roof Framing Scheme 1, Pitched Steel Truss
SK-06A ..... Varsity Arena – Alternate Roof Framing Scheme 1, Pitched Steel Truss Roof Sections
SK-07 ..... Varsity Arena – Alternate Roof Framing Scheme 2, Steel Joist
SK-08 ..... Varsity Arena – Alternate Roof Framing Scheme 3, Glulam King Post Truss
SK-09 ..... Varsity Arena – Alternate Concourse Framing Scheme, Precast Option
SK-10 ..... Community Arena – Alternate Roof Framing Scheme 1, Pre-Engineered Frame
SK-11 ..... Parkade – Typical Framing Plan
SK-12 ..... Parkade – Typical Building Section

APPENDIX C – STRUCTURAL MATERIALS

Unless otherwise noted, structural materials shall meet the following specifications and requirements:

C.1 STRUCTURAL STEEL AND CONCRETE REINFORCEMENT

W Sections: ..... Grade 350W CAN/CSA-G40.20/G40.21 or Grade 50 (345MPa) ASTM A992/A992M

WWF Sections: ..... Grade 350W CAN/CSA-G40.20/G40.21

Channels, Angles & Plates: ..... Grade 350W CAN/CSA-G40.20/G40.21

HSS Sections: ..... ASTM A500 Class C

Steel Reinforcement for Concrete ..... CSA G30 Series (F_y=400MPa)

Glulam ..... Douglas Fir (24f-EX)

C.2 REINFORCED CONCRETE STRENGTHS

Reinforced concrete shall meet the requirements of CSA A23.1/A23.2-04 "Concrete Materials and Methods of Concrete Construction/Methods of Testing for Concrete" and shall generally adhere to the following requirements shown in ***Table C1***:

Element or Location	Concrete Strength (MPa) (f'c @ 28d UNO)	Exposure Class
Precast concrete (columns, slabs, and beams)	45	N/C1
Foundation walls	35	F1
Pile caps	35	N
Other walls	30	N
Concrete topping on metal deck	25	N
Structural slab-on-grade	35	N
Arena slab (cold slab)	35	N-CF
Slab on Grade, Interior	25	N

Table C1: Concrete Requirements

APPENDIX D – ALTERNATE VALUE ENGINEERING FRAMING SCHEMES

Appendix D describes two framing schemes that are to be costed separately from the base building structure to evaluate their feasibility. The two value engineering schemes include the ice level slab-on-grade for the entire facility as well as the Varsity Arena roof structure. The two schemes are described below with the primary purpose of estimating each of their construction values at a schematic design level.

D.1 ICE LEVEL SLAB ON GRADE

The slabs on grade for both arenas require a relatively high level of slab performance with minimal slab movement. Due to the geotechnical condition of high plastic clay found on site, to mitigate potential future slab movement of both arenas the base building design includes for a 220mm structural cast-in-place concrete reinforced slab on grade (complete with 100mm of void form) for both the ice level slab system and grade supported spectator level.

A potential cost savings is to replace the 220mm structural cast-in-place concrete reinforced slab on grade (complete with 100mm of void form) with a 125mm cast-in-place concrete slab on grade supported on well compacted gravel. Because the site is founded on high plastic clay, it shall be assumed approximately 900mm to 1200mm of the in-situ clay will be removed and replaced with well compacted engineered gravel. Note, this option will require input from a geotechnical engineer to determine expected soil settlement as well as the final depth of engineered fill. This alternate concept is shown in sketch **SK-04**. This concept will apply to both the Varsity and the Community arena ice level slabs, but not the cold slabs (ice slabs).

D.2 VARSITY ARENA ROOF FRAMING SCHEME

Flat Steel Truss with OWSJ, will be comprised of a steel truss spanning the width of the arena at an assumed spacing of 11 meters on centre (column spacing). The steel trusses vary in depth across the span, from 3300mm (at the support) to 3600mm (at the mid-span). The trusses support W460 purlins which support 76mm roof deck. 900mm deep OWSJ spaced at 2750mm on centre span across the concourse level. The OWSJs are supported on W690 beams spanning between steel columns spaced at 11m on centre. Refer to sketch **SK-05**.

APPENDIX E – EXPLORED ALTERNATE FRAMING CONCEPTS

Recommendations for alternate structural framing concepts for the Varsity Arena concourse level, Varsity Arena roof, and Community Arena roof were explored and are described below. These alternate framing concepts are not part of the base building and shall not be included in the overall project cost estimate.

E.1 VARSITY ARENA CONCOURSE

An alternate pre-cast concrete concourse framing scheme is provided on sketch **SK-09**. With this alternate option the spectator level will be comprised of pre-cast concrete hollow core panels (both 200mm and 300mm in depth depending on span) with a 75mm concrete topping, supported on pre-cast beams, refer to sketch **SK-09**. The pre-cast beams are supported on pre-cast columns of varying dimensions, refer to sketch **SK-09**.

Included in this alternate framing scheme is a precast concrete 600 x 600DP raker beam is shown on sketch **SK-09**.

E.2 VARSITY ARENA ROOF

Three alternate framing schemes are provided below to span the Varsity Arena Roof (Scheme 1, Pitched Steel Truss; Scheme 2, Steel Joist; Scheme 3, and Glulam King Post Truss). The framing schemes for all three alternate options are described below.

Scheme 1, Pitched Steel Truss, consists of a pitched steel truss spanning the width of the arena at an assumed spacing of 11 meters on centre (column spacing). The steel trusses vary in depth across the span from 1200mm (at the support) to 5600mm (at the mid-span). The trusses support W460 purlins which support 76mm roof deck. Refer to sketch **SK-06** for approximate truss geometry and sketch **SSK-06A** for typical truss joint details.

Scheme 2, Steel Joist, consists of a series of steel joists with varying depth (2500mm to 3050mm) spanning the width of the arena. The joists are spaced at 2750mm on centre and are supported on W840 and W1000 beams spanning between the steel columns (refer to sketch **SK-07**). 900mm deep OWSJ spaced at 2750mm on centre will span over the entrance concourse level.

Scheme 3, Glulam King Post Truss, consists of paired 365x1330 DP Glulam king post trusses at 5500mm on centre. The trusses support 130x418DP Glulam purlins and 76mm roof deck. The king post trusses are supported on either steel columns or 365x1330DP Glulam beams spanning between columns (refer to sketch **SK-08).**

E.3 COMMUNITY ARENA ROOF

Scheme 1, Pre-Engineered Frame, consists of pre-engineered steel moment frames at 6m on centre. The frames support 152mm deep Z-girts and 76mm roof deck, refer to sketch **SK-10**. Note, the East wall varies in height to support exterior grade changes. Due to the expansive clays, it is not recommended the pre-engineered frame bear directly on the exterior wall. Therefore, for this alternate, the East exterior wall is located further East to allow the frame to be supported at the ice level.

APPENDIX F – PARKADE

The section below describes the primary structural system for the new three level, 600 stall parkade, with the primary purpose of estimating each of their construction values at a schematic design level.

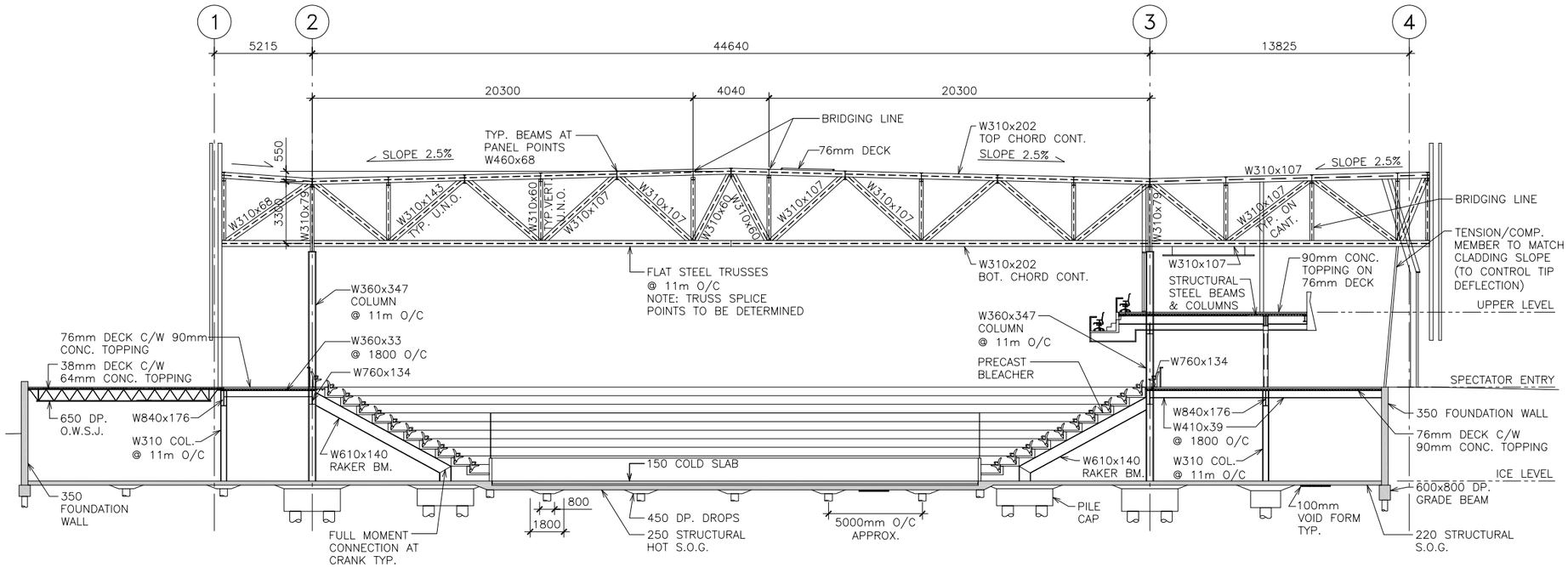
F.1 FOUNDATIONS

The superstructure will be supported on cast-in-place concrete belled piles, founded in the very stiff clay till. It should be noted temporary pile casings will be required to advance the piles through the overlying sandy layers, where encountered above the clay layer.

F.2 SUPERSTRUCTURE

The superstructure consists of precast 3660mm x 813mm DP double tees spanning 18 metres. The interior double tees are supported on the pre-cast beams and interior 300mm wide vista wall, whereas the exterior double tees are supported on load bearing 300mmx2000mm DP pre-cast spandrel panels. All columns are spaced 10980mm on centre. Refer to sketches SK-11 and SK-12 for typical framing plan.

The lowest level of parkade (P1) will consist of either a 125mm cast-in-place reinforced concrete slab on grade, or asphalt paving.

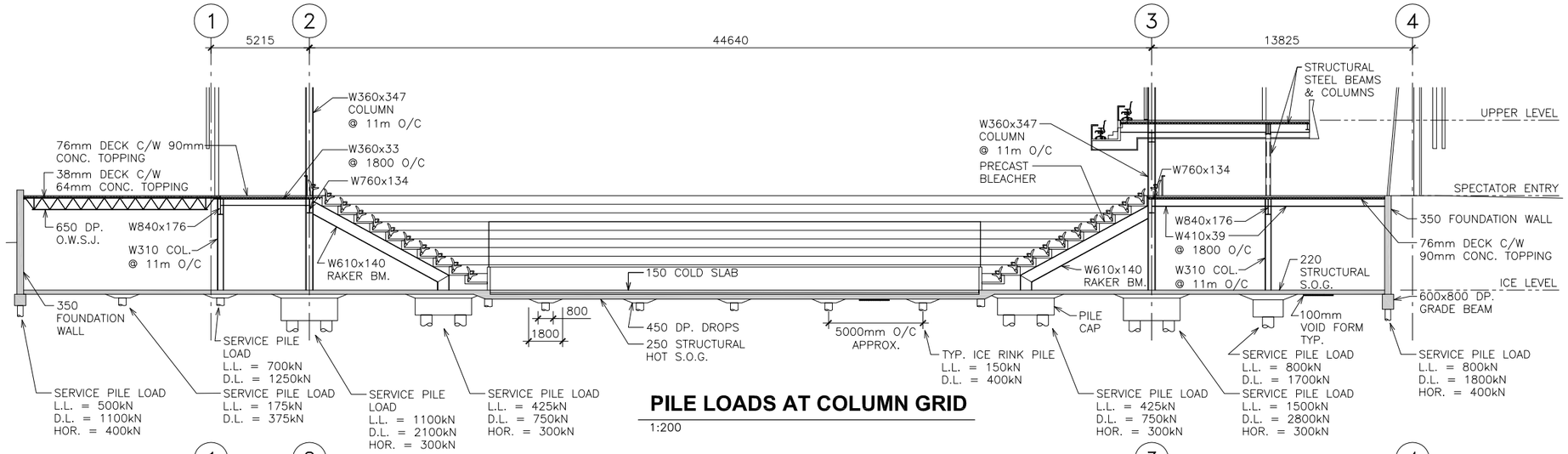


BASE BUILDING

rjc Engineers

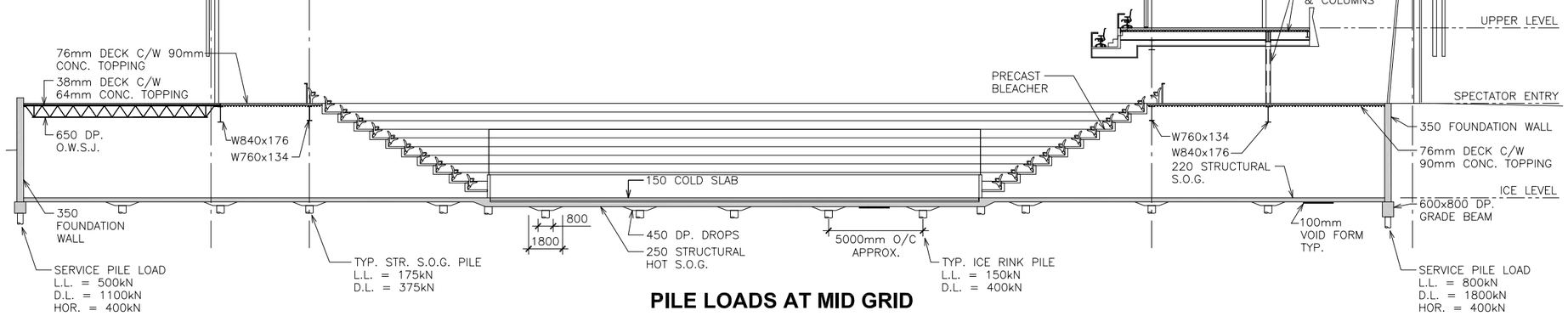
Project Name
U OF A SOUTH CAMPUS ARENAS
Sketch Title
VARSITY ARENA - RINK SECTION

Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-01**
Rev. **-**



PILE LOADS AT COLUMN GRID

1:200



PILE LOADS AT MID GRID (BETWEEN COLUMN LINES)

1:200

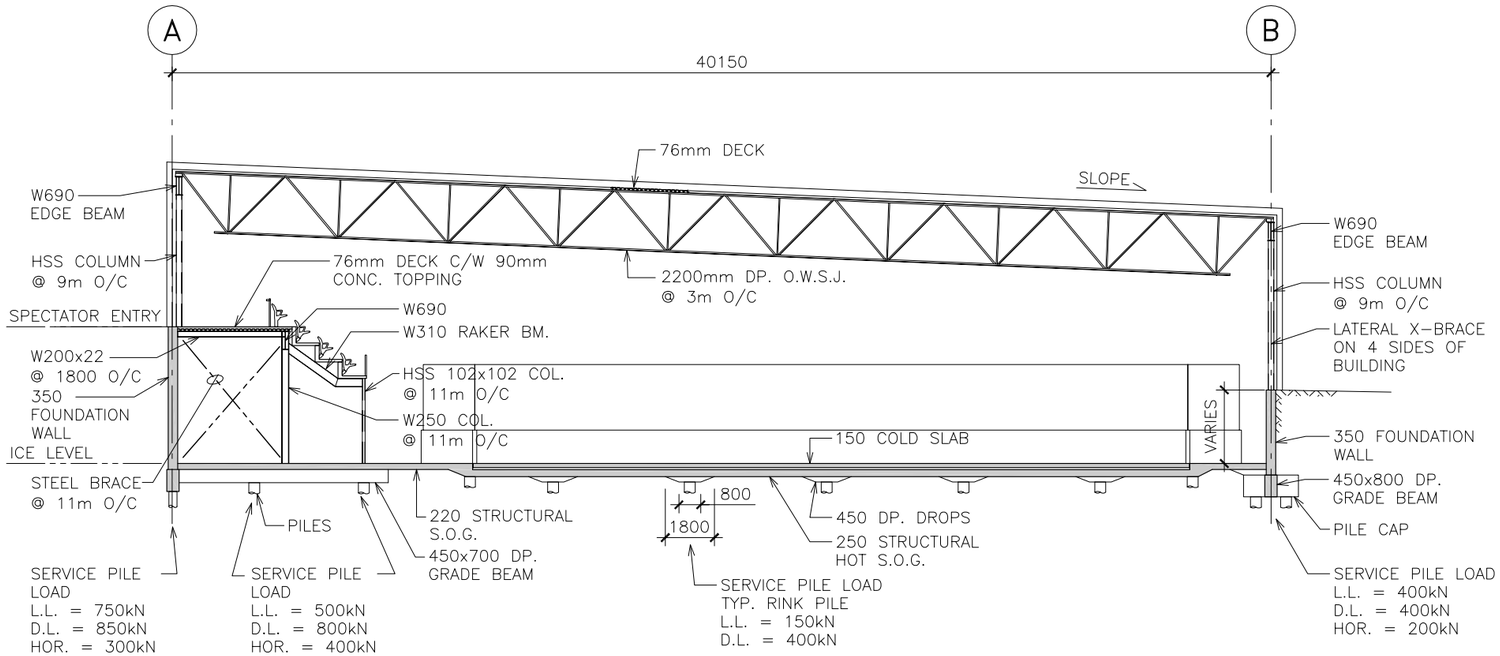
BASE BUILDING

Project Name
U OF A SOUTH CAMPUS ARENAS

Sketch Title
VARSITY ARENA
PILE LOADS AT MID GRID & COLUMN GRID (ASSUME 11m O/C)

rjc Engineers

Dwg. Ref.	.
Scale	1:200
Date	2018-06-21
Project No.	CAL.118882.0002
Sketch Number	Rev.
SK-02	-

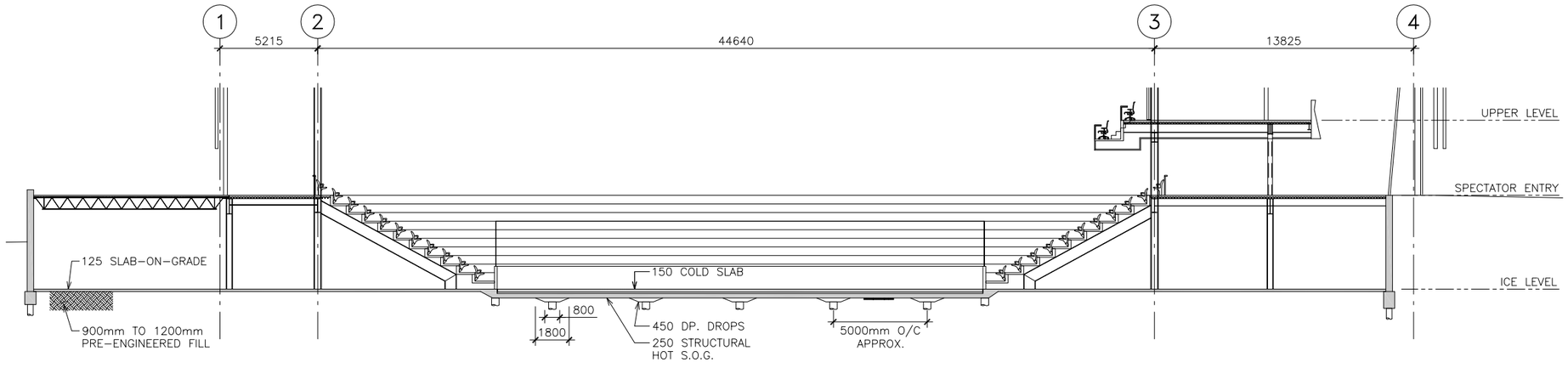


rjc Engineers

BASE BUILDING

Project Name
U OF A SOUTH CAMPUS ARENAS
Sketch Title
COMMUNITY ARENA - RINK SECTION

Dwg. Ref.	.
Scale	1:200
Date	2018-06-21
Project No.	CAL.118882.0002
Sketch Number	Rev.
SK-03	-

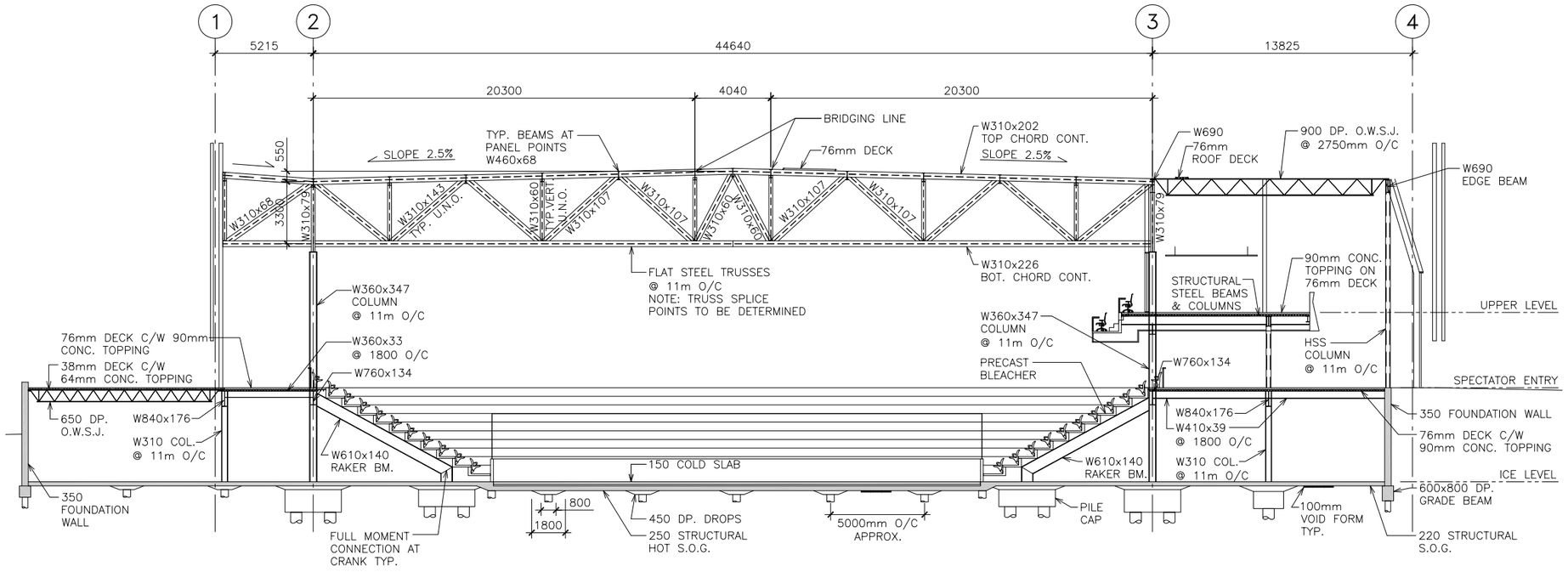


VALUE ENGINEERING - SEPARATE COST

rjc Engineers

Project Name
U OF A SOUTH CAMPUS
ARENAS
Sketch Title
VALUE ENGINEERING - ALTERNATE SLAB-ON-GRADE
ICE SLAB LEVEL

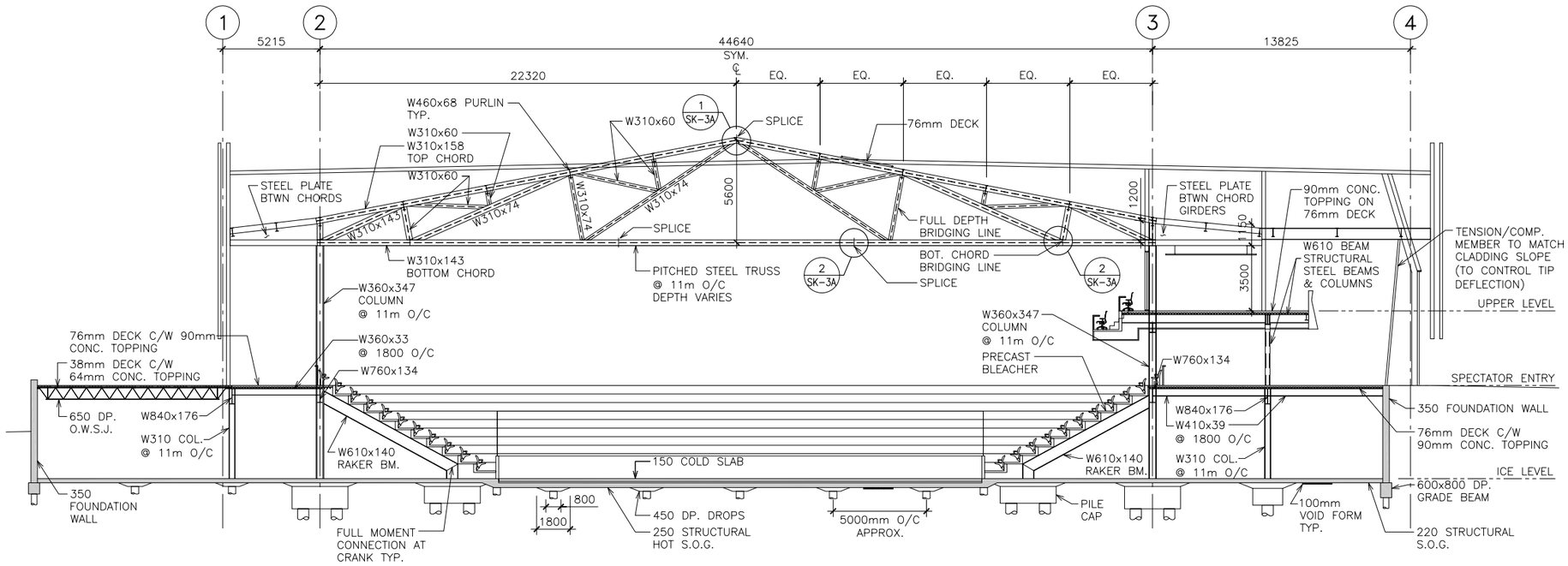
Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-04**
Rev. **-**



VALUE ENGINEERING - SEPARATE COST

rjc Engineers

Project Name	
U OF A SOUTH CAMPUS ARENAS	
Sketch Title	
VARSITY ARENA VALUE ENGINEERING ROOF FRAMING - FLAT STEEL TRUSS WITH O.W.S.J.	
Dwg. Ref.	.
Scale	**1:200**
Date	**2018-06-21**
Project No.	**CAL.118882.0002**
Sketch Number	Rev.
SK-05	**-**

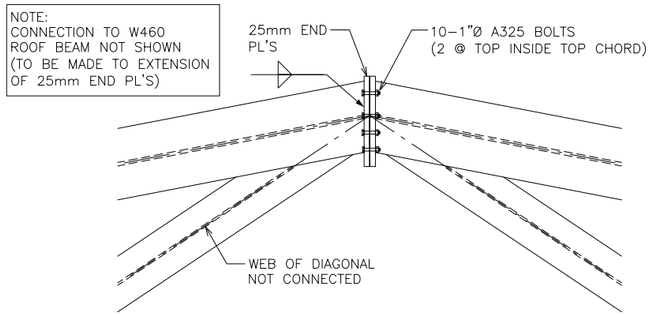


rjc Engineers

EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

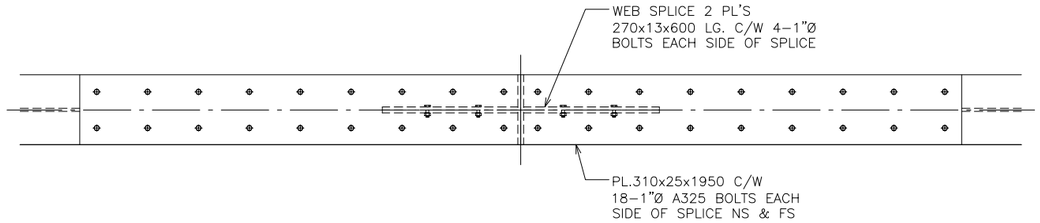
Project Name
U OF A SOUTH CAMPUS
ARENAS
Sketch Title
VARSITY ARENA
ALTERNATE ROOF FRAMING SCHEME 1
- PITCHED STEEL TRUSS

Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-06**
Rev. **-**



1 SK–06A TOP CHORD SPLICE AT MID SPAN

1:20

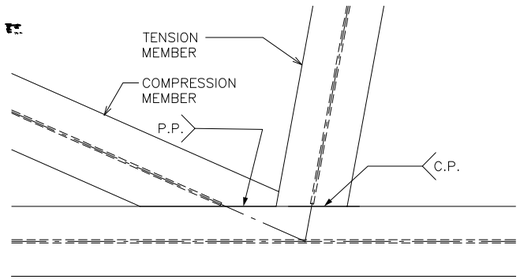


2 SK–06A ALTERNATE BOT. CHORD SPLICES

1:20

NOTE:
IF TRANSPORT HEIGHT OF TRUSS IS NOT CRITICAL
A SINGLE SPLICE AT MIDSPAN MAY BE USED.

WITH THICKER & NARROWER PL'S ONE SIDE OF
THE SPLICE COULD BE SHOP WELDED



3 SK–06A TYPICAL WEB TO CHORD DETAIL

1:20

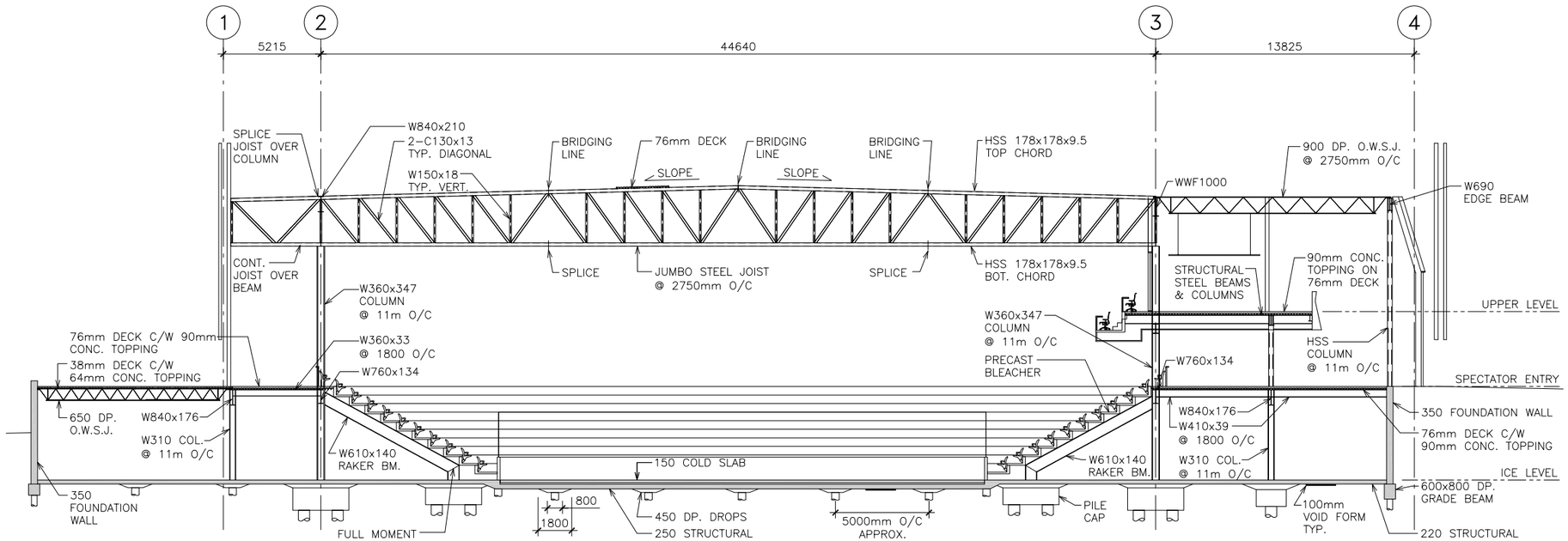
NOTE:
WEB MEMBERS TO BE ACCURATELY CUT TO FIT.
WEBS OF DIAGONALS NEED NOT BE CONNECTED TO
WEBS OF CHORDS.
BACKING PLATES MAY BE USED ON INTERIOR SIDE
AND LEFT IN PLACE.

rjc Engineers

EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

Project Name
U OF A SOUTH CAMPUS ARENAS
Sketch Title
VARSITY ARENA
ALTERNATE ROOF FRAMING SCHEME 1
- PITCHED STEEL ROOF SECTIONS

Dwg. Ref.	.
Scale	1:20
Date	2018-06-21
Project No.	CAL.118882.0002
Sketch Number	Rev.
SK-06A	-

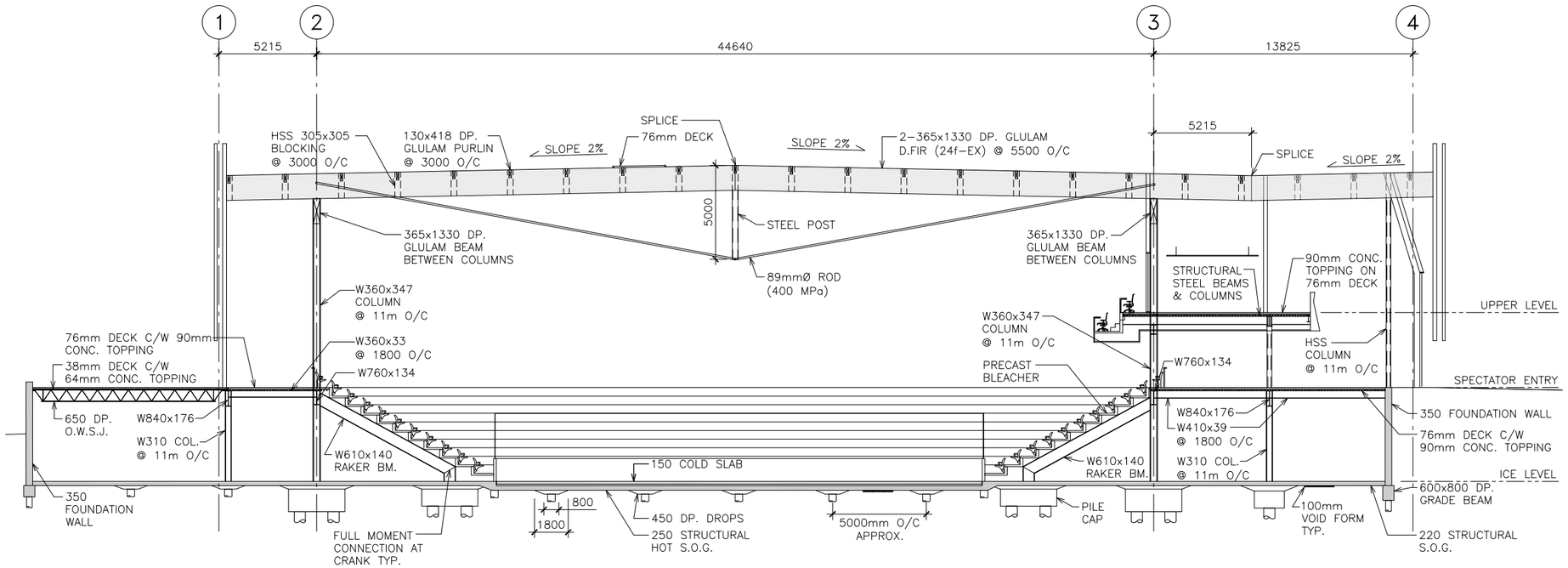


rjc Engineers

EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

Project Name
U OF A SOUTH CAMPUS
ARENAS
Sketch TItle
VARSITY ARENA
ALTERNATE ROOF FRAMING SCHEME 2 - STEEL JOIST

Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-07**
Rev. **-**

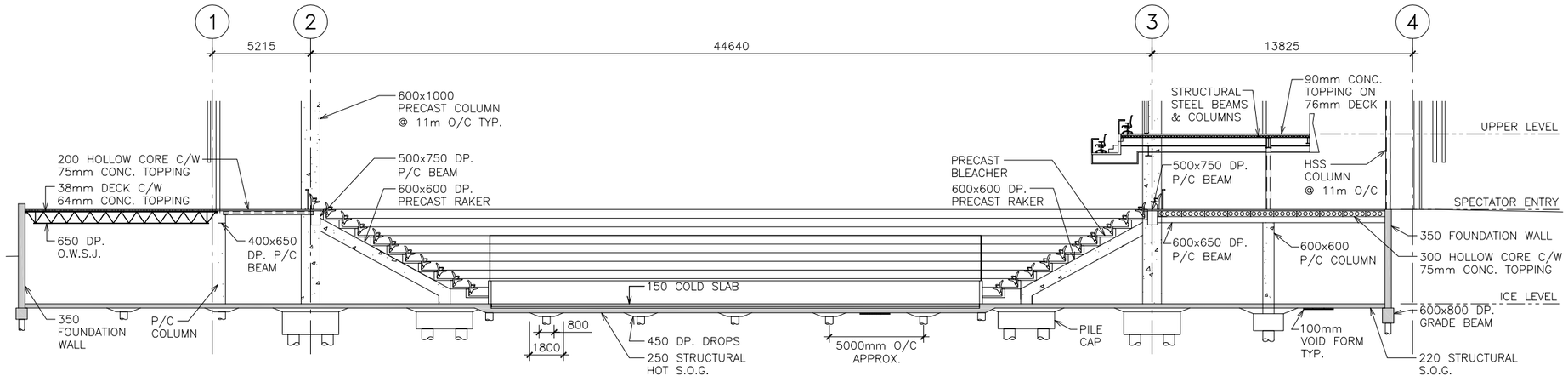


EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

rjc Engineers

Project Name
U OF A SOUTH CAMPUS
ARENAS
Sketch Title
VARSITY ARENA
ALTERNATE ROOF FRAMING SCHEME 3
- GLULAM KING POST TRUSS

Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-08**
Rev. **-**



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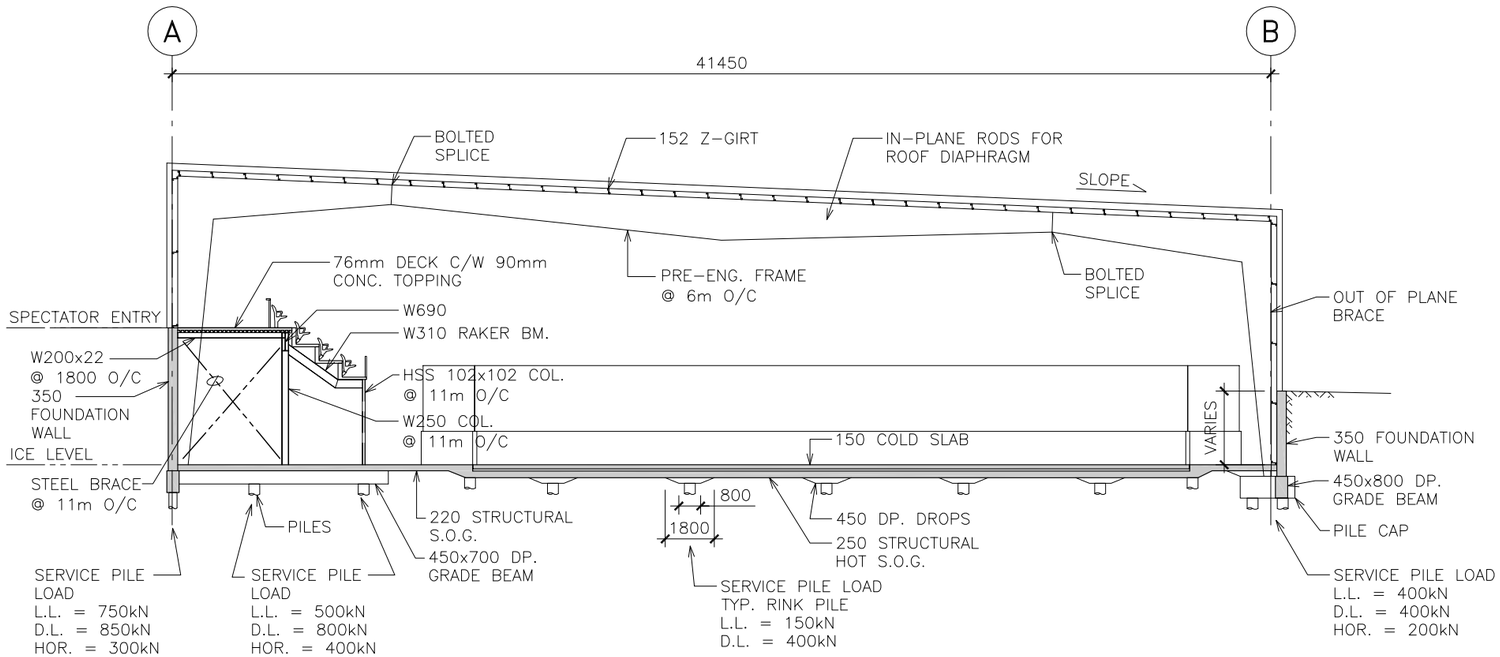
EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

Project Name
U OF A SOUTH CAMPUS ARENAS

Sketch Title
VARSITY ARENA
ALTERNATE CONCOURSE FRAMING SCHEME - PRECAST OPTION

Dwg. Ref.	.
Scale	1:200
Date	2018-06-21
Project No.	CAL.118882.0002
Sketch Number	SK-09
Rev.	-



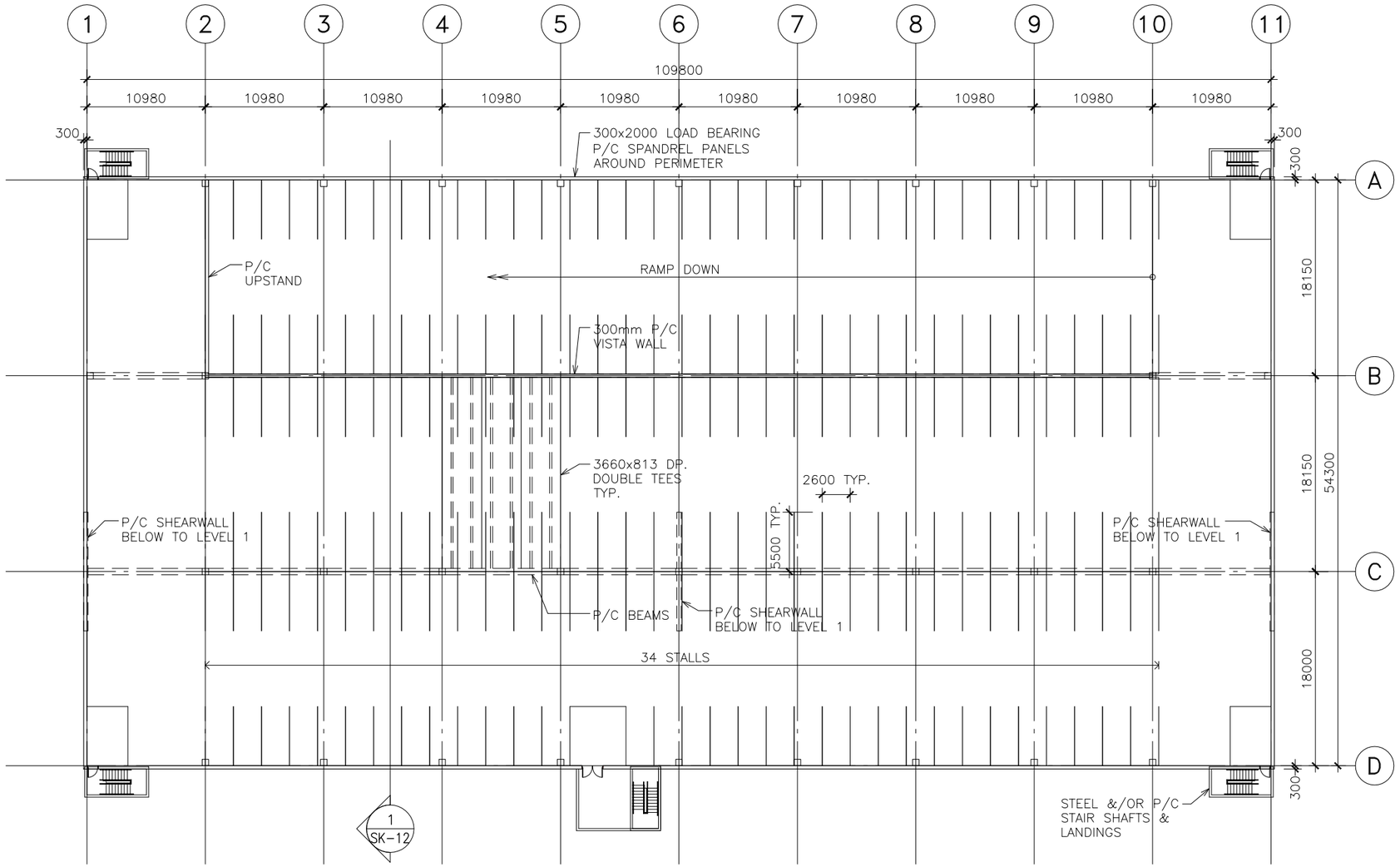
EXPLORED FRAMING CONCEPT - NO BUDGET REQ. - FOR INFO ONLY

rjc Engineers

Project Name
U OF A SOUTH CAMPUS ARENAS

Sketch Title
COMMUNITY ARENA ALTERNATE FRAMING SCHEME 1 - PRE-ENGINEERED FRAME

Dwg. Ref.	.
Scale	1:200
Date	2018-06-21
Project No.	CAL.118882.0002
Sketch Number	Rev.
SK-10	-

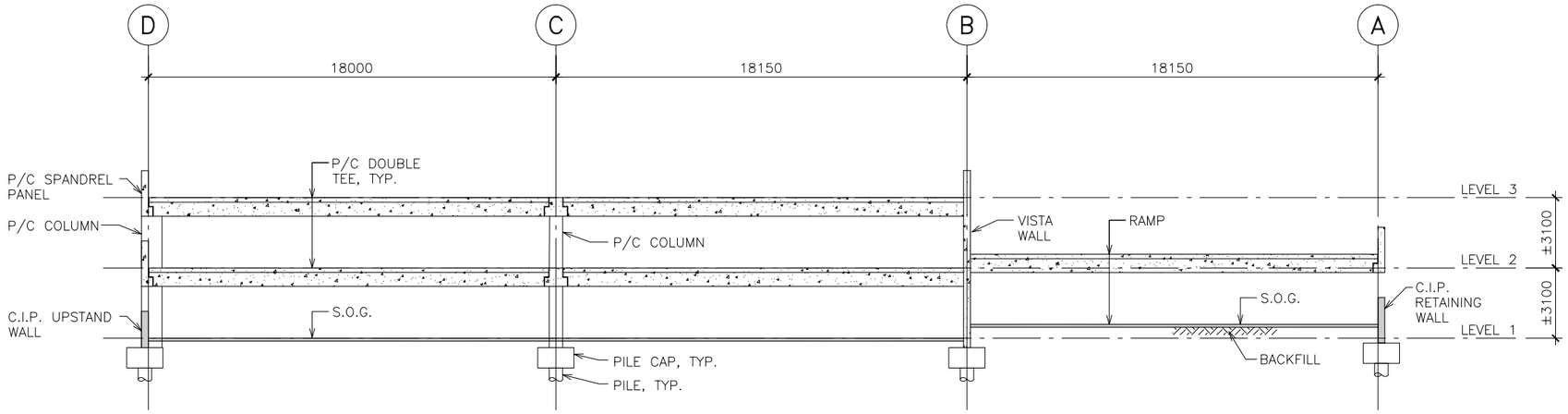


Engineers

PARKADE - NOT PART OF BASE BUILDING

Project Name
U OF A SOUTH CAMPUS
PARKADE
Sketch Title
PARKADE - TYPICAL FRAMING PLAN

Dwg. Ref. .
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-11** Rev. **-**



Engineers

PARKADE - NOT PART OF BASE BUILDING

Project Name
U OF A SOUTH CAMPUS PARKADE
Sketch Title
PARKADE - TYPICAL BUILDING SECTION

Dwg. Ref. -
Scale **1:200**
Date **2018-06-21**
Project No. **CAL.118882.0002**
Sketch Number **SK-12** Rev. **-**

APPENDIX C
MECHANICAL

University of Alberta

South Campus Community Arena

Mechanical Schematic Design Report

(Revised for Cost Reductions)

Remedy Project No.: 17-185

~~May 2018~~June 20, 2018

Prepared For:

GEC Architecture
300, 2207 – 4th Street S.W.
Calgary, AB T2S 1X1

Submitted By:

Remedy Engineering
200, 1422 Kensington Road N.W.
Calgary, AB T2N 3P9

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P:\2017\17-185-UofAArena\Design\Corres\U of A South Campus Mechanical Schematic Design Report - REVISED.docx~~P:\2017\17-185-UofAArena\Design\Corres\Recovered\U of A South Campus Mechanical Schematic Design Report.docx~~

1 Introduction

This report outlines the Mechanical Design Concept for the proposed University of Alberta South Campus Community Arena. The mechanical systems have been selected to:

- Provide a safe and comfortable indoor environment for all students and visitors
- Provide exceptional indoor air quality for an enhanced user experience.
- Provide systems designed for longevity that are accommodating to maintenance and renewal
- Be cost effective in design and energy efficient in operation
- Provide appropriate levels of humidity control for the variety of different space types (e.g., Arenas)
- Utilize a pragmatic design philosophy with well tested and robust system and equipment choices

The primary focus of any building mechanical system is to provide thermal comfort and acceptable indoor air quality, the two of which are critical elements that contribute to a facility occupant's well-being. Indoor environmental conditions such as air temperature, humidity levels, presence of drafts, and other design considerations such as mechanical system aesthetics, sound levels and energy efficiency all contribute to the promotion of well-being.

2 Design Criteria

2.1 External Design Criteria

External design conditions are as per the Alberta Building Code and ASHRAE recommendations as described below. Individual systems and components may be designed to slightly different criteria as discussed in the respective sections.

- Outside design dry-bulb temperature, Heating: -34°C is the design heating temperature, per Alberta Building Code
- Standard cooling design condition, Cooling: 28°C DB/19°C WB per Alberta Building Code

2.2 Internal Design Criteria

Internal comfort conditions are designed to comply with ASHRAE Standard 55-2010 for regularly occupied spaces.

Design Criteria:

SPACE TYPE	COOLING DESIGN TEMP. (°C)	HEATING DESIGN TEMP. (°C)	DESIGN RH (%)
Ice Rinks	N/A	7-13	40-50
Rink Team Rooms	N/A	18 ± 2	Uncontrolled
Change rooms	N/A	24	Uncontrolled
Educational and Administrative Spaces, Suites	24	22	Uncontrolled
Meeting Rooms	24	22	Uncontrolled
Elevator Machine Rooms	29	–	N/A
IT/Telecom Rooms	18-24	–	N/A

Notes:

.1 The indoor design temperature is the temperature at which the systems are sized. The system and space set point temperatures may be operated at different temperatures from above.

.2 With the exception of the arena spaces, spaces are not actively humidified or dehumidified.

Special Exhaust Systems

~~Dedicated smoke exhaust systems are recommended for the varsity arena.~~ Dedicated exhaust systems will be required for the arena refrigeration room. All washrooms and food service areas will be served by dedicated exhaust systems. The change and team room wet area will be fully exhausted with no recirculation.

3 Code and Code-Reference Standards

3.1 Applicable Codes and Standards

The mechanical design shall comply with the most current version of the following codes and industry standards:

- Alberta Building Code
- Model National Energy Code Building (MNECB), Canada
- Plumbing Code of Canada 2010
- Alberta Fire Code 2006
- CAN/CSA B149.1 Natural Gas Installation Codes
- National Fire Protection Association (NFPA) Standards
- Canadian Standards Association (CSA)
- CSA B52-99 – Mechanical Refrigeration Code
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- ASHRAE 55-2010 Thermal Environmental Conditions for Human Occupancy
- ASHRAE 62.1-2001 Ventilation for Acceptable Indoor Air Quality
- ASHRAE 90.1-2010 Energy Standard for Buildings
- University of Alberta Design and Construction Standards and Guidelines

3.2 Life Safety Systems

No optional life safety systems are required. Smoke control systems are not required, and no stairwells or elevators will be pressurized or vented.

4 Site Services

The plumbing utility design responsibility terminates 1m from the edge of the building. Our mechanical design will coordinate the natural gas, water, sanitary sewer and storm sewer utilities with the civil consultant beyond that point.

4.1 Natural Gas

A natural gas connection will be required to supply heating boilers, domestic water heaters, kitchen equipment, and laundry equipment.

Gas meter and pressure reducing valve will be located outside the building. The gas pressure will be reduced at the point of entry and will be piped through the building at 35kPa (5psi) pressure and reduced where connected to the gas fired appliances.

4.2 Water

A single 150mm water service connection will be made to the campus main and will serve for domestic use and for the firefighting service.

4.3 Sanitary Sewer

A single 150mm connection will be made to the sanitary sewer from the building. This will serve all domestic discharges

4.4 Storm Sewer

A storm sewer connection will be required to discharge the flow from the building roof as well as the surrounding areas of hardscape, which forms part of the civil engineers work.

The design rainfall intensity for Edmonton is 23 mm based on 15 minutes of rainfall duration as per the Alberta Building Code. Rainwater leaders will be connected inside the building before exiting the building

5 Plumbing

5.1 Domestic Water

Piping for all domestic water systems will be copper. Hot, cold, recirculated and tempered water piping will be insulated.

Velocities in the pipes will be limited to 2.0 m/s to help limit water hammer and cavitation in the system.

.1 Domestic Cold Water

The incoming domestic water main will be fitted with an approved backflow preventer, this will safeguard the City of Edmonton from any contamination from within the building.

.2 Domestic Hot Water

Hot water will be provided at lavatories, sinks, showers and other fixtures as required.

Primary heat for domestic hot water will be supplied from 2 condensing tank type commercial water heaters sized at 40% capacity each. Water heaters will be used along with 2-120 gallon storage tanks to ensure there is enough hot water to meet the peak hour requirement. The water will be stored at 60°C (140°F) and distributed around the building at 60°C.

~~A separate domestic hot water system will be provided to supply hot water to ice making equipment in the mechanical room. This system will consist of two (2) condensing tank type commercial water heaters and a single 120 gal storage tank and will be located in the mechanical room adjacent to the ice resurfacing room. The domestic hot water supply temperature will be 72°C (160°F).~~

The domestic hot water system~~s~~ will be arranged with a recirculating/return system to minimize heat loss within the system and ensure quick delivery of hot water to all fixtures.

5.2 Sanitary Waste and Vent

A complete and fully vented gravity soil and waste system will be provided to drain all plumbing fixtures and equipment rooms throughout the buildings. The system will connect to the 150 mm sanitary sewer. The system will be designed to maintain a minimum 1:50 slope. Vent and soil stacks will be provided as required. The vent lines will be located through the building roof. Adequate vent piping will be provided to equalize pressure fluctuations within the system stacks and branches within acceptable limits.

Trench drains will be installed in loading docks and flood rooms. Due to soil conditions, all underground sanitary piping will be supported from the structural slab. Hangers will be maximum 3 m apart with hangers on either side of a joint and at every change in direction.

5.3 Rainwater

Rainwater will pass by gravity from the roof drains to the storm sewer via internal building rain water leaders. Buried storm lines within the building will tie into a storm main at the building exit.

Due to soil conditions, all underground storm piping will be supported from the structural slab. Hangers will be maximum 3 m apart with hangers on either side of a joint and at every change in direction.

5.4 Natural Gas

Natural gas will be piped to the heating boilers, water heaters, gas fired make-up air units, dehumidification units and laundry equipment. The piping will run at 35kPa (5 psi) within the building and will be reduced locally to supply the gas fired appliances.

5.5 Plumbing Fixtures

The plumbing fixtures will be selected to minimize the amount of water usage in accordance with the University of Alberta's sustainability requirements to maintain the project's sustainability goals. ~~In addition to water savings, features will include infrared touchless activation which can enhance occupant experience.~~

The final selection of the fixtures will be made in conjunction with the Architect and the Owner but will generally be commercial grade quality as follows:

Water Closet	~~Battery operated infrared flush valve,~~ 1.3 US gpm (4.8L) per flush, vitreous china, floor mount, W.C in change rooms, wall mounted, W.C. in all other areas, barrier free

Urinals	Ultra low flow type, 0.5 L per flush, vitreous china wall hung
Public Lavatories	Modular lavatory systems with infrared controls, 0.5 US gpm (5.7 L per min) flow rate
Showers	Tempered water to a metering valve equal to Bradley Touch Time and vandal proof head
Janitor Sinks	Molded stone 600 mm x 600 mm floor mount basin, wall trim with vacuum breaker
Sinks	Single or double compartment stainless steel sinks with 200 mm centers

5.6 Piping Material

In general, plumbing pipe and fitting material used within the building will be as follows:

Service	Material
Sanitary Drainage and Vent	-Below Grade: PVC -Above Grade: "DWV" copper, cast iron or XFR PVC
Storm Drainage	-Below Grade: PVC -Above Grade: Cast iron or XFR PVC
Domestic Water	-Type L Hard Copper

5.7 Miscellaneous Systems

Weeping tile will be added around the building foundation in accordance with recommendation from the geotechnical engineer. Weeping tile will drain into a sump located in the mechanical room with duplex pumps and will then be pumped into the storm system via a force main.

In lieu of water heaters for the arena flood rooms, each room will be housed with a "Realice' system to remove micro-air bubbles from the water when resurfacing.

6 Fire Protection

6.1 Automatic Sprinkler System

The building will be sprinklered throughout. Upright heads will be used in exposed areas while pendant heads will be used where there are suspended ceilings. Wire guards for exposed heads will be supplied in areas that require protection.

In areas subject to freezing, such as the Loading Dock, a dry pipe sprinkler system will be provided.

Sprinkler zones will be designed to the following NFPA13 hazard:

- Arenas – ordinary hazard
- Mechanical Rooms, Storage Rooms, Refrigeration Room – ordinary hazard
- Admin/Meeting Rooms/Office – light hazard

A stand pipe system will be installed throughout in accordance with NFPA 14. Hose stations will be located in accordance with code requirements.

A pre-assembled preaction fire protection valve package enclosed within a free standing cabinet will be utilized in the main electrical and main communication rooms.

6.2 Extinguishers

Handheld extinguishers in wall mounted cabinets will be provided throughout in compliance with NFPA 10 and local authorities.

7 Heating

The primary heating system will make use of hot water radiation equipment. Most areas will use radiant panel which is a quiet, efficient and aesthetically pleasing system. Hot water systems are energy efficient and are also a common choice for the Alberta climate.

The heating plant will consist of 3~~2~~ fully modulating condensing boilers with a 15:1 turndown and an anticipated seasonal efficiency of approximately 93% which will provide exceptional heating performance. The heating load will be cascaded from a high temperature water loop to a lower temperature glycol loop in order to maximize temperature differential which in turn will maximize boiler efficiency. The heating plant will be sized to accommodate skin load and ventilation load. The boilers will be sized for peak heating requirements.

The boilers will be piped in variable primary arrangement with variable speed pumps on the primary loop. Preliminary required boiler plant capacity is 7,000MBH. This load will be met with 3 - 2,500MBH high efficiency condensing boilers with stainless steel heat exchangers and full modulation. Exact boiler plant capacity will be adjusted once a detailed load calculation is developed.

Two pumps will circulate heating water to terminal heating equipment throughout the building. The pumps will be controlled by variable frequency speed controllers to maintain constant pressure in the heating distribution main piping. The pumps will operate in duty/standby configuration with the standby pump operating only if the duty pump fails. Continuous hot water radiant panel or radiation along all outside walls will heat the building perimeter. Cabinet unit heaters will also heat the entrances. The suspended unit heaters will heat the mechanical rooms and loading docks, and the two-way modulating valves will control heating water flow to all terminal heating units.

Vertical in-line pumps will circulate the heat transfer fluid through a primary loop and a glycol loop. The glycol loop will feed heating coils on the ventilation units and the primary loop will feed the perimeter radiation, unit heaters, entrance heaters, etc. Standby pumps will be provided on each loop. Pumps will be complete with integral variable frequency speed drives

8 Ventilation

Adequate ventilation is one of the most critical elements contributing the health and wellness of a building occupant. Ventilation is required to maintain a high level of indoor air quality by removing contaminants, odors, dust and replenish a space with oxygen and fresh outdoor air. In the northern Alberta climate this process can be energy intensive with the requirements for heating outdoor air during the winter months. Our proposed ventilation systems are designed to maintain exceptional levels of indoor air quality by utilizing energy saving technologies such as demand controlled ventilation, exhaust air heat recovery, ~~and~~ free cooling and fan arrays.

8.1 System Descriptions

.1 Varsity Arena – Dehumidification

A single roof mounted standalone package dehumidification unit will serve the Varsity Arena. This unit will utilize a low temperature desiccant wheel technology. The roof mounted units desiccant wheel will absorb moisture from the air in the main air tunnel and that moisture will get burned off the wheel by a direct fired burner in the second air tunnel. This unit will minimize the potential for slushy ice, vision obscuring fog and moisture that condenses on surfaces causing decay of the building structure. The unit will feed the Varsity rink from a high level duct located about the suites.

.2 Varsity Arena – Secondary Ventilation System

A second ventilation unit will feed the arena seating bowl. This unit will be a constant volume ventilation system will be housed with VFD's on the supply and return fans for capacity control during non- peak events. Demand controlled ventilation with CO_2 sensors will be utilized to reduce the outside air and supply air volumes for the arena space. The air system will be sized for special events occupancy of 3,200 people while working in conjunction with the roof mounted dehumidification unit. ~~This unit will also be housed with DX cooling to provide secondary dehumidification as well as air conditioning during summer and shoulder seasons.~~

.2 Community Arena

Like the Varsity Arena, a single standalone package dehumidification unit will serve the community arena to provide dehumidification. The package unit will utilize the same technology as the Varsity Arena with a low temperature desiccant wheel. Air will be supplied by a duct at high level and returned at low level to ensure ventilation effectiveness throughout the high volume space.

.3 Hockey Team Rooms

Each hockey change room consists of approximately 1/3 wet area (showers, washrooms) and 2/3 change room. Wet areas will be exhausted at a rate of 2 CFM/ft2 in accordance with ASHRAE 62. An equal amount of outside air will be fed into the change room area and exhausted thru the wet areas.

The ventilation system will be a ~~variable air~~constant volume ~~(VAV)~~ ventilation System with 100% outside air and 100% exhaust and full heat recovery. ~~Each locker room will be housed with a VAV box for supply air and a VAV box for exhaust air. The boxes will be fed from medium pressure supply & exhaust duct systems off the ventilation unit.~~ Because the locker rooms are variable occupancy, when they are occupied, the air will be delivered at 100%, however when they are unoccupied, the ~~boxes will close to 20% (adjustable)~~ ventilation unit will ramp down to reduce air volumes and energy consumption dramatically.

There will be 2 of these units. One will feed the varsity rink and one will feed the community rink. Reheat coils will be added to the supply air feeds in the varsity change rooms to encourage drying of equipment during unoccupied periods.

.4 Lobby/Suites/MPR's

A variable air volume (VAV) air handling system will serve these spaces. A mixed air air handling unit will feed a medium pressure duct system. VAV

Boxes will vary the air volume to maintain the space at setpoint. The low pressure ductwork downstream of the VAV box will feed overhead ceiling diffusers and grilles. The unit will be a roof mounted unit and will be housed with supply and return fans, glycol heating coil, mixed air section sized for 100% free cooling and DX cooling for air conditioning for summer and shoulder season operation.

.5 Miscellaneous Systems

.1 Refrigeration Room

The ice plant room will be independent from building HVAC systems. It will be designed as a class 'T' engine room provided with a make-up air and exhaust system sized in accordance with CSA code B-52 for Mechanical Refrigeration. The system will be activated by ammonia sensors located within the refrigeration room.

.2 Servery

The serveries will each function with commercial kitchen exhaust hoods and will be provided with NFPA 96 approved hoods and exhausted directly outside. A direct fired make-up air unit will be interlocked to the kitchen hood exhaust fan.

.3 Telecomm Rooms and Server Rooms

Telecomm rooms and server rooms will be provided with transfer fans for cooling. Fans will be sized to maintain a room condition of no more than 29°C based on an adjacent space temperature of 24°C. Fans will be located above the adjacent space ceiling, connecting to an exhaust grille in the sidewall of the telecom or elevator machine room and exhausting into the adjacent ceiling plenum. Transfer air will be provided via a door grille.

.4 Main Communication Room

The main communication room will be serviced with a split air conditioning unit sized to meet the space loads. Room will be maintained between 18-21°C

.5 Ceiling Fans

The high volume spaces (main lobby) will utilize high volume ceiling fans to minimize stratification. The 2.4m (8ft) diameter fans are aerodynamically designed to quietly increase downward velocity to stabilize air movement and maximize energy efficiency.

~~.6 Smoke Exhaust~~

~~2 smoke exhaust fans will be supplied on the Varsity Arena roof to evacuate any smoke from events utilizing pyrotechnics.~~

~~.7 Radiant Heaters~~

~~Gas fired infrared heaters will be provided over the stands in the community arena only for occupant comfort. Heaters will be controlled by a 0-60 min spring return timer located in the rink attendants office.~~

8.2 Additional Requirements

.1 Redundancy and Flexibility

The hot water heating system is provided with some redundancy to ensure that heat is provided to the building in the event of equipment failure. Three (3) boilers each size at 40% capacity, are proposed. If one boiler fails, the building will still have 80% of full capacity, which is sufficient to meet the full design day building heating and ventilation load. Two hot water circulation pumps are provided, each sized at 100% of system flow (1 duty and 1 standby). Additionally, the reheat coils in the air handling units are sized as if the heat wheels were not operational, so if the heat wheel motor fails the system will still have sufficient capacity to maintain temperature in the building.

.2 Future Sizing

The boiler plant and domestic hot water plant will be designed with the ability to add additional capacity for the future Health and Wellness addition.

9 Controls

A complete Direct Digital Control (DDC) Energy Management Control System (EMCS) will be installed to control to monitor all building systems. Controlled and monitored systems include.

- All HVAC systems and components
- Central plant systems and components
- Plumbing systems and components

The EMCS will be of a standard architecture consisting of terminal controllers, remote control panels, and operator interface workstations.

Space temperature control will be provided through terminal controllers, electronic room temperature sensors, and electronic reheat control valves.

Standalone remote control panels will operate and monitor major mechanical equipment.

Building operators will interface with the EMCS through personal computer based operator workstations using graphical software. The interface from the wellness center to the existing campus will utilize the proposed fiber optic cable communication network expansion.

All field devices including valve and damper actuators, room temperature controllers, and HVAC system and equipment control and monitoring devices will be electronic. The EMCS will not be utilized for lighting control, it will be controlled form a standalone system.

10 Sustainable Initiatives

The mechanical design of this building will address many features that contribute to lowering building energy consumption, enhancing occupant comfort and increasing the sustainability of the building. The following is a listing of mechanical features that contribute to sustainable design.

.1 All cooling equipment will utilize CFC and HCFC free refrigerants.

.2 Plumbing fixtures will be low water consumption type.

.3 The heat recovery ventilation units will provide full heat recovery on all washroom, shower & general exhaust.

.4 Heating plant will utilize fully modulating high efficiency condensing boilers to maximize plant efficiency striving for a seasonal boiler efficiency of 93%.

.5 The heating and glycol pumps will utilize VFD's to control flow/pressure and reduce pump energy.

.6 All air handling systems will utilize VFD's to control air volumes and reduce fan energy during low peak times.

.7 The varsity ~~and~~ arena space~~s~~ (variable occupancy space~~s~~) will utilize demand controlled ventilation using CO2 sensors to regulate the quantity of outside air being delivered.

.8 The following systems will capture waste heat from the refrigeration plant:

- Domestic hot water preheat
- Underfloor heating below ice surfaces
- Snow melt pit

.9 The energy management control system will optimize start/stop, occupancy, boiler ~~& chiller~~ plant efficiency, etc. to maximize the HVAC system efficiency.

~~.10 The arena change room ventilation will be minimized thru the use of occupancy sensors and VAV boxes.~~

11 BELOW THE LINE MECHANICAL COSTS

The following are mechanical items that could be considered if the budget allows it:

.1 The arena change room ventilation could be minimized thru the use of occupancy sensors and VAV boxes on the supply and exhaust air.

.2 In-slab heating could be utilized to heat the varsity arena concourse and the main spine of the building.

.3 Air conditioning could be added to the varsity seating bowl to allow for non-hockey functions during summer and shoulder season events.

.4 Smoke exhaust could be added to the varsity Arena to accommodate potential concerts with pyrotechnics.

.5 Gas fired infrared heaters could be added to the community arena.

.6 Snow/water from the ice resurfacing could be harvested, stored, filtered and treated for reuse to flush toilets and urinals.

~~PARKADE~~

~~1 Introduction~~

~~This report outlines the Mechanical Design Concept for the proposed University of Alberta South Campus Community Arena Parkade. It is an open parkade and will not require any heating or ventilation.~~

~~2 Code and Code-Reference Standards~~

~~2.1 Applicable Codes and Standards~~

~~The mechanical design shall comply with the most current version of the following codes and industry standards:~~

- ~~Alberta Building Code~~
- ~~Model National Energy Code Building (MNECB), Canada~~
- ~~Plumbing Code of Canada 2010~~
- ~~Alberta Fire Code 2006~~
- ~~CAN/CSA B149.1 Natural Gas Installation Codes~~
- ~~National Fire Protection Association (NFPA) Standards~~
- ~~Canadian Standards Association (CSA)~~
- ~~Sheet Metal and Air Conditioning Contractors National Association (SMACNA)~~
- ~~University of Alberta Design and Construction Standards and Guidelines~~

~~2.2 Life Safety Systems~~

~~No optional life safety systems are required. Smoke control systems are not required, and no stairwells or elevators will be pressurized or vented.~~

~~3 Site Services~~

~~The plumbing utility design responsibility terminates 1m from the edge of the building. Our mechanical design will coordinate the natural gas, water, sanitary sewer and storm sewer utilities with the civil consultant beyond that point.~~

~~3.1 Water~~

~~A single 40mm water service connection for the parkade will be made to the campus main and will serve for domestic use only.~~

~~3.2 Sanitary Sewer~~

~~A single 150mm connection will be made to the sanitary sewer from the parkade. This will serve all domestic discharges~~

~~3.3 Storm Sewer~~

~~A storm sewer connection will be required to discharge the flow from the parkade top deck as well as the surrounding areas of hardscape, which forms part of the civil engineers work.~~

~~The design rainfall intensity for Edmonton is 23 mm based on 15 minutes of rainfall duration as per the Alberta Building Code. Rainwater leaders will be connected inside the building before exiting the building~~

~~4 Plumbing~~

~~4.1 Domestic Water~~

~~Piping for all domestic water systems will be copper. Cold water piping will be insulated.~~

~~Velocities in the pipes will be limited to 2.0 m/s to help limit water hammer and cavitation in the system.~~

~~.1 Domestic Cold Water~~

~~The incoming domestic water main will be fitted with an approved backflow preventer, this will safeguard the City of Edmonton from any contamination from within the building. Water will be provided for parkade cleaning only.~~

~~.2 Domestic Hot Water: not required~~

~~4.2 Sanitary Waste and Vent~~

~~A complete and fully vented gravity soil and waste system will be provided to drain all parkade drains. The system will connect to the 150 mm sanitary sewer. The system will be designed to maintain a minimum 1:50 slope. Vent and soil stacks will be provided as required. The vent lines will be located through the building roof. Adequate vent piping will be provided to equalize pressure fluctuations within the system stacks and branches within acceptable limits. A grit and oil interceptor will be supplied for all parkade waste.~~

~~4.3 Rainwater~~

~~Rainwater will pass by gravity from the top level parkade deck drains to the storm sewer via internal building rain water leaders. Buried storm lines within the building will tie into a storm main at the building exit. A storm scepter will be required to pick up all grit and oil prior to tying into the municipal main.~~

~~5 Fire Protection~~

~~5.1 Fire Extinguishers~~

~~Hand held extinguishers in wall mounted cabinets will be provided throughout in compliance with NFPA 10 and local authorities.~~

~~6 Heating~~

~~Not required.~~

~~7 Ventilation~~

~~Not required.~~

Mechanical Outline Specifications

.1 Fire Suppression

- Provide wet-pipe sprinkler system, and standpipes in locations described.
- Provide a packaged preaction valve cabinet and schedule 40 galvanized pipe will be utilized in all main electrical & switch gear rooms.

.2 Plumbing Insulation

- Provide pre-formed rigid mineral fiber insulation for all domestic cold and hot water piping as well as storm drainage piping and vent piping.
- Conductivity of 0.039 W/m-K at 24°C.
- Provide ASJ jacket with PVC fitting covers. Provide PVC jacket on all exposed piping.
- Insulate all fittings, joints and valves.
- Domestic Cold and Hot water piping: 25mm insulation for up and including 75mm pipe; 40 mm for 100 mm pipe and larger.
- Storm lines shall be insulated within the first 3 meters downstream of roof drains in non-gymasium/fitness areas and shall be insulated for their entire length in gymnasium/fitness areas.
- Plumbing vent lines shall be insulated for 3 meters from the roof penetration.

.3 Domestic Water Piping and Valves

- Provide inline close-coupled pumps for small circulating pumps. Pumps shall be cast iron with cast bronze impeller.
- Provide copper tubing, type L, hard drawn on all domestic hot and cold, tempered water and grey water. Provide Type K, hard drawn, on all domestic hot water recirculation.
- Provide ball type isolation valves at all heat exchangers, pumps, and fixtures. Valves for throttling, bypass or manual flow control shall be calibrated ball, or globe valves.
- Provide preinsulated 120 us gal package storage tanks for domestic hot water.
- Perform pressure testing with water on all domestic water piping.

.4 Sanitary Sewer Piping – Above Grade

- PVC XFR Pipe and Fittings: Solvent Weld Joints.

- Cast Iron Pipe and Fittings: Hubless with neoprene gaskets and stainless steel clamp-and- shield assemblies.
- Copper Tubing with Cast Bronze or Wrought Copper Fittings: 50/50 solder joints.

.5 Sanitary Sewer Piping: Buried

- ABS Pipe and Fittings: Solvent weld joints. PVC Pipe and Fittings: Solvent weld joints.

.6 Storm Water Piping – Above Grade

- PVC XFR Pipe and Fittings: Solvent weld joints.
- Cast Iron Pipe and Fittings: Hubless with neoprene gaskets and stainless steel clamp-and- shield assemblies.

.7 Storm Piping: Buried.

- ABS Pipe and Fittings: Solvent weld joints. PVC Pipe and Fittings: Solvent weld joints.

.8 Plumbing Equipment

- Provide indirect gas-fired condensing water heaters for production of domestic and rink flood hot water.

.9 Plumbing Pumps

- Domestic hot water recirculation pumps to be bronze body, stainless steel volute, and flange connection, suitable for use with domestic water.

.10 HVAC Insulation

- Provide mineral fiber blanket insulation for round and rectangular ductwork.
- Conductivity of 0.039 W/m-K at 24°C.
- Supply ductwork on systems with air conditioning: 50 mm, with vapor retarder.
- Return ductwork: no insulation required.
- Exhaust ductwork: insulation with 50 mm insulation for 5 m from building exterior
- Provide flexible closed cell elastomeric duct liner on ductwork where acoustic duct liner is required.
- Conductivity of 0.039 W/m-K at 24°C.
- 25 mm thickness for acoustic applications.
- Provide semi-rigid glass fiber insulation for equipment.
- Conductivity of 0.039 W/m-K at 24°C.
- Provide 1” stainless steel hexagonal wire mesh stitched on one face of insulation.
- Provide vapor retarder.
- Provide canvas jacket for all equipment.
- 50 mm for heat exchangers, breeching, etc.
- Provide pre-formed rigid mineral fiber insulation for piping.
- Conductivity of 0.039 W/m-K at 24°C.
- Provide PVC fitting covers. Provide PVC jacket on all exposed piping.
- Insulate all fittings, joints and valves.
- Hot water piping: 25 mm insulation for up to and including 75 mm pipe; 40 mm for 100 mm pipe and larger.

.11 Natural Gas Piping

- Provide Schedule 40 black steel piping and malleable iron fittings. Provide shutoff valves as two-piece, full-port bronze ball valves with a pressure rating of 862 kPa. Meter and pressure reducing valve shall be in accordance with utility requirements.

.12 HVAC Piping and Pumps

- Provide vertical in-line centrifugal pumps for all large hot water and chilled water pumps. Provide inline close-coupled pumps for smaller circulating pumps. Pumps shall be cast iron with cast bronze impeller.
- Provide Schedule 40 black steel pipe for piping 65 mm and larger with welded joints. Grooved coupling (i.e., Victaulic) is not acceptable for heating and chilled water piping.
- Provide copper tubing, type L, hard drawn for piping 50 mm and smaller, with soldered joints.
- Provide calibrated balancing valves at all AHU coils.
- Provide isolation valves at all coil connections, heat exchangers, chillers and boilers. Isolation valves shall be ball valves for pipe sizes up to and including 50 mm, and gate valves for pipe size 65 mm and above. Valves for throttling, bypass or manual flow control shall be calibrated ball, or globe valves.
- Provide pressure and temperature (P/T) gauges and temperature sensors on all AHU coil connections and heat exchanger

connections. Provide P/T taps at all coil connections. Provide thermometer and temperature sensor on boiler connections. Provide air vents at all piping system high points and drain valves (ball valves) at low points including at all coil connections. Provide strainers on all coil connections.

- Provide ASME stamped expansion tanks and air separators. Perform pressure testing with water on all hydronic piping.

.13 HVAC Water Treatment

- Provide chemical treatment for closed loop hydronic systems (hot water heating and glycol) to include corrosion inhibitors, and conductivity enhancers, to adjust pH.
- Provide propylene glycol, dowfrost or equal, for AHU coil loops at 50% concentration. Provide glycol pot feeder for each sub-system.

.14 HVAC Ductwork

- Ductwork shall be galvanized steel. Thickness, fabrication and reinforcement shall be per SMACNA.
- Provide radiused elbows with centerline radius of 1.5 times the duct width, or provide mitered bends with turning vanes for all bends greater than or equal to 45 degrees. Provide 45 degree entry on rectangular branches. Transitions shall have an angle of no more than 30 degrees, with an angel of 15 degrees where space allows.
- Flexible ducts are permitted for supply duct runouts to ceiling diffusers, maximum length of 1,200 mm (4 ft.)

.15 Air Duct Accessories

- Provide flexible connections at all connections between fans and fan-powered equipment and rigid ductwork.
- Provide curtain type fire dampers. Isolation dampers shall have insulated frame and blade where located at building perimeter.

.16 Fans

- Fans shall be direct-driven, forward-curved inline centrifugal cabinet fans, galvanized steel fan cabinet construction.

.17 Variable Air Volume Air Terminal Units

- Terminal units shall be single-duct VAV boxes with galvanized steel volume dampers, velocity sensor, and electronic DDC controls. Provide hot water reheat coils at the suites and administration zones, public corridor and any other interior zones requiring zone control.

.18 Air Inlets and Outlets

- Provide square cone ceiling diffusers and perforated ceiling return grilles in the changing room areas and adjacent corridors. Provide sidewall double deflection grilles in the arena & gymnasium/fitness area.

.19 Air Filtration

- Provide MERV 13 filtration on the supply side of all air handling units. Provide MERV 8 filters in HRVs on each side of the heat exchangers.

.20 Central Heating Equipment

- Boiler basis of design is the AERCO Benchmark water boiler designed for condensing application, full modulation, and stainless steel heat exchanger.
- Provide direct venting for boilers; flue shall be double wall AL29-4C Class IV stainless steel. Inlet shall be galvanized steel pipe with fully sealed joints.
- Provide condensate neutralization tank for each boiler.

.21 Heat Exchangers for HVAC

- Provide single pass ASME stamped plate type heat exchangers constructed with removable head to allow plates to be added or removed. Frame plates and pressure plates shall be carbon steel. Plate pack shall use positive plate alignment system to ensure proper plate to gasket seals.

.22 Central HVAC Equipment

- Air handling units and heat recovery ventilators shall be custom units:
  - 50 mm insulated double-wall galvanized steel construction, with structural steel base.
  - Provide galvanized steel double wall access doors with double glazed laminated glass window to each AHU section.
  - Fans shall be direct drive ~~air foil or plenum~~ fan~~s~~ arrays.

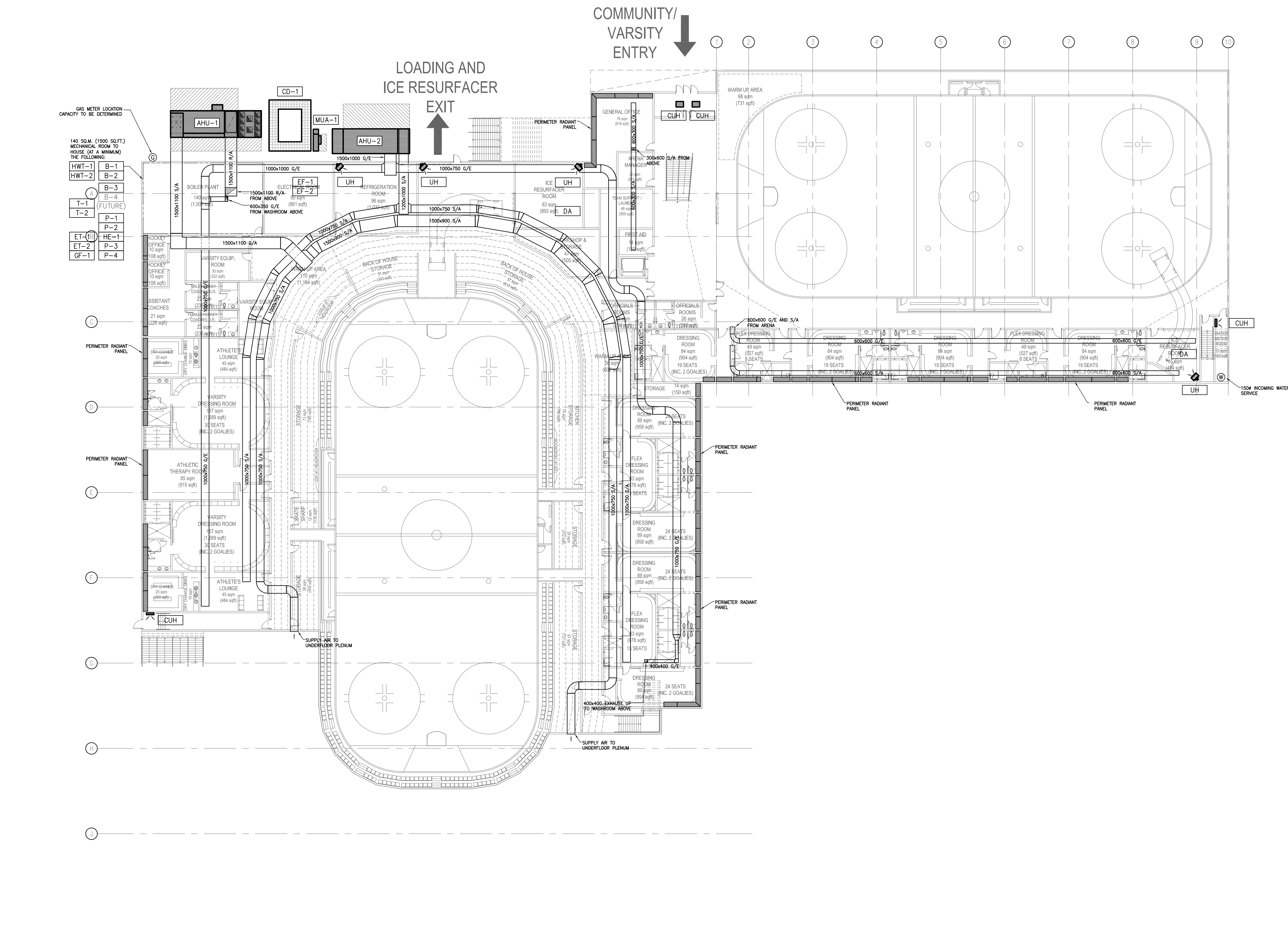
- Glycol heating coils shall be copper tubes with aluminum fins.

.23 Terminal Heating Equipment

- Radiant ceiling panels shall consist of a rigid aluminum panel faced with copper tubes mechanically fastened to the panel using a hardening heat transfer paste.
- Force flow hydronic unit heaters shall be provided in all entry vestibules, with 7.5 kW of heating output for a single door vestibule and 15 kW of heat output for double door vestibule.

.24 Instrumentation and Control for HVAC

- Provide EMCS as described in narrative above.
- Instrumentation and Control Devices:
  - Provide Platinum RTD sensors for duct, space, and fluid temperature sensing.
  - Provide solid state carbon monoxide sensor in loading dock.
  - Provide relative humidity sensors in AHU supply and return.
  - Provide CO2 sensor in rooms indicated to have demand-control ventilation in the design criteria tables earlier in this narrative.
  - Provide ULC and CSA certified actuators compatible with damper or valve provided.
  - Provide insertion magnetic flow meter for hot water and chilled water flow sensing.
  - Provide shielded room static pressure probe and static outdoor air probe for sensing building pressurization.
  - Provide fan inlet mounted air flow measuring stations on AHU fans. Provide thermal dispersion type air flow measuring station for outside air intakes.
  - Provide magnahelic differential pressure sensors on AHU filters.
  - Control valves: AHU coil control valves shall be globe type. Terminal unit control valves shall be Pressure Independent Characterized Control Valve type.



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Revisions

No.	Description	Date
1	ISSUED FOR COSTING	2018-04-20
2	ISSUED FOR SD	2018-05-24
3	ISSUED FOR COST SAVINGS	2018-06-21

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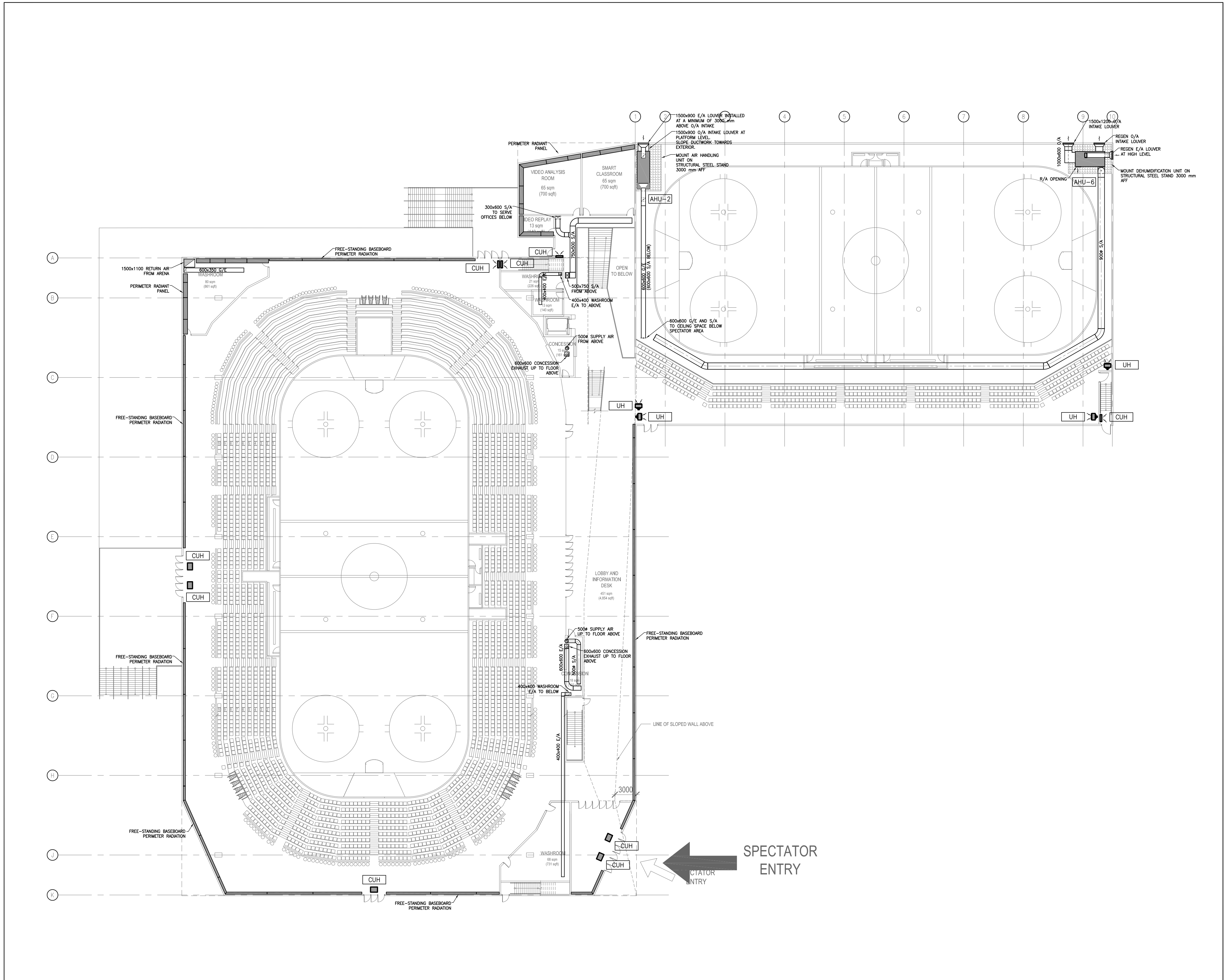
SOUTH CAMPUS
COMMUNITY ARENA

UNIVERSITY OF ALBERTA
116 STREET & 85 AVENUE
EDMONTON, ALBERTA

Drawing Title:

MECHANICAL -
VENTILATION
ENTRY LEVEL

Drawn By: DK		Date:	2018-04-11
Designed By: DK		Scale:	1:200
Engineer: JS		Job number:	18-185
Drawing Number	M1	Rev. No.	△



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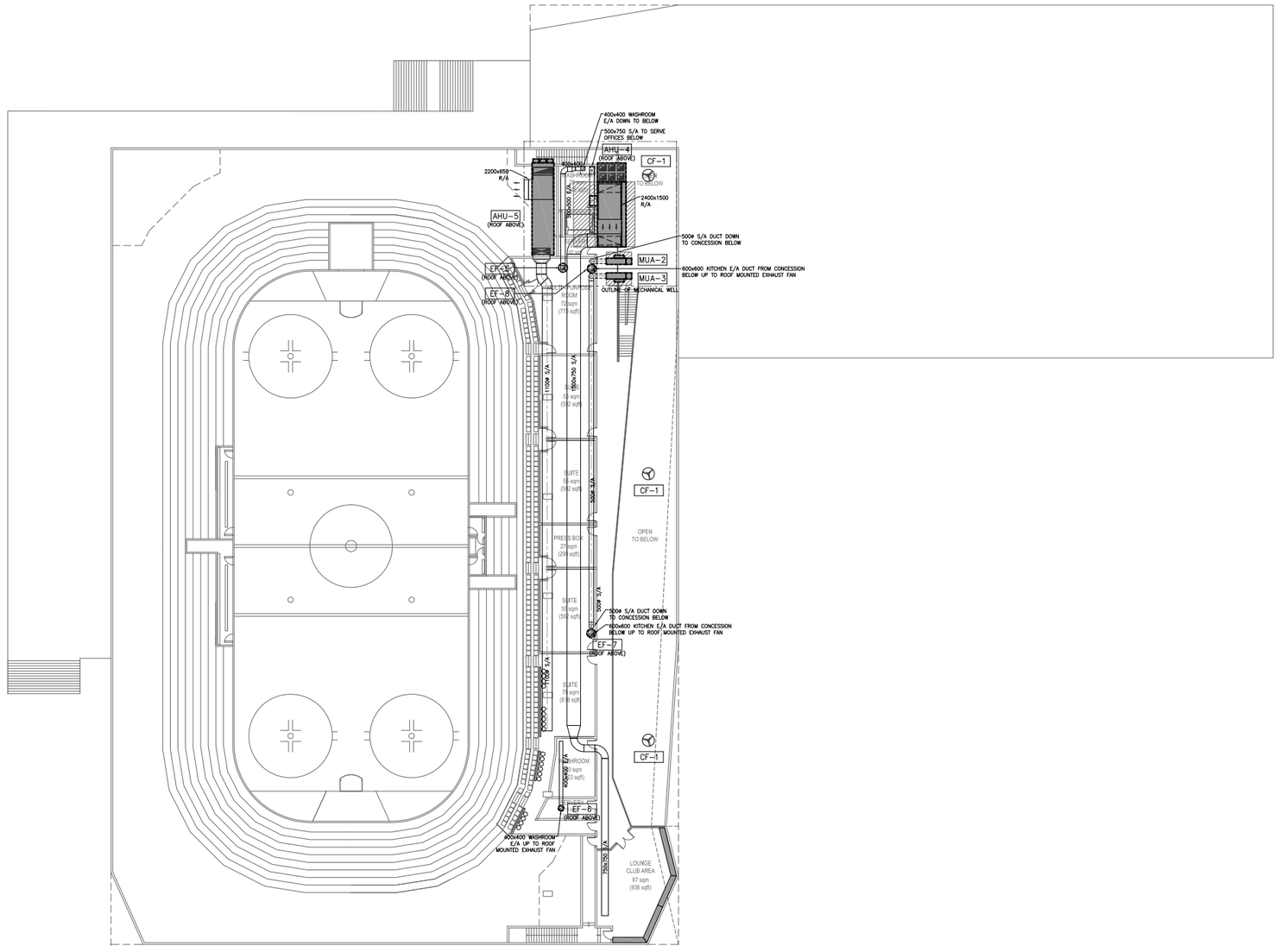
Drawing Title:

MECHANICAL -
VENTILATION
SPECTATOR LEVEL

Drawn By: DK	Date: 2018-04-11
Designed By: DK	Scale: 1:200
Engineer: JS	Job number: 18-185
Drawing Number: M2	Rev. No. △



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Drawing Title:

MECHANICAL - VENTILATION ENTRY LEVEL

Drawn By:	DK	Date:	2018-04-11
Designed By:	DK	Scale:	1:200
Engineer:	JS	Job number:	18-185

Drawing Number: M3 — Rev. No.: △

MECHANICAL VENTILATION EQUIPMENT SCHEDULE

TAG No.	SYSTEM	LOCATION/ SERVICE	SUPPLY AIR		RETURN / EXHAUST AIR		ELECTRICAL (V/Ph/Hz)	VARIABLE SPEED DRIVE	REMARKS
			CAPACITY L/s	MOTOR HP	CAPACITY L/s	MOTOR HP			
AHU-1	100% OUTSIDE AIR HRV	VARSITY ARENA EVENT LEVEL	9,910	30	11,562	50	600/3/60	YES	OUTDOOR, 100% OUTSIDE AIR, STACKED HEAT RECOVERY AIR HANDLING UNIT. SUPPLY TUNNEL C/W INLET DAMPERS, SUMMER/WINTER FILTERS, GLYCOL PRE-HEAT COIL, HEAT WHEEL, FAN W/ VFD AND GLYCOL RE-HEAT COIL. GENERAL EXHAUST AIR TUNNEL C/W FILTERS, FAN W/ VFD, HEAT WHEEL AND DISCHARGE DAMPERS.
AHU-2	MIXED AIR - DISPLACMENT	VARSITY ARENA SPECTATOR LEVEL	16,517	50	16,517	25	600/3/60	YES	OUTDOOR, MIXED AIR, AIR HANDLING UNIT C/W CONDENSER, RETURN FAN W/ VFD. OUTDOOR, RELIEF AND RETURN AIR DAMPERS, FILTERS, SUPPLY FAN, GLYCOL HEATING COIL AND DX COOLING.
AHU-3	100% OUTSIDE AIR HRV	COMMUNITY ARENA EVENT LEVEL	2,360	10	2,360	15	600/3/60	YES	INDOOR, 100% OUTSIDE AIR, STACKED HEAT RECOVERY AIR HANDLING UNIT. SUPPLY TUNNEL C/W INLET DAMPERS, SUMMER/WINTER FILTERS, GLYCOL PRE-HEAT COIL, HEAT WHEEL, FAN W/ VFD AND GLYCOL RE-HEAT COIL. GENERAL EXHAUST AIR TUNNEL C/W FILTERS, FAN W/ VFD, HEAT WHEEL AND DISCHARGE DAMPERS.
AHU-4	MIXED AIR	VARSITY ARENA SUITE LEVEL	9,436	25	9,438	10	600/3/60	YES	OUTDOOR, MIXED AIR, HANDLING UNIT C/W CONDENSER, RETURN FAN W/ VFD, OUTSIDE, RELIEF AND RETURN AIR DAMPERS, FILTERS, SUPPLY FAN, GLYCOL HEATING COIL AND DX COOLING COIL.
AHU-5	MIXED AIR, HRV, DEHUMIDIFICATION	VARSITY ARENA DEHUMIDIFICATION	9,438	30	9,438	10	600/3/60	NO	OUTDOOR, MIXED AIR, AIR HANDLING UNIT C/W OUTSIDE AND RETURN, AIR DAMPERS, SUPPLY FAN, RETURN FAN. INDIRECT GAS FIRED BURNER AND DESICCANT HEAT RECOVERY WHEEL.
AHU-6	MIXED AIR, HRV, DEHUMIDIFICATION	COMMUNITY ARENA DEHUMIDIFICATION	3,539	15	3,539	3	600/3/60	NO	OUTDOOR, MIXED AIR, AIR HANDLING UNIT C/W OUTSIDE AND RETURN, AIR DAMPERS, SUPPLY FAN, RETURN FAN. INDIRECT GAS FIRED BURNER AND DESICCANT HEAT RECOVERY WHEEL.
MUA-1	INDIRECT GAS FIRED	REFRIGERATION PLANT	1,180	3	-	-	600/3/60	NO	OUTDOOR, INDIRECT GAS FIRED MAKE-UP AIR UNIT C/W INLET DAMPER, SUMMER FILTERS, BURNER, SUPPLY FAN,
MUA-2	DIRECT GAS FIRED	CONCESSION / KITCHEN MAKE-UP AIR	1,180	3	-	-	600/3/60	NO	OUTDOOR, DIRECT GAS FIRED MAKE-UP AIR UNIT C/W INLET DAMPER, SUMMER FILTERS, BURNER, SUPPLY FAN,
MUA-3	DIRECT GAS FIRED	CONCESSION / KITCHEN MAKE-UP AIR	1,180	3	-	-	600/3/60	NO	OUTDOOR, DIRECT GAS FIRED MAKE-UP AIR UNIT C/W INLET DAMPER, SUMMER FILTERS, BURNER, SUPPLY FAN,
EF-1	INLINE EXHAUST FAN	REFRIGERATION ROOM EMERG. EXHAUST	-	-	1,180	3	600/3/60	NO	INLINE EXHAUST FAN C/W SPARK-RESISTANT CONSTRUCTION, SPRING ISOLATION, LOCAL DISCONNECT, FLEXIBLE CONNECTIONS AND BELT DRIVE MOTOR. INTERLOCK W/ MUA-1.
EF-2	INLINE EXHAUST FAN	REFRIGERATION ROOM MIN. EXHAUST	-	-	236	1/2	120/1/60	NO	INLINE EXHAUST FAN C/W SPARK-RESISTANT CONSTRUCTION, SPRING ISOLATION, LOCAL DISCONNECT, FLEXIBLE CONNECTIONS AND BELT DRIVE MOTOR. EXHAUST FAN OPERATES CONTINUOUSLY.
EF-3	NOT USED								
EF-4	NOT USED								
EF-5	ROOF MOUNTED EXHAUST FAN	OFFICE AND SUITE LEVEL WASHROOMS	-	-	1,062	3	600/3/60	NO	ROOF MOUNTED, DOWNBLAST EXHAUST FAN C/W LOCAL DISCONNECT, ROOF CURB AND BELT DRIVE MOTOR.
EF-6	ROOF MOUNTED EXHAUST FAN	SE SUITE LEVEL WASHROOM	-	-	448	1	600/3/60	NO	ROOF MOUNTED, DOWNBLAST EXHAUST FAN C/W LOCAL DISCONNECT, ROOF CURB AND BELT DRIVE MOTOR.
EF-7	ROOF MOUNTED, KITCHEN EXHAUST FAN	CONCESSION	-	-	1,180	3	600/3/60	NO	ROOF MOUNTED, UPBLAST KITCHEN EXHAUST FAN C/W SPARK RESISTANT CONSTRUCTION TO NFPA 96, LOCAL DISCONNECT, ROOF CURB, GREASE TRAP AND BELT DRIVE MOTOR.
EF-8	ROOF MOUNTED, KITCHEN EXHAUST FAN	CONCESSION	-	-	1,180	3	600/3/60	NO	ROOF MOUNTED, UPBLAST KITCHEN EXHAUST FAN C/W SPARK RESISTANT CONSTRUCTION TO NFPA 96, LOCAL DISCONNECT, ROOF CURB, GREASE TRAP AND BELT DRIVE MOTOR.
CF-1	CEILING FAN	ATRIUM	-	-	-	-	120/1/60	NO	

MECHANICAL HEATING EQUIPMENT SCHEDULE

TAG No.	SYSTEM	LOCATION / SERVICE	CAPACITY (INPUT/OUTPUT) kW	FLUID FLOW L/S	ELECTRICAL (V/Ph/Hz)	MOTOR HP	VFD	REMARKS
B-1	PRIMARY HEATING BOILERS	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	723.8 / 681.5	-	120/1/60	-	YES	CONDENSING BOILER
B-2	PRIMARY HEATING BOILERS	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	723.8 / 681.5	-	120/1/60	-	YES	CONDENSING BOILER
B-3	PRIMARY HEATING BOILERS	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	723.8 / 681.5	-	120/1/60	-	YES	CONDENSING BOILER
B-4	FUTURE	FUTURE WELLNESS	723.8 / 681.5	-	120/1/60	-	YES	CONDENSING BOILER
P-1	PRIMARY HEATING WATER CIRCULATION PUMPS (DUTY/STANDBY)	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	31.55	600/3/60	15	YES	VERTICAL INLINE CIRCULATION PUMP C/W VFD, SUCTION GUIDE
P-2	PRIMARY HEATING WATER CIRCULATION PUMPS (DUTY/STANDBY)	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	31.55	600/3/60	15	YES	VERTICAL INLINE CIRCULATION PUMP C/W VFD, SUCTION GUIDE
P-3	PRIMARY HEATING GLYCOL CIRCULATION PUMPS (DUTY/STANDBY)	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	22.4	600/3/60	10	YES	VERTICAL INLINE CIRCULATION PUMP C/W VFD, SUCTION GUIDE
P-4	PRIMARY HEATING GLYCOL CIRCULATION PUMPS (DUTY/STANDBY)	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	22.4	600/3/60	10	YES	VERTICAL INLINE CIRCULATION PUMP C/W VFD, SUCTION GUIDE
HE-1	HEATING WATER TO HEATING GLYCOL HEAT EXCHANGER - AIR HANDLING UNIT COILS	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	1875.8	-	-	-	-	HEATING WATER TO HEATING GLYCOL PLATE AND FRAME HEAT EXCHANGER
HWT-1	DOMESTIC HOT WATER TANK	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	147	-	120/1/60	-	-	CONDENSING DOMESTIC HOT WATER TANK, 60°C SUPPLY WATER TEMPERATURE
HWT-2	DOMESTIC HOT WATER TANK	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	147	-	120/1/60	-	-	CONDENSING DOMESTIC HOT WATER TANK, 60°C SUPPLY WATER TEMPERATURE
HWT-3	NOT USED							
HWT-4	NOT USED							
T-1	DOMESTIC HOT WATER STORAGE TANK	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	-	-	-	-	454 L (120 GALLON) DOMESTIC HOT WATER STORAGE TANK
T-2	DOMESTIC HOT WATER STORAGE TANK	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	-	-	-	-	454 L (120 GALLON) DOMESTIC HOT WATER STORAGE TANK
T-3	NOT USED							
GF-1	GLYCOL FILL SYSTEM	VARSITY ARENA EVENT LEVEL MECHANICAL ROOM	-	-	120/1/60	-	-	PACKAGED GLYCOL FILL SYSTEM
UH	UNIT HEATER	VARIOUS	15	-	120/1/60	FRAC	-	HORIZONTAL, SUSPENDED, HYDRONIC UNIT HEATERS C/W LINE VOLTAGE THERMOSTAT
RH	RADIANT HEATER	COMMUNITY ARENA	44	-	120/1/60	-	-	GAS-FIRED RADIANT TUBE HEATER C/W MODULATING BURNER
CUH	CABINET UNIT HEATER	ENTRANCES	9.9	-	120/1/60	FRAC	-	WALL MOUNTED, HYDRONIC CABINET UNIT HEATER C/W LINE VOLTAGE THERMOSTAT
DA	DE-AERATOR FOR PROCESS WATER	ICE RE-SURFACING ROOMS	-	-	-	-	-	INLINE COLD WATER DE-AERATOR

LST_DATE:2018-04-19 2:39 PM
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LOTTED_BY:damian.klose

REMEDY Engineering
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NOTES

VERIFY ALL DIMENSIONS, ELEVATIONS, AND DATUM. REPORT ANY ERRORS AND/OR DISCREPANCIES TO THE ENGINEER PRIOR TO CONSTRUCTION.

DO NOT SCALE DRAWINGS.

THIS DRAWING SUPERCEDES PREVIOUS ISSUES.

Revisions

No.	Description	Date
1	ISSUED FOR COSTING	2018-04-20
2	ISSUED FOR SD	2018-05-24
3	ISSUED FOR COST SAVINGS	2018-06-21

UNIVERSITY OF ALBERTA
SOUTH CAMPUS
COMMUNITY ARENA

UNIVERSITY OF ALBERTA
116 STREET & 85 AVENUE
EDMONTON, ALBERTA

Drawing Title:

MECHANICAL - SCHEDULES

Drawn By:	DK	Date:	2018-04-11
Designed By:	DK	Scale:	1:200
Engineer:	JS	Job number:	18-185

Drawing Number: **M10** Rev. No.: △

APPENDIX D
ELECTRICAL

Smith + Andersen
10320–102 Ave NW #501 Edmonton Alberta T5J 4A1
780 701 0331 smithandandersen.com

ELECTRICAL REPORT

FOR

UNIVERSITY OF ALBERTA VARSITY ARENA

EDMONTON, ALBERTA

OUR PROJECT NUMBER:

17533.000

DATE:

2018-06-20

ISSUED / REVISION:

SCHEMATIC DESIGN **–** REV 6

1. LIMITS OF LIABILITY ASSOCIATED WITH THIS DOCUMENT THIRD PARTY USE

1.1. Any use that a third party makes of this document, or reliance on or decisions to be based on it, are the responsibility of such third party. Smith + Andersen accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based upon this document.

1.2. This document has been prepared solely for the use of the University of Alberta and its design team associated with the University of Alberta Varsity Arena project. The material contained in this document reflects Smith + Andersen's best judgement in light of the information available at the time of preparation. There is no warranty expressed or implied. Professional judgement was exercised in gathering and assessing information. The recommendations presented are the product of professional care and competence and cannot be construed as an absolute guarantee.

1.3. Where equipment sizing is provided it should be considered order-of-magnitude only as the project details that may affect systems have not been established or finalized.

1. INTRODUCTION

1.1. A proposed sports arena located in Edmonton, Alberta.

1.2. The facility is to be owned and operated by the University of Alberta.

1.3. The building is to be approximately 140,300 square feet.

1.4. The facility includes the following unique features:

- A main NHL size rink to accommodate 3000 spectators;
- A community NHL size ice rink with seating for 400 spectators;
- Four suites and a club lounge area;
- Ancillary support spaces;
- Academic High Performance Research and Training Centre; and

2. DESIGN STANDARDS

2.1. The electrical systems will be designed in accordance with the current edition of the following Codes and Standards:

- Alberta Building Code
- Canadian Electrical Code
- National Fire Protection Authority (NFPA)
- Local Ordinances and Authorities
- University of Alberta design and installation standards
- Institute of Electrical and Electronic Engineers (IEEE) standards
- Illumination Engineering Society (IES) Standards
- ASHRAE 90.1 “Energy Efficient Design of New Buildings”
- The National Energy Code For Buildings (NECB)
- CAN/CSA-B72; Installation Code for Lightning Protection Systems

3. POWER DISTRIBUTION

3.1. The local distribution authority is the University of Alberta. A new feed to the buildings is via the existing 15 KV substation located to the east of the Arena on 118 Street.

3.2. The new incoming services will be provided at 600V, 3 phase, 4 wire. Routing will be on the North side of the Arena.

3.3. The primary utility feeders will come below ground in concrete duct banks off of the local 15 KV utility tapping points to the north side of the Arena where the pad mount transformer will be located, in the area shared with the Air Handling Units.

3.4. The University of Alberta Varsity Arena will be serviced from a pad mount switch cubicle feeding a 1500 kVA/600/347V delta/wye transformer to a 2000A switchboard in the main electrical room.

3.5. The conduits will be protected by concrete encased ductbanks from the transformer pad to the buildings.

3.6. The switch cubicle will incorporate a vacuum fault interrupter in its design. The service will have provision for Utility CT’s and digital metering which can be connected into the building BMS system. Lightning arrestors are to be provided on the incoming utility load switches.

3.7. Utility metering to be done on the secondary side of the main transformer.

3.8. Our design will be based on power density calculations as required by the Canadian Electrical Code (CEC) rule 8-210 for ‘other types of occupancies’.

3.9. The primary distribution voltage, throughout the facility will be 600/347V.

3.10. Main electrical rooms and any room housing emergency distribution equipment will have a 2-hour fire rating. All sub-electrical rooms and closets are to have a minimum 1-hour fire rating.

3.11. A central battery system consisting of two 20 kW inverters is to be provided for all emergency lighting and exit signs in the arena.

3.12. Electrical rooms provided through the facility will contain 600V/120/208V 3 phase, 4 wire transformers for electrical power distribution. Electrical panels will be located within these electrical rooms.

3.13. Provisions for shore power for broadcasting are to be located inside the main arena, and at two exterior locations for broadcast trucks.

3.14. All electrical equipment is to be sprinkler proof.

3.15. All electrical conductors are to be copper. All equipment to be copper bus.

3.16. Emergency power will meet the minimum operation requirements for a period of no less than 30 minutes.

3.17. All emergency wiring is to be rated for a minimum of one hour with all wiring not installed in slab to be two-hour fire rated cable.

4. FIRE ALARM

4.1. The arena facility will be provided with an addressable two stage fire alarm system with battery charger and standby batteries.

4.2. Remote annunciator panels will be provided at the main entrance of each arena.

4.3. The main fire alarm control panel will be located in the main communication room, with the main annunciator panel located in the firefighter’s entrance vestibule.

4.4. All fire alarm detection and addressable loop wiring will be class A. All output device wiring will be Class B.

4.5. Speakers, speaker-strobes and horn-strobes will be provided throughout the building. The speakers are to be integrated with the public address system.

4.6. Visual strobes will be installed in public corridors and in floor areas where public may congregate in Group A occupancy.

4.7. Visual strobes will also be utilized in areas of high ambient noise including all mechanical rooms and as required by code.

4.8. Primary means of detection will be via manual pull stations and the sprinkler system. Smoke and heat detectors will be provided where required by Alberta Building Code.

4.9. All magnetic locks will be released upon activation of the evacuation signal on the fire alarm.

4.10. The sprinkler system will be electrically supervised via flow switches and supervised valves.

4.11. The complete fire alarm system will be tested and verified as per the requirements of the Alberta Building Code.

4.12. All fire alarm wiring shall be by Electrical contractor.

5. LIGHTING

5.1. Refer to the attached luminaire schedules for light levels and fixture types at the end of this report.

5.2. The lighting system is designed to achieve the functionality and provide a safe comfortable environment for the building occupants. The light power densities have been optimized through efficient lighting design and designing to appropriate lighting levels for the expected task.

5.3. The lighting levels are in accordance with the current edition of the Illuminating Engineering Society (“IES”) guidelines to suit the functionality of the program spaces based on the occupant age categories and intended program space function in accordance with good engineering principles.

5.4. All lighting systems shall be energy efficient in nature and by design. The lighting design will achieve the required average illumination at the task area primarily directed to the desired location with minimal direct glare or reflection.

5.5. To minimize the light power density standard LED luminaires will be used throughout. All luminaires will be located to provide ease of maintenance with appropriate mounting and will be integrated with the various architectural ceiling types such as drywall, exposed and ceiling panels.

5.6. Rinks and spectator areas will utilize suspended, linear high performance LED luminaires

5.7. Site areas will maintain safe light levels with a full cut-off and glare control to avoid off site lighting spill and night sky pollution. Exterior areas of the site will be illuminated with

LED source luminaires mounted on the building, canopy lighting, pedestrian areas and pole mounted luminaires.

5.8. All exterior luminaires will be selected for energy efficiency, quality and durability

5.9. Full cut-off Bollards will be located along pathways.

5.9.1. The exterior lawn area in the southeast corner of the facility is to be illuminated.

5.10. Emergency lighting will be provided by the invertor system.

5.11. Battery units will provided in all electrical and mechanical rooms as supplementary lighting for emergency purpose.

5.12. Green Running Person Exit lights will be energy efficient LED type.

5.13. Street lighting between the Arena and the Parkade shall be tied to the campus street lighting power and control system.

5.14. Envelope lighting will be provided around the perimeter of the building to illuminate the building façade.

6. LIGHTING CONTROL

6.1. A low voltage lighting control system will be provided for the facility, including LV switches, occupancy sensors, photo sensors and time-clocks.

6.2. Washrooms, storage rooms, locker rooms, office areas and any other areas with transient occupancy will be provided with ceiling or wall mounted occupancy sensors.

6.3. Exterior lighting shall be automatically controlled and capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during night time hours.

6.4. Motion sensors to be PIR, Ultrasonic or a combination sensor with a capability to add slaves. These will be optional wall mounted in small rooms and ceiling mounted in all other areas.

6.5. In areas with natural lighting, luminaires will be controlled by daylight sensors to make maximum use of natural light. Daylight sensors to switch or dim fixtures.

6.6. Rink lighting will be controlled by low voltage lighting control stations at the entry level and in the control booth to provide 25%, 50%, 75% and 100% levels

6.7. Mechanical and electrical room lighting shall be controlled by standard wall switches.

7. METERING

7.1. A networked digital based electric metering system with embedded webpage will be provided. A detailed power meter with demand metering will be provided on the main

incoming service with additional metering being provided in the building to allow for proper monitoring of mechanical equipment, outdoor lighting and indoor lighting.

7.1.1. The power metering system will all be one manufacturer. All the power meters will be networked together on an independent wiring loop with Ethernet gateways provided to read the data remotely.

8. GROUNDING SYSTEM

8.1. An AC grounding system with new main ground electrode that will consist of a perimeter ground loop with 3m ground rods installed around the foundation of the building.

8.2. A minimum of four 3m ground rods spaced 3m apart and connected to the main electrical ground bus located in the main electrical room with two separate #3/0AWG ground connections.

8.3. The grounding system for the building will be provided connecting each typical electrical room to the main grounding system in the main electrical room in a radial connection. A ground bar will be provided in each electrical room. All transformer neutrals will be connected to the grounding bar and a common cable connected back to the system ground.

8.4. Grounding will be provided following IEEE 1100 and Electrical Code Section 10 standards.

8.5. Separate #2/0AWG telecommunication ground riser will be provided off of the main building ground bus and the telecommunication ground riser will be connected in a radial pattern with ground bars in each telecommunication room.

8.6. Dedicated ground cables will be run from the electrical ground riser to all elevator shafts and elevator machine rooms to ground all elevators and equipment in the elevator pit.

9. EMI CONSIDERATIONS

9.1. All wiring will be in conduit.

9.2. Routing of power cables and bus duct will be selected to minimize the effect of magnetic fields on other equipment.

9.3. Single conductor Teck or armoured cable will be avoided.

10. COMMUNICATIONS

10.1. Communications rooms for building telephone/internet/CATV will be provided to meet the needs of the University.

10.2. 101mm conduits or cabletrays will run between communication rooms.

10.3. One wall of each Communications room will have a 20mm thick fire rated plywood back board and a dedicated quad receptacle

10.4. Two 100mm conduits with pull-strings will be run from the main communications room to the project boundary for connection to the main campus. It is anticipated that 2 - 6 strand multimode 65um fibre will be run from the main campus by the owner to the Varsity Arena.

10.5. Power provisions, conduits, and wiring are to be provided for main and auxiliary scoreboards, game clocks, coaching boxes and benches, instant replay and video systems. Devices are to be provided by the U of A suppliers.

10.6. Power, cabling, wiring for AV equipment in dressing rooms, classrooms and throughout the facility is to be included. Devices are to be provided by the U of A suppliers.

10.7. Conduits, cables and outlet boxes are for wireless, telephone and data outlets will be provided within offices and similar spaces requiring high bandwidth. These data terminals will be fed by Cat 6A cable in 19mmC minimum conduit to the data cable tray or the nearest electrical room. Devices are to be provided by the U of A suppliers

10.8. Use of wireless access points will be used throughout the building to provide an overall coverage for wireless devices.

10.9. Boxes, conduit and wiring for television outlets will be provided in all classrooms, suites, lounges, offices and Varsity Arena team dressing rooms. Devices are provided by the U of A suppliers.

10.10. All data cabling installed will be tested end to end and a data cable report issued demonstrating compliance with CSA T529 standards.

11. SECURITY SYSTEM

11.1. Conduit, junction boxes, cables, and UPS for the security system will be provided and installed by the Electrical Contractor.

11.2. Devices including door contacts, electric strikes, magnetic cameras and card readers will be provided by the U of A suppliers. It is anticipated that the door access system will use either proximity cards or FOB devices provided at the staff entry and team dressing rooms.

11.3. Provision will be made for CCTV POE cameras connected to Cat 6A wiring run in conduit to cover all exterior doors, main corridors, rinks, exterior parking area and building perimeter.

11.4. All data cabling installed will be tested end to end and a data cable report issued demonstrating compliance with CSA T529 standards All security tie-ins shall be to the University FMNET dedicated Network

11.5. Blue emergency stations will be provided at each principal entrance, at locations directed by the University, allow for 10 stations.

12. CO-ORDINATION OF MECHANICAL AND ELECTRICAL AND OTHERS

12.1. All starters, fire alarm shutdown, pressurization control, smoke evacuate control, motor control centres, and power wiring shall be by the electrical division except for units with starters as part of a package or for VFDs.

12.2. All power wiring shall be by the Electrical contractor including power wiring from variable speed drives to motors. VFDs to be mounted on or near the equipment and VFD cable will be run from the VFD drive to the motor with no disconnect between them.

12.3. All control wiring and controls shall be by Mechanical contractor. The Electrical contractor will provide 15A, 120V, 1 phase circuits at designated panels and they will be terminated in a junction box near the respective electrical panels. The Mechanical/Controls contractor is required to extend the 120V circuits to all of their respective equipment.

12.4. Electrical pipe tracing and snow melting are to be provided and installed by the electrical contractor.

13. LIGHTNING PROTECTION

13.1. Lightning protection will be designed and installed in accordance to CAN/CSA-B72; Installation Code for Lightning Protection Systems.

13.1.1. Intercepting conductor shall be installed on the entire roof perimeter at the highest part of the roof and as close to the edge as possible but never more than 0.5m from the edge of the roof or air terminals are to be provided, located within 0.5m of the outside corner of the roof, spaced on intervals not exceeding 8m around the perimeter.

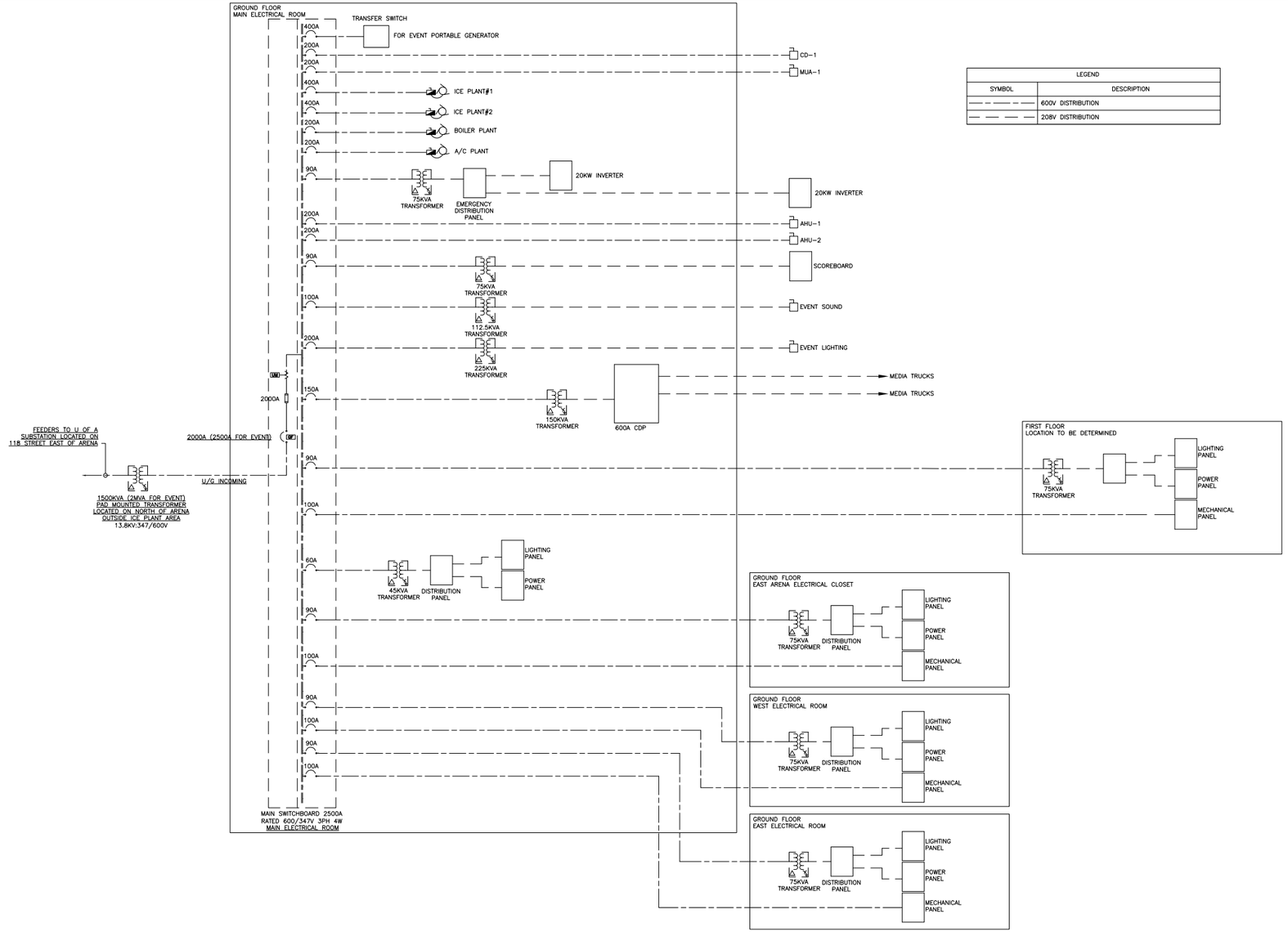
13.2. An intercepting conductor connected at both ends and at least every 50m shall be installed within the perimeter so that no point on the roof is more than 5m away from a conductor

13.3. Every stack, and other objects or mechanical equipment located on the roof susceptible to strikes will have air terminals

13.4. Conductor cables will interconnect air terminals and offer a multiple path to ground. Down lead conductors will be placed every 30m around the perimeter of the building (but never less than two), run down exterior columns, and terminate in a ground rod system in the lowest level of the building. Metal objects within 6 feet of conductor cable will be grounded.

13.5. The lightning ground grid will be connected to the main building electrical ground grid at a minimum of 2 locations

END OF ELECTRICAL DESIGN BRIEF



LEGEND	
SYMBOL	DESCRIPTION
— — — —	600V DISTRIBUTION
— — — —	208V DISTRIBUTION

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10320–102 Ave Suite 501 Edmonton Alberta T5J 4A1
780 701 0331 www.smithandandersen.com

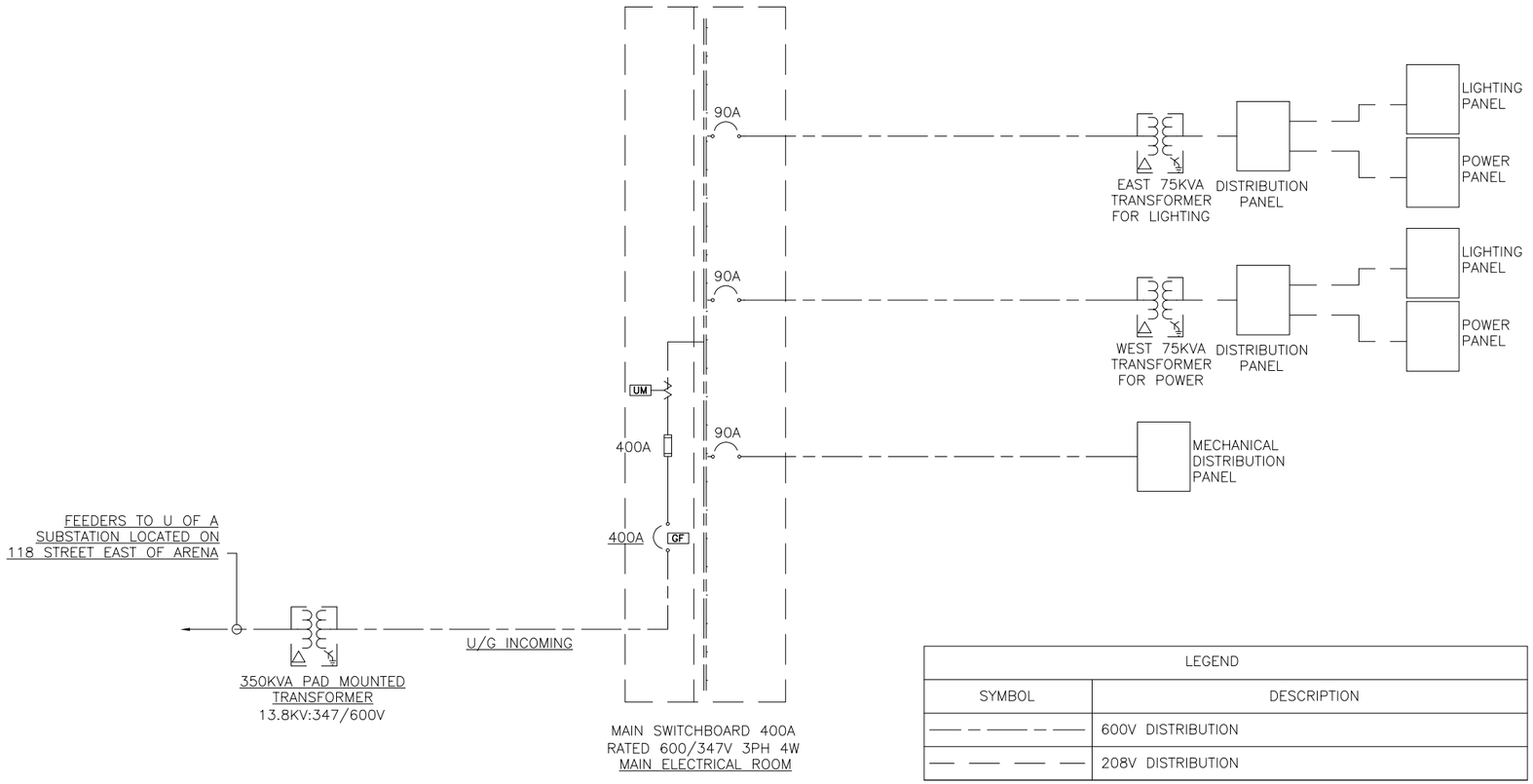
PROJECT NAME: U OF A VARSITY ARENA

ISSUED FOR:

DRAWING TITLE: PART PLAN OF SINGLE LINE DIAGRAM

DRAWING NO:

DATE:	PROJECT NO:	SCALE:	PART OF DWG:
2018-05-23	17533.000.001E	1:200	REVISION No.:



LEGEND	
SYMBOL	DESCRIPTION
—— – —— – ——	600V DISTRIBUTION
— —— —— ——	208V DISTRIBUTION

Smith + Andersen
10320–102 Ave Suite 501 Edmonton Alberta T5J 4A1
780 701 0331 www.smithandandersen.com

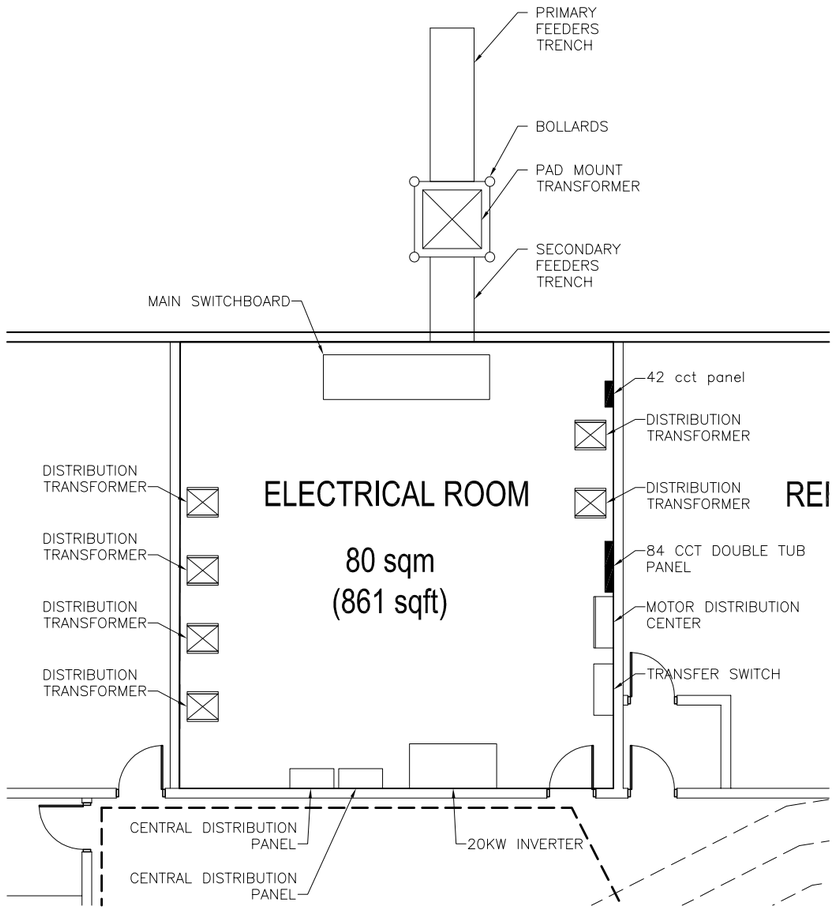
PROJECT NAME: U OF A PARKADE

ISSUED FOR:

DRAWING TITLE: PART PLAN OF SINGLE LINE DIAGRAM

DRAWING NO:

DATE:	PROJECT NO:	SCALE:	PART OF DWG:
2018-05-23	17533.000.001E	1:100	REVISION No.:



Smith + Andersen
10320–102 Ave Suite 501 Edmonton Alberta T5J 4A1
780 701 0331 www.smithandandersen.com

PROJECT NAME: U OF A ARENA MAIN ELECTRICAL ROOM LAYOUT			ISSUED FOR:
DRAWING TITLE: PART PLAN OF ARENA MAIN FLOOR			DRAWING NO:
DATE: 2018-05-23	PROJECT NO: 17533.000.001E	SCALE: 1:100	PART OF DWG: REVISION No.:

Smith + Andersen

10320-102 Ave NW Suite 501

Edmonton Alberta T5J 4A1
t 780 701 0331

17533.001

Building Electrical Power Calculations

23-May-18

Building areas	Areas sq-ft		
Total GFA	140,278	7	w/sqft

Description	Estimated Connected Load (W)	Demand Factor	Estimated Demand Load (kVA)	Assumed Power Factor	Estimated Demand Load (kW)	Diversity Factor	Actual Demand Load(KW)	Assumed Emergency Factor	Actual Em. Demand Load (kW)
Rink Lighting	981946.0	100%	525341.1						
Lighting		80%							
Receptacle Loads		45%							
Stair Press Fans		100%							
Boiler Force Draft		70%							
Gen. Exhast Fan		70%							
Sanitary Pump		20%							
Storm Pump		20%							
Security		100%							
Tele.		100%							
Comms.		100%							
Domestic HWT System		0%							
Domestic CLD Pumps		70%							
Aux. Cooling Loops		0%							
Misc. Mechanical (U.H,Fan powered,HUMIDIFIER)		70%							
TV Trucks (60A + 100A)		0%							
Event Audio Power (400A)		0%							
Event Visual Power (400A)		0%							
Elevator		25%							
Exterior Lighting		100%							
Ice Plant 1	600000.0	80%	480000.0						
Ice Plant 2	600000.0	25%	150000.0						
Mechanical A/C System	192000.0	70%	134400.0						
Total	**2373946.0**		**1289741.1**						

Notes

Connected Service Amps	**2284.3306**	**Amps**
Demand Service Amps	**1241.05396**	**Amps**

Average Power Factor	0.96
VLL	600.00

LUMINAIRE SCHEDULE
Project Name: U of Alberta Varsity and Community Arenas
Project number: 17533.000.E000

Smith + Andersen
4211 Yonge St., Suite 500
Toronto, Ontario M2P 2A9

TYPE	VOLT.	LAMP(S)	DIMENSIONS	DESCRIPTION	MANUFACTURER/ CATALOGUE NUMBER	MINIMUM PERFORMANCE REQUIRED	LOCATED
LED							
L1	120V	320W LED (4000K)	12.75" W x 5.5" H x 48" L	**Pendant Mount High Bay LED.** Polycarbonate protective LED clear lens. 200,000 hours life rating. Temperature rating: -40°C - + 50°C. Complete with dimming driver. ETL/cETL certified and DLC listed	• Delviro Energy: Titan HB320	37912 Lumens	Ice Rink area
L2	120V	80W LED (4000K)	6.75" W x 5.5" H x 24" L	**Pendant Mount High Bay LED.** Polycarbonate protective LED clear lens. 200,000 hours life rating. Temperature rating: -40°C - + 50°C. Complete with dimming driver. ETL/cETL certified and DLC listed **NOTE:** • Add dimming required at **Spectator Area**	• Delviro Energy: Titan HB80	9609 Lumens	Spectator area (Ice Rink), (Locate 2 fixtures per aisle)
L3	120V	18.5W LED (3500K) 80 CRI	6-1/4"aperture 7-9/16" H	**Recessed LED downlight**. Self-flanged, spun .050" thick aluminum lower reflector in combination with a lensed upper optical chamber for superior lumen output with minimal source brightness. Lower reflector is retained with two torsion springs holding the flange tightly to the ceiling surface. Die cast aluminum 1-1/2" deep collar accommodates ceiling material up to 2". Extruded aluminum heat sink conducts heat away from the LED module to improve performance. CSA certified wet location, IP 65 rated. **c/w Vandal-Resistant Trim accessory (GVRT)**	• Gotham: EVO 35/15 6AR MD MVOLT AZ10	1500 Lumens	shower/Washrooms
L3A	120V	17.3W LED (3500K) 80 CRI	4-5/16"aperture x 6-5/8" H	**Recessed LED downlight**. Self-flanged, spun .050" thick aluminum lower reflector in combination with a lensed upper optical chamber for superior lumen output with minimal source brightness. Lower reflector is retained with two torsion springs holding the flange tightly to the ceiling surface. Die cast aluminum 1-1/2" deep collar accommodates ceiling material up to 2". Extruded aluminum heat sink conducts heat away from the LED module to improve performance.	• Gotham: EVO 35/15 4AR MD MVOLT AZ10	1500 Lumens	Suites
L4	120V	49W LED (3000K) 80 CRI	4" W x 5.06" H x 4' L	**Recessed Drywall Straight and Narrow LED fixture**. Extruded aluminum housing. High transmission diffuser. Matte finish using electrostatically applied polyester powder coat paint. LED modules are driven using universal voltage switch mode LED drivers. Certified to UL and CUL standards	• Metalumen: Rail 4 RM4D series • Neo-Ray: Define 4 • Axis: Beam 4 Series • Focal Point: Seem 4 • a-light: Accolade D5 Series	4338 Lumens	Main lobby area

LUMINAIRE SCHEDULE
Project Name: U of Alberta Varsity and Community Arenas
Project number: 17533.000.E000

Smith + Andersen
4211 Yonge St., Suite 500
Toronto, Ontario M2P 2A9

TYPE	VOLT.	LAMP(S)	DIMENSIONS	DESCRIPTION	MANUFACTURER/ CATALOGUE NUMBER	MINIMUM PERFORMANCE REQUIRED	LOCATED
L4A	120V	48.3W LED (3000K) 80 CRI	3.7" W x 5.3" H x 4' L	**Pendant Direct Indirect Straight and Narrow LED fixture**. Extruded aluminum housing. High transmission diffuser. Matte finish using electrostatically applied polyester powder coat paint. LED modules are driven using universal voltage switch mode LED drivers. Certified to UL and CUL standards	• Metalumen: Rail 4 RM4D series • Neo-Ray: Define 4 • Axis: Beam 4 Series • Focal Point: Seem 4	5496 Lumens	Main lobby area -exposed ceiling, Information desk, Varsity dressing room.
L5	120V	42W LED (3500K) 80 CRI	2-3/16" W x 2-1/8" H x 48" L	**Surface Mount Strip LED**. Compact-design channel and cover are formed from code-gauge cold-rolled steel. High-gloss, baked white enamel finish. Five-stage iron phosphate pre-treatment ensures superior paint adhesion and rust resistance. Snap on frosted diffuse lens. CSA Certified to meet U.S. and Canadian standards. Tested to LM80 standards.	• Lithonia Lensed LED Striplight ZL1N Series ZL1NL48 5000LM FST MVOLT 35K 80CRI	5000 Lumens	Stairs
L6	120V	13.14W LED (3000K) 85 CRI	24-1/4"L x 1-1/4"W x 1/2" H	**Surface mounted under cabinet LED fixture.** Extruded aluminum housing. Remote transformer. LEDs have a 50,000 hour L70 rated life. Mounting clips for flush installation. CUL listed to US and Canadian safety standards.	• Lithonia: Rayzer Modular LED Lighting System.	441 lumens	Undercounter Light kitchen bar,
L7	120V	48W LED (3500K) 85 CRI	11-3/4" W x 3-3/4" H x 48-3/8" L	**Recessed 1x4 Architectural Basket LED**. Low profile housing constructed of die formed 20 gauge cold rolled steel with integral 20 gauge gear tray. High reflectance white powder coat painted reflector system. Smooth opal acrylic lens designed to provide low glare ambient illumination. removable pan assembly from below	• Corelite: Class R2X-WO- 2L35-Series • Prudential Lighting: Wing LED Series • Metalumen: Carliste TC4 Series • Pinnacle: Lucien 1x4	4345 Lumens	Offices,
L8	120V	29W LED (3500K) 85 CRI	2-11/16" W x 3-11/16" H x 48" L	**Pendant Mount Lensed LED Striplight.** Die formed cold rolled steel channel with numerous KOs for ease of installation. Channel / wireway secured with sheet metal screw. White reflector. **Clear lens**. Long-life LED system with electronic driver.	• Metalux: SNLED Lensed Series • GE Lighting: Albeo LED • Columbia Lighting: LCS	3100 Lumens	Janitor, storages
L9	120V	48W LED (3500K) 85 CRI	11-3/4" W x 3-3/4" H x 48-3/8" L	**Surface Mount Vapour Tight LED luminaire.** UV stabilized polycarbonate enclosed housing with gasket and integrated steel mounting brackets. Flat, steel reflector system finished in durable powder coat white. Complete with high efficiency driver. Wet location rated.	• Beghelli: BS100LED Series • Columbia: LXEM Series • Lithonia: FEM LED Series	4100 Lumens	Public washrooms. Washrooms shower areas refrigeration room, service corridors, Change rooms

LUMINAIRE SCHEDULE

Project Name: U of Alberta Varsity and Community Arenas

Project number: 17533.000.E000

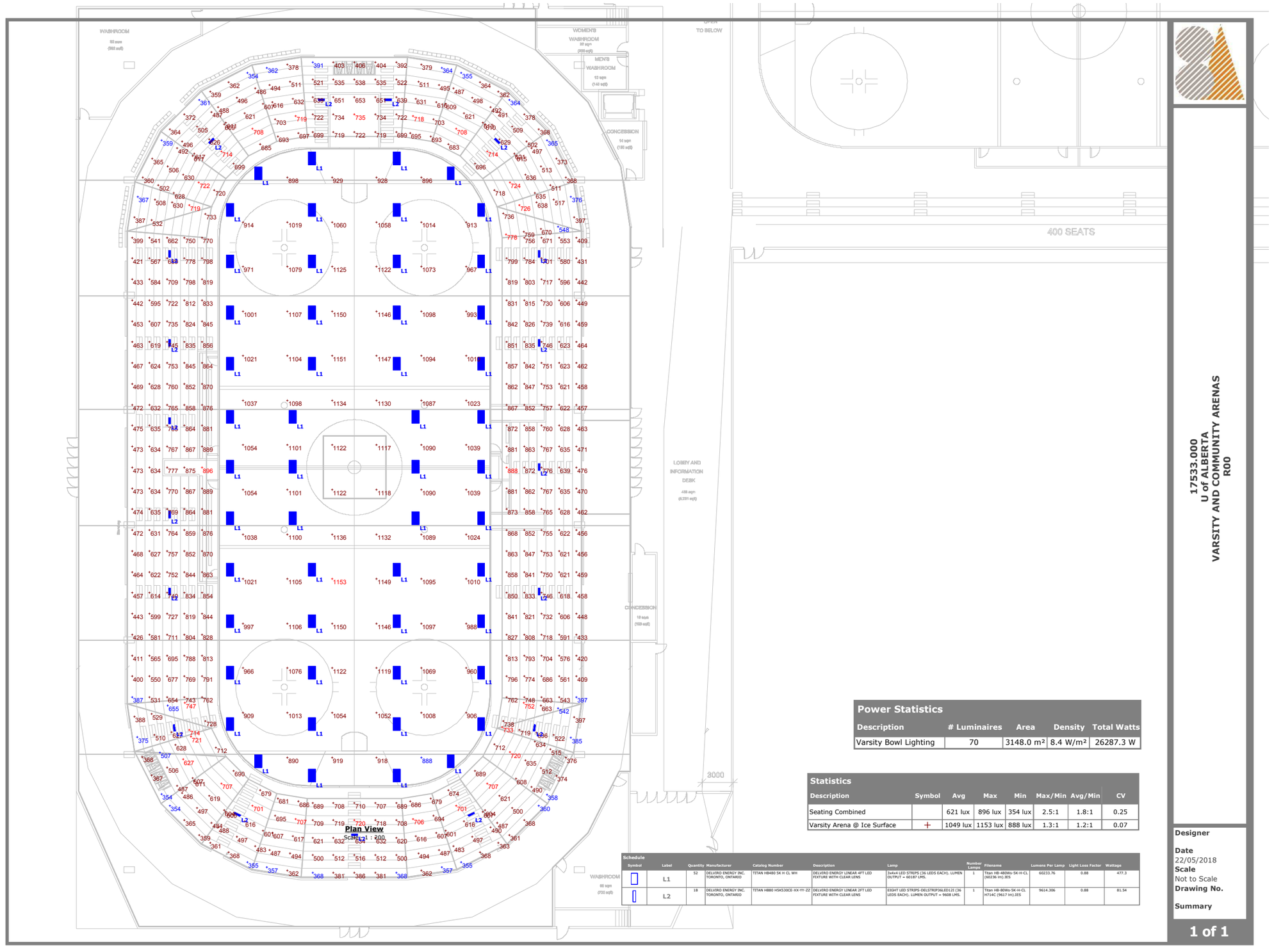
Smith + Andersen

4211 Yonge St., Suite 500

Toronto, Ontario M2P 2A9

TYPE	VOLT.	LAMP(S)	DIMENSIONS	DESCRIPTION	MANUFACTURER/ CATALOGUE NUMBER	MINIMUM PERFORMANCE REQUIRED	LOCATED
L10	120V	20W LED 3000K 10ºx60º optics	2.8" W x 2.7" H x 8' L	**DMX-Enabled Monochromatic LED Linear.** Low-profile Extruded anodized aluminum housing. Clear polycarbonate lens. 1**0ºx60º optics**. UL / cUL certified. Wet Location listed, IP66 rating. C/w adjustable mounting hardware and louvres.	• GVA: STR9 Mono Series • Philips CK: eWGraze MX Powercore	2,988 Lumens	Façade mesh
L10A	120V	20W LED 3000K 30ºx60º optics	2.8" W x 2.7" H x 8' L	**DMX-Enabled Monochromatic LED Linear.** Low-profile Extruded anodized aluminum housing. Clear polycarbonate lens. **30ºx60º optics**. UL / cUL certified. Wet Location listed, IP66 rating. C/w adjustable mounting hardware and louvres.	• GVA: STR9 Mono Series • Philips CK: eWGraze MX Powercore	2,988 Lumens	Façade mesh
L11	120V	49.9W LED 3000K	8-1/4" W x 3-1/16" H x 49-9/16" L	**Pendant Linear Direct-Indirect LED luminaire**. Low profle design - 3” in deep housing which combines both aluminum extruded frame and steel channel housing. End plates are securely attached with positive capture details which offer both strength and rigidity while elimination of gaps. Long-life LED system coupled with electrical driver to deliver optimal performance. Precision formed optical assembly with positively retained high optical grade acrylic lenses provide a directed optical distribution using WaveStream technology. Durable frame has high refectance baked matte white enamel fnish for luminous uniformity.	• Metalux: 4WSL series	5,500 Lumens	Concourse, Varsity equipment room, circulation ground level, concourse level, Plus 15 connector.

ELECTRICAL DATA SUMMARY _ Varsity Arena				
Type and Quantity of Programmed Space	**Lighting Levels (lux) Average values**	**Note #'s**	**Ceiling Type**	**Fixture Type**
Arena #1				
Varsity Ice Arena	1000 lux at 3' above ice	Class II	Exposed	L1
Workshop	500 lux at task	Medium bench or machine work	Exposed	L9
Mechanical Room	200 lux at 3' AFF	Equipment room	Exposed	L9
Ice Resurfacer	200 lux at 3' AFF	Equipment room	Exposed	L9
Storage	100 lux at floor level 50 lux at floor level	Storage •Frequent use Storage •Infrequent use	Exposed	L9 - L8
Skate Sharpening	500 lux at task	Medium bench or machine work	Exposed	L9
Arena Manager/First Aid Office	300 at task (office) 500 lux at task (first aid)	Medium bench or machine work	Acustic Ceiling Tile	L7
Public Washrooms	150 lux at sinks and toilets (3 foot AFF) 50 lux washoom floor average Accessible washroom - 200 lux		Drywall - exposed	L3 - L9
Multipurpose Room	400 lux at task		Acustic Ceiling Tile	L7
Ticketing Area	300 lux at task		Acustic Ceiling Tile	L7
Lobby and Information Desk	150 lux at room 300 lux at task		Drywall - exposed	L4 - L4A
Concession	10 lux (emergency)	Shell space	Exposed	L8
Merchandise Storefront	by tenant			
Suites	150 lux at room 300 lux at task		Acustic Ceiling Tile	L3A
Lounge/Club Area	100 lux at task	dimmers	Drywall	L3 and L4
Video Replay/Production Room	300 lux at task	dimmers	Acustic Ceiling Tile	L7
Press Box	300 lux at task	dimmers	Acustic Ceiling Tile	L7
User Dressing Rooms	200 lux at room		Exposed	L9
Flexible Dressing Rooms	200 lux at room		Exposed	L9
Officials Rooms	200 lux at task		Exposed	L9
Varsity Dressing Rooms	300 lux avg. at room		Featured ceiling	L4 -L4A - L3
Varsity Equipment Rooms	300 lux avg. at room		Exposed	L11
Athletes Lounge	100 lux at task	dimmers	Drywall	L3 and L4
Video Analysis Room	300 lux at task	dimmers	Acustic Ceiling Tile	L7
Athletic Therapy Rooms	500 lux at task	dimmers	Acustic Ceiling Tile	L7
Male Hockey Coaches Dressing Room	200 lux at task		Exposed	L8
Female Hockey Coaches Dressing Room	200 lux at task		Exposed	L8
IT/Communications Room	300 lux at task		Acustic Ceiling Tile	L7
Servery	500 lux at task		Acustic Ceiling Tile	L7
Dry Change	200 lux at room		Exposed	L9
Laundry	300 lux at task		Exposed	L9
Assistant Coaches	300 lux at task		Exposed	L9
Hockey Office	300 lux at task		Acustic Ceiling Tile	L7
Warm Up Bikes	400 lux at room		Exposed	L9
Warm Up Area	400 lux at room		Exposed	L9
Boiler Plant	200 lux at 3' AFF	Equipment room	Exposed	L9
Electrical Room	200 lux at 3' AFF	Equipment room	Exposed	L9
Refrigeration Room	200 lux at 3' AFF	Equipment room	Exposed	L9
Back of House Storage	100 lux at floor level 50 lux at floor level	Storage •Frequent use Storage •Infrequent use	Exposed	L9
Kitchen Storage	100 lux at floor level 50 lux at floor level	Storage •Infrequent use Storage •Infrequent use	Exposed	L9
Arena #2	750 lux at 3' above ice	Class III	Exposed	L1
User Ice Sheet	300 lux at 3' AFF		Exposed	L9
User Dressing Rooms	200 lux at 3' AFF		Exposed	L9
Auxilliary Dressing Rooms	200 lux at 3' AFF		Exposed	L9
Officials Rooms	200 lux at room		Exposed	L9
Ancillary				
General Office	300 lux at task		Acustic Ceiling Tile	L7
Staff Offices	300 lux at task		Acustic Ceiling Tile	L7
Staff Washrooms/Locker Rooms	Washroom: 150 lux at sinks and toilets (3 foot AFF). 50 lux washoom floor avg Locker room: 200 lux Accessible washroom - 200 lux		Drywall - exposed	L3 - L9
Team Support	300 lux at task		Acustic Ceiling Tile	L7
Combative Sports Multi-Purpose Rooms/Washrooms	150 lux at sinks and toilets (3 foot AFF). 50 lux washoom floor average Accessible washroom - 200 lux			
Combative Sports Multi-Purpose Room	400 lux at task		Acustic Ceiling Tile	L7
High Performance Athlete Training and Research Centre (HPTRC) * Academic				
Reception	200 lux at waiting area 400 lux at desk		Acustic Ceiling Tile	L7
Open Floor Training Space	400 lux at task		Acustic Ceiling Tile	L7
Biomechanics Research and Training Space	400 lux at task		Acustic Ceiling Tile	L7
Sport Medicine Health Research and Assessment Space	400 lux at task		Acustic Ceiling Tile	L7
Body Composition Laboratory	500 lux at bench 1000 lux demonstration area			
Wet Lab	500 lux at bench 1000 lux demonstration area			
Smart Classroom	400 lux at task		Acustic Ceiling Tile	L7
Research Offices	300 lux at task		Acustic Ceiling Tile	L7
Staff Offices	300 lux at task		Acustic Ceiling Tile	L7
Seminar/Meeting Rooms	300 lux at task	Dimmers	Acustic Ceiling Tile	L7
Maintenance/Storage Room	100 lux at floor level 50 lux at floor level	Storage •Frequent use Storage •Infrequent use	Exposed	L9 - L8
Locker Rooms/Washrooms	Washroom: 150 lux at sinks and toilets (3 foot AFF). 50 lux washoom floor average Accessible washroom - 200 lux		Drywall - exposed	L3 - L9
Staff Room	300 lux at task		Acustic Ceiling Tile	L7
Circulation				
Ground Level	100 lux at floor		Exposed	L11
Concourse Level	100 lux at floor		Exposed	L11
Plus 15 Connector	100 lux at floor		Exposed	L11



Plan View
Scale: 1 : 200

Power Statistics

Description	# Luminaires	Area	Density	Total Watts
Varsity Bowl Lighting	70	3148.0 m²	8.4 W/m²	26287.3 W

Statistics

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min	CV
Seating Combined		621 lux	896 lux	354 lux	2.5:1	1.8:1	0.25
Varsity Arena @ Ice Surface	+	1049 lux	1153 lux	888 lux	1.3:1	1.2:1	0.07

Schedule

Symbol	Label	Quantity	Manufacturer	Catalog Number	Description	Lamp	Number Lamps	Filename	Lumens Per Lamp	Light Loss Factor	Wattage
	L1	52	DELVRO ENERGY INC. TORONTO, ONTARIO	TITAN HB480 5K H CL WH	DELVRO ENERGY LINEAR 4FT LED FIXTURE WITH CLEAR LENS	3x4x4 LED STRIPS (36 LEDS EACH). LUMEN OUTPUT = 60187 LMS.	1	Titan HB-480Wx-5K-H-CL (60236 lm).IES	60233.76	0.88	477.3
	L2	18	DELVRO ENERGY INC. TORONTO, ONTARIO	TITAN HB80 H5K530CE-XX-YY-ZZ	DELVRO ENERGY LINEAR 2FT LED FIXTURE WITH CLEAR LENS	EIGHT LED STRIPS-DELSTRIP36LED121 (36 LEDS EACH). LUMEN OUTPUT = 9608 LMS.	1	Titan HB-80Wx-5K-H-CL H714C (9617 lm).IES	9614.306	0.88	81.54

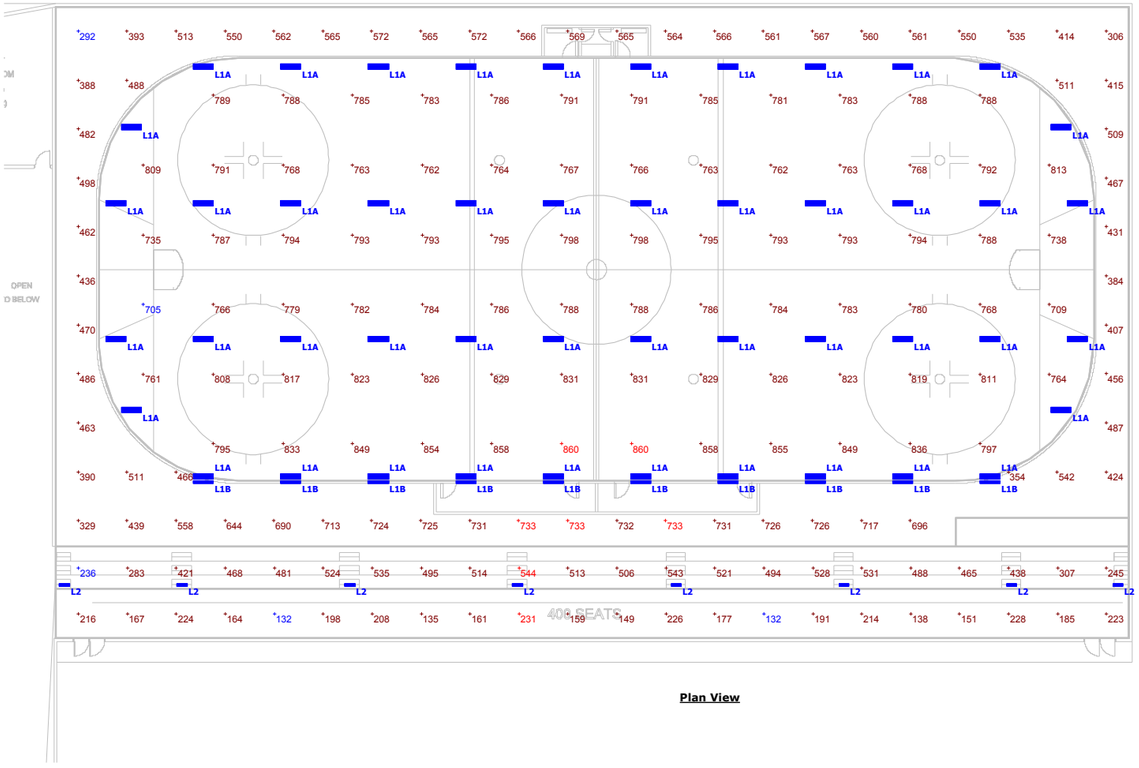
17533.000
U of ALBERTA
VARSITY AND COMMUNITY ARENAS
R00

Designer

Date
22/05/2018
Scale
Not to Scale
Drawing No.

Summary

1 of 1



Plan View

Power Statistics

Description	# Luminaires	Area	Density	Total Watts
Community Arena	64	2543.5 m²	6.8 W/m²	17342.8 W

Statistics

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min	CV
Community Arena @ Ice Surface	+	795 lux	860 lux	705 lux	1.2:1	1.1:1	0.04
Community Arena Seating	+	458 lux	544 lux	236 lux	2.3:1	1.9:1	0.21
Community Seating corridor	+	182 lux	231 lux	132 lux	1.8:1	1.4:1	0.19

Schedule

Symbol	Label	Quantity	Manufacturer	Catalog Number	Description	Lamp	Number Lamps	Filename	Lumens Per Lamp	Light Loss Factor	Wattage
	L1A	48	DELVIRO ENERGY INC. TORONTO, ONTARIO	TITAN HB320 H5K530CE-XX-YY-ZZ	DELVIRO ENERGY LINEAR 4FT LED FIXTURE WITH CLEAR LENS	4x8 LED STRIPS (36 LEDS EACH). LUMEN OUTPUT = 37912 LMS.	1	Titan HB-320Ws-5K-H-CL H718C (37954 lm).IES	37942.27	0.88	317.99
	L1B	10	DELVIRO ENERGY INC. TORONTO, ONTARIO	TITAN HB160 H5K530CE-XX-YY-ZZ	DELVIRO ENERGY LINEAR 4FT LED FIXTURE WITH CLEAR LENS	16 LED STRIPS-DELSTRIP36LED12I (36 LEDS EACH). LUMEN OUTPUT = 20048 LMS.	1	Titan HB-160Ws-5K-H-CL H716C (20071 lm).IES	20064.81	0.88	159
	L2	8	DELVIRO ENERGY INC. TORONTO, ONTARIO	TITAN HB80 H5K530CE-XX-YY-ZZ	DELVIRO ENERGY LINEAR 2FT LED FIXTURE WITH CLEAR LENS	EIGHT LED STRIPS-DELSTRIP36LED12I (36 LEDS EACH). LUMEN OUTPUT = 9608 LMS.	1	Titan HB-80Ws-5K-H-CL H714C (9617 lm).IES	9614.306	0.88	81.54

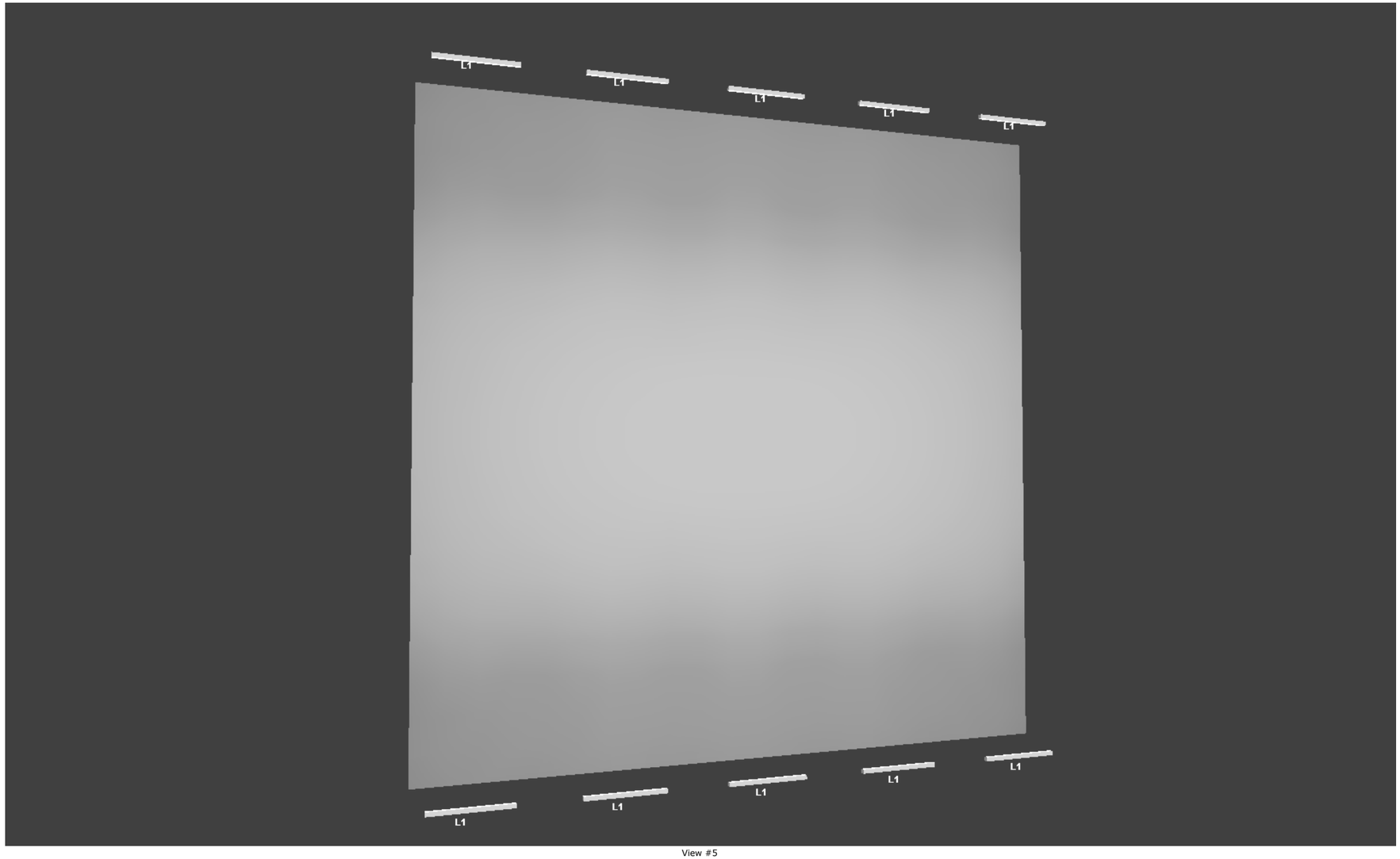
17533.000
U of ALBERTA
VARSITY AND COMMUNITY ARENAS
R00

Designer

Date
22/05/2018
Scale
Not to Scale
Drawing No.

Summary

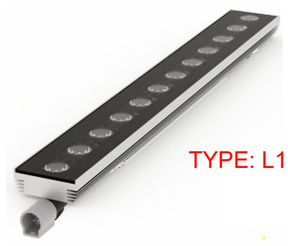
1 of 1



View #5

Schedule

Symbol	Label	QTY	Catalog Number	Description	Lumens per Lamp	LLF	Wattage	Polar Plot
	L1	10	GVA STR9 10x60	PH-STR9-300-7.5W-3000K-10X60-21.08.15	514	0.88	6.6	Max: 1717cd



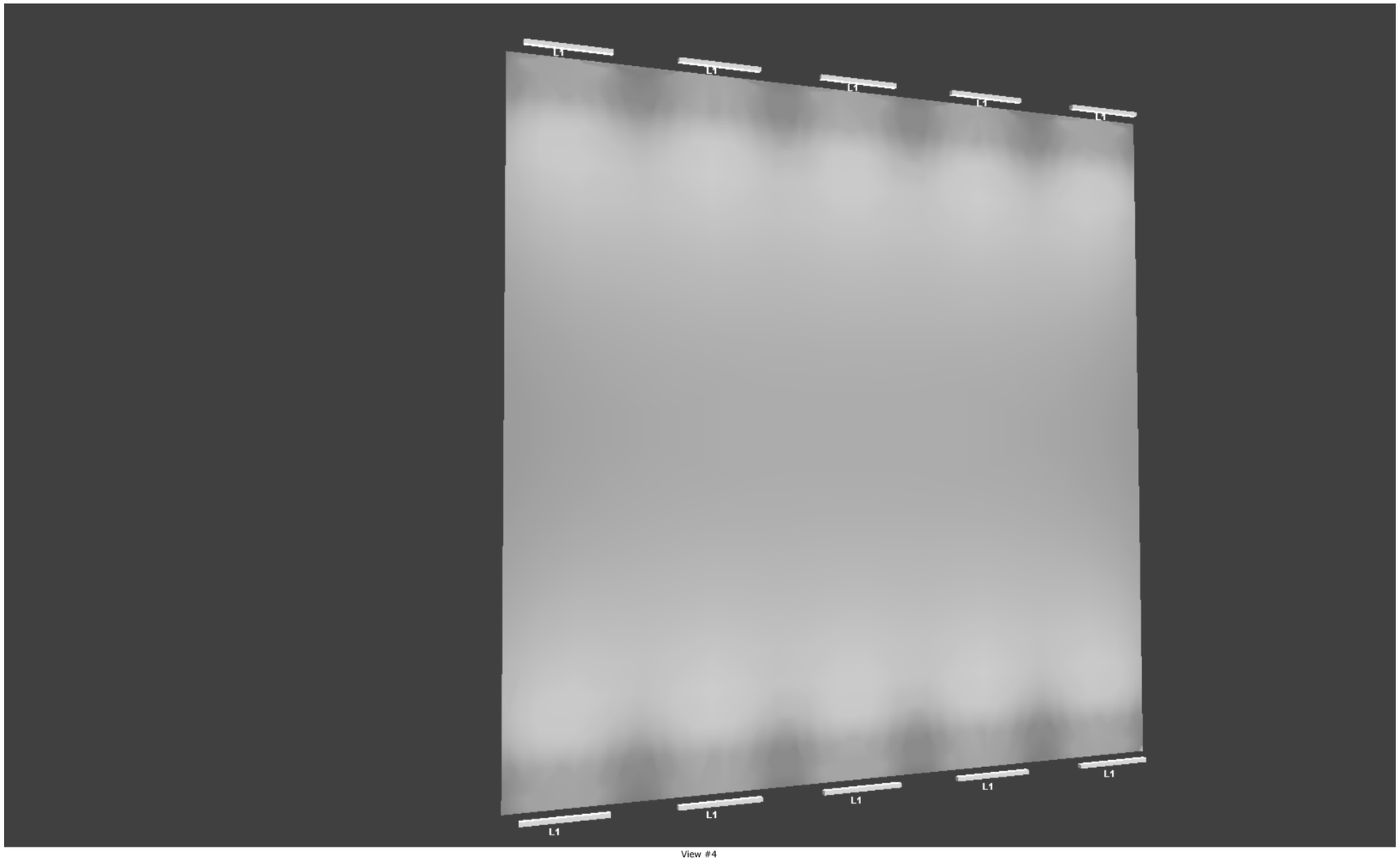
Note

1. LUMINAIRES INSTALLED AT 1M FROM THE WALL
2. L1 (10X60 DEG OPTICS) AIMED AT 5 DEG.
3. QUANTITIES: L1 (4 FT LONG) 10 UNITS
4. WALL SIZE 10M X 10M

SOUTH CAMPUS COMMUNITY ARENA
EXTERIOR WALL

Designer	
Date	03/28/2018
Scale	Not to Scale
Drawing No.	
Summary	

1 of 4



View #4

Schedule

Symbol	Label	QTY	Catalog Number	Description	Lumens per Lamp	LLF	Wattage	Polar Plot
	L1	10	GVA STR9 10x60	PH-STR9-300-7.5W-3000K-10X60-21.08.15	514	0.88	6.6	Max: 1717cd

Note

1. LUMINAIRES INSTALLED AT 0.3M (1 FT.) FROM THE WALL
2. L1 (10X60 DEG OPTICS) AIMED AT 0 DEG.
3. QUANTITIES: L1 (4 FT LONG) 10 UNITS
4. WALL SIZE 10M X 10M

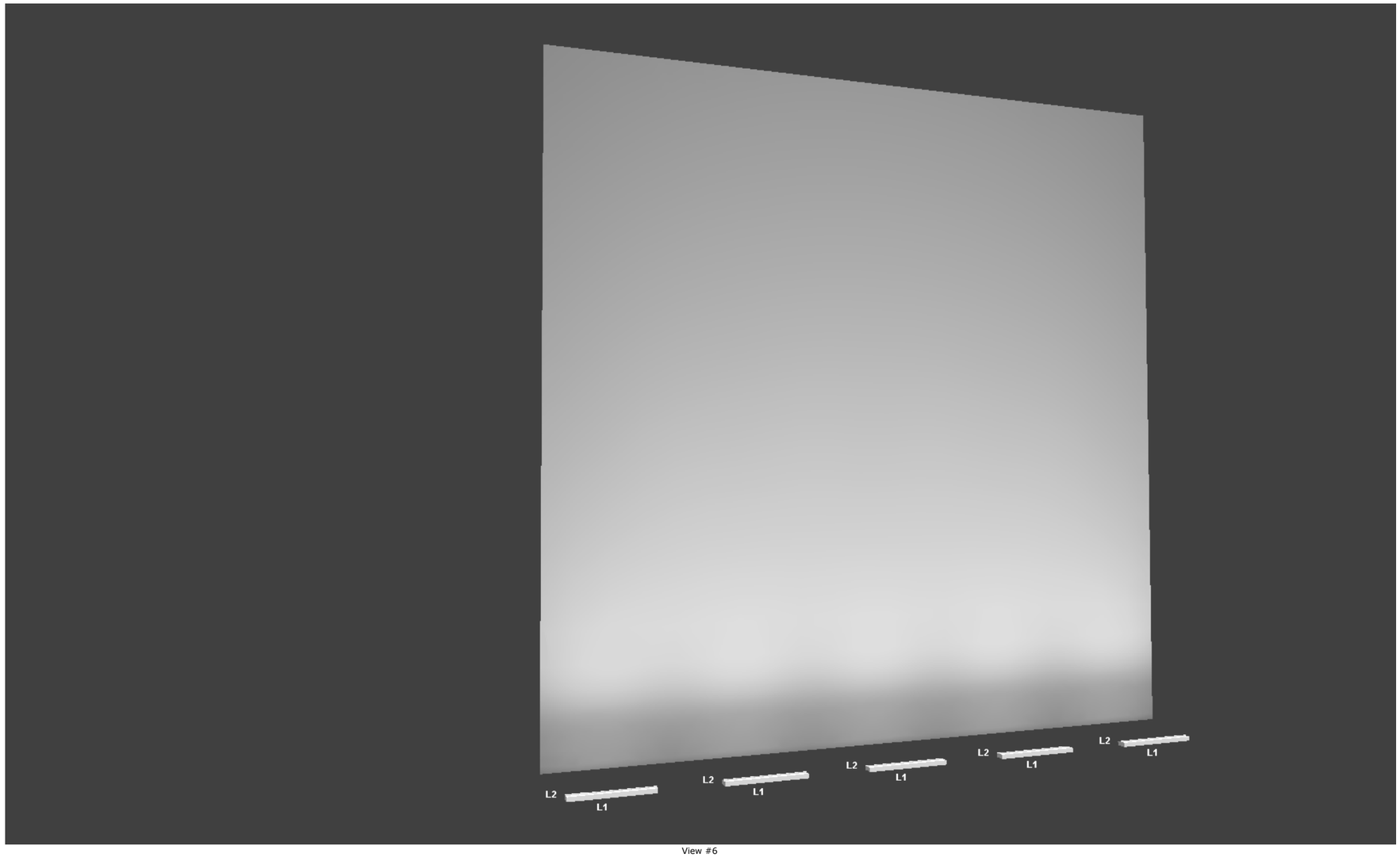
SOUTH CAMPUS COMMUNITY ARENA
EXTERIOR WALL

Designer

Date
03/28/2018
Scale
Not to Scale
Drawing No.

Summary

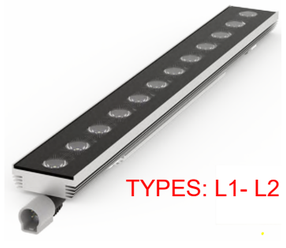
2 of 4



View #6

Schedule

Symbol	Label	QTY	Catalog Number	Description	Lumens per Lamp	LLF	Wattage	Polar Plot
	L1	5	GVA STR9 10x60	PH-STR9-300-7.5W-3000K-10X60-21.08.15	514	0.88	6.6	Max: 1717cd
	L2	5	GVA STR9 30x60	PH-STR9-300-7.5W-3000K-30X60-21.08.15	497	0.88	6.6	Max: 709cd



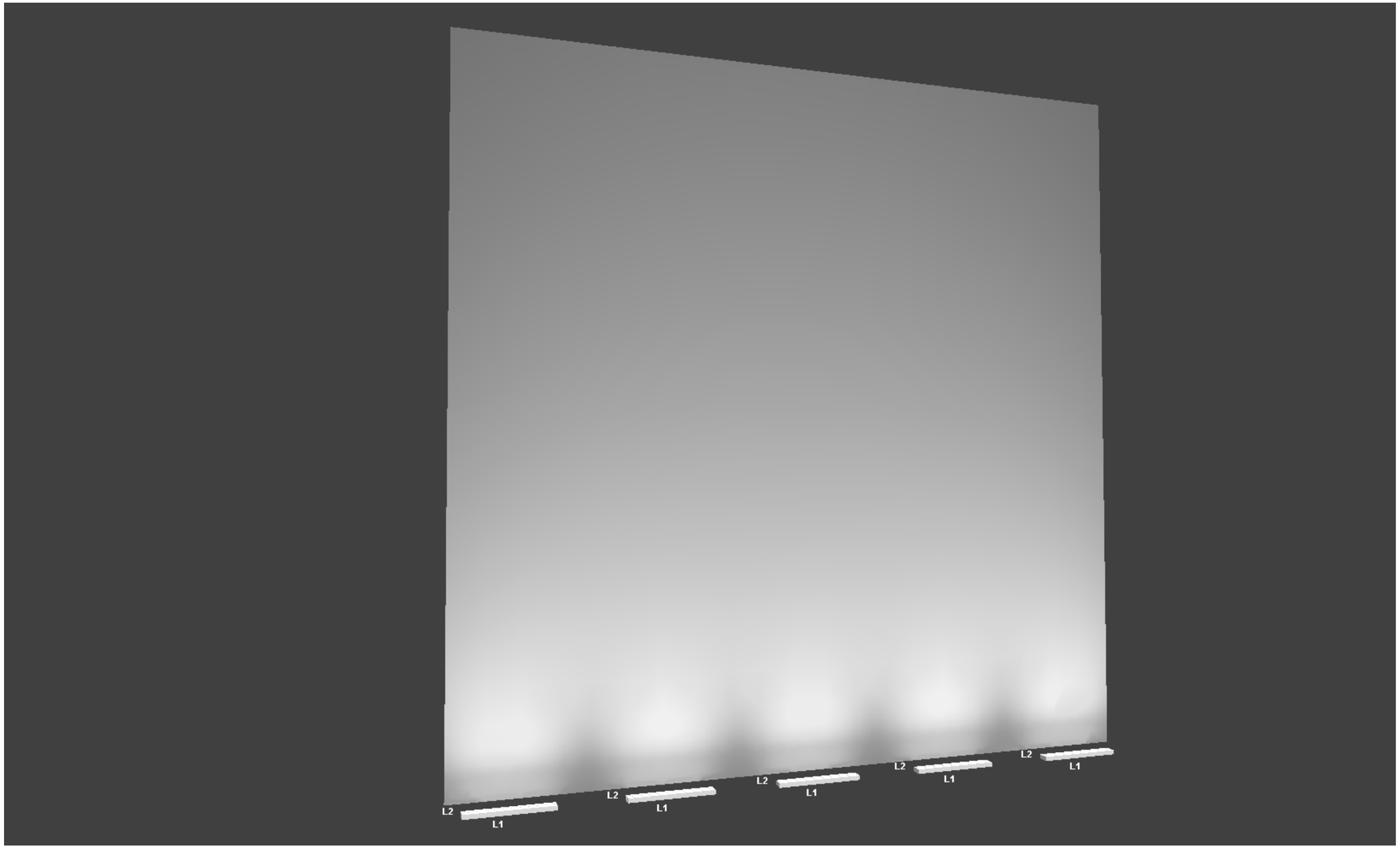
Note

1. LUMINAIRES INSTALLED AT 1M FROM THE WALL
2. L1 (10X60 DEG OPTICS) AIMED AT 4 DEG.
3. L2 (30X60 DEG OPTICS) AIMED AT 10 DEG.
3. QUANTITIES: L1 (4 FT LONG) 5 UNITS
   L2 (4 FT LONG) 5 UNITS
4. WALL SIZE 10M X 10M

SOUTH CAMPUS COMMUNITY ARENA
EXTERIOR WALL

Designer	
Date	03/28/2018
Scale	Not to Scale
Drawing No.	
Summary	

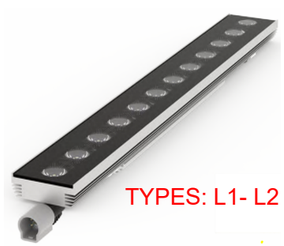
3 of 4



View #7

Schedule

Symbol	Label	QTY	Catalog Number	Description	Lumens per Lamp	LLF	Wattage	Polar Plot
	L1	5	GVA STR9 10x60	PH-STR9-300-7.5W-3000K-10X60-21.08.15	514	0.88	6.6	Max: 1717cd
	L2	5	GVA STR9 30x60	PH-STR9-300-7.5W-3000K-30X60-21.08.15	497	0.88	6.6	Max: 709cd



Note

1. LUMINAIRES INSTALLED AT 0.3M (1FT.) FROM THE WALL
2. L1 (10X60 DEG OPTICS) AIMED AT 1 DEG.
3. L2 (30X60 DEG OPTICS) AIMED AT 0 DEG.
3. QUANTITIES: L1 (4 FT LONG) 5 UNITS
   L2 (4 FT LONG) 5 UNITS
4. WALL SIZE 10M X 10M

SOUTH CAMPUS COMMUNITY ARENA
EXTERIOR WALL

Designer

Date
03/28/2018
Scale
Not to Scale
Drawing No.

Summary

4 of 4

STR9®

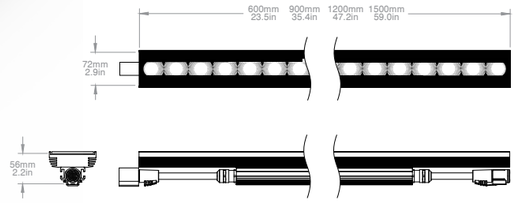
INFINITY® GVA TECHNOLOGY UNIBODY GVA TECHNOLOGY

GVA LIGHTING

Monochromatic Linear Wall Washing and Grazing LED Lighting

PRODUCT SPECIFICATION SHEET

DATE:	
TYPE:	
COMPANY:	
PROJECT:	



FEATURES:

- Up to 4000 delivered lumens/meter (1200 lumens/foot)
- Superior quality of white light: excellent LED to LED color consistency and specified color over angle
- Diffusing optical film creates uniform light output immediately adjacent to luminaire
- DMX, DALI or 0~10V dimming through GVA's power-data equipment
- Through wiring for end-to-end connection via snap-in connectors
- Compact size, only 56mm (2.20in) high x 72mm (2.83in) wide
- Four standard nominal lengths: 600mm (2ft), 900mm (3ft), 1200mm (4ft) and 1500mm (5ft)
- IP66 rated with UNIBODY™ design & proprietary sealing process
- Meets 3G ANSI C136.31-2010 Vibration standard for Bridge and Overpass Applications
- Projected lifetime: L70 >150,000hrs @ 25°C/77°F
- Operating temperature -40°C to +50°C, -40°F to 122°F
- Optically clear tempered glass lens (no yellowing over time)
- 8 adjustable and 3 non-adjustable mounting brackets
- Guaranteed long life time and high performance, no electrolytic capacitors in all DC designs

OPTIONS:

- INFINITY® Technology for exceptionally long runs from a single power source
- Power Options: 5W (ASHRAE/IESNA), 10W, or 15W per 300mm (1ft)
- Custom lengths: 300[1] or 1800[1]
- Glare control louvers
- Custom LED color combinations
- Non-standard beam distributions available
- Maximum lumen output adjustable during commissioning

SPECIFICATION LOGIC: STR9® MONO

FAMILY	NOMINAL LENGTH	BODY COLOR	POWER (per 300mm/1ft)	LED COLOR	OPTICS (FWHM)	INPUT VOLTAGE
STR9	300[1] **600** **900** **1200** **1500** 1800[1]	**BM** - Black Matte Anodized **CM** - Clear Matte Anodized	**5W** **10W** **15W**	2200K [1] **2700K** **3000K** **3500K** **4000K** **5000K** **6500K** **RD** - Red **AM** - Amber **GR** - Green **BL** - Blue **RB** - Royal Blue	**8** - 8°x8° **10** - 10°x10° **15** - 15°x15° **30** - 30°x30° **60** - 60°x60° **80** - 80°x80° **10x30** - 10°x30° **10x60** - 10°x60° **30x60** - 30°x60° Other Distributions available. Consult Factory	**ELV** - 24VDC or 48VDC [2,3] **INF** - 380VDC [4]
PRODUCT CONFIGURATION						

1 - Custom; consult factory, some restrictions apply
2 - For short/medium runs; 300mm (1ft) addressability for dimming; remote power-data equipment required
3 - For landscape lighting use 24VDC power-data equipment
4 - For long runs; full luminaire addressability for dimming; remote INFINITY® power-data equipment required

STR9®

INFINITY® GVA TECHNOLOGY UNIBODY GVA TECHNOLOGY

GVA LIGHTING

Monochromatic Linear Wall Washing and Grazing LED Lighting

PRODUCT SPECIFICATION SHEET

PRODUCT SPECIFICATIONS: STR9® MONO

Nominal Length		300[1]	600	900	1200	1500	1800[1]
Electrical	Rated Input Voltage	24VDC, 48VDC or 380VDC					
	Power Consumption (maximum)	5W 7.5W 15W	5W 10W 15W	10W 20W 30W	15W 30W 45W	20W 40W 60W	25W 50W 75W	30W 60W 90W
Optical	Light Source	6 x Nichia 219 LEDs per 300mm/1ft					
	CRI	83					
	Lumen Output (typical)[2]	5W 7.5W 15W	420 841 1261	840 1682 2522	1260 2523 3783	1680 3364 5044	2100 4205 6305	2520 5046 7566
	Beam Angle (FWHM)	10°, 30°, 60°, 80°, 10°x60°, 30°x60°					
Control	Control Protocol	DMX, DALI or 0~10V control through GVA Power-Data Equipment					
Physical	Size (WxH)	mm inches	72.0 x 56.4 2.83 x 2.22				
	Length	mm inches	298 11.7	598 23.5	898 35.4	1198 47.2	1498 59.0	1798 70.8
	Weight	kg lbs	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
	Housing	Solid extruded aluminum IP66 rated UNIBODY™, tempered flat glass lens					
	Fixture Connections	IP68 rated input and output snap-in connectors for end-to-end connection (sealed unmated)					
	Rated Operation Temperature	-40°C to +50°C, -22°F to 122°F					
	Minimum Starting Temperature	-30°C, -22°F					
	Environment	Dry, Damp or Wet Locations, 0-100% humidity					
Certification & Safety	IES Classifications	Class 1 LED Luminaire					
		c UL us CE RoHS ANSI C136.31-2010					

1 - Custom configuration, consult factory
2 - Measured with 4000K. Warmer color temperatures typically have a lower lumen output.

These figures are subject to change due to further development and innovations of LED light sources.

SELECTING LUMINAIRE VOLTAGE

24VDC
- for short runs only
- use when class 2 circuit is required

48VDC
- for any short and medium length run, up to 34.5m/115ft

380VDC
- for long runs, up to 325.5m/1085ft
- compatible with data center power grids
- compatible with solar and wind power

MAXIMUM RUN LENGTHS

Input Voltage	Power Per 300mm (1ft)		
	5W	10W	15W
24VDC	13.8m/46ft	12m/40ft	6m/20ft
48VDC	34.5m/115ft	24m/80ft	12m/40ft
380VDC	325.5m/1085ft	225m/750ft	117m/390ft

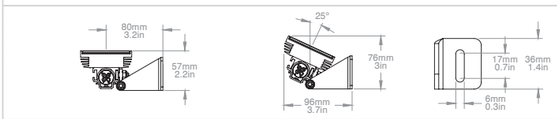
Ratings are for 30°C, de-rating will be used for higher ambient temperatures

ORDERING LOGIC: STR9® MOUNTING ACCESSORIES

WXX - ADJUSTABLE WALL MOUNT BRACKET KIT

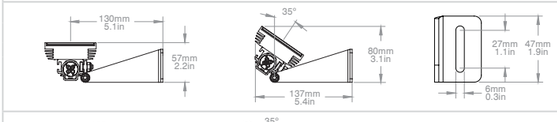
W40 - WALL MOUNT ADJUSTABLE

COLOR	PART NUMBER
Clear Matte Anodized	121128
Black Matte Anodized	121129



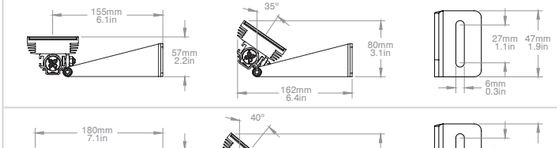
W80 - WALL MOUNT ADJUSTABLE

COLOR	PART NUMBER
Clear Matte Anodized	121130
Black Matte Anodized	121131



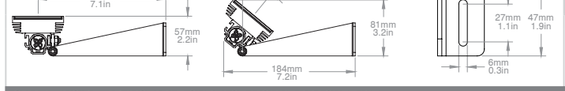
W130 - WALL MOUNT ADJUSTABLE

COLOR	PART NUMBER
Clear Matte Anodized	121132
Black Matte Anodized	121133



W155 - WALL MOUNT ADJUSTABLE

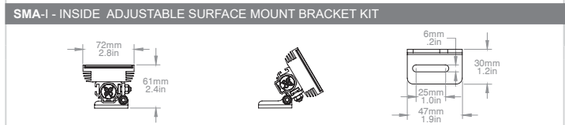
COLOR	PART NUMBER
Clear Matte Anodized	121134
Black Matte Anodized	121135



W180 - WALL MOUNT ADJUSTABLE

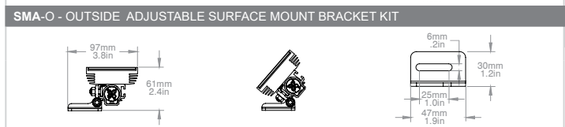
COLOR	PART NUMBER
Clear Matte Anodized	121136
Black Matte Anodized	121137

SMA-I - INSIDE ADJUSTABLE SURFACE MOUNT BRACKET KIT



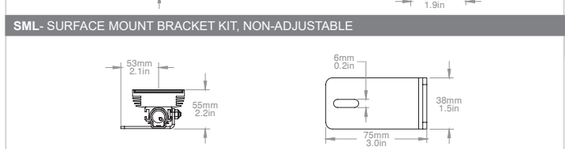
COLOR	PART NUMBER
Clear Matte Anodized	121138
Black Matte Anodized	121139

SMA-O - OUTSIDE ADJUSTABLE SURFACE MOUNT BRACKET KIT



COLOR	PART NUMBER
Clear Matte Anodized	121825
Black Matte Anodized	121826

SML- SURFACE MOUNT BRACKET KIT, NON-ADJUSTABLE



COLOR	PART NUMBER
Clear Matte Anodized	121140
Black Matte Anodized	121141

APPENDIX E
REFRIGERATION

ThermoCarb Ltd.	**University of Alberta South Campus Community Arena Refrigeration Schematic Design**	UNIVERSITY OF ALBERTA
REV.0	May 25, 2018	TITLE PAGE

CLIENT:	University of Alberta
PREPARED FOR:	GEC Architecture
CONSULTANT:	THERMOCARB LTD.
RE:	U of A South Campus Arena – Refrigeration Schematic Design Report
ATTENTION:	Leslie Webb
SUBMISSION DATE:	May 25, 2018
CONTACT:	**ThermoCarb Ltd.** 200, 1204 Kensington Road Calgary, Alberta, Canada T2N 3P5
CHIEF CONTACT:	Craig Weller Ph: (403) 262-1051 Cell: (587) 435-3125 Email: craig.weller@thermocarb.ca

EXECUTIVE SUMMARY

The University of Alberta plans to construct a new twin arena facility with seating capacities of 3000 and 400 respectively. A central refrigeration system located in a dedicated refrigeration mechanical room will provide cooling for the two NHL sized ice surfaces. The proposed refrigeration system is a low charge ammonia system sized with 250 TR capacity, with calcium chloride brine or ethylene glycol as the secondary refrigerant circulated under the refrigerated slabs. The proposed system has the required capacity to allow both arenas to operate year-round, and provide optimal ice conditions in high load conditions such as a Golden Bears hockey game in high outside ambient conditions.

A low charge ammonia system can reduce the mass of ammonia in a system to as low as 0.5 lbs/TR, compared to existing ammonia systems servicing twin arenas which may have as much as 10-12 lbs/TR. Low charge systems allow the entire ammonia system including the relief system to be enclosed within the Class T mechanical room. The proposed system will use energy efficient compressors, exchangers, fluid cooler, VFDs and controls to maximize the efficiency of the system. The system includes the following components:

- PLC Control system including required transmitters, with MCC to house all starters
- Three Mycom MII series compressors with VFDs to provide redundancy, efficiency and long maintenance intervals
- Plate and frame condenser to minimize piping volumes and refrigerant charge
- An adiabatic fluid cooler to reduce the water usage by up to 80%, and remove water treatment requirements when compared to a traditional system
- Two direct expansion, plate and frame chillers for redundancy, efficiency and to minimize piping volume and refrigerant charge
- VFD control of secondary refrigerant pumps to maximize efficiency
- Heat reclaim for underslab heating, snow melt pit, and domestic water preheat
- A deluge tank for the relief system discharge to keep all ammonia within the Class T mechanical room envelope
- Calcium chloride or ethylene glycol secondary refrigerant to be circulated under the refrigerated slabs
- Secondary refrigerant distribution system to provide cooling the refrigerated slabs for each arena.

Ammonia is up to 25% more efficient that alternative refrigerants, is a natural refrigerant with no ozone depleting or green house gas effects, and is easily detectible by smell (self alarming) at low concentrations.

ThermoCarb Ltd.	University of Alberta South Campus Community Arena Refrigeration Schematic Design	UNIVERSITY OF ALBERTA
REV.0	May 25, 2018	Page 2 of 4

PROJECT OVERVIEW

The University of Alberta plans to build a new twin arena facility to serve as the home for the University of Alberta Golden Bears hockey program, and service the greater University population and surrounding area. The arenas will have seating capacities of approximately 3000 and 400 people respectively.

DESIGN CRITERIA

The refrigeration system requires enough capacity to allow two NHL ice surfaces with seating for 3000 and 400 people respectively. A capacity of 250 TR is proposed to allow year round operation and rapid ice making if required.

ICE PLANT SYSTEM

A low charge ammonia system is proposed as the primary refrigerant. A secondary refrigerant of calcium chloride brine of ethylene glycol will be circulated under the refrigerated slabs. A low charge system can reduce the mass of ammonia in a system to as low as 0.5 lbs/TR, compared to existing ammonia systems servicing twin arenas which may have as much as 10-12 lbs/TR. Low charge systems allow the entire ammonia system including the relief system to be enclosed within the Class T mechanical room. The proposed system will be built up in a new refrigeration room and will include the following components:

- PLC Control system including required transmitters, with MCC to house all starters. The system will have remote viewing capabilities to allow operations to view the plant operation from offsite
- Three Mycom MII series compressors with VFDs to provide redundancy, efficiency and long maintenance intervals
- Plate and frame condenser to minimize piping volumes and refrigerant charge
- An adiabatic fluid cooler to reduce the water usage by up to 80%, and remove water treatment requirements when compared to a traditional system
- Two direct expansion, plate and frame chillers for redundancy, efficiency and to minimize piping volume and refrigerant charge
- VFD control of secondary refrigerant pumps to maximize efficiency
- Heat reclaim for underslab heating, snow melt pit, and domestic water preheat. The condenser glycol loop will capture the waste heat to be used by the other systems.
- A deluge tank for the relief system discharge to keep all ammonia within the Class T mechanical room envelope

THERMOCARB LTD. 2018

- Calcium chloride or ethylene glycol secondary refrigerant to be circulated under the refrigerated slabs
- Secondary refrigerant distribution system to provide cooling the refrigerated slabs for each arena.

FLOOR PIPING DESIGN

The proposed floor piping systems uses a traditional header trench with accessible supply and return headers and individual floor circuits. This design allows for future trouble shooting such as leaks or blockages of individual circuits without the need to cut into the refrigerated slab. Calcium chloride is recommended for this design for its excellent heat transfer and pumping properties. To increase the performance of the 3000 person capacity arena the number of floor circuits will be increased to add additional surface area for heat transfer.

New designs utilize a buried header design where the headers and all floor piping connections are cast into the concrete floor. The headers and floor circuit piping is constructed of HDPE piping with polyfusion welded joints. This removes the header trench and associated maintenance but also removes the ability to trouble shoot individual brine circuits (for issues such as leaking or blockages) without cutting into the concrete floor. Ethylene glycol is the recommended secondary refrigerant for buried header systems to reduce the risk of circuit blockages that can occur with crystallization of calcium chloride brine. Using glycol reduces the efficiency of the heat transfer and pumping in the system by 5-10% compared to brine. This is an option for this project and may be preferred due to the construction requirements of the site.

VENTILATION SYSTEM

Room ventilation including ammonia detection and system interlocking is provided by mechanical divisions.

ALTERNATIVE REFRIGERANTS

Ammonia is used in most recreational ice facilities across North America and when designed and operated correctly is a low risk system. Freon and CO2 systems are the primary alternate refrigerants used from recreational systems. Freon systems contribute to global warming and CO2 systems operate at pressures up to 5 times that of ammonia systems. Ammonia is a natural refrigerant with no ozone depleting or green house gas effects, and is up to 25% more efficient when compared to alternative Freon or CO2 systems. Ammonia is more toxic than other refrigerants but has specific design requirements to increase safety, and is self alarming

as it is easily detectible by humans at very low concentrations. See table below for refrigerant comparisons.

Ammonia vs Alternate Refrigerants							
	Ammonia	CO2 (R744) Transcritical	R507A	R404A	R134A	R448A	R22
Global Warming Potential (GWP)	0	1	3300	3300	1300	1273	1700
Ozone Depletion Potential (ODP)	0	0	0	0	0	0	0.05
Mechanical Required	Class T	Yes	Yes	Yes	Yes	Yes	Yes
Refrigerant Classification	B2	A1	A1	A1	A1	A1	A1
COP at 85°F SCT/12°F SST	4.62	2.24	3.74	3.76	3.58		4.28
HP/TR	1.02	2.11	1.26	1.25	1.32		1.10
Efficiency Penalty to NH3 at (85°F/12°F)	0	106%	24%	23%	29%	26%	8%

SUSTAINABILITY

As a natural refrigerant ammonia is not affected by global treaties and protocols such as the Montreal or Kyoto Protocols which limit the production of ozone depleting gases and greenhouse gas emissions. This provides security to the owner that ammonia will not be phased out in the future for environmental reasons, resulting in an expensive retrofit.

DRAWING LIST

R101	EQUIPMENT SCHEDULE & LEGEND
R102	EQUIPMENT LAYOUT

REGISTRATION DATA

1. AMMONIA PIPING TO CONFORM TO CSA B52 MECHANICAL REFRIGERATION CODE AND ASME/ANSI B31.5
2. CLASSIFICATION OF REFRIGERANT: GROUP B2 R717
3. WEIGHT OF REFRIGERANT CHARGE IN THE SYSTEM: 82 kg (180 lbs)
4. CLASSIFICATION OF REFRIGERATION SYSTEM BY TYPE: INDIRECT
5. CLASSIFICATION OF OCCUPANCY: MIXED
6. SYSTEM PRESSURES:

	DESIGN	OPERATING	TEST
HIGH SIDE	1724 kPa	1250 kPa	1898 kPa
LOW SIDE	1724 kPa	177 kPa	1898 kPa

7. SYSTEM DESIGN CONDITIONS:

	FPS	SI
PRIME MOVERS	375 HP	280 kW
REFRIGERATION CAPACITY	250 TR	880 kW
EVAPORATION HIGH STAGE	12 °F	-11.1 °C
CONDENSING	95 °F	35 °C
WET BULB	64 °F	17.8 °C

8. TESTING MEDIUM: AIR/NITROGEN
9. ONLY REGISTERED FITTINGS TO BE USED
10. MACHINERY ROOM CLASSIFICATION: CLASS T
11. MACHINERY ROOM VENTILATION: (--- CFM)

SYMBOL LEGEND

- DDC — DIGITAL DATA CONTROLLER
- LCP — LOCAL CONTROL PANEL
- PSV — PRESSURE SAFETY VALVE
- POV — PRESSURE CONTROL VALVE
- TCV — TEMPERATURE CONTROL VALVE
- LCV — LEVEL CONTROL VALVE
- MCV — MOTOR CONTROL VALVE
- SV — SOLENOID VALVE
- HT — HUMIDITY TRANSMITTER
- SG — SIGHT GLASS
- PI — PRESSURE INDICATOR
- PT — PRESSURE TRANSMITTER
- TI — TEMPERATURE INDICATOR
- TT — TEMPERATURE TRANSMITTER
- NEEDLE VALVE
- GATE VALVE
- ANGLE VALVE
- BALL VALVE
- GLOBE VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- HAND EXPANSION VALVE
- SIGHT GLASS
- FLOW METER
- LG — LEVEL GAUGE
- LT — LEVEL TRANSMITTER
- FI — FLOW INDICATOR
- HLSD — HIGH LEVEL SHUT DOWN
- PSL — PRESSURE SWITCH LOW
- PSH — PRESSURE SWITCH HIGH
- WM — WATER METER
- ADP — AMMONIA DETECTION PROBE
- FM — FLOW METER
- FT — FLOW TRANSMITTER
- ESD — EMERGENCY SHUTDOWN SWITCH
- CONTROL VALVE
- MOTORIZED VALVE
- SOLENOID VALVE
- PRESSURE CONTROL VALVE
- RELIEF VALVE
- CONCENTRIC REDUCER
- TXV
- UNION
- WELD END CAP
- SCREWED CAP
- FLANGE
- STRAINER
- FLANGE BLIND

COMPRESSORS

ITEM NO.	MAKE	MODEL	SST/SCT °C	SPEED RPM	CAPACITY kW	BRAKE POWER kW	MOTOR HP	DRIVE	COMMENTS
K-100	MYCOM	N4MII	-11.1/35	1180	297.1	75.4	125	BELT	
K-110	MYCOM	N4MII	-11.1/35	1180	297.1	75.4	125	BELT	
K-120	MYCOM	N4MII	-11.1/35	1180	297.1	75.4	125	BELT	

ADIABATIC FLUID COOLER

ITEM NO.	MAKE & MODEL	WARM SIDE FLUID	WARM SIDE FLOW	WARM SIDE T in / T out	COLD SIDE FLUID	COLD SIDE DB TEMP	COLD SIDE WB TEMP	# FANS	HP/FAN	DUTY (kW)	SERIAL NO.	COMMENTS
FC-600	GUNTNER S-GFD 2x7	50% ETH GLY		34.5°C / 31.5°C	AIR	35°C	18°C	14	3	900		Dry Operation below 2°C

VESSELS AND TANKS

ITEM NO.	NAME	MAKE & MODEL	DIA. (mm)	LENGTH (mm)	D.W.P. (kPa)	CRN NO.	COMMENTS
V-100	DISCHARGE OIL SEPARATOR	COS-140	406	1063	2758		
V-110	DISCHARGE OIL SEPARATOR	COS-140	406	1063	2758		
V-120	DISCHARGE OIL SEPARATOR	COS-140	406	1063	2758		
T-300	COLD BRINE EXP.	POLY	500 L		NA		
T-310	COLD BRINE EXP.	POLY	500 L		NA		
T-600	CONDENSER GLYCOL EXP.	POLY	250 L		NA		
T-800	DELUGE TANK	POLY	1000 L		NA		SIZED TO HOLD AMMONIA CHARGE AND 8 KG OF WATER/KG OF AMMONIA

HEAT EXCHANGERS

ITEM NO.	MAKE & MODEL	WARM SIDE FLUID	WARM SIDE FLOW	WARM SIDE T in / T out	COLD SIDE FLUID	COLD SIDE FLOW	COLD SIDE T in / T out	DUTY (kW)	SERIAL NO.	COMMENTS
C-600	CONDENSER	R-717	34.4 kg/min	38°C / 36°C	50% PRP GLY	72.6 L/s	31.5°C / 34.5°C	777		PLATE & FRAME
E-300	RINK 1 COLD BRINE CHILLER	1.22 SG $CaCl_2$	69.4 L/s	-5.7°C / -8.3°C	R-717	17.5 kg/min	-11.1°C / + SH	317		PLATE & FRAME
E-310	RINK 2 COLD BRINE CHILLER	1.22 SG $CaCl_2$	56.8 L/s	-6.7°C / -8.3°C	R-717	17.5 kg/min	-11.1°C / + SH	317		PLATE & FRAME
E-320	SUBCOOLER	NH3	4.5 L/s	23.9°C / -21.1°C	1.15 SG $CaCl_2$	19 L/s	4.5°C / -5.1°C	44		PLATE & FRAME
E-340	EVAPCO HYCA 9-41-6	50% ETH GLY	5.1 L/s	23.9°C / 18.3°C	SNOW	1088 kg/hr	0°C / 10°C	103		
E-350	DOUCETTE CADS 38.5M5.5	HSD R-717	170 TR	136°C / 43.3°C	DOM. H20	0.5 L/s	7.8°C / -37.8°C	63		

PUMPS

ITEM NO.	NAME	MAKE & MODEL	FLUID	FLOW L/S	HEAD m	SPEED RPM	HP	SERIAL NUMBER	COMMENTS
P-200	GLYCOL JACKET COOLING	ARMSTRONG 4380 1.5X1.5X8	50% ETH GLY	1.9		1760	1.5		
P-300	RINK 1 COLD BRINE	ARMSTRONG 4030 6x5x11	1.22 SG $CaCl_2$	69.4		1760 VFD	30		W/VFD
P-310	RINK 2 COLD BRINE	ARMSTRONG 4030 6x5x10	1.22 SG $CaCl_2$	56.8		1760 VFD	20		W/VFD
P-320	RINK 1 WARM BRINE	ARMSTRONG 4030 3x2.5x6	50% ETH GLY	9.5		1760	3		
P-330	RINK 2 WARM BRINE	ARMSTRONG 4030 3x2.5x6	50% ETH GLY	9.5		1760	3		
P-340	SNOW MELT PUMP	ARMSTRONG 4380 3x3x8	50% ETH GLY	9.5		1760	2		
P-350	DOM H20 PREHEAT PUMP	GRUNDFOS UPS 15-55SFC	H20	0-1.6					BY MECHANICAL
P-600	CONDENSER GLYCOL PUMP	ARMSTRONG 4300 8x8x10	50% ETH GLY	72.6		1790 VFD	30		W/VFD

NOTE: CONTRACTOR RESPONSIBLE FOR FINAL PUMP HEAD CALCULATIONS AND IMPELLER TRIM SIZING. FLOW TO BE CONFIRMED BY CONTRACTOR DURING COMMISSIONING.

SAFETY VALVES

TAG	LOCATION	MAKE	MODEL	CONFIG.	SET PRESSURE (kPa)	CAPACITY (kg/min AIR)	REQ. CAPACITY (kg/min AIR)	SIZE (mm)
100	K-100	HANSEN	H5604	SINGLE	1724	52.7		32X48
101	V-100	HANSEN	H5600R	SINGLE	1724	7.8		15x20
110	K-110	HANSEN	H5604	SINGLE	1724	52.7		32X48
111	V-110	HANSEN	H5600R	SINGLE	1724	7.8		15x20
120	K-110	HANSEN	H5604	SINGLE	1724	52.7		32X48
121	V-110	HANSEN	H5600R	SINGLE	1724	7.8		15x20
300	E-300	HANSEN	H5602	DUAL	1724	26.2		20x25
310	E-310	HANSEN	H5602	DUAL	1724	26.2		20x25
320	E-320	HANSEN	H5600R	SINGLE	1724	7.8		15x20
350	E-350	HANSEN	H5600R	SINGLE	1724	7.8		15x20
600	C-600	HANSEN	H5602	DUAL	1724	26.2		20x25

NOTE: CONTRACTOR RESPONSIBLE FOR CORRECT RELIEF VALVE AND RELIEF PIPE SIZING BASED ON THE FINAL INSTALLATION.

PIPE IDENTIFICATION LEGEND

DESCRIPTION	ABBRV.		ABBRV.
CONDENSER GLYCOL RETURN	COR	RELIEF VENT	RV
CONDENSER GLYCOL SUPPLY	COS	VENT	V
HIGH PRESSURE LIQUID	HPL	JACKET COOLING WATER SUPPLY	JWS
HIGH STAGE DISCHARGE	HSD	JACKET COOLING WATER RETURN	JWR
HIGH STAGE SUCTION	HSS	CONDENSER DRAIN	CD

PIPE IDENTIFICATION: BLACK LETTERS ON SAFETY YELLOW BACKGROUND

PIPE IDENTIFICATION EXAMPLE:

HTRS	L I Q	V A P	AMMONIA	LOW
ABBREVIATION SECTION	PHYSICAL STATE (LIQ) = ORANGE (VAP) = BLUE			PRESSURE LEVEL LOW = GREEN HIGH = RED

TEMPERATURE TRANSDUCER SCHEDULE

TAG	LOCATION	TAG	LOCATION
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

gec architecture

Project Team
Construction Manager
CONSTRUCTION
Structural Consultant
STRUCTURAL
Mechanical Consultant
MECHANICAL
Electrical Consultant
ELECTRICAL

Client

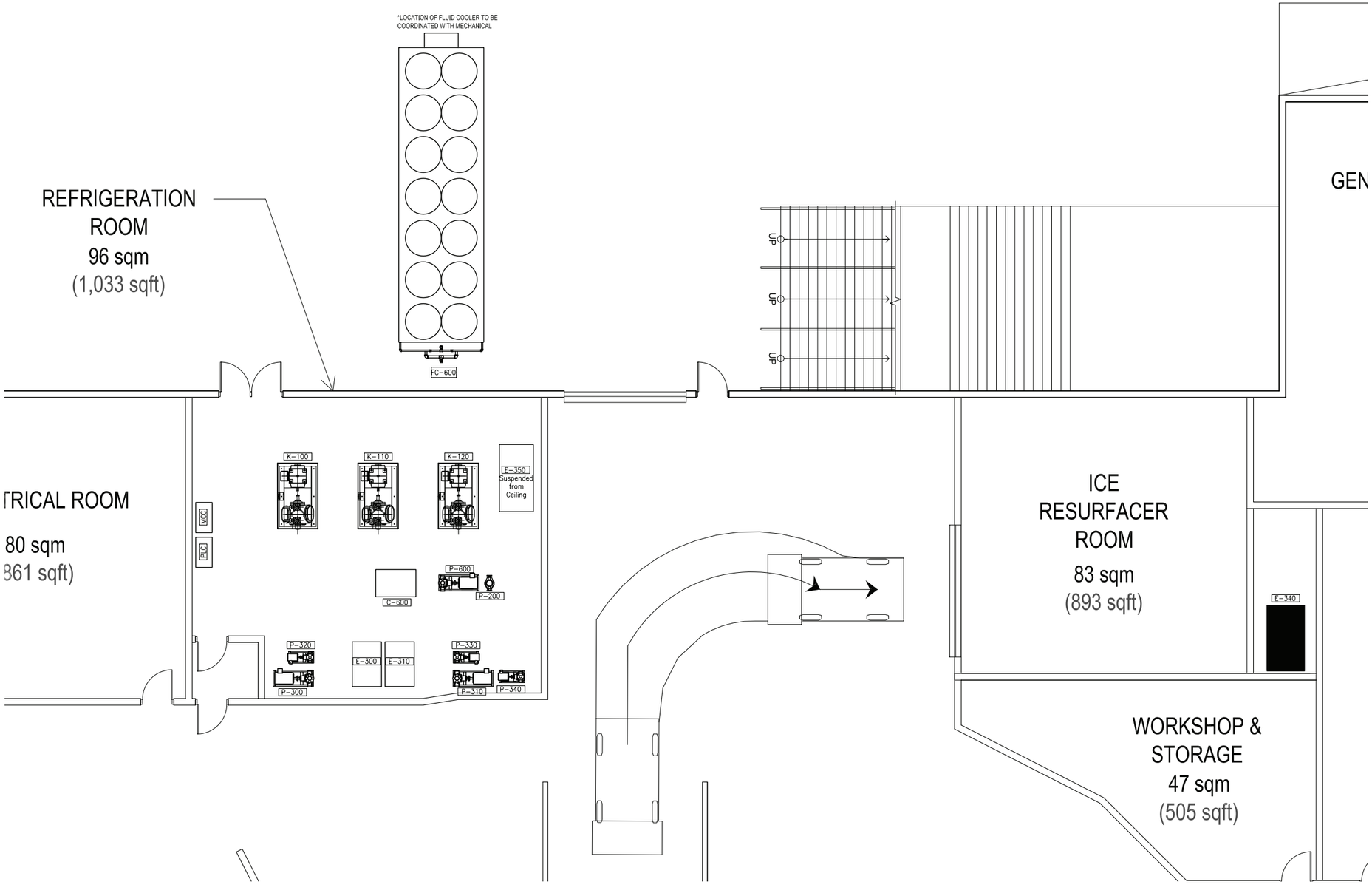
Seal & Permit

No.	Description	Date
Drawing History		
Scale		Checked By

Project
University of Alberta
South Campus
Community Ice Arena
PROJ4

Drawing Title
Equipment Schedule
and Legend

Project Number 5594
Drawing Number R101



gec architecture

Project Team
Construction Manager
CONSTRUCTION
Structural Consultant
STRUCTURAL
Mechanical Consultant
MECHANICAL
Electrical Consultant
ELECTRICAL

Client

Seal & Permit

No.	Description	Date

Drawing History

Scale
1:50

Checked By

Project
University of Alberta
South Campus
Community ice Arena
PROJ4

Drawing Title
Equipment Layout

Project Number

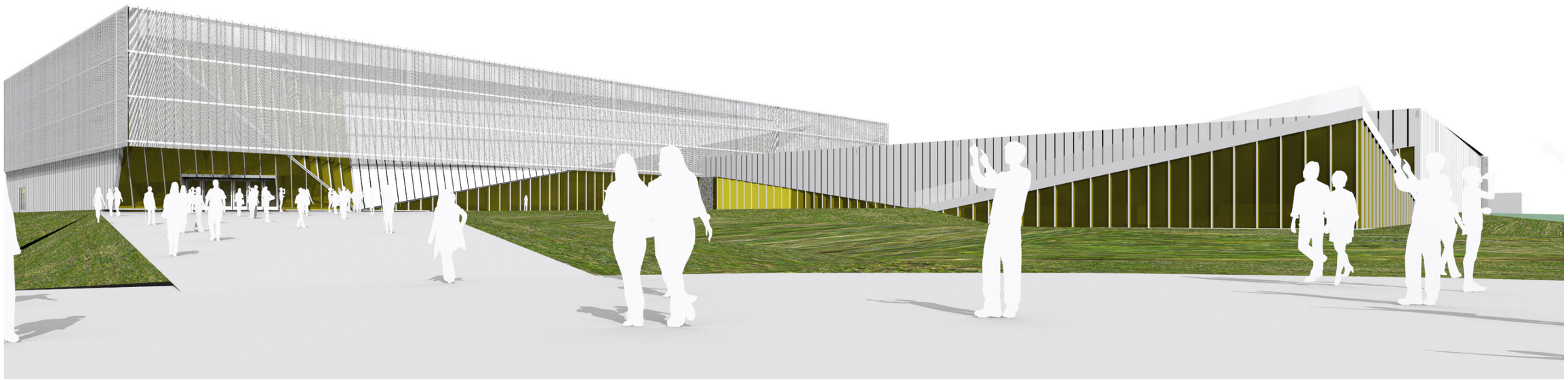
Drawing Number

APPENDIX F
SPORT PERFORMANCE CENTRE
AUGUST 30TH, 2018 UPDATE

The following represents a progress update of the South Campus Community Ice Arena project that includes the addition of the Sport Performance Centre. Subsequent to the initial completion of the Schematic Design Phase in June 2018, GEC was given approval to advance the Sport Performance Centre design to a level comparable to the remainder of the Ice Arena project.

Through consultation with the University of Alberta project team, building program and plan refinements have allowed the design to take advantage of newly created efficiencies and design opportunities.

Architecturally, the design concept remains consistent as previously presented. The two main arena boxes are still the prominent building mass with the Sport Performance Centre subtly raising out of the ground as it approaches 118 street to access natural light. Internally the Sport Performance Centre is connected to the remainder of the building though open to below spaces providing views from the public concourse areas into the main training spaces.



View looking West

PROGRAM UPDATE

FACILITY PROGRAM Event Facility + Community Rink + High Performance

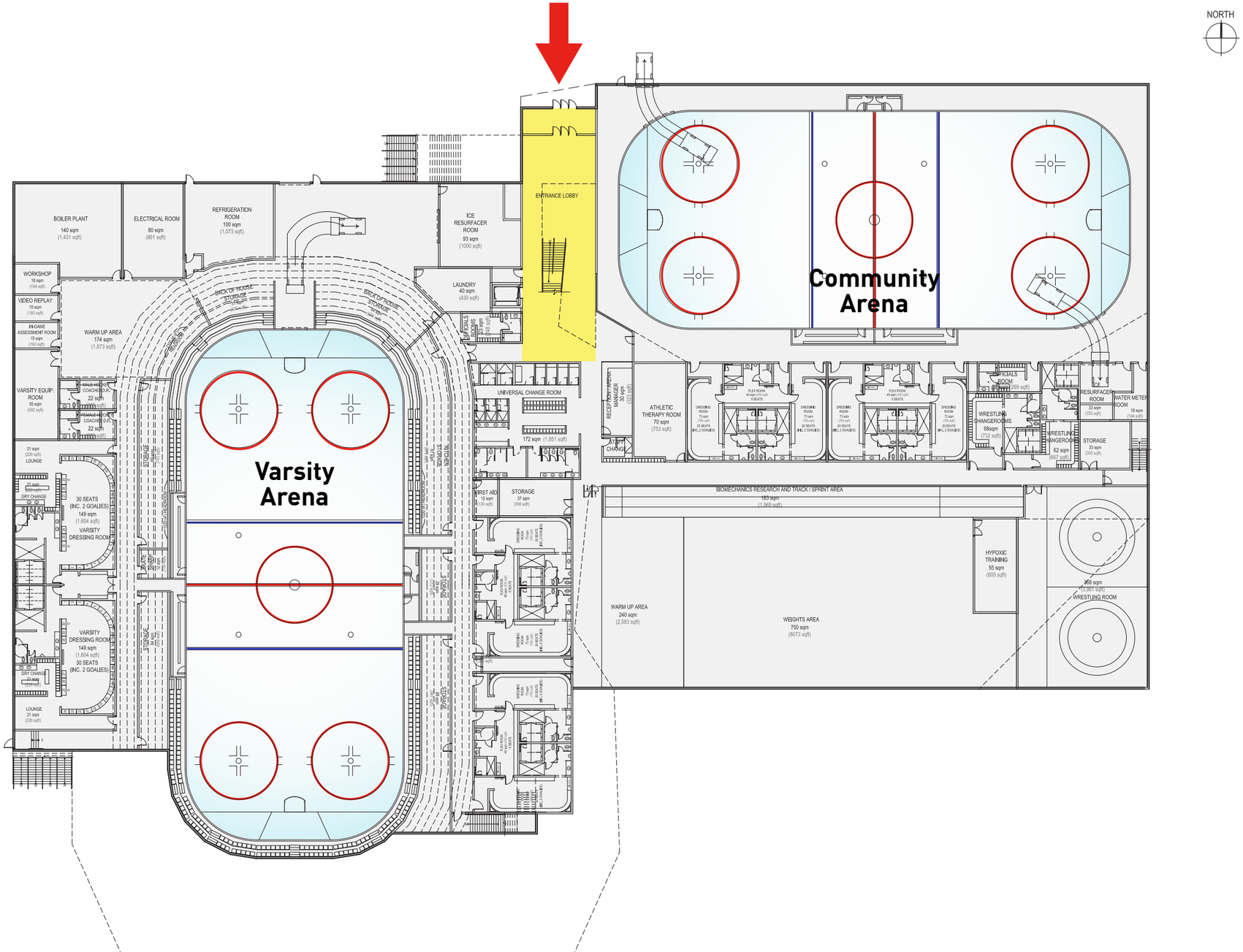
SD REPORT - UPDATE AUGUST 30, 2018

PRELIMINARY FACILITY PROGRAM FROM BUSINESS CASE (2016)			APPROVED SCHEMATIC DESIGN PROGRAM (MARCH 03 2018)			CURRENT SD DESIGN NET AREA (AUGUST 30, 2018 UPDATE)			
Type and Quantity of Programmed Space	**Intended Activity**	**Required Area (ft2)**	**Units**	**NFA Per Unit**	**NFA Total**	**# of Rooms**	**NFA Per Room**	**NFA Total**	**DELTA (SF)**
Varsity Ice Arena		**50,900**	**Varsity Ice Arena**		**60,200**	**Varsity Ice Arena**		**49,331**	**-10,869**
Arena bowl	3,000 seats, 200'x85' ice	41,700	3,000	15	46,000			46,758	758
Public Washrooms	men and women, 3,000 spectators	3,400	3,000	1.13	3,400	2	(861 + 1044)	1,905	-1,495
Ticketing Area	spectator event support (small area should be ok)	1,000			300	MOVED TO GROSS AREA		0	-300
Lobby and Information Desk	spectator event support	3,200			4,000	MOVED TO GROSS AREA		0	-4,000
Concession	spectator event support, food and beverage, secured, with dry storage and garbage areas	600			500	2	(205 + 463)	668	168
Merchandise Storefront	spectator event support	1,000			1,000			0	-1,000
Stairs					5,000	MOVED TO GROSS AREA		0	-5,000
Arena Support Spectator Level		**2,535**	**Arena Support Spectator Level**		**5,533**	**Arena Support Spectator Level**		**6,511**	**979**
Multipurpose Room	100 people, viewing to rink-preferably between the 2 rinks	1,025			1,000			732	-268
Servery					100	2	(140 + 97)	237	137
Suites	4 suites, 20 seats each, 2 per side, convertible to classroom space	1,350	4	600	2,400	4	(592 + 592 + 592 + 818)	2,594	194
Areana Spectator Seating (on level 3)					0			1,162	1,162
Lounge/Club Area	program area included in multipurpose room			1,500	1,500			915	-585
Public Washrooms			250	1.13	283	2	(323+258)	581	299
Press Box	media production, 8 – 10 people plus equipment	160	10	25	250			290	40
Arena Support Participant Level		**16,365**	**Arena Support Participant Level**		**16,185**	**Arena Support Participant Level**		**17,802**	**1,617**
Workshop	arena support (2 sheets)	200			200			194	-6
Mechanical Room	arena support (2 sheets)	4,900						0	0
Refrigeration Room					1,000			1,073	73
Ice Resurfacer shared	arena support (2 sheets)	1,150			1,000	2	(1000+355)	1,355	355
Storage	arena support (2 sheets), loading dock	400				4	(743 + 689 + 947 + 312)	2,691	2,691
Back of House Storage/Event Logistics	Event support, rink protection storage,				1,500	2	(333 + 527)	860	-640
Kitchen/Storage					1,500			872	-628
Skate Sharpening	kiosk/small shop	80						130	130
First Aid Office	first aid multipurpose	110			220			130	-90
Video Replay/Production Room		125			125			160	35
In-Game Assessment		150			700			160	-540
Community and Visitor Dressing Rooms	2 @ 30 stalls (20 stalls x 4 rooms - 2018.08.30)	1675	4	900	3,600	4	785	3,140	-460
Community and Visitor Dressing Rooms	2 @ 22 stalls	1675						0	0
Flexible Dressing Rooms	2 off gender dressing rooms, 6 stalls (9 stalls x2 rooms-2018.08.30)	600	2	300	600	2	430	860	260
Officials Rooms	2 officials dressing rooms, 4 – 6 people per room	600	12	20	240			248	8
Varsity Dressing Rooms	2 dressing rooms (Bears and Pandas), 30 stalls each	2,000	2	1,500	3,000	2	1,604	3,208	208
Varsity Dressing Rooms - Dry Change + Sink Area					0	2	226	452	452
Varsity Equipment Rooms	2 equipment rooms (Bears and Pandas)(300 ft2 each)	600			600			592	-8
Athletes Lounge	sufficient for 4 teams	600			800	2	226	452	-348
Athletic Therapy Rooms	1 room, 2 – 4 athletes at a time and 2 whirlpool tubs	800			800			753	-47
Male Hockey Coaches Dressing Room	6 coaches	400	6	25	150			236	86
Female Coaches Dressing Room		300	6	25	150			236	86
Event Level Public Washrooms									
Event Level Concessions				150	0			0	0
High Performance Athlete Training and Research Centre (HPTRC) * Academic		**25,160**	**HPTRC * Academic**		**22,960**	**HPTRC * Academic**		**26,258**	**2,698**
Reception / Arena Manager		200			200			323	123
Open Floor Training Space	Weight Area + Warm Up Space	10,000	200	40	8,000	2	(2583 + 8073)	10,656	2,656
Combative Sports/Wrestling Washrooms + Change	2 for 25 athletes @ 800'	1,600	2	800	1,600	2	(732 + 667)	1,399	-201
Combative Sports Room/ Wrestling	wrestling	3,600			3,600			3,961	361
Biomechanics Research and Training Space	artificial turf track surface: 12' x 150'	1,800			1,800			1,969	169
Sport Medicine Health Research and Assessment Space		3,000			3,000			3,918	918
Body Composition Laboratory		600			600	combined w/ Sport Med. (above)		0	-600
Wet Lab / Hypoxic Training		600			0			600	0
Smart Classroom / Video Analysis	70 –80 Students	700			700	1		742	42
Research Offices	3 @ 110'	330			330			0	-330
Staff Offices	3 @ 110'	330			330			0	-330

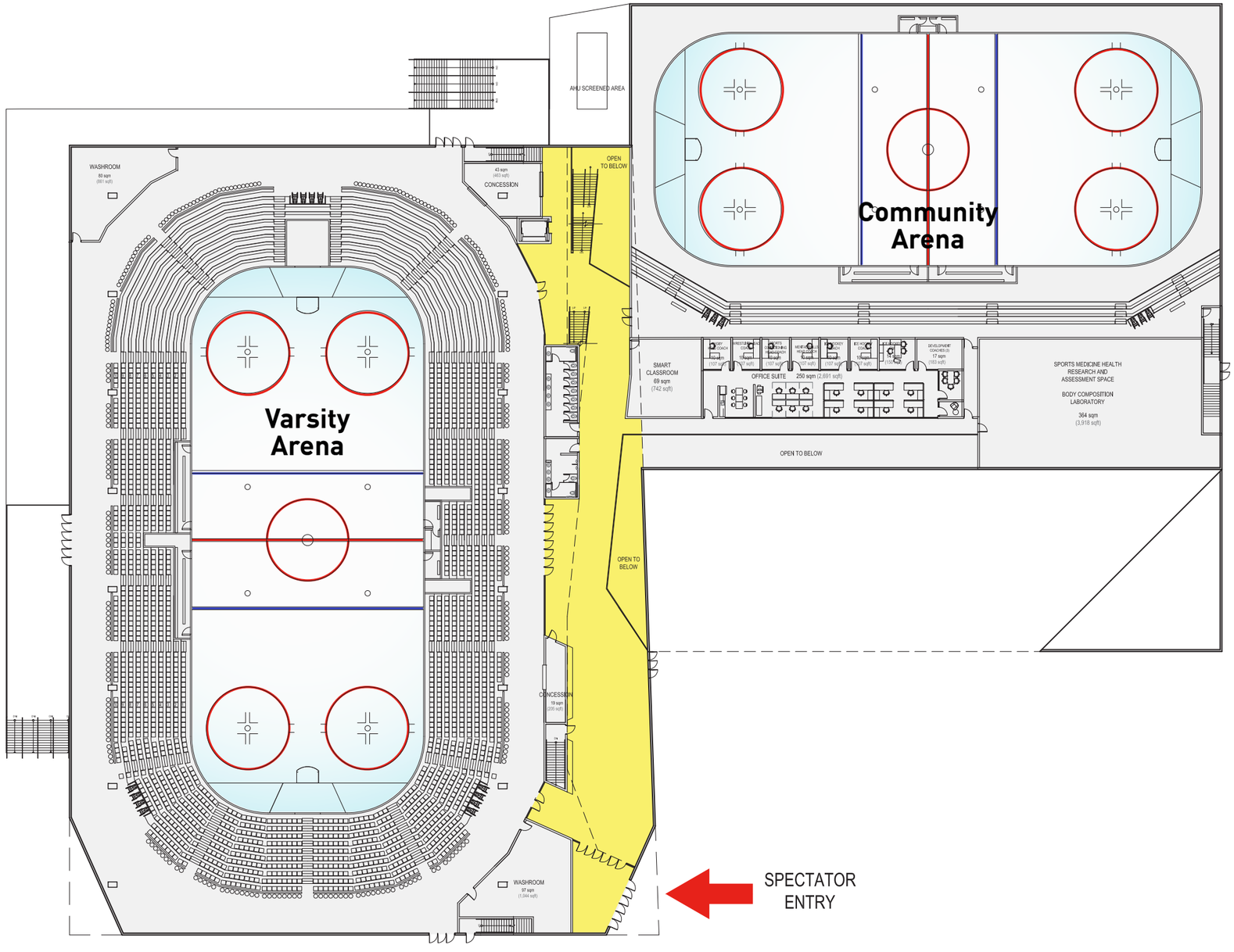
Seminar/Meeting Rooms	1 @ 200	200			200			0	-200
Maintenance/Storage Room		400			400	2	398+355)	753	353
Locker Rooms/Washrooms - Universal Change	2 @ 800': 40 persons	1,600	100	20	2,000			1,851	-149
Staff Room / Staff Change		200			200			86	-114
Ancillary		**2,740**	**Ancillary**		**1,740**	**Ancillary**		**3,121**	**1,381**
General Office / Office Suite	support staff, mail, photocopy, event management, and reception, (add hockey and other sport offices, meeting room, coaches offices, research offices and meeting room - 2018.08.30)	800			800			2,691	1,891
Staff Offices	hockey 3, wrestling 1	440			440			0	-440
Staff Washrooms/Locker Rooms	2 @ 500', 12/room	1,000		25	0			0	0
Team Support	laundry, storage, equipment	500			500			430	-70
Community Arena		**27,500**	**Community Arena**		**26,500**	**Community Arena**		**29,985**	**3,485**
User Ice Sheet	rentals/practice, ~400 seats, 200'x85'	24,000			22,000			23,175	1,175
Community Arena Spectator Level Seating	(400 bench seating - 2018.08.30)	0			0			1,905	1,905
User Dressing Rooms	4 dressing rooms for user groups, 20 stalls per room (2 dressing rooms should be "accessible" to ice— i.e. for sledge hockey)	2,600	4	900	3,600	4	785	3,140	-460
Auxilliary / Flex Dressing Rooms	2 auxilliary dressing rooms, 6 stalls, (9 stalls x 2 rooms - 2018.08.30)	600			600	2	430	860	260
Public Washrooms	on spectator level				0	2	(248+388)	636	636
Officials Rooms	1 officials dressing room, 4 – 6 people per room or 1 room for 10 people	300			300	1		269	-31
NET PROGRAM AREA		**125,200**			**133,118**			**133,008**	**-110**
Building Services + Circulation		**45,100**	**Building Services + Circulation**		**9,200**	**Building Services + Circulation**		**2,292**	**-6,908**
IT/Communications Room		200	2	100	200			0	-200
Electrical and contoll room			1	1,000	1,000	1	861	861	-139
Ground Level		20,000			0				0
Concourse Level		18,900			0				0
Plus 15 Connector		6,000			0				0
Air Handling Room Arena 1					2,500			0	-2,500
Air Handling Room Arena 2					1,500			0	-1,500
Air Handling Room High Performance					2,000			0	-2,000
Central Boiler Plant					2,000			1,431	-569
SUB-TOTAL OF NET AREA W/ CIRC. AND BUILDING SERVICES		**170,300**			**142,318**			**135,300**	
GROSS BUILDING AREA								**169,165**	
Participant Level								108,758	
Spectator Level								50,547	
Upper Suite Level (3rd Floor)								9,860	
Gross Up Factor (includes exterior walls and exterior		**1.1**			**1.17**			**1.25**	****Refer to Note**
TOTAL BUILDING GROSS AREA		**187,330**			**166,549**			**169,165**	**2,617**

** Gross Factor includes the following programs:
Ticketing Area
Lobby + Information Desk
Warm Up Areas
Stairs + Circulation
Wall Area

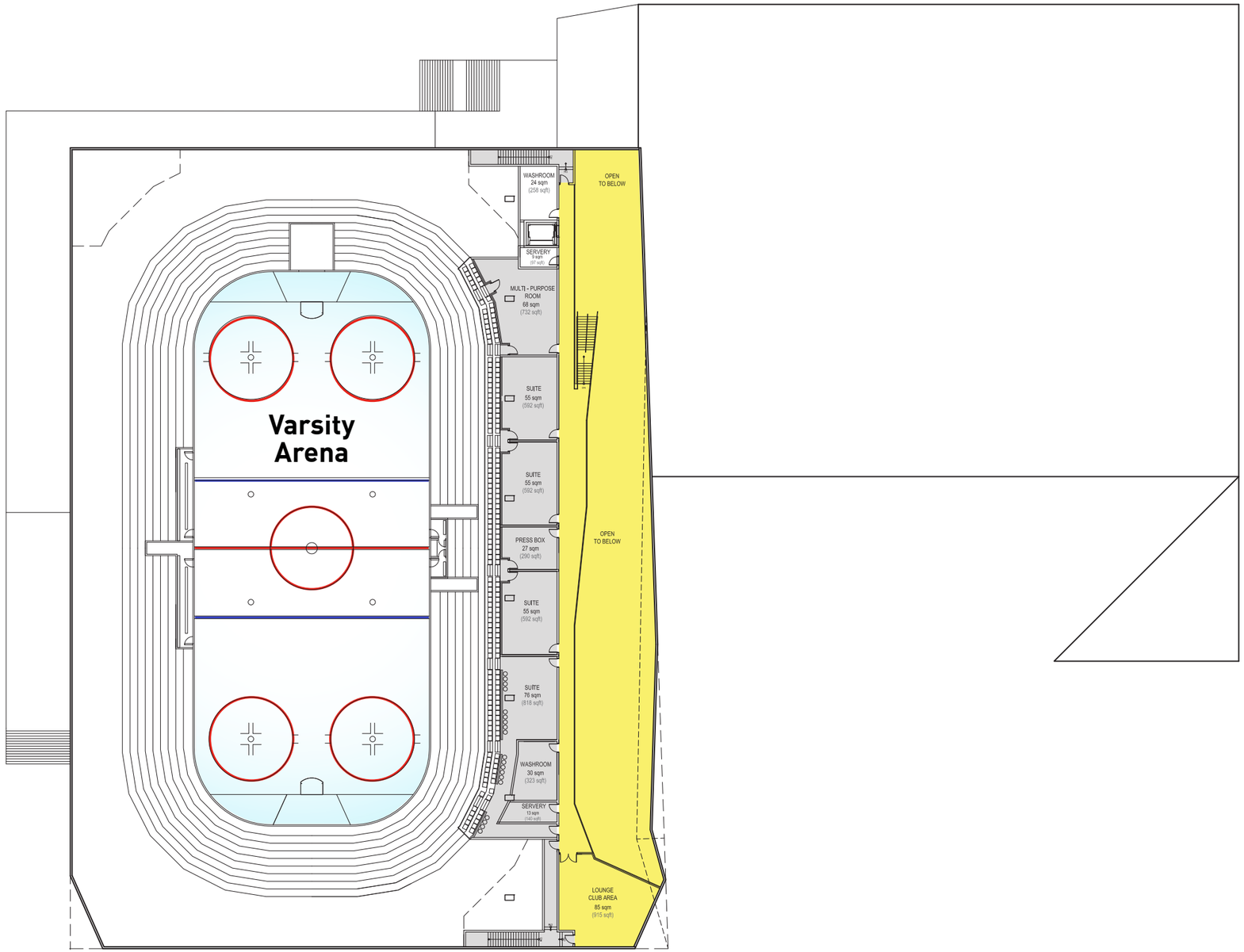
PARTICIPANT LEVEL PLAN



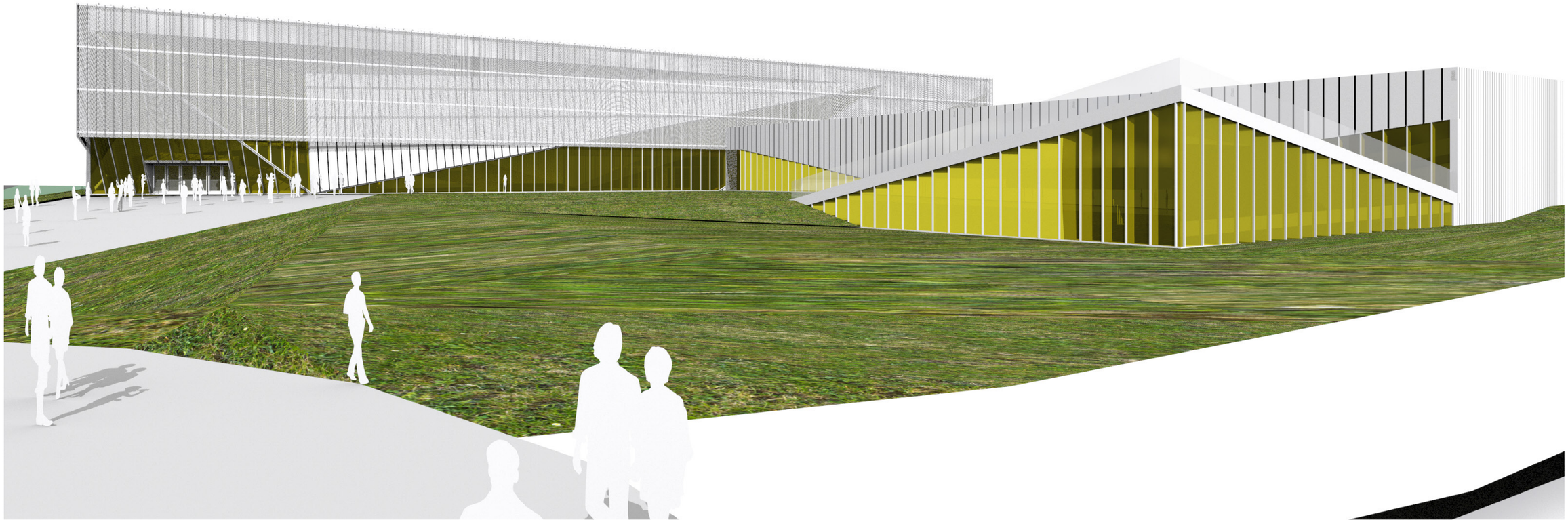
SPECTATOR LEVEL PLAN



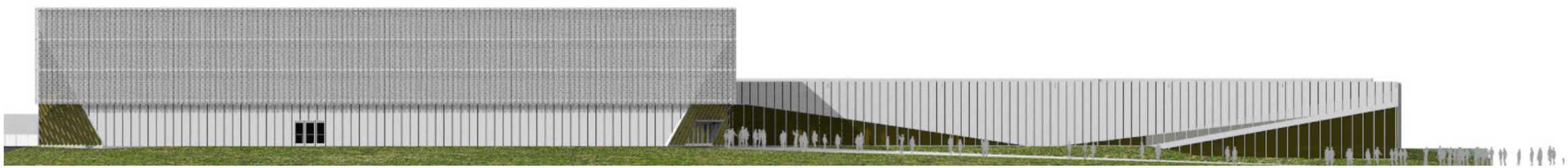
UPPER SUITE LEVEL PLAN



MODEL VIEWS



View looking West



South elevation

APPENDIX G
COST ESTIMATE - COST PLAN

UNIVERSITY OF ALBERTA - VARSITY ARENA

SCHEMATIC DESIGN ESTIMATE - REVISION #2

JULY 13, 2018

Prepared by:

Costplan Management Ltd.
Suite 214, 5925 12th Street S.E.
Calgary, Alberta
T2H 2M3
Phone: (403) 262-9360

UNIVERSITY OF ALBERTA - VARSITY ARENA
SCHEMATIC DESIGN ESTIMATE - REVISION #2
JULY 13, 2018

These hard construction cost estimates for the University of Alberta South Campus Varsity and Community Arenas have been developed from the updated Issued for Costing drawings and Schematic Design reports received on June 21 & 25, 2018 as provided by GEC Architecture. Modifications and clarifications to the SD Reports as provided by GEC on July 10, 2018 have also been incorporated into the base price estimate. Where the information is incomplete or has discrepancies, we have included for our understanding of the designers intent. As much of the information is still preliminary, this estimate should be used as a budget guideline only.

These estimates include for all contractor overhead and profit based on a stipulated sum competitive tender strategy utilizing completed construction documents. We have assumed that at least 4 competitive bids will be received for all general contractor and subcontractor work. We have also assumed a reasonable construction schedule.

As the scope of work and much of the project information and details are yet to be fully developed, we have included a 5% design contingency allowance in the estimate.

All costs have been estimated in current July 2018 dollars and exclude GST. Market variations from now until construction will have to be factored into the estimate total.

Estimate Summary (rounded)

• **Total Facility Construction Cost**	**$45,100,000**	
• **Total Site Development Cost**	**$1,800,000**	
Total Hard Construction Costs	**$46,900,000**	
Offsite Service Costs by U of A	**$830,000**	**To Be Confirmed by U of A**
FF&E - Items related to event requirements (Scoreboard & video; Rigging Grid; Kitchen & Concession Equipment)	**$1,600,000**	

Excluded from these construction cost estimates are:

- All design & consulting fees, testing and all other soft costs
- Furniture, Furnishings and Equipment not included in the FFE allowance above
- Athletic Equipment
- Retail Tenant Improvements / Tenant Improvement to Upper Suites / T.I.'s by Operator or Sublessors
- Public Art Allowance
- Hazardous Material Remediation
- Exterior Signage
- Operating and Maintenance Reserve Fund
- Audio / Visual Systems to Meeting Rooms / Multi-purpose Rooms Empty raceways only
- Voice / Data / Equipment & Devices and incoming fibre optic by U of A
- Security systems devises and panels (to be supplied by U of A)
- Owner Internal Costs
- Moving and Relocation Costs
- **Construction or Post-tender Contingency Allowances**
- All work beyond the construction boundary identified
- **Escalation Contingency**
- Bonding and Course of Construction Insurance (by U of A)
- Goods and Services Tax

UNIVERSITY OF ALBERTA - VARSITY ARENA
SCHEMATIC DESIGN ESTIMATE - REVISION #2
JULY 13, 2018

ELEMENTAL BREAKDOWN
GROSS AREA IN S.M. 13,140

	COST	TOTAL COST	COST/S.M.	TOTAL/S.M.
SUBSTRUCTURE				
FOUNDATIONS	5,443,000		414.23	
SLAB ON GRADE	2,465,000		187.60	
		7,908,000		601.83
SUPERSTRUCTURE	8,248,000		627.70	
		8,248,000		627.70
EXTERIOR CLADDING				
WALLS	3,024,000		230.14	
WINDOWS	497,000		37.82	
ENTRANCES	184,000		14.00	
PROJECTIONS	124,000		9.44	
		3,829,000		291.40
WEATHERPROOFING				
ROOFING	2,234,000		170.02	
SKYLIGHTS	0		0.00	
		2,234,000		170.02
VERTICAL MOVEMENT				
STAIRS	110,000		8.37	
ELEVATORS	105,000		7.99	
		215,000		16.36
INTERIOR DIVISION				
PARTITIONS	1,635,000		124.43	
DOORS	424,000		32.27	
		2,059,000		156.70
INTERIOR FINISHES				
FLOORS	533,000		40.56	
CEILINGS	483,000		36.76	
WALLS	477,000		36.30	
		1,493,000		113.62
FITTINGS AND FIXTURES	2,310,000		175.80	
		2,310,000		175.80
MECHANICAL	5,525,000		420.47	
		5,525,000		420.47
ELECTRICAL	3,880,000		295.28	
		3,880,000		295.28

SUBTOTAL		37,701,000	2,869.18 /S.M.
GENERAL CONDITIONS & FEE	14%	5,278,000	401.67 /S.M.
DESIGN CONTINGENCY	5%	2,149,000	163.55 /S.M.
FACILITY CONSTRUCTION TOTAL		**$45,128,000**	**$3,434.40** /S.M.

UNIVERSITY OF ALBERTA - VARSITY ARENA
SCHEMATIC DESIGN ESTIMATE - REVISED
JULY 13, 2018

BUILDING GROSS AREA

PARTICIPANT LEVEL	8,044	
SPECTATOR ENTRY LEVEL	4,164	
UPPER SUITE LEVEL	932	
TOTAL GROSS AREA	**13,140**	**SM**

SUBSTRUCTURE

STRIP SITE - SEE SITEWORKS				-
MASS EXCAVATION & BACKFILL BENEATH BUILDING	33,785	CM	11.87	400,952
SITE RAISING FILL	11,858	CM	5.00	59,290
TEMPORARY SHORING TO BUILDING EXCAVATION - ALLOW	1	LOT	20,000.00	20,000
DISPOSE OF UNDESIRABLE EXCAVATED MATERIALS - ALLOW	1	LOT	15,000.00	15,000
SUBGRADE PREPARATION TO MITIGATE SLAB SETTLEMENT ON FILL MATERIALS	ALLOW		50,000.00	50,000
CAST-IN-PLACE CONCRETE BELLED PILES	503	EA	4,061.63	2,043,000
PILE CAPS	58	EA	3,996.59	231,802
DROP PANELS	291	EA	648.83	188,811
PILE CAPS / SLABS AT SNOW MELT PITS & ELEVATOR PIT	3	EA	6,994.30	20,983
PERIMETER GRADE BEAMS	480	LM	618.33	296,487
INTERIOR GRADE BEAMS	793	LM	453.40	359,456
STEPS IN GRADE BEAMS - ALLOW	1	LOT	15,000.00	15,000
ADDITIONAL FOUNDATIONS - ALLOW	1	LOT	35,000.00	35,000
CONCRETE FOUNDATION WALLS	613	LM	2,520.00	1,545,768
CONCRETE WALLS NOT SHOWN				
SNOW MELT PIT WALLS - 2 EA	20.0	LM	1,300.00	26,000

ELEVATOR PIT WALLS	12.0	LM	730.00	8,760
BUCK DOWN FOUNDATION WALL AT EXIT DOOR LOCATIONS	ALLOW		5,000.00	5,000
PILASTERS - ALLOW	25	EA	1,100.00	27,500
MISC. FOUNDATIONS / THICKENINGS				
SUMP PIT AT ELEVATOR	1	LOT	1,500.00	1,500
SUMP PIT FOR PERIMETER DRAINS - ALLOW	1	LOT	2,500.00	2,500
SANITARY / GREASE INTERCEPTOR SUMP PITS	1	LOT	5,000.00	5,000
PERIMETER DRAINS - ALLOW (ALSO SEE SLAB ON GRADE FOR BENEATH ICE)	371	LM	100.00	37,100
CONTINUOUS GEO-DRAINAGE LAYER TO BASEMENT WALLS - ALLO (AND CONNECTED HYDRAULICALLY TO THE PERIMETER DRAINS)	1,369	SM	35.00	47,921
FOUNDATIONS TOTAL				**5,442,829**

SLAB ON GRADE

SPECTATOR LEVEL				
220MM STRUCTURAL CONCRETE REINFORCED SLAB ON GRADE	859	SM	190.00	163,210
EXTRA AT TRANSITION TO SUSPENDED FLOOR SYSTEM (INCLUDING TRANSITION TO VARSITY ARENA GRADE SUPPORTED BLEACHERS)	137	LM	200.00	27,300
PARTICIPANT LEVEL				
220MM STRUCTURAL CONCRETE REINFORCED SLAB ON GRADE	4,944	SM	190.00	939,360
ICE SLAB ASSEMBLIES (SEE MECHANICAL FOR COOLING & HEATING PIPING)				
150MM CONCRETE REINFORCED COLD SLAB (SEE MECHANICAL FOR COOLING PIPING)	3,100	SM	140.00	434,000
COOLING HEADER SLAB THICKENING	180.0	LM	225.00	40,500
RETURN SLAB THICKENINGS - INCLUDED IN ABOVE				
250MM REINFORCED CONCRETE HOT STRUCTURAL SLAB ON GRA (SEE MECHANICAL FOR HEATING PIPING)	3,100	SM	240.00	744,000
HEATING HEADER SLAB THICKENINGS	178.4	LM	114.00	20,338
RETURN SLAB THICKENINGS - INCLUDED IN ABOVE				
HEADER TRENCH EDGE DETAIL NOT REQUIRED TRENCHLESS HEADER	0	LM	100.00	0

EXTRA FOR RETURN TRENCHES NOT REUIRED TRENCHLESS	0	LM	300.00	0
EXTRA FOR THICKENINGS, CURBS, RAMPS, UPSTANDS, SLAB STEPS, ETC.	ALLOW		25,000.00	25,000
EXTRA FOR SLOPED SHOWER FLOORS / TRENCH DRAINS	ALLOW		15,000.00	15,000
EXTRA FOR SLOPED SLAB AT ICE RESURFACER ROOMS / TRENCH DRAINS	377	SM	50.00	18,850
EXTRA FOR VESTIBULE RECESS FOR PEDIMAT	ALLOW		2,000.00	2,000
HOUSEKEEPING PADS	200	SM	100.00	19,975
DASHER BOARD INSERTS	ALLOW		10,000.00	10,000
MINOR WATERPROOFING TO SUPPORT AREAS - ALLOW	ALLOW		5,000.00	5,000
ACCOMMODATE DIFFERENTIAL SOIL MOVEMENT IN PIPING (ITEM 4.5J IN GEOTECH REPORT); EXCLUDED AS PER GEC	NIC			0
SLAB ON GRADE TOTAL				**2,464,533**

STRUCTURE

ELEVATOR SHAFT / STAIR SHAFTS - SEE INTERIOR PARTITIONS ARCHITECTURAL CONCRETE				-
BLEACHER FRAMING				
VARSITY ARENA BLEACHER SYSTEM	1,067	SM	510.00	544,170
COMMUNITY ARENA BLEACHER SYSTEM	235	SM	450.00	105,750
SPECTATOR LEVEL FLOOR FRAMING				
VARSITY ARENA - SUSPENDED FLOOR SYSTEM - ALL-IN	1,774	SM	630.00	1,117,620
COMMUNITY ARENA - SUSPENDED FLOOR SYSTEM - ALL-IN	301	SM	550.00	165,550
ADDITIONAL FRAMING AT FEATURE STAIR OPENING	1	LOT	20,000.00	20,000
UPSTANDS / CURBS / EMBEDS, ETC. - ALLOW	1	LOT	15,000.00	15,000
UPPER SUITE LEVEL FLOOR FRAMING				
VARSITY ARENA - UPPER SUSPENDED FLOOR SYSTEM - ALL-IN	932	SM	720.00	671,040
UPSTANDS / CURBS / EMBEDS, ETC. - ALLOW	1	LOT	5,000.00	5,000
ROOF FRAMING				
LOW ROOF FRAMING SYSTEM - ALL-IN	875	SM	235.00	205,625
COMMUNITY ARENA ROOF FRAMING SYSTEM - ALL-IN	2,822	SM	285.00	804,270

VARSITY ARENA ROOF FRAMING SYSTEM - ALL-IN	5,525	SM	585.00	3,232,125
MISC STRUCTURAL ITEMS				
SECONDARY SUPPORT STEEL FOR CLADDING ASSEMBLIES (780 KG / LM HORIZONTAL LENGTH OF WALL)	231,660	KG	4.75	1,100,385
SECONDARY FRAMING FOR MECHANICAL EQUIPMENT - ALLOW	400	SM	100.00	40,000
SECONDARY FRAMING FOR FLOOR AND ROOF OPENINGS - INCL. W/ ASSEMBLIES (AS WELL AS SLEEVES FOR FLOOR PENETRATIONS)				-
SECONDARY FRAMING AT CATWALKS AND OTHER MISC. STRUCTURAL STEEL INDICATED ON THE ARCHITECTURAL DRAWINGS	1	LOT	50,000.00	50,000
SUPPORTS AT TALL PARAPET FRAMING	480	LM	200.00	96,000
SUPPORTS FOR HANGING TOILET PARTITIONS (NOT DETAILED)	1	LOT	15,000.00	15,000
ELEVATOR HOIST BEAM	1	LOT	1,500.00	1,500
STRUCTURE AT TOP OF ELEVATOR SHAFT	12	SM	500.00	6,000
SUPPORTS AT OVERHEAD DOORS	1	EA	2,500.00	2,500
DRIFT LOAD ALLOWANCE	ALLOW		50,000.00	50,000
STRUCTURE TOTAL				**8,247,535**

EXTERIOR WALLS

ENTRANCES

AUTOMATIC BI-PARTING ALUMINUM ENTRY DOORS	2	PR	20,000.00	40,000
GLAZED ALUMINUM EXIT DOORS TO MATCH CURTAIN WALL	16	EA	5,000.00	80,000
BARRIER-FREE OPERATOR TO ABOVE - ALLOW	4	EA	3,000.00	12,000
HOLLOW METAL INSULATED EXIT DOORS	9	EA	2,000.00	18,000
MOTORIZED, INSULATED, SECTIONAL STEEL O.H. DOOR	1	EA	6,000.00	6,000
ADDITIONAL FIRE EXIT DOORS - ALLOW	8	EA	2,000.00	16,000
EXTRA/OVER FOR SECURITY FINISHED HARDWARE	10	EA	1,000.00	10,000
ROOF ACCESS DOOR	1	EA	2,000.00	2,000
ENTRANCES TOTAL				**184,000**

WINDOWS

GL - CURTAINWALL VISION GLASS W/ CAP LESS VERTICALS **REDUCE BY 50% AS PER GEC**	442	SM	1,125.00	497,041
LOUVRES - SEE WALL CLADDING				-
WINDOWS TOTAL				**497,041**

WALL CLADDING

INSULATED METAL WALL PANEL ASSEMBLY NO GWB BACKUP VARSITY .5M LOWER; REPLACE 50% OF GLAZING	5,262	SM	360.00	1,892,952
PERFORATED ALUMINUM STANDING SEAM SCREEN VARSITY .5M LOWER	4,314	SM	250.00	1,078,594
SOFFITS	35	SM	250.00	8,835
METAL FLASHINGS - ALLOW	200	LM	75.00	15,000
OVERHEAD DOOR DETAILS	ALLOW		1,000.00	1,000
ANODIZED ALUMINUM LOUVRES	31.20	SM	900.00	28,080
WALL CLADDING TOTAL				**3,024,461**

PROJECTIONS				
PERIMETER PARAPET CAP FLASHING	608	LM	75.00	45,578
PARAPET REAR DETAIL	780	SM	75.00	58,493
FALL ARREST SYSTEM	ALLOW		20,000.00	20,000
SEE WALL CLADDING FOR SCREENING / SOFFITS				-
PROJECTIONS TOTAL				**124,071**
WEATHERPROOFING				
ROOFING				
SBS ROOF SYSTEM TO MID & HIGH ROOF (WHITE)	8,339	SM	225.00	1,876,320
EXTRA FOR BACK SLOPE INSULATION 10% ROOF AREA	834	SM	20.00	16,678
EXTRA FOR TRAFFIC LAYER	ALLOW		5,000.00	5,000
INVERTED ROOF SYSTEM WITH PAVERS 600 X600	260	SM	350.00	90,895
INVERTED ROOF SYSTEM WITH GRAVEL BALLAST	760	SM	275.00	208,918
EMERGENCY ROOF SCUPPERS - ALLOW	20	EA	300.00	6,000
OPENINGS FOR EXHAUST, GOOSENECKS, ETC.	ALLOW		20,000.00	20,000
ROOF ACCESS HATCHES	ALLOW		10,000.00	10,000
ROOFING TOTAL				**2,233,811**
SKYLIGHTS				
NONE SHOWN				-
SKYLIGHTS TOTAL				**0**

VERTICAL MOVEMENT				
STAIRS				
SERVICE STAIRS TO UPPER SUITE LEVEL	2	EA	8,500.00	17,000
FEATURE STAIR TO UPPER SUITE LEVEL	1	EA	25,000.00	25,000
SERVICE STAIR TO PARTICIPANT LEVEL	1	EA	12,500.00	12,500
FEATURE STAIR TO PARTICIPANT LEVEL	1	EA	35,000.00	35,000
ARENA EMERGENCY EXIT STAIRS - ALLOW	3	EA	5,000.00	15,000
ARENA EMERGENCY EXIT STAIRS - ADDED AT COMMUNITY RINK	1	EA	5,000.00	5,000
STAIRS AT SPECTATOR SEATING - SEE BLEACHERS (ALL-IN COSTS)				-
STEPS / LANDINGS AT EXTERIOR EXITS - SEE SITE DEVELOPMENT				-
STAIRS TOTAL				**109,500**
ELEVATORS				
3,500 LB HYDRAULIC ELEVATOR, 3-STOP, SINGLE DOOR (PASSENGER ELEVATOR)	1	EA	105,000.00	105,000
ELEVATORS TOTAL				**105,000**
INTERIOR DIVISION				
INTERIOR DOORS				
AUTOMATIC SLIDING DOORS AT VESTIBULES AND LOBBY TO VARSITY RINK (3.5M WIDE)	3	PR	15,000.00	45,000
GLAZED DOORS TO ARENAS / SPECTATOR SEATING	35	EA	3,500.00	122,500
HOLLOW METAL SERVICE DOORS IN PRESSED STEEL FRAMES	72	EA	1,850.00	133,200
ALLOW FOR DOORS NOT SHOWN	12	EA	1,850.00	22,200
EXTRA FOR BARRIER-FREE OPERATORS - ALLOW 10% OF DOORS	11	EA	2,500.00	26,750
EXTRA TO ABOVE FOR SECURITY FINISHED HARDWARE 25% DRS	27	EA	750.00	20,063
EXTRA TO HM DRS FOR GLASS PANELS / RATED / WIRED GLASS / I	24	EA	200.00	4,800
EXTRA FOR CONTINUOUS S.S. HINGES / HALF HEIGHT S.S. PLATE GUARDS	18	EA	500.00	9,000
GLAZED OH DOORS TO ZAMBONI (IN ACOUSTIC GLASS WALL)	1	EA	15,000.00	15,000

OH DOORS TO ZAMBONI TRAVEL PATHS	3	EA	8,000.00	24,000
ALUMINUM COILING SHUTTERS AT FOOD SERVICE	3.0	SM	500.00	1,500
INTERIOR DOORS TOTAL				**424,013**
INTERIOR PARTITIONS				
BUTT JOINTED GLAZING SYSTEM C/W 12 MM LAMINATED GLAZING IN CONCEALED ALUMINUM CHANNEL AT TOP / BOTTOM	201	SM	750.00	150,750
INTERIOR GLAZING BUTT JOINED - SPECTATOR ENTRY LEVEL VAR	149	SM	750.00	111,863
INTERIOR GLAZING BUTT JOINED - SPECTATOR ENTRY LEVEL COM	21	SM	750.00	15,675
INTERIOR GLAZING BUTT JOINED - SUITES	177	SM	750.00	132,960
REDUCE BY 50% ALL OF ABOVE INTERIOR GLAZING	-274	SM	750.00	-205,624
REPLACE 50% OF GLAZING WITH DRYWALL PARTITIONS	274	SM	85.60	23,469
190MM / 240MM CONCRETE BLOCK PARTITIONS	4,874	SM	195.00	950,358
CONCRETE WALLS NOT PICKED UP IN STRUCTURE ABOVE THIS IS THE ELEVATOR SHAFT (ARCHITECTURAL FINISH DELETED)	183	SM	300.00	54,954
DRYWALL PARTITIONS	2,423	SM	85.60	207,422
ACOUSTIC DRYWALL PARTITIONS	258	SM	156.50	40,335
FIRE RATED DRYWALL PARTITIONS	504	SM	92.20	46,423
DEFLECTION DETAIL TO ABOVE	629	LM	50.00	31,455
DRYWALL BULKHEADS - ALLOW	1	LOT	10,000.00	10,000
PARTITION / BULKHEAD ABOVE GLAZING AT HIGH VOLUME SPACE	40	SM	200.00	8,040
200MM CONCRETE CURB AT ICE PIT	36	LM	200.00	7,200
SEE FITTINGS AND FIXTURES FOR DASHER BOARDS				-
FIRE SEALING AND STOPPING	ALLOW		50,000.00	50,000
INTERIOR PARTITIONS TOTAL				**1,635,279**
INTERIOR FINISHES				
FLOOR FINISHES				
SEALED CONCRETE	863	SM	25.00	21,580

SEALED CONCRETE (SHOWN AS POLISHED CONCRETE)	2,964	SM	25.00	74,110
CARPET	1,289	SM	60.00	77,334
HARDWOOD FLOORING		SM	200.00	0
STATIC DISSIPATIVE FLOORING		SM	150.00	0
CERAMIC MOSAIC FLOOR TILE - TO WET AREAS	244	SM	175.00	42,718
RESILIENT FLOORING C/W WELDED SEAMS AND BASE		SM	75.00	0
SKATE FLOORING	1,548	SM	100.00	154,800
SPORTS FLOORING	161	SM	100.00	16,120
ARTIFICIAL ICE	70	SM	180.00	12,510
VINYL SAFETY FLOORING	52	SM	150.00	7,860
PORCELAIN TILE	0	SM	150.00	0
EPOXY	362	SM	115.00	41,619
GROUND, SEALED, COLOURED, HARDENED CONCRETE	408	SM	45.00	18,342
BASEBOARDS USE 7.5% OF FLOOR FINISHES	ALLOW		30,527.36	30,527
EXTRA FOR ENTRY VESTIBULE FOOT GRILLE	ALLOW		35,000.00	35,000
FLOOR FINISH TOTAL				**532,519**
CEILING FINISH				
600 X 600 SUSPENDED ACOUSTIC TILE CEILINGS (ASTRO TILE BY CGC C/W FINELINE EDGE BY ARMSTRONG)	390	SM	55.00	21,445
PAINTED GYPSUM BOARD (SEE PARTITIONS FOR BULKHEADS / SKYLIGHT WELL)	1,321	SM	115.00	151,938
ALLOWANCE FOR MOISTURE RESISTANT GYPSUM IN TILED AREAS	244	SM	115.00	28,072
FEATURE CEILINGS (CHANGED TO GWB OR OPEN)	0	SM	400.00	0
WOOD PANEL UNDER FEATURE STAIR ONLY	52	SM	450.00	23,490
MYLAR FACED ACOUSTIC TILE CEILINGS	52	SM	110.00	5,709
LOW - E CEILINGS (COMMUNITY ONLY)	1,500	SM	35.00	52,500
PAINTED EXPOSED CEILINGS - ARENAS & LOBBY	6,031	SM	15.00	90,465

PAINT EXPOSED - PARTICIPANT LEVEL	2,957	SM	20.00	59,144
EPOXY COATING TO STEEL STRUCTURE	ALLOW		50,000.00	50,000
CEILING FINISH TOTAL				**482,762**
WALL FINISHES				
PAINT TO INNER SIDE OF EXTERIOR WALLS	2,926	SM	15.00	43,893
PAINT TO ALL INTERIOR PARTITIONS	15,414	SM	13.00	200,376
WOOD PANELLING (QTY AS PER GEC)	290	SM	450.00	130,500
CERAMIC MOSAIC WALL TILES TO W/C'S, SHOWERS, ETC.	703	SM	145.00	101,863
WALL FINISHES TOTAL				**476,631**
FITTINGS AND FIXTURES				
PUBLIC WASHROOM ACCESSORIES				
TOILET PARTITIONS - SOLID PHENOLIC	43	EA	1,100.00	47,300
URINAL SCREENS - SOLID PHENOLIC	11	EA	500.00	5,500
TOILET PAPER ROLL HOLDERS	43	EA	100.00	4,300
TOWEL DISP / WASTE RECEPTACLE	13	EA	500.00	6,500
ELECTRIC HAND DRYERS	13	EA	500.00	6,500
SOAP DISP	43	EA	100.00	4,300
S/N DISPENSER - ALLOW	4	EA	500.00	2,000
S/N DISPOSAL	30	EA	150.00	4,500
VANITIES - SOLID SURFACE	29	LM	600.00	17,460
MIRRORS - UNBREAKABLE	29	SM	250.00	7,275
GRAB BARS - SET	8	PR	350.00	2,800
COAT HOOK	43	EA	25.00	1,075
BABY CHANGE STATION - ALLOW	8	EA	800.00	6,400
CHANGE ROOMS				
TOILET PARTITIONS - SOLID PHENOLIC	24	EA	1,100.00	26,400

URINAL SCREENS - SOLID PHENOLIC	13	EA	500.00	6,500
PAPER ROLL HOLDERS	24	EA	100.00	2,400
TOWEL DISP / WASTE RECEPTACLE	13	EA	500.00	6,500
ELECTRIC HAND DRYERS	13	EA	500.00	6,500
SOAP DISP	13	EA	100.00	1,300
SHOWER SOAP DISP.	24	EA	150.00	3,600
S/N DISPOSAL	25	EA	150.00	3,750
B.F. SHOWER SEAT	14	EA	500.00	7,000
VANITIES - SOLID SURFACE	31	LM	600.00	18,540
MIRRORS - UNBREAKABLE	31	SM	250.00	7,725
GRAB BARS - SET	14	EA	200.00	2,800
BENCHES	216	LM	300.00	64,680
COAT HOOK RAIL	323	LM	75.00	24,255
WHITEBOARDS	14	EA	500.00	7,000
COACH AND OFFICIALS ROOM FITTINGS				
TOILET PARTITIONS - NONE - SEE PARTITIONS	0	EA	1,000.00	0
PAPER ROLL HOLDERS	4	EA	100.00	400
TOWEL DISP / WASTE RECEPTACLE	4	EA	500.00	2,000
ELECTRIC HAND DRYERS	4	EA	500.00	2,000
SOAP DISP	4	EA	100.00	400
S/N DISPOSAL	3	EA	100.00	300
VANITIES - SOLID SURFACE	5	LM	600.00	3,000
MIRRORS - UNBREAKABLE	4	SM	250.00	1,000
BENCHES	10	LM	300.00	3,090
LOCKERS	8	LM	1,000.00	8,200
VARSITY CHANGE ROOM ADDITIONAL FITTINGS				
VARSITY BENCHES	41	LM	400.00	16,200

VARSITY DRESSING MILLWORK/LOCKERS		61	LM	1,500.00	91,800
FACILITY STAFF - MILLWORK / FITTINGS - ALLOW					
COUNTERS & STORAGE		ALLOW		2,500.00	2,500
LOCKERS - METAL		15	EA	375.00	5,625
FIRST AID ROOM - MILLWORK / FITTINGS - ALLOW		ALLOW		1,500.00	1,500
LAUNDRY ROOM FITTINGS		ALLOW		2,500.00	2,500
ATHLETIC THERAPY ROOM - NON INDICATED OR ALLOWED					-
JANITOR ROOM FITTINGS		3	EA	500.00	1,500
BALUSTRADES AND HANDRAILS FOR RAMPS / STAIRS					
SPECTATOR SEATING BALUSTRADES PAINTED PIPE		155	LM	250.00	38,665
EXIT STAIR HANDRAILS PAINTED PIPE		66	LM	150.00	9,971
GLASS & SS BALUSTRADES ALONG SUITE SEATING AREA		67	LM	1,750.00	116,375
PAINTED STEEL & WOOD VENEER BALUSTRADES ALONG OPEN TO BELOW & FEATURE STAIR		312	LM	800.00	249,840
BAR PIPE RAILS & SEATS BEHIND FIXED SEATING NOT INCLUDED AS PER GEC		0	LM	600.00	0
RINK DASHER BOARD SYSTEMS (ALLOWANCES AS PER GEC)	COMMUNITY RINK	1	EA	200,000.00	200,000
	VARSITY RINK	1	EA	250,000.00	250,000
BOARDS C/W INTEGRAL ADVERTISING PANELS GLASS AND FASTENING SYSTEM PROTECTIVE NETTING SUSPENDED HOCKEY BOARD DOORS BOARDS AND DIVIDERS AT PLAYERS BENCH AND AT PENALTY / TIMEKEEPERS AREA TIMEKEEPER TABLE TWO PLAYERS BENCHES TWO GOAL FRAMES AND NETTING W/ BREAKAWAY ANCHOR INSETS NO EXTRA TO ABOVE FOR VERTICAL LIFT / GATES					
SCAFFOLD TYPE FRAME TO SUPPORT FIRST TWO ROWS OF SEATING IN THE VARSITY ARENA		254	SM	200.00	50,800
SPECTATOR SEATING - FIXED BENCH VARSITY 932 SEATS - GEC		932	EA	100.00	93,200
SPECTATOR SEATING - FOLDING SEATS VARSITY 2,037 - GEC		2037	EA	300.00	611,100

SPECTATOR SEATING - FIXED FOLDING SEATS COMMUNITY		400	EA	300.00	120,000
SNOW MELT PIT LADDER (NO DETAIL)		2	EA	2,000.00	4,000
ELEVATOR PIT LADDER		1	EA	1,500.00	1,500
SNOW MELT PIT GRATE & GATES & RAILS (NO DETAIL)		2	EA	10,000.00	20,000
LADDERS TO HIGH ROOF - ALLOW		1	EA	5,000.00	5,000
GENERAL OFFICE AREA FITTINGS & FIXTURES					
RECEPTION COUNTER		2	LM	1,500.00	3,000
OFFICE FURNITURE & FURNISHINGS					NIC
CLASSROOM/VIDEO ROOMS		3	EA	2,000.00	6,000
LOBBY MILLWORK & INFORMATION DESK EXCLUDED PER GEC		NIC		0.00	0
CORNER GUARDS / BUMPER RAILS / S.S. POSTS - ALLOW		ALLOW		5,000.00	5,000
STORAGE ROOM SHELVING - ALLOW		ALLOW		3,000.00	3,000
PARTICIPANT LEVEL STORAGE ROOM SHELVING - ALLOW		ALLOW		30,000.00	30,000
MULTI-PURPOSE/ PRESSBOX/ LOUNGE		3	EA	2,000.00	6,000
SUITES - ASSUME THESE ARE TENANT IMPROVEMENTS		4	EA		NIC
SCORE BOARDS AND TIME CLOCKS - COMMUNITY RINK		1	EA	10,000.00	10,000
SCORE BOARDS AND TIME CLOCKS - VARSITY ARENA SEE FF&E					
RIGGING GRID -SEE FF&E					
EVENT POWER - SEE ELECTRICAL					
KITCHEN & CONCESSION EQUIP -SEE FF&E					
INTERIOR SIGNAGE - ALLOW		ALLOW		15,000.00	15,000
EXTERIOR BUILDING SIGNAGE - NO ALLWANCE AS PER GEC		ALLOW		0.00	0
WINDOW COVERINGS - ALLOW MANUAL SHADES AT ALL MEETING ROOMS AND ADMIN AREAS	ALLOW	100	SM	150.00	15,000
APPLIANCES - ASSUMED PART OF FF&E					NIC
FITTINGS AND FIXTURES TOTAL					**2,310,326**

MECHANICAL				
PLUMBING SYSTEMS				
PLUMBING				
EQUIPMENT				
DOMESTIC WATER HEATER - NON CONDENSING	2	EA	7,500.00	15,000
PROCESS HOT WATER TANK (SEE REALICE BELOW)	0	EA	15,000.00	0
DOMESTIC WATER STORAGE TANK	2	EA	3,000.00	6,000
PROCESS WATER STORAGE TANK (SEE REALICE BELOW)	0	EA	5,000.00	0
MIXING VALVES	2	EA	3,500.00	7,000
BACKFLOW PREVENTER	1	EA	3,000.00	3,000
RECIRC PUMPS, EXPANSION TANKS AND ACCESSORIES	1	L/S	5,000.00	5,000
PIPING				
DOMESTIC HOT WATER PIPING	1	L/S	30,000.00	30,000
DOMESTIC HOT WATER RECIRC. PIPING	1	L/S	20,000.00	20,000
DOMESTIC COLD WATER PIPING	1	L/S	80,000.00	80,000
TEMPERED WATER	1	L/S	40,000.00	40,000
INSULATION	1	L/S	50,000.00	50,000
VALVES	1	L/S	20,000.00	20,000
SANITARY DRAINS	1	L/S	90,000.00	90,000
CLEAN OUT	1	L/S	3,000.00	3,000
VENT PIPING	1	L/S	20,000.00	20,000
STORM DRAINAGE SYSTEM	1	L/S	80,000.00	80,000
PIPING SPECIALTIES	1	L/S	35,000.00	35,000
FIXTURES				
WATER CLOSET (INCL BF)	71	EA	1,100.00	78,100
URINALS	22	EA	1,500.00	33,000
LAVATORIES	70	EA	1,800.00	126,000

BOTTLE FILLER	12	EA	500.00	6,000
SINK	1	L/S	10,000.00	10,000
SERVICE SINK	1	L/S	7,500.00	7,500
SHOWER	1	L/S	50,000.00	50,000
DRINKING FOUNTAIN	1	L/S	16,000.00	16,000
FLOOR DRAINS	1	L/S	50,000.00	50,000
FOOD SERVICE FIXTURES	1	L/S	50,000.00	50,000
INFRARED CONTROLLERS	163	EA	250.00	40,750
FIXTURE SPECIALTIES	1	L/S	15,000.00	15,000
SPECIAL PIPING AND FITTINGS				
REALICE SYSTEMS FOR FLOODING	2	EA	35,000.00	70,000
PLUMBING SYSTEMS TOTAL				**1,056,350**
FIRE PROTECTION				
EQUIPMENT				
FIRE EXTINGUISHERS	1	L/S	4,000.00	4,000
FIRE DEPARTMENT CONNECTIONS	1	L/S	8,000.00	8,000
SPRINKLER VALVE	1	EA	5,000.00	5,000
SPRINKLER TREE	1	EA	10,000.00	10,000
BACKFLOW PREVENTION	1	L/S	8,000.00	8,000
PRE-ACTION SYSTEM	1	L/S	15,000.00	15,000
STANDPIPE SYSTEM	1	L/S	25,000.00	25,000
SPRINKLERS				
WET SPRINKLER SYSTEM	13,140	m2	30.00	394,200
FIRE PROTECTION TOTAL				**469,200**
HVAC SYSTEMS				
EQUIPMENT				

CONDENSING BOILERS	3	EA	65,000.00	195,000
HEAT EXCHANGER	1	EA	27,000.00	27,000
HEATING PUMPS P1/2	4	EA	1,200.00	4,800
HEATING PUMPS P3/4	4	EA	9,500.00	38,000
GLYCOL EQUIPMENT	1	L/S	25,000.00	25,000
AHU-1 VARSITY ARENA 21000 40,000 CFM	1	EA	320,000.00	320,000
~~AHU-2 VARSITY ARENA 35000 CFM CCOMBINED WITH AHU-1~~	~~0~~	~~EA~~	~~220,000.00~~	~~0~~
AHU-3 COMMUNITY ARENA 5000 CFM	1	EA	68,000.00	68,000
AHU-4 VARSITY ARENA SUITE LEVEL 20000 CFM	1	EA	115,000.00	115,000
AHU-5 VARSITY ARENA TEAM ROOMS 20,000 CFM	1	EA	203,000.00	203,000
AHU-6 COMMUNITY ARENA 7500 CFM	1	EA	85,000.00	85,000
MUA-1 REFRIGERATION PLANT 2500 LPS	1	EA	13,000.00	13,000
MUA-2 CONCESSION / KITCHEN 2500 CFM	1	EA	13,000.00	13,000
MUA-3 CONCESSION / KITCHEN 2500 CFM	1	EA	13,000.00	13,000
EF-1 2500 LPS	1	EA	2,000.00	2,000
EF-2 1000 LPS	1	EA	1,200.00	1,200
EF-3 / 4 SMOKE EXHAUST	0	EA	5,000.00	0
KITCHEN EXHAUST	2	EA	4,000.00	8,000
MISCELLANEOUS EXHAUST	1	L/S	15,000.00	15,000
CEILING FANS	0	EA	7,500.00	0
DUCTWORK				
RECTANGULAR DUCT	15,500	KG	16.00	248,000
SPIRAL DUCT	450	LM	180.00	81,000
INSULATION	2,400	SM	25.00	60,000
DUCT HANGERS AND SPECIALTIES - ALLOW	1	SUM	12,000.00	12,000
FIRE DAMPERS	1	L/S	3,000.00	3,000
KITCHEN DUCT	1	L/S	10,000.00	10,000

DUCT SPECIALTIES	1	L/S	45,000.00	45,000
PIPING				
NATURAL GAS PIPING	1	L/S	25,000.00	25,000
VALVES AND SPECIALTIES	1	L/S	5,000.00	5,000
HEATING PIPING	1	L/S	250,000.00	250,000
HEATING SPECIALTIES	1	L/S	25,000.00	25,000
DUCTWORK TERMINAL DEVICES				
AIR TERMINALS (NO VAV BOXES)	1	L/S	35,000.00	35,000
AIR BALANCE	1	L/S	15,000.00	15,000
PIPING TERMINAL DEVICES				
PERIMETER HEAT	1	L/S	135,000.00	135,000
REHEAT COILS - ONLY TWO AS PER REMEDY	2	EA	1,500.00	3,000
WATER BALANCE	1	L/S	15,000.00	15,000
CONTROLS & INSTRUMENTATION				
DDC CONTROLS SYSTEM W/O VAV	1	L/S	250,000.00	250,000
HVAC SYSTEMS TOTAL				**2,363,000**
RADIANT SLAB HEATING / COOLING /SNOWMELT PIT				
UNDER RINK SLAB RADIANT HEATING / COOLING PIPING	3,250	SM	100.00	325,000
HEADER PIPING TO ABOVE (CAST INTO SLAB THICKENING TO STRUC SOG)				111,285
SNOW MELT PIT HEAT EXCHANGER / PIPING / PUMP	2	LOT	50,000.00	100,000
RADIANT SLAB HEATING / COOLING TOTAL				**536,285**
ICE PLANT REFRIGERATION SYSTEM / EQUIPMENT				
BUDGET AS ADVISED BY THERMOCARB	1	LOT	1,100,000.00	1,100,000
ICE PLANT REFRIGERATION TOTAL				**1,100,000**
MECHANICAL TOTAL				**5,524,835**

ELECTRICAL

SERVICE AND DISTRIBUTION

MAIN DISTRIBUTION CENTRE	1	L/S	130,000.00	130,000
DISTRIBUTION EQUIPMENT AND PANELBOARDS	1	L/S	135,000.00	135,000
GENERATORS - XFER SWITCH & JB ONLY	1	L/S	45,000.00	45,000
TRANSFORMERS	1	L/S	60,000.00	60,000
PANELBOARD FEEDERS	1	L/S	330,000.00	330,000
GROUNDING	1	L/S	25,000.00	25,000
PV ROUGH IN	1	L/S	10,000.00	10,000
LIGHTNING PROTECTION	1	L/S	90,000.00	90,000
MOTOR CONTROLS AND WIRING	1	L/S	200,000.00	200,000
JOB EXPENSE, PERMITS, MOBILIZE	1	L/S	60,000.00	60,000
COMMISSIONING	1	L/S	60,000.00	60,000
SERVICE & DISTRIBUTION TOTAL				**1,145,000**

LIGHTING AND POWER

BUILDING LIGHTING FIXTURES	1	L/S	1,020,000.00	1,020,000
BRANCH CIRCUIT DEVICES AND WIRING	1	L/S	990,000.00	990,000
LIGHTING CONTROL - ALLOWANCE	1	L/S	60,000.00	60,000
LIGHTING & POWER TOTAL				**2,070,000**

SYSTEMS

FIRE ALARM SYSTEMS	1	L/S	150,000.00	150,000
CABLE TRAY - COMMUNICATIONS	1	L/S	65,000.00	65,000
TELEPHONE/DATA OUTLETS & CABLES	1	L/S	140,000.00	140,000
TELEVISION OUTLETS/CABLES	1	L/S	30,000.00	30,000
INTERCOM & SOUND SYSTEM - ROUGH INS	1	L/S	100,000.00	100,000
SECURITY SYSTEMS - EQUIPMENT SUPPLIED BY U OF A	1	L/S	180,000.00	180,000
SYSTEMS TOTAL				**665,000**
ELECTRICAL TOTAL				**3,880,000**

UNIVERSITY OF ALBERTA - VARSITY ARENA
SCHEMATIC DESIGN ESTIMATE - REVISION #2
JULY 13, 2018

Site Development Summary

•	Site Preparation - Mass Excavation in Building Estimate	144,000
•	Roads and Parking	202,000
•	Plaza and Sidewalks	347,000
•	General Landscaping & Irrigation	192,000
•	Site Fittings, Fixtures and Signs	174,000
•	Offsite Sidewalk, Road Entrances and Landscaping- by Others	0
•	Mechanical Site Services	190,000
•	Electrical Site Services	230,000
	Subtotal	1,479,000
	General Conditions @15%	222,000
	Design Contingency @ 5%	85,000
	Site Development Total	**$1,790,000**

Off-Site Service connections Cost by U of A

•	Storm Sewer & Water Storage		70,000
•	Sanitary Sewer Servicing		110,000
•	Water Servicing		30,000
•	Natural Gas Tie-in		20,000
•	15kV Service, Switch Cubicle & Transformer	tbc	600,000
	TOTAL SUGGESTED SERVICING COST		**$830,000**

UNIVERSITY OF ALBERTA - VARSITY ARENA
SCHEMATIC DESIGN ESTIMATE
JULY 13, 2018

SITE PREPARATION				
REMOVE GARBAGE AND EXCESS MATERIAL	19,482	SM	0.25	4,871
INSTALL SILT FENCE	675	LM	30.00	20,250
INSTALL SEDIMENT TRAPS	100	SM	25.00	2,500
PROTECT SEWERS AND ENTRY PADS	1	ALWC	4,000.00	4,000
GRUB & CLEAR SITE GRASSY AREAS	19,482	SM	0.60	11,689
STRIP TOPSOIL STOCKPILE	7,793	CM	5.00	38,964
COMMON EXCAVATION & COMPACTION (SEE BUILDING ESTIMATE)				-
MOVE EXCESS TOPSOIL OFFSITE	5,902	CM	7.00	41,313
SCREEN TOPSOIL	1,891	CM	3.00	5,673
SCARIFY & COMPACT FILL ONLY AREAS (SIDEWALK)	2,487	SM	2.50	6,218
SCARIFY & COMPACT 300MM SUB-SUBGRADE UNDER PAVING	2,506	SM	3.50	8,771
SITE PREPARATION TOTAL				**144,249**
ROADS AND PARKING				
PROOF ROLL AND SPOT REPAIRS FINAL GRADING	2,506	SM	5.00	12,530
HEAVY DUTY ASPHALT PAVING (420 MM DEPTH)	2,506	SM	60.00	150,360
STANDARD CURB & GUTTER (OR EQUIVALENT)	340	LM	100.00	34,000
PARKING LINES & SYMBOLS	1	ALW	2,000.00	2,000
PARKING SIGNAGE	20	EA	150.00	3,000
ROADS AND PARKING TOTAL				**201,890**

PLAZA AND SIDEWALKS (INCL PATHWAYS)				
DECORATIVE CONCRETE SIDEWALKS (PEDESTRIAN ONLY AREA)	1,907	SM	150.00	286,050
CONCRETE SIDEWALK	580	SM	90.00	52,227
WHEELCHAIR CURB CUT RAMPS	4	EA	1,000.00	4,000
LOW LANDSCAPE RETAINING WALLS	1	ALW	5,000.00	5,000
PLAZA AND SIDEWALKS TOTAL				**347,277**
GENERAL LANDSCAPING				
SUB GRADING FOR LANDSCAPE AREAS	5,241	SM	2.00	10,482
SOD OTHER AREA; APPROX. BY PLAN	3,811	SM	10.00	38,107
TREE & SHRUB BEDS	1,430	SM	35.00	50,061
UNDERGROUND IRRIGATION	5,241	SM	13.00	68,133
IRRIGATION CONTROL 5% OF IRRIGATION	0	LS	68,133.00	3,407
SPREAD SCREENED TOPSOIL	1,644	CM	10.00	16,443
GRADING FOR BERMS SWALES ETC.	1	ALW	5,000.00	5,000
GENERAL LANDSCAPING TOTAL				**191,632**
GENERAL SITE FITTINGS				
TRASH RECEPTACLE	4	EA	750.00	3,000
BENCHES	25	LM	750.00	18,750
ENTRY SIGNS & BASE	1	EA	10,000.00	10,000
BIKE RACK	20	EA	350.00	7,000
CIP CONCRETE STAIRS ON GRADE	166	SM	400.00	66,400
EXTRA/OVER FOR STRUCTURAL SUPPORT TO STAIRS & LANDING AT NORTH ENTRY	83	SM	250.00	20,870
RAILINGS AT EXTERIOR STAIRS & LANDINGS	132	LM	300.00	39,630
BOLLARDS - ALLOW	8	EA	1,000.00	8,000
GENERAL SITE FITTINGS TOTAL				**173,650**

MECHANICAL SITE WORK

WATER				
6" VALVE	1	EA	1,130.00	1,130
6" C900 PVC PIPE	8	LM	250.00	1,900
SERVICE CONNECTIONS IN STREET	1	EA	15000.00	15,000
SANITARY				
8" SDR35	11	LM	275.00	3,025
MANHOLES	1	EA	5,000.00	5,000
TIE INTO EXISTING MH	1	EA	5000.00	5,000
STORM				
MANHOLES 5A GRATED TOP	4	EA	3,000.00	12,000
STORM INTERCEPTOR	1	EA	35,000.00	35,000
INLET CONTROL DEVICES	1	EA	750.00	750
STORM PIPING	177	LM	220.25	38,918
STORM DETENTION SYSTEM				
OVERSIZED PIPE ACTING AS STORM RETENTION/STORAGE	1	ALW	30,000.00	30,000
GAS				
GAS PIPING--BY UTILITY	162	LM	0.00	N/C
EXCAV/B'FILL - ALLOW	162	LM	200.00	32,360
MISC				
UTILITY CHARGES--EXCLUDED	1	SUM	0.00	N/C
WATER TREATMENT--DOMESTIC	1	SUM	1,750.00	1,750
TESTING	1	SUM	5,000.00	5,000
PERMITS/BONDS/MISC/	1	SUM	2,700.00	2,700
MECHANICAL SITE WORK TOTAL				**189,533**

ELECTRICAL SITE WORK

SITE LIGHTING FIXTURES	1	SUM	80,000.00	80,000
SITE BRANCH WIRING	1	SUM	35,000.00	35,000
SITE - MAIN SERVICE DUCTS	1	SUM	90,000.00	90,000
CIVIL WORK	1	SUM	25,000.00	25,000
ELECTRICAL SITE WORK TOTAL				**230,000**

APPENDIX H
VALUE ENGINEERING

Pre-Engineered Frame - Community Rink	$	(130,047)	Standard pre-engineered building system with bagged insulation. Potential for increased damages.
community rink screen only	$	(300,000)	
Replace precast bleachers with retractable seating/scaffolding system - deletes some storage areas (needs to be validated) - 1 side of bowl only	$	(100,000)	Loss of storage space, however increased floor space when seats retracted.
Replace structural slabs with 100mm slabs on grade to all areas except for the rink slabs - add 1m of additional granular below SOG	$	(280,000)	Possible increase in cracks to slabs and movement
Delete LED lighting and use fluorescent lighting	$	(100,000)	Increased energy consumption and maintenance costs
Change roofing to a single membrane TPO roof	$	(370,000)	Increased maintenance and operational costs
Delete Low E ceiling in Community Rink	$	(40,000)	Increased operational costs
Delete header trench for inslab cooling piping	$	(100,000)	Reduced ability to effectively service cooling system.
Drop the whole Varsity Arena height by 1.0m (700lm x $300/lm)	$	(210,000)	Decreases operation costs for heating and cooling, possibly reduces Aesthetics
Remove seats from the Community Arena and go to benches (reduce to 300 seats from 383 seats)	$	(38,000)	
Delete Precast at lower 2 rows in Varsity Arena - use bleacher style seating	$	(20,000)	
Supports at Tall Parapet Framing	$	(27,000)	
Reduction in Exterior Exit Stair Width	$	(40,000)	$100,000 total for exterior stairs in PCL budget.
Deletion of third floor. This is a rough order of magnitude budget savings as additional details will require development to confirm actual costs. This savings could potentially exclude the savings above to Drop the whole Varsity Arena height by 1.0m" $(1,938,800)	$	(1,938,800)	Reduction of Varsity Arena building height by 1.5m, roof access and press gondola to be provided
Suite Finishes- remove interior finishes (flooring/ceiling/paint) and try to sponsor (3,962sf @ $80/sf)	$	(315,000)	Potential delay to these areas due to sponsorship challenges.
General Area reduction with HP	$	(700,000)	

APPENDIX I
LEED SCORE CARD

Proposed LEED Scorecard

Rating System: LEED v4 BD+C: New Construction and Major Renovation
Project Name: South Campus Community Ice Arena
Date: 2018-08-10

48	40	22

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110, **Total Possible Points:** 110

Y	?	N	Phase	Responsibility	Campus Credit	LEED Prerequisites & Credits		LEED Requirements	LEED Points
1			C	Energy Modeller/ Architect/Mechanical/ LEED	No	Credit 1	Integrative Process	Prior to the end of schematic design, conduct a simple box energy modelling analysis that explores how to reduce energy loads in the building. Also, conduct a preliminary water budget analysis that explores how to reduce potable water loads in the building.	1
8	**2**	**6**				**Location and Transportation**			**16**
			D	LEED	Yes	Credit 1	LEED for Neighborhood Development Location	N/A	16
1			D	Owner/LEED	No	Credit 2	Sensitive Land Protection	Option 1: Locate the development footprint on land that has been previously developed. Option 2: Locate the development footprint on land that is not prime farmland, on a floodplain, on threatened or endangered habitat land, on or within X meters from water bodies and wetlands.	1
		2	D	Owner/LEED	Yes	Credit 3	High Priority Site	Option 1: Locate the project on an infill location in a historic district. Option 2: N/A to Canadian projects (as it relates to priority designation only applicable to the USA) Option 3: Locate on a brownfield where soil or groundwater contamination has been identified and requires remediation.	2
2		3	D	LEED	No	Credit 4	Surrounding Density and Diverse Uses	Option 1: Locate the project on a site whose surrounding existing density within 400-m radius of the project meets residential and non-residential densities. Option 2: Locate the project on a site within 800-m walking distance of 4-7 or 8+ existing/publicly available diverse uses.	5
4		1	D	LEED	No	Credit 5	Access to Quality Transit	Locate any functional entry of the project within 400-m walking distance of existing or planned bus, streetcar, or rideshare stops, OR within 800-m walking distance of existing or planned bus rapid transit stops, light or heavy rail stations, commuter rail stations, or commuter ferry terminals. Meet minimums listed in table. *Planned stops and stations may count if they are sited, funded, and under construction by the date of the certificate of occupancy and are complete within 24 months of that date.	5

8	2	6							
			Location and Transportation						**16**
			D	LEED	Yes	Credit 1	LEED for Neighborhood Development Location	N/A	16
1			D	Owner/LEED	No	Credit 2	Sensitive Land Protection	Option 1: Locate the development footprint on land that has been previously developed. Option 2: Locate the development footprint on land that is not prime farmland, on a floodplain, on threatened or endangered habitat land, on or within X meters from water bodies and wetlands.	1
		2	D	Owner/LEED	Yes	Credit 3	High Priority Site	Option 1: Locate the project on an infill location in a historic district. Option 2: N/A to Canadian projects (as it relates to priority designation only applicable to the USA) Option 3: Locate on a brownfield where soil or groundwater contamination has been identified and requires remediation.	2
2		3	D	LEED	No	Credit 4	Surrounding Density and Diverse Uses	Option 1: Locate the project on a site whose surrounding existing density within 400-m radius of the project meets residential and non-residential densities. Option 2: Locate the project on a site within 800-m walking distance of 4-7 or 8+ existing/publicly available diverse uses.	5
4		1	D	LEED	No	Credit 5	Access to Quality Transit	Locate any functional entry of the project within 400-m walking distance of existing or planned bus, streetcar, or rideshare stops, OR within 800-m walking distance of existing or planned bus rapid transit stops, light or heavy rail stations, commuter rail stations, or commuter ferry terminals. Meet minimums listed in table. *Planned stops and stations may count if they are sited, funded, and under construction by the date of the certificate of occupancy and are complete within 24 months of that date.	5
	1		D	Architect	**Yes**	Credit 6	Bicycle Facilities	- Design or locate the project such that a functional entry or bicycle storage is within 180-m walking distance or bicycling distance from a bicycle network that connects to at least 10 diverse uses or a bus rapid transit stop, light or heavy rail station, commuter rail station, or ferry terminal. All destinations must be within 4800-m bicycling distance from the project boundary. - Provide short-term bike storage for at least 2.5% of all peak visitors (no less than 4 stalls per building). Provide long-term bike storage for at least 5% of reg. building occupants (no less than 4 stalls per building in addition to the short-term stalls). Provide at least 1 on-site shower with changing facility for the first 100 reg. building occupants (one additional shower for every 150 thereafter).	1
1			D	Architect	**Yes**	Credit 7	Reduced Parking Footprint	- Do not exceed the minimum local code requirements for parking capacity. - Provide parking capacity that is a percentage reduction below the base ratios recommended by the Parking Consultants Council, as shown in the Institute of Transportation Engineers' Transportation Planning Handbook. Case 1. Achieve 20% reduction from ratios if the project does not earn points under Surrounding Density and Diverse Uses or Access to Quality Transit. Case 2. Achieve 40% reduction from ratios if the project earns 1 point or more in the above mentioned credits. - Provide preferred parking for carpools for 5% of the total parking spaces after reductions are made from the base ratios. *On-street parking in public rights-of-way is excluded from calculations	1
	1		D	Architect	**Yes**	Credit 8	Green Vehicles	- Designate 5% of all parking spaces used by the project as preferred parking for green vehicles. Option 1: Install electrical vehicle supply equipment (EVSE) in 2% of all parking spaces used by the project. Option 2: Intsall liquid, gas or battery facilities equal to at least 2% of all parking spaces.	1

2	6	2					Sustainable Sites		10
Y			C	Contractor	No	Prerequisite 1	Construction Activity Pollution Prevention	Create and implement an ESC plan for all construction activities associated with the project.	Required
1			D	Owner	**Yes**	Credit 1	Site Assessment	Complete and document a site survey or assessment that includes topography, hydrology, climate, vegetation, soils, human use, human health effects.	1
	1	1	D	Landscape	**Yes (both options)**	Credit 2	Site Development - Protect or Restore Habitat	If part or all of the project site contains greenfield areas, this credit requires that projects preserve and protect a minimum of 40% of such areas from all development and construction activity. Option 1 (2 points): Using native or adapted vegetation, restore 30% (including the building footprint) of all portions of the site identified as previously disturbed. Projects that achieve a density of 1.5 floor-area ratio may include vegetated roof surfaces in this calculation if the plants are native or adapted, provide habitat, and promote biodiversity. Option 2 (1 point): Provide financial support equivalent to at least $5.25 per square meter for the total site area (including the building footprint).	2
	1		D	Landscape	**Yes**	Credit 3	Open Space	Provide outdoor space greater than or equal to 30% of the total site area (including building footprint). A minimum of 25% of that outdoor space must be vegetated (turf grass does not count as vegetation) or have overhead vegetated canopy. Outdoor space must be physically accessible and must be able to accomodate social activities, or physical activity, or garden space or urban food production or preserved habitat.	1
	2	1	D	Architect	**Yes**	Credit 4	Rainwater Management	Option 1 (2 points) Path 1: Manage on site the runoff from the developed site for the 95th percentile of regional or local rainfall events using low-impact development and green infrastructure. Option 1 Path 2 (3 points): "" 98th percentile Option 1 Path 3 (3 points): "" zero lot line projects Option 2 (3 points): Manage on site the annual increase in runoff volume from the natural land cover condition to the postdeveloped condition.	3
	2		C	Architect	**Yes**	Credit 5	Heat Island Reduction	Option 1 (2 points): Use the combination of area of non-roof measures, area of high-reflectance roof and/or area of vegetated roof to total a higher number than the total site paving area + total roof area. Option 2 (1 point): Locate 75% or more of parking spaces under cover. The roof to shade or cover parking must have SRI of 32+, be vegetated or be covered by energy generation systems	2
1			D	Electrical	**Yes**	Credit 6	Light Pollution Reduction	Meet uplight and light trespass requirements, using either the backlight-uplight-glare (BUG) method (Option 1) or the calculation method (Option 2). Projects may use different options for uplight and light trespass. Meet these requirements for all exterior luminaires located inside the project boundary.	1

8	**2**	**1**				**Water Efficiency**			**11**
Y			D	Landscape	**Yes**	Prerequisite 1	Outdoor Water Use Reduction	Option 1: Do not provide irrigation system beyond a max. 2-year establishment period. Option 2: Reduce the project's landscape water requirements by at least 30% from baseline for the site's peak watering month.	Required
Y			D	Mechanical	No	Prerequisite 2	Indoor Water Use Reduction	Reduce aggregate water consumption by 20% from the baseline. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled	Required
Y			D	Mechanical	No	Prerequisite 3	Building-Level Water Metering	Install permanent water meters that measure the total potable water use for the building and associated grounds. Meter data must be compiled into monthly and annual summaries; meter readings can be manual or automated. Must also share data with USGBC for 5-year period.	Required
1	1		D	Landscape	**Yes**	Credit 1	Outdoor Water Use Reduction	Option 1 (2 points): Do not provide irrigation system beyond a max. 2-year establishment period. Option 2: Reduce the project's landscape water requirements by at least 50% from baseline for the site's peak watering month.	2
4	1	1	D	Mechanical	No	Credit 2	Indoor Water Use Reduction	Same as prerequisite but using following percentage reductions: 25% 1 point, 30% 2 points, 35% 3 points, 40% 4 points, 45% 5 points, 50% 6 points.	6
2			D	Mechanical	**Yes**	Credit 3	Cooling Tower Water Use	Conduct a one-time potable water analysis, measuring at least the following five control parameters: Calcium carbonate, total alkalinity, Silicon dioxide, chloride, conductivity. And limit cooling tower cycles to avoid exceed max. values. OR Demonstrate that the project no longer needs a cooling tower because through design optimization the project reduced water consumption and need for cooling towers.	2
1			D	Mechanical	No	Credit 4	Water Metering	Install permanent water meters for two or more of the following water subsystems, as applicable to the project: irrigation, indoor plumbing fixtures and fittings, domestic hot water, boiler with projected annual water use of 375 000 L or more, reclaimed water, other process water.	1
12	**13**	**8**				**Energy and Atmosphere**			**33**

Y			C	Cx	**Yes**	Prerequisite 1	Fundamental Commissioning and Verification	Develop OPR and BOD. Hire a CxA that will review OPR, BOD, develop and implement Cx plan, confirm incorporation of Cx requirements in construction docs, develop construction checklists, develop system test procedure, verify test execution, maintan issues and benefits log, prepare final Cx process report and document all findings and recommendations and report directly to owner.	Required
Y			D	EM	No	Prerequisite 2	Minimum Energy Performance	Option 1: Demonstrate an improvement of 5% (NC), 3% (MR), 2% (CS) in the proposed building performance rating compared to baseline building performance rating (according to ASHRAE 90.1-2010).	Required
Y			D	Elec/Mech	No	Prerequisite 3	Building-Level Energy Metering	Install new or use existing base building-level energy meters, or submeters that can be aggregated to provide base building-level data representing total building energy consumption (electricity, natural gas, chilled water, steam, fuel oil, propane, etc.). Utility-owned meters capable of aggregating base building- level resource use are acceptable. Commit to sharing with USGBC the resulting energy consumption data and electrical demand data (if metered) for a five-year period	Required
Y			D	Mech	**Yes**	Prerequisite 4	Fundamental Refrigerant Management	Do not use chlorofluorocarbon (CFC)-based refrigerants in new heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems.	Required
4	2		C	Cx	No	Credit 1	Enhanced Commissioning	Option 1 Path 1 (3 points): Enhanced Cx The commissioning authority must do the following: - Review contractor submittals. - Verify inclusion of systems manual requirements in construction documents. - Verify inclusion of operator and occupant training requirements in construction documents. - Verify systems manual updates and delivery. - Verify operator and occupant training delivery and effectiveness. - Verify seasonal testing. - Review building operations 10 months after substantial completion. - Develop an on-going commissioning plan. OR Option 1 Path 2 (4 points): Enhanced Cx + Monitoring Based Develop monitoring-based procedures and identify points to be measured and evaluated to assess performance of energy- and water-consuming systems. AND/OR Option 2 (2 points): Building Envelope Cx Conduct commissioning process (CxP) activities (same as enhanced cx activities but) for the building's thermal envelope.	6
8	5	5	D	EM	No	Credit 2	Optimize Energy Performance	Same as prerequisite but using different percentage improvements.	18
	1		C	Elec/Mech/Cx	No	Credit 3	Advanced Energy Metering	Install advanced energy metering for the following: - all whole-building energy sources used by the building; and - any individual energy end uses that represent 10% or more of the total annual consumption of the building. In most cases, this is likely to apply to lighting, cooling and heating loads, or air flow specifically, depending on usage. It could also apply to plug loads, process usage, or domestic hot water, depending on the building program. These meters are required to be connected to a data collection network, which could be separate from the DDC (direct digital control) network, but does not have to be. Whatever approach is utilized, it must be remotely accessible.	1
		2	D	Elec/Mech	No	Credit 4	Demand Response	N/A	2

	2	1	D	Electrical/Architect	No	Credit 5	Renewable Energy Production	Use renewable energy systems to offset building energy costs. Percentage renewable energy and associated points: 1% 1 point, 5% 2 points, 10% 3 points	3
	1		D	Mechanical	**Yes - Option 1** No - Option 2	Credit 6	Enhanced Refrigerant Management	Option 1 (1 point): Do not use refrigerants or use only refrigerants that an ODP of zero and GWP of less than 50. Option 2 (1 point): Select refrigerants used in HVAC&R equipment to minimize or eliminate the emission of compoounds that contribute to ozone depletion and climate change using a specific formula.	1
	2		C	Owner	No	Credit 7	Green Power and Carbon Offsets	Engage in a contract for qualified resources for a minimum of five years, to be delivered at least annually. The contract must specify the provision of at least 50% or 100% of the project's energy from green power, carbon offsets, or renewable energy certificates (RECs).	2
2	**6**	**5**					**Materials and Resources**		**13**
Y			D	Architect	**Yes**	Prerequisite 1	Storage and Collection of Recyclables	Provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Additionally, take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste.	Required
Y			C	Contractor	**Yes**	Prerequisite 2	Construction and Demolition Waste Management Planning	Develop and implement a construction and demolition waste management plan that establishes a waste diversion goal and specifying whether material will be seperated or comingled.	Required
	3	2	C	Architect	No	Credit 1	Building Life-Cycle Impact Reduction	Options 1-3: N/A Option 4: Conduct a life-cycle assessment of the project's structure and enclosure that demonstrates a minimum of 10% reduction, compared with a baseline building, in at least three of the six impact categories: GWP, depletion of stratospheric ozone layer, acidification of land and water sources, eutrophication, formation of tropospheric ozone and depletion of nonrenewable energy resources.	5
	1	1	C	Architect/Contractor	No	Credit 2	Building Product Disclosure and Optimization - Environmental Product Declarations	Option 1 (1 point): Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria Option 2 (1 point): N/A	2
	1	1	C	Architect/Contractor	No	Credit 3	Building Product Disclosure and Optimization - Sourcing of Raw Materials	Option 1 (1 point): N/A Option 2 (1 point): Use products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project: extended producer responsibility, bio-based materials, wood products, material reuse, recycled content, etc.	2
	1	1	C	Architect/Contractor	No	Credit 4	Building Product Disclosure and Optimization - Material Ingredients	Option 1 (1 point): Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm). Option 2 (1 point): N/A	2
2			C	Contractor	No	Credit 5	Construction and Demolition Waste Management	Option 1 Path 1 (1 point): Divert 50% and three material streams Option 1 Path 2 (2 points): Divert 75% and four material streams Option 2 (2 points): Do not generate more than 12.2 kilograms of waste per square meter of the building's floor area.	2

7	9	0					Indoor Environmental Quality		16
Y			C	Mechanical	No	Prerequisite 1	Minimum Indoor Air Quality Performance	Comply with ASHRAE 62.1 2010.	Required
Y			C	Architect/Contractor	**Yes**	Prerequisite 2	Environmental Tobacco Smoke Control		Required
1	1		C	Architect/Mechanical	No	Credit 1	Enhanced Indoor Air Quality Strategies	Option 1. Enhanced IAQ Strategies (1 point) Comply with the following requirements, as applicable. Mechanically ventilated spaces: A. entryway systems; B. interior cross-contamination prevention; and C. filtration. Option 2. Additional Enhanced IAQ Strategies (1 point) Comply with the following requirements, as applicable. Mechanically ventilated spaces (select one): A. exterior contamination prevention; B. increased ventilation; C. carbon dioxide monitoring; or D. additional source control and monitoring.	2
2	1		C	Architect/Contractor	No	Credit 2	Low-Emitting Materials		3
1			C	Contractor	No	Credit 3	Construction Indoor Air Quality Management Plan		1
2			C	Contractor	No	Credit 4	Indoor Air Quality Assessment		2
1			C	Mechanical	No	Credit 5	Thermal Comfort	Comply with ASHRAE 55 2010.	1
	2		C	Electrical	No	Credit 6	Interior Lighting		2
	3		C	Architect	No	Credit 7	Daylight		3
	1		C	Architect	No	Credit 8	Quality Views		1
	1		C	Architect	No	Credit 9	Acoustic Performance		1

6	0	0					Innovation		6
1			C	Owner	N/A	Credit 1.1	*Innovation: Green Building Education*		1
1			C	Owner	N/A	Credit 1.2	*Innovation: LEED EB:OM Starter Kit*		1
1			C	Electrical	N/A	Credit 1.3	*Innovation: Purchasing - Lamps*		1
1			C	TBD	N/A	Credit 1.4	Innovation or Pilot or Exemplarary Performance: TBD		1
1			C	TBD	N/A	Credit 1.5	Innovation or Pilot or Exemplarary Performance: TBD		1
1			C	LEED	N/A	Credit 2	LEED Accredited Professional		1

2	2	0					Regional Priority		4
1			C	LEED	N/A	Credit 1	Regional Priority: Access to Quality Transit (min. threshold 3 pts)		1
1			C	LEED	N/A	Credit 2	Regional Priority: Indoor Water Use Reduction (min. threshold 4 pts)		1
	1		C	LEED	N/A	Credit 3	Regional Priority: Optimize Energy Performance (min. threshold 10 pts)		1
	1		C	LEED	N/A	Credit 4	Regional Priority: Enhanced commissioning (min. threshold 5 pts)		1

APPENDIX J

SCIA - OPEN HOUSE BOARDS

JUNE 27, 2016

WELCOME

SOUTH CAMPUS COMMUNITY ICE ARENA

OPEN HOUSE #1

JUNE 27, 2016 • 5:00 TO 8:00 PM

University of Alberta and City of Edmonton representatives are on hand to answer your questions.
Please fill out the evaluation form.

WHAT IS THE SOUTH CAMPUS COMMUNITY ICE ARENA?

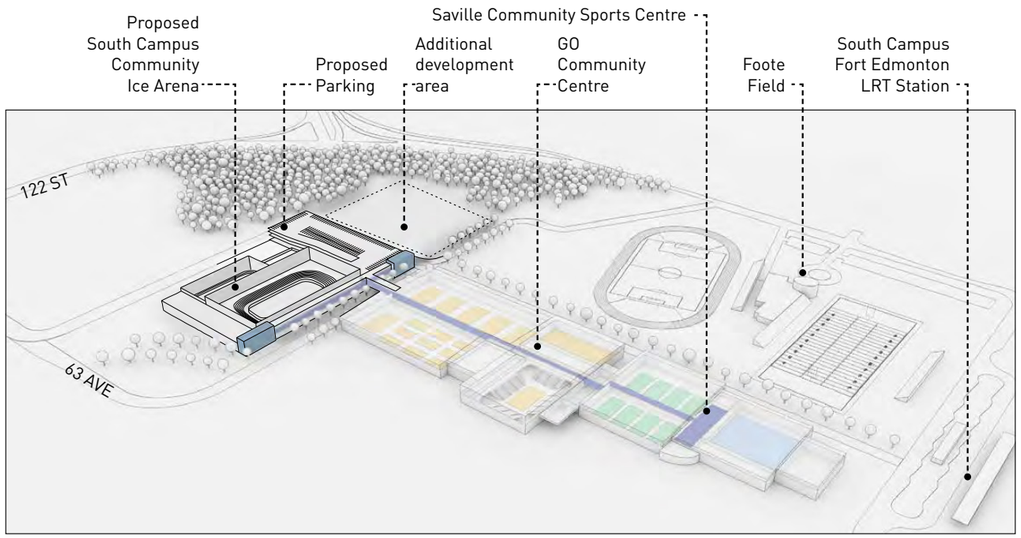
INTRODUCTION

The City of Edmonton and the University of Alberta recognize the significance of public recreation facilities and the strength of partnerships. An alignment of common objectives between municipal entities and educational institutions can provide important and relevant recreation opportunities.

Given this shared vision, the University of Alberta approached the City of Edmonton as a potential partner for the development of a community arena that would be part of the South Campus development. After the development of an MOU – signed in 2015 – the two partners began discussions on an implementation phase for a community arena. The University of Alberta and City of Edmonton have established an executive steering committee and a project steering committee to guide the development and planning of the arena project. After months of discussion and business case development, the University of Alberta met with City of Edmonton City Council to present a proposal for a South Campus Community Ice Arena in April 2016. The proposal outlined how a new South Campus Community Ice Arena would strategically align to the:

- City of Edmonton Recreation Facility Master Plan
- 10 Year Arena Capital Development Strategy
- Facility use and services that promote healthy living for Edmontonians
- Enhance the City of Edmonton as a sport tourism destination and further capitalize on existing infrastructure supported by public investment
- Effective resource stewardship with affirmed budget and schedule alignment

Public engagement is an important part of project development. The University of Alberta and the City of Edmonton through their consultative mandates are committed to engaging stakeholder, neighbours and citizens in decisions that affect them. Your input at tonight's consultation opportunity is appreciated and will help inform the project development.



FACTS ABOUT THE SOUTH CAMPUS COMMUNITY ICE ARENA

- The City of Edmonton and the University of Alberta have entered into a Memorandum of Understanding to explore a potential partnership for the development of the South Campus Community Ice Arena project.
- City Council has not committed any funding to the project. Council will review the request for funding in the fourth quarter of 2016.
- The South Campus Community Ice Arena project cost estimate is $65 million.
- If the project proceeds, the proposed timeline for construction is estimated to be 28 to 32 months. Occupancy would be likely take place in 2018/2019 season.
- The South Campus Community Ice Arena will have a 3,000 seat spectator arena for varsity use and other ice based spectator events, a 500 seat user arena primarily for community use (to support ice hockey, ringette, ball hockey, etc.), wrestling program areas, varsity and community athletics support areas (lounge, dressing rooms, therapy, etc.).
- The entire facility is estimated to be approximately 161,000ft^2 (~15,000m^2). The facility will be operated by University staff and will be accessible to, and utilized by, varsity athletics and community ice users as well as users of the many other purpose built spaces within the project (i.e. academics, etc.).
- Initial road access to South Campus will be from 122 Street at 63 Avenue and from 60 Avenue at 115 Street; additional access points will be from 116 Street via Belgravia Road and from 65 Avenue via 113 Street in the longer term.

WHAT IS THE SOUTH CAMPUS COMMUNITY ICE ARENA?

UNIVERSITY OF ALBERTA ACADEMIC NEEDS, GOALS, OBJECTIVES FOR THE PARTNERSHIP/PROJECT

The South Campus Community Ice Arena project will help the University of Alberta achieve the following goals:

- academic achievement
- student outcomes and retention
- high performance sports development, leadership & team development
- research development
- overall fitness and well being
- mental health
- culture importance
- community engagement

CITY OF EDMONTON STRATEGIC ALIGNMENT OF PARTNERSHIP PROJECT

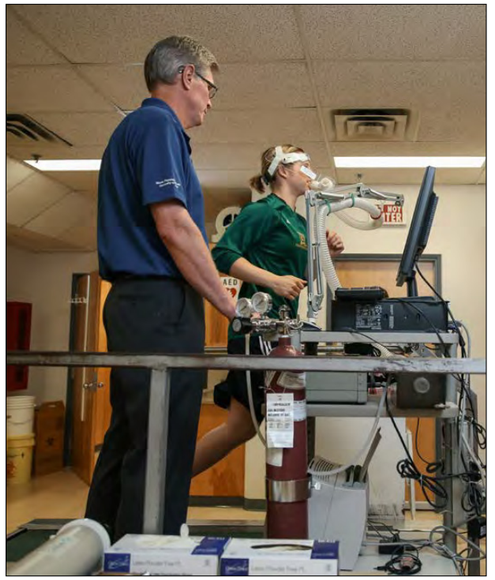
- The City's 10-Year Arena Capital Development Strategy (2009-2019) indicates that the City will need 34 public ice arenas by 2019 to meet demand. Currently, there are 31 ice arenas available.
- The Strategy indicates the need to replace six existing ice sheets in the short to medium term.
- The South Campus Community Ice Arena would be considered a replacement sheet for Coronation Arena given its planned closure in 2018 in conjunction with the start of construction of the Coronation Community Recreation Centre.

Athletics - Women's Hockey (Pandas)

BENEFITS

Benefits to the broader Edmonton community, region, and beyond include:

- Expanded provision of indoor ice for user groups of all activities, ages and abilities (1.25 ice sheets of good (prime) time for both sheets will be available for community use).
- Enabling the current supply of indoor ice arenas to be sustained and expanded amidst the pressures of aging infrastructure (the City has indicated that the arena shortfall in 2014 is five with six existing facilities needing to be replaced in the short- and mid-term).
- Enabling affiliated stakeholders such as the City of Edmonton and Province of Alberta for further meet strategic goals (City of Edmonton Recreation Facility Master Plan, Province of Alberta Active Alberta Policy, etc.).
- Enabling local, Provincial and National sport organizations to better meet program goals (Edmonton hockey and ringette groups, Skate Canada, Hockey Canada, etc.).



Academic research

WHY ARE WE HERE?

- **To fulfill the consultation requirements of Appendix 18 of the Long Range Development Plan (LRDP) which indicates that when the U of A undertakes a substantial development it will hold two open houses: the first open house to show site options and conceptual plans, the second open house to show preliminary design.**

- **The South Campus Community Ice Arena is a substantial development and tonight is the first open house and opportunity for our neighbours to review the project.**

- **To have an opportunity to meet with U of A representatives and ask questions about the South Campus Community Ice Arena project.**

WHAT IS THE SOUTH CAMPUS COMMUNITY ICE ARENA?

BACKGROUND / OPPORTUNITY

The University of Alberta currently operates one ice arena facility—the Clare Drake Arena (which will remain in operation). It is located on the University's north campus and is part of the Faculty of Physical Education and Recreation Van Vliet Complex. The arena is 85' x 196', can seat approximately 2,700 spectators and was opened in 1959. While the Clare Drake Arena is a cherished facility for the University and stakeholders throughout the region, a number of needs and opportunities exist that require planning attention.

Should this facility be built, the University's South Campus will offer in the area of 500,000 square feet of linked, athletic and physical activity facilities together with two major outdoor rectangular fields. The addition of these spaces to the existing Saville Community Sports Centre would create the most comprehensive athletic and physical activity complex in all of Canadian Inter-University Sport; fully accessible via the City of Edmonton's LRT public transit system.

1. Facilities and amenities for University Athletics: The Clare Drake Arena is limiting in terms of the amenities and space requirements that are necessary for a major Canadian Interuniversity Sport athletic program. While the development of the Saville Community Sports Centre has provided needed space for many University athletic programs, Golden Bears and Pandas hockey and wrestling programs still face a number of space related issues.

2. Need for additional community ice: The City of Edmonton Recreation Facility Master Plan and Ice Arena Strategy has identified the need to provide new ice arenas to service a growing population and help alleviate the demand on a number of other City operated facilities.

3. Create a "Focal Gathering Space" for South Campus: Developing a community ice arena facility on South Campus offers the opportunity to create a facility that will be a central gathering place and focal point for the University's South Campus Vision.

4. Provide additional physical activity opportunities for students and residents: Recreation Services will have increased access to facilities.

5. In addition, the enhanced complex (home of virtually all University of Alberta Varsity Bears and Pandas teams - with the exception of swimming) will also represent a major community based sport facility serving all levels of community sports and recreation, ranging from youth and adult programs for all ages and abilities to high performance sport competition and training programs.

Athletics - Men's Hockey (Golden Bears)

Sporting event spectating venue

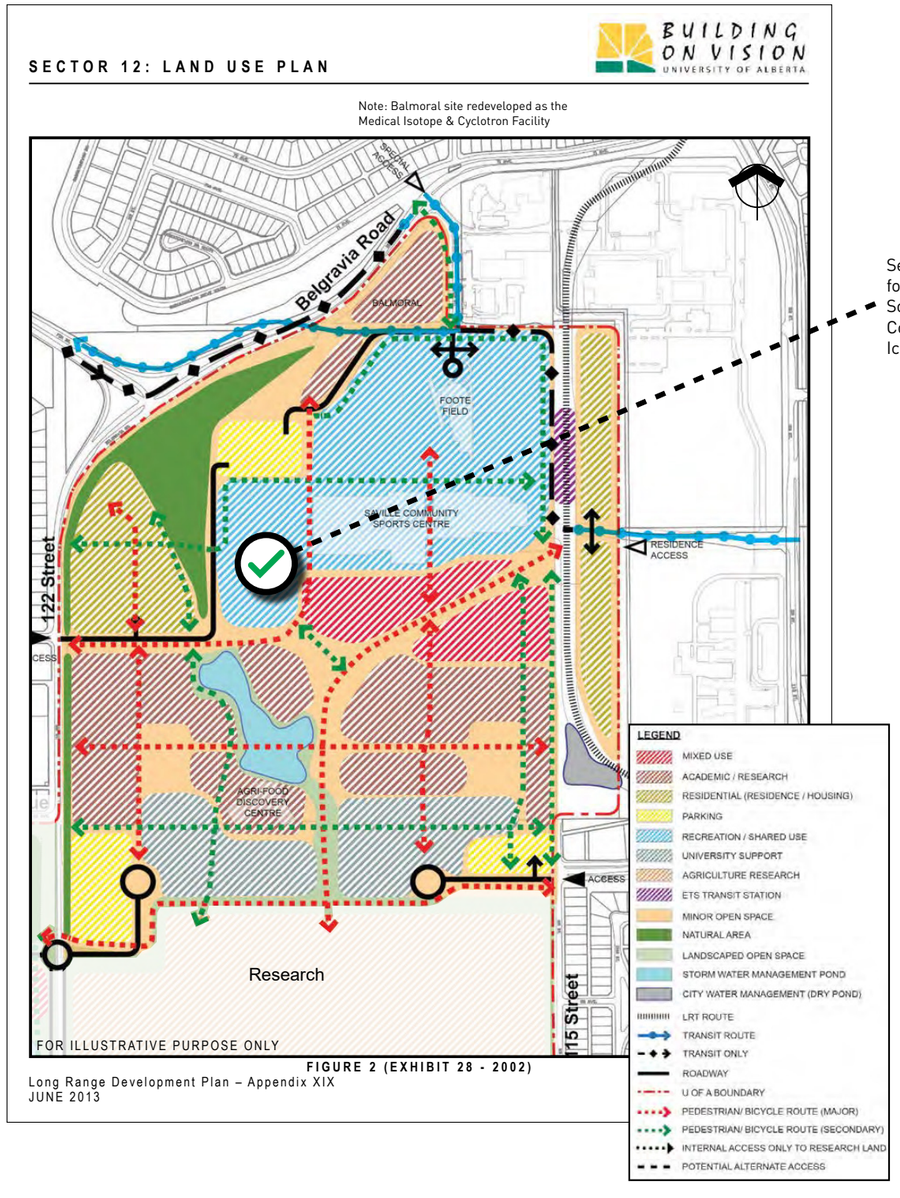
Varsity sports training and coaching.

Athletics - University of Alberta Wrestling program

Diversified recreational opportunities

Sport performance and monitoring

LONG RANGE DEVELOPMENT PLAN - SOUTH CAMPUS - LAND USE



Selected site for proposed South Campus Community Ice Arena

FIGURE 2 (EXHIBIT 28 - 2002)
Long Range Development Plan – Appendix XIX
JUNE 2013

WHAT IS A LONG RANGE DEVELOPMENT PLAN?

The LRDP is responsive to the University's Academic Plan, Strategic Research Plan and the Strategic Business Plan. It is a flexible document rather than a rigid template.

The LRDP identifies a set of Strategic Planning Principles that should form the basis for achievements of the goals, objectives and strategies expressed in the Academic, Research and the Business Plans. It identifies as well how the University's lands and facilities should be developed in response to these plans and it outlines the operational planning initiatives and guidelines that will direct development.

The LRDP is the overall organizing framework for development and is approved by the Board of Governors as the guiding document for physical planning.

SUSTAINABLE CAMPUS VISION

The vision and goals for South Campus call for an innovative, sustainable campus. The following seven systems were identified as components of the sustainable framework of South Campus:

- Energy Efficiency
- Waste and Wastewater Management
- Water and Stormwater Management
- Ecology and the Environment
- Transportation
- Built Environment
- Healthy and Complete Communities

This matrix of sustainability categories summarizes a holistic, inter-connected approach to guide the development of South Campus and solidify and enhance the University of Alberta's reputation as a leader in campus development.

SOUTH CAMPUS

South Campus will accommodate much of the growth of the University of Alberta for the next thirty years. Over time, it may accommodate faculties and other activities from North Campus, as well as new faculties and new areas of teaching, research and development.

Architectural guidelines will encourage a diversity of quality architecture. Significant open space will be created as an amenity to those on-site and in the adjacent communities. Development will be graduated from lower density at the edges of campus to higher density in the center.

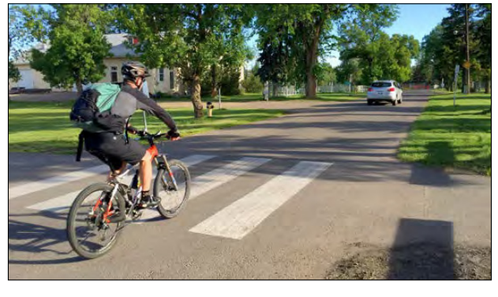
South Campus will be developed based upon a series of Smart Growth and Planned Communities Principles that will ensure the creation of an exemplary campus community.

LAND USE PATTERN

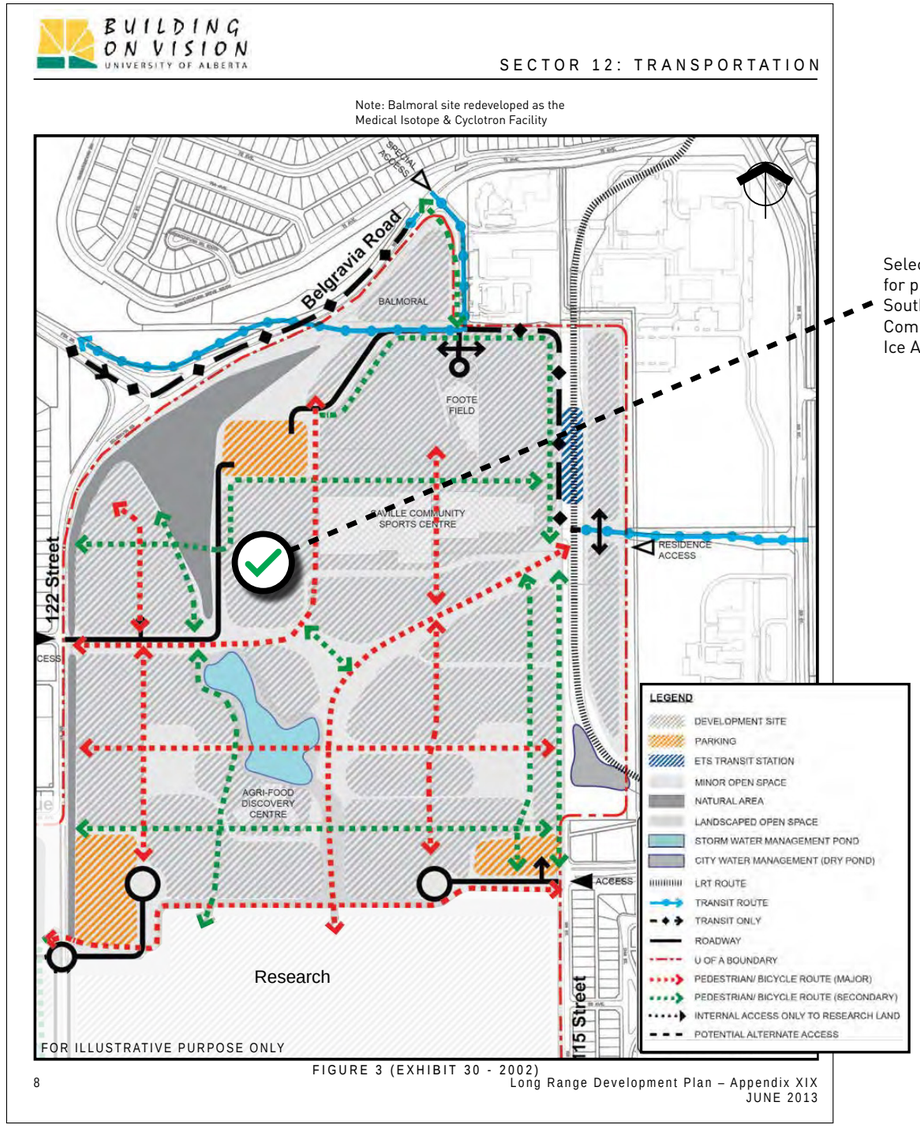
The land use pattern follows five fundamental strategies:

1. Faculty-specific sectors will be accommodated to the extent practical;
2. A higher density main street will be developed connecting the LRT station in the north east corner of the site with an improved gateway feeding to the center of the sector;
3. Lower density uses will be located toward the periphery of the site to reduce the impact on surrounding neighbours;
4. The campus will be pedestrian-oriented with distributed formal points of access from vehicles with sufficient parking on the periphery; and
5. Creation of a university support area in the southern portion of Sector 12 with direct vehicular access from 60 Avenue.

Developments will occur with consideration to suitable land use transitions and adjacent uses as determined at the sector plan level of detail.



ACCESS TO SOUTH CAMPUS COMMUNITY ICE ARENA



Selected site for proposed South Campus Community Ice Arena

FIGURE 3 (EXHIBIT 30 - 2002)
Long Range Development Plan – Appendix XIX
JUNE 2013

8

SOUTH CAMPUS – TRANSPORTATION GOALS

- The development of South Campus is intended to take advantage of the enormous potential of the City of Edmonton's LRT system to efficiently move people.
- South Campus offers a real opportunity to grow the University in an effective, integrated, and quality manner. It also allows the University to do so in a manner that utilizes the transportation infrastructure of the City of Edmonton effectively and with minimal impact on communities.
- A sustainable campus is characterized by a mixture of transport modes, with a strong emphasis on sustainable modes in order to shrink the energy and land consumptive characteristics of existing and future transportation features to and within the site.

ROAD ACCESS

Road access to Sector 12 (South Campus) will be from 122 Street at 63 Avenue and from 60 Avenue at 115 Street; additional access points will be from 116 Street via Belgravia Road and from 65 Avenue via 113 Street in the longer term.

PEDESTRIAN & BICYCLE CIRCULATION

The campus street will be the major intra-campus spine for pedestrian and bicycle traffic.

PARKING (TRANSITIONAL PLAN)

Parking will be accommodated on-site through a combination of surface and structured parking facilities located at the entrances to the campus. Initially, parking is provided as surface lots. As development progresses and land is required, parking will be designed in structured facilities.

OVERALL DEVELOPMENT STRATEGY

- Create an integrated transportation system that encourages non-vehicular movement and public transportation
- Develop an on-campus resident population to reduce travel demand
- Continue to implement TDM (Transportation Demand Management) initiatives
- Maximize the utilization of internal service roadways to multiple destinations on campus (i.e. one roadway serves several areas, limiting the extent of the service roadway network)
- Apply minimal roadway cross sections/widths that meet the intended use(s) of the roads
- Avoid the bisection of South Campus by limiting public vehicular access to parking areas at the periphery of the campus and necessary access to Recreation/Shared Use facilities
- Cluster parking facilities including structured parking to reduce pedestrian walking distances and to create more attractive pedestrian environments

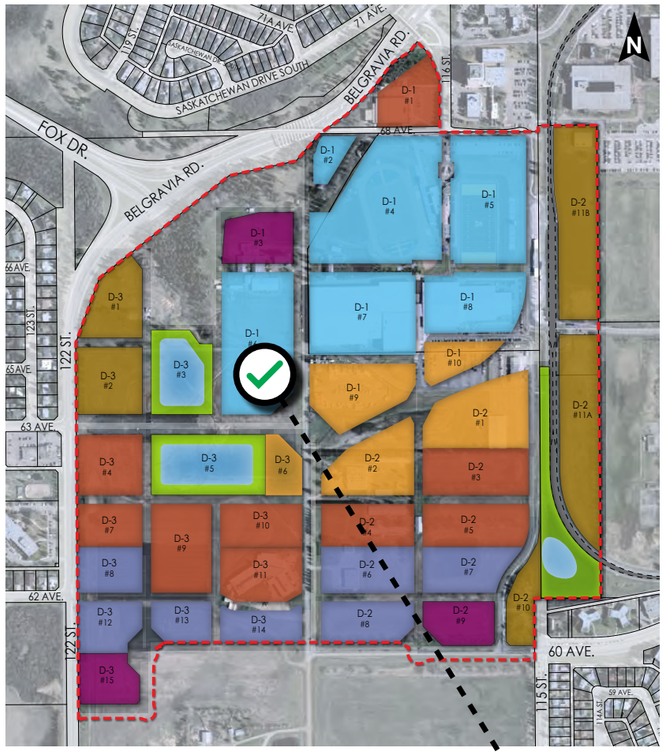
PROPOSED SOUTH CAMPUS COMMUNITY ICE ARENA PARKING

- A Car Park will be constructed as part of the South Campus Community Ice Arena project development.
- Future parking development will be located as defined in the South Campus LRDP and Sector Planning documents.
- Traffic Impacts studies will be updated from the bases of design Traffic Impact Assessment (TIA) conducted in conjunction with the City of Edmonton in the fall of 2016.
- The University receives no support for the capital funding or operational aspects of any of its parking infrastructure initiatives.
- Challenges are recognized by the partners in parking garage use and pressures to adjacent communities.
- The proposed South Campus Community Arena parking garage is not to be considered part of any support infrastructure for LRT parking.
- **Operational considerations and cost recovery models are still in review, options may include; collective development levy, parking entry payment and other considerations as determined in the consultative processes.**

SOUTH CAMPUS SECTOR 12 PLAN

SITE SPECIFIC DEVELOPMENT GUIDELINES (D1-#6)

- Recreational/Shared Use
- Plan D1-#6: 3.14 ha (31,400 m2)
- Floor Area Ratio (FAR): 0.4 to 0.8
- Site Coverage 80%
- Building Height: 1 Storey, 8 metres
- Setbacks
  East: 10.0m (max)
  North: not applicable
  South: 10.0m (max)
  West: not applicable



LEGEND
- Mixed Use
- Academic/Research
- Recreation/Shared Use
- Residential (Residence/Housing)
- University Support
- Parking
- Stormwater Management Facility
- Sector 12 Boundary

Figure 1:
Proposed Land Uses

Campus Planning and Design Guidelines for Implementation

Selected site for proposed South Campus Community Ice Arena

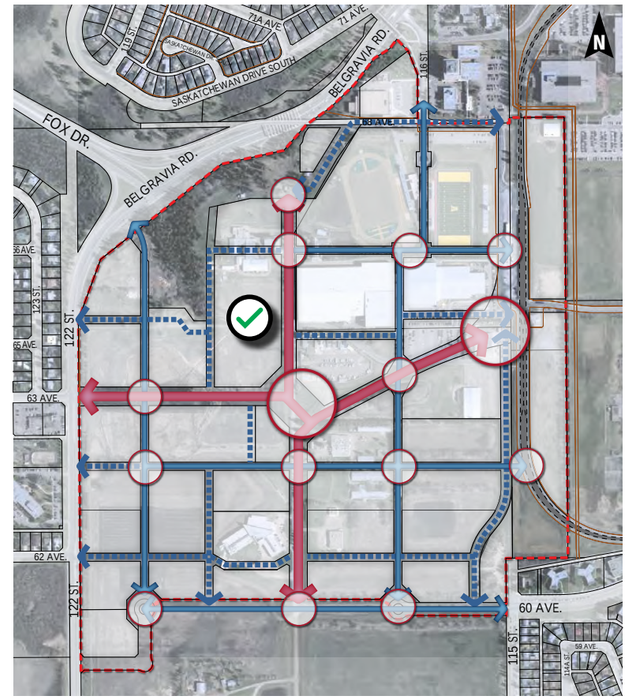
MAJOR CAMPUS MOVEMENT & VIEW CORRIDORS

The campus movement corridors are based on the hierarchy of paths established. The LRT station is an important asset to the South Campus, especially as many faculty and students use this as a major transportation corridor. The 63 Avenue entrance to the west is also an important asset as it will act as a gateway to the campus from the west. Therefore linking these two major assets was logical and was designated as the main east-west route through the campus. Additionally, the existing 118 Street alignment acts as a north-south route between Sector 12 and Sector 13 and therefore has also been designated as an important corridor. These main routes have been labeled Campus Way and are the widest corridors on campus featuring high quality landscaping, areas designed as gathering places particularly at the intersections of major routes, and multi-modal movement infrastructure for pedestrians, cyclists, service and emergency access, and public vehicular access along the 63 Avenue alignment.

MAJOR CAMPUS GATHERING PLACES

The Major Campus Gathering Places are informed by the intersection of the Major Movement corridors. The Campus Way paths join at the heart of the Sector, creating an important node for campus activity and events, and playing an essential placemaking role within the campus.

While these movement corridors inform the locations of major gathering places, it is their node, landmark, and edge characteristics that will help support these spaces as major gathering places for activity. These nodes will feature high quality landscaping and material, and animated open spaces for users to inhabit. Landmarks in the form of public art, enhanced landscaping, and other varieties will further establish these nodes as gathering places. The edges of the buildings that front onto these gathering places will also offer further support through enhanced building treatment and programming. Since the two major campus gathering places are anchored on either end of the Mixed Use section of Campus Way, this section will act as a pedestrian-oriented mall and essentially be a long linear urban park lined with active ground-floor uses. Together, these gathering places and pedestrian mall will act as the centre of activity for the entire Sector.



LEGEND
- Campus Way
- Major Pedestrian Path
- Secondary Path
- LRT Corridor with Shared Use Path
- Major Node
- Secondary Node
- Sector 12 Boundary

Figure 2:
Proposed Paths and Nodes

Campus Planning and Design Guidelines for Implementation

CAMPUS PLANNING & DESIGN GUIDELINES - SECTOR 12

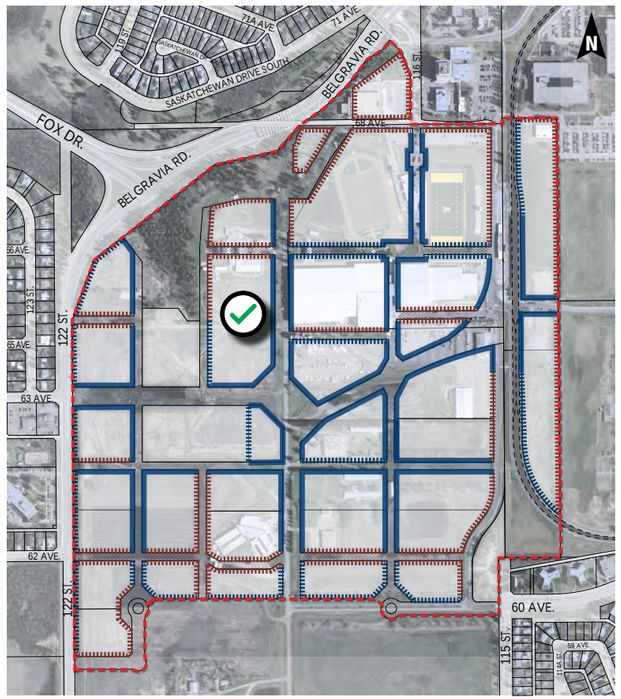


Figure 3:
Proposed Edges

Campus Planning and Design Guidelines for Implementation

PARCEL PLANNING GUIDELINES

Floor Area Ratio (FAR) and Site Coverage
The LRDP and South Campus Sectors Plan currently establish a maximum Floor Area Ratio (FAR) of 1.0 across Sectors 12, 13 and 14. As such, in order to achieve typical program requirements for different land uses, and meet urban design goals for campus open spaces, FAR ranges and maximum site coverages have been established for each development parcel.

Building Heights
Maximum building heights are determined by a number of factors, including typical program requirements for different land uses, urban design considerations, location within the Sector, and adjacency considerations regarding adjoining communities and the interplay of site coverage and FAR maximums.

BUILDING DESIGN GUIDELINES

Authenticity and Context
The design of buildings or landscape elements in Sector 12 should strive to achieve an authenticity of locale and design purpose.

Massing, Scale, and Articulation
The massing of all buildings should adhere to the following principles:

- Buildings should support the creation of a comfortable pedestrian environment along adjacent campus paths
- Massing should reduce microclimatic impacts and provide an appropriate human scale and visual relationship between the building and adjacent campus paths
- Upper storeys should enhance and complement the surrounding campus or neighbourhood skyline through their articulation and massing. Unique architectural/ sculptural forms, as well as various materials and lighting should be utilized to screen HVAC and other building systems/services
- Materials and detailing should be articulated to distinguish upper storeys from the lower storeys
- Large flat walls and incompatible materials are to be avoided

Materials
Buildings and landscape materials should:

- Be chosen for their character, durability and connection to the University's history and place in the Western Canadian urban landscape
- Acknowledge and harmonize with overall campus use of materials that narrows the palette instead of continuously expanding it. They should be chosen to weather well, maintaining or improving their appearance over time
- Follow winter city design guidelines and utilize glass and transparency to help brighten the long winter nights

Internal & External Relationships
Buildings should address adjacent campus open space, and vice versa, through the following design considerations:

- Building corners should address and enhance Path and Node intersection development
- The ground level of buildings should be designed to create the feeling of extending the outdoors indoor, and vice versa
- Existing mature trees should be integrated with new tree plantings wherever possible
- A seamless transition between pathways and building edge should be provided
- Exterior lighting should be pedestrian scaled, whether mounted on poles or on building facades
- Bicycle storage should be accommodated at each building. The location of bicycle racks should be in a safe and secure location, without conflicting with movement around key building entrances. Bicycle storage should be aesthetic, practical, and integrated with the architecture of the building
- Winter city design guidelines to promote year round usability and utilizing transparency to provide visual interest and illumination

Arrival & Entry
Building entrances:

- Should be clearly visible to create a sense of arrival, occupancy, activity, and gathering to the adjacent campus pathway, and should be accessible
- Should be highlighted and defined through the use of architectural and landscape devices (e.g. lighting, benches, planting, etc.)
- Should be visible, safe, and inviting
- Should incorporate canopies, arcades, colonnades, awnings, pergolas, porticos, etc. to create a comfortable and seasonal pedestrian environment in any season

EDGE GUIDELINES

- Buildings fronting this type of edge should build to the edge for at least 75% of their frontage
- No portion of the building should be a distance greater than 10 m from the parcel boundary
- Position building entry and orientation on Primary Edges
- When part of the programming of a building, the following types of spaces should be located adjacent to Primary Edges
  - Retail, commercial, and food service
  - Student gathering
  - Student study
  - Assembly
- Building facades facing Primary Edges should have a high degree of transparency to the exterior, particularly at ground level

NODE GUIDELINES

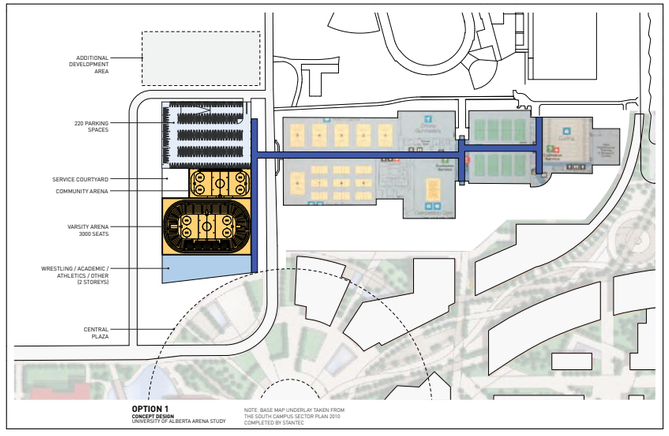
Nodes are locations where campus movement corridors come together to create opportunities for students, staff, faculty, and campus visitors to meet and recreate.

Development guidelines for buildings adjacent to Major Nodes are as follows:

- Position uses adjacent to Major Nodes that consist of:
  - Building entry and orientation
  - Retail, commercial, and food service
  - Student gathering
  - Student study
  - Assembly
- Buildings should be built to the parcel edge for at least 75% of their length adjacent to Major Nodes.
- The building edge should be highly transparent at ground level.

SITE OPTIONS

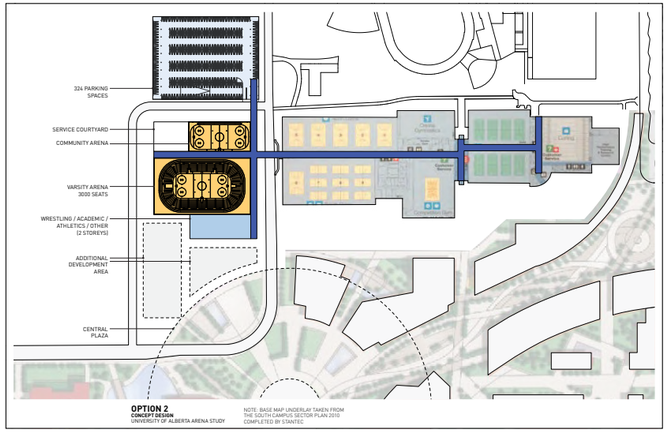
OPTION 1 (PREFERRED)



Pros:
- Pedestrian-friendly frontage on three sides.
- Convenient drop-off on west side (southwest corner)
- Efficiency of operations
- Compact building massing
- Leaves current research facility in operation.
- Can accommodate 600 parking spaces and can expand to 1200 if required.

Cons:
- Circulation from Saville directly into carpark rather than arena.

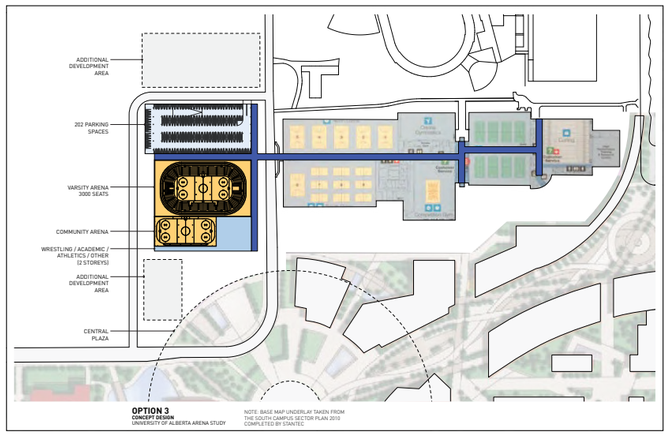
OPTION 2



Pros:
- Additional development area to south of arena.
- More direct pedestrian connection to Saville.
- Can accommodate 600 parking spaces and can expand to 1200 if required.

Cons:
- Requires building new research facility and demolishing existing research facility
- Setback too far from future central plaza.

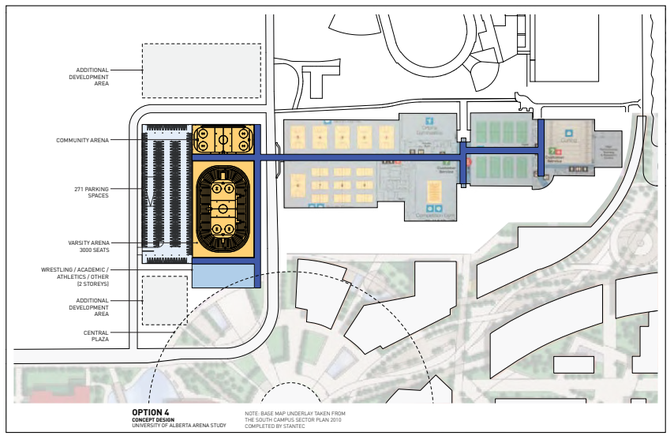
OPTION 3



Pros:
- Dense development within one 'block.'
- Arena is close to the central plaza.
- Circulation links entrances on all sides of the arena.
- Additional development area to north and south of arena.
- Can accommodate 600 parking spaces and can expand to 1200 if required.

Cons:
- Setback too far from future central plaza - without additional development site has too much empty space.
- Weak west facade.

OPTION 4



Pros:
- Arena has prominent face to future central plaza.
- Major west facade matches scale of major roadway.
- Minimal bridging required.
- Additional development area to north and south of arena.
- Parking lot can link directly to additional developments.
- Can accommodate 600 parking spaces and can expand to 1200 if required.

Cons:
- Poor west facade.
- Difficult servicing to spectator arena.
- Longer walkways.

PEER FACILITIES

Hillcrest Centre, Vancouver

McGill University, McConnell Arena, Montreal

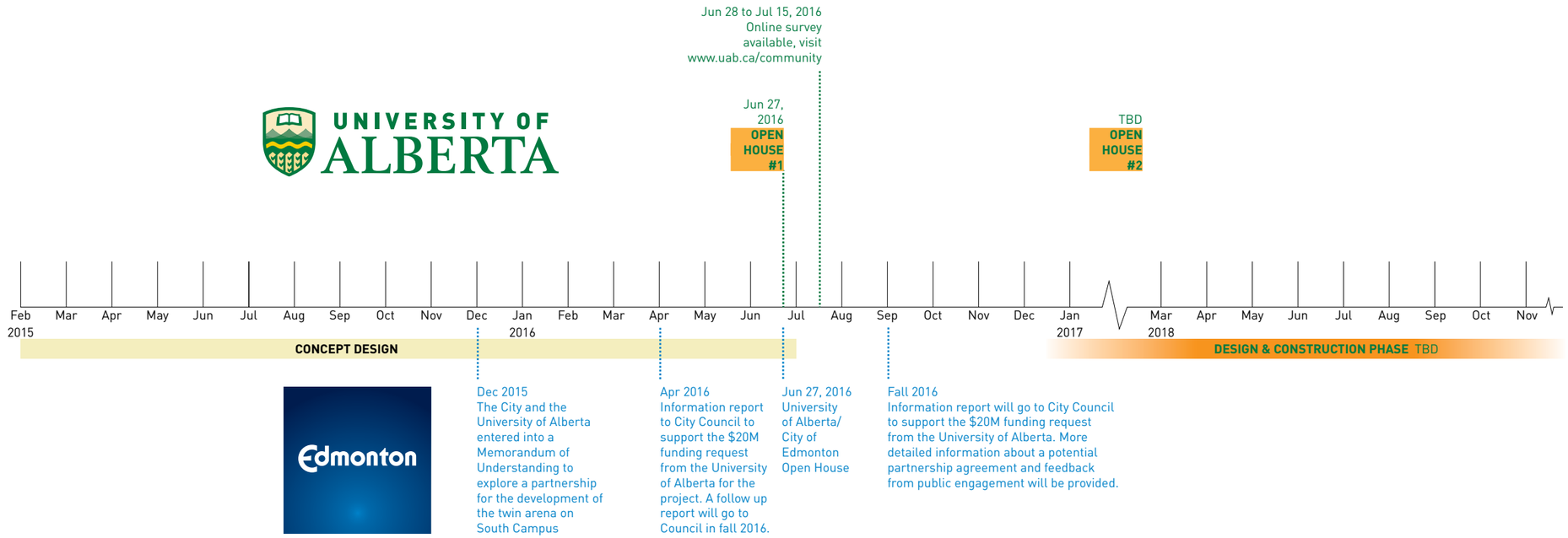
UBC, Doug Mitchell Thunderbird Sports Centre, Vancouver

Commonwealth Community Recreation Centre, Edmonton

CONCEPT PLAN DEVELOPMENT

South Campus Community Ice Arena concepts:

PRELIMINARY SCHEDULE



THANK YOU FOR COMING

Please submit your completed evaluations and comments in the box provided.
Should you have comments to submit after the open house, please visit: www.uab.ca/community or www.edmonton.ca/city_government/projects_redevelopment/park-facility-partner-projects.aspx

The University of Alberta and the City of Edmonton will receive comments until July 15, 2016.

NEXT STEPS

The University of Alberta will continue ongoing engagement with South Campus Consultation Group (SCCG)

REFERENCE

Relevant University of Alberta planning documents and processes include:

- Post-Secondary Learning Act
- Comprehensive Institutional Plan
- Long Range Development Plan
- Appendix XVIII: Consultation Protocol - 2002
- Memorandum of Understanding between the University of Alberta and City of Edmonton South Campus Community Ice Arena Project
- Appendix XIX: South Campus LRDP - Amendment June 2013
- South Campus Sector Plans
- South Campus Consultation Group (SCCG)
- Sector 12 Campus Planning & Design Guidelines for Implementation - March 2016

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