



ourMontrose

SOUTH MONTROSE SITE MASTER PLAN

APPENDIX

JUNE 2016



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Williamson Chong Architects



Parkland 
GEO

APPENDIX A

OUR MONTROSE
PHASE 1: ADMINISTRATION,
STAKEHOLDER AND PUBLIC
WHAT WE HEARD REPORT

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OUR MONTROSE
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PUBLIC WHAT WE HEARD
REPORT

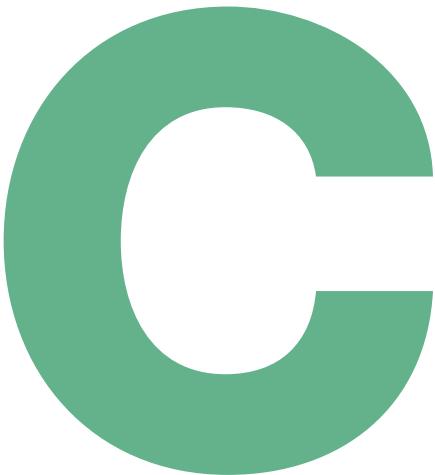
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March 2016

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OUR MONTROSE
“FUNCTIONAL
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LAYOUT OPTIONS
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Williamson Chong Architects

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APPENDIX A

our Montrose
Phase 1: Administration,
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What We Heard Report



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OurMontrose

PHASE 1: ADMINISTRATION, STAKEHOLDER AND PUBLIC
WHAT WE HEARD REPORT

January 2016

WHAT WE HEARD REPORT

1.0 ourMontrose Engagement Overview

The focus of the first phase of the ourMontrose engagement process was to continue the conversation about the South Montrose Site, building upon the prior work, direction and policy established for the site. Since the site was not a blank slate, stakeholders required background information about the site's history to inform their comments.

This phase of engagement took place from November 2015 to January 5, 2016. It focused on two key methods for citizen participation: an online survey (with a paper survey complement) and a workshop series (one administration workshop and another invited stakeholder workshop). The survey allowed for broader citizen engagement, while the workshops supported more focused discussions with representatives from key stakeholders including city administration, the Downtown Association, the local arts and culture community and City Councillors, among others.

Overall, more than 1,100 Grande Prairie (and surrounding area) residents participated in this first phase of engagement about potential uses for the South Montrose Site. The feedback from this first phase of engagement will be considered with existing policy direction, best practices and design expertise to inform the future master plan for the site.

THE ONLINE SURVEY RESULTS

2.0 About the Online Survey

This survey allowed for broader citizen feedback on the South Montrose Site. It ran from December 10, 2015 to January 5, 2016. Online traffic was referred from www.cityofgp.ca/ourmontrose, and a paper version was available at The Montrose Cultural Centre and other locations around the city.

Over the four weeks of the survey, **1051** people participated. The survey asked the following seven questions:

1. Thinking about the future of the South Montrose Site, what do you see as the best uses?

This question provided eight options (municipal uses, institutional uses, art/cultural facilities, park space, recreational uses, commercial uses, housing, office/start-up space) as well as an 'other' category for participants to offer their insights.

2. City Council has recommended several programs and uses for the site. Please mark your priorities.

This question offered a series of options (performing arts centre, mixed use building, parking, transit opportunities, greenway/pedestrian links, public square) for participants to rank in order of their priorities from 1 to 7.

3. The South Montrose Site could include many different public uses and amenities. What public spaces and amenities would you like to see included?

The participants were offered 12 outdoor space options to choose from as well as space to suggest their own uses. These options included children's play equipment, skating rink, outdoor performance space, outdoor exhibits, passive seating, water feature, skateboard feature, interactive features/art, flexible seating area, outdoor winter activities, winter shelter and flexible plaza space.

4. What public space, recreational and cultural facilities do you use in Grande Prairie?

A list of recreational and cultural facilities within Grande Prairie was presented to participants to select the facilities they patronize the most, in order to generate information on what spaces they value the most in the city.

5. Are there any arts/cultural or public spaces/plazas that you enjoy in Grande Prairie or elsewhere that you would like to see as an inspiration for the South Montrose site? And if so -- why?

This open-form question allowed participants to offer their suggestions on spaces within Grande Prairie and beyond that could be inspirational to the project team in the master planning process.

6. Do you have any additional comments you'd like to share?

This provided participants with an area to offer any thoughts, considerations or insights they have for the South Montrose Site.

7. What neighbourhood do you live in?

This question helped to provide an overview of the participant's locations. .

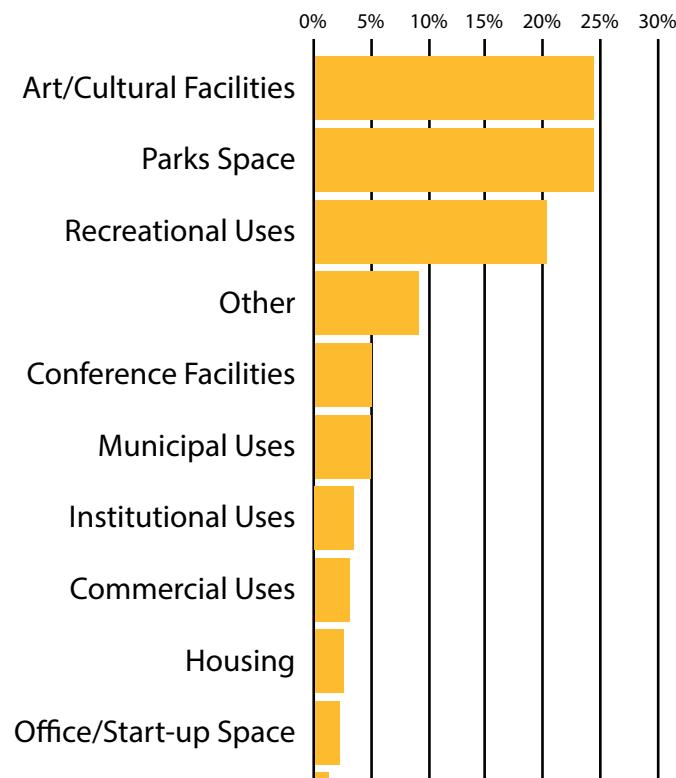
The following pages summarize the results from the online survey regarding these questions.

Thinking about the future of the South Montrose Site, what do you see as the best uses?

The most common response, as seen in the table to the right, was a tie between art/cultural facilities and a parks space, each with 24% support. When participants were asked to elaborate, they spoke to the specific activities they'd like to see on the site including community gardens, a conference or performing arts centre, space for food trucks, venue for short films, etc.

Beyond specific site uses, most of the 'why' responses spoke to the need for parking on this site.

Preferred Uses for the South Montrose Site



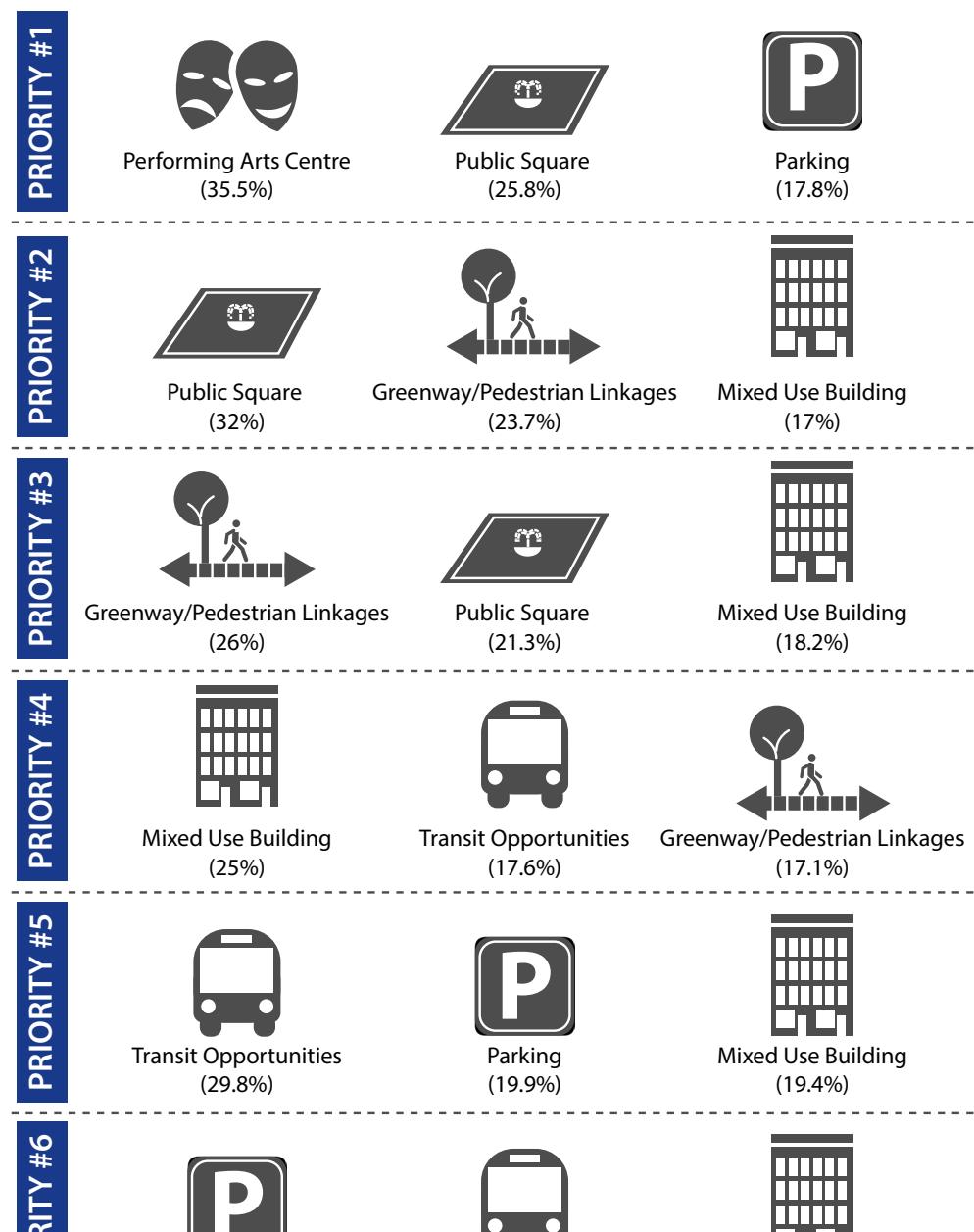
City Council has recommended several programs and uses for the site. Arrange the uses to match your priorities.

The table to the right indicates the three most popular uses picked for each of the six priorities that participants selected from:

1. Performing Arts Centre
2. Mixed Use Building
3. Parking
4. Transit Opportunities
5. Greenway/Pedestrian Links to City Hall/Downtown
6. Public Space

Beyond the overall top pick of performing arts centre, participants supported public squares, greenway/pedestrian linkages to City Hall/Downtown and mixed use buildings. These options also had repeat mentions in the top four of six priorities. The mixed use building, though predominately chosen third, appeared frequently throughout the ranking.

Priorities for Site Use Based on City Council Recommendations

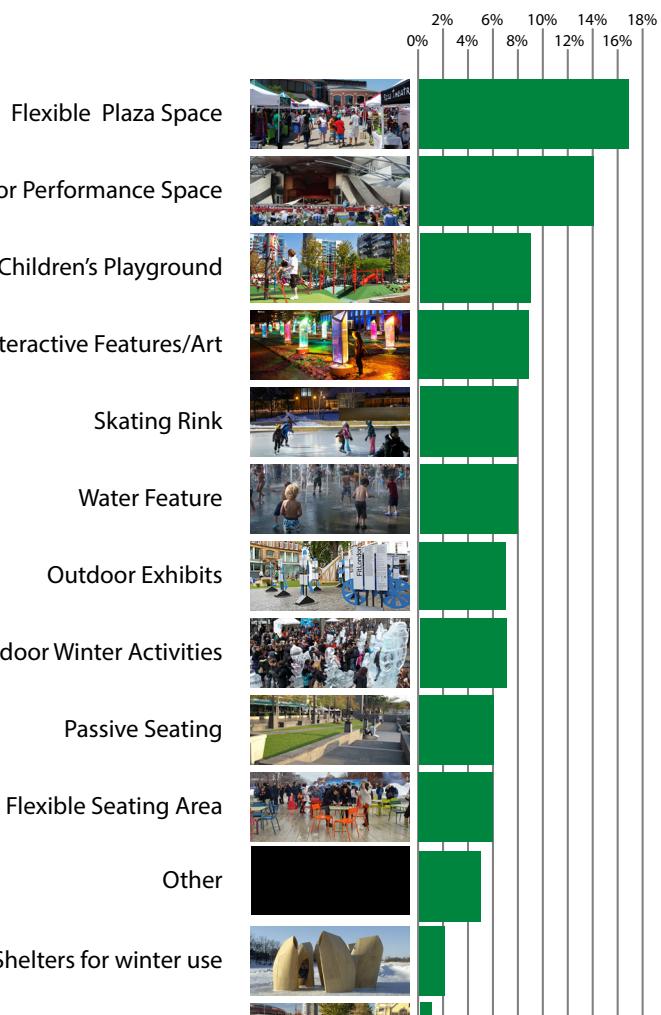


What public spaces and amenities would you like to see on this site?

The most favoured public space amenities were Flexible Plaza Space (17%) and Outdoor Performance Space (14%). The remaining options saw fairly even support, other than shelters for winter use and skateboard features, which ranked the lowest overall. Children's play equipment, interactive feature/art, skating rink, and water features each captured 8-9% of the total response, just slightly above the remaining options.

Participants also stressed the need for the continued availability of parking on the site. Parking was the most popular 'other' suggestion. Many of the participants chose to suggest other amenities used the 'why' section to speak to the need for parking at this site.

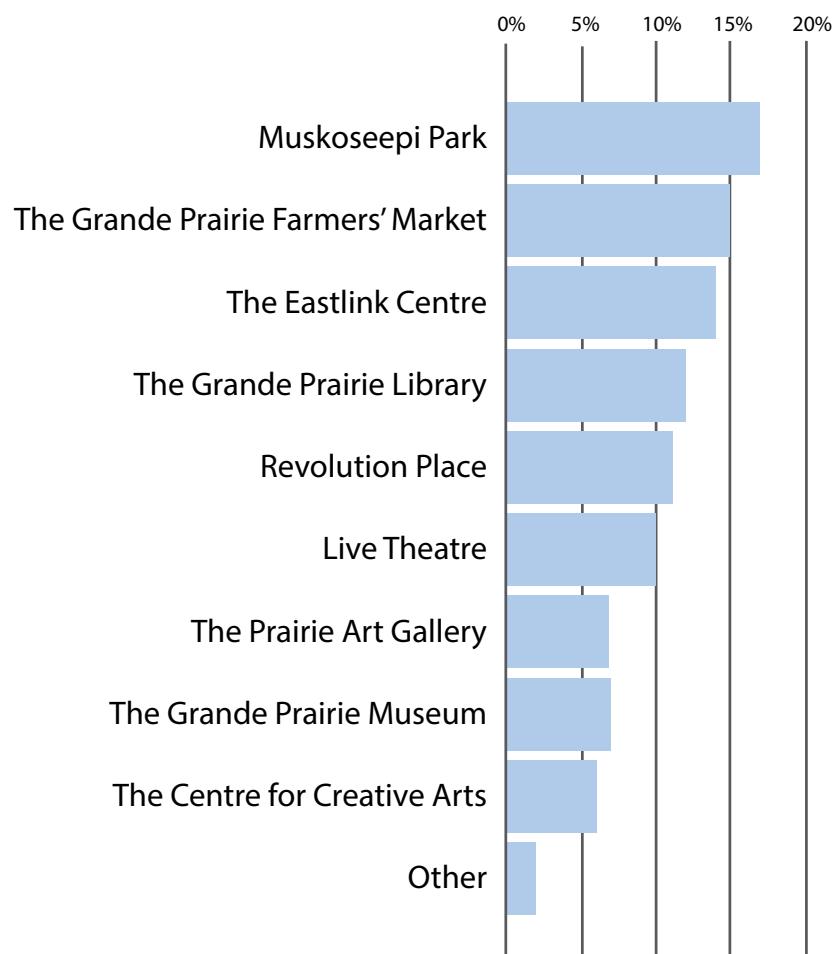
Preferred Public Spaces and Amenities



What public space, recreational and cultural facilities do you use in Grande Prairie?

When asked about what recreational and cultural facilities residents already use, Muskoseepi Park (17%), The Grande Prairie Farmers' Market (15%) and The Eastlink Centre (14%) were highly ranked. The next two most popular options included The Grande Prairie Public Library (12%) and Revolution Place (11%).

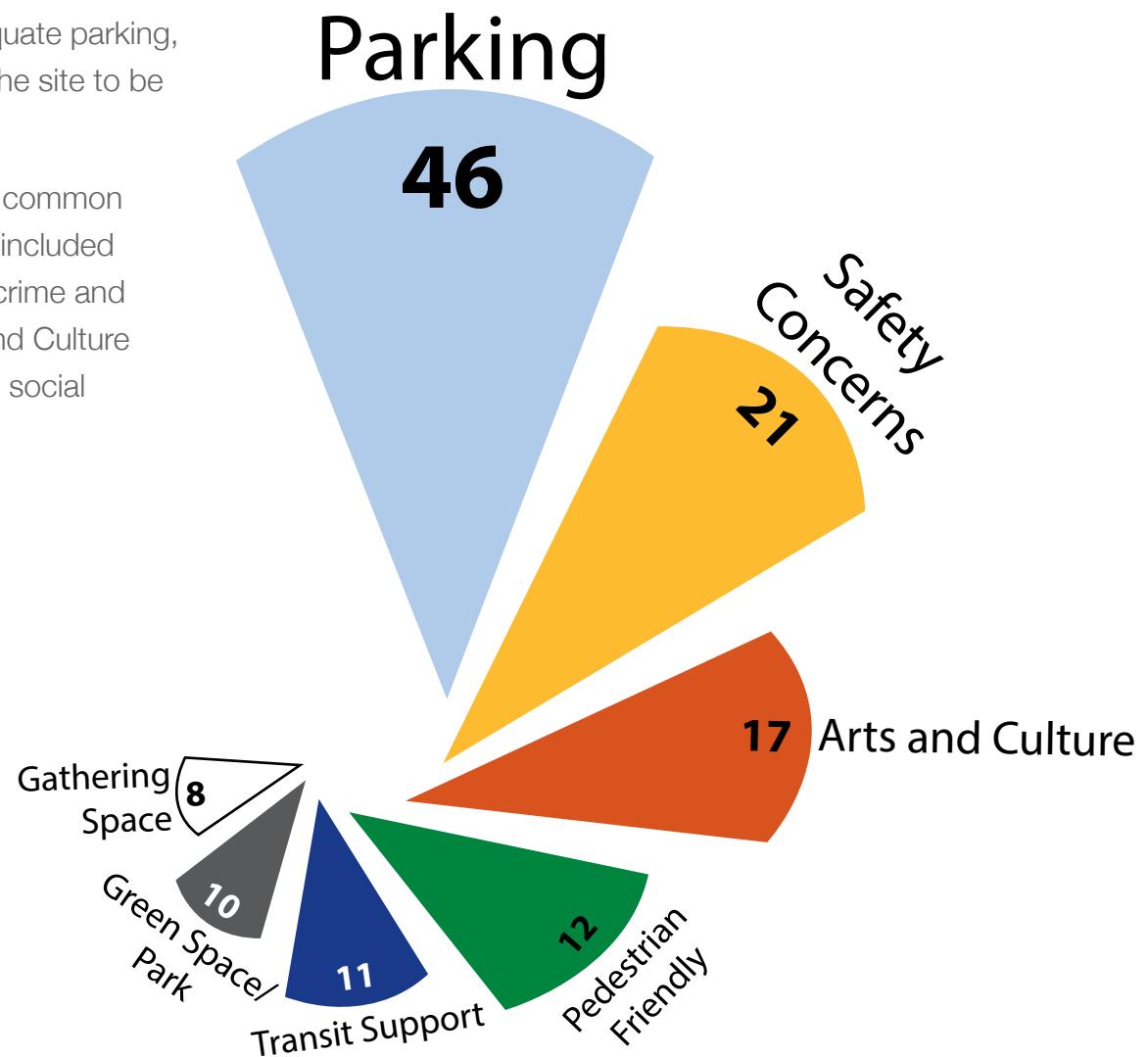
The 'other' option was chosen by only 2% of participants. Other places suggested included parks, playgrounds, trails, the Coca Cola Centre, Centre 2000, Grande Prairie Regional College and Grande Prairie Regional Archives.



Do you have any additional comments you'd like to share?

The most frequently raised other comments are illustrated in the diagram below. The dominant topic in this section was parking. Comments ranged from providing adequate parking, including underground parking, to not allowing the site to be under-utilized as a parking lot.

Safety and Arts and Culture were the next most common issues raised. Comments in the safety category included concerns about antisocial behaviour, drug use, crime and the proliferation of homeless people. The Arts and Culture category included comments encouraging more social opportunities and community connections.



Are there any arts/cultural or public spaces /plazas that you enjoy in Grande Prairie or elsewhere that you would like to see as an inspiration for the South Montrose site?

Many arts/cultural facilities and/or public spaces/plazas around Alberta, Canada and the world were suggested by participants in both the online survey and the workshop. The diagrams below and to the right combine the suggestions from the survey and workshops to present a comprehensive picture of the places suggested.

When speaking of their inspirations and the qualities of the spaces they value, participants specified the following uses:



Many spaces were cited multiple times as shown in the list to the right.

Most Popular Places

45	Churchill Square, Edmonton
13	Muskoseepi Park, Grande Prairie
8	Olympic Plaza, Calgary
5	Alberta Legislature
5	Grande Prairie Regional College, Grande Prairie
4	Jubilee Auditorium, Edmonton
4	William Hawrelak Park, Edmonton
4	Winspear Centre, Edmonton
4	The Eastlink Centre, Grande Prairie
4	The Forks, Winnipeg
3	Nathan Phillips Square, Toronto
3	Yonge and Dundas Square, Toronto
3	European Squares (generally)
3	St. Albert (generally)
3	Prairie Art Gallery, Grande Prairie
3	Jubilee Park, Grande Prairie
2	Stephen Avenue, Calgary
2	Prince's Island Park, Calgary
2	Grande Prairie Public Library
2	Montrose Cultural Centre, Grande Prairie (overall)
2	Whitecourt (generally)
2	Town Square, Kelowna
2	Casino Rama Entertainment Centre

Arts and culture facilities and public spaces from across the world inspired participants. The following images highlight this range.



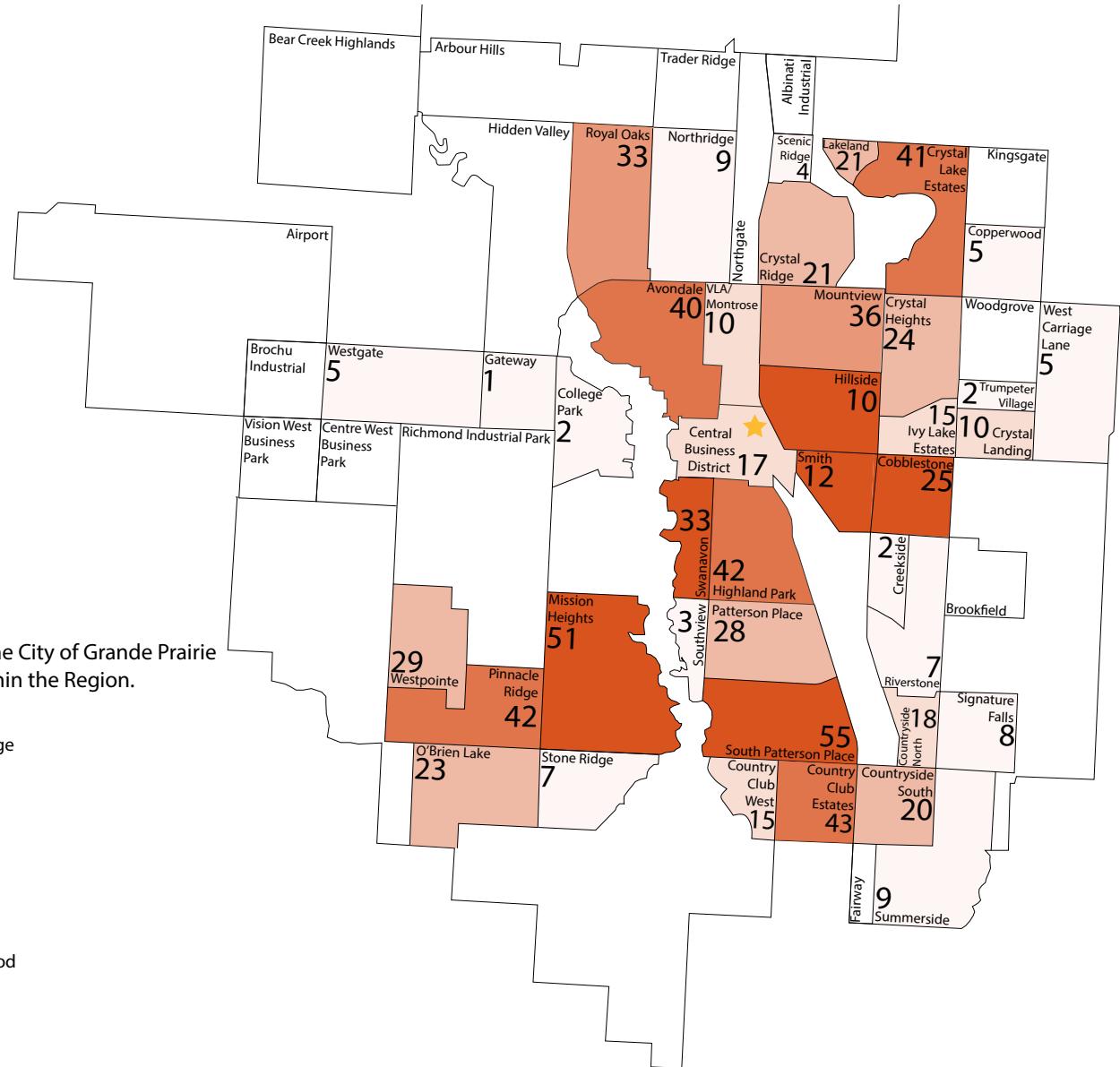
What neighbourhood do you live in?

The online survey benefited from wide participation from across the city and region. In total we heard from **52** communities within and around Grande Prairie.

The 10 communities with the highest response rate

- | | | | |
|-----------|-----------------------|-----------|-------------|
| 55 | South Patterson Place | 19 | County |
| 51 | Mission Heights | 3 | Beaverlodge |
| 43 | Country Club Estates | 1 | Bezanson |
| 42 | Pinnacle Ridge | 1 | Calgary |
| 42 | Highland Park | 6 | Clairmont |
| 41 | Crystal Lake Estates | 1 | Dimsdale |
| 40 | Avondale | 1 | Grovedale |
| 36 | Mountview | 1 | Hythe |
| 33 | Royal Oak | 4 | Sexsmith |
| 33 | Swanavon | 4 | Wedgewood |
| | | 1 | Wembley |

Areas beyond the City of Grande Prairie borders but within the Region.



THE WORKSHOP RESULTS

3.0 About the Workshops

Both the administration and the stakeholder workshops followed the same format, beginning with a discussion about the participant's favourite public spaces and cultural hubs from anywhere in the world (these results are combined with the results of the online engagement for the same question on the previous two pages). Attendees then discussed potential uses, design options and outdoor activities appropriate for the site based on national and international examples. The workshop concluded with a discussion about potential layout options and allowed participants to offer insight into important local factors and uses for the designers to consider when master planning this site.

Both workshops were hosted on December 15, 2015 at the Montrose Cultural Centre. The internal workshop had 24 attendees and the external workshop had 28 attendees.

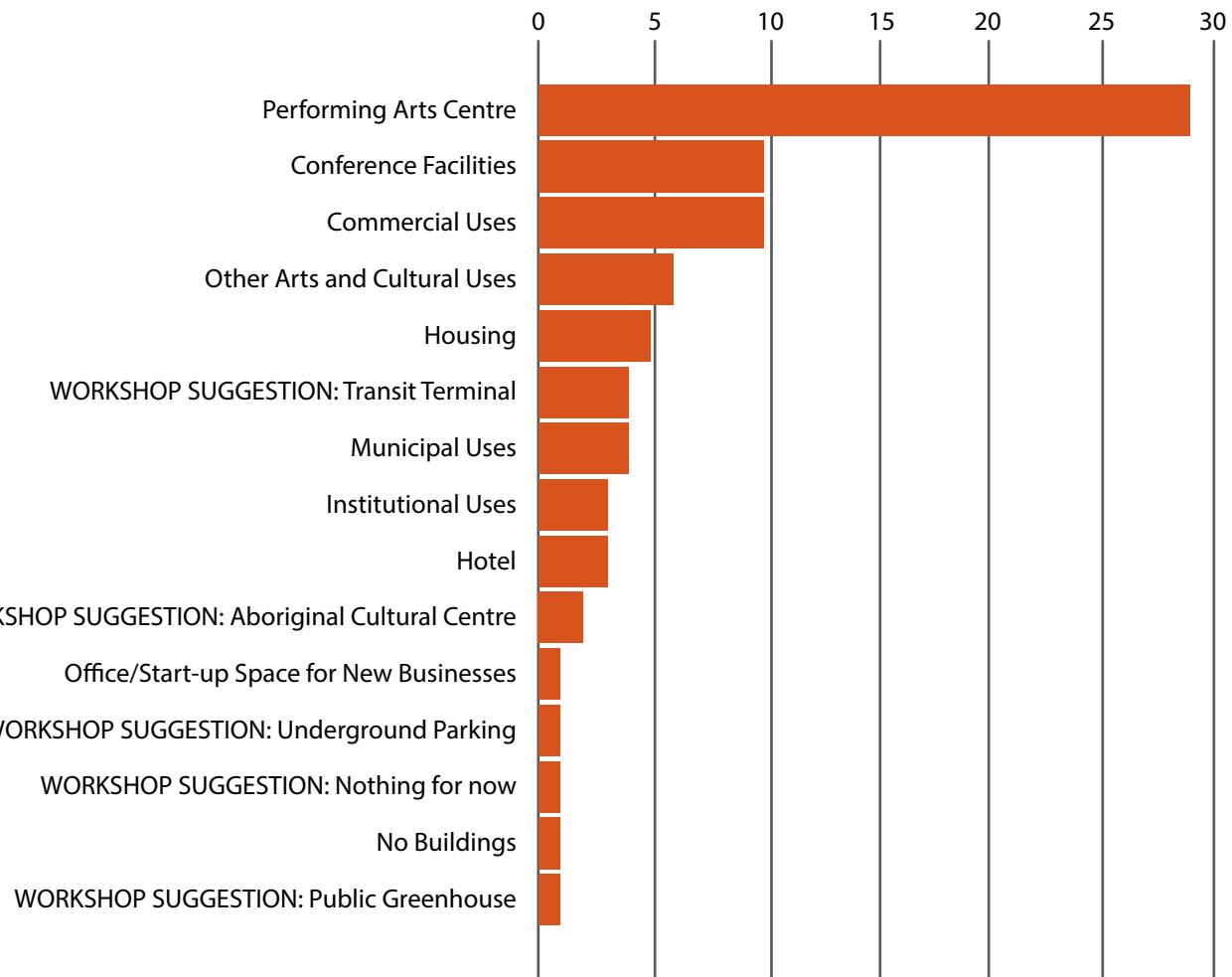


Preferred Uses from the Workshop Discussion

Each table in the workshops was given two sets of 10 poker chips to illustrate their preferences in each activity. The first activity revolved around their preferred uses for the site. The performing arts centre was clearly the most popular option followed by conference facilities, commercial uses and other arts and cultural uses.

Many tables also suggested uses and included those in their priorities. These included transit terminals, an aboriginal cultural centre, underground parking and a public greenhouse.

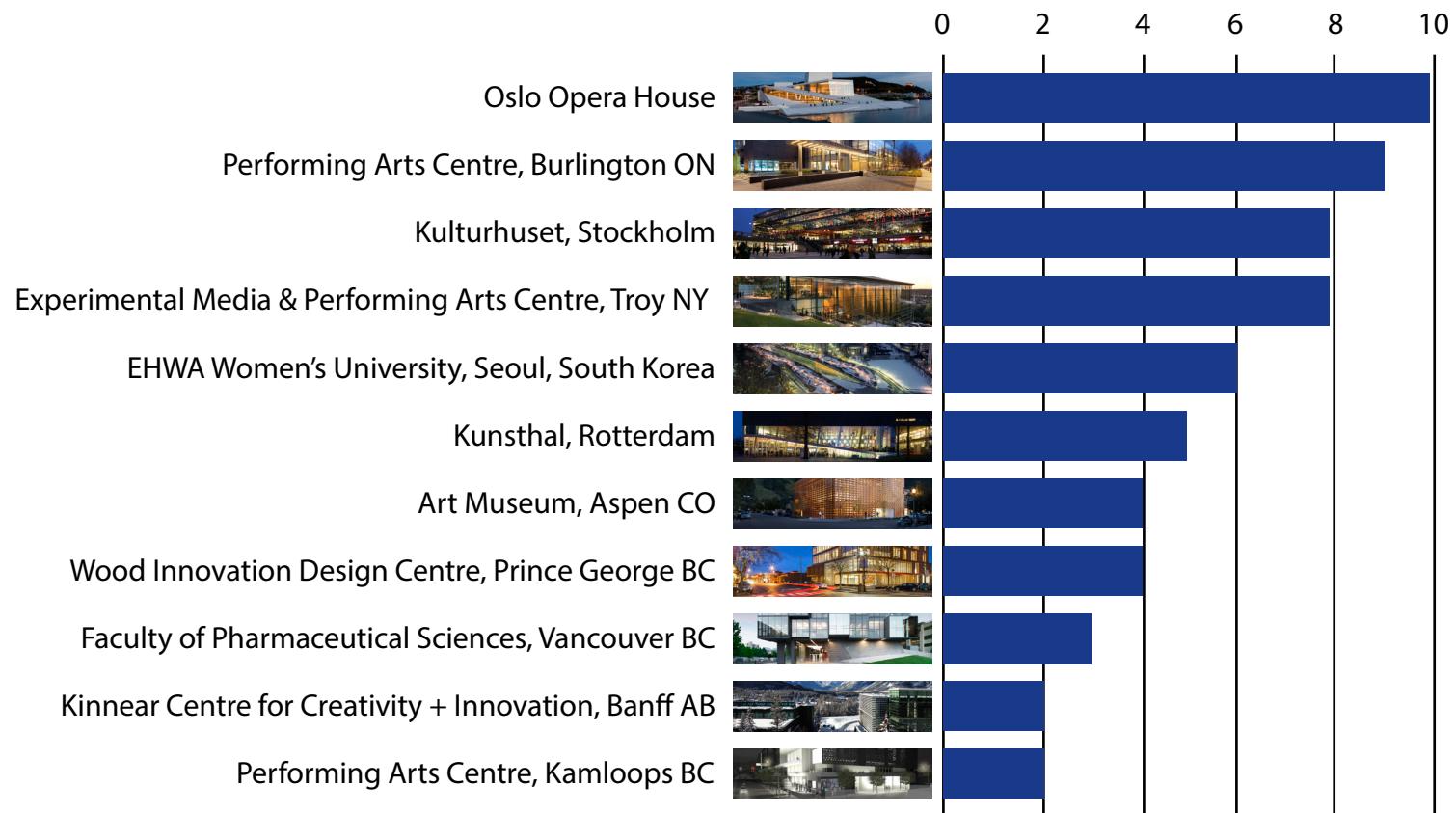
The reasoning participants gave to the priorities largely revolved around creating lots of activity on the site, facilitating an arts and culture hub, drawing people downtown, serving a community need and creating flexible spaces.



Preferred Design Inspirations from the Workshop Discussion

Numerous design inspirations were presented to participants at the workshop to discuss and prioritize with poker chips. Many of the examples came from other winter cities in Canada and often had an arts, cultural or innovation focus.

The Oslo Opera House was the most popular among participants, followed by Burlington Ontario's Performing Arts Centre and the Kulturhuset in Stockholm. In their comments, people focused on buildings that would complement the Montrose Cultural Centre, offer a comfortable pedestrian experience, demonstrate sustainability, incorporate flexible spaces and create an inviting design. Parking frequently arose as an important component to the site.

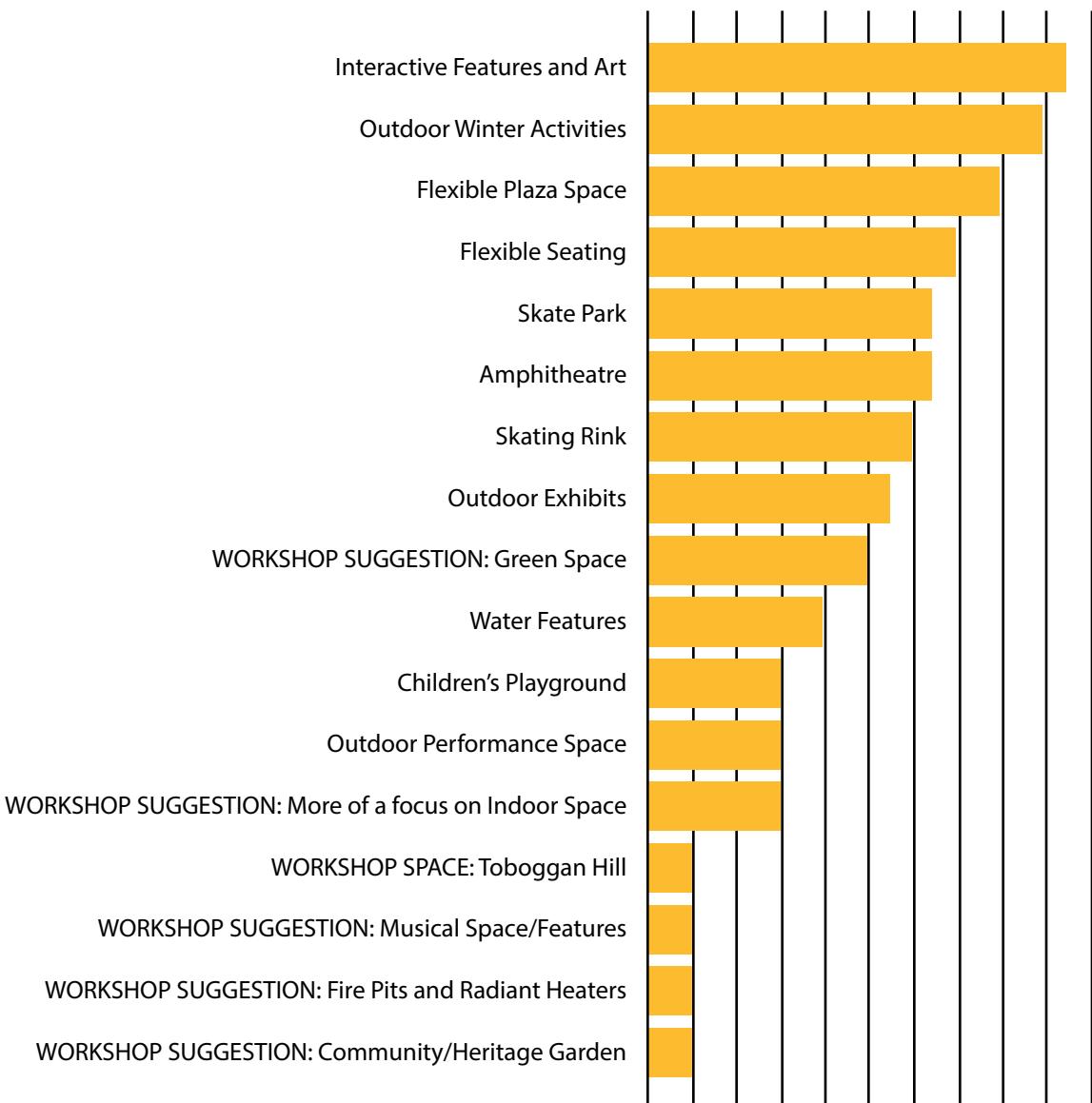


Preferred Landscape Elements from the Workshop Discussion

After discussing potential uses and building design, participants focused on the outdoor space and its programming. Many potential uses were presented and participants also had the opportunity to suggest additional uses to consider and prioritize.

Interactive features and art, outdoor winter activities and a flexible plaza space were suggested most often in this exercise. Other suggestions included green space, a toboggan hill, music space, fire pits and community gardens.

The winter shelter idea did not receive any votes to place it on the ranking. Also, participants included many suggestions that did not make the final ranking, such as rooftop bars/ice bars, rooftop gardens and public graffiti walls

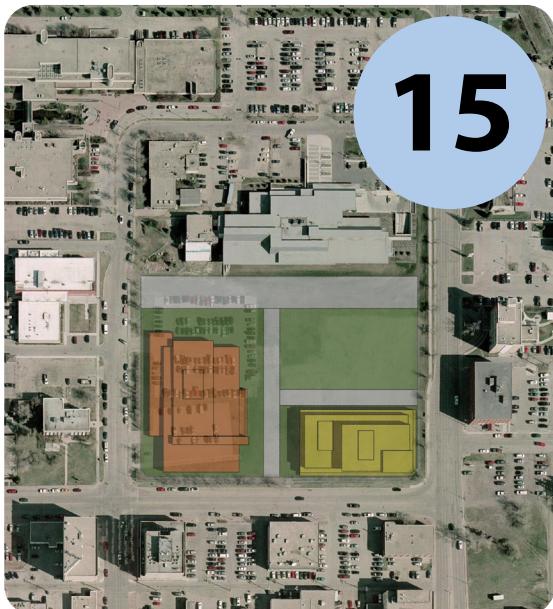


Preferred Layout Options from the Workshops

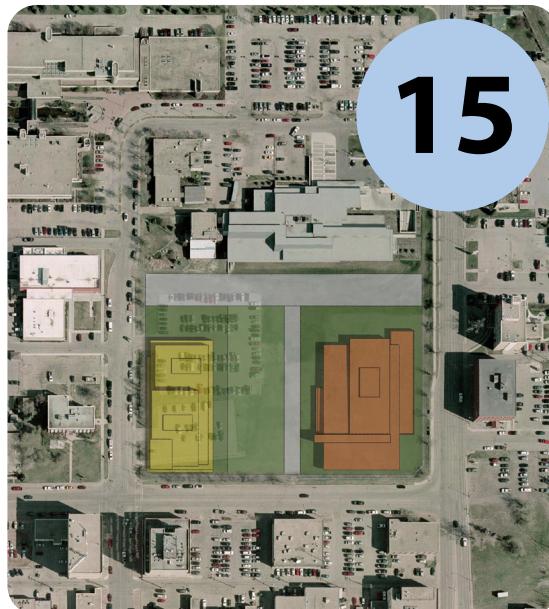
The design team presented three layout options for the workshop participants to consider. Each of these options demonstrated a particular focus: civic, culture and downtown. Participants were asked to evaluate the pros and cons, suggest other layouts and vote on their preferred options.

Out of the three options presented, the civic and culture focuses received the most votes. Participants could also create their own layouts, which are illustrated on the next page, and which were included in voting. Participants largely preferred options where the greenway/concourse flowed directly into the plaza and layouts that left open space near the Montrose Cultural Centre. They also considered flow, wind, shadow, exposure to traffic and winter comfort. Participants were thoughtful about the interface between the Montrose Cultural Centre and the South Montrose Site and wanted to ensure both were integrated attractively, comfortably and functionally.

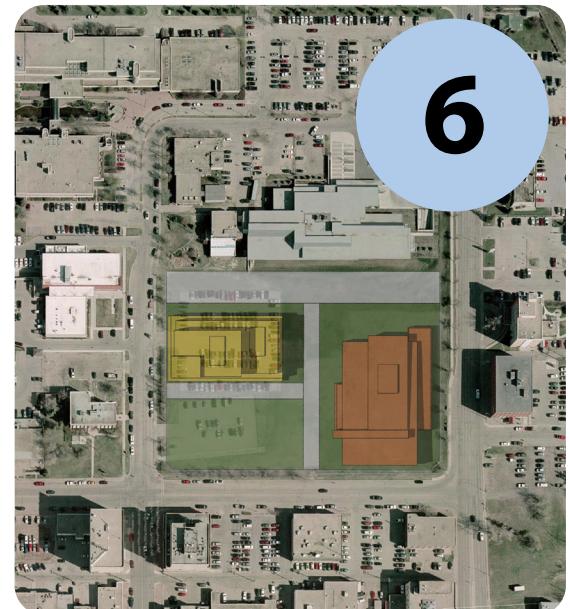
Civic Focused



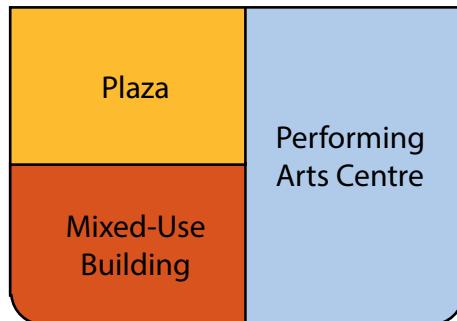
Culture Focused



Downtown Focused



WORKSHOP SUGGESTION



23

**note that one table gave this option 18 votes.*

WORKSHOP SUGGESTION



2

**note this option allows the plaza to extend underneath the performing arts centre and mixed use building.*

WORKSHOP SUGGESTION



0

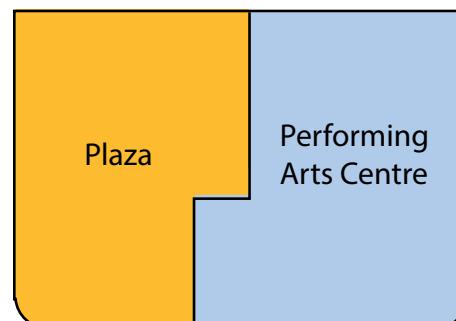
**note this option also allows the plaza to extend underneath the performing arts centre and mixed use building.*

WORKSHOP SUGGESTION



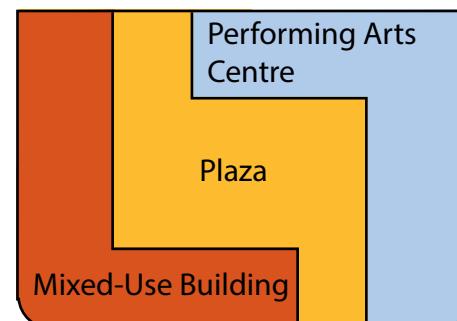
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WORKSHOP SUGGESTION



0

WORKSHOP SUGGESTION



0

**this idea included +15 connections to surrounding buildings, residential uses, flexible spaces, transit, walkways through the building and food-related uses.*

4.0 Next Steps

Administration and Stakeholder Workshops #2

To continue the conversation about the future of the South Montrose Site, a second set of workshops will be held in the beginning of February 2016. As with the first workshop series, the Phase 2 sessions will include an internal (administration) workshop for staff representing various city departments, and a workshop for stakeholders representing the Downtown Association, the arts and cultural community in Grande Prairie and City Council, among others.

These workshops will include discussion about design principles to frame future development on the site and will present two design options, based on the first phase's feedback, for participants to comment upon. The results from these workshops, feedback from the Phase 2 engagement strategies, existing policy direction and the expertise of the design team will be used to create a master plan for the site. This plan will be presented publicly at the end of April 2016 after committee approval.

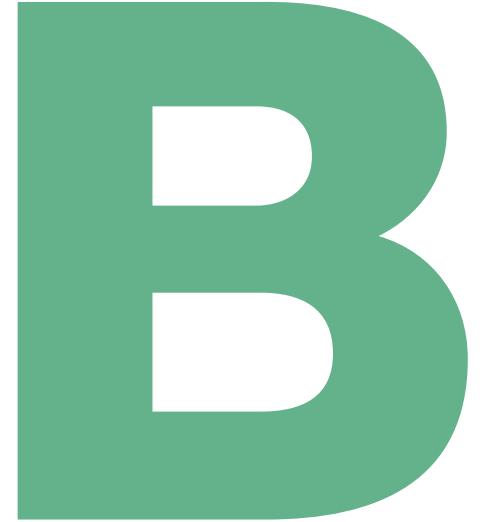
Continuation of Public Engagement

A thorough public engagement program involves providing multiple entry points into the conversation through three key avenues: in-person, online and in-situ (place based). Offering a variety of methods for the public to have their say ensures an accessible and thorough engagement process.

To complement the Phase 2 administration and stakeholder workshops described above, an online survey will be created along with a paper survey version available at the Montrose Cultural Centre. For citizens who do not wish to fill out a survey, a kiosk will be available at the Montrose Cultural Centre allowing participants to provide quick feedback on-site, and to share their design preferences. This kiosk will be manned at specific times with a City of Grande Prairie staff member to answer questions, discuss the project and collect additional insights. Digital engagement options will also be provided during this phase, including opportunities for the public to provide feedback and vote via text and mobile apps. The results from these Phase 2 engagement opportunities will then be compiled and used to inform the final master plan.

For more information and project updates, please visit cityofgp.ca/ourmontrose.

APPENDIX



our Montrose
**Phase 2: Administration,
Stakeholder and Public
What We Heard Report**

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March 2016

Pages: 17

OurMontrose

PHASE 2: ADMINISTRATION, STAKEHOLDER AND PUBLIC
WHAT WE HEARD REPORT

March 2016

WHAT WE HEARD REPORT

1.0 ourMontrose Engagement: Phase 2 Overview

ourMontrose is a community engagement process designed to give Grande Prairie residents a voice in shaping the future of the South Montrose Site in downtown Grande Prairie.

The first phase of engagement took place from November 2015 to January 5, 2016, and gave more than 1,100 citizens a chance to provide feedback on potential uses for the site. In this phase, citizen priorities for the site included arts/cultural facilities, parks spaces and recreational facilities. (*A copy of the full What We Heard report from Phase 1 is available for download at cityofgp.com/ourMontrose.*)

This community feedback, existing policy guidelines and unique site considerations (including infrastructure and climate realities) were used to develop three initial design concepts for the site.

The second phase of engagement, from February 23 to March 14, 2016, included a chance for more than 500 participants to review these initial proposed designs for the site, and to offer feedback on potential amenities. Each of the design concepts included citizen priorities (a Performing and Media Arts Centre, a plaza space, recreational options and a mixed use building), as well as 475 underground parking stalls.

In Phase 2, citizens were able to provide input through online and print surveys, at an information kiosk in the Montrose Cultural Centre, via social media and at two stakeholder workshops.

The results of the second phase of engagement are detailed in this report.

ENGAGEMENT RESULTS

2.0 Approach to Phase 2 Engagement

Phase 2 ourMontrose engagement consisted of online and paper surveys, social media feedback, and stakeholder workshops. The following incorporates the results received from all feedback channels.

Over almost three weeks of engagement, more than **500** people participated.

The survey asked the following four questions:

1. Having reviewed the options, which is your preferred design?

This question presented three options for layouts of the site involving a mixed-use building, plaza space, and a pond/skating feature. There was an opportunity for participants to address why they chose one over the others.

2. Check the top three (3) businesses or services you'd like to see included in the mixed use building.

Participants were presented with a list of businesses or services (Conference Facilities, Event Space, Housing, Learning Facilities, Municipal Government Uses, Office Space, Pub/Bar, Restaurant, Retail, Services Uses (e.g. hair salon), Sports and Recreation Facilities) and had to select the three they prefered to see on the site. There was space for them to include other suggestions or additional comments.

3. In previous engagement, the community chose six (6) uses as their priorities for the plaza and public space. Select your preferred style/format for each of these options.

This question presented three pictures as options for each use (Flexible Plaza Space, Outdoor Performance Space, Children's Playground, Interactive Features/Art, Skating Rink, Water Feature) and asked participants to select the one they liked the most. For each use there was the option to explain why the choice was made.

4. Do you have any additional comments you'd like to share? (Online only)

This question allowed people to add any other thoughts or input in addition to what was asked of them in the survey.

The following pages summarize the results regarding these questions.

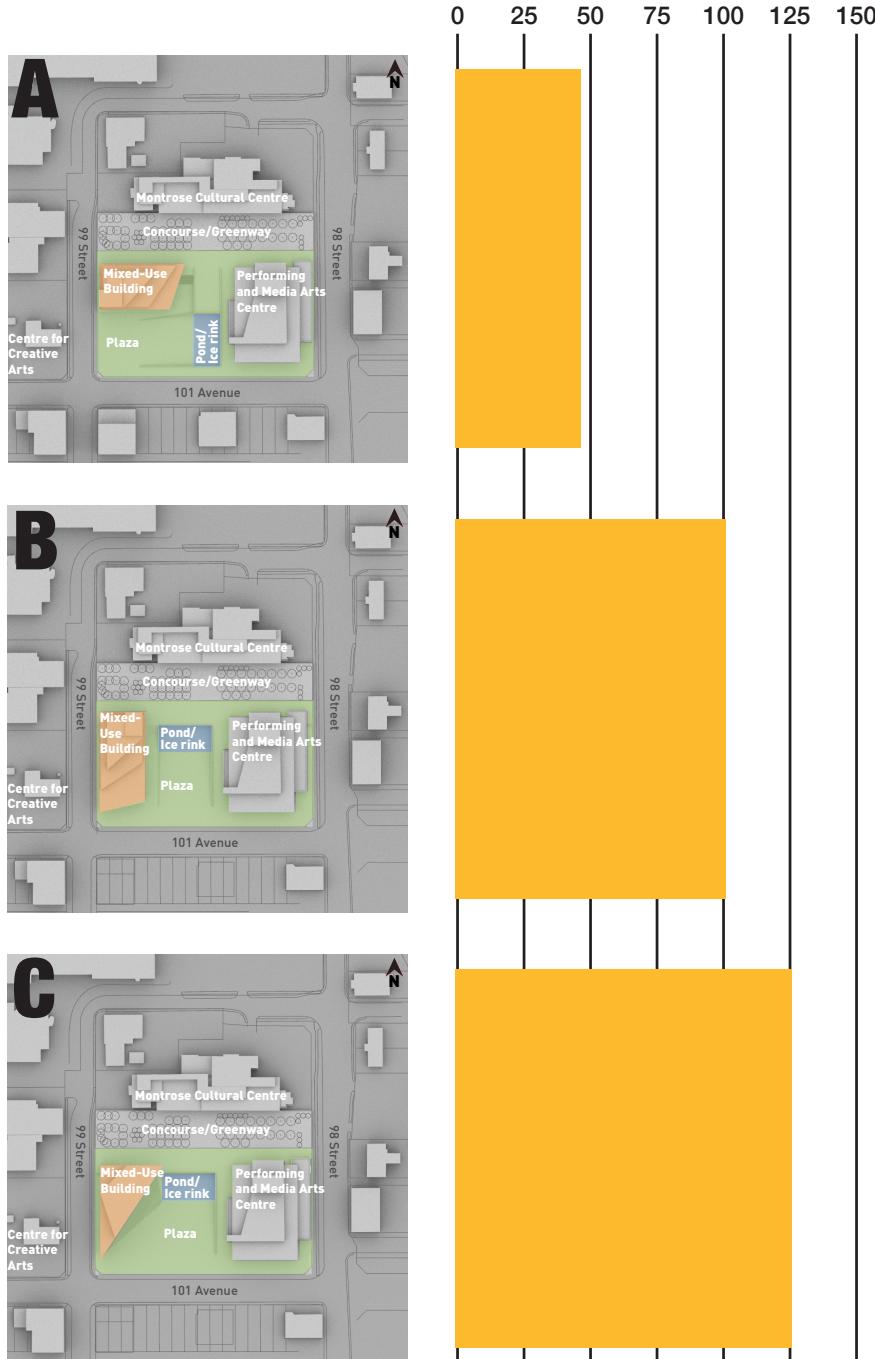
Question 1:

Having reviewed the options, which is your preferred design?

The most popular of the three options was Option C (126), followed by Option B (101), with Option A (45) being the least preferred option.

The mixed use building was one of the top reasons for those who selected B or C. Some of these reasons were the same (interesting looking) while others were in opposition (how big or small it was). Option B was also popular for its protection from the elements, especially the wind. Option C was preferred for its larger plaza space and the sunlight.

The main issue people had with Option A was the plaza exposure to the elements and roadway. Those who liked it cited its sunlight, easy access to downtown, and openness.



Question 2:

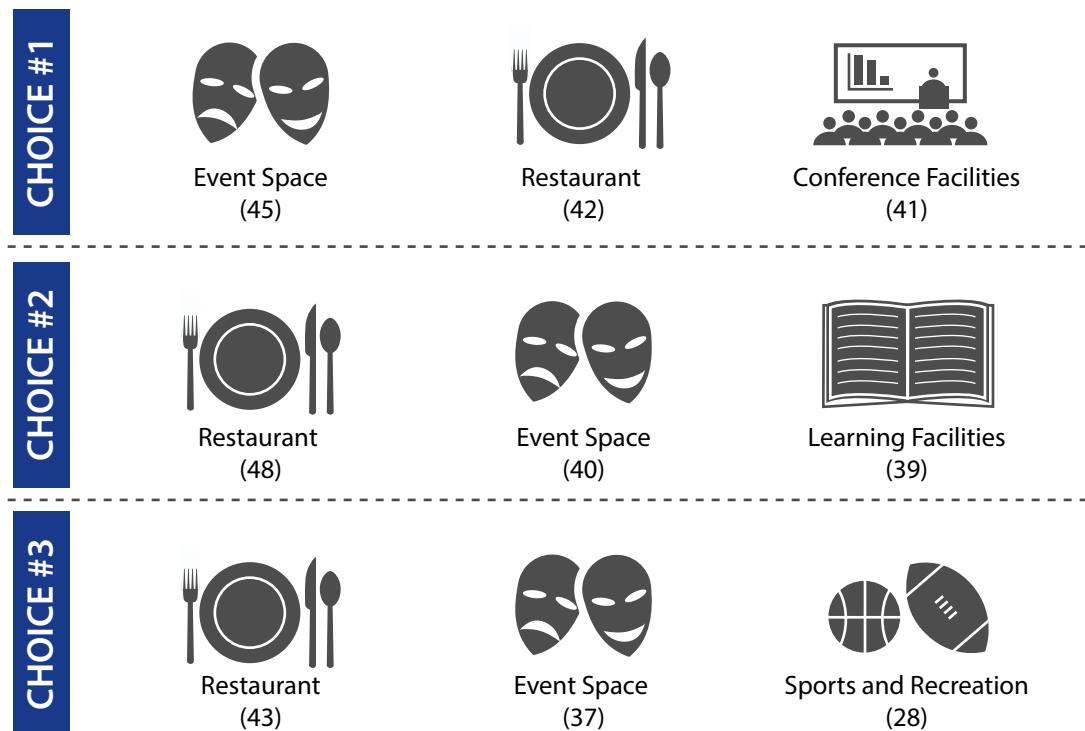
Check the top three (3) businesses or services you'd like to see included in the mixed use building.

The most popular options from the list of potential uses for the mixed use building (*Conference Facilities, Event Space, Housing, Learning Facilities, Municipal Government Uses, Office Space, Pub/Bar, Restaurant, Retail, Services Uses* (e.g. hair salon), *Sports and Recreation Facilities*) are shown to the right. These choices are not in a priority sequence, the popularity of the option is best measured by the number of votes (seen below the option icon).

After the obvious top two choices of Event Space and Restaurant, participants chose Conference Facilities, Learning Facilities, and Sports and Recreation. It should be noted that while Pub/Bar did not appear on this list, many felt that this was the same as the restaurant option.

The “Other” suggestions included things like Parking, Arts & Culture Oriented, and All Day Use.

Top choices for uses in the mixed use building



Question 3:

In previous engagement, the community chose six (6) uses as their priorities for the plaza and public space. Select your preferred style/format for each of these options.

Flexible Space

Options 1 and 2 were noticeably more popular than Option 3 due in part to their ability to accommodate large groups. Commercial Kiosks and Openness were also cited as reasons for their popularity. Across all three options, people felt their choice maximized the flexibility of the plaza.

Outdoor Performance Space

The grass and green space - along with its openness and tiered amphitheater style terrain - of Option 3 made it the most popular option. The seating and tiered terrain was also highly valued in Option 2 with Flexibility and Easy Maintenance cited as Option 1's strengths.

Children's Playground

Option 1's design and layout and variety of activities made it the most popular option. Option 2 was preferred by many due to its design and ability to double as public art.

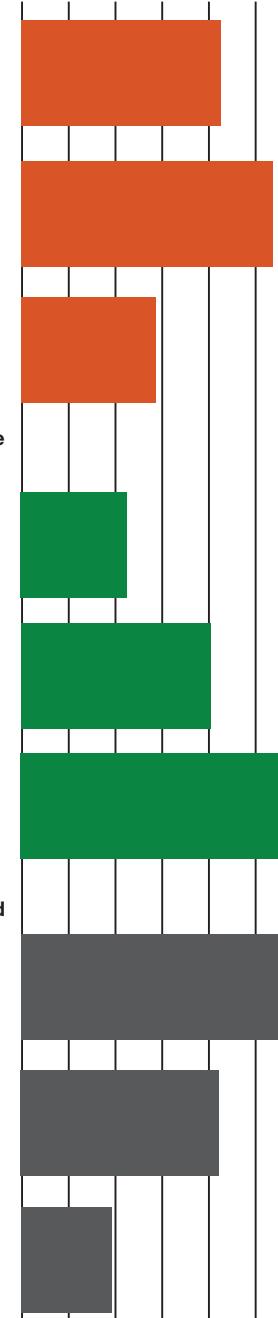
Interactive Feature/Art

Option 1 and 2 were very close in popularity with only 16 votes separating them. The scale and multi-use factor was the tipping point for Option 1. Other reasons given for all three were visual appeal and the fact they were seen as artistic.

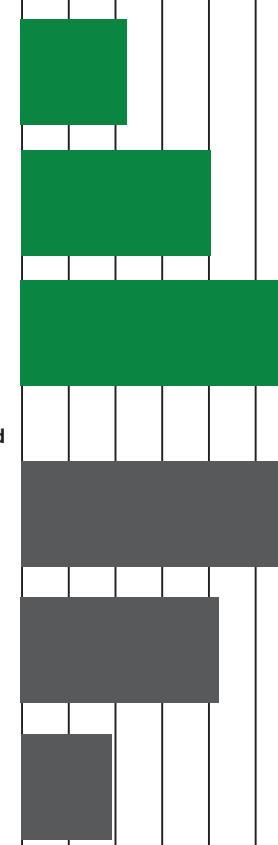
Flexible Space



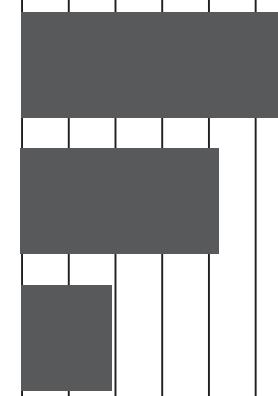
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Outdoor Performance Space



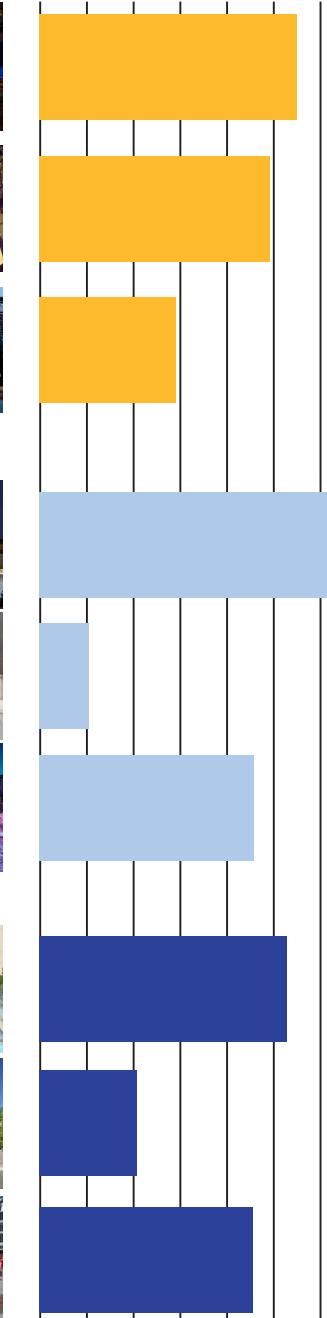
Children's Playground



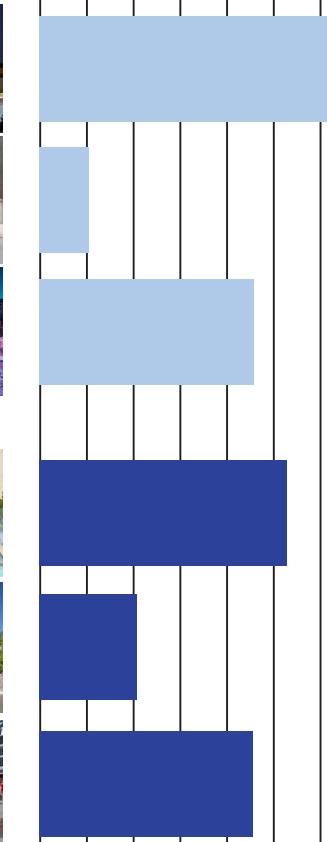
Interactive Feature/Art



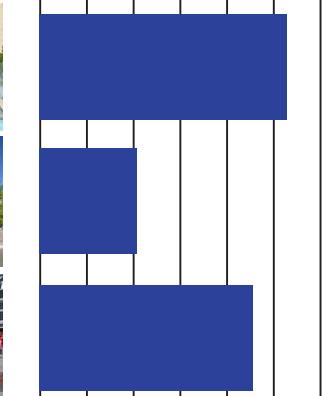
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Skating Rink



Water Feature



Skating Rink

This feature had the widest range of results with Option 1 being the most popular (163) and Option 2 chosen by only 26 participants. The idea of an indoor or covered rink was not appealing. This is further shown in Option 1 being chosen due to its openness, simplicity, and being outdoors. Option 3 was cited for its path design and being something new for Grand Prairie.

Water Feature

The idea of a water feature was a more contentious feature than the rest with more choosing “none” as an option compared to any other features. Participants cited climate and underuse of similar features already in place. Adding to this, water conservation was a big reason why people chose Options 2 and 3, particularly for the ability to turn the water off in Option 3. Overall Option 1 was the most popular, and was chosen for its design and the fact that it includes a pool.

Question 4:

Do you have any additional comments you'd like to share?

The most frequently raised comments are illustrated in the diagram below. The dominant topic in this section was parking. The feedback ranged from asking for the site to remain as parking to questioning the cost of underground parking and feeling unheard in the last phase when they mentioned parking.

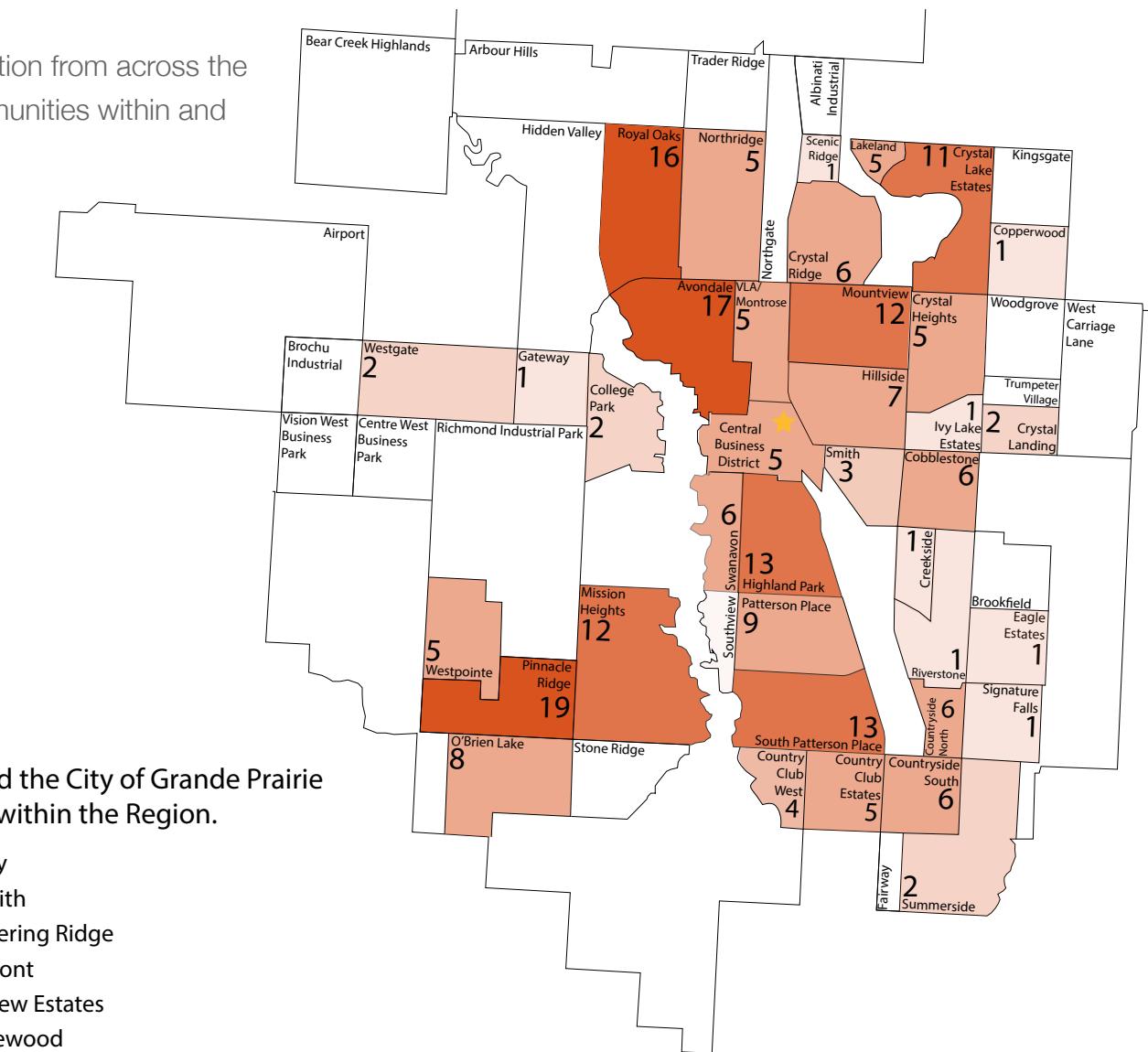
The next common theme was General Positive Comments supporting the project and looking forward to it, and then Questions/Concerns about the project. These ranged from asking if food trucks will be allowed on the plaza to concerns about people living in the Rotary House Shelter nearby.

Other common themes seen included general negative comments, wanting to keep the cost of the project down, keeping green space, and making it welcoming.



What neighbourhood do you live in?

The online survey benefited from wide participation from across the city and region. In total we heard from **44** communities within and around Grande Prairie.



The 5 communities with the highest response rate

- 19** Pinnacle Ridge
- 17** Avondale
- 16** Royal Oaks
- 13** South Patterson Place
- 13** Highland Park
- 6** County
- 6** Sexsmith
- 4** Whispering Ridge
- 2** Clairmont
- 1** Lakeview Estates
- 1** Wedgewood

Areas beyond the City of Grande Prairie borders but within the Region.

THE WORKSHOPS

3.0 About the Workshops

In February 2016, two workshops were hosted to give stakeholders an opportunity to provide additional input. These stakeholders included staff from The City of Grande Prairie, City Councillors, representatives from the Downtown Business Association, local arts and culture organizations and businesses and groups located near the South Montrose Site.

A total of 69 individuals participated in the stakeholder workshops, providing input on the initial design concepts, potential programming for the plaza space and potential uses for the mixed use building.



At the workshops, participants were asked to discuss and provide feedback on the same three questions asked on the online and paper surveys and this feedback is incorporated in the previous section. In addition, they were provided with the opportunity to evaluate each of the three options using a scorecard and discuss each options positive and negative qualities.

The scorecard had participants score components on a scale of 1-5 with 5 being the best:

- Provides good site access
- Provides good views and connections to the Montrose Cultural Centre
- Provides opportunities for flexible plaza programming
- Provides comfort in all seasons
- Provides an interesting mixed use building

In all of above the categories in both workshops, Option C rated the highest.

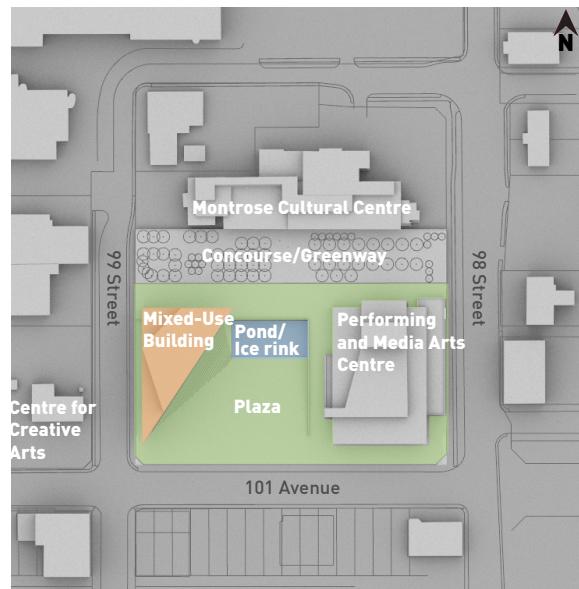
	A	B	C
Provides good site access	2.98	2.97	3.84
Provides good views and connections to the Montrose Cultural Centre	3.00	2.40	4.12
Provides opportunities for flexible plaza programming	3.09	2.87	3.96
Provides comfort in all seasons	3.28	2.56	3.40
Provides an interesting mixed use building	3.19	2.92	3.55

The participants were also asked to note the positive and negative qualities for each.

Option A was seen as inviting, open, and with an easy connection to downtown. The most common arguments against it were the lack of sightline of the Montrose Cultural Centre, natural element concerns like wind and shadows, and concerns about the plaza being near main roads.

Option B was liked for its wind protection and good sightlines of the Montrose Cultural Centre (though the latter was also a common negative). The combination of plaza and mixed use building was seen as positive for the functionality of the building and the flexibility of the plaza. But it was criticized for being closed off and unwelcoming and having lighting issues.

Option C was liked for the sightline of the Montrose Cultural Centre and its access and connectivity to downtown. It was also viewed as safe, open, and protected from the elements. There was one recurring negative, though. and that was the mixed use building. It was criticized primarily for its shape lacking functionality and being more expensive to build.



NEXT STEPS

4.0 Next Steps

The community feedback provided during Phase 2 of the ourMontrose public engagement process will be used by the design team in the development of a final Master Plan for the South Montrose Site.

Phase 3 of the ourMontrose process will include the release of the final Master Plan in May 2016.

Further information is available at cityofgp.com/ourMontrose.

APPENDIX C

our Montrose
“Functional Principles Test”
Layout Options Filtering Process
Phase 2: Public, Administration &
Stakeholder Engagement



Williamson Chong Architects

February 2016

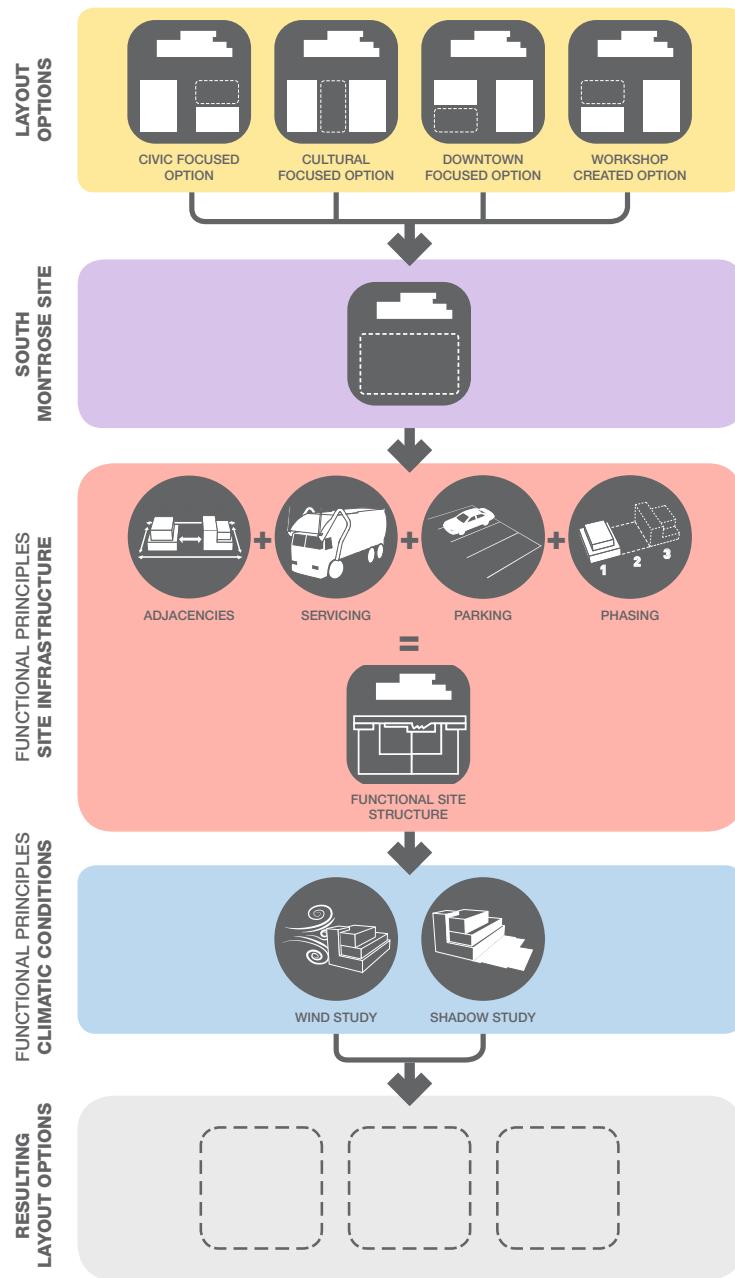
Pages: 48

ourMontrose

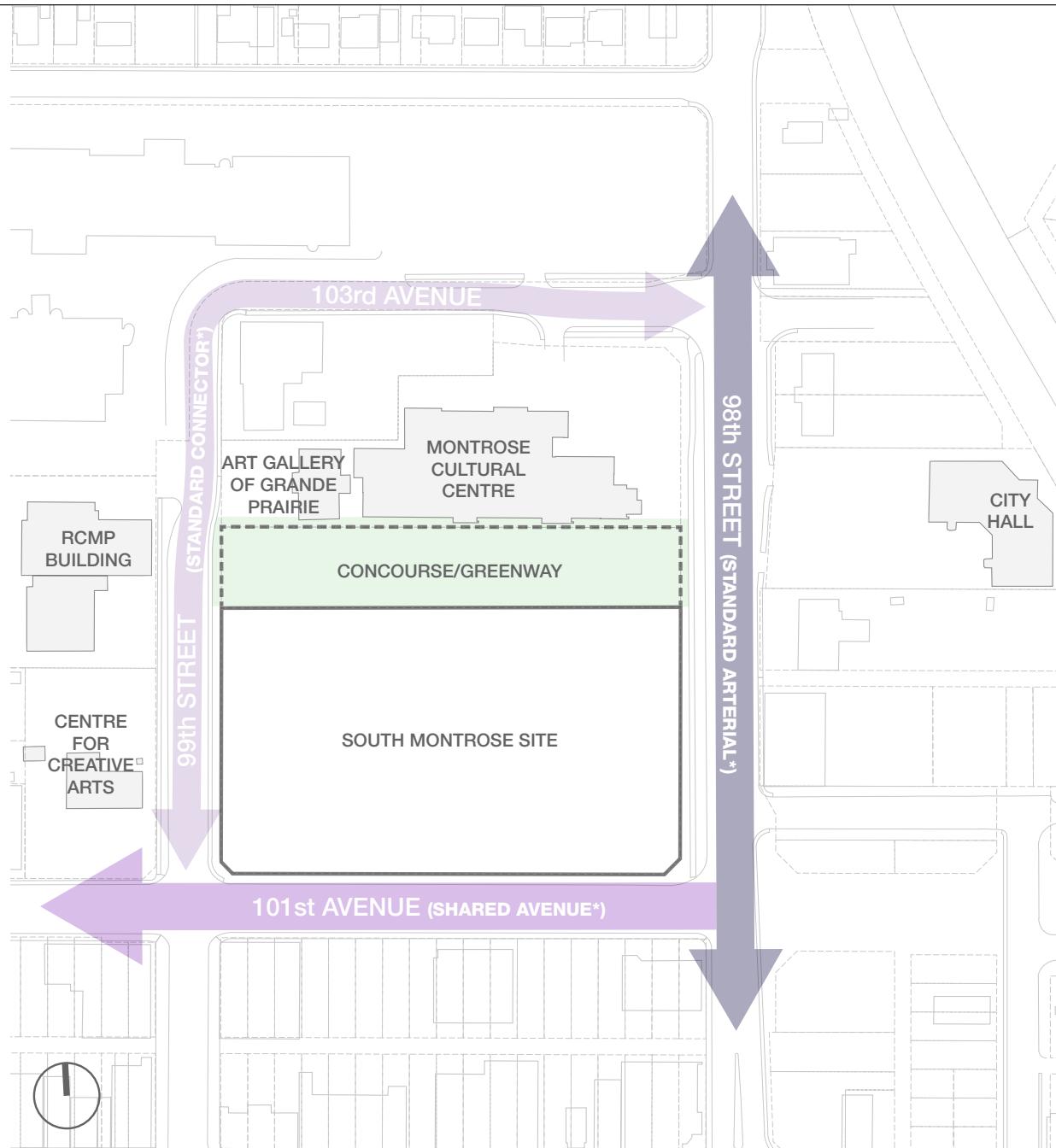
**“FUNCTIONAL PRINCIPLES TEST”
LAYOUT OPTIONS FILTERING PROCESS**

**PHASE 2: PUBLIC, ADMINISTRATION & STAKEHOLDER
ENGAGEMENT**

FEBRUARY 2016



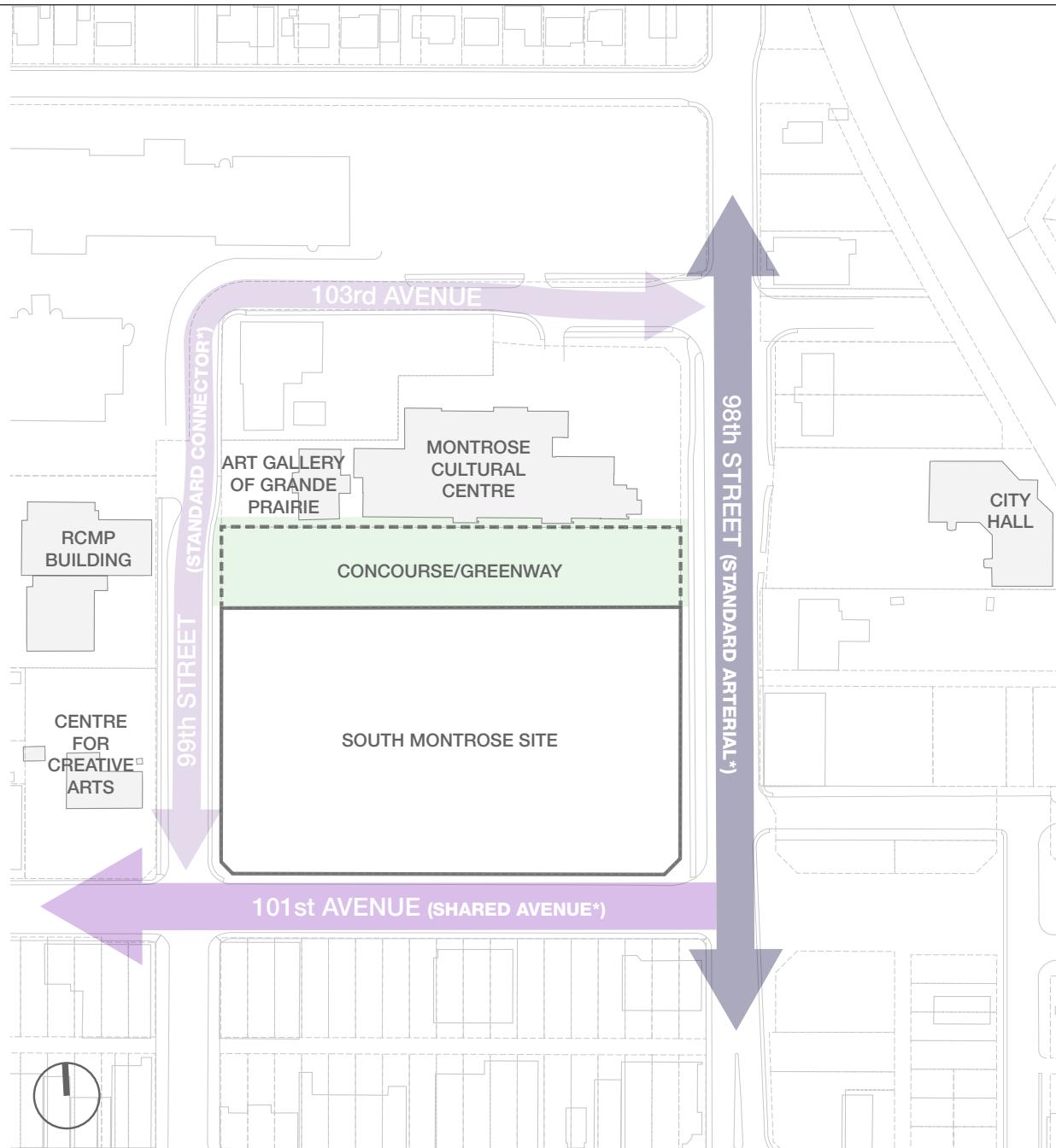
- Layout options presented during the Phase 1 workshop - including the created layout option - will undergo a “test” to filter out the most appropriate options for the South Montrose site and/or reveal new options based on the results
- In order to “test” the layout options, an assessment of the uses and characteristics surrounding the South Montrose will be conducted, and then establish an efficient “Functional Site Infrastructure” scenario based on a set of “Functional Principles”
- These “Functional Principles” - consisting of ‘Site Infrastructure’ and ‘Climatic Conditions’ - were developed from the Phase 1 online engagement and workshop feedback
- Layout options will be overlaid on the “Functional Site Infrastructure” scenario in order to determine which option relates best to the infrastructure conditions
- Layout options will also be tested with respect to wind direction and shadow impacts
- The resulting layout options will be carried forward into the master planning process



ADJACENT BUILDING USES

- North side of South Montrose site:
 - Montrose Cultural Centre
 - Art Gallery of Grande Prairie
 - Approved Concourse/Greenway
- West side of South Montrose site:
 - RCMP Building
 - Centre for Creative Arts
- East side of South Montrose site:
 - City Hall

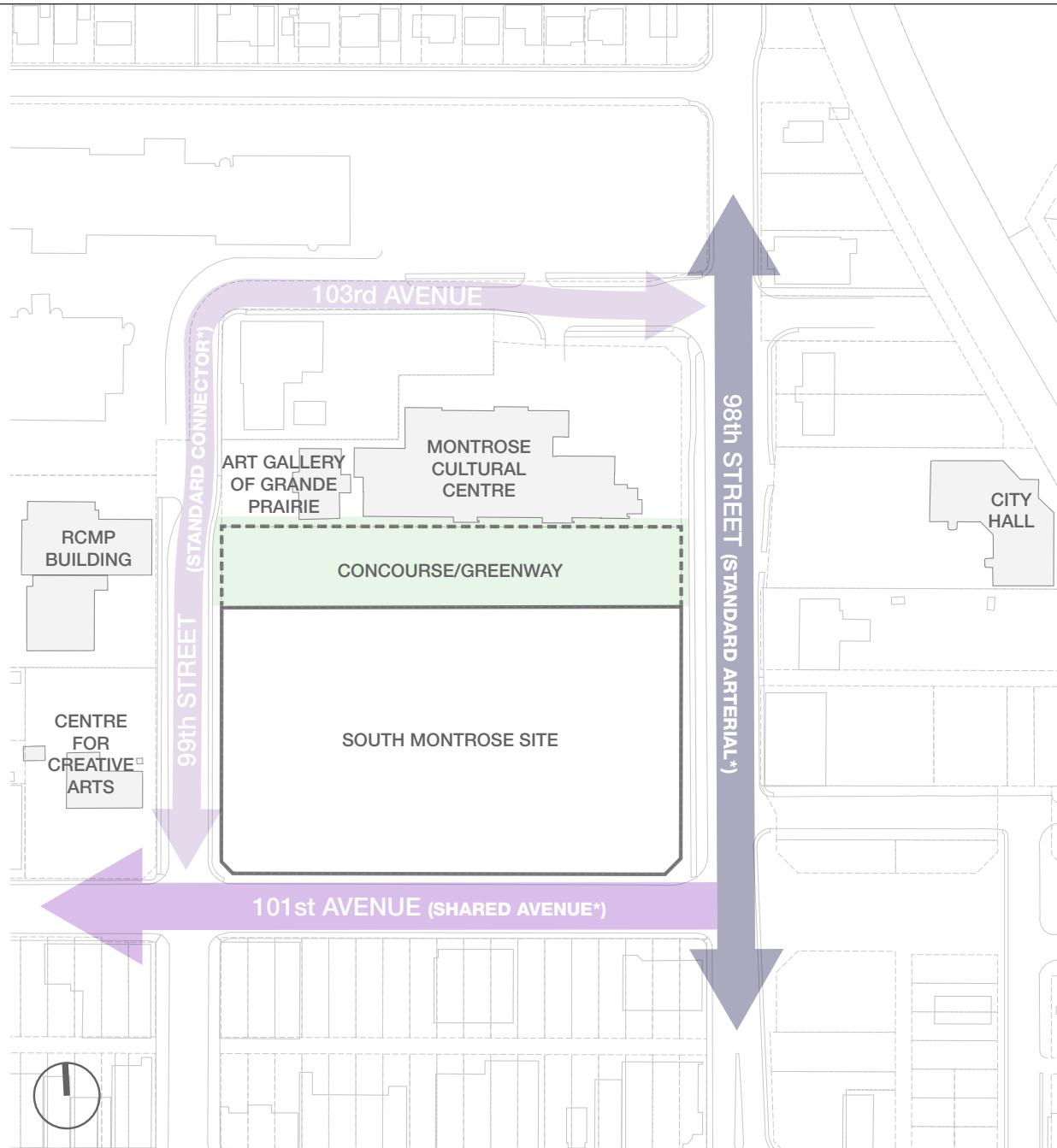
* Street classification based on Downtown Streetscape Enhancement Project



ADJACENT STREETS AND CHARACTERISTICS *:

- Standard Connector (99th Street):
 - ±21.0m to 24.0m Right-of-way
 - One northbound and one southbound vehicular lanes
 - Two lanes of standard on-street parking
 - Drive lanes reduced in size from 3.70m to 3.50m
- Standard Arterial (98th Street):
 - ±25.0m Right-of-way
 - Two northbound and two southbound vehicular lane
 - No on-street parking
 - Drive lanes reduced in size from 3.70m to 3.50m

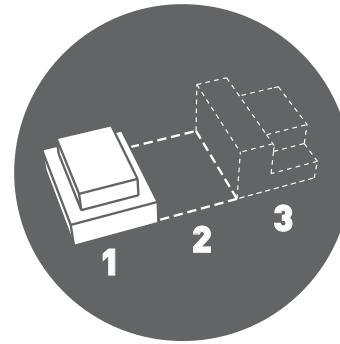
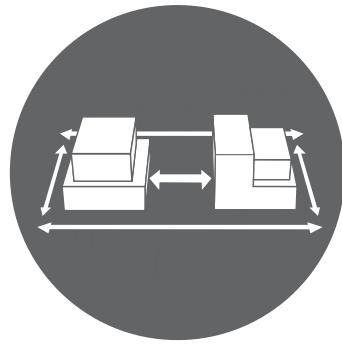
* Street classification and characteristics based on Downtown Streetscape Enhancement Project



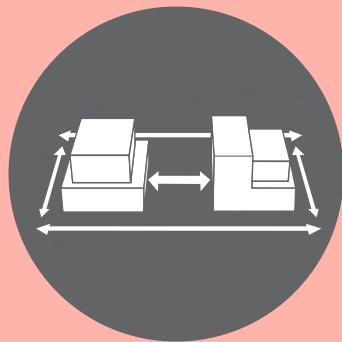
- Shared Avenue (101st Avenue)
 - ±20.0m Right-of-way
 - Maintain two-way vehicular lanes and two parking lanes on either side
 - Driveway lanes can be reduced in size from 3.70m to 3.50m
 - On-street parking separated by flush curb with paving treatment from building facade to building facade
 - Continuous trench drain and bollards delineates pedestrian and vehicular zones

* Street classification and characteristics based on Downtown Streetscape Enhancement Project

FUNCTIONAL PRINCIPLES: SITE INFRASTRUCTURE



SITE INFRASTRUCTURE



ADJACENCIES

- Assess the important views and potential service entry locations with respect to the surrounding uses



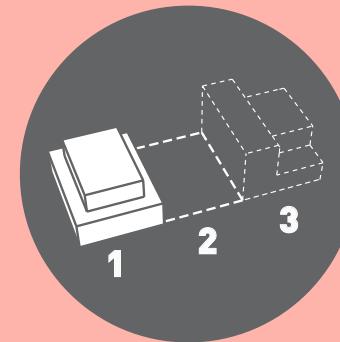
SERVICING

- Assess several scenarios with respect to entry points, servicing form and loading design options



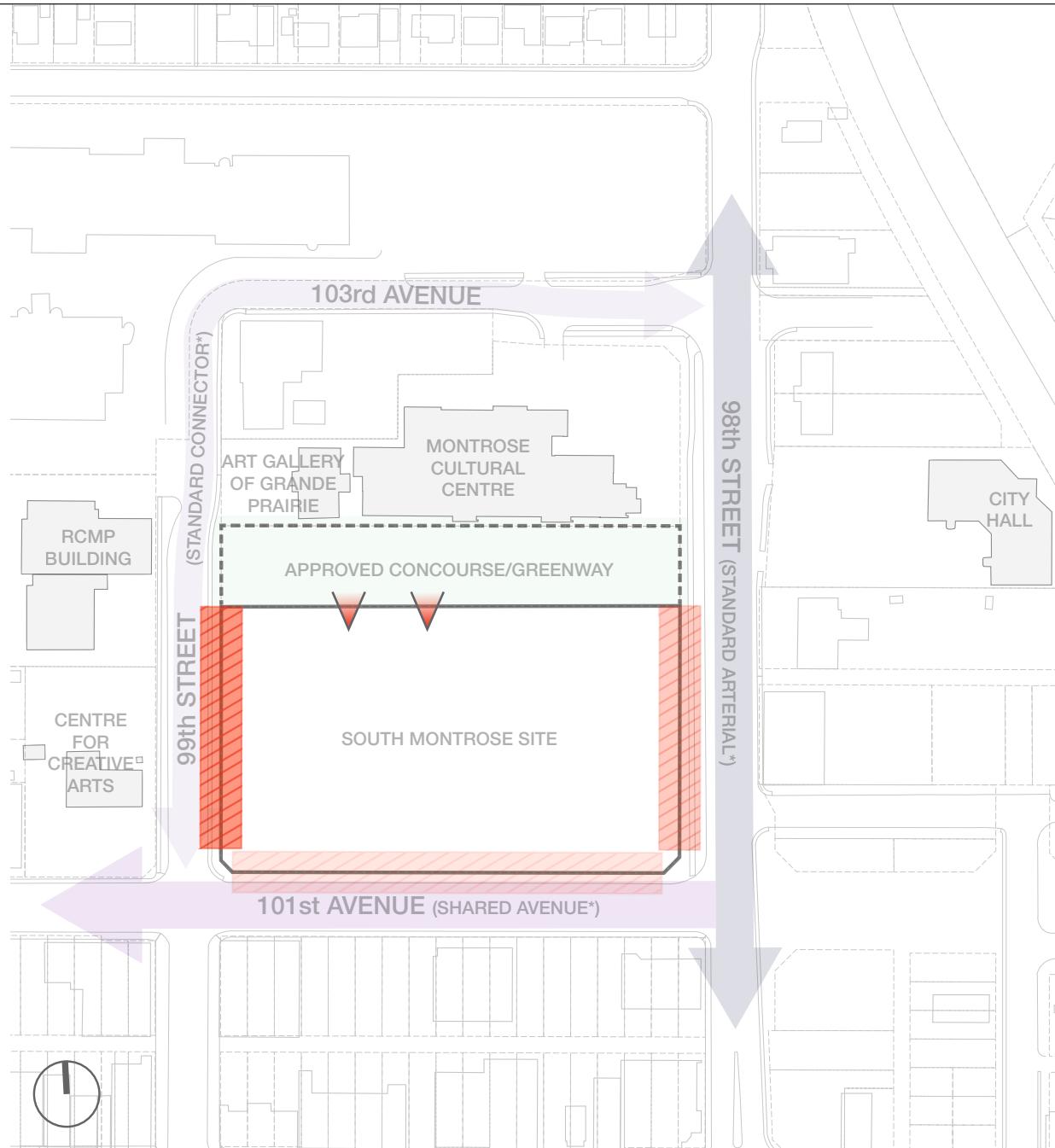
PARKING

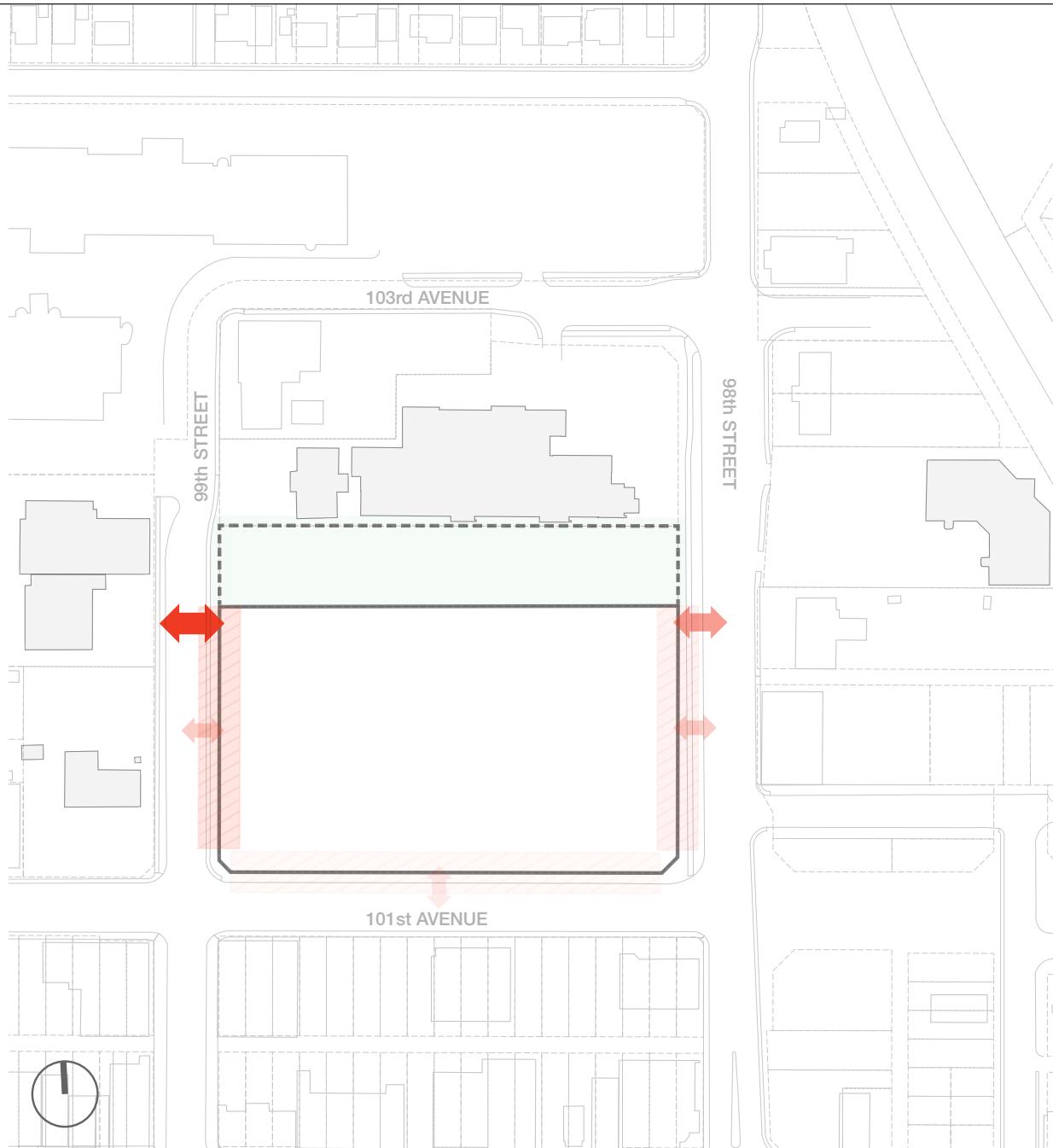
- Discuss potential underground parking scenarios and resulting parking yields



PHASING

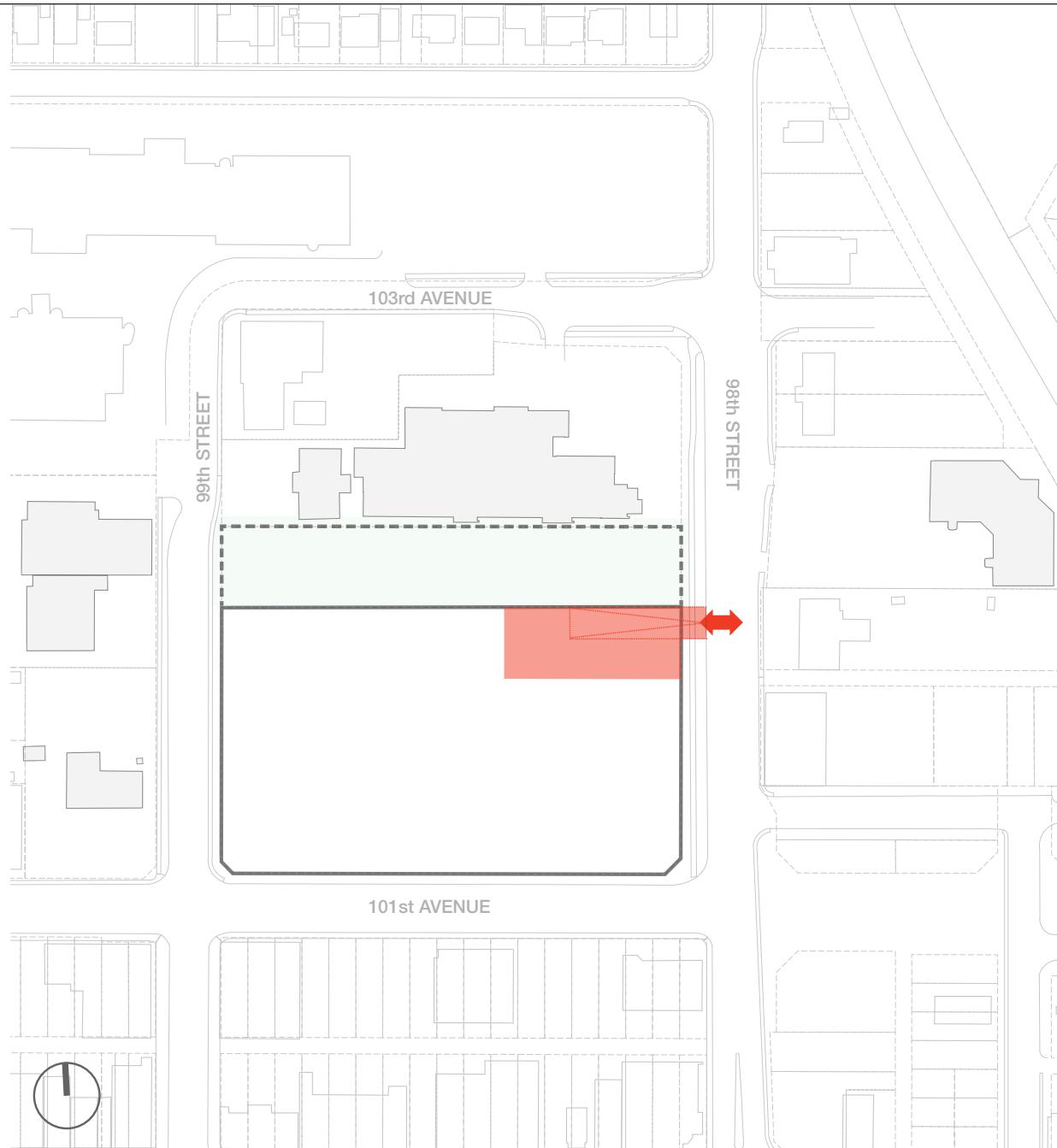
- Discuss the build-out phase of the site programming elements in relation to the infrastructure layout



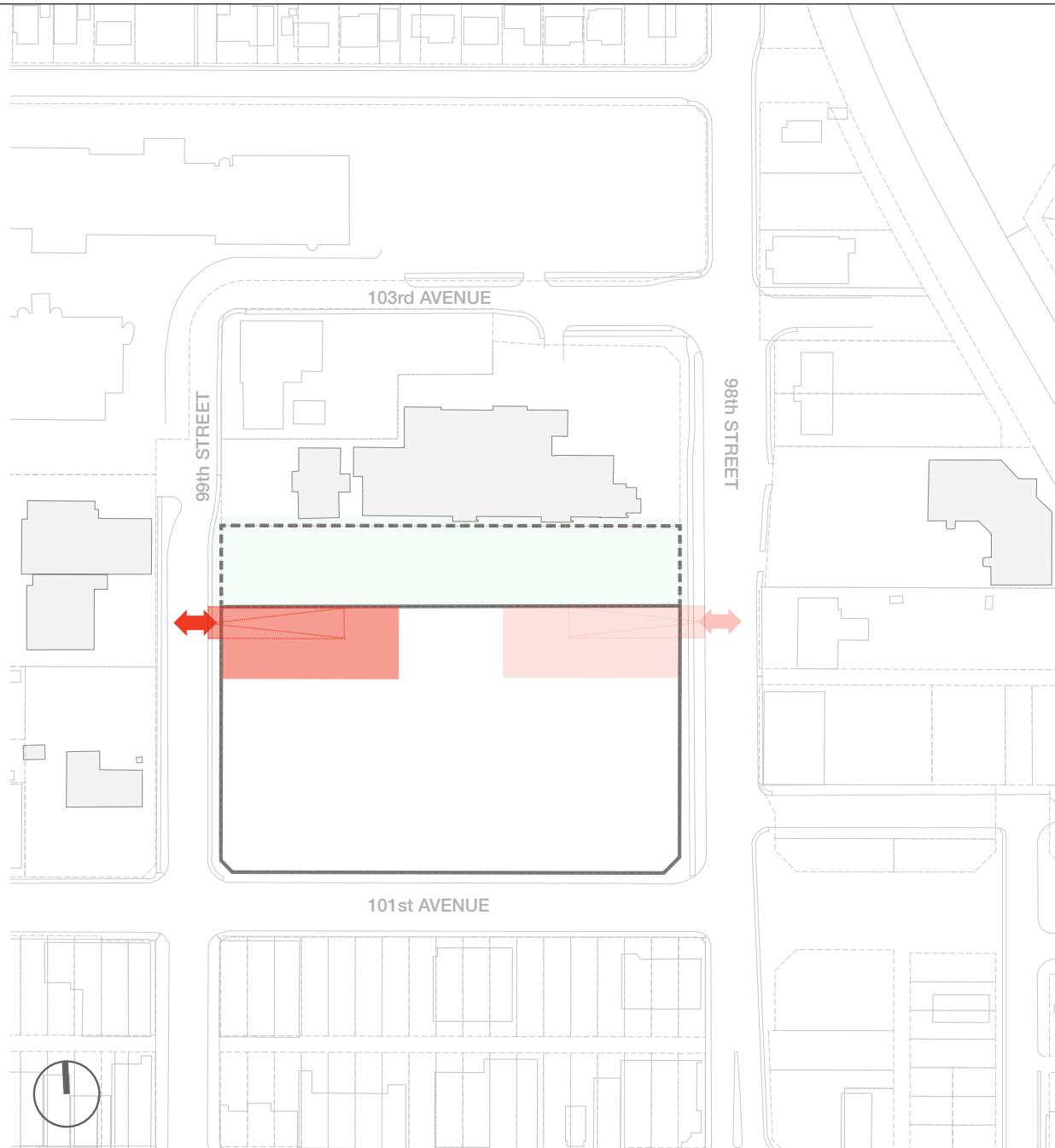


SERVICE ENTRY LOCATION

- ↔ □ Mid-site service entry along 101st Avenue is not desirable as it conflicts with the potential use of the Shared Avenue (101st Avenue) as extended public space
- ↔ □ Mid-site service entry along 98th or 99th Street is not desirable as it bisects the overall site, reducing the overall utilization of an efficient site infrastructure layout
- ↔ □ Service entry adjacent to the approved Concourse/Greenway on 98th Street is less desirable due to truck loading and the potential traffic conflicts of being along a north-south arterial
- ↔ □ Service entry adjacent to the approved Concourse/Greenway along 99th Street is most desirable as it provides thorough in/out manoeuvrability of a service vehicle without impacting major traffic, as well as full utilization of the site for an efficient site infrastructure layout

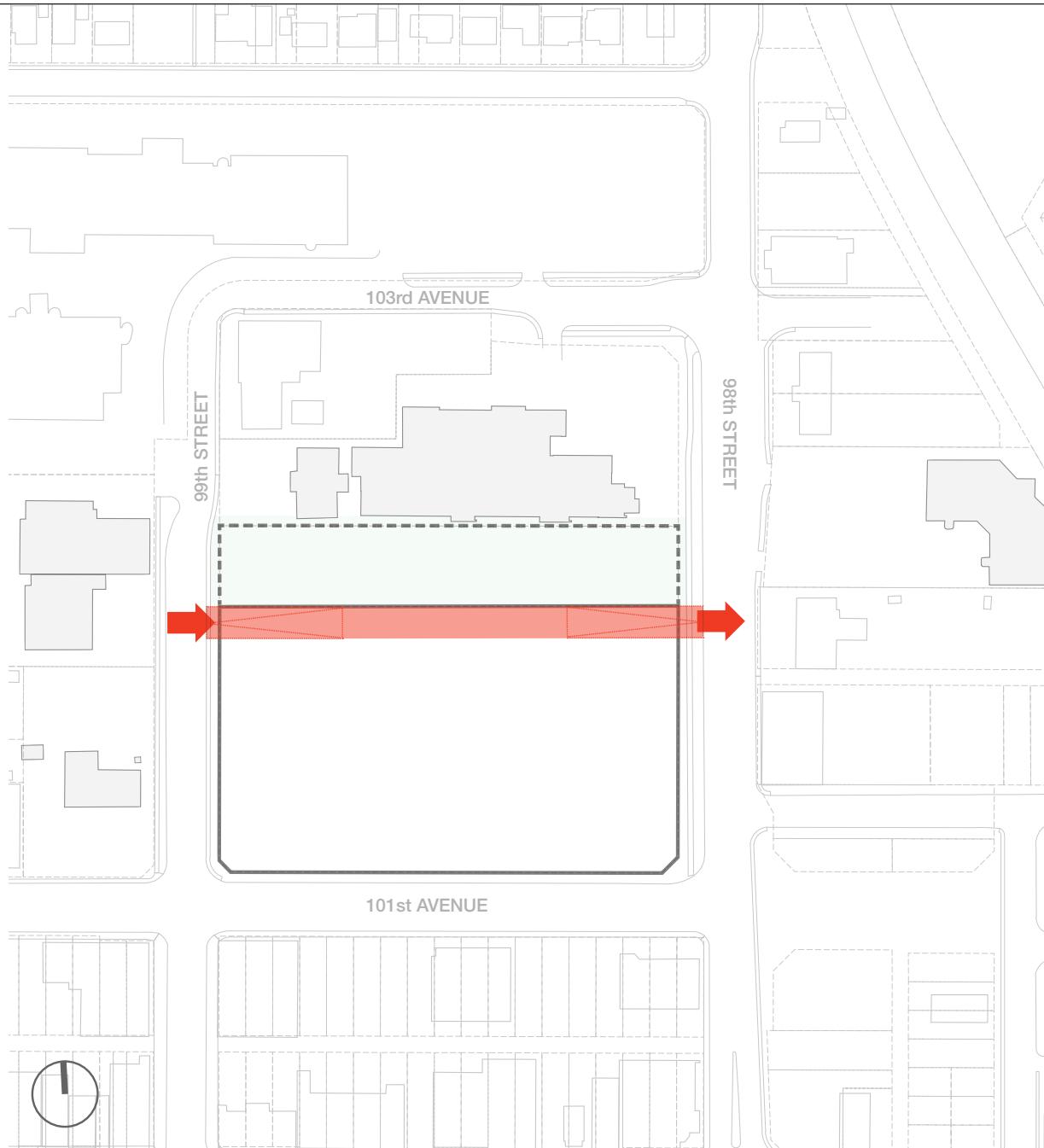
**SERVICE AREA WITH ENTRY AT GRADE**

- Separated service area with entry at grade - adjacent to the Concourse/Greenway, with access on 98th Street - is less desirable as it exposes the service entry on the surface and only caters to the building use on the side it is located



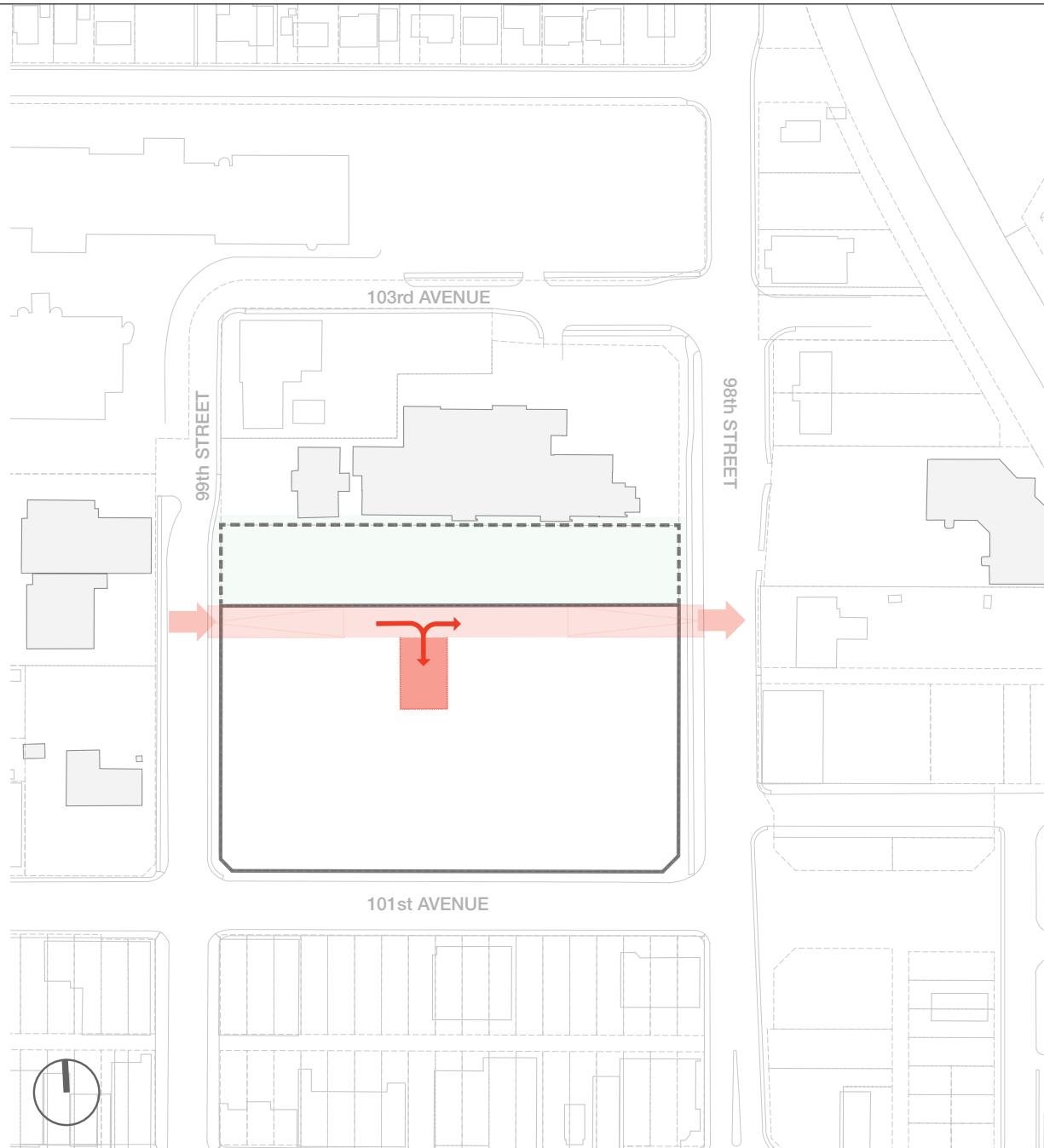
SERVICE AREA WITH ENTRY AT GRADE

- Separated service area with entry at grade - adjacent to the Concourse/Greenway, with access on 99th Street - is less desirable as it exposes the service entry on the surface and only caters to the building use on the side it is located
- Subsequent separated servicing area at later phases reduces the sub-surface infrastructure area potential for other amenities (i.e. parking)



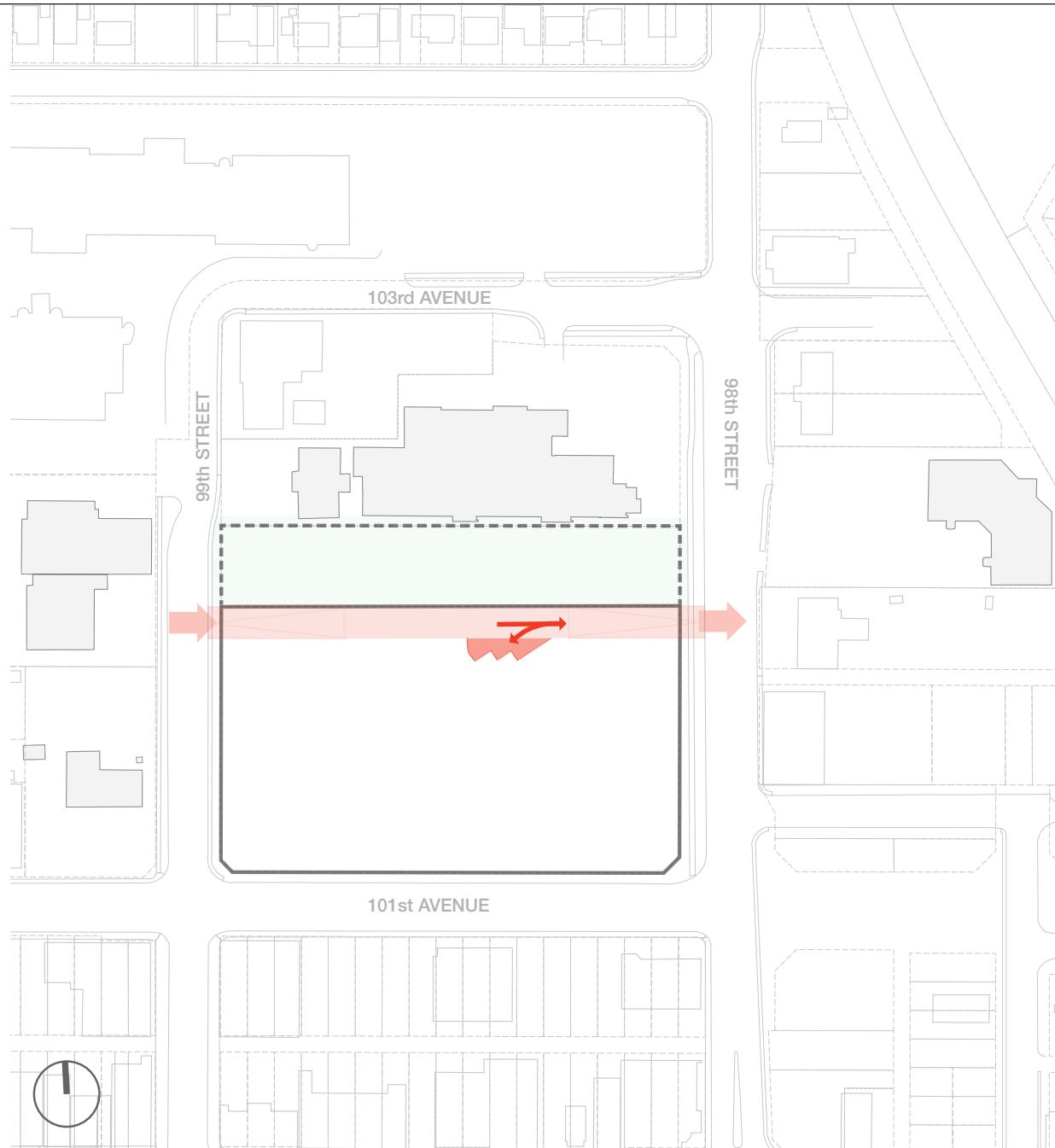
SERVICE CHANNEL

- Sub-surface service channel running east-west along the Concourse/Greenway is most desirable as it creates a “clothes line effect” of being able to service multiple elements at first build, and future phases
- It fully utilizes the site by providing ample room for sub-surface amenities such as underground parking and other site infrastructure elements
- A one-way, east-west service channel provides an efficient travel route and encompasses less area
- Having the service channel underground will not visually impact the adjacent Concourse/Greenway
- Sub-surface service channel allows for more building faces to be active



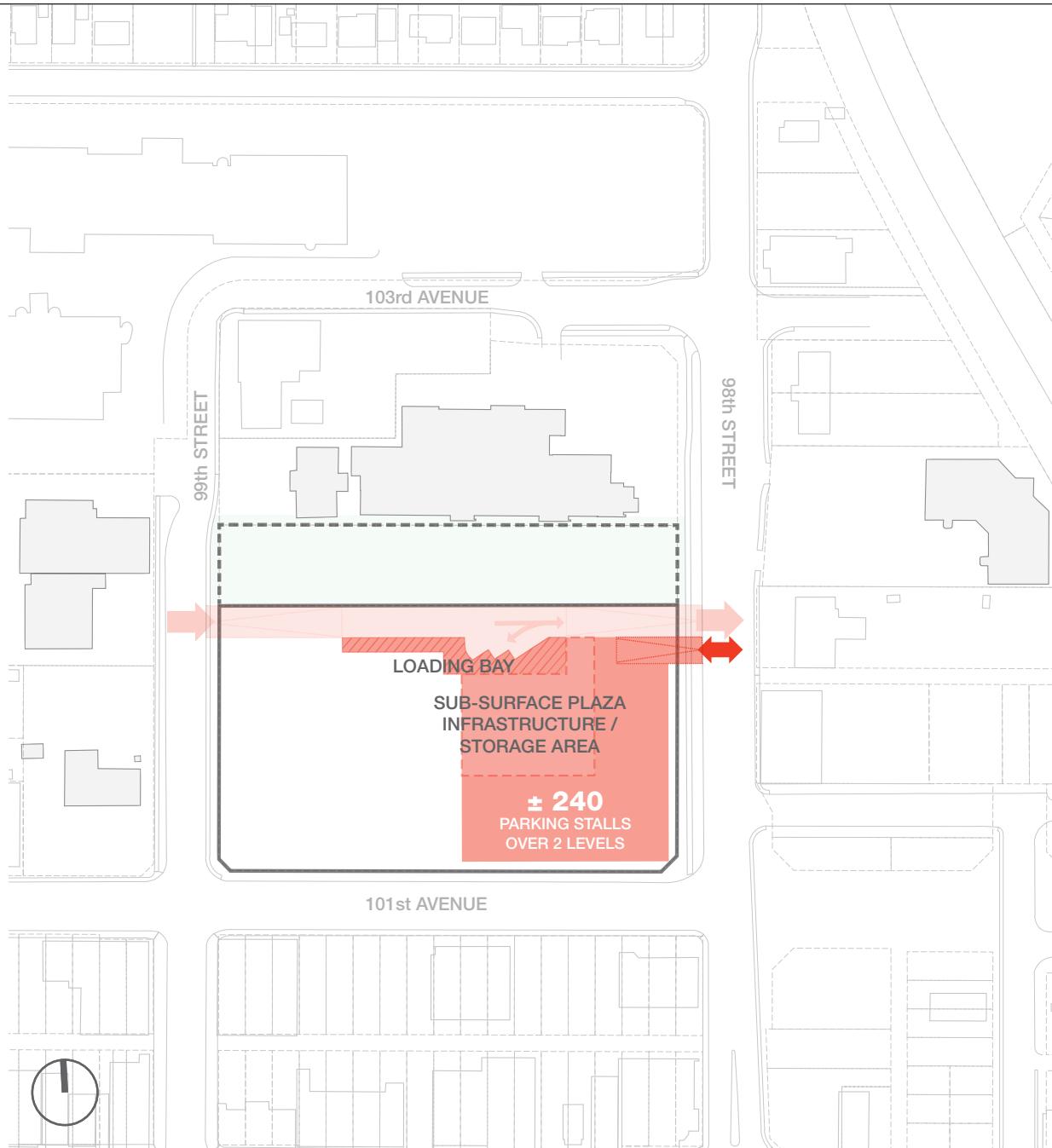
SERVICE LOADING DESIGN

- Perpendicular loading design is least desirable as it will need to encompass a larger turning radius and overall apron for service vehicle manoeuvrability and stationing



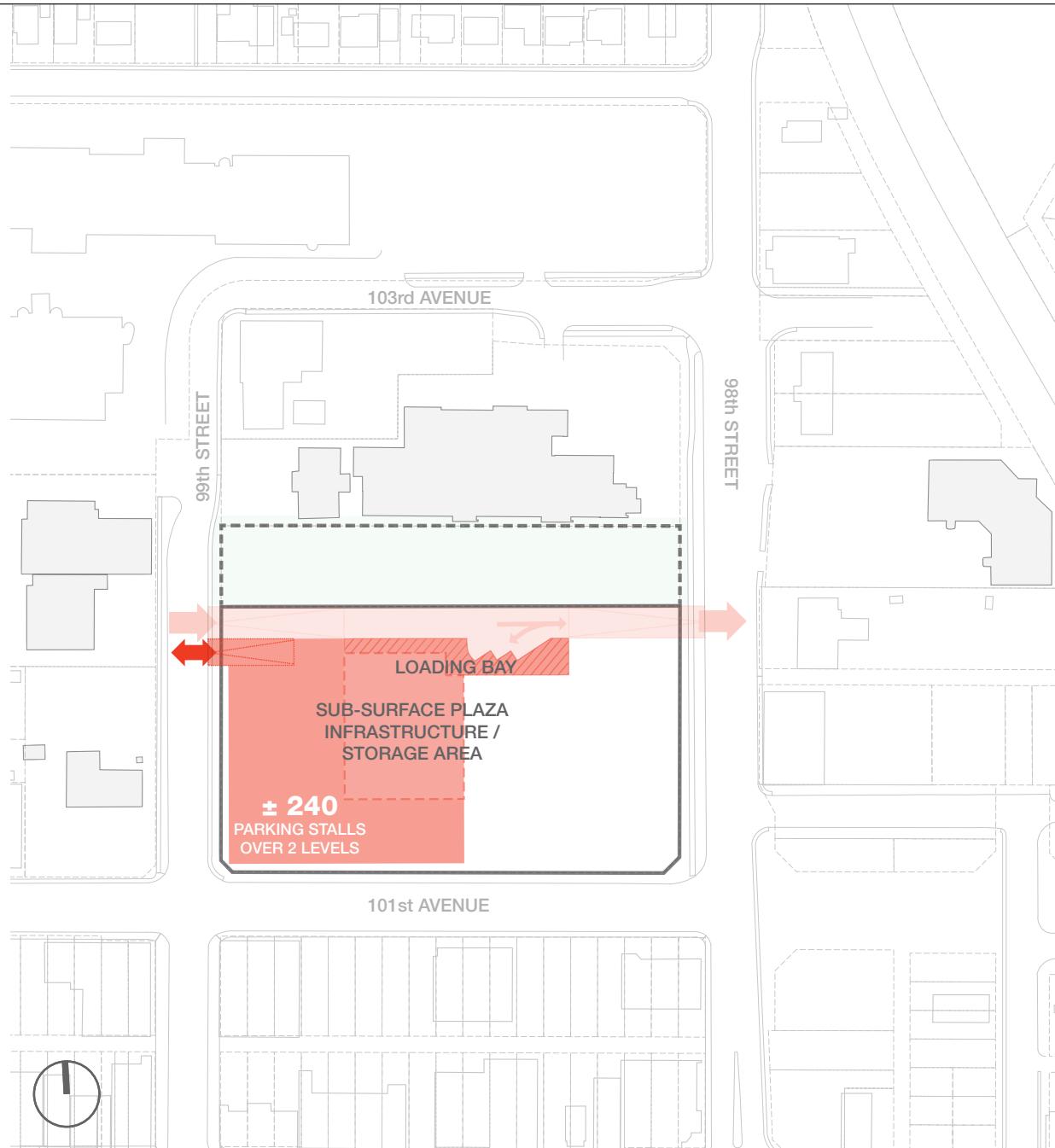
SERVICE LOADING DESIGN

- Saw-tooth loading design is most desirable as it requires less apron space and minimizes large turning radii for service vehicles



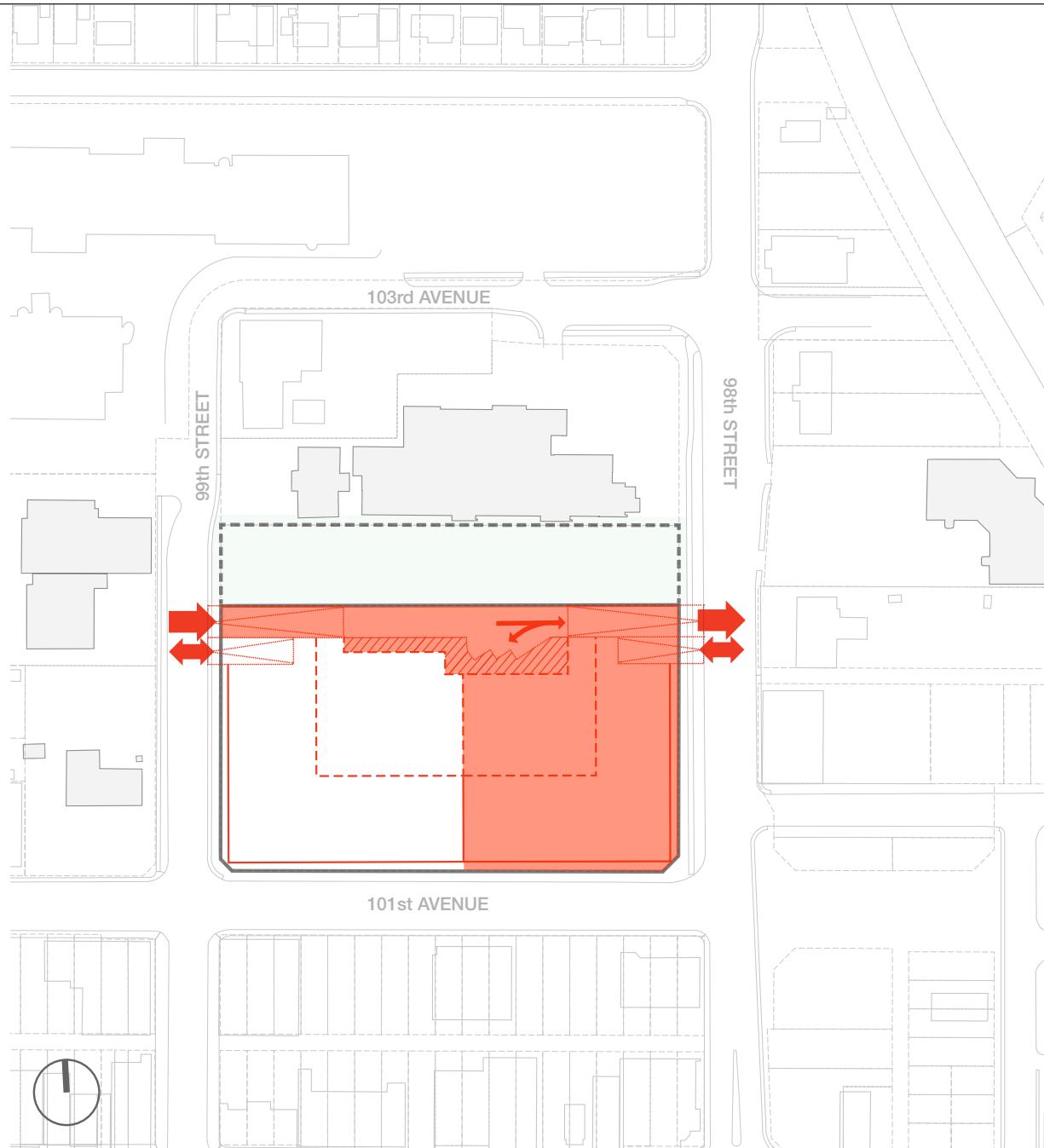
98th STREET UNDERGROUND PARKING ACCESS

- In/out vehicular access for underground parking on 98th Street
- Underground parking area yields \pm 240 stalls over two levels (\pm 120 stalls per level)
- Parking area efficiently located to accommodate at grade building location
- Underground parking location can easily be incorporated into a phased build-out



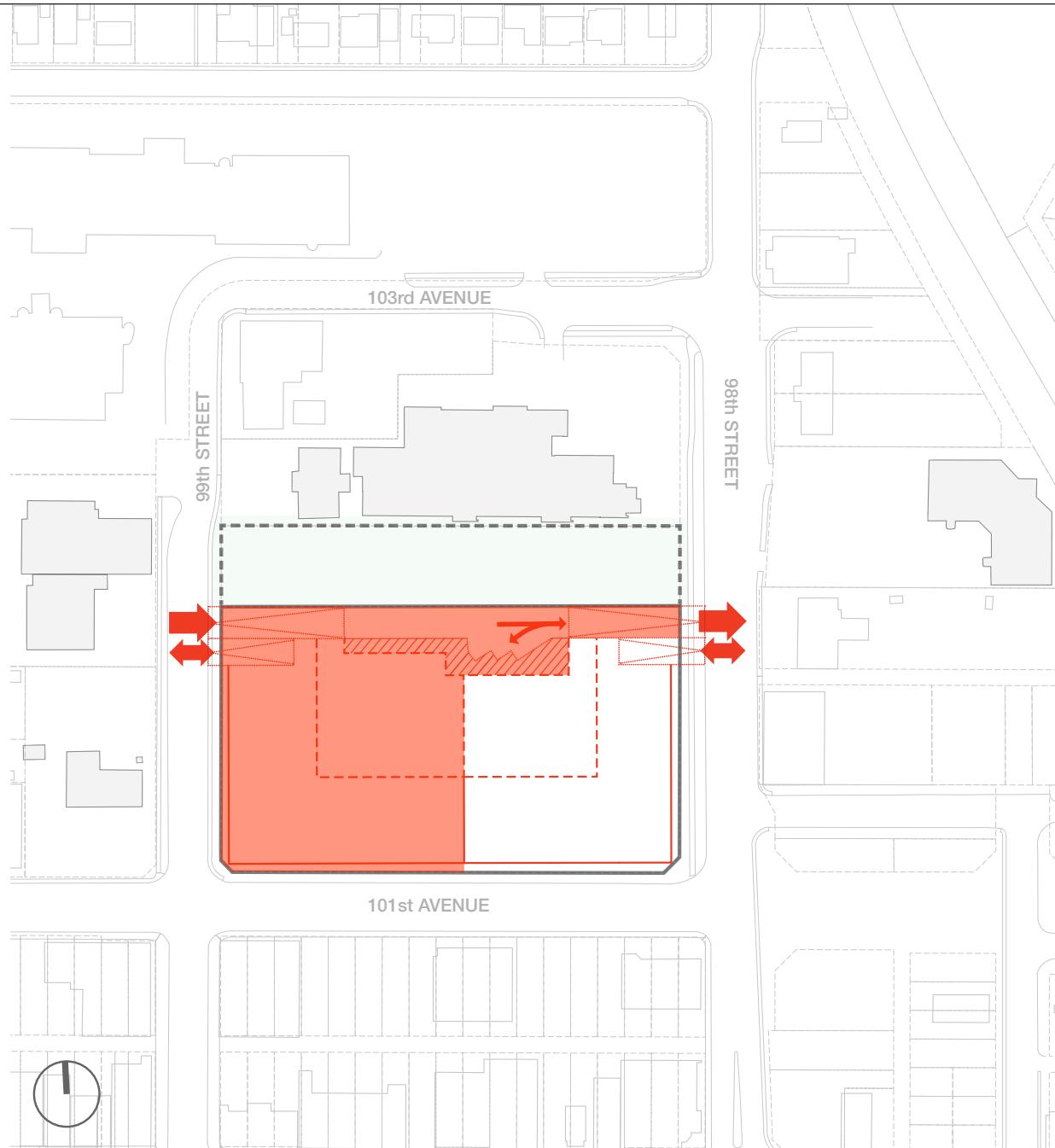
99th STREET UNDERGROUND PARKING ACCESS

- In/out vehicular access for underground parking on 99th Street
- Layout mirrors that of the 98th underground parking access
- Underground parking area yields ± 240 stalls over two levels (± 120 stalls per level)
- Parking area efficiently located to accommodate at grade building location
- Underground parking location can easily be incorporated into phase build-out



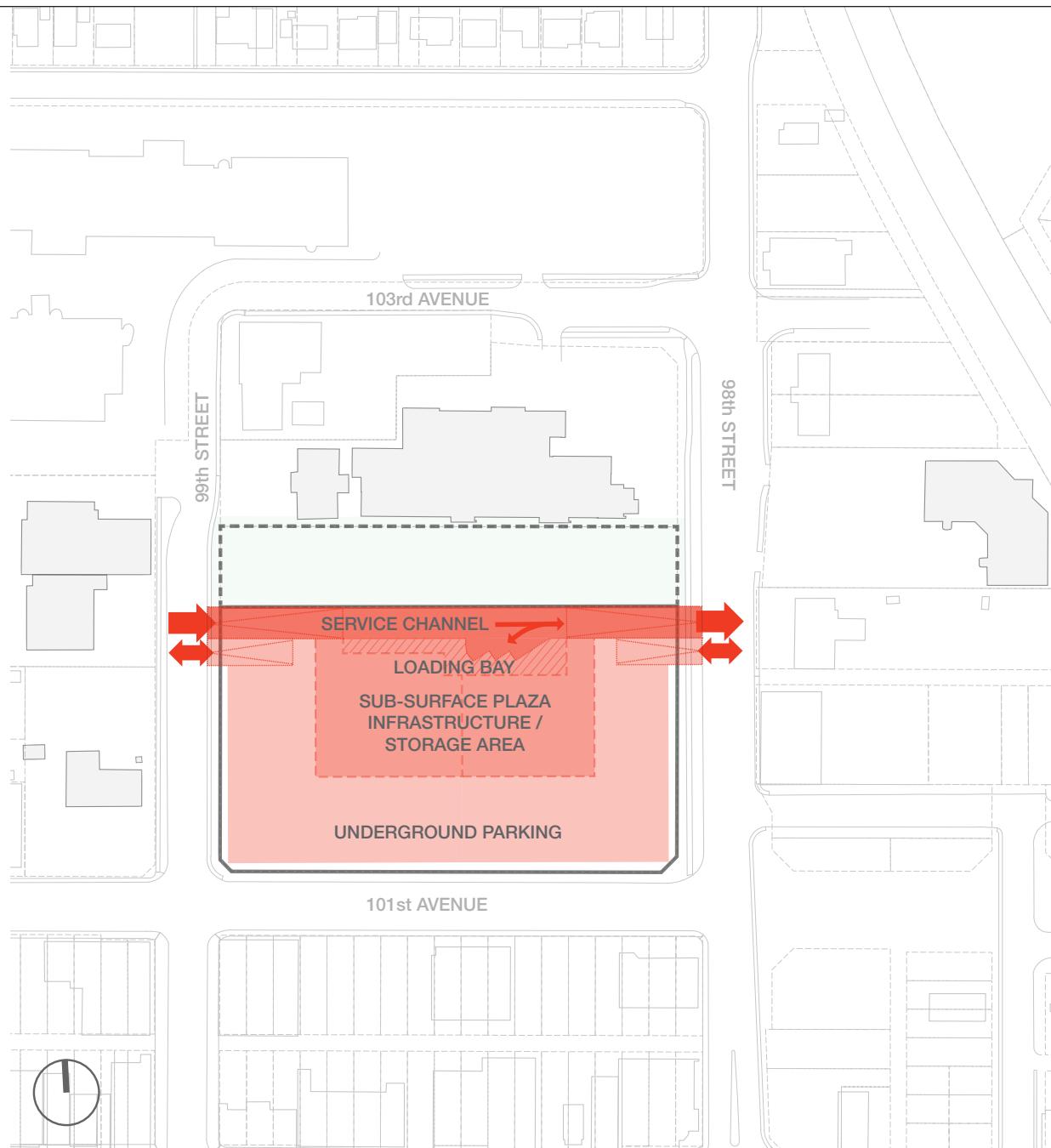
FIRST PHASE ON 98th STREET

- Resulting site infrastructure layout suggests either the Performing and Media Arts Centre or mixed-use building could be built first on the site, but the first building must be accompanied by the public plaza



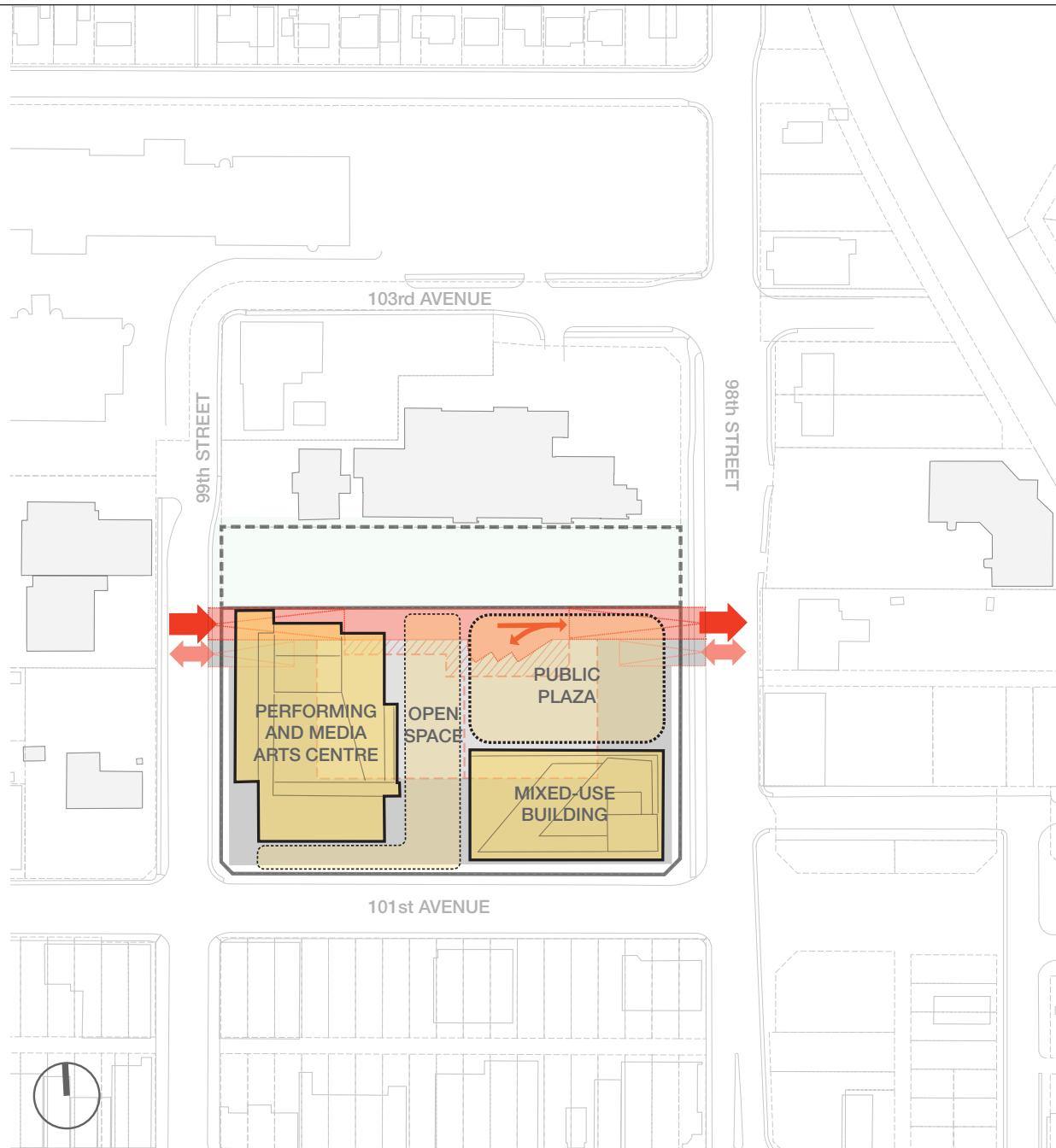
FIRST PHASE ON 99th STREET

- Resulting site infrastructure layout suggests either the Performing and Media Arts Centre or mixed-use building could be built first on the site, but the first building must be accompanied by the public plaza



- Sub-surface service channel running east-west along the Concourse/Greenway creates a “clothes line effect” where multiple at grade and sub-surface elements can connect to the channel
- Sub-surface plaza infrastructure/storage area and underground parking layout mirrored on either side allows for a flexible phased build-out at grade, with the potential for either building to be constructed in the first phase

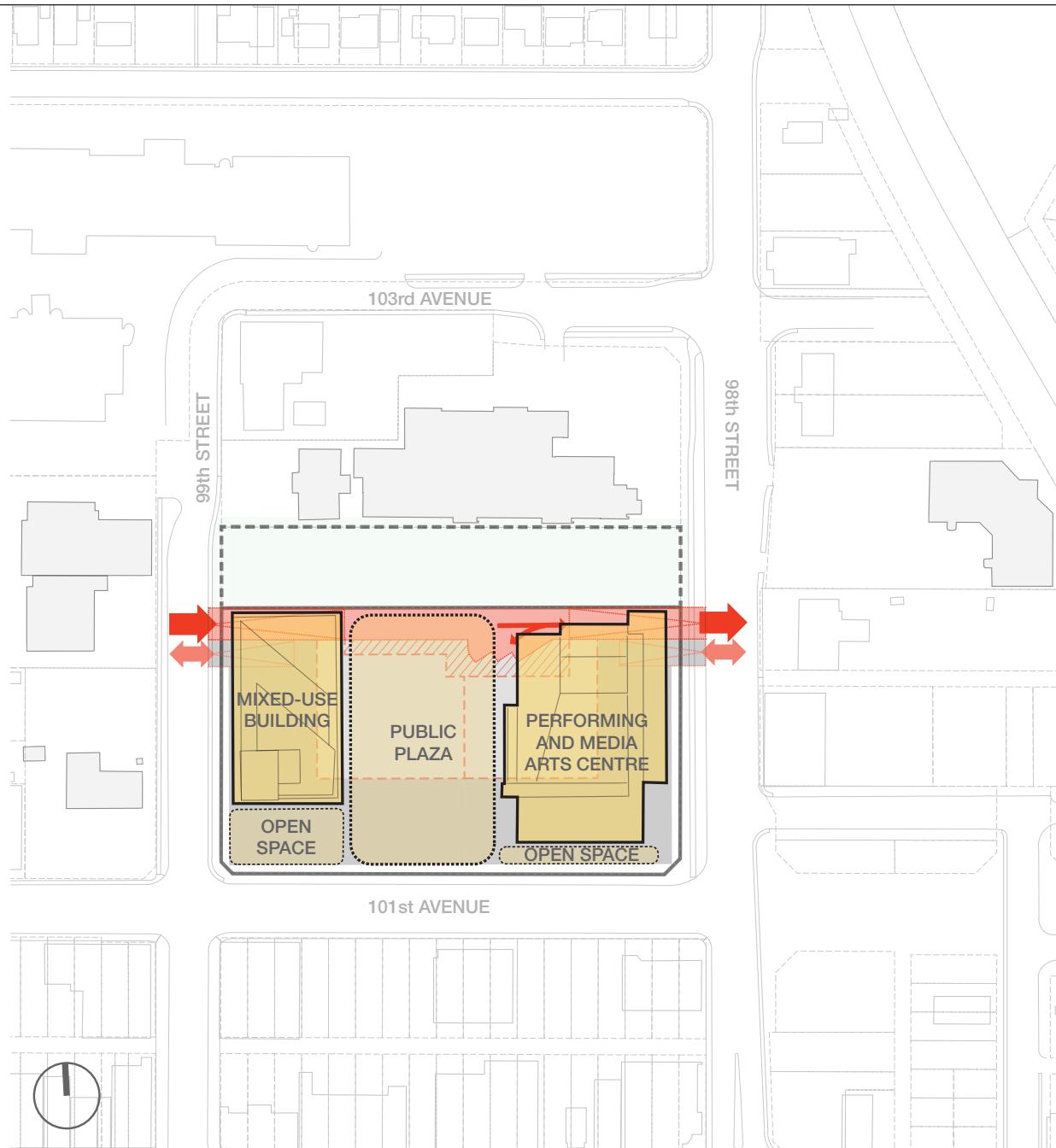
LAYOUT OPTIONS OVERLAY



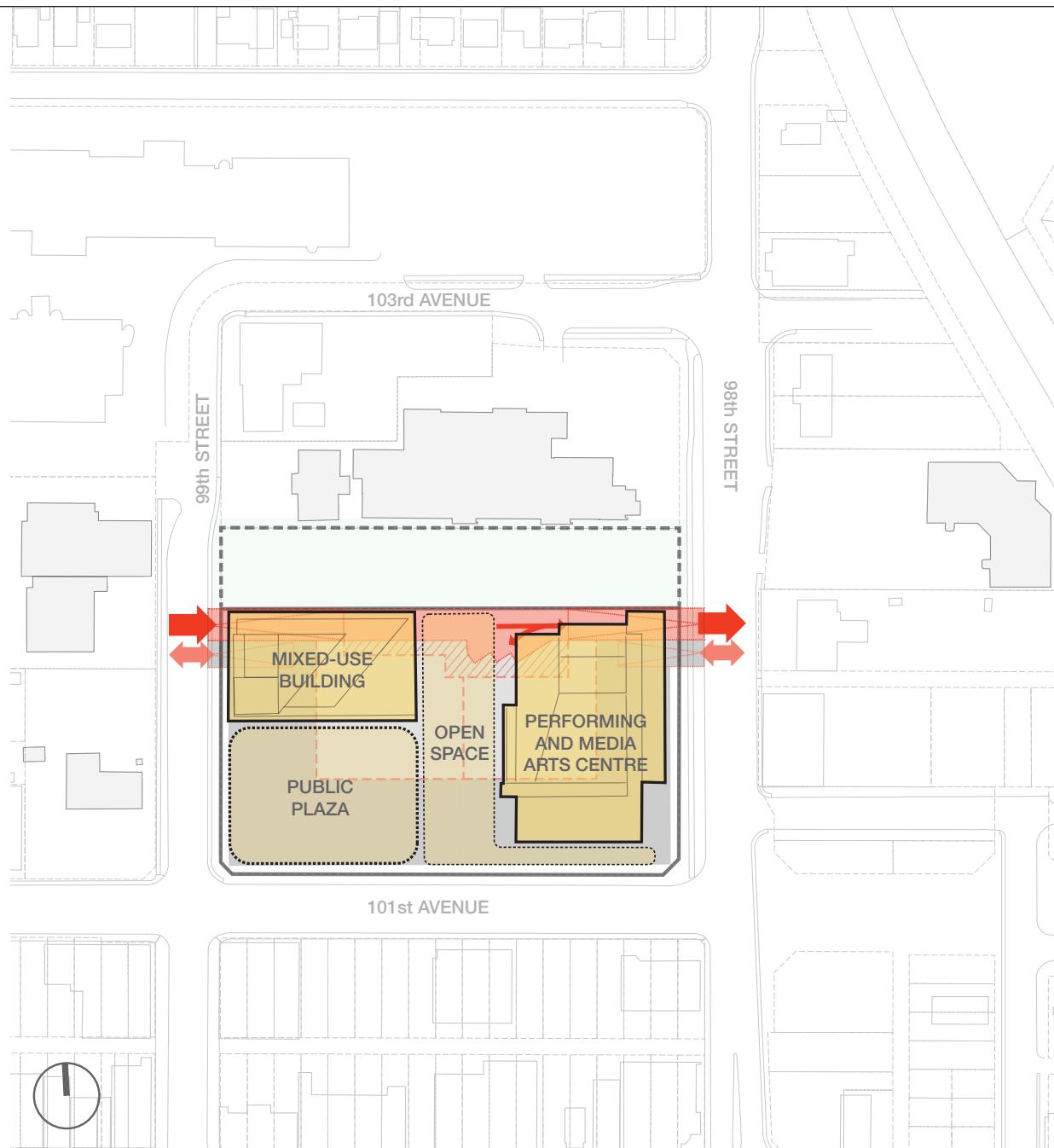
- Performing and Media Arts Centre (PMAC) located along sub-surface service channel - which allows for direct servicing access
- Sub-surface service channel entry and underground parking entry/exit on 99th Street is functional for the PMAC building - eliminates the visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into the building
- Mixed-use building location is not functional with the sub-surface service channel as it will need a secondary connection from the channel
- Sub-surface service channel exit and underground parking entry/exit on 98th Street impacts the public plaza as they would be visible on the surface
- Public plaza not located centrally above the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)

LAYOUT OPTIONS OVERLAY

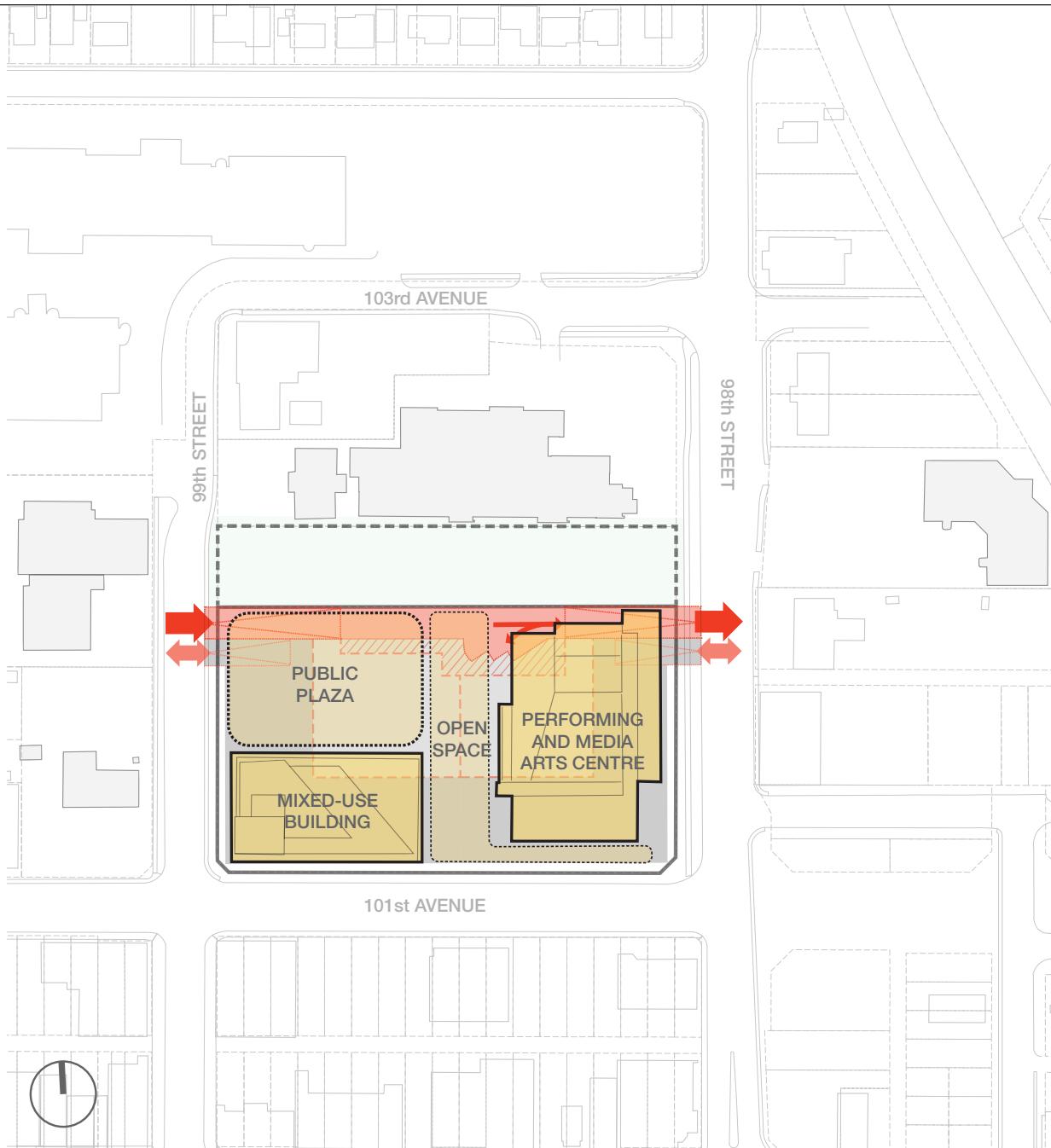
CULTURAL FOCUSED OPTION



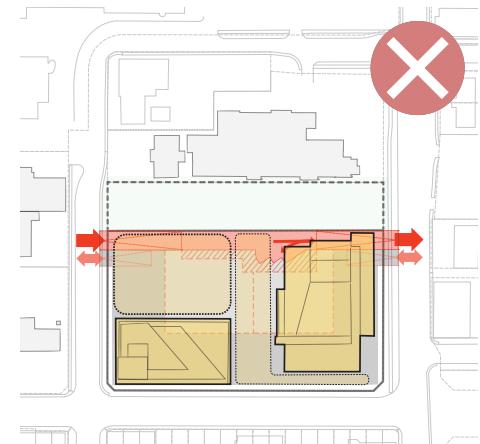
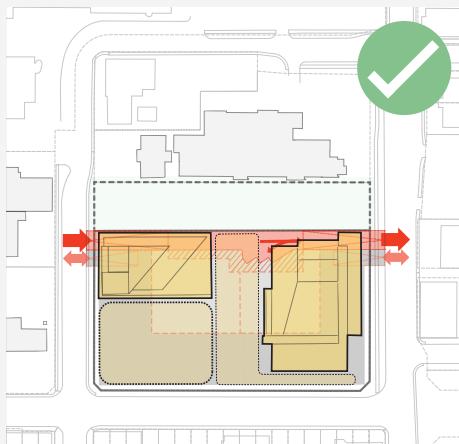
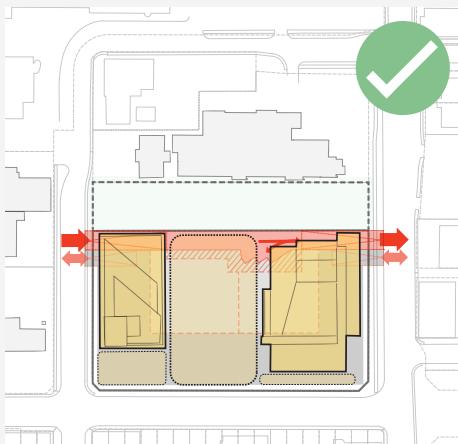
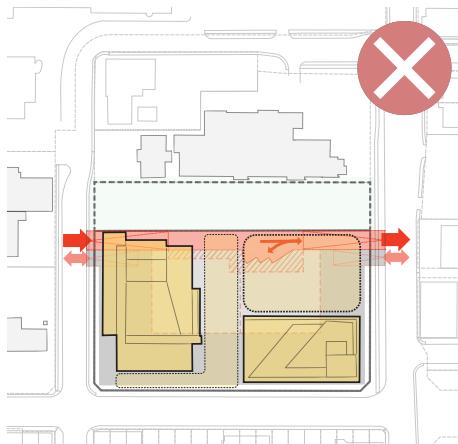
- Performing and Media Arts Centre (PMAC) and mixed-use building located along sub-surface service channel - which allows for direct servicing access
- Sub-surface service channel entry/exit is functional for both the mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- Underground parking entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- Centre of public plaza relatively encompasses the sub-surface plaza infrastructure area - which allows for more flexibility when arranging certain landscape elements (i.e. water features)



- Performing and Media Arts Centre (PMAC) and mixed-use building located along sub-surface service channel - which allows for direct servicing access
- Sub-surface service channel entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- Underground parking entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- Public plaza not located centrally above, and encompasses a small portion of the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)



- Performing and Media Arts Centre (PMAC) located along sub-surface service channel - which allows for direct servicing access
- Sub-surface service channel exit and underground parking entry/exit on 98th Street is functional for the PMAC building - eliminates the visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into the building
- Public plaza not located centrally above the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)
- Mixed-use building location is not functional with the sub-surface service channel as it will need a secondary connection from the channel
- Sub-surface service channel entry and underground parking entry/exit on 99th Street impacts the public plaza as they would be visible on the surface



CIVIC FOCUSED OPTION

- ✓ Performing and Media Arts Centre (PMAC) located along sub-surface service channel - which allows for direct servicing access
- ✓ Sub-surface service channel entry and underground parking entry/exit on 99th Street is functional for the PMAC building - eliminates the visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into the building
- ✗ Mixed-use building location is not functional with the sub-surface service channel as it will need a secondary connection from the channel
- ✗ Sub-surface service channel exit and underground parking entry/exit on 98th Street impacts the public plaza as they would be visible on the surface
- ✗ Public plaza not located centrally above the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)



CULTURAL FOCUSED OPTION

- ✓ Performing and Media Arts Centre (PMAC) and mixed-use building located along sub-surface service channel - which allows for direct servicing access
- ✓ Sub-surface service channel entry/exit is functional for both the mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- ✓ Underground parking entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- ✓ Centre of public plaza relatively encompasses the sub-surface plaza infrastructure area - which allows for more flexibility when arranging certain landscape elements (i.e. water features)



DOWNTOWN FOCUSED OPTION

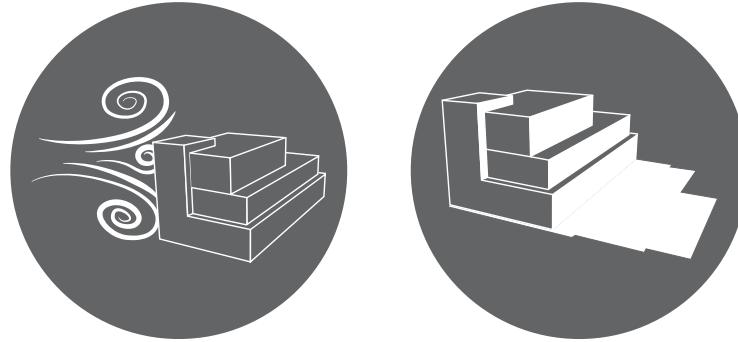
- ✓ Performing and Media Arts Centre (PMAC) and mixed-use building located along sub-surface service channel - which allows for direct servicing access
- ✓ Sub-surface service channel entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- ✓ Underground parking entry/exit is functional for both mixed-use building and PMAC - eliminates visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into each building
- ✗ Public plaza not located centrally above, and encompasses a small portion of the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)



WORKSHOP CREATED OPTION

- ✓ Performing and Media Arts Centre (PMAC) located along sub-surface service channel - which allows for direct servicing access
- ✓ Sub-surface service channel exit and underground parking entry/exit on 98th Street is functional for the PMAC building - eliminates the visual impacts onto the Concourse/Greenway and potential open space as it can be integrated into the building
- ✗ Public plaza not located centrally above the sub-surface plaza infrastructure area which limits the arrangement of certain landscape elements (i.e. water features)
- ✗ Mixed-use building location is not functional with the sub-surface service channel as it will need a secondary connection from the channel
- ✗ Sub-surface service channel entry and underground parking entry/exit on 99th Street impacts the public plaza as they would be visible on the surface

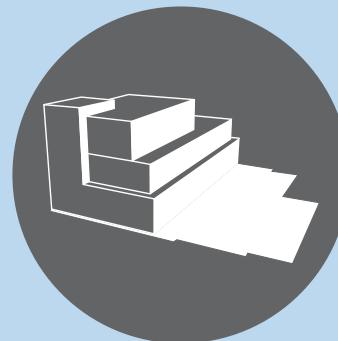
FUNCTIONAL PRINCIPLES: CLIMATIC CONDITIONS



CLIMATIC
CONDITIONS

WIND STUDY

- Assess the impacts of wind direction on the public plaza and open space



SHADOW STUDY

- Assess the impacts of shadows on the public plaza and open space

Dominant Wind Direction *

↗ Jan
↖ Feb
↗ Mar

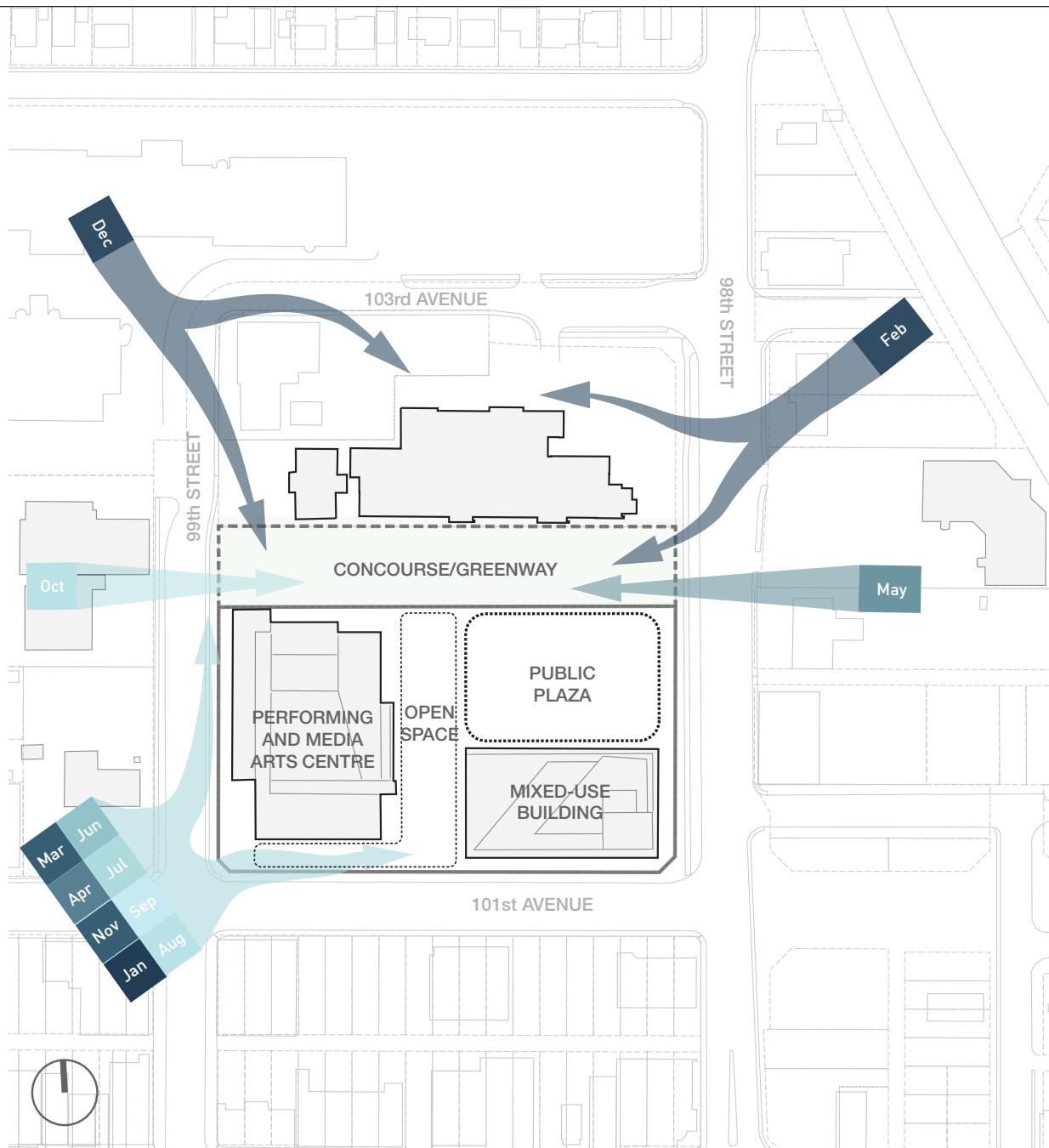
↗ Apr
↖ May
↗ Jun

↑ Jul
↑ Aug
↑ Sep

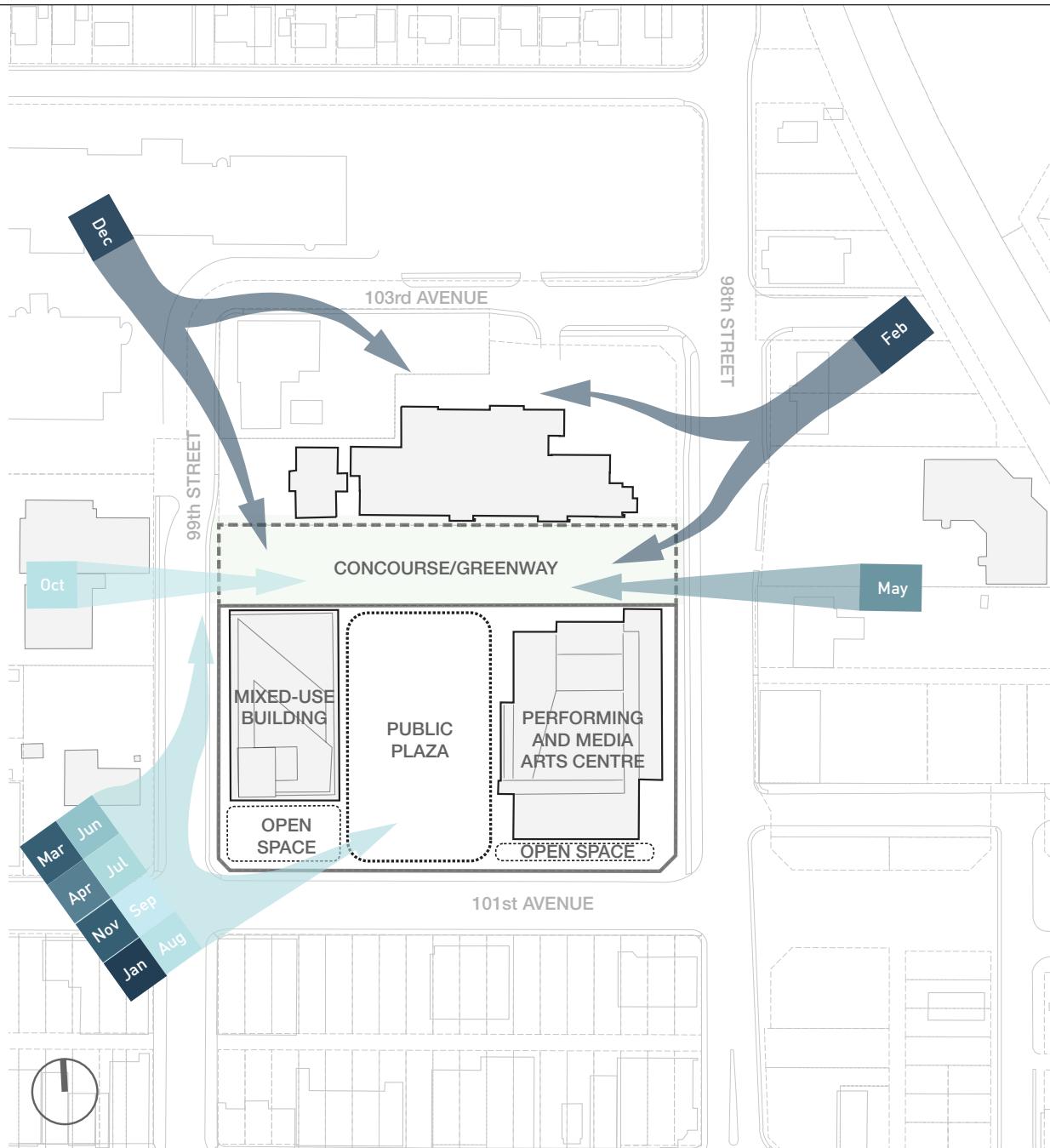
↗ Oct
↖ Nov
↖ Dec

* Information Source: http://www.windfinder.com/windstatistics/grande_prairie_airport

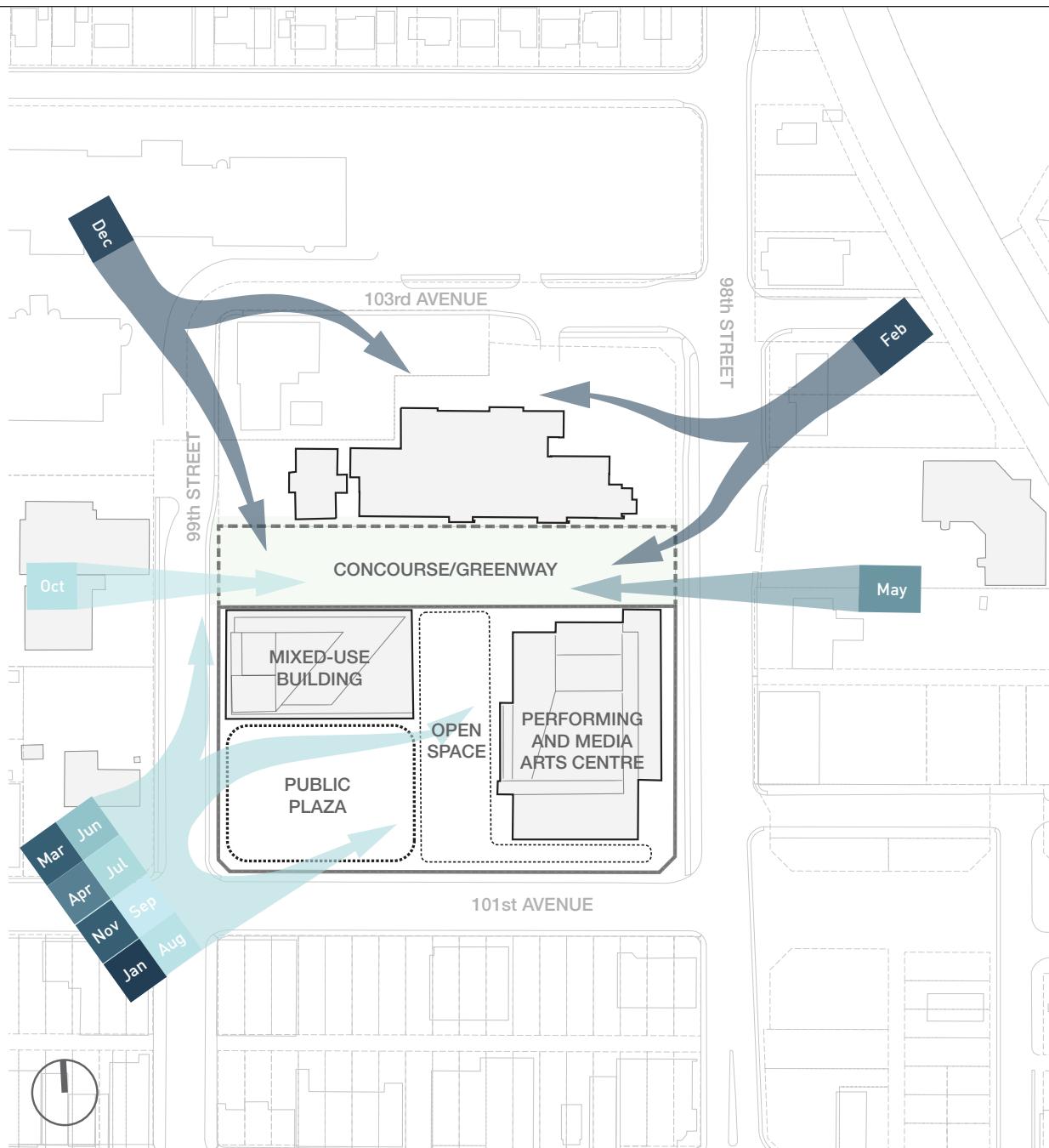
WIND STUDY



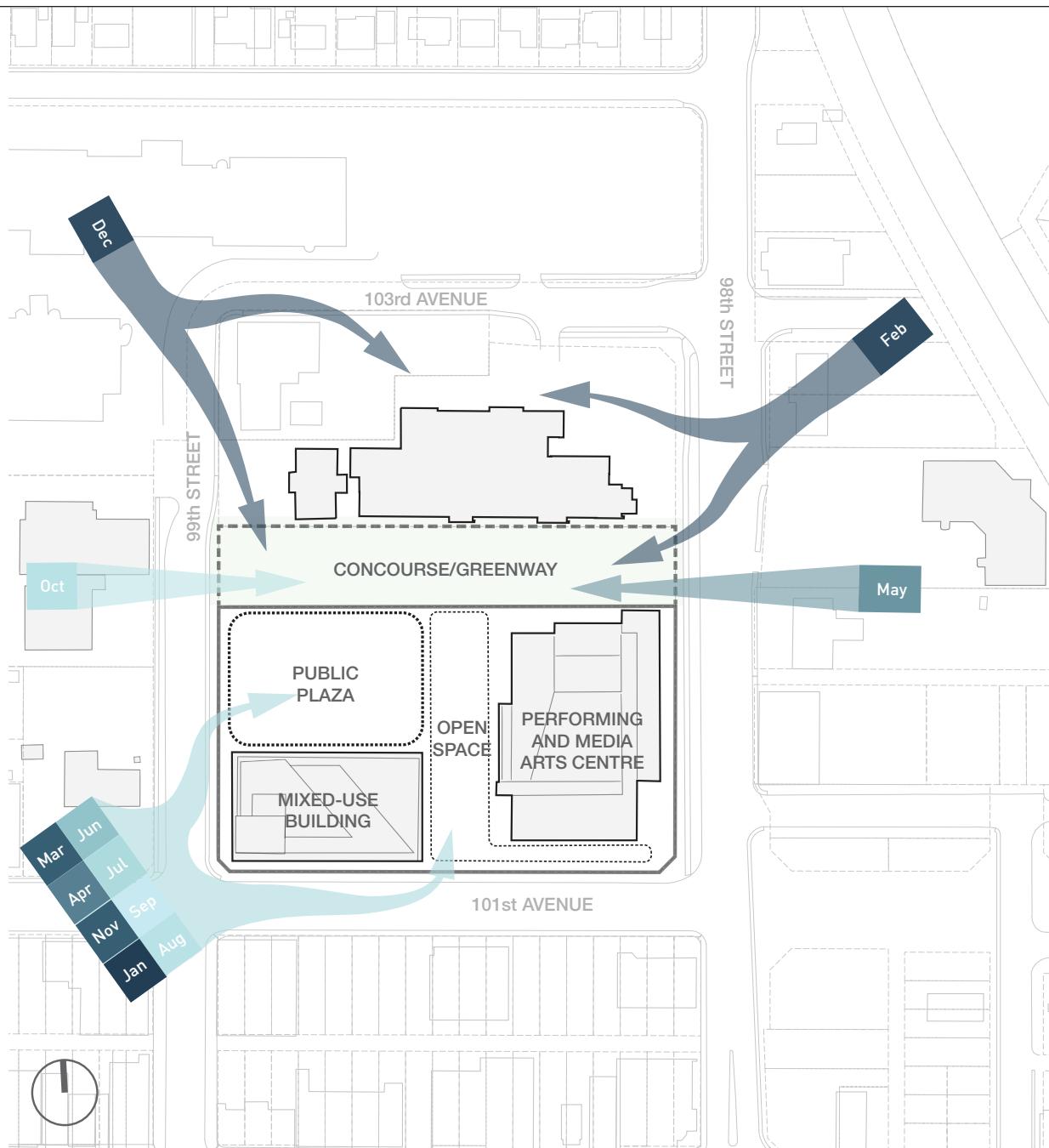
- Public plaza and northern portion of potential open space is exposed to north-easterly and easterly winds during the months of February and May - which is exposed to cold winds during the winter months
- Performing and Media Arts Centre blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space and public plaza
- Performing and Media Arts Centre blocks dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - relatively blocking unfavourable winds into the potential open space



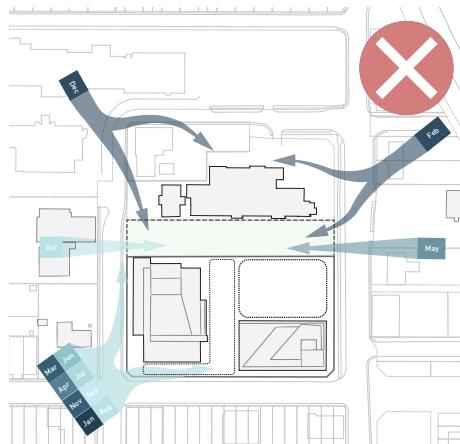
- Performing and Media Arts Centre blocks north-easterly and easterly winds during the months of February and May - relatively blocking unfavourable winds into the public plaza
- Mixed-use building blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space
- Mixed-use building relatively blocks dominant south-westerly winds to the north, but is exposed at the south during the months of January, March, April, June, July, August, September, November - allowing favourable cool winds during the summer, but cold winds during the winter



- Performing and Media Arts Centre blocks north-easterly and easterly winds during the months of February and May - relatively blocking unfavourable winds into the potential open space
- Mixed-use building blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space
- Public plaza and open space to the south are exposed to the dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - allowing favourable cool winds during the summer, but cold winds during the winter



- Performing and Media Arts Centre blocks north-easterly and easterly winds during the months of February and May - relatively blocking unfavourable winds into the potential open space and public plaza
- Public plaza and northern portion of potential open space is exposed to the north-westerly and westerly winds during the months of October and December - which is exposed to cold winds during the winter months
- Mixed-use building dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - relatively blocking unfavourable winds into the public plaza potential open space



CIVIC FOCUSED OPTION

- ✖ Public plaza and northern portion of potential open space is exposed to north-easterly and easterly winds during the months of February and May - which is exposed to cold winds during the winter months
- ✓ Performing and Media Arts Centre blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space and public plaza
- ✓ Performing and Media Arts Centre blocks dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - relatively blocking unfavourable winds into the potential open space



CULTURAL FOCUSED OPTION

- ✓ Performing and Media Arts Centre blocks north-easterly and easterly winds during the months of February and May - relatively blocking unfavourable winds into the public plaza
- ✓ Mixed-use building blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space
- ✓ Mixed-use building relatively blocks dominant south-westerly winds to the north, but is exposed at the south during the months of January, March, April, June, July, August, September, November - allowing favourable cool winds during the summer, but cold winds during the winter



DOWNTOWN FOCUSED OPTION

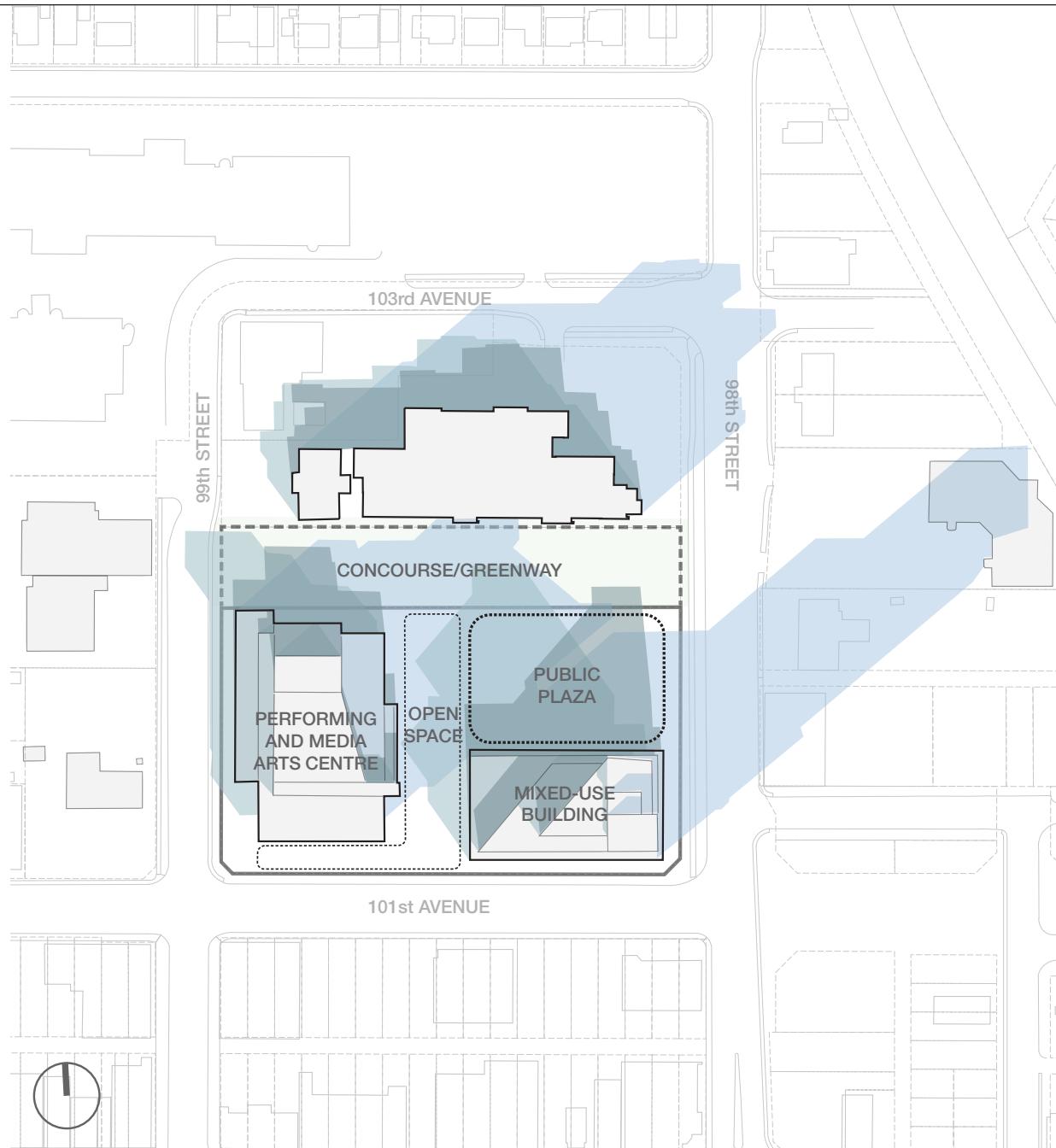
- ✓ Performing and Media Arts Centre blocks north-easterly and easterly winds during the months of February and May - relatively blocking unfavourable winds into the potential open space
- ✓ Mixed-use building blocks north-westerly and westerly winds during the months of October and December - relatively blocking unfavourable winds into the potential open space
- ✓ Public plaza and open space to the south are exposed to the dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - allowing favourable cool winds during the summer, but cold winds during the winter



WORKSHOP CREATED OPTION

- ✖ Public plaza and northern portion of potential open space is exposed to the north-westerly and westerly winds during the months of October and December - which is exposed to cold winds during the winter months
- ✓ Mixed-use building blocks dominant south-westerly winds during the months of January, March, April, June, July, August, September, November - relatively blocking unfavourable winds into the public plaza potential open space

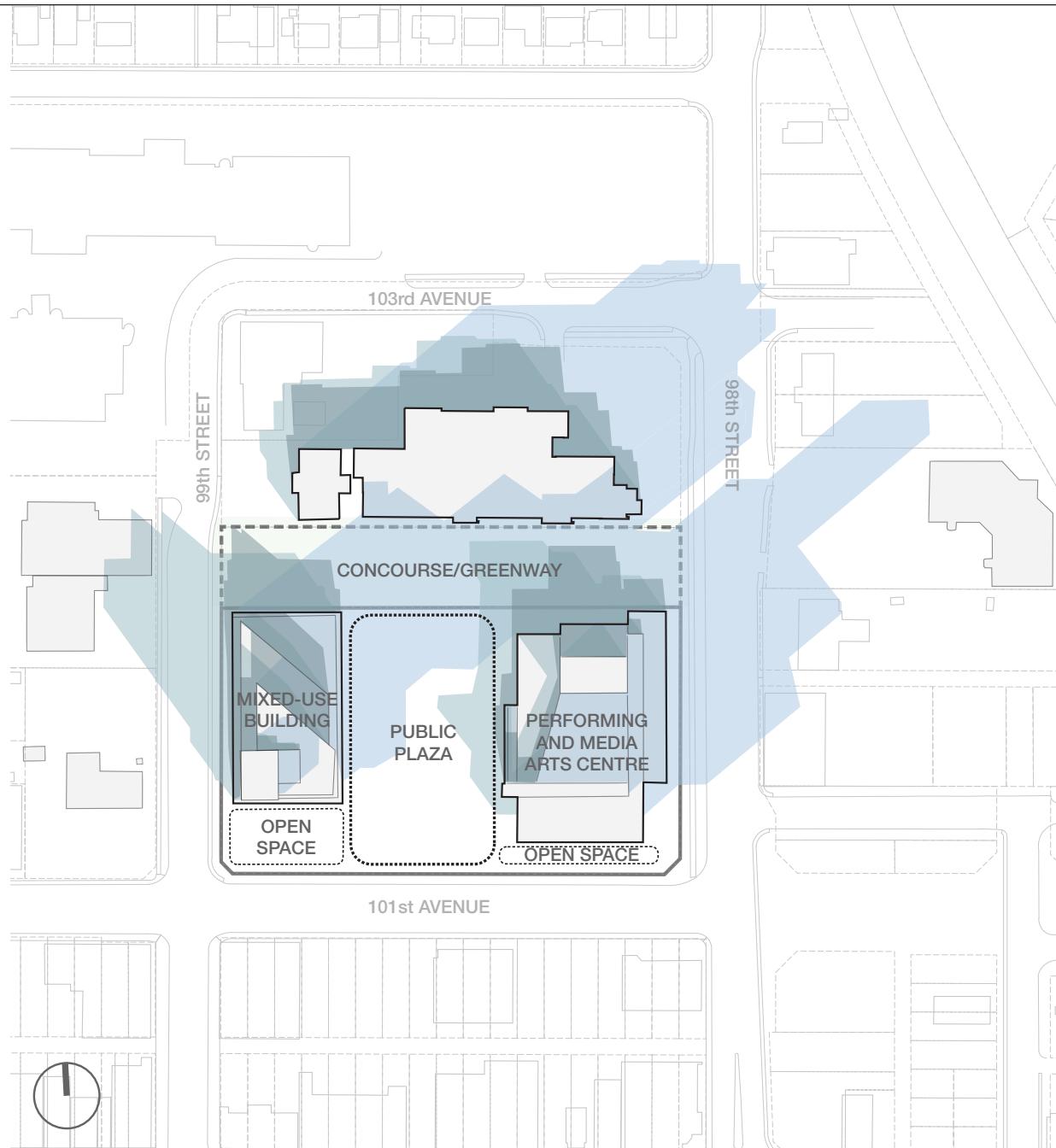
SHADOW STUDY: WINTER | JANUARY 15th



WINTER | JANUARY 15th

10 am **12 pm** **4 pm**

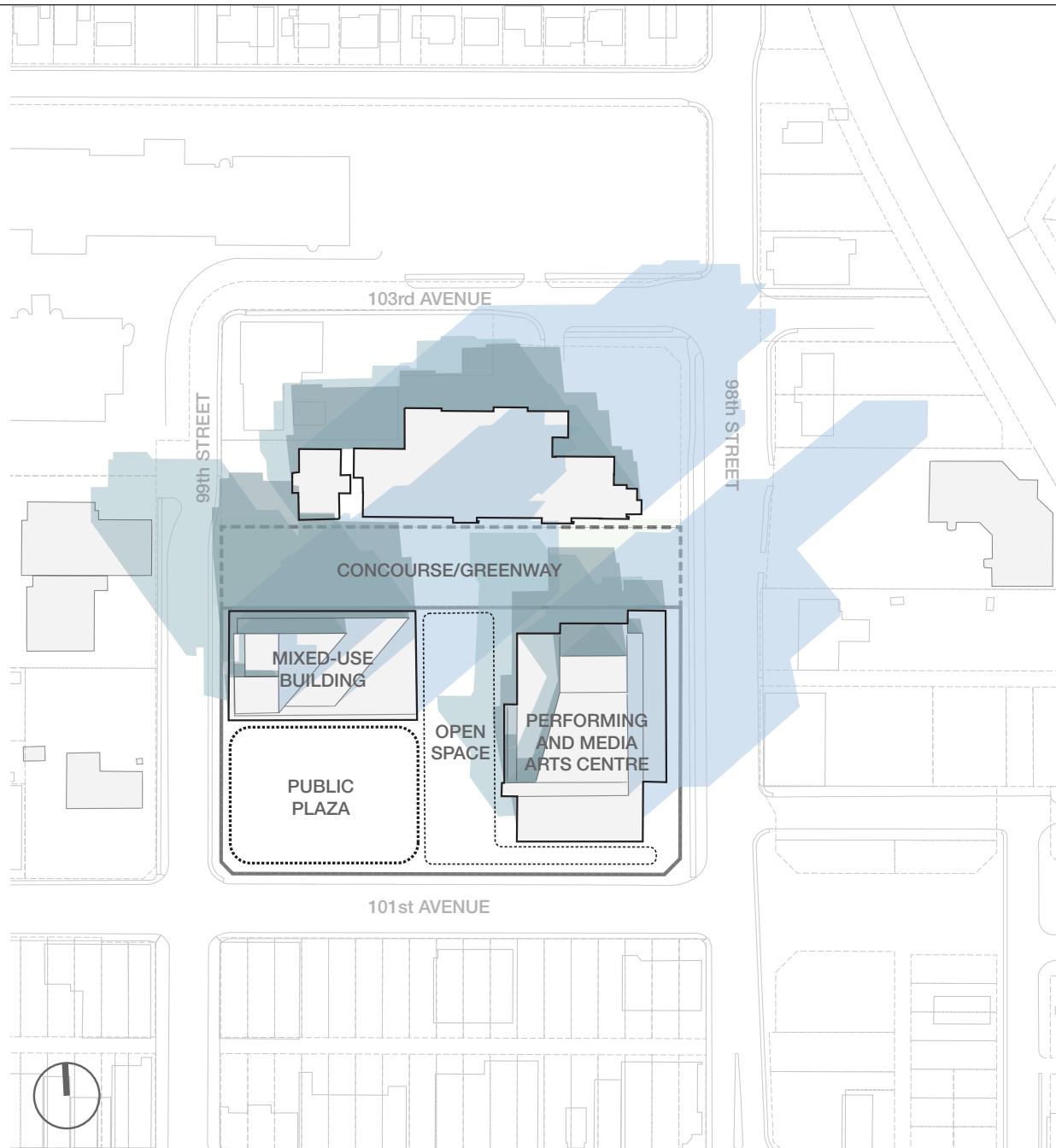
- Public plaza and majority of potential open space experiences dominant shadowing at 10 AM, 12 PM and 4 PM from the mixed-use building - reducing favourable sun exposure throughout the day
- Central and western edge of Concourse/Greenway experiences shadowing 10 AM, 12 PM and 4 PM from the Performing and Media Arts Centre and 10 AM shadowing from the mixed-use building - reducing favourable sun exposure throughout the day
- Performing and Media Arts Centre casts 4 PM shadowing onto the public plaza - reducing favourable sun exposure



WINTER | JANUARY 15th

10 am 12 pm 4 pm

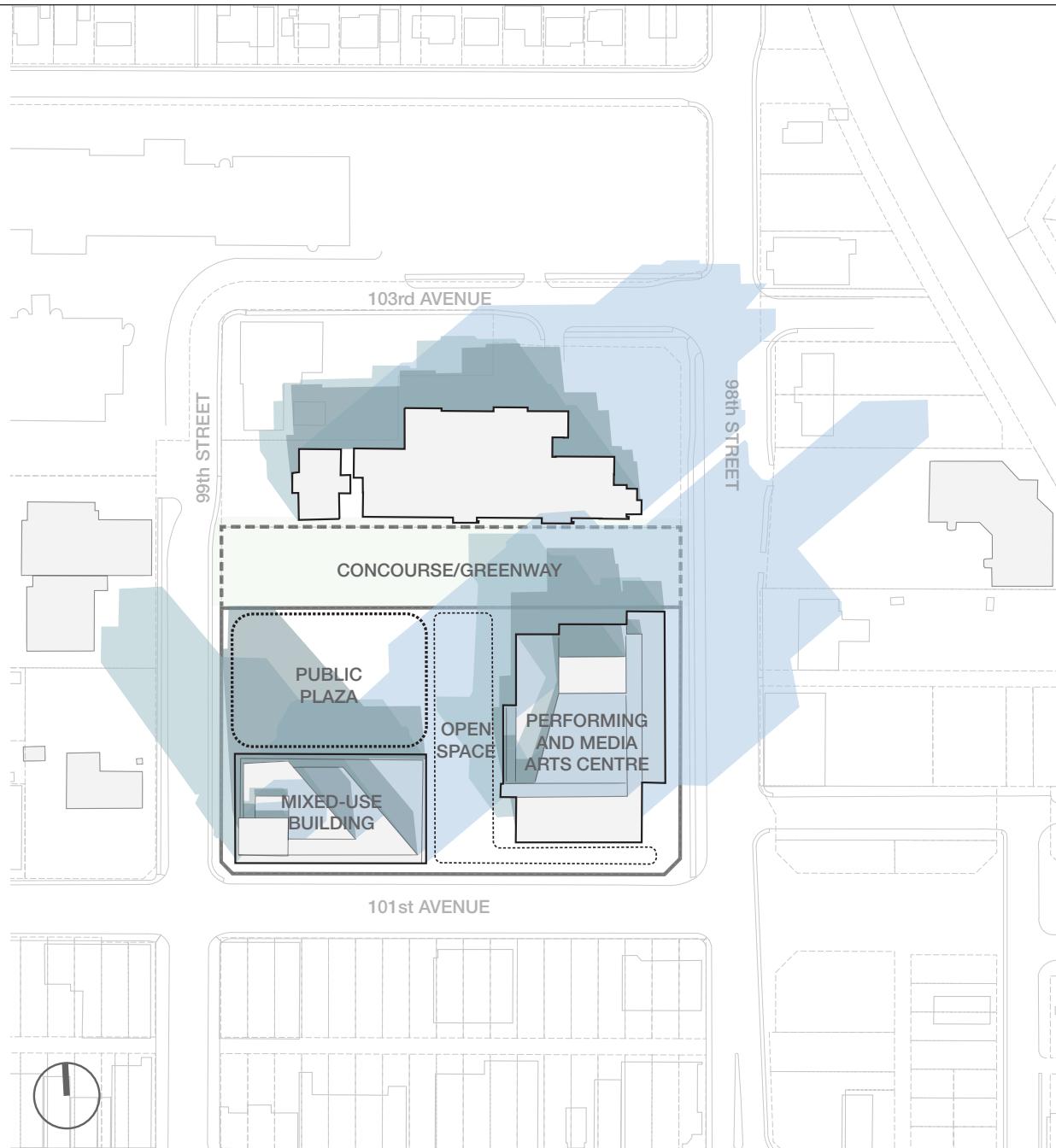
- Northern portion of public plaza (and along the eastern edge of the mixed-use building) experiences 4 PM shadowing - allowing favourable sun exposure throughout the majority of the day
- Performing and Media Arts Centre casts minimal 10 AM and 12 PM shadowing onto the public plaza along its western edge - allowing some favourable sun exposure
- Concourse/Greenway experiences constant shadowing throughout the day
- Potential open space south of the mixed-use building and public plaza experiences favourable sun exposure throughout the day



WINTER | JANUARY 15th

10 am 12 pm 4 pm

- Potential open space south of the Concourse/Greenway experiences 4 PM shadowing from the mixed-use building and 10 AM shadowing from the Performing and Media Arts Centre
- Concourse/Greenway experiences constant shadowing throughout the day
- Public plaza and majority of potential open space to the south experiences favourable sun exposure throughout the day



WINTER | JANUARY 15th

10 am **12 pm** **4 pm**

- Public plaza and majority of potential open space experiences dominant shadowing at 10 AM, 12 PM and 4 PM from the mixed-use building - reducing favourable sun exposure throughout the day
- Eastern edge of Concourse/Greenway experiences shadowing 10 AM, 12 PM and 4 PM from the Performing and Media Arts Centre and 4 PM shadowing from the mixed-use building - reducing favourable sun exposure
- Western edge of Concourse/Greenway experiences no shadowing throughout the day



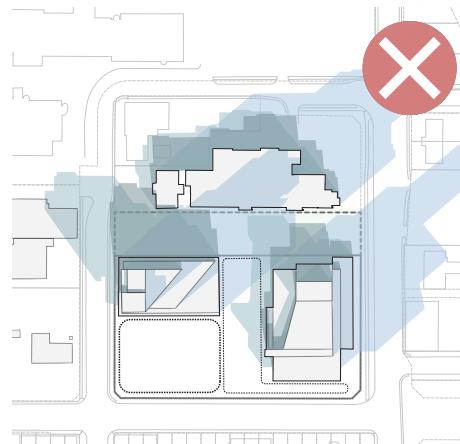
CIVIC FOCUSED OPTION

- ✖️ Public plaza and majority of potential open space experiences dominant shadowing at 10 AM, 12 PM and 4 PM from the mixed-use building - reducing favourable sun exposure throughout the day
- ✖️ Central and western edge of Concourse/Greenway experiences shadowing 10 AM, 12 PM and 4 PM from the Performing and Media Arts Centre and 10 AM shadowing from the mixed-use building - reducing favourable sun exposure throughout the day
- ✖️ Performing and Media Arts Centre casts 4 PM shadowing onto the public plaza - reducing favourable sun exposure



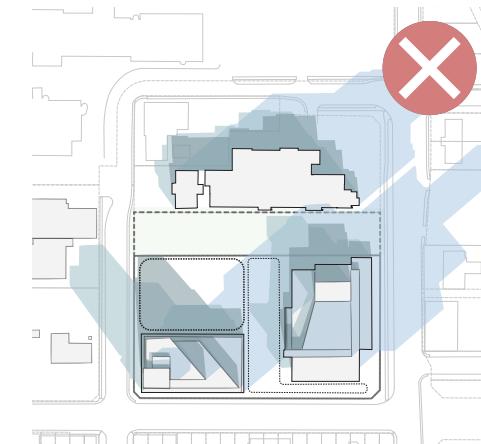
CULTURAL FOCUSED OPTION

- ✓ Northern portion of public plaza (and along the eastern edge of the mixed-use building) experiences 4 PM shadowing - allowing favourable sun exposure throughout the majority of the day
- ✓ Performing and Media Arts Centre casts minimal 10 AM and 12 PM shadowing onto the public plaza along its western edge - allowing some favourable sun exposure
- ✖️ Concourse/Greenway experiences constant shadowing throughout the day
- ✓ Potential open space south of the mixed-use building and public plaza experiences favourable sun exposure throughout the day



DOWNTOWN FOCUSED OPTION

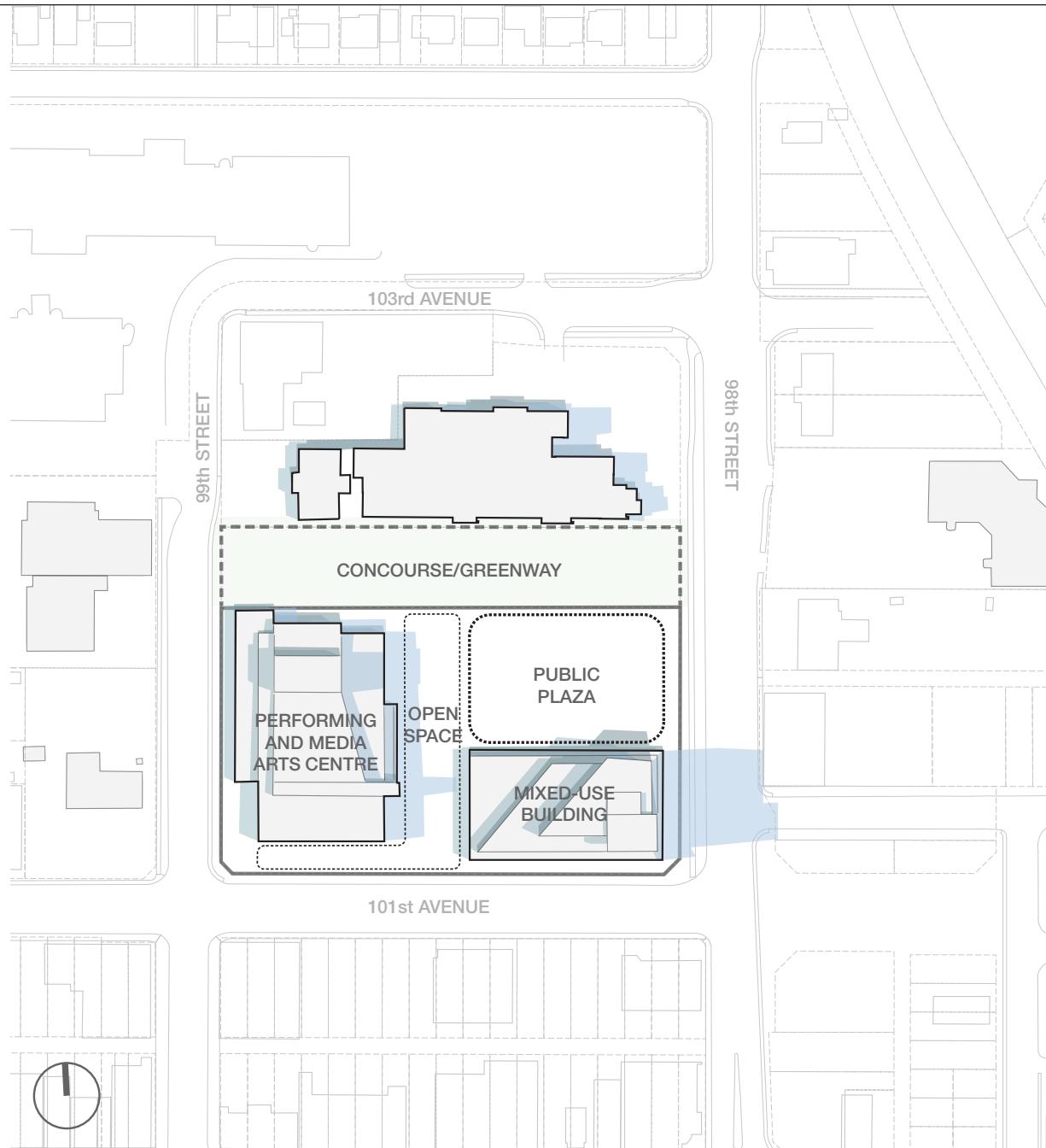
- ✖️ Potential open space south of the Concourse/Greenway experiences 4 PM shadowing from the mixed-use building and 10 AM shadowing from the Performing and Media Arts Centre
- ✖️ Concourse/Greenway experiences constant shadowing throughout the day
- ✓ Public plaza and majority of potential open space to the south experiences favourable sun exposure throughout the day



WORKSHOP CREATED OPTION

- ✖️ Public plaza and majority of potential open space experiences dominant shadowing at 10 AM, 12 PM and 4 PM from the mixed-use building - reducing favourable sun exposure throughout the day
- ✖️ Eastern edge of Concourse/Greenway experiences shadowing 10 AM, 12 PM and 4 PM from the Performing and Media Arts Centre and 4 PM shadowing from the mixed-use building - reducing favourable sun exposure throughout the day
- ✓ Western edge of Concourse/Greenway experiences no shadowing throughout the day

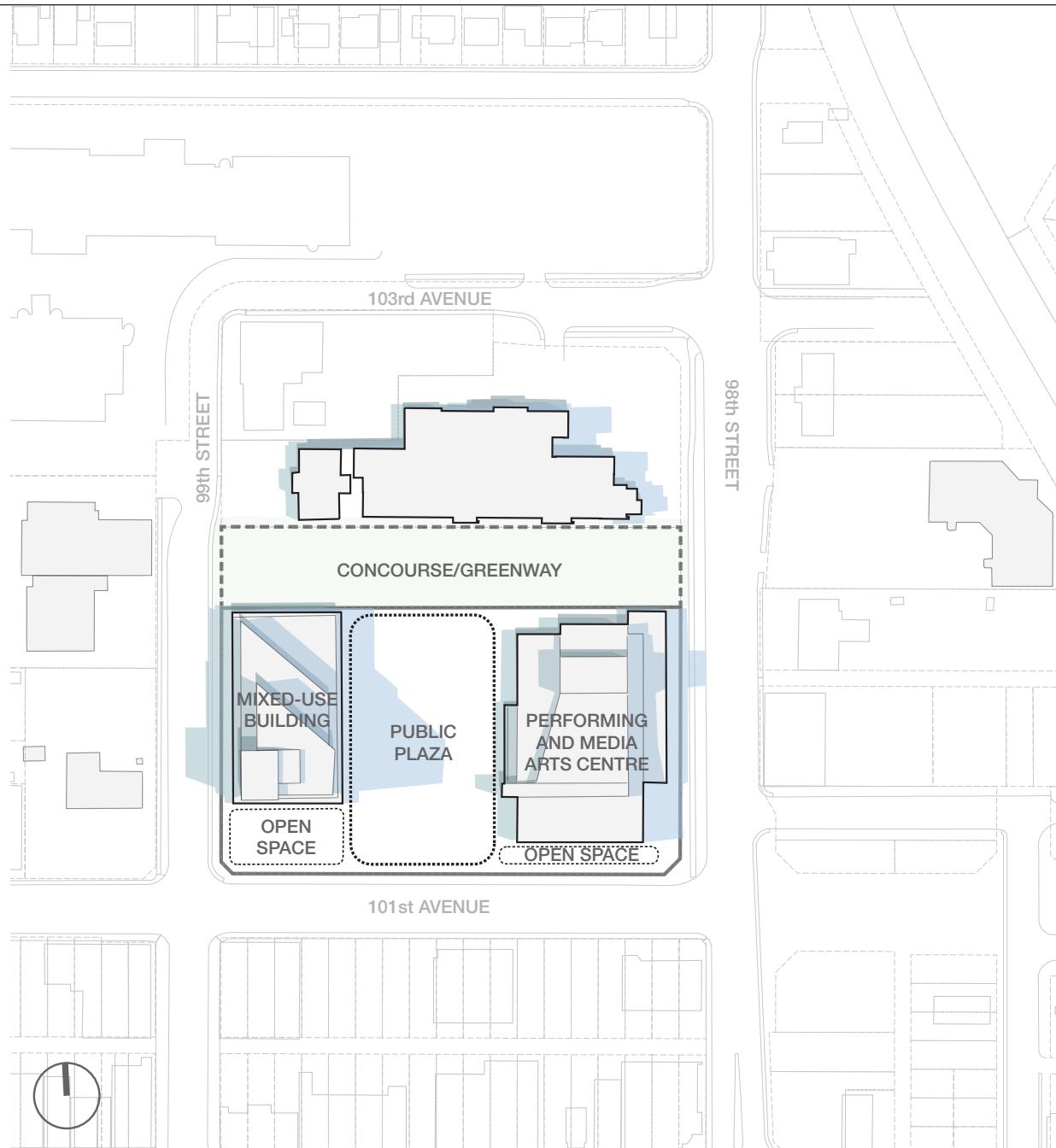
SHADOW STUDY: SUMMER | JULY 15th



SUMMER | JULY 15th

10 am 12 pm 4 pm

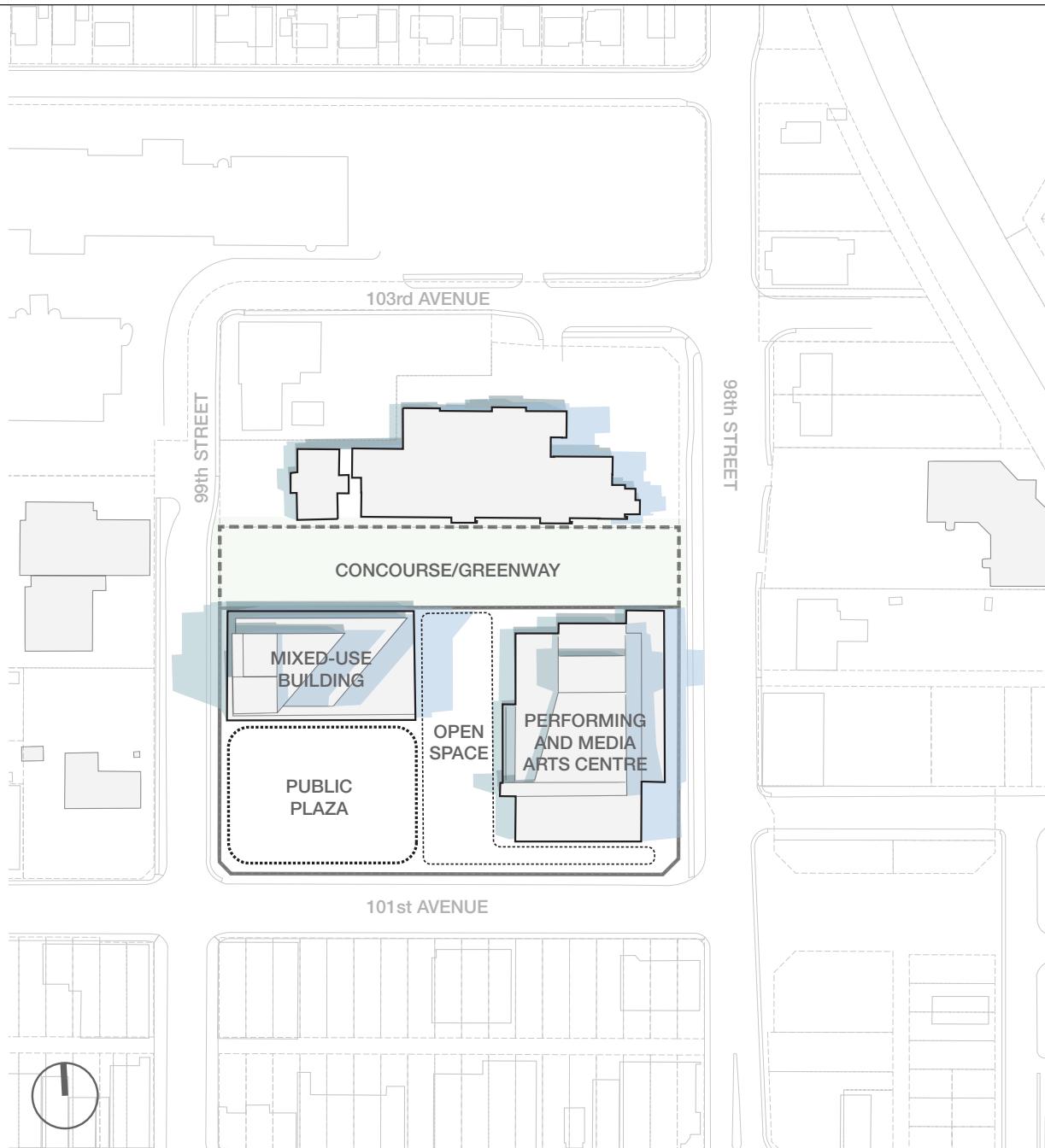
- Public plaza experiences very minimal 10 AM and 12 PM shadowing along the northern edge of the mixed-use building
- Performing Arts Building casts minimum 4 PM shadow onto the potential open space



SUMMER | JULY 15th

10 am 12 pm 4 pm

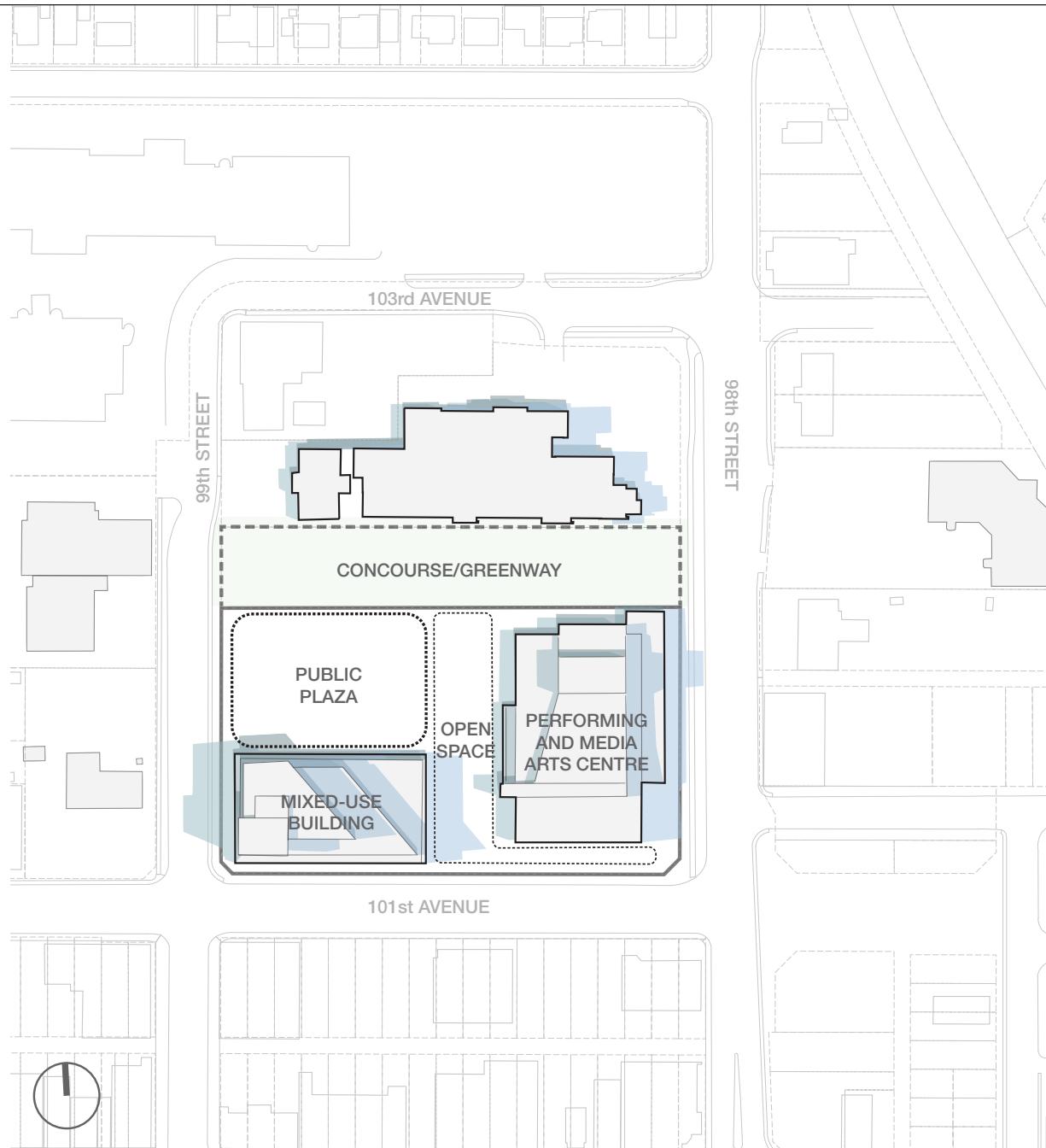
- Public plaza experiences 4 PM shadowing from the mixed-use building
- Performing and Media Arts Centre casts minimal 10 AM shadow onto the public plaza near its western edge



SUMMER | JULY 15th

10 am **12 pm** **4 pm**

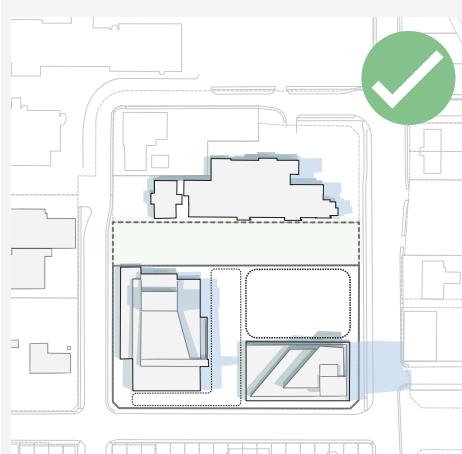
- Public plaza does not experience any shadowing
- Open space south of the Concourse/ Greenway experiences minimal 4 PM shadowing from the mixed-use building and 10 AM shadowing from the Performing and Media Arts Centre



SUMMER | JULY 15th

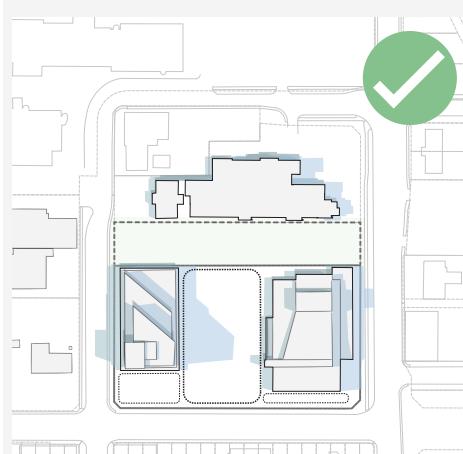
10 am 12 pm 4 pm

- Public plaza experiences very minimal 12 PM shadowing along the northern edge of the mixed-use building
- Performing Arts Building casts minimal 10 AM shadowing onto southern area of the open space
- Mixed-use building casts 4 PM shadowing onto southern area of the open space



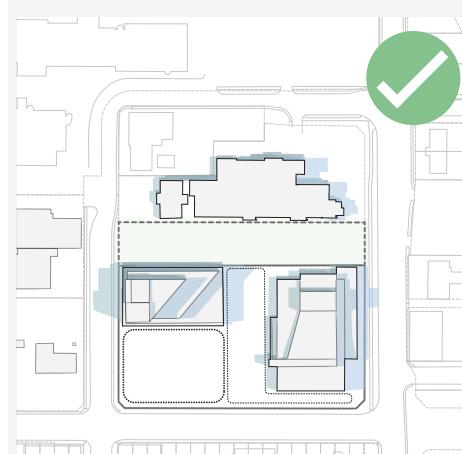
CIVIC FOCUSED OPTION

- Public plaza experiences very minimal 10 AM and 12 PM shadowing along the northern edge of the mixed-use building
- Performing Arts Building casts minimum 4 PM shadowing onto the potential open space



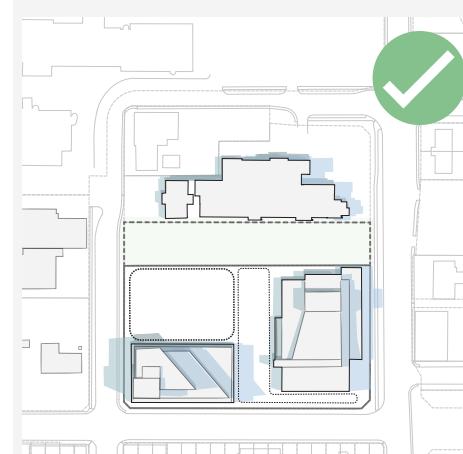
CULTURAL FOCUSED OPTION

- Potential open space does not experience any shadowing - summer sun exposure can be mitigated through
- Public plaza of the Concourse/Greenway experiences minimal 4 PM shadowing from the mixed-use building and 10 AM shadowing from the Performing and Media Arts Centre



DOWNTOWN FOCUSED OPTION

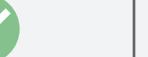
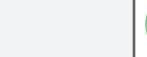
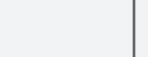
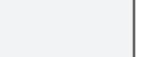
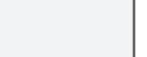
- Public plaza does not experience any shadowing
- Open space south of the Concourse/Greenway experiences minimal 4 PM shadowing from the mixed-use building and 10 AM shadowing from the Performing and Media Arts Centre

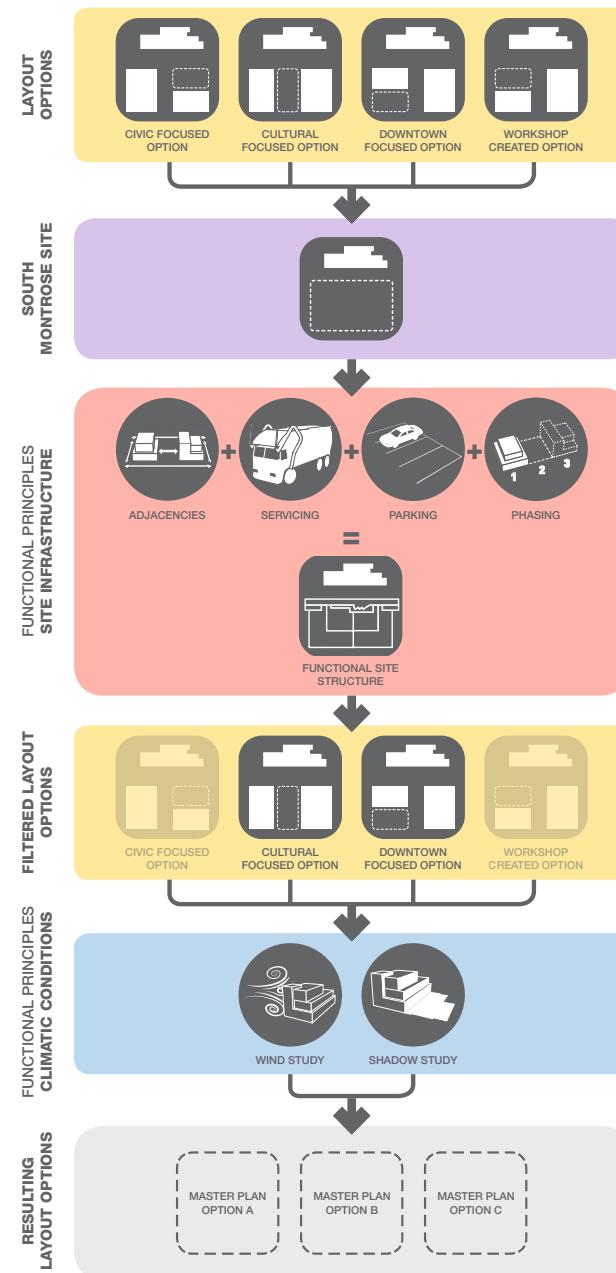


WORKSHOP CREATED OPTION

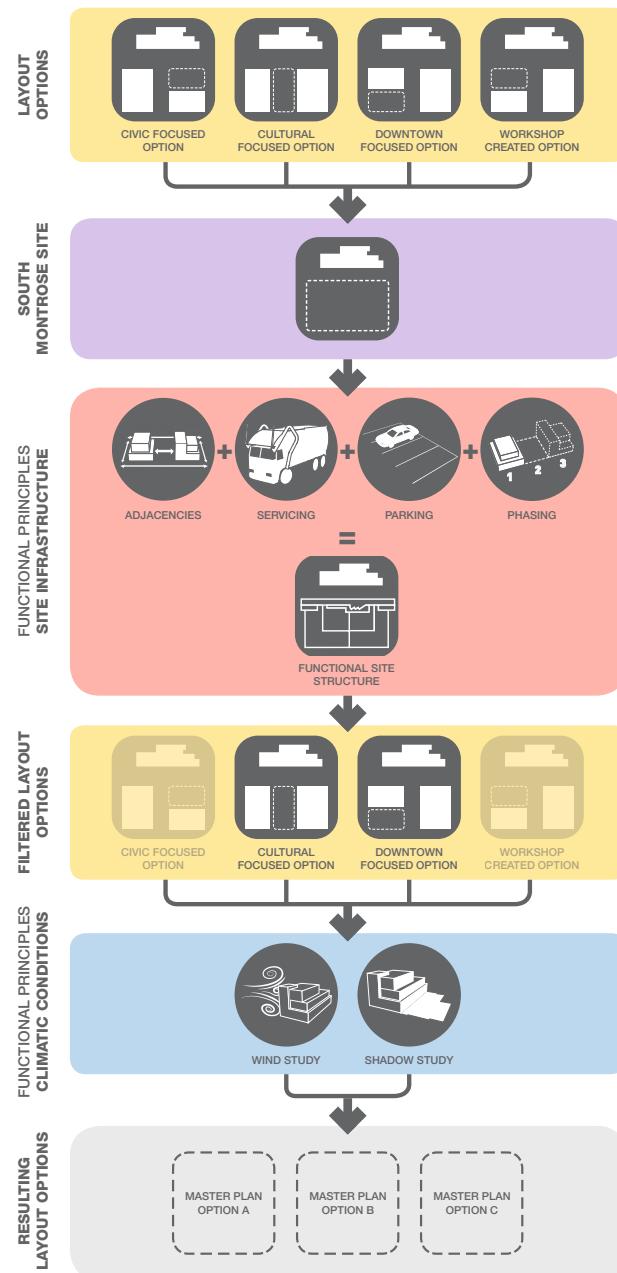
- Public plaza experiences very minimal 12 PM shadowing along the northern edge of the mixed-use building
- Performing Arts Building casts minimal 10 AM shadowing onto southern area of the open space
- Mixed-use building casts 4 PM shadowing onto southern area of the open space

LAYOUT OPTIONS TEST SUMMARY

	 CIVIC FOCUSED OPTION	 CULTURAL FOCUSED OPTION	 DOWNTOWN FOCUSED OPTION	 WORKSHOP CREATED OPTION
 FUNCTIONAL SITE STRUCTURE	   	   	   	   
 WIND STUDY	 	   	   	 
 SHADOW STUDY	   	    	   	   



- The resulting structure incorporates a sub-surface service channel running east-west along the Concourse/Greenway, which creates a “clothes line effect” where multiple surface and sub-surface elements can connect to the channel, thereby providing a very efficient servicing scenario
- A sub-surface plaza infrastructure/storage area and underground parking layout mirrored on either side allows for a flexible phased build-out at grade, with the potential for either building to be constructed in the first phase
- The Cultural Focused Option and Downtown Focused Option fit best with the ‘Functional Site Structure’ as the building locations allow direct servicing access due their proximity to the sub-surface service channel
- In addition, the sub-surface service channel and underground parking entry/exit can be integrated into each building, therefore eliminating visual impacts onto the Concourse/Greenway and potential open space



- The second set of ‘Functional Principles’ assessed the ‘Climatic Conditions’ of wind direction and shadow impacts on the public plaza and open space for the Cultural Focused Option and Downtown Focused Option
- The building locations in the Cultural Focused Option and Downtown Focused Option reasonably block the unfavourable winter winds entering the Public Plaza and open space from the north-west in December, and the north-east in February
- Both layout options experience favourable sun exposure during the winter months

APPENDIX



South Montrose
Servicing Assessment

Infracor

May 4, 2016

Pages: 3

SOUTH MONTROSE SERVICING ASSESSMENT

Stormwater Management

The stormwater constraints were examined based on the results of the 2012 Grande Prairie Storm Drainage Master Plan by Focus Engineering. The Plan recommends that:

“For infill or redevelopment in neighbourhoods that do not have a stormwater management facility the City should adopt a requirement for stormwater management on parcels large enough to support some level of stormwater management. For instance, the City of Edmonton requires parcels larger than 0.2 ha to provide stormwater management to restrict flows to 0.035 m³/s/ha with the return period varying from the 1:5 year when there is a downstream stormwater management facility to 1:100 year when there is no downstream facility.”

This project constitutes a redevelopment in an area which does not have a stormwater management facility, therefore in our judgement a release rate of 35 L/s/ha in a 1:100 year event is appropriate. Given a total development area (including the concourse to the north, but not the cultural centre) of 2.27 ha, this results in a total storm sewer release rate of 79.5 L/s.

Based on the preliminary plan for the southern part of the site, we anticipate that site coverage will ultimately be approximately 30% building, 50% paving, and 20% landscaping, for an overall rational method coefficient of 0.84. With a 95.73 mm/hr (1:100) event this requires 251 m³ of storage. Assuming an average depth of 0.20m within any ponding areas the total ponding area required is 3,770 m². This can be integrated within the approximately ~6,100 m² of open space currently shown in the preliminary site plan. Note that these areas would only pond during extreme rainfall events (1:2 and upwards), not during every rainfall.

The off-site storm infrastructure is not projected to require upgrades based on Figure 5.13 of the Drainage Master Plan. If possible, storm ties should be made to the manholes at the southwest or southeast of the site, at the intersections with 101st Avenue. The northern two manholes of 99th Street and the manhole directly east of the site on 98th Street should be avoided, as they are projected to surcharge to within 0.50m of ground level in the 1:100 event.

Sanitary Sewer

The 2015 Downtown Infrastructure Assessment by Morrison Hershfield determined that the main servicing constraint for the sanitary sewers in the downtown area is the high level of inflow and infiltration due to age/condition of the existing vitrified clay tile sewers, which are beyond serviceable life. The report states that “The additional dry weather flow for the redevelopment is not significant in comparison to the total peak wet weather flow”. The sanitary sewer within 99th Street is vitrified clay tile, and we agree with Morrison Hershfield’s assessment that is past serviceable life. The addition of more

sanitary sewer flow from a large redevelopment such as the South Montrose project will very likely trigger a life cycle upgrade to current standards (e.g. PVC sewer), if only due to the difficulty of tying services into the aged infrastructure. The extent of the life cycle replacement will depend on a condition assessment during detailed design but can be reasonably expected to extend downstream to the next higher size of sewer; in this case from the tie-in within 99th Street southwards to 100th Avenue.

For planning purposes, InfraCor estimated that the Performing Arts Centre seats up to 4,000 as a concert venue, which would produce an average daily flow of 128 m³. The 9,750 m² mixed-use building was estimated as a purely residential development, which represents a worst-case scenario for sanitary flow generation. Assuming ~35 m² of gross floor area per resident, or 280 residents, the mixed-use building will produce an average daily flow of 106 m³. Together these flows represent a peak dry flow rate of 10.6 L/s, which for a 200 mm PVC sanitary sewer at minimum slope represents 50% of capacity. Fortunately, the life cycle upgrades identified will free up capacity by reducing inflow and infiltration flows. Given the findings of the Morrison Hershfield report, we expect reductions in inflow and infiltration will more than offset the 10.6 L/s impact on the downstream sanitary infrastructure; therefore the off-site sanitary upgrades will be limited to life cycle requirements.

Water Distribution

Figure 5 of the Downtown Infrastructure Assessment by Morrison Hershfield shows eight hydrants in the adjacent roadways; with such dense coverage private hydrants are not expected to be required. 250mm AC water mains available in 101st Avenue and 98th Street, and a 150mm AC water main is available in 99th Street. Services for buildings of this size should be to the south or east, to take advantage of the larger water mains. Specific sizing of water services will need to be determined during detailed design, however given the size & height (up to 6 storeys) of buildings a dual service is likely required for each building.

The Downtown Infrastructure Assessment modeled sufficient fire flows at the intersections of 99th Street and 101st Avenue, and 98th Street and 101st Avenue. No off-site water upgrades are expected to be required.

Servicing/Parkade Conflicts

The preliminary site plans incorporate underground parkades. Although exact servicing designs will be determined during detailed design, at a high level there are a few considerations for the site plan.

Sanitary servicing must come from the west (99th Street), and water must come from the south (101st Avenue) or east (98th Street). Therefore, a route for services must be left free of parkade conflicts from the road to the west, and from the road to the south or east, to a water/mechanical room in each building. The water/mechanical room can be located in the parkade level and services can be brought directly into the P1 level.

Storm collection in the plaza area can be plumbed through the building storm services if necessary, and therefore does not pose as significant a conflict with parkades. The main constraint will be the depth of the storm tie-in, which will dictate how much grade can be established on storm collection. The public storm system in the vicinity is approximately 2.5m below grade, therefore storm servicing is feasible provided that it does not have to extend across the entirety of the site (i.e. each building will draw a service from a nearby storm main, or one storm tie that must be located centrally).

Corporate Authorization

This document was prepared by InfraCor Consulting Ltd. and is intended for the use of the City of Grande Prairie, their consultants, and contractors. The contents of the report represent InfraCor Consulting Ltd's best judgement based on the information available at the time of preparation. Any third party which uses, relies on, or makes decisions based on the information in this report does so at its own risk. InfraCor Consulting Ltd. accepts no responsibility for damages suffered by any third party as a result of any such use, reliance, or decisions.



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CORPORATE PERMIT

RESPONSIBLE ENGINEER

APPENDIX



Geotechnical Investigation Report
South Montrose Concourse
Grande Prairie, Alberta



May 2016

Pages: 50

GEOTECHNICAL INVESTIGATION

SOUTH MONTROSE SITE
GRANDE PRAIRIE, ALBERTA

PREPARED FOR

NAK DESIGN STRATEGIES
CALGARY, ALBERTA



PREPARED BY

PARKLAND GEOTECHNICAL CONSULTING LTD.
CALGARY, ALBERTA



Parkland **GEO**

The logo for Parkland GEO. The word "Parkland" is written in a blue serif font, and "GEO" is in a larger, bold green sans-serif font. A thick blue curved line starts from the top left of the "P" and sweeps down and around the "GEO" text.

PROJECT No. CA0192

MAY 2016

Geotechnical, Environmental and Materials Engineering
Red Deer · Sherwood Park · Grande Prairie · Calgary · Fort McMurray
Peace River · Medicine Hat · Lethbridge · Estevan

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- Figure 2 - Site Plan
- Figure 3 - Aerial Plan
- Figure 4 - Site Photographs

Appendix A

- Borehole Logs
- Soil Test Results
- Explanation of Terms and Symbols

Limitations

- General Terms, Conditions and Limitations

1.0 INTRODUCTION

The City of Grande Prairie is proposing to develop a 2.2 hectare multi-use recreational site in Grande Prairie, Alberta. Parkland Geotechnical Consulting Ltd. (ParklandGEO) was requested to perform a geotechnical investigation of the site as part of the preliminary stage of the proposed development. The scope of the work is outlined in ParklandGEO's proposal dated July 21, 2015 (File# PRO4410). Authorization to proceed with this investigation was given by Mr. Jack Vanstone of NAK Design Strategies, acting on behalf of the City of Grande Prairie. This report summarizes the results of the field and laboratory testing programs and presents geotechnical recommendations for general site development.

1.1 PREVIOUS INVESTIGATIONS

ParklandGEO issued a previous geotechnical report for the adjacent South Montrose Concourse on March 3, 2016.

- “Geotechnical Investigation - South Montrose Concourse, Grande Prairie, Alberta”, prepared for The City of Grande Prairie, prepared by Parkland Geotechnical Consulting Ltd., dated March 3, 2016. (File #CA0211).

A geotechnical report for a development north of the subject property was provided to ParklandGEO for review as part of this investigation.

- “Grande Prairie Public Library/Prairie Art Gallery Addition - Geotechnical Investigation - Grande Prairie, Alberta,” prepared for City of Grande Prairie, prepared by Thurber Engineering Ltd., dated June 7, 2004. (File No. 14-17-21.)

2.0 PROJECT INFORMATION

2.1 SITE DESCRIPTION

The subject property is located on 2.2 hectares of land located south of the Montrose Cultural Centre, at 9839 - 103 Avenue in downtown Grande Prairie, Alberta. The site is shown on the Key Plan, Figure 1. At the time of the field investigation, the site was snow covered however, based on recent aerial maps, the site is predominately grass covered and a gravel surfaced parking lot is located on the west side of the property. The site gently slopes to the south at less than 5H:1V away from the existing building for about 10 m, at which point it becomes relatively level. There was an elevation difference of less than 1.2 m between the five borehole locations. The site is bordered by the Montrose Cultural Centre to the north, 98th Street to the east, 99th Street to the west, and 101 Avenue to the south. The surrounding land use was generally commercial developments. The subject property is shown on the Site and Aerial Plans, Figures 2 and 3.

2.2 PROJECT DESCRIPTION

The proposed developments include a performing arts centre, a mixed use building, a civic square, and landscaping features. An underground parkade is also being considered. Planning for the development is presently in its preliminary stages and a building layout was not available at the time of this investigation. Photographs taken at the time of the field investigation are shown on Figure 4.

3.0 FIELD AND LABORATORY PROGRAM

On November 3, 2015, five boreholes (Boreholes 1 to 5) were drilled across the site to depths of 9.5 m below grade. On January 26, 2016, three additional boreholes (Boreholes 6 to 8) were drilled for the proposed concourse, directly south of the cultural centre, to depths of 6.5 m below grade. The locations of the boreholes are shown on the Aerial Site Plan, Figure 2. The soils encountered were visually examined during drilling and logged according to the Modified Unified Soil Classification System. Standard Penetration Tests (SPTs) were performed at selected depths in the boreholes. Soil samples were taken at 1.0 m depth intervals to determine the soil/moisture profile. All soil samples were returned to ParklandGEO's soil laboratory for selected testing to determine the soil properties.

Upon completion of drilling, standpipes were installed in Boreholes 1 to 5. Groundwater level measurements were taken upon completion of drilling and on December 11, 2015. The ground surface elevations at the borehole locations were surveyed by ParklandGEO personnel.

4.0 SOIL CONDITIONS

The general the soil profile encountered at the borehole locations was, in descending order: topsoil; fill; buried organics; clay; and clay till. The detailed soil conditions encountered at each borehole location are described on the borehole logs in Appendix A. The soil test results and definitions of the terminology and symbols used on the borehole logs are provided on the explanation sheets, also in Appendix A. The following is a brief description of the soil types encountered.

4.1 TOPSOIL

A surficial layer of topsoil up to 100 mm thick was encountered at each borehole location, except Borehole 6. The topsoil was silty and contained little to trace sand, was moderately organic, black and moist. Based on observations and experience, topsoil thicknesses are expected to vary and may exist in greater thicknesses across the site. In general, this topsoil is considered to be weak and compressible under load.

4.2 FILL

A 400 mm thick layer of silty sand fill was encountered below the topsoil in Borehole 3. The sand was fine grained and poorly graded with little to some clay and trace gravel. The sand was encountered in a damp condition. Due to the proximity of the borehole to the adjacent parking lot, the sand was most likely placed during development of the parking area.

Clay fill was encountered in Boreholes 6, 7, and 8, and extended to depths of 0.8, 2.5, and 2.0 m below grade, respectively. The fill contained little to some silt, trace to little sand, trace to little gravel, and was stiff. The Liquid Limit (LL) of the fill was 58 percent and the Plasticity Index (PI) was 43 percent, indicating that the fill was generally high plastic. The moisture content of the fill ranged from 16 to 31 percent. This fill was most likely placed during the development of the Montrose Cultural Centre to the north between 2006 and 2010.

4.3 BURIED ORGANICS

A 200 mm thick layer of buried organic soil was encountered below the fill at a depth of 0.8 m in Borehole 6. The organic soil was moist and black. The organic content of the soil sample tested was 10 percent, which is considered to be low to moderate. It is possible that deeper and/or thicker layers of buried organic soil are present elsewhere at the site.

4.4 CLAY

A 700 mm thick layer of silty clay was encountered below the topsoil in Borehole 1. The silty clay was medium to low plastic with a stiff consistency. Occasional rust stains and coal inclusions were noted in the material. The fill was encountered in a damp condition.

Lacustrine clay was encountered below the topsoil and/or fill at each borehole location and extended to depths ranging from 5.0 to 6.8 m below grade. The clay was a variable mixture of silt, sand, and little to trace gravel. Occasional rust stains and cobble inclusions were noted in the clay. The LL of the clay ranged from 44 to 90 percent and the PI ranged from 31 to 72 percent, indicating that the clay is medium to high plastic. The Standard Penetration Test (SPT) "N" values ranged from 8 to 22 blows per 300 mm of penetration, indicating that the clay has stiff to very stiff consistency. The moisture content of the clay ranged from 15 to 33 percent which is considered to be above the Optimum Moisture Content (OMC) for this material.

4.5 CLAY TILL

Clay till was encountered below the lacustrine clay at depths of 5.0 to 6.8 m below grade in each borehole. The till extended beyond the maximum 9.5 m depths drilled. In general, the clay till contained some silt, some sand, trace to little gravel, and was medium to high plastic. Occasional rust stains and coal inclusions were noted within the till. Although not encountered during this investigation, the local clay till is known to contain large boulders and water bearing sand lenses. The SPT "N" values ranged from 16 to 32 blows per 300 mm of penetration, indicating that the clay till has a very stiff to hard consistency. The consistency seemed to increase at a depth of about 7.0 m. The moisture content of the clay till ranged from 14 to 19 percent which is near the OMC for this material.

4.6 WATER SOLUBLE SULPHATES

Soil samples were taken at selected depths in the boreholes for water soluble sulphate concentration testing. The concentrations of sulphates are expressed as a percentage of the dry mass of soil. The concentrations of water soluble sulphates in the soil samples tested were as high as 0.26 percent, which indicates a "severe potential for sulphate attack on buried concrete in direct contact with soil." The following table summarizes the soil test results.

TABLE 1
SOIL TEST SUMMARY

BH #	Depth (mbg)	Soil Sulphate Results (%)
1	7.0	0.113
2	2.0	0.023
3	7.0	0.133
4	2.0	0.255
5	7.0	0.140
6	2.0	0.019
7	2.0	0.156
8	2.0	0.213

5.0 GROUNDWATER

No groundwater seepage was observed in the boreholes during or after drilling. Groundwater levels were measured on December 11, 2015. The following table summarizes the observed groundwater conditions.

TABLE 2
GROUNDWATER MEASUREMENTS

BH #	Ground Elevation (m)	Depth of Borehole (m)	Groundwater Level on Dec. 11, 2015 (mbg)	Groundwater Elevation on Dec. 11, 2015 (m)
1	658.9	9.5	9.40	649.50
2	659.0	9.5	Dry	< 649.50
3	658.6	9.5	6.14	652.46
4	659.2	9.5	6.45	652.75
5	659.7	9.5	7.25	652.45

Groundwater elevations are expected to fluctuate on a seasonal basis and will be highest after periods of heavy or prolonged precipitation and snow-melt. The observed groundwater conditions suggest a relatively deep groundwater table and a low permeable subgrade. The low permeable subgrade may inhibit groundwater infiltration and lead to perched conditions during periods of higher precipitation.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 GEOTECHNICAL EVALUATION

The proposed developments is expected to include a performing arts centre, a mixed use building, a civic square, and landscaping features. It is understood that an underground parkade is also being considered. The overall depth of the underground parkade is expected to be in the order of 4 m below grade. Foundation loads for the buildings are expected to be moderate to heavy depending on the possible parkade configuration. Paved parking areas and access roads at the site are expected to be subject to frequent light vehicle traffic and occasional heavy truck traffic.

The soil profile was generally consistent and the groundwater table was relatively deep in the proposed development areas. The near surface high plastic clays encountered will require careful consideration prior to and during construction, however, with proper site preparation measures, the subsurface conditions will be suitable for the proposed developments. The main geotechnical issues are discussed below.

1. Near surface high plastic clays were encountered at the site. This soil will impact shallow foundations, slabs and pavements since these clays are prone to swelling (heave) and shrinkage with changes in soil moisture content. Deep pile foundations are preferable over conventional footings at this site due to the presence of the high plastic clays at typical footing depths. Problems related to swelling clays and some recommendations to mitigate these problems are presented in Section 6.2.
2. Pile foundations are considered to be the most practical foundation option for the soil conditions at this site. Recommendations have been provided for bored cast-in-place concrete piles which are considered to be well suited to the soil conditions. Recommendations for other deep foundations such as driven steel piles can be provided upon request.
3. The site soil conditions are less suitable for footing foundations due to the presence of high plastic clays at typical footing depths. If footings are considered, special precautions must be taken during preparation of the bearing surfaces to ensure that the in-situ soil moisture is not significantly altered during construction. All bearing surfaces must be covered with a mud slab (ie. lean mix concrete) immediately after excavation to prevent exposed clays from drying out excessively. Preparation of the bearing surfaces should be monitored by a qualified geotechnical engineer to verify that design criteria are met.
4. Deeper large footings or a monolithic mat foundation may be considered for the parkade structure. Detailed settlement analysis and a review of the proposed bearing pressures versus swelling potential will need to be undertaken as part of the design if large footings or a mat foundation is selected for the parkade structure. In general, mixing of shallow and

- deep foundation systems is not recommended unless the structural elements act independently, because footings will experience greater sensitivity to vertical movement due to settlement and swelling.
5. The near surface clay soils will be moderately frost susceptible within the zone of seasonal frost (estimated to an average depth of 2.6 m below grade). Frost considerations are discussed in Section 6.5.
6. Due to the fine grained nature of the surficial soils, subgrade conditions may be adversely impacted by wet weather and seasonal groundwater including temporary perched conditions in the upper deposits. Shallow groundwater in fine grained silty soils are a concern because of the potential for groundwater to “pump up” to surface due to repetitive construction traffic resulting in a significant weakening/failure of the subgrade.
7. The surficial silty clay will provide a low to moderate level of subgrade support for pavement areas. The silty subgrade will be stable if not excessively disturbed. Like most fine grained soils, these materials will encounter some problems if surface fill or backfill materials are placed during periods of wet weather when perched groundwater conditions are present.

6.2 SWELLING CLAY ISSUES

Near surface high plastic clays were encountered at the site. This is typical for many areas around Grande Prairie. High plastic soils will exhibit volume changes such as swelling (heave) and shrinkage with changes in soil moisture content. The typical problem with swelling soils is that they are exposed and allowed to dry out during construction, and then, once concrete flatwork or pavement is placed over the soil, the evapo-transpiration conditions change and the soils gain moisture resulting in swelling (heave). Since structural features are placed after shrinkage, the effects of swelling are magnified when the soil re-establishes a new soil - moisture equilibrium. Swelling pressures in excess of 200 kPa are considered possible at this site which is well in excess of some foundation and typical slab loads. The swelling problems area magnified by the variation of plasticity in the subgrade, which might lead to non uniform swelling and harmful differential heave.

If swelling is a concern, the ideal option is to provide a structurally supported floor slab underlain by a crushable void form or crawl space. This option is relatively expensive but it will provide the most predictable level of slab performance and may be justified for slabs with strict vertical tolerances. If the Owner is willing to accept some risk then it may be acceptable to construct a grade supported slab and try to minimize the potential for differential slab movement. If subgrade conditions are uniform, heave will still occur but the potential for differential heave may be reduced. The following construction practices can be used to try and reduce possible problems with heaving/shrinking:

1. Higher plastic clays could be removed and replaced or mixed with a suitable low to medium plastic material. However, given the thick deposits of high plastic clay at this site removal may not be considered to be practical. An alternative to removing the high plastic clay is to cap it with low to medium plastic clay which will provide a seal and help prevent the underlying high plastic clay from experiencing significant moisture increase, which would induce swelling. A minimum of 1.0 m of cover is recommended. With either of the options above, a diligent testing program should be carried out to ensure that sufficient density and moisture content are achieved. More recommendations for site preparation are presented in Section 5.3.

2. Swelling pressures and heave potential are reduced when soil moisture contents approach 35 percent. Soils drier than this will be subject to higher swelling. The existing moisture content ranged from 15 to 33 percent. It is crucial not to allow exposed subgrade soils to dry during construction through the use of protective layer such as mud slabs; or the subgrade can be saturated by flooding or injection prior to placement of the gravel base and slab.
3. The design of water lines and heating ducts beneath slab on grade floors can have a significant impact on subgrade soils and require very careful design and construction measures.
4. Interior non-load bearing walls need to be designed to accommodate potential vertical movement of the slab.
5. Exterior drainage around the building perimeter is important to minimize the potential for infiltration into subgrade soils. Roof and other drains should discharge well clear of storm sewers. If this is not possible, roof drains should discharge well clear of the building. The use of paving stones adjacent to buildings is also not recommended unless special design considerations are used to promote the drainage of water away from buildings. Pavement areas around the building should be kept high, especially in the gravel surfaced areas. The surface of the top of the subgrade should mirror the surface grades and shed infiltration water away. The placement of snow piles from parking or landscaped areas should be located well away from buildings.
6. Landscaping should be designed to minimize the need for watering adjacent to the proposed building. Planting trees and larger shrubs within 1 - 2 m of the building should be avoided, because root systems can take moisture from subgrade soils and lead to possible subgrade shrinkage and settlement.

These steps can be taken to reduce and possibly eliminate the detrimental effects of swelling clays on foundations and slab work. Due the nature of these soils however, there is no procedure that can be followed that can to totally eliminate the risk other than construction of a structural floor slab.

6.3 SITE PREPARATION

All topsoil, buried organics or weak native subgrade should be removed from areas to be occupied by the proposed building and pavement areas. Topsoil could be stockpiled for future landscaping use at the site. Once the area is stripped, the exposed subgrade should be proofrolled under the supervision of experienced geotechnical personnel to identify potential soft areas prior to fill placement.

The proposed parkade structure is expected to be excavated to a depth of at least 4 to 5 m below grade. Care will need to be taken when exposing the high plastic clay soils since exposure will affect the soil moisture content of these deposits and will promote future heave. Ideally, it is recommended to undertake bulk excavations to within 150 to 300 mm of final subgrade elevation. The final excavation can be undertaken in a manner to expose larger areas of the subgrade and allow the placement of a thin mud slab of lean mix concrete to protect the surface from disturbance and dessication while the parkade floor is being prepared and cast.

In pavement areas and building areas that are not in cut the exposed subgrade soils should be scarified to a minimum depth of 150 mm, moisture adjusted and compacted to a minimum of 98 percent of Standard Proctor Maximum Dry Density (SPMDD). In building areas, the clay surface should be moisture adjusted to a moisture content 2 to 4 percent above Optimum Moisture Content (OMC). The preparation of these subgrade areas should be carefully monitored to detect potential soft spots. The work should be monitored by experienced geotechnical personnel to verify that the final exposed soils are uniform and stable. If soft subgrade conditions are encountered the site preparation procedures should be reviewed based on the actual subgrade conditions, final grades and intended use for the designated area. Typically soft areas should be sub-cut and replaced with a suitable fill material. The depth of excavation should be sufficient to remove the soft material or to bridge over the material to give proper support to slabs and pavement structures.

Fill required to bring the site up to grade should be low to medium plastic clay, well graded select granular material such as sand or gravel. The native surficial clay is a medium to high plastic which is marginally suitable for use as engineered fill. High plastic clay should be selectively used or should be mixed with lower plastic clays to reduce swelling potential. If high plastic clay must be used as fill, it should be placed well wet of OMC.

Shallow fill material within the proposed building areas should be placed to a uniform density of 98 percent of Standard Proctor Maximum Dry Density (SPMDD-ASTM D698). Fills of over 1.0 m deep, including trench backfill within the building, should be placed uniformly to at least 100 percent of SPMDD and be either at or slightly over OMC. Exterior backfill outside of building footprints should be placed in thin lifts compacted to at least 95 percent of SPMDD. Compliance with this recommendation for exterior areas is important because poorly compacted backfill adjacent to foundation structures will settle, which may lead to ponding of surface water against foundation walls or grade beams. It is recommended the maximum thickness of any lift after compaction should not exceed 200 mm. Uniformity is of most importance. If soft subgrade conditions are

encountered these compaction recommendations and proposed construction procedures should be reviewed.

Site grading during and after construction is an important consideration. Flatwork surfaces and the landscaped areas should be sloped and graded to effectively and rapidly remove all surface water during and after construction. Excess surface water should be drained away from the building site as quickly as possible, both during and after construction. Site drainage should be directed away from the foundation walls. It is recommended to provide a 5 percent backslope from the buildings for a distance of at least 3 m. The slope of exterior backfill should be checked periodically to verify water is shed away from the buildings. If the backfill settles causing water to pond against the foundation walls, the surface should be regraded.

Roof and other drains should discharge into storm sewers or, if this is not possible, should discharge well clear of the buildings. Landscaping should be designed to minimize the need for watering adjacent to the proposed buildings. Water should not be allowed to pond adjacent to the proposed buildings or on the proposed pavement areas. A minimum grade of 2 percent is recommended to promote surface runoff and minimize potential saturation and degradation of the subgrade. High traffic areas within the site should be kept high. The surface of the top of the subgrade should mirror the surface grades and shed infiltration water away from areas of high traffic.

6.4 ALBERTA BUILDING CODE

In accordance with the most recent version of the Alberta Building Code (ABC), the use of Limit States Design (LSD) is required for the design of buildings and their structural components including foundations. The limit states of LSD design are classified into two groups; the Ultimate Limit States (ULS) and the Serviceability Limit States (SLS). The ULS design requirements in the ABC reference the Structural Commentaries in the User Guide of the National Building Code of Canada (NBCC).

6.4.1 Ultimate Limit States (ULS)

The ULS case is primarily concerned with safety and the levels of load and resistance at the point of collapse or structural failure. The geotechnical value for this case is the ultimate resistance. For foundation design this ultimate resistance value is reduced using a Geotechnical Resistance Factor (GRF) which is based on the reliability index of the geotechnical data used to determine the ultimate resistance for the foundation loading case. The following GRF values should be used for foundation design at this site.

TABLE 3
LSD GEOTECHNICAL RESISTANCE FACTORS

GEOTECHNICAL CASE	Resistance Factors
DEEP FOUNDATIONS (PILES)	
Vertical resistance by semi-empirical analysis and in-situ test data	0.4
Vertical resistance from analysis of dynamic monitoring results	0.5
Vertical resistance from analysis of static load test results	0.6
Uplift resistance by semi-empirical analysis and in-situ test data	0.3
Uplift resistance from analysis of static load test results	0.4
Lateral Load Resistance	0.5
SHALLOW FOUNDATIONS (FOOTINGS)	
Vertical resistance by semi-empirical analysis and in-situ test data	0.5

* NBCC - Users Guide - Structural Commentaries (Part 4 of Division B) - Commentary K - Foundations.

6.4.2 Serviceability Limit States (SLS)

The SLS case occurs when the foundation loads cause movements or vibrations that are greater than the structure can tolerate before the intended use of the structure is restricted or hindered. The SLS case is addressed by determining the maximum available resistance to keep the foundation deformation within tolerable limits under service loads (ie. settlement, lateral deflection, etc.). Typically, the foundation loads, configurations and serviceability tolerances have to be known to properly determine geotechnical SLS resistance values. In some foundation cases, such as small footings, basic assumptions can be used to provide preliminary SLS resistance values under specific stated conditions.

For pile foundations under axial loading conditions, the SLS resistance is addressed by determining the limiting load to keep foundation settlements within tolerable limits. Tolerable total and differential settlements should be verified by the structural engineer, but for normal buildings the tolerable limit of total settlement for foundations is typically about 25 mm. For the pile sizes expected on this project, less than 25 mm of settlement is expected to be required to mobilize the ultimate resistance. Therefore, the serviceability limit states are not expected to govern this foundation design unless very strict settlement tolerances are required (i.e. less than 10 to 15 mm of settlement). The settlement potential of the proposed piles may be checked once pile design and loading conditions are finalized.

6.4.3 Seismic Considerations

The Alberta Building Code requires buildings to be designed to resist a minimum earthquake force. The formula for obtaining minimum earthquake force is dependent on several factors including Foundation Factor (F) which should be determined using a Site Class of C for this site (Table 4.1.8.4.A). The subgrade soil is a stiff to very stiff clay overlying a stiff to hard clay till based on the Standard Penetration Testing.

6.5 PILE FOUNDATIONS

6.5.1 Bored Cast In Place Concrete Piles - ULS Design

The soil conditions for this site are suitable for bored cast-in-place concrete piles. Either straight-shaft skin friction or belled end-bearing piles could be considered. Bored cast-in-place concrete piles may be designed based on the ultimate skin friction or end bearing resistance provided in the following table:

TABLE 4
BORED CAST-IN-PLACE CONCRETE PILES - ULTIMATE RESISTANCE

Soil Type	Depth (m)	Ultimate Resistance (kPa)	
		Skin Friction	End Bearing
Clay	0 - 1.5*	0	-
Clay	1.5 - 6.0	45	-
Clay Till	6.0 +	60	1250

* For heated structures. For unheated structures use 2.5 m.

The ultimate resistance values in this table are based on semi-empirical data; therefore the factored ULS resistance should be calculated by multiplying the ultimate values above by a GRF of 0.4. The upper 1.5 m of pile shaft or the length of shaft embedded in fill, whichever is greater, should be assumed to carry no load. For unheated buildings or structures, the upper 2.5 m of pile shaft should be assumed to carry no load. Piles installed through new fills should be assumed to have a downdrag (negative skin friction) equal to 15 kPa for the section of pile within the fill. The downdrag is an ultimate load. The end bearing contribution to pile capacity should be neglected in the design of bored friction piles.

For end bearing piles (ie. belled piles), the shaft should be assumed to carry no load. For end bearing piles, care must be taken to provide a bearing surface at the base of the pile free from all loose and disturbed soil. Additional recommendations for cast-in-place concrete piles at the site are as follows:

1. To resist uplift forces created by frost action, the minimum depth of straight shaft piles for heated structures should be 6.0 m below final grade. The minimum depth of straight shaft piles for unheated structures should be 7.0 m below final grade. Bellied piles should have a minimum depth of 5.0 m below final grade.
2. Steel casing should be available on site during construction and should be used to prevent sloughing and groundwater seepage into the drill-hole, if required.
3. Pile excavations should be filled with concrete immediately upon completion of the pile excavation.
4. If bellied piles are used:
 - the bell diameter should not exceed the shaft diameter by more than a factor of 2.5.
 - a bell to shaft ration of 3:1 would be acceptable, as long as the roof of the bell is steeper than 1:1 or 45° to ensure that the entire load being transferred to the bell is spread over the entire area of the bell.
 - the minimum distance from the underside of any sand layer to the roof of the bell should be 1.5 m.
 - bells should not be placed within sand lenses, sand, gravel, or coal layers (if encountered).
 - to avoid potential settlement in loose soils remaining after shaft is drilled, the base of the bell should be founded a minimum of 100 mm below the final depth achieved by the auger used to drill the shaft.
5. Steel reinforcement should extend the full length of the pile for bellied end bearing piles and at least 6 m for straight shaft friction piles. The minimum recommended pile diameter is 400 mm.
6. All pile installations should be inspected by a qualified geotechnical engineer or technician to verify that design criteria are met or exceeded

6.5.2 Frost Action on Piles

Pile shafts within the frost zone of the subgrade will be subjected to adfreeze forces which can cause frost jacking. The minimum embedment depths given in Sections 6.5.1 are intended to counter these forces and prevent uplift from frost.

Frost heave and/or soil swelling forces will act on the underside of pile caps and grade beams with upward heaving pressures in the order of 200 kPa or greater. The potential of for these forces can be greatly reduced by the placement of a compressible material or by providing a void of at least 125 mm between the underside of the concrete cap or grade beam and soil. A product such as Voidform or an equivalent is recommended. If a compressible material is used as an alternative to the Voidform, the uplift pressure acting on the underside of the concrete may be taken as the crushing strength of the compressible medium. The finished grade adjacent to foundation walls should be sloped away so that surface runoff is not allowed to infiltrate and collect in the void space or the compressible medium. If water is allowed to accumulate in the void space or the compressible medium becomes saturated, the beneficial effect will be negated and frost heaving/soil swelling pressures will occur.

6.6 FOOTINGS

The site soil conditions are less suitable for footing foundations due to the presence of high plastic clays at typical footing depths. Deep pile foundations are preferable at this site. If footings are considered, all bearing surfaces must be covered with a mud slab immediately after excavation to prevent exposed clays from drying out excessively. Footings should not be oversized to reduce the bearing pressure because the larger footing and lower bearing pressure will reduce resistance to heave.

Footings founded on native silty clay and clay till may be designed based on the Ultimate Limit States (ULS) and Serviceability Limit States (SLS) using the bearing resistance values given in the following table:

TABLE 5
BEARING RESISTANCE FOR FOOTINGS

Type	ULS (kPa)		SLS (kPa)
	Unfactored	Factored	
Strip Footing	300	150	100
Spread Footing	360	180	120

* For footings bearing in native site soils within 3.0 m of existing grade.

The “factored” ULS resistance given above has been calculated by multiplying the unfactored bearing capacity values by a geotechnical resistance factor of 0.5, in accordance with the building code as summarized in Section 6.4. The SLS bearing resistance values given above are based on limiting the settlement to 25 mm or less, and are applicable to footings with a maximum dimension of 1.2 m wide or $1.5 \times 1.5 \text{ m}^2$. If very strict settlement tolerances are required or if larger footings are proposed, the footing sizes and settlement potential should be reviewed.

Preparation of the bearing surfaces should be monitored by a qualified geotechnical engineer prior to placement of footings to verify that design criteria are met. The following additional recommendations are submitted for footing design and construction:

1. It is assumed all footings will be below the depth of frost. Excavations should be undertaken in such a manner to reduce disturbance to the exposed subgrade. All loosened or disturbed soil should be removed from the bearing surface. The clay and clay till deposits are high plastic. It is crucial not to allow this material to dry out during or after construction through the use of a protective layer such as a mud slab; or the subgrade can be saturated by flooding or injection prior to placement of the footings or slabs.
2. For protection against frost action, exterior footings in continuously heated structures should be provided with a minimum depth of ground cover of 1.5 m. Isolated footings and exterior footings in unheated structures will require at least 2.5 m of ground cover. Styrofoam insulation may be used to prevent frost penetration where adequate depths of ground cover cannot be economically provided.
3. If unsuitable soil is encountered at (or below) footing depth, the unsuitable material must be subcut and replaced with lean mix concrete.
4. Excavations should be protected against large amounts of surface water run-off and seepage water through the use of conventional sumps and ditches, if required. The exposed surface may be protected with a thin mud slab of lean mix concrete.
5. Foundation soils must not be allowed to freeze at anytime during or after construction. Footings founded on frozen soils will settle when the founding soils are weakened by thawing.

6.7 GRADE SUPPORTED SLABS

Typical to many areas of Grande Prairie, the site soil conditions are not well suited to slab on grade floor construction within the surficial clays, because of high plastic swelling soils. Ideally, the preferred design option is to provide structurally supported slabs. If grade supported slabs are proposed, it is suggested to remove and replace 1.0 m of the high plastic clay subgrade with low to medium plastic clay. It should be noted that this level of subgrade replacement is rarely done and suitable replacement soils are not easily found in Grande Prairie.

The swelling potential for the clay on this site is estimated between 50 to 150 mm, depending on what precautions are taken to minimize drying of the subgrade during construction. For concrete slab design, a modulus of subgrade reaction (K_s) of 30,000 kN/m³ may be used for slabs placed on at least 150 mm of gravel base compacted to 98 percent of SPMDD. The following recommendations are provided for grade supported floor slabs in buildings which will be continuously heated:

1. Grade supported slabs should be supported on 150 mm of base gravel. The gravel should consist of well graded, free draining, granular base with a maximum aggregate size of 50 mm and less than 10 percent passing the 0.080 mm sieve. The gravel should be compacted uniformly to 98 percent SPMDD.
2. It is important not to allow clay subgrades to dry out during or after construction. This is crucial for high plastic clays. Prior to placement of the gravel base for the slab, the subgrade underneath the slab should be saturated to provide moisture for swelling prior to placement of slabs to reduce potential for swelling after the slab is placed.
3. Slabs should be constructed independently of all walls, columns and grade beams and may be tied into the grade beam with dowels at doorways. Alternatively, the slab can be tied into the grade beam at all points provided that a construction joint or cut is placed parallel to the grade beam and at a distance of approximately 2.0 m.
4. Slabs should be provided with construction joints or sawcuts consistent with local practice and should be reinforced with steel bars dimensioned in accordance with the structural engineer's requirements. The reinforcing bars can be carried through the saw-cut joints.
5. Non-load bearing partitions should be designed to accommodate slight vertical movements. Mechanical equipment placed on floor slabs should be designed to permit some rel levelling should the equipment be susceptible to small changes in level.

6. Piping and electrical conduit connections should be laid out to permit some flexibility, as vertical movement of such equipment as water meters, furnaces and electrical equipment may cause distress in the pipes. This provision is particularly important where there are short pipe runs between mechanical equipment and points where piping passes through the walls. Heating ducts beneath the floor should be insulated with at least 75 mm of rigid insulation to prevent drying of subgrade soils. If possible, water lines should not be placed beneath slab on grade floors.

If slabs with very strict tolerances for vertical movement are proposed at this site, structural floor slabs should be considered. The performance levels for structural slabs can be engineered.

6.8 LATERAL EARTH PRESSURES

Lateral earth pressures will act against the foundation walls of the underground parkade. In addition, if a shored excavation is used, lateral earth pressures will act against the shoring walls. Three earth pressure cases will exist at this site.

Active Case. Active earth pressures (K_A) should be used behind retaining walls which are unrestrained at the top and flexible walls which are allowed to move away from the restrained soil mass (ie. shoring).

"At Rest" Case. "At rest" pressures (K_O) should be used behind retaining walls which are restrained at the top and would include typical basement walls for the possible underground parkade. At-rest conditions should be assumed for any sections of the shoring wall required to support adjacent development to minimize potential loss of support for existing foundations.

Passive Case. Passive earth pressures (K_P) act on the front of a wall (ie. against the base of the wall). Horizontal stresses on the wall push against the soil creating a much larger resisting force than is produced by the active or at rest conditions.

Lateral earth pressures may be computed using the following equation:

$$P = K Q + K Y H$$

where:
 P = lateral earth pressure at depth H below ground level (kPa)
 Q = Any surcharge loading at the ground surface (kPa)
 K = coefficient of lateral earth pressure
 Y = total unit weight of backfill compacted to 95 % SPMDD (kN/m³)
 H = depth below ground level

The preceding relationship makes no allowance for hydrostatic pressures to build up behind the wall. This relationship may be used if the parkade elevation is above the high groundwater elevation or if a sub-drainage system capable of handling the anticipated groundwater flows is installed.

Recommended design values for these parameters depend on the type of backfill used.
Recommended design values are given in the following table.

TABLE 6
LATERAL EARTH PRESSURE PARAMETERS

Type of Backfill	Total Unit Weight (kN/m ³)	Coeff. of Lateral Earth Pressure		
		K _A	K _O	K _P
Native clay material	18.0	0.51	0.6	2.0
Native clay till material	19.0	0.45	0.6	2.2
Free draining granular material	21.5	0.33	0.4	3.0

The preceding relationship makes no allowance for additional horizontal forces due to frost build up behind the wall on the assumption that heat or frost protection will be utilized. The earth pressure relationship given above assumes nominal compaction of the backfill to a maximum of 95 percent SPMDD. Only light, hand operated equipment should be operated within 1.5 m of walls and walls should be braced prior to backfilling. If higher levels of compaction are proposed, the earth pressure relationship given above should be reviewed. If no frost protection is provided the active or at rest lateral earth pressures pushing on the wall should be increased by a factor of 2 for the depth of frost.

6.9 SUB-DRAINAGE SYSTEM

The local groundwater table appears to be relatively deep at this site. This site will be subject to infiltration from snow melt and precipitation. Seasonal perched groundwater conditions from this infiltration will have the potential to intersect through the footprint of the parkade structure.

A perimeter sub-drainage system is recommended for the underground structure. The permanent sub-drainage system (weeping tile drain) should consist of a minimum 200 mm diameter perforated rigid plastic pipe surrounded by a filter of free draining gravel and enveloped in a filter fabric. The filter gravel should provide at least 150 mm of free draining washed rock or clean crushed gravel cover over the weeping tile pipe. The drain pipes do not need to be enveloped in filter cloth if the gravel drain is wrapped. The drain pipes should be sloped towards one or multiple collection sumps. Each sump should be provided pumps for dewatering. The subdrainage system should be provided with clean-outs for protection against siltation.

It is recommended to use medium to high plastic select clay backfill to provide a clay cap at ground surface above the weeping tile to minimize infiltration flows. The back-slope away from the buildings as recommended in Section 6.3 will be an important consideration in reducing infiltration into the sub-drainage systems.

6.10 EXCAVATIONS AND BACKFILL

All excavation work must comply with the requirements of the Alberta Occupational Health and Safety Code (OHS Code, 2009). The OHS Code contains the technical requirements that support the Act and Regulation.

Excavation side slopes are not expected to be able to stand near vertical for extended periods of time. For excavations, the soils must be sloped to within 1.5 m of the bottom of the excavation at an angle of not less than 45 degrees measured from the vertical (1H:1V). Alternatively, near vertical trenched excavations may be constructed in conjunction with a movable shield.

For excavations through old fill, organic soil or groundwater, flatter side-slopes may be required. Stockpiles of materials and excavated soil should be kept back from the crest by a distance equal to at least the depth of excavation. Similarly, wheel loads should be kept back at least 1 m from the crest.

The underground parkade excavation is not expected to require a significant volume of backfill. The fill should be placed evenly around the basement structure to distribute the stresses on the structure during backfilling procedures. Recommendations regarding fill materials and compaction specifications given above in Section 6.3 should be followed. Compliance with compaction recommendations around buildings is especially important, because poorly compacted backfill adjacent to foundation walls or grade beams will settle and may lead to ponding of surface water.

6.11 CONCRETE

Water-soluble sulphate concentrations from the samples tested indicated a severe potential for chemical attack of subsurface concrete. Therefore, Sulphate Resistant (Type HS) hydraulic cement is recommended for use in all subsurface concrete in contact with the soil at this site in accordance with CSA Standard CAN-A23.1-14. The recommended minimum 56 day compressive strength is 32 MPa with a water cement ratio of 0.45. All concrete exposed to a freezing environment either during or after construction should be air entrained.

6.12 SIDEWALKS AND EXTERIOR FLATWORK

The subgrade soils at the site are moist and fine grained and therefore moderately susceptible to ice lens formation. Frost heave of exterior flatwork in front of doorways is a common problem in Alberta especially in areas shaded by buildings. Unprotected sidewalks dowelled into foundations often tip up due to heave rotating around the dowel connection, blocking doors and promoting drainage towards the foundation wall. Unprotected sidewalks that are not dowelled into foundations may heave adjacent to the wall blocking doors and crushing any exterior wall facing not given enough clearance above the sidewalk.

If possible, exterior sidewalks should be moved away from foundation walls and exterior flatwork or sidewalks in front of doorways should be designed to minimize the impact of frost penetration on foundation walls and doors. The use of rigid structural insulation, heat tracing or a crushable, non-degradable void form material (so the void does not fill with water) should be considered in front of doorways. At least 50 mm of rigid insulation (Styrofoam HI or equivalent) should be placed below flatwork to restrict frost penetration into the subgrade soils. The insulation should taper out from the buildings, providing a gradual transition to unprotected subgrade. The exterior flatwork should slope away from the building and the sidewalk/building interface should be sealed to prevent seepage of surface runoff into the foundation soils.

6.13 PAVEMENTS

6.13.1 Rigid Concrete Pavement

If an underground parking structure is proposed for this development, the basement slab will effectively be a rigid concrete pavement.

The rigid concrete pavement section should be supported by at least 150 mm of gravel conforming to Alberta Transportation (AT) specifications, as shown on Table 8. A modulus of subgrade reaction (K_s) of 30,000 kN/m³ may be used. The surface layer should consist of at least 175 mm of reinforced concrete with a minimum 28 day compressive strength of 25 MPa. The maximum aggregate size should be 20 mm and the concrete mix should contain 5-7 percent air entrainment. The slump when placed should not exceed 100 and the net water cement ratio, by weight, should not exceed 0.5.

Contraction joints should be spaced no less than 4.5 m apart. Good finishing practices should follow placement of concrete. Reinforcement details can be provided when the final panel configuration is established.

6.13.2 Flexible Asphalt Pavement

Proposed pavement design sections are based on the assumption that the pavement will be constructed on a stable, prepared subgrade with a soaked California Bearing Ratio (CBR) of 3.0. This is indicative of a relatively low level of subgrade support as expected during spring thaw when the subgrade soils will exist in a weakened condition. If soft subgrade conditions are encountered, it is assumed that the subgrade will be improved with coarse gravel to support construction traffic and paving activities. This subgrade improvement gravel is placed together with the subbase.

Two flexible pavement designs are proposed for this site, one for light traffic in the parking areas; and one for heavier traffic on access roads and any truck loading areas. The assumed loading for heavy truck traffic is 10 trucks per day. If it is anticipated that traffic will exceed these levels, the design sections provided below should be reviewed.

TABLE 7
FLEXIBLE PAVEMENT DESIGN

	Light	Moderate
Asphalt Concrete Pavement (ACP)	75 mm	100 mm
20 or 25 mm Granular Base Course	300 mm	450 mm
Prepared Subgrade (150 mm)	Yes	Yes

The performance of the proposed pavement design section will be, in part, dependent on achieving an adequate level of compaction in the subgrade and pavement materials. The recommended levels of compaction for the granular materials in the pavement section should be a minimum of 98 percent of SPMDD. The asphalt concrete should be compacted to a minimum of 97 percent of Marshall density based on a 50 blow laboratory Marshall test. It is recommended to use pavement materials conforming to the following specifications:

TABLE 8
ASPHALT CONCRETE

Parameter	Specification
Stability (kN, minimum)	8.0
Flow (mm)	2 - 4
Air Voids (percent)	3 - 5
VMA (minimum percent)	14.5
Asphalt Cement (penetration grade)	150 - 200 (A)

Aggregate materials for base gravel should be composed of sound, hard, durable particles free from organics and other foreign material. It is recommended to use aggregates conforming to the following Alberta Transportation (AT) specifications.

TABLE 9

RECOMMENDED AGGREGATE SPECIFICATIONS

	AT Specifications
Asphalt Gravel	Designation 1, Class 12.5 or 16
Crushed Base Gravel	Designation 2, Class 20 or 25
Subbase Gravel	Designation 2, Class 40

Based on the availability of local materials at the time of tendering or construction, alternate materials could be considered upon review by the geotechnical engineer.

The parking areas should be sloped and graded to effectively remove all surface water as rapidly as possible. To minimize the occurrence of surface water ponding in parking areas, surface grades of at least 2 percent are recommended. Allowing water to pond on the pavement surface will lead to infiltration of the water into the subgrade which could result in weakening of the subgrade soils.

6.14 INSPECTION

It is recommended that on-site inspection and testing be performed to verify that actual site conditions are consistent with assumed conditions which meet or exceed design criteria. Based on the Alberta Building Code, adequate levels of inspection include: testing of engineered fill, review of all completed bearing surfaces for footings and full time inspection during construction of deep foundations.

7.0 CLOSURE

This report is based on the findings at eight borehole locations at the site, soil testing and a review of other available site information. If new information or different subsoil/groundwater conditions are encountered, this office must be notified and recommendations submitted herein will be reviewed and revised as required. This report has been prepared for the exclusive use of **The City of Grande Prairie, NAK Design Strategies**, and their approved agents for the specified application to the proposed South Montrose Site developments in Grande Prairie, Alberta. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. Use of the report is subject to acceptance of the General Terms and Conditions provided in the Limitations appendix of this report.

Respectfully submitted,

PARKLAND GEOTECHNICAL CONSULTING LTD.

APEGAA Permit #07312



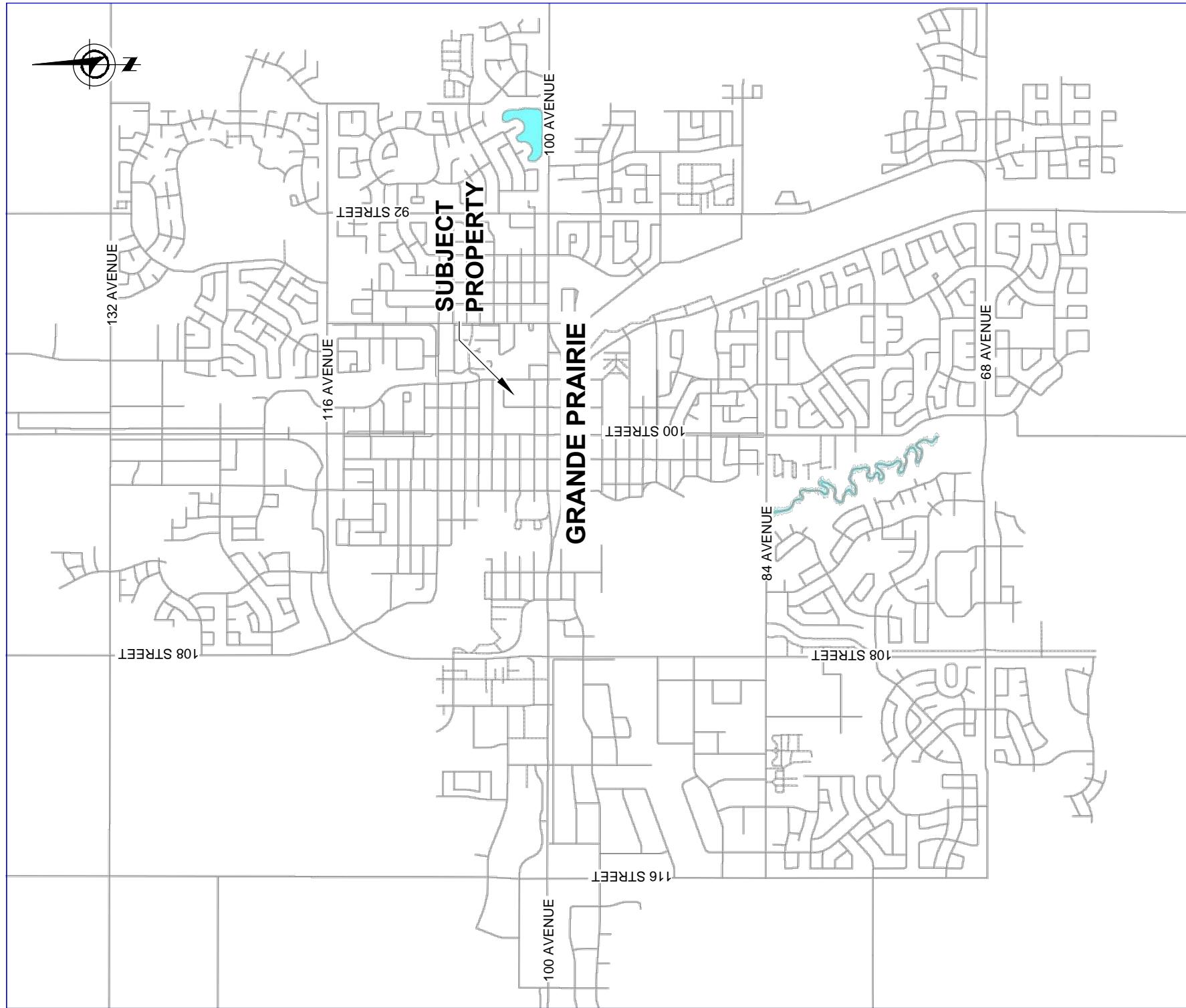
Aisha Wynter, P.Eng.
Geotechnical Engineer

Reviewed by:

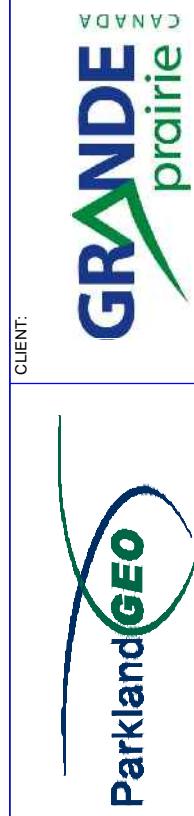
Mark Brotherton, P.Eng.

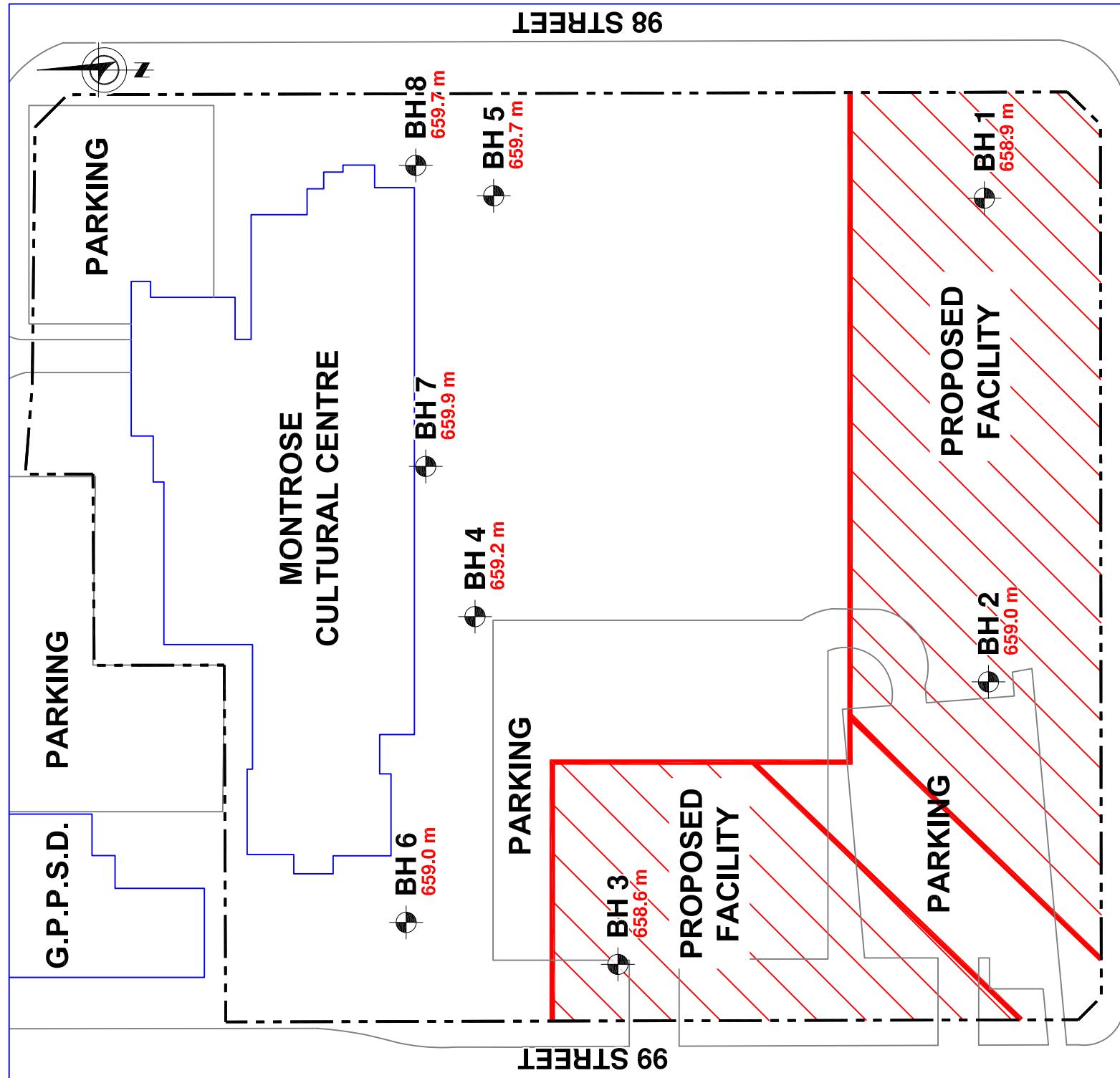
FIGURES

- Figure 1 - Key Plan
- Figure 2 - Site Plan
- Figure 3 - Aerial Plan
- Figure 4 - Site Photographs

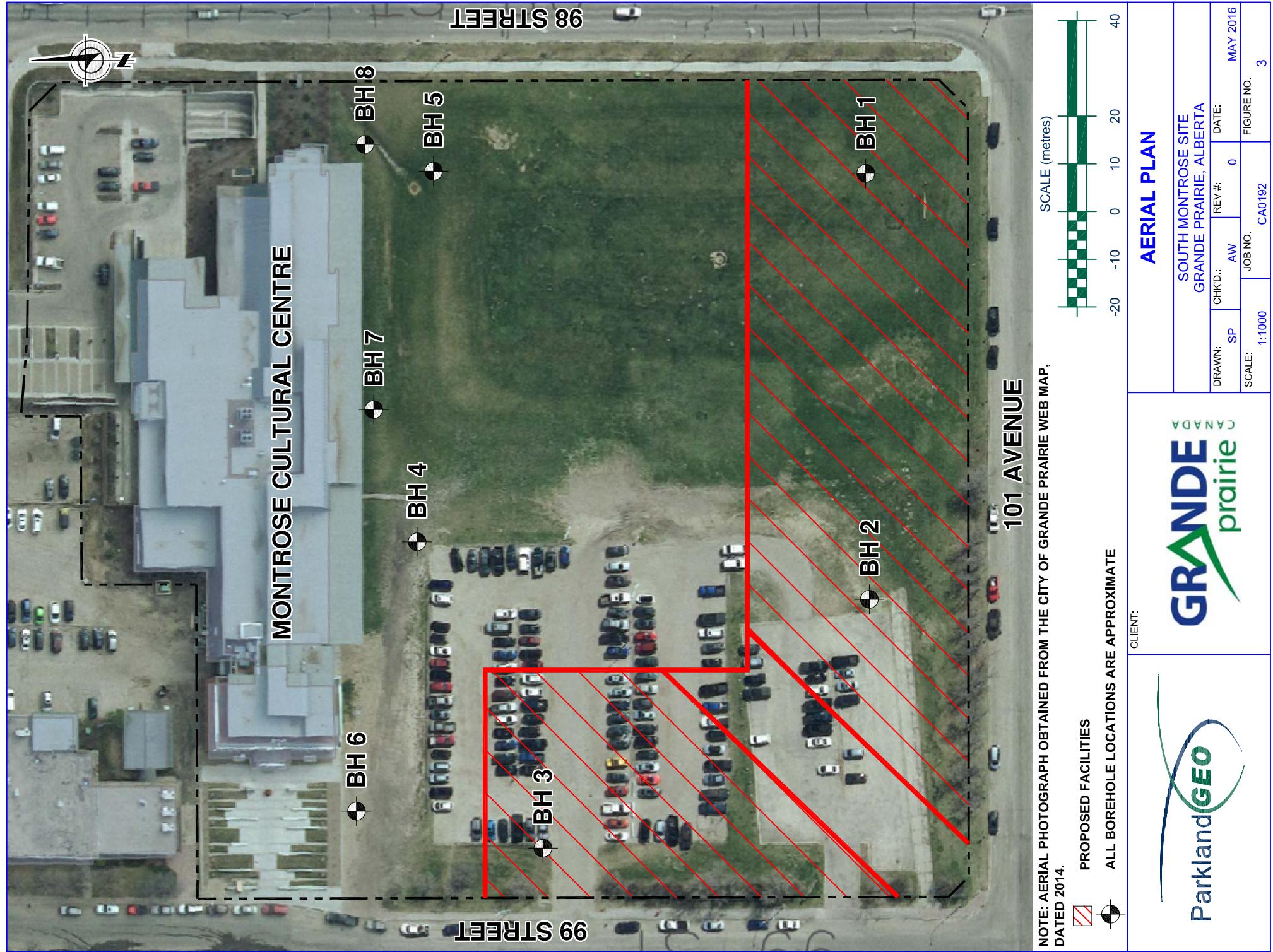


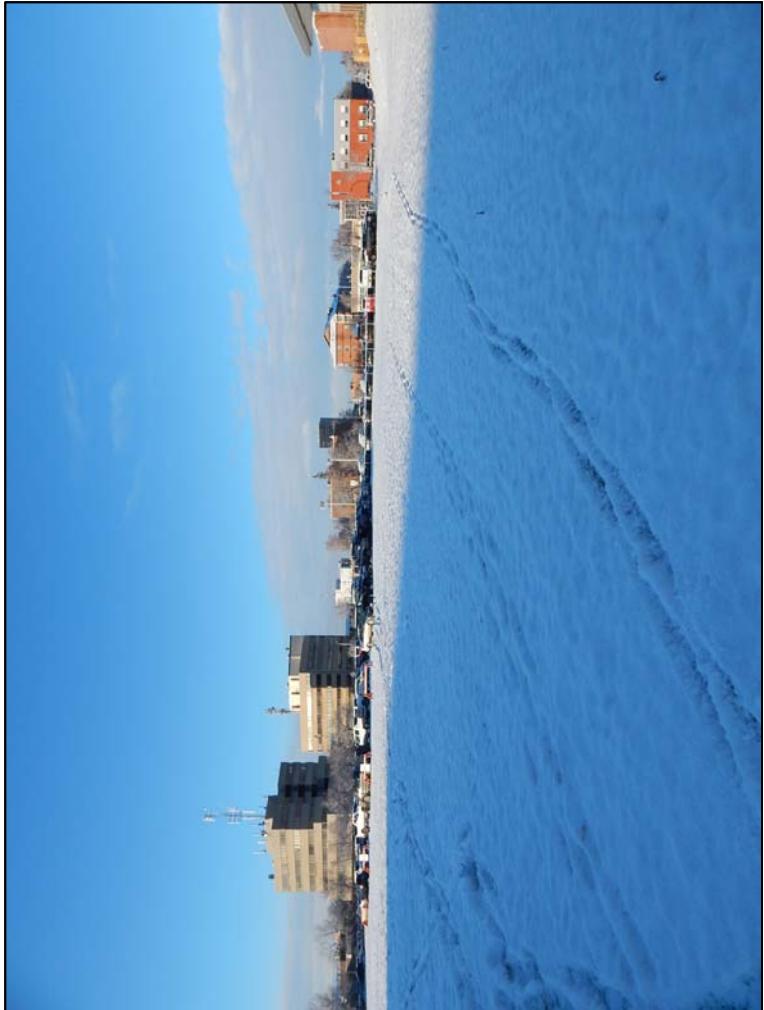
KEY PLAN			
SOUTH MONTROSE SITE GRANDE PRAIRIE, ALBERTA			
DRAWN: SP	CHK'D.: AW	REV #: 0	DATE: MAY 2016
SCALE: NTS	JOB NO. CA0192	FIGURE NO. 1	





SITE PLAN			
SOUTH MONTROSE SITE GRANDE PRAIRIE, ALBERTA			
DRAWN:	CHK'D:	REV #:	DATE:
SP	AW	0	MAY 2016
SCALE:	JOB NO.:	FIGURE NO.:	
1:1000	CA0192	2	
CANADA			
GRANDE prairie			
ParklandGEO			
SCALE (metres)			
-20	-10	0	10 20 30 40





February 4, 2016 - Proposed development area. Facing southwest.



February 9, 2016 - Proposed development area. Facing northeast.

CLIENT:

Parkland **GEO**

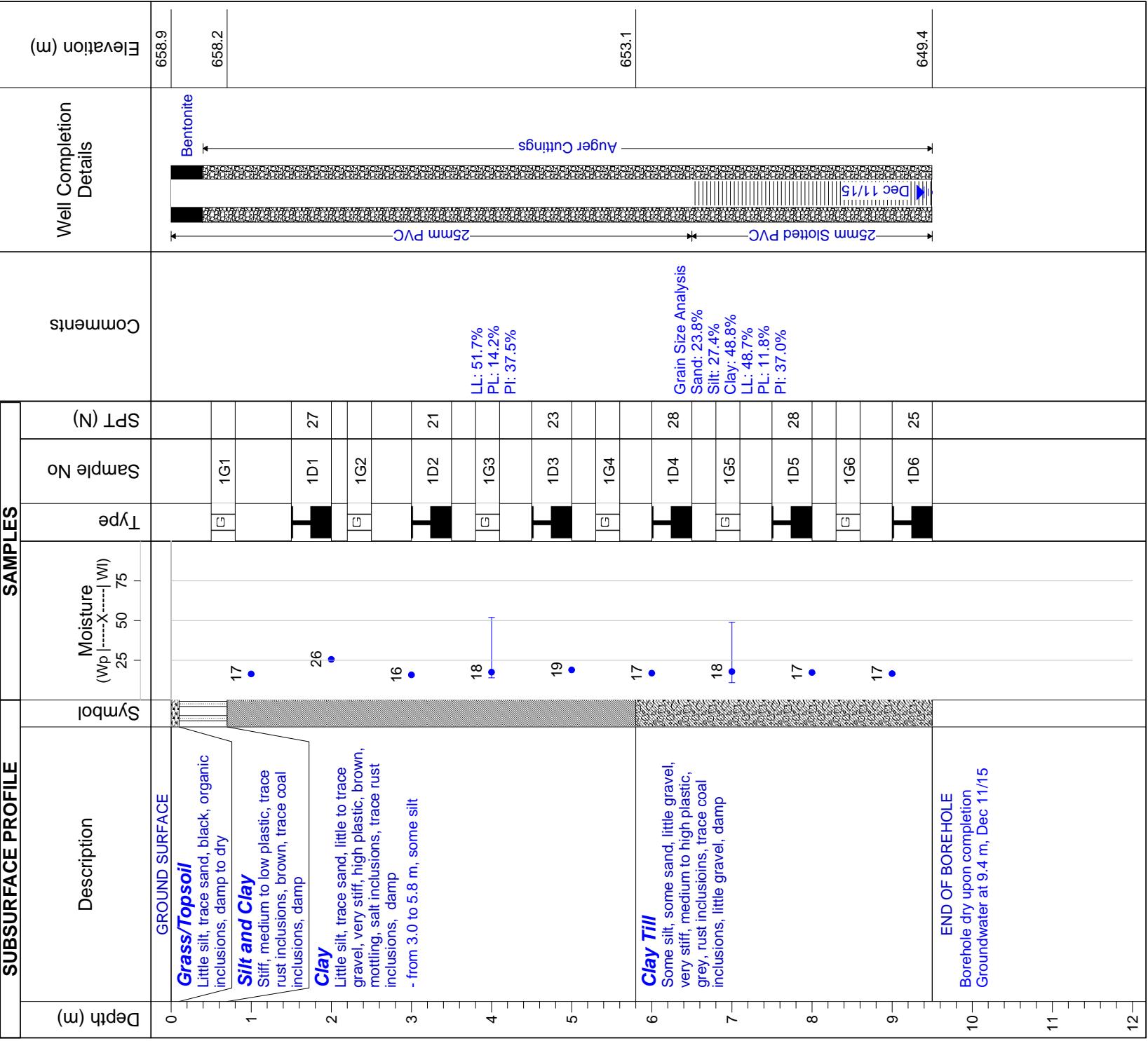
CANADA
GRANDE prairie

SITE PHOTOGRAPHS

SOUTH MONTROSE SITE GRANDE PRAIRIE, ALBERTA			
DRAWN: SP	CHK'D.: AW	REV #: 0	DATE: MAY 2016
SCALE: CA0192	JOB NO.:	FIGURE NO. 4	

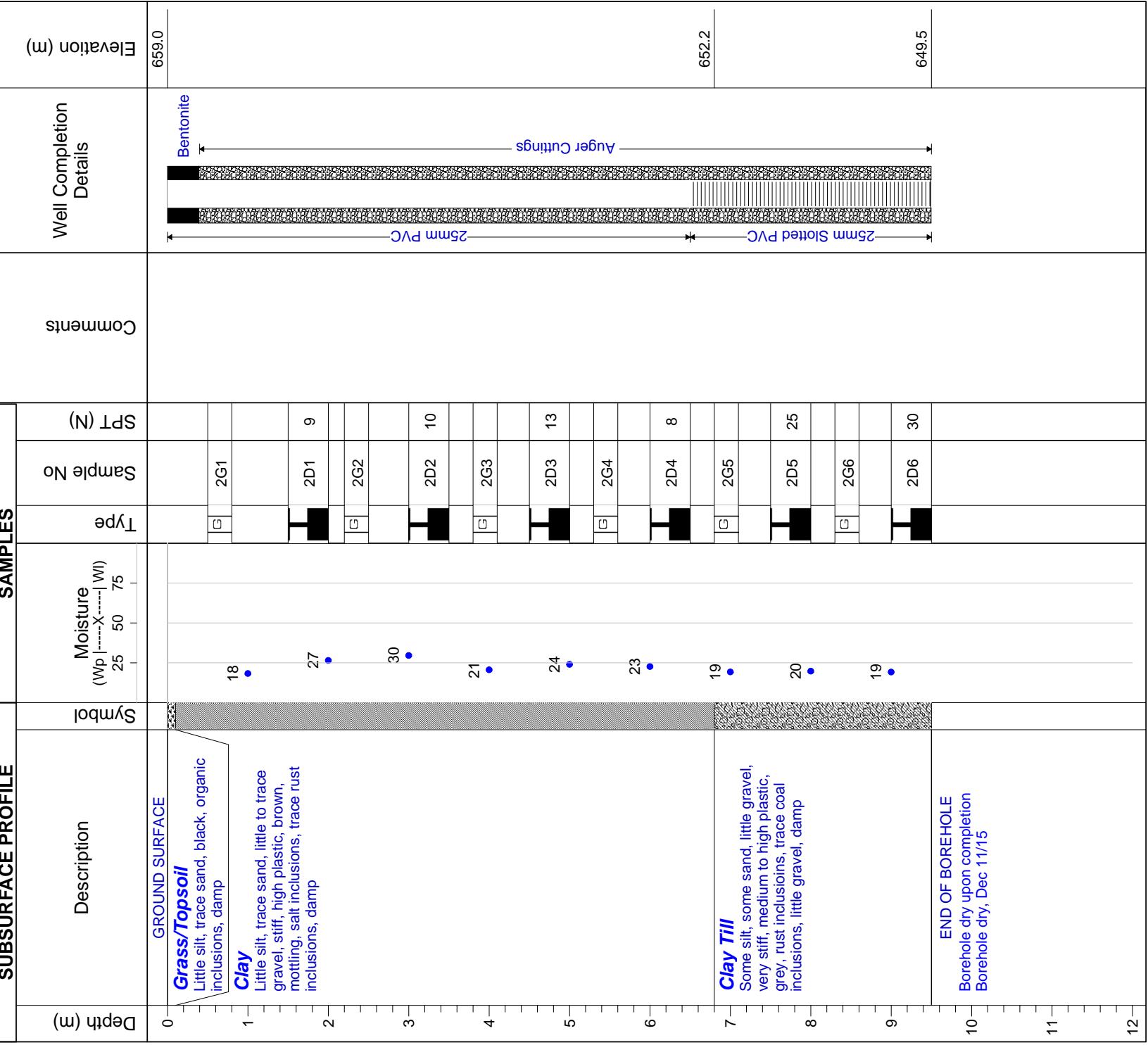
APPENDIX A

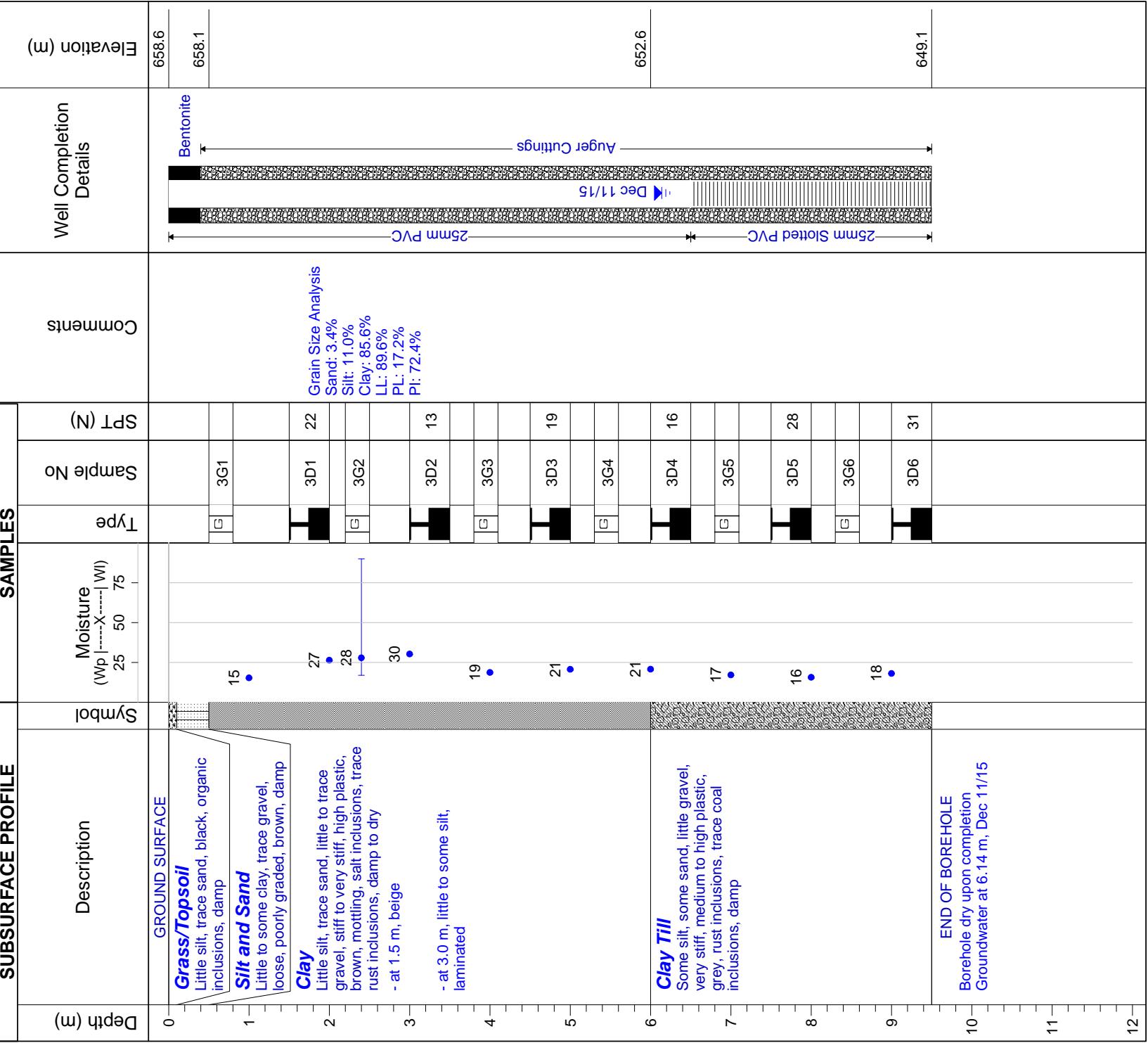
Borehole Logs
Soil Test Results
Explanation Sheets

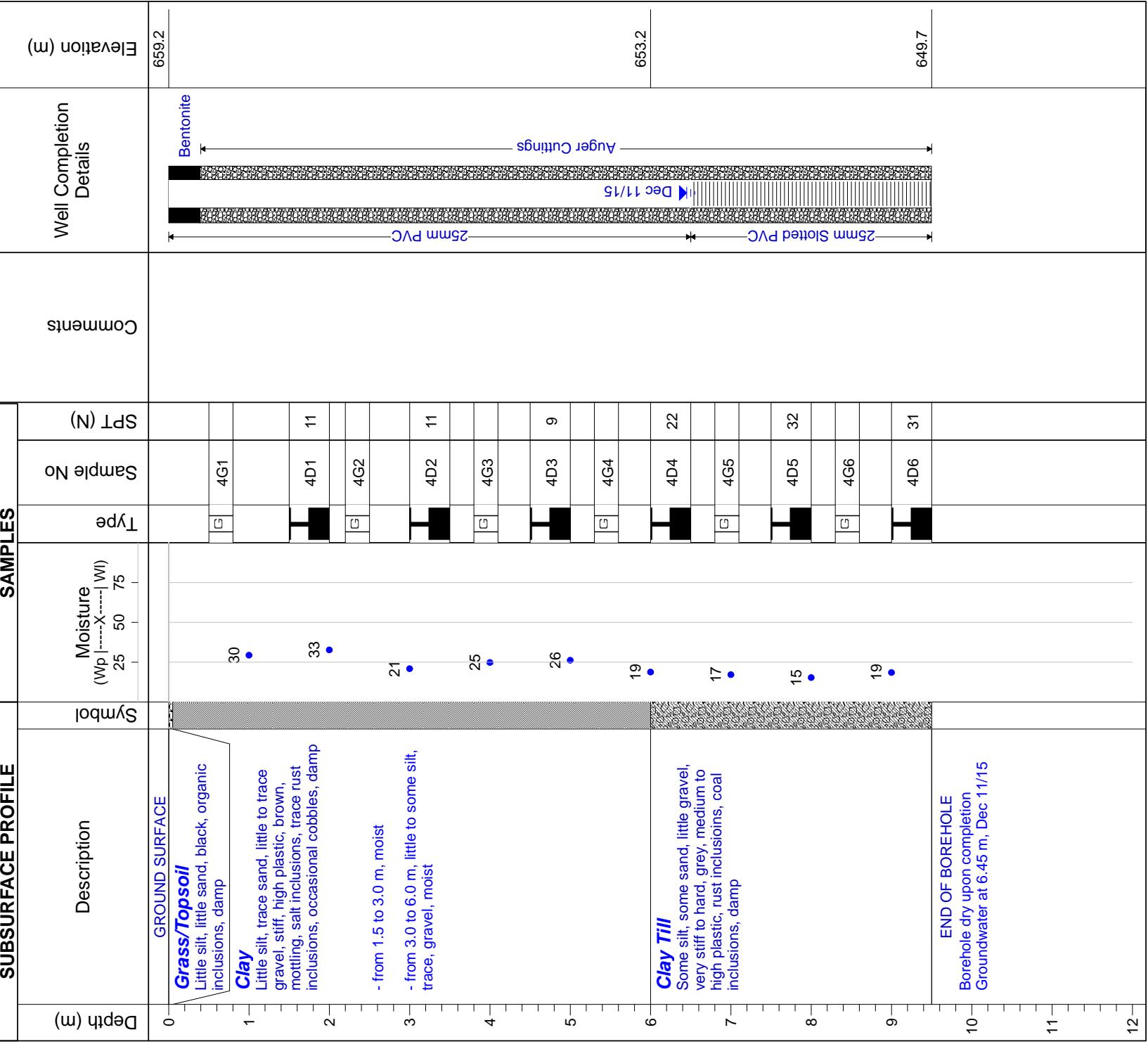


LOGGED BY: K.A
 CONTRACTOR: Frontier Enviro-Drilling Ltd
 RIG/METHOD: Truck Mounted Solid Stem
 NOTES:

DATE: Nov 3, 2015
 GROUND ELEVATION (m): 658.9
 NORTHING (m): 6115382
 EASTING (m): 386052

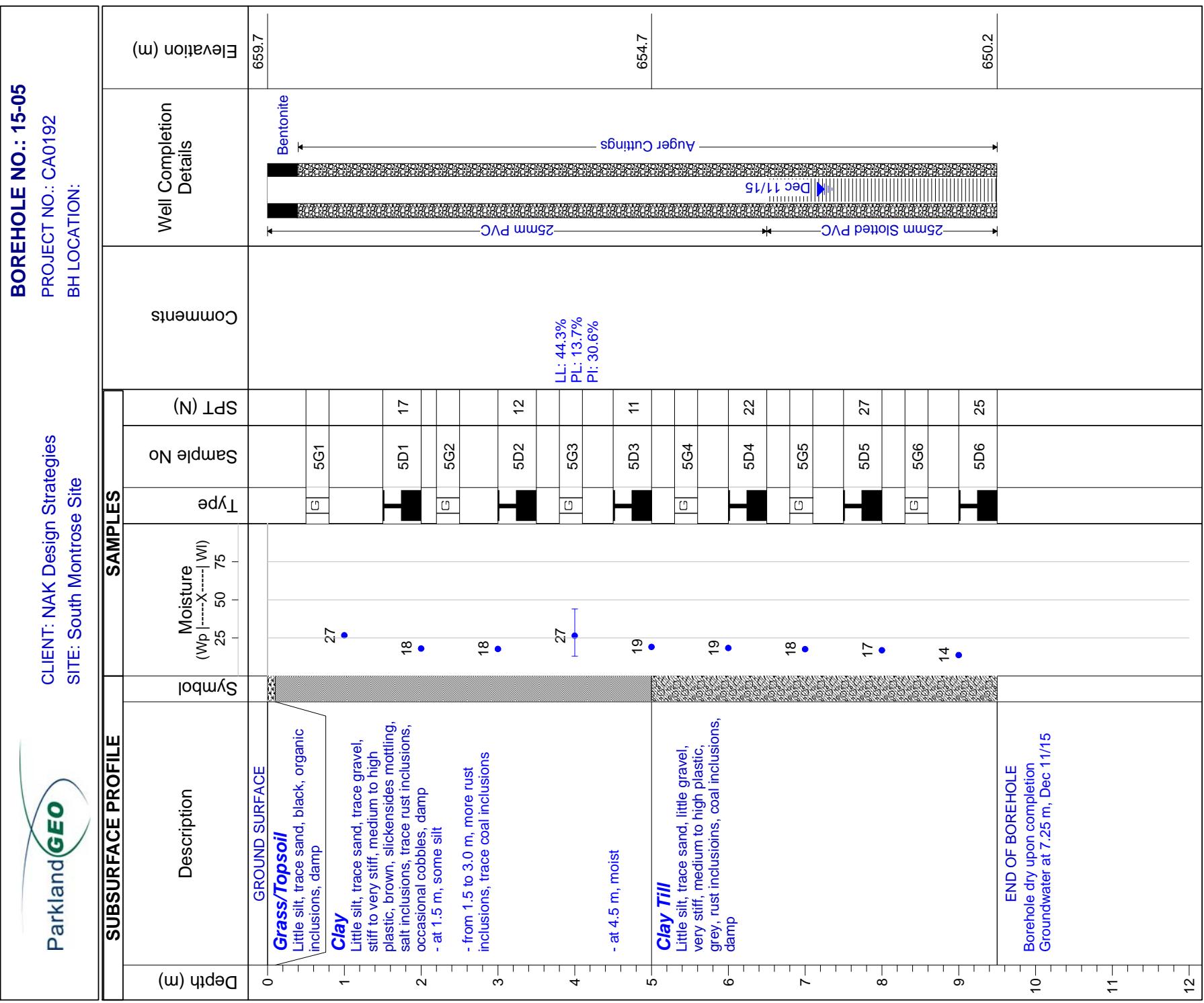






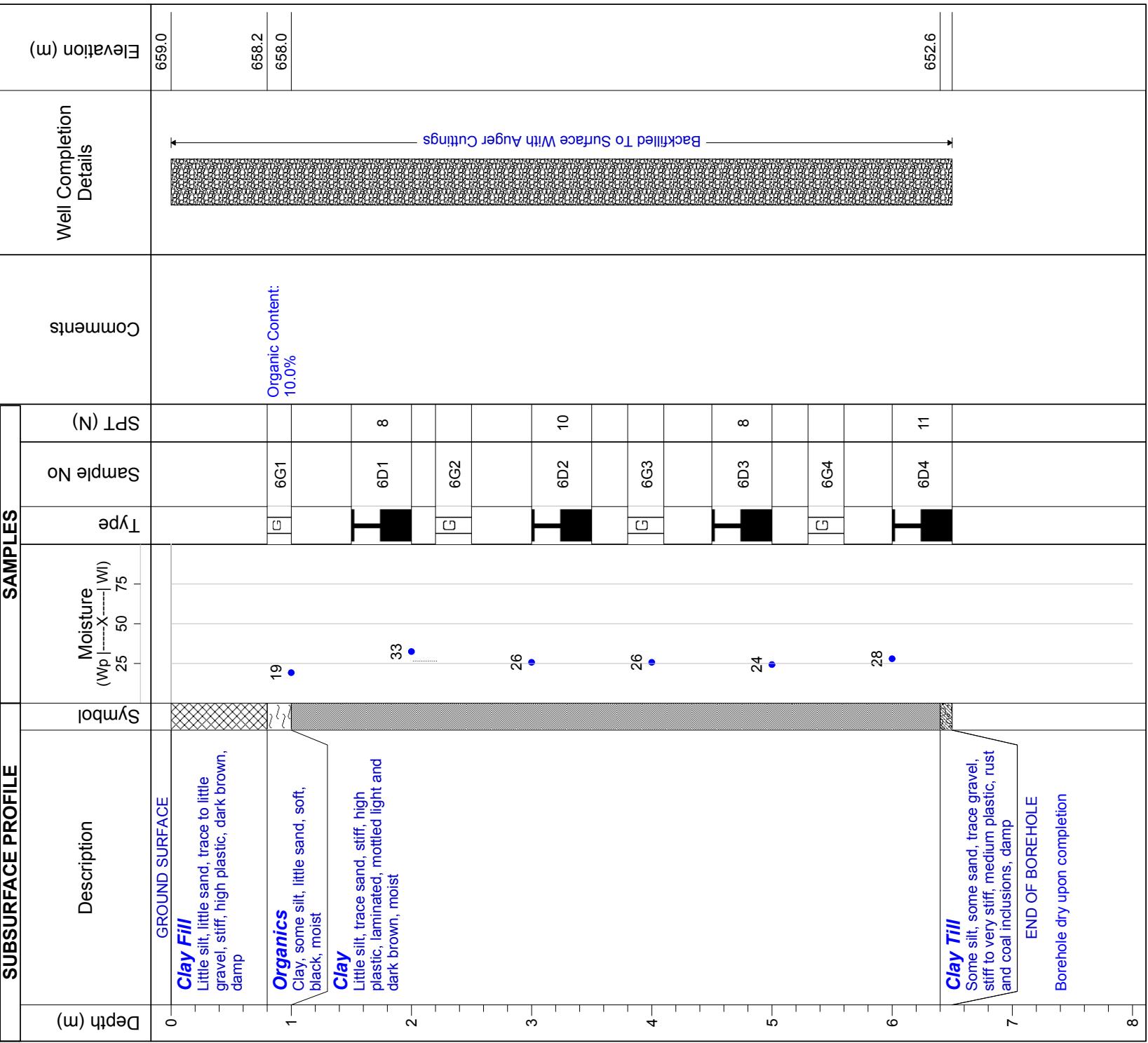
LOGGED BY: K.A
 CONTRACTOR: Frontier Enviro-Drilling Ltd
 RIG/METHOD: Truck Mounted Solid Stem
 NOTES:

DATE: Nov 3, 2015
 GROUND ELEVATION (m): 659.2
 NORTHING (m): 6115478
 EASTING (m): 385977



LOGGED BY: K.A
 CONTRACTOR: Frontier Enviro-Drilling Ltd
 RIG/METHOD: Truck Mounted Solid Stem
 NOTES:

DATE: Nov 3, 2015
 GROUND ELEVATION (m): 659.7
 NORTHING (m): 6115474
 EASTING (m): 386053



LOGGED BY: CS
CONTRACTOR: Frontier Enviro Drilling Ltd
RIG/METHOD: Truck Mounted Solid Stem
NOTES:

DATE: January 26, 2016
GROUND ELEVATION (m): 659.00
NORTHING (m): 6115493
EASTING (m): 385920



CLIENT: NAK Design Strategies
SITE: Montrose Supplementary Boreholes

BOREHOLE NO.: 16-07

PROJECT NO.: CA0211
BH LOCATION:

SITE: Montrose Supplementary Boreholes

SUBSURFACE PROFILE

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (W _p X W _i)		Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
			25	50						
0	GROUND SURFACE									659.9
0.5	Topsoil Some silt, little sand, dark brown, damp									
1	Clay Till Little silt, little sand, trace to little gravel, stiff, high plastic, medium gray, dry to damp - At 1.1 m, trace sand, dark brown, damp					7G1				
2			28			7D1	10			
2.5						G	7G2			
3	Sand Fine grained, little silt, trace clay, poorly graded, compact, light brown, damp		18			7D2	15			
3.5						G	7G3			
4	Clay Little silt, trace sand, stiff, medium to high plastic, dark brown, moist		21			7D3	15			
4.5						G	7G4			
5			28			7D4	20			
5.5										653.9
6	Clay Till Some silt, some sand, trace gravel, very stiff, medium plastic, dark brown, rust and coal inclusions, damp		31							653.4
7										
8										

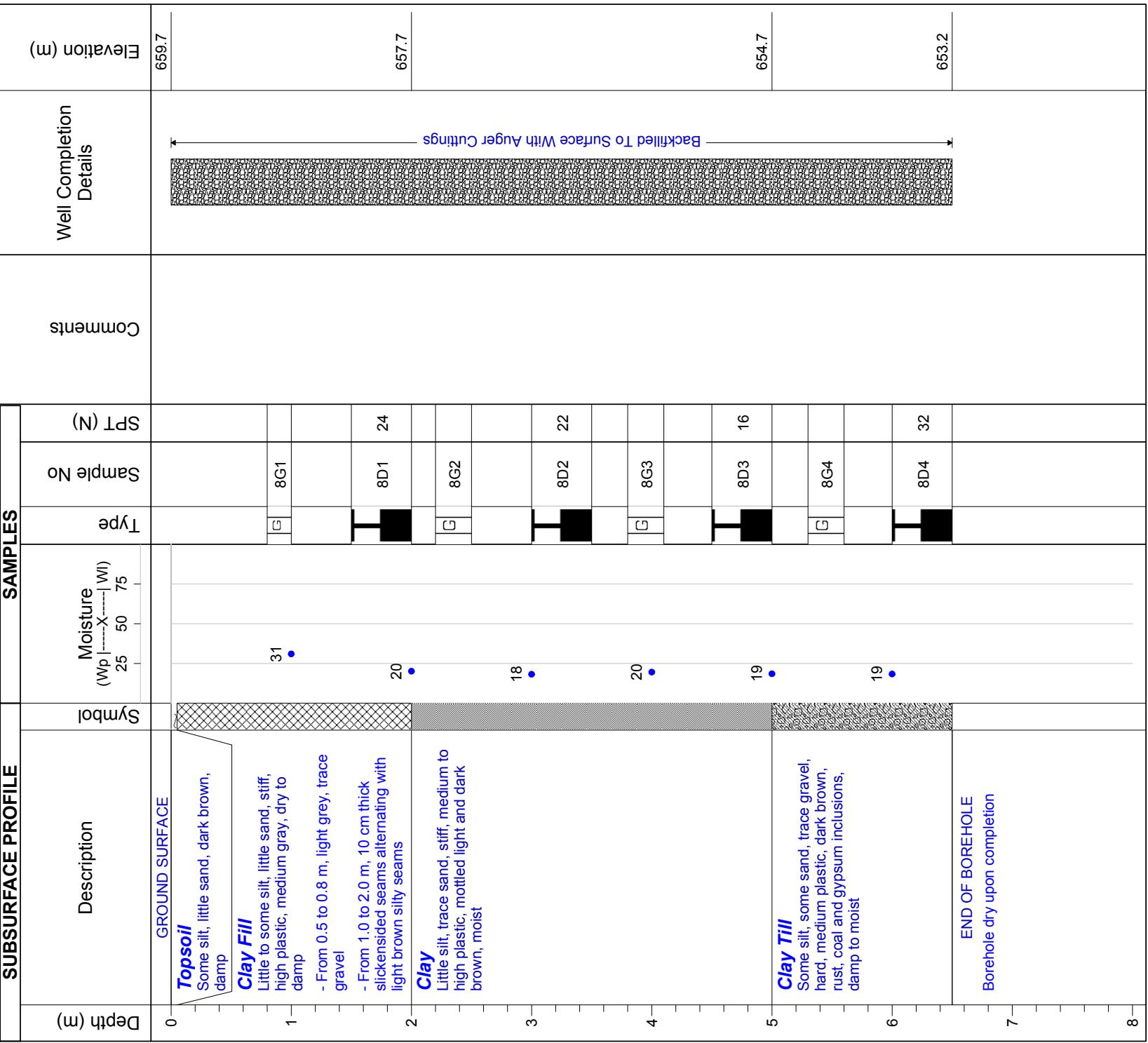
Backfilled To Surface With Auger Cuttings

LOGGED BY

CONTRACTOR: Frontier Enviro Drilling Ltd
RIGIMETHOD: Truck Mounted Solid Stem

NOTES:

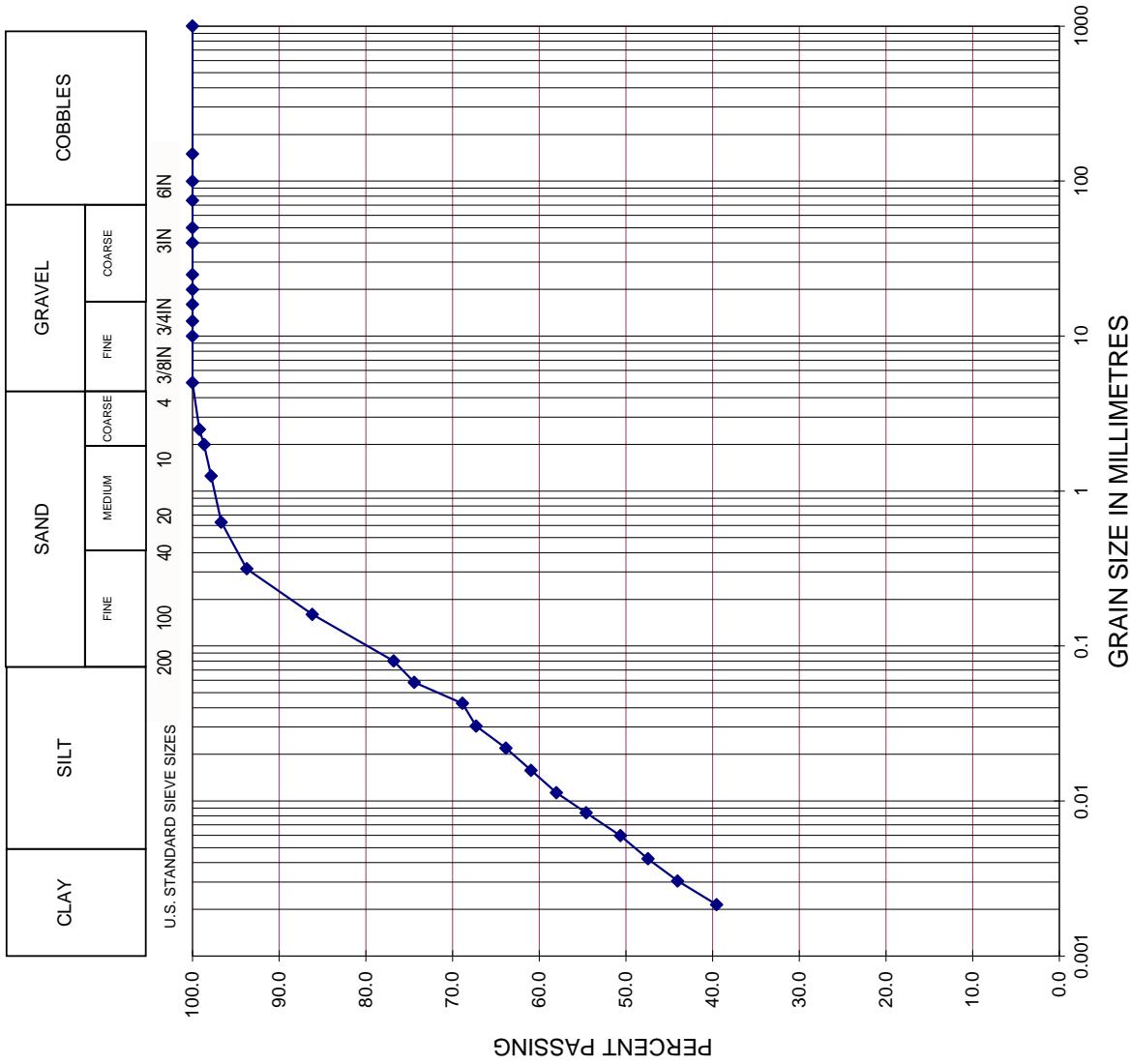
DATE: January 26, 2016
GROUND ELEVATION (m): 659.86
NORTHING (m): 6115486
EASTING (m): 3886004



LOGGED BY: CS
CONTRACTOR: Frontier Enviro Drilling Ltd
RIG/METHOD: Truck Mounted Solid Stem
NOTES:

DATE: January 26, 2016
GROUND ELEVATION (m): 659.66
NORTHING (m): 6115487
EASTING (m): 386060

GRAIN SIZE DISTRIBUTION



COMMENTS:

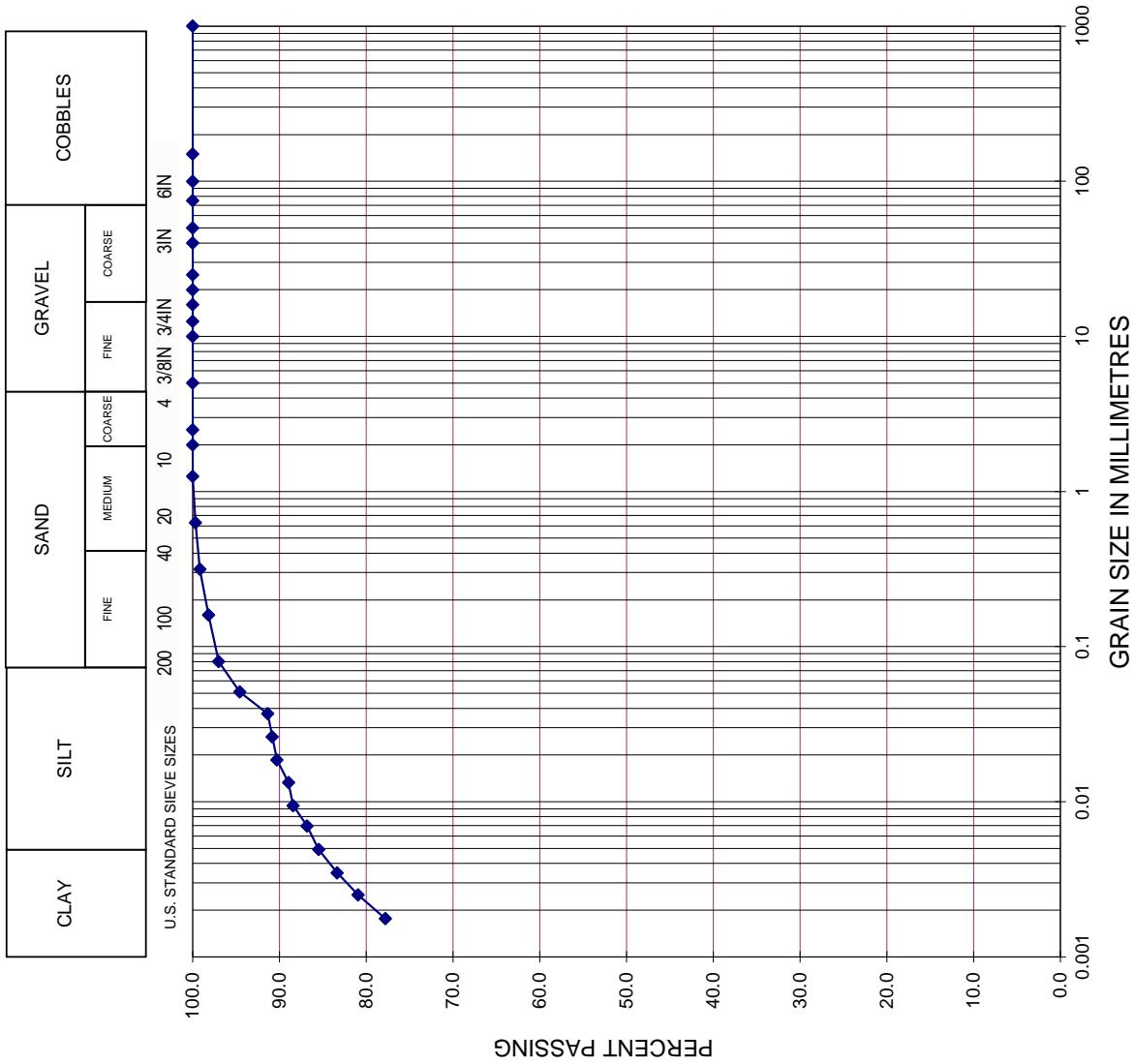
% Retained on 2 mm sieve 1.33%
 Soil Type Clay, some silt, some sand

SUMMARY	
D10 =	GRAVEL 0.00%
D30 =	SAND 23.76%
D60 =	SILT 27.40%
CU =	CLAY 48.85%
CC =	

PROJECT South Montrose Concourse
PROJECT # CA0192
BOREHOLE # 15-03
DEPTH 2.2 m
SAMPLE # 3G2
LOCATION

8-Dec-15
JL

GRAIN SIZE DISTRIBUTION



COMMENTS:

% Retained on 2 mm sieve 0.00%
 Soil Type Clay, little silt, trace sand

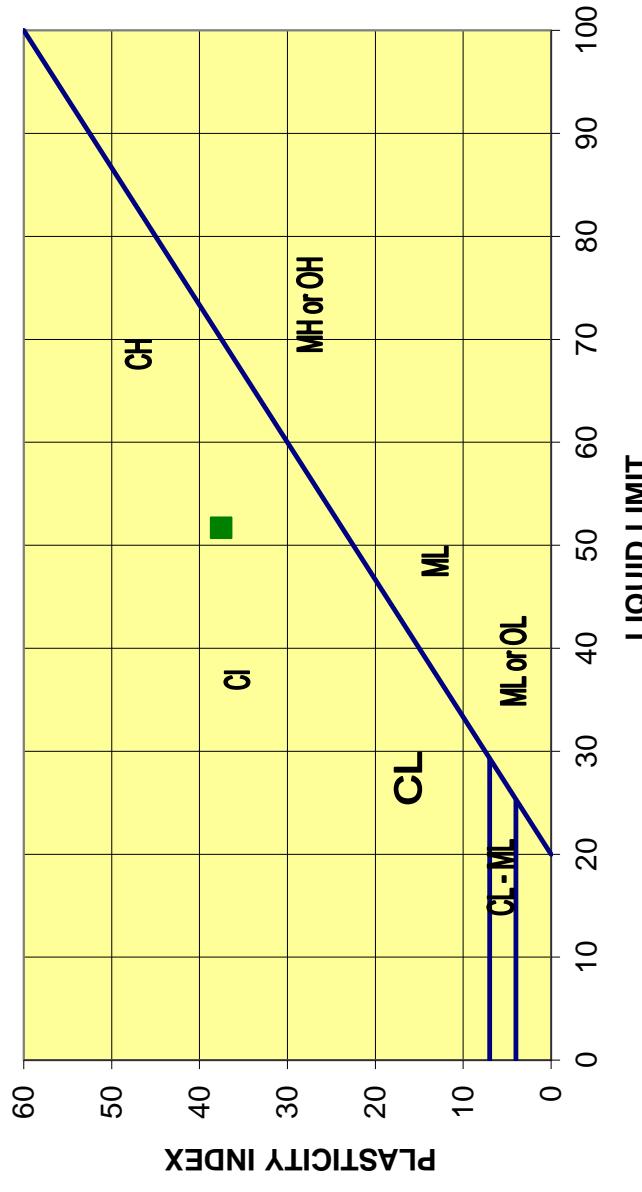
SUMMARY	
D10 =	GRAVEL 0.00%
D30 =	SAND 3.42%
D60 =	SILT 10.98%
CU =	CLAY 85.61%
CC =	

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)	
Trial No.	1 2
No. Blows	26 23
Wt. Sample Wet + Tare	52.211 54.252
Wt. Sample Dry + Tare	44.382 45.739
Wt. Water	7.829 8.513
Tare Container	29.282 29.326
Wt. Dry Soil	15.100 16.413
Moisture Content	51.848 51.867
Corrected for Blow Count	52.094 51.347
Liquid Limit Average	51.7

PLASTIC LIMIT (PL)	
Trial No.	1 2 3
Wt. Wet Worm + Tare	12.725 12.700 12.643
Wt. Dry Worm + Tare	12.586 12.556 12.493
Wt. Water	0.139 0.144 0.150
Tare Container	11.567 11.549 11.466
Wt. Dry Worm	1.019 1.007 1.027
Moisture Content	13.641 14.300 14.606
Plastic Limit Average	14.2

PLASTICITY INDEX (PI) = LL-PL 37.5

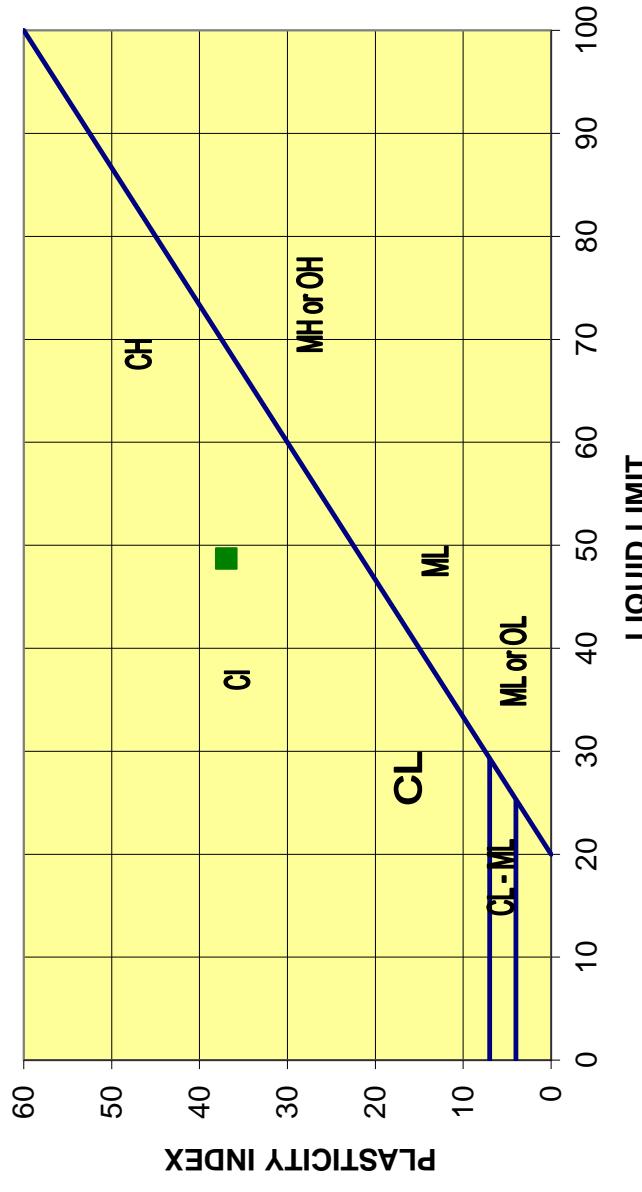


SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)	
Trial No.	1 2
No. Blows	20 23
Wt. Sample Wet + Tare	56.096 54.426
Wt. Sample Dry + Tare	47.085 46.167
Wt. Water	9.011 8.259
Tare Container	28.887 29.572
Wt. Dry Soil	18.198 16.595
Moisture Content	49.516 49.768
Corrected for Blow Count	48.197 49.268
Liquid Limit Average	48.7

PLASTIC LIMIT (PL)	
Trial No.	1 2 3
Wt. Wet Worm + Tare	12.654 12.647
Wt. Dry Worm + Tare	12.545 12.461
Wt. Water	0.109 0.117
Tare Container	11.597 11.511
Wt. Dry Worm	0.948 0.950
Moisture Content	11.498 12.316
Plastic Limit Average	11.8

$$\text{PLASTICITY INDEX (PI)} = \text{LL-PL} \quad 37.0$$



Parkland **GEO**

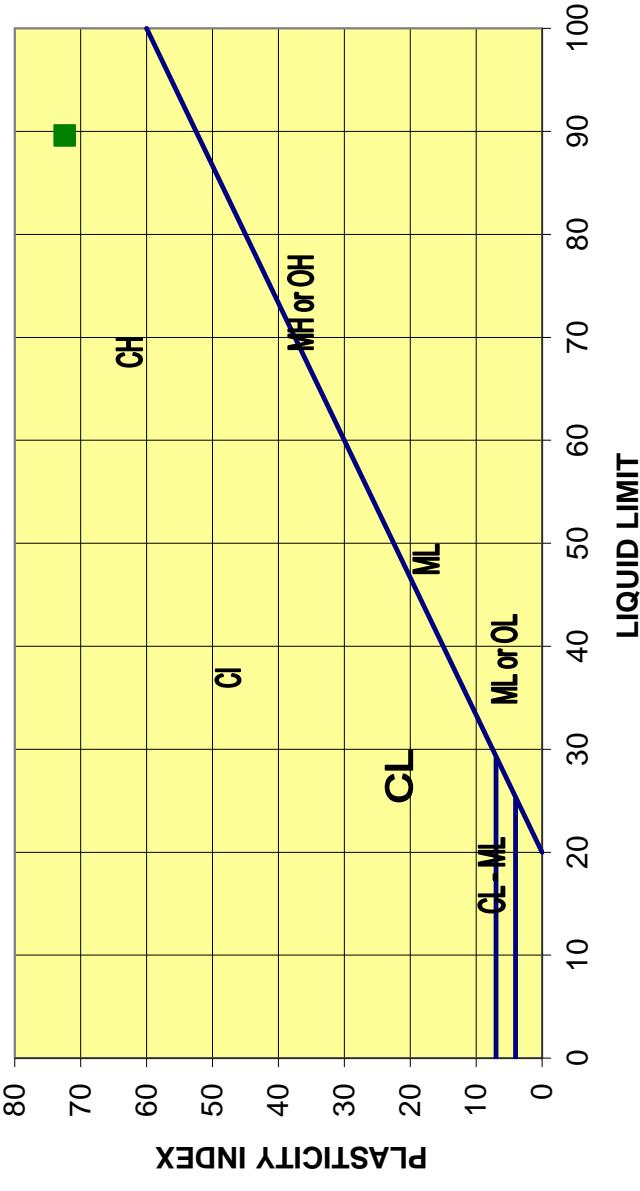
PROJECT# CA0192
PROJECT South Montrose Concourse
BOREHOLE 15-03
DEPTH 2.2 m
SAMPLE # 3G2
DATE 8-Dec-15
TECH JL

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)	
Trial No.	1 2
No. Blows	29 28
Wt. Sample Wet + Tare	50.248 50.614
Wt. Sample Dry + Tare	40.350 40.533
Wt. Water	9.898 10.081
Tare Container	29.115 29.122
Wt. Dry Soil	11.235 11.411
Moisture Content	88.100 88.345
Corrected for Blow Count	89.696 89.564
Liquid Limit Average	89.6

PLASTIC LIMIT (PL)	
Trial No.	1 2 3
Wt. Wet Worm + Tare	12.477 12.383 12.546
Wt. Dry Worm + Tare	12.341 12.249 12.395
Wt. Water	0.136 0.134 0.151
Tare Container	11.541 11.467 11.532
Wt. Dry Worm	0.800 0.782 0.863
Moisture Content	17.000 17.136 17.497
Plastic Limit Average	17.2

$$\text{PLASTICITY INDEX (PI)} = \text{LL-PL} \quad 72.4$$



Parkland **GEO**

PROJECT# CA0192
PROJECT South Montrose Concourse
BOREHOLE 15-05
DEPTH 3.8 m
SAMPLE # 5G3
DATE 8-Dec-15
TECH JL

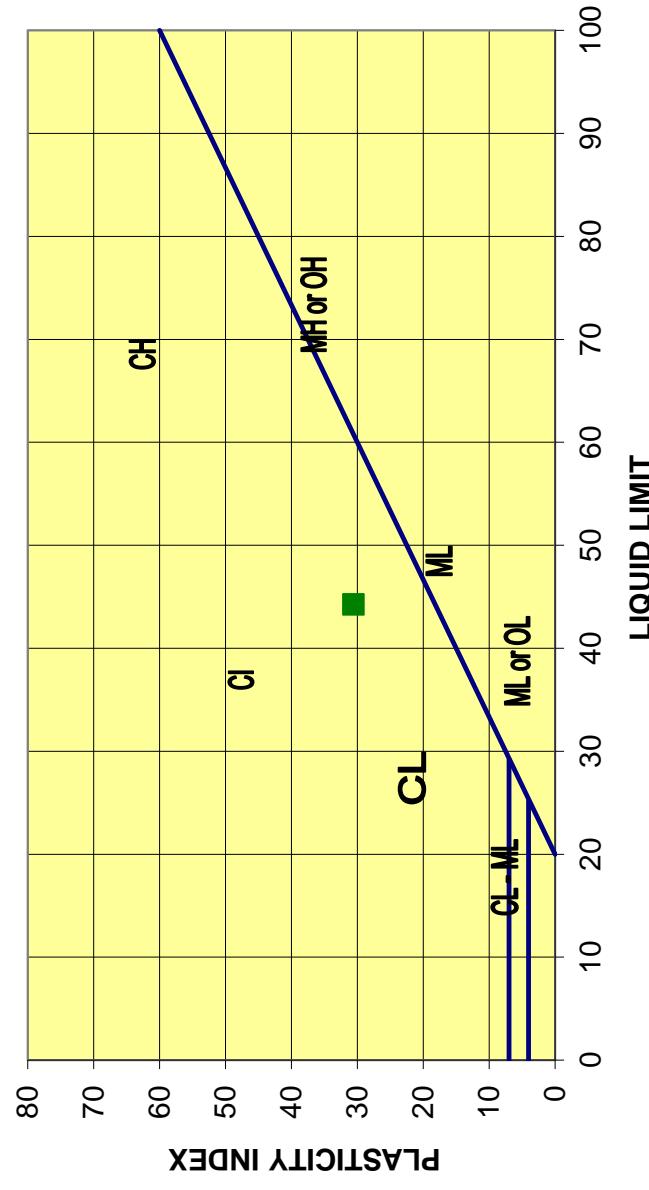
SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)	
Trial No.	1 2
No. Blows	28 29
Wt. Sample Wet + Tare	58.050 53.340
Wt. Sample Dry + Tare	49.270 46.078
Wt. Water	8.780 7.262
Tare Container	29.125 29.422
Wt. Dry Soil	20.145 16.656
Moisture Content	43.584 43.600
Corrected for Blow Count	44.186 44.390
Liquid Limit Average	44.3

PLASTIC LIMIT (PL)

PLASTIC LIMIT (PL)	
Trial No.	1 2 3
Wt. Wet Worm + Tare	12.705 12.751 12.635
Wt. Dry Worm + Tare	12.564 12.612 12.494
Wt. Water	0.141 0.139 0.141
Tare Container	11.526 11.581 11.495
Wt. Dry Worm	1.038 1.031 0.999
Moisture Content	13.584 13.482 14.114
Plastic Limit Average	13.7

$$\text{PLASTICITY INDEX (PI)} = \text{LL-PL} \quad 30.6$$



The terms and symbols used on the borehole logs to summarize the results of the field investigation and subsequent laboratory testing are described on the following two pages.

The borehole logs are a graphical representation summarizing the soil profile as determined during site specific field investigation. The materials, boundaries, and conditions have been established only at the borehole location at the time of drilling. The soil conditions shown on the borehole logs are not necessarily representative of the subsurface conditions elsewhere across the site. The transitions in soil profile usually have gradual rather than distinct unit boundaries as shown on the borehole logs.

1. PRINCIPAL SOIL TYPE – The major soil type by weight of material or by behaviour.

Material	Grain Size
Boulders	Larger than 300 mm
Cobbles	75 mm to 300 mm
Coarse Gravel	19 mm to 75 mm
Fine Gravel	5 mm to 19 mm
Coarse Sand	2 mm to 5 mm
Medium Sand	0.425 mm to 2 mm
Fine Sand	0.075 mm to 0.425 mm
Silt & Clay	Smaller than 0.075 mm

2. DESCRIPTION OF MINOR SOIL TYPE – Minor soil types are identified by weight of minor component.

Percent	Descriptor
35 to 50	and some little trace
20 to 35	
10 to 20	
1 to 10	

3. RELATIVE STRENGTH OF COARSE GRAINED SOIL – The following terms are used relative to Standard Penetration Test (SPT), ASTM D1586, N value for blows per 300 mm.

Description	N Value
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Over 50

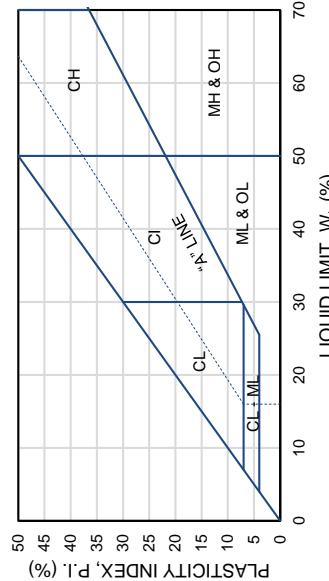
4. CONSISTENCY OF FINE GRAINED SOILS – The following terms are used relative to undrained shear strength and Standard Penetration Test (SPT), ASTM D1586, N value for blows per 300 mm. It is noted that this correlation needs to be used with caution as the correlation is only very approximate.

Description	Undrained Shear Strength, C_u (kPa)	N Value
Very Soft	Less than 12	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 150	15 to 30
Hard	Over 150	Over 30

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS					
MAJOR DIVISION	GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
CLEAN GRAVELS (LITTLE OR NO FINES)	GW		WELL GRADED GRAVELS, GRAVEL-FINES SAND MIXTURE, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}}$ > Cc = $\frac{(D_{30})^2}{D_{10} \times D_{60}}$ = 1 to 3	
DIRTY GRAVELS (WITH SOME FINES)	GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	NOT MEETING ABOVE REQUIREMENTS	
CLEAN SANDS (LITTLE OR NO FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12% ATTERBERG LIMITS BELOW "A" LINE OR P.I.	
	GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE OR P.I. LESS THAN 7	
CLEAN SANDS (LITTLE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS WITH LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}}$ > Cc = $\frac{(D_{30})^2}{D_{10} \times D_{60}}$ = 1 to 3	
	SP		Poorly graded sands, gravelly sands, little or no fines	NOT MEETING ABOVE REQUIREMENTS	
DIRTY SANDS (WITH SOME FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12% ATTERBERG LIMITS BELOW "A" LINE OR P.I.	
	SC		CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE OR P.I. LESS THAN 7	
W _L < 50%	ML		INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY		
W _L > 50%	MH		INORGANIC SILTS, MICAEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS		
W _L < 30%	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY SOILS	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)	
30% < W _L < 50%	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS		
W _L > 50%	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
W _L < 50%	OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW AND MEDIUM PLASTICITY		
W _L > 50%	OH		ORGANIC CLAYS OF HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS	Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE	

NOTES ON SOIL CLASSIFICATION AND DESCRIPTION:

- Soil are classified and described according to their engineering properties and behaviour.
- Boundary classification for soil with characteristics of two groups are given combined group symbols (e.g. GW-GC is a well graded gravel sand mixture with clay binder between 5 and 12%).
- Soil classification is in accordance with the Unified Soil Classification System (ASTM D2487) with the exception that an inorganic clay of medium plasticity (CI) is recognized.
- The use of modifying adjectives may be employed to define the estimated percentage range by eight of minor components.



LIMITATIONS

General Terms, Conditions and Limitations

THE PARKLANDGEO CONSULTING GROUP GENERAL TERMS, CONDITIONS AND LIMITATIONS



The use of this attached report is subject to the following general terms and conditions.

1. **STANDARD OF CARE** - In the performance of professional services, ParklandGEO used the degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No other warranty expressed or implied is made in any manner.
2. **INTERPRETATION OF THE REPORT** - The CLIENT recognizes that subsurface conditions will vary from those encountered at the location where borings, surveys, or explorations are made and that the data, interpretations and recommendation of ParklandGEO are based solely on the information available to him. Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities will be based on commonly accepted practices in geotechnical or environmental consulting practice in this area. ParklandGEO will not be responsible for the interpretation by others of the information developed.
3. **SITE INFORMATION** - The CLIENT has agreed to provide all information with respect to the past, present and proposed conditions and use of the Site, whether specifically requested or not. The CLIENT acknowledged that in order for ParklandGEO to properly advise and assist the CLIENT, ParklandGEO has relied on full disclosure by the CLIENT of all matters pertinent to the Site investigation.
4. **COMPLETE REPORT** - The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to ParklandGEO by the CLIENT, communications between ParklandGEO and the CLIENT, and to any other reports, writings or documents prepared by ParklandGEO for the CLIENT relative to the specific Site, all of which constitute the Report. The word "Report" shall refer to any and all of the documents referred to herein. In order to properly understand the suggestions, recommendations and opinions expressed by ParklandGEO, reference must be made to the whole of the Report. ParklandGEO cannot be responsible for use of any part or portions of the report without reference to the whole report. The CLIENT has agreed that "This report has been prepared for the exclusive use of the named CLIENT. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ParklandGEO accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report."

4. **COMPLETE REPORT** - The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to ParklandGEO by the CLIENT, communications between ParklandGEO and the CLIENT, and to any other reports, writings or documents prepared by ParklandGEO for the CLIENT relative to the specific Site, all of which constitute the Report. The word "Report" shall refer to any and all of the documents referred to herein. In order to properly understand the suggestions, recommendations and opinions expressed by ParklandGEO, reference must be made to the whole of the Report. ParklandGEO cannot be responsible for use of any part or portions of the report without reference to the whole report. The CLIENT has agreed that "This report has been prepared for the exclusive use of the named CLIENT. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ParklandGEO accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report."
5. **LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER**
There is no warranty, expressed or implied, by ParklandGEO that:
 - a) the investigation uncovered all potential geo-hazards, contaminants or environmental liabilities on the Site; or
 - b) the Site is entirely free of all geo-hazards or contaminants as a result of any investigation or cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential geo-hazards or contaminants on the Site.

The CLIENT acknowledged that:

- a) the investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
- b) unless specifically stated in the agreed Scope of Work, the investigation will not, nor is it intended to assess or detect potential contaminants or environmental liabilities on the Site;
- c) any assessment regarding geological conditions on the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations, hence there can be no assurance that undetected geological conditions, including soils or groundwater are not located on the Site; any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
- d) any assessment is also limited by the scientific possibility of determining the presence of unsuitable geological conditions for which scientific analyses have been conducted; and
- e) the laboratory testing program and analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation; and
- f) there are risks associated with the discovery of hazardous materials in and upon the lands and premises which may inadvertently discovered as part of the investigation. The CLIENT acknowledges that it may have a responsibility in law to inform the owner of any affected property of the existence or suspected existence of hazardous materials and in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed. The CLIENT further acknowledges that any such discovery may result in the fair market value of the lands and premises and of any other lands and premises adjacent thereto to be adversely affected in a material respect.
6. **COST ESTIMATES** - Estimates of remediation or construction costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for construction or remediation are based on the known site conditions, which can vary as new information is discovered during construction. As some construction activities are an iterative exercise, ParklandGEO shall therefore not be liable for the accuracy of any estimates of remediation or construction costs provided.
7. **LIMITATION OF LIABILITY** - The CLIENT has agreed that to the fullest extent permitted by the law ParklandGEO's total liability to CLIENT for any and all injuries, claims, losses, expenses or damages whatsoever arising out of or in anyway relating to the Project is contractually limited, as outlined in ParklandGEO's standard Consulting Services Agreement. Further, the CLIENT has agreed that to the fullest extent permitted by law ParklandGEO is not liable to the CLIENT for any special, indirect or consequential damages whatsoever, regardless of cause.
8. **INDEMNIFICATION** - To the fullest extent permitted by law, the CLIENT has agreed to defend, indemnify and hold ParklandGEO, its directors, officers, employees, agents and subcontractors, harmless from and against any and all claims, defence costs, including legal fees on a full indemnity basis, damages, and other liabilities arising out of or in any way related to ParklandGEO's work, reports or recommendations.



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