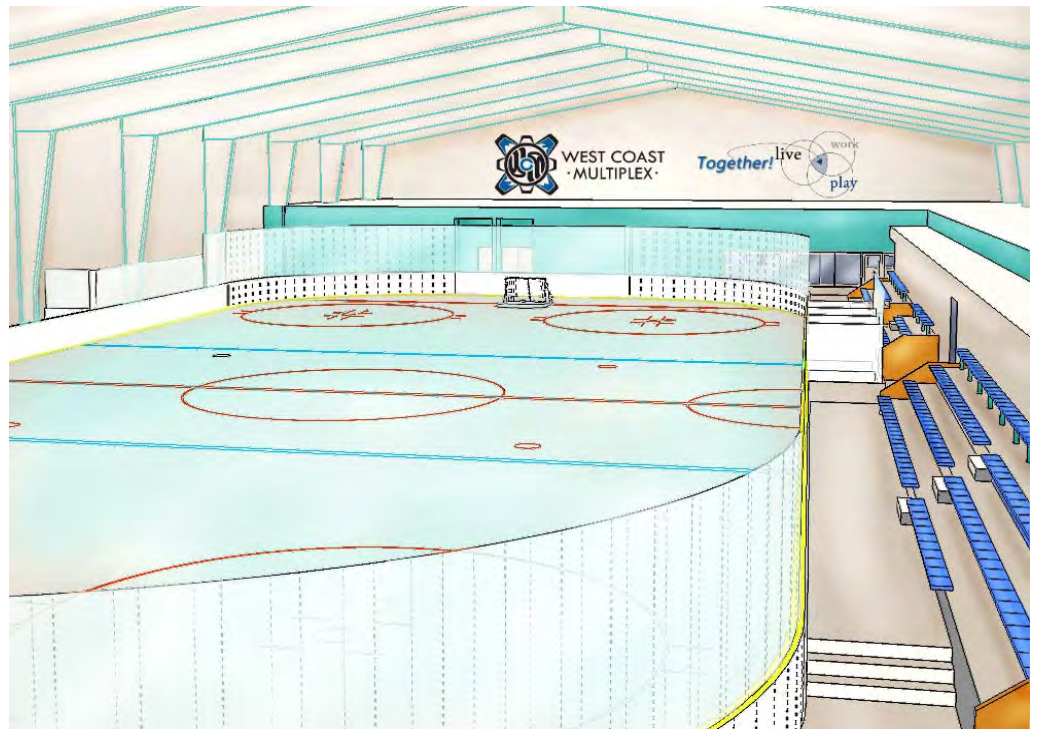




WEST COAST  
· MULTIPLEX ·



# WEST COAST MULTIPLEX



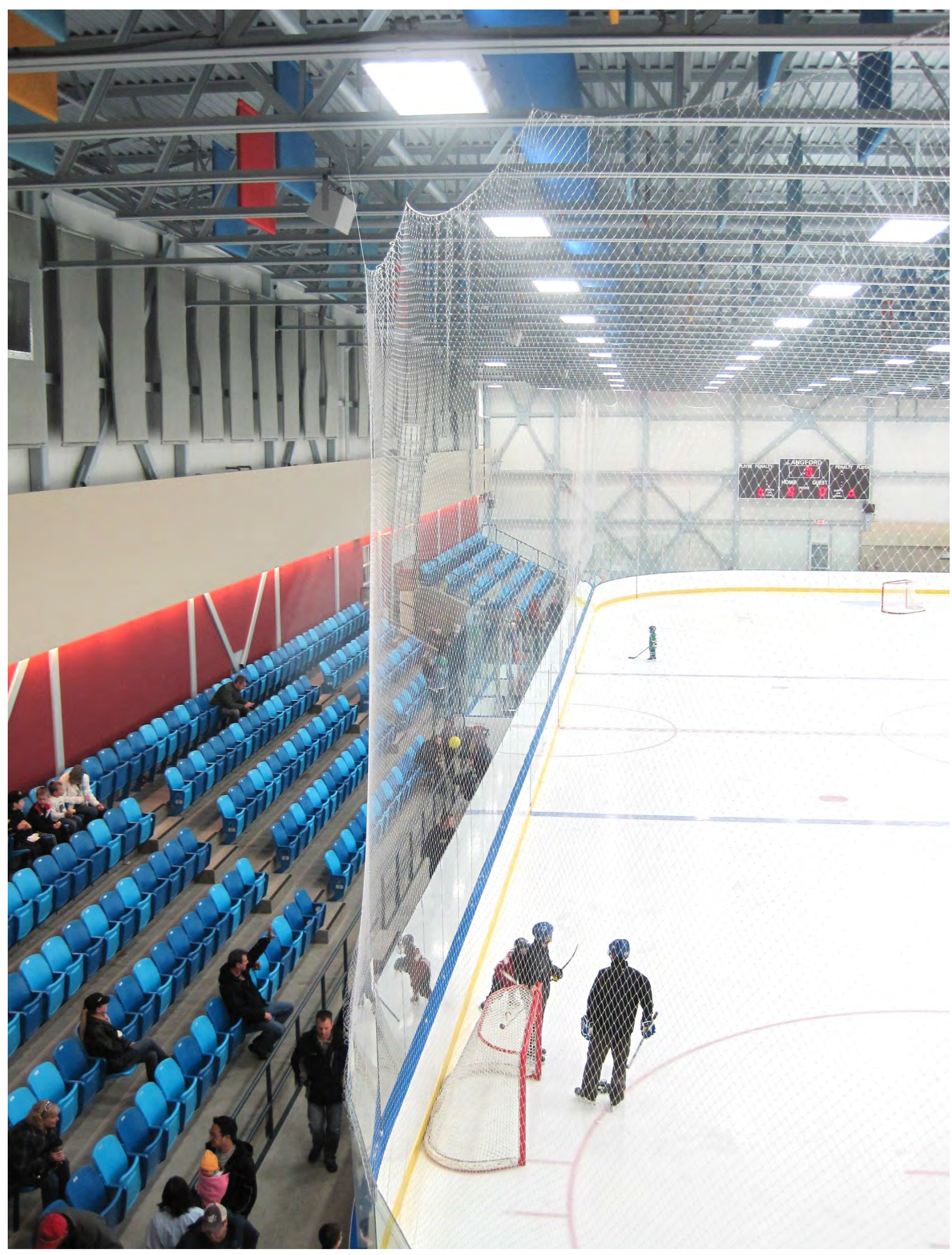
10/12/2017

## Design Report

The planning, design, and construction of any recreation or community space represents a major component in the lifestyle and wellness of a community.







LANGFORD  
HOME GUEST  
PERIODS



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## INTENT OF THIS REPORT

A number of studies to explore the possibility of providing recreational facilities on the west coast of Vancouver Island serving the communities of Ucluelet, Tofino and the surrounding First Nations have been undertaken in the past. The most recent being a Feasibility Study, in 2016, authored by Recreational Excellence (RecEx) which explored the use, programming, operational costs and provided very preliminary capital costs for the first phase of a multiuse recreation centre consisting of ice and dry floor activities. This report builds upon the RecEx study to verify the assumptions made for the capital costs as the RecEx report was based on a comparison of similar facilities rather than on the design of a facility specific to the needs as established by the West Coast Multiplex Society.

The intent of this report was to develop a schematic design specific to the selected site that meets the programming needs and objectives outlined in the RecEx report, and to verify through an independent cost consultant the anticipated capital costs for the project. Should the project move forward, the schematic design is likely to change due to further development; however, the costs as outlined in this report should be sufficient to provide a reasonable construction budget based on the program and areas described in the drawings and consultant systems descriptions.

We would like to thank those involved from the communities of Ucluelet, Tofino, and the surrounding First Nations for their many hours of involvement, insight, and commitment to this study.



## EXECUTIVE SUMMARY

The findings of this study indicate cost to construct a single sheet ice arena, according to the program as outlined further in this document, would be in the range of \$14 - \$15m for construction costs and in the range of \$18 - \$19m for total capital costs, in 2017 dollars. These figures are significantly higher than previous studies and the reasons for this are not clear but could be related to inflation, the difficulty in anticipating inflation and location costs for the region, and a somewhat larger program developed for this study than anticipated previously. The cost estimate is even significantly higher than figures contractors have provided for either a pre-engineered with insulated metal building structure or a Sprung Structure. Again, it's difficult to ascertain why this would be the case other than the contractor's figures are at a lower level of accuracy for a construction estimate, Class D vs. Class C, and likely do not fully account for the programming specifics of this project.

When the first draft of the cost estimate was shared with the consultant team, each consultant took a hard look at the numbers, challenged the assumptions made by the cost consultant and reviewed what could be done to bring the costs down without sacrificing the program. Based on this value engineering exercise, the final cost estimate should accurately represent the correct figures for the proposed program and design. Further cost reductions are possible but this would likely impact either programming requirements or quality of materials and equipment.

The recommendation of the consultant team is to anticipate construction costs and total capital costs as per the figures above to ensure funds are available to complete the project. If savings can be found, perhaps through working directly with a contractor or through re-examining the program spaces, the above costs could be lowered.



## Design Report

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Contributors to this report include:

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**Herold Engineering Limited.** – Structural Engineer

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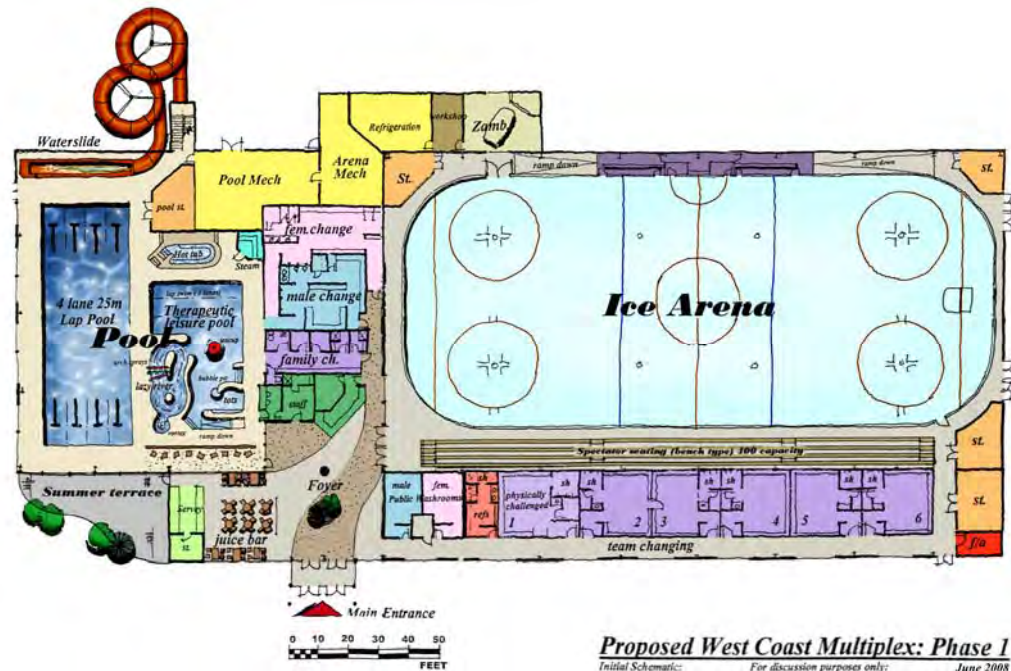
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## BACKGROUND

The communities of Ucluelet, Tofino and the surrounding First Nations have been exploring how a multiuse recreational facility could be provided for their communities for a long time now. A number of studies have been undertaken, several site locations have been considered and options on what kind of facility should be built have been explored. VDA Architecture (VDA) was previously involved with one of those studies when the location was on the other side of the airport lands, next to the golf course, and the program was for an arena together with an aquatic centre. Based on that study, it was determined a larger, multiuse facility with both aquatics and ice was beyond the financial capability of the region to provide the capital costs at that time. The goal of having a multiuse facility has not been abandoned, but rather than providing all at once a more practical approach would be to start with one of the main components and build from there as funding becomes available. As there is an immediate need for a local ice facility, an ice facility is more flexible for alternate programming due to the ability to provide dry floor activities, and capital costs for ice is less than it would be for aquatics, starting with an arena is the most practical approach.

The first step in looking at providing an arena with dry floor activities is through a feasibility study to confirm the costs, both capital and operational, programming and use, etc. which all contribute to whether the proposed facility is appropriate and affordable for the community. The Feasibility Study was completed, by RecEx in 2016. Capital costs used for that study were determined by a comparison method where similar facilities already completed were used to establish what might be expected for the proposed facility. This high-level costing is a good starting point but important factors specific to the proposed facility can't be taken into account using the comparison cost method. These would include project specific issues such as:

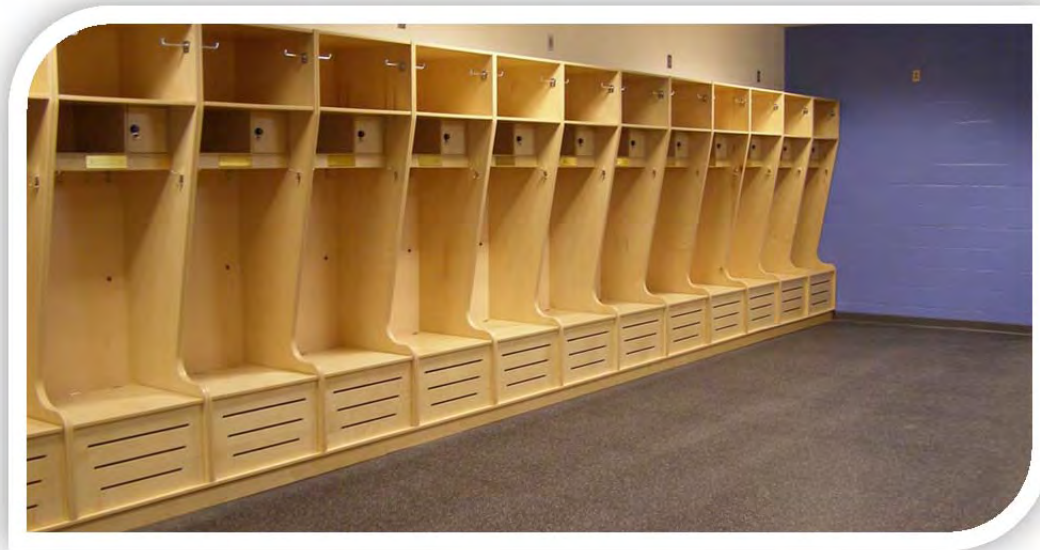


## Design Report

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- Availability of local services (sanitary, electrical service, water supply, roads, etc.),
- Soil conditions of the selected site,
- Location of the site relative to construction trades and services,
- Location of the site relative to deliveries,
- Local and regional current construction costs,
- Programming specific to the needs of the community:
  - Ability to provide for future expansion,
  - Program areas which are to be included in the proposed facility but are not present in the compared facilities.

The following report is the next step to verify a more project specific design and the associated capital costs.



## METHODOLOGY

The following is an overview of the process followed for this study resulting in this report.

### **Review Existing Documentation:**

The first task for the VDA consultant team was to review all of the information available to date in order to become immersed in the particulars of the proposed development. This included the Feasibility Study by RecEx, surveys, site plans, photos, civil exploratory work, a previously completed geotechnical report and any other information the West Coast Society could provide. We had discussions with the authors of the above work to ensure we understood their findings and recommendations.

### **Review of Sprung Structures:**

As one of the directives to the consultant team was to explore the viability of a Sprung Structure, the team toured the recently completed Sprung Structure ice arena at the Shawnigan Lake School on May 3<sup>rd</sup>, 2017. We met with representatives of the school as well as representatives from Sprung Structures to thoroughly review the results one year after completion. VDA also contacted representatives of owners from other completed Sprung facilities including some featuring ice arenas. Sprung Structures was contacted directly as well, in order to provide more information on their systems, typical details and design considerations.



### **Site Layouts Developed:**

Based on information gathered to date, a number of options for site layouts were developed with an emphasis on how best to locate the arena first phase, accommodate future phases, parking and site services.

### **Start-Up Meeting with the West Coast Multiplex Society:**

Although there was much discussion with the West Coast Multiplex Society (WCMS) prior to the 'start-up meeting', the meeting was scheduled for the consultant team to have the opportunity to explore the background information, get through a significant amount of the research of Sprung Structures (including the tour of Shawnigan Lake), and have site layout options ready for discussion with the WCMS. During the meeting, objectives and priorities were established, program elements were discussed and modified as necessary to meet the WCMS objectives, site layout options reviewed and an open discussion of the potential advantages and concerns of proceeding with a Sprung Structure took place. The direction at the conclusion of this meeting was to proceed with the program as modified in the discussions, further explore the site options and to continue in the exploration of a Sprung Structure as one of the viable options.

### **Concept Design:**

The full consultant team met separately to review and comment on the site options presented to the WCMS and to review coordination issues and concerns that would impact the site and building design.

Based on the input for the sub-consultants and the discussions in the start-up meeting, site design layout options were further developed and a conceptual building design developed.

Further research on Sprung Structure also occurred.

### **Second Meeting with the West Coast Multiplex Society:**

For the second meeting with the WCMS, more in-depth information was presented to the WCMS regarding structural and building envelope options (Sprung Structures, Pre-Engineered structure and Structural Steel, bagged insulation vs. insulated metal panels), site layouts options were discussed in detail, the conceptual building layout reviewed and discussed, and the programming elements reviewed in greater detail. The direction at the conclusion of this meeting was to proceed with exploring two (2) structural/envelope options: Sprung Structure and Pre-engineered with insulated metal panels. A final preferred site layout option was selected, and the consultant team was to proceed with the building design with modifications as per the discussions in the meeting and confirmation of the programming.

**Schematic Design:**

With the overall site layout established and general confirmation by the WCMS on the conceptual building layout, both the site plan and the building design were developed by VDA to a level the sub-consultants could use for their drawings and/or reports. Sub-consultants issued drawings/reports to VDA for coordination which was then incorporated into the final Schematic Design and issued to the Cost Consultant for pricing to a Class C level.

A draft cost report was produced and reviewed by VDA and the sub-consultants. The initial costs were proving to be higher than anticipated and rather than issue as is to the WCMS, the consultant team worked with each other to value engineer, modify the design and have re-costed. A second draft report was produced which the consultant team reviewed and commented on resulting in a final cost report of which a summary is appended to this report.

The final stage of the process is a presentation (pending) to the WCMS to review the results of the design exercise and the costing in detail.



## PROGRAM SUMMARY

Phase 1 of the West Coast Multiplex will be an ice arena with accommodation for dry floor activities and is to include the following programming/planning elements.

- The minimum spaces required for the arena are as follows:
  - NHL size ice
  - Spectator seating for 200+ persons
  - Players' benches opposite spectator seating
  - 4 full size change rooms
  - 2 small change rooms
  - 2 referee change rooms
  - First Aid room
  - Sound Booth
  - Janitor room
  - Indoor ice machine area with indoor snow melt pit
  - Storage large enough for general storage and to accommodate a floor covering system
  - Space for future Junior B team change room
  - Ice plant located to be able to tie into future phases for heat recovery
  - Warm Room for public skate change and viewing
  - Small concession off Warm Room
  - Skate Rental Shop
  - Administration Office
  - Truck access to rink to accommodate dry floor activities such as trade shows



- Phase 1 is to consider and accommodate future Phase 2 expansion for an aquatic centre and possible further phased expansion for other activities which may be desired in the years ahead such as community meeting spaces, a gym, a fitness centre or other activities which might be best served from a centralized and integrated recreational, community focused multiplex. It is important not just to look at the immediate project but also what might be in the years ahead.
- Phase 1 should have the ability to take advantage of the overall height needed for an arena and consider the possibility of adding additional spectator seating and usable mezzanine space above the lobby and administration levels.

## BUILDING STRUCTURE OPTIONS

One of the requirements of this study, as directed by the WCMS, was to consider up to two (2) structural systems that would be appropriate for an ice arena. The systems selected, based on the Feasibility Study by RecEx, are a Pre-Engineered steel structure with insulated metal panels or a Sprung Structure, which is an aluminium framed rib system with insulation sandwiched between two fabric membranes.



### Pre-Engineered Structure with Insulated Metal Panels

Pre-Engineered structural systems are typically very cost effective because the supplier of the pre-engineered steel frames engineers the frames to use the minimal amount of steel required to meet the structural design. Structural steel buildings that aren't pre-engineered are limited to the standard shapes and sizes that are individually available and therefore there is inherently a redundancy in the amount of steel in the structural frame. The primary source of the cost savings is in the reduction of the amount of steel used. That said, there is another aspect of pre-engineered systems that contribute to cost savings since the structural frames are prefabricated offsite. This leads to less time in the field bolting or welding steel connections, reduces construction schedule and shortens the time needed to enclose the building.

Pre-Engineered systems are often incorrectly associated with a building envelope system that is comprised of metal cladding over batt insulation with a vapour barrier exposed on the interior. Many of these structures have been built as it is extremely cost effective and an appropriate building system in the right application. It's easy to spot these buildings from the inside as the vapour barrier is fully exposed. This type of building envelope system is not appropriate for an arena design and many arenas which have used this system are, or are in the process of, failing as arenas. It is highly recommended not to consider this system and unfortunately for the pre-engineered building suppliers, the value of the pre-engineered system has been tainted due to the previously high use of the pre-eng structures with this building envelope assembly.

For an arena, a pre-engineered system with an insulated metal panel building envelope system would be appropriate. The insulated metal panel is a premanufactured panel consisting of foam insulation sandwiched between two thin metal sheets. With proper detailing and construction oversight, it's not difficult to achieve a very well insulated building with extremely good air tightness values. One of the benefits of this system is the continuous insulation over the structure, as the insulated panels are on the exterior side of the structure, and none of the thermal bridging that is

inherent in other systems. This results in the nominal R-value, say R20 for a 4” thick panel, being equal to the effective R-value, R20, and no need to over-insulate in order to make up for thermal bridging.

As pre-engineered systems are designed to minimize the amount of steel and there are no structural redundancies, it is not easy to add onto or modify a pre-eng building unless those modifications and expansions have been considered in the initial design.

To fully take advantage of the cost benefits of a pre-eng design it is important to recognise the importance of the repetition of structural bays and minimize variations to the buildings massing. Deviations in the structural bays or a design that doesn't conform to a rectangular shape can be accomplished and, if kept to a reasonable amount, don't have a significant impact on costs. But odd shaped buildings with few or no regular bays takes away from a pre-eng solution cost effectiveness over a typical structural steel design. Typical small to mid-size arenas are rectangular with perhaps a few bays for special features and lend themselves well to respecting the limitations of a pre-eng design. The ability to have areas that don't conform to the rectangle provides flexibility with the design at a small cost to the overall project.

Pre-eng buildings incorporate tie beams in the foundations which contribute to the reduction in the amount of steel required. The foundations work with the steel structure rather than the steel structure sitting on top of the foundations and can lead to reduced foundations and site preparation especially in areas with poor soil conditions.

There are a number of pre-eng manufacturer's and erectors which benefits owners as it's not difficult to get competitive bids during the tender period and this also contributes to the cost effectiveness of a pre-eng approach.

One of the drawbacks of using pre-eng is that the building isn't engineered by the Owner's consultant team but by the Contractor's selected pre-eng trade. This means the final engineering isn't started until the award of the contract and can delay the early portion of the construction schedule as the engineered shop drawings are produced, and then reviewed and coordinated with the Owner's consultant team.

## **Sprung Structures**

A Sprung Structure is a proprietary structural and building envelope system where the structure consists of bent aluminium ribs designed to hold in place the building envelope system. The building envelope is batt insulation sandwiched between two layers of fabric. The manufacturer claims very good air tightness values which contributes to the success of these structures. They also claim very high insulation values as they use R30 batts between the aluminium ribs.

Traditionally insulation values have been based on simply the value of insulation that is included within the assembly (nominal R-value). This method of measuring thermal resistance doesn't take into account thermal bridging of elements that interrupt or reduce the insulation. Recent changes to the BC Building Codes require thermal resistance be measured in overall values of the assembly (the effective R-value), not just the insulation. For example, a typical 2x6 wood framed wall with batt insulation of R20 only has an effective R-value of about R13.4. A steel stud framed wall with



R20 insulation has even less effective R-value due to the thermal characteristics of metal vs. wood, somewhere around R10. Although Sprung claim an R-value of R30, that is the nominal value and the effective value is much less, estimated to be in the range of R22.

Further to the understanding of thermal resistance (R-values) and current BC Building Codes, it is no longer acceptable to have significant areas of thermal bridging as per the typical details for Sprung Structures. In discussing this issue with Sprung Structures, we understand they are in the process of working with a Building Envelope Engineer to develop a thermal break for the aluminium ribs. Should they be successful, they are likely to achieve a much better effective R-value, although it's not yet known what that value might be. For Sprung Structures to be considered, compliance with current codes would be mandatory, and effective not nominal R-values should be considered.

One of the benefits of a Sprung Structure is in the use of a concrete ring beam as a foundation system. As this method spreads the loads and the Sprung system is a relatively light structure, for locations with poor soils there could be significant savings in the foundations and site preparation.

Other comments and considerations for a Sprung system:

- Vandalism is a concern as although the fabric is reputedly very strong (strong enough to withstand a hurricane), it might be a temptation to try to cut through and destroy. For this reason, a protective shield can be provided by Sprung to the height of 8 feet.
- Sprung claims the fabric only needs to be cleaned every couple of years, however, both Shawnigan Lake School and the City of Coquitlam have confirmed it needs a clean twice a year due to the amount of algae growth in our climate.
- The City of Coquitlam has experienced a number of rips and tears that needed repairs. Repairing the membrane is relatively easy but they have found it's not always easy to find where the repair is needed. The structure at Coquitlam is a single membrane and uninsulated. A dual membrane with insulation in-between would make it even more difficult to locate areas of leakage.
- Likely due to the white interior membrane and the absence of a lot of overhead services and structure, the light distribution is excellent and commented on by users of existing Sprung Structures.

As it's a proprietary system, there are not a lot of arenas in existence with this method. Our understanding is there are perhaps five such facilities, and therefore it's difficult to determine how successful they are. There is a local example at the Shawnigan Lake School, completed approximately a year or two ago, and they seem to be very pleased with the results as do the others we contacted. All claimed to have great air tightness and great ice. While on the tour of Shawnigan Lake School, an excessive amount of moisture was apparent at the base of the exterior wall and at some points on the interior side. It's not known for certain what is causing this and both the school and Sprung Structures believe it to be an air-handling and dehumidification issue, not a building envelope issue. Without further evidence of the cause, we are assuming Sprung is correct and it is not a building envelope issue; however, prior to proceeding with a Sprung Structure it would be advisable to verify if the issue has been resolved and if it is in fact not related to the Sprung system.

Pre-Engineered Structure

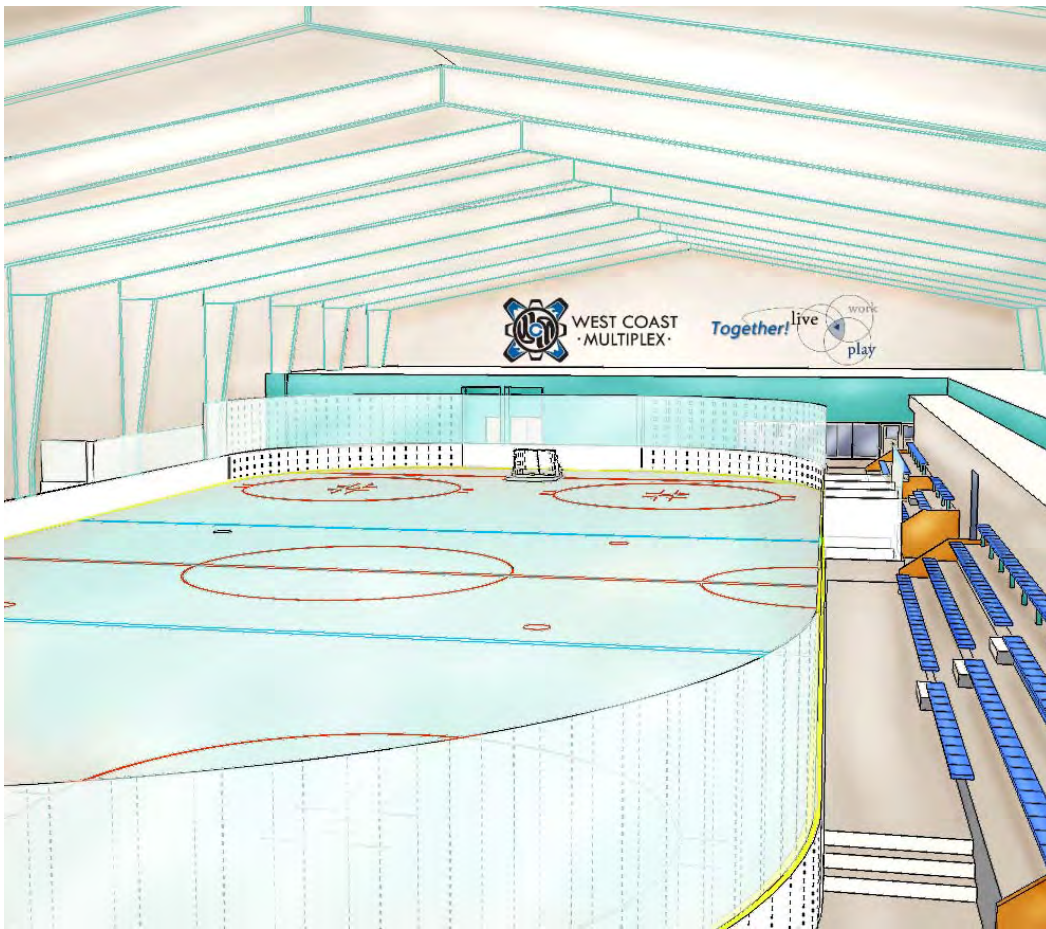


Sprung Structure



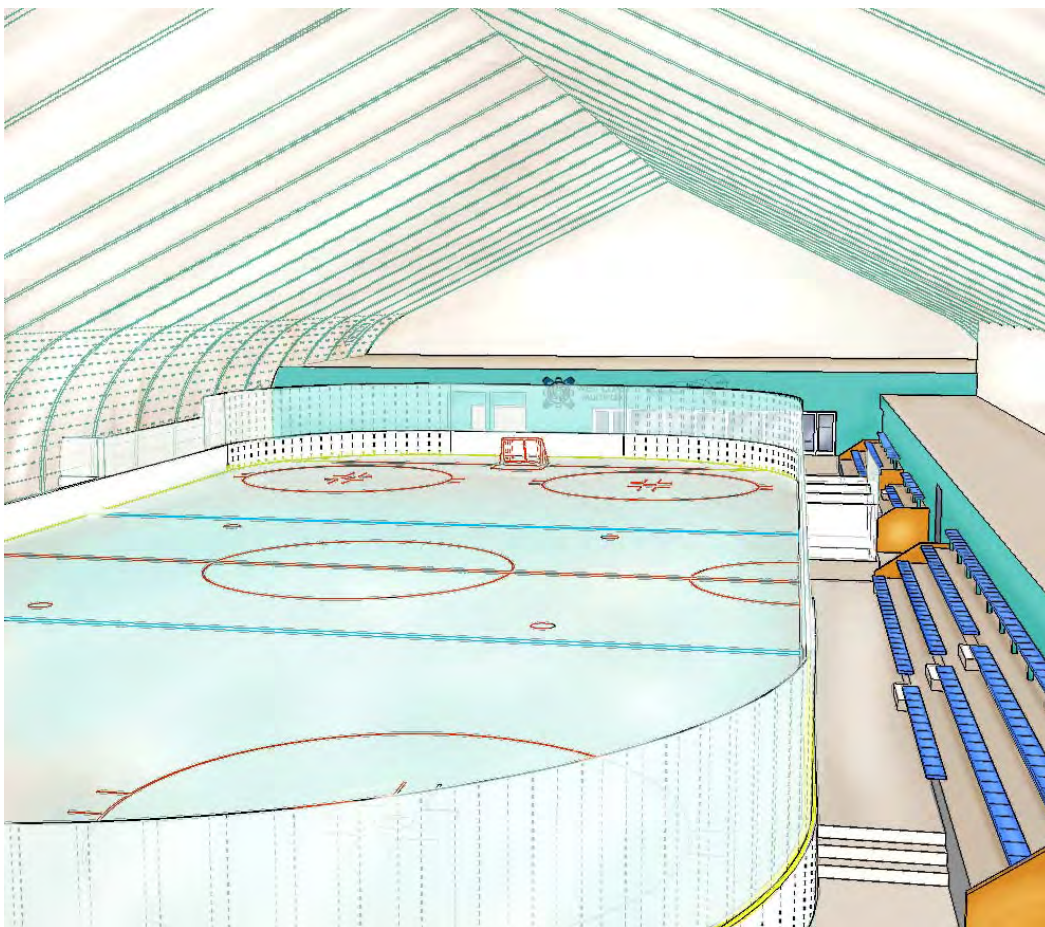
## Design Report

### Pre-Engineered Structure





Sprung Structure



**Pre-Engineered vs. Sprung**

Item	Pre-eng with insulated metal panel	Sprung Structure
Effective R-value	R20 with 4" insulated metal panel	R22 (estimated) currently, likely to improve with a thermal break solution
Air Tightness	Excellent with proper detailing and construction review	Excellent
Design Flexibility	Moderate	Poor
Ability to Accommodate Future Expansions or Modifications	Very good if considered in advance.	Limited abilities due to locations expansions could occur
Use in areas of poor soils	Very good	Excellent
Competitive Tendering	Very good	Poor due to being a proprietary system
Maintenance	Very little	Twice yearly cleaning and patching of any rips and tears
Cost of Construction	Very good	Excellent (based on Sprung)
Ability to Reduce Construction Schedule	Very good	Excellent
Control of Condensation	Excellent, as long as envelope has been well detailed and constructed. Could be very poor with poor details and attention in the construction.	Unable to determine due to potential issues of existing facilities. Requires further research.
Ability to provide great ice conditions	Excellent, with good detailing and review of building envelope	Excellent, based on conversations with existing facilities.



## REFRIGERATION

There are a number of aspects that contribute to 'good ice' and all must be carefully considered. Air tightness of the building envelope alone can mean the difference between an excellent facility and one that no skaters wish to use. Condensation control is also essential. Once those building envelope aspects are dealt with properly through good building engineering, it comes down to the refrigeration system for both how good the ice is and how much energy is expended to produce the ice.

As reviewed in more detail in the Feasibility Study by RecEx, ammonia is the preferred refrigerant. There are drawbacks to ammonia, but it has been proven to be cost effective and reliable. This can be an energy intensive system and advancements in heat recovery and other efficiencies can reduce the operational costs very significantly. Heat recovery design becomes even more beneficial when an aquatic centre is added.

There are several proprietary refrigeration systems, some of which are described in the Feasibility Study and this report won't go into detail on these other than to mention that the claims of the manufactures of these proprietary systems are very difficult to confirm as the manufacturers want to protect their proprietary information. Contrary to manufacturer's early claims, they often come in at significantly higher cost than an independently engineered solution. This isn't to say these systems shouldn't be considered, but that any proprietary system considered needs careful independent examination of the claims to ensure the benefits are truly as claimed. This detailed examination of proprietary systems is beyond the scope of this study and would be more appropriate once the project has the funding to proceed into detailed design. The cost analysis in this report is based on a non-proprietary, ammonia refrigeration system that utilizes heat recovery and has been proven to be an excellent system in terms of energy efficiency, capital costs and producing good ice.





## COST ESTIMATE

As the design flexibility for a Sprung Structure is more limiting than it is for a pre-engineered building, it was decided early on to base the schematic design on the layout for a Sprung Structure. However, to best reflect the design flexibility of a pre-eng structure, and where the consultant team believed it would benefit the programming, modifications were made to the layout of the pre-eng option to reflect more accurately what might be the final result. The intention of the above approach is to provide, as accurately as possible, the costs associated with either solution selected. A pre-eng option may be costlier simply because it addresses the programming in a better manner than would a Sprung Structure. It is important to note that both options do not necessarily represent what will be built, just what is reasonable to expect from either option regarding spaces provided and associated costs based on the program provided and the selected site.

The capital costs outlined in the Feasibility Study using a comparison method of costing were for approx. \$10.8m for a Sprung Structure and approx. \$13.5m for a pre-eng, insulated metal panel option including all project costs, soft and hard. The following chart is from the Feasibility Study.

Costs	Range of Estimates	
	Sprung	Prefabricated Insulated Panel
Construction Proposal Including Builder's Soft Costs	\$8,613,500	\$10,000,000 to \$11,400,000
Site Servicing	1,605,688	1,605,688
Owners Insurance and Financing	100,000	100,000
Owner Start Up Costs	<u>437,030</u>	<u>437,030</u>
<b>TOTAL CAPITAL COST</b>	<b>\$10,756,218</b>	<b>\$12,142,718 to \$13,542,718</b>

Based on the independent analysis of our cost consultant, the above costs appear to be much lower than what should be anticipated. A summary of the report can be found in Appendix G of this report and the full cost report for the proposed West Coast Multiplex is provided as a separate document for further examination for those who wish.

Using a similar breakdown as above, for the schemes as designed by the VDA consultant team the costs are estimated to be as follows. Professional fees are listed separately as they were excluded from the cost report for this study but included in the RecEx study and need to be considered in the overall capital costs.

Costs	Range of Estimates	
	Sprung	Prefabricated Insulated Panel
Construction Proposal Including Builder's Soft Costs	\$14,034,700	\$14,599,000
Site Servicing	2,441,900	2,369,700
Professional Fees (8%)	1,122,776	1,167,920
Owners Insurance and Financing	100,000	100,000
Owner Start Up Costs	<u>437,030</u>	<u>437,030</u>
<b>TOTAL CAPITAL COST</b>	<b>\$18,136,406</b>	<b>\$18,673,650</b>

There is a very substantial difference between the capital costs presented in the Feasibility Study and those estimated based on this study and this deserves some exploration on why this is the case.

To further analyze why there is such a spread in the costs between the Feasibility Study and this report, we contacted directly the author of that report, Peter MacLeod of RecEx, to get a better understanding of his assumptions. Our initial guess was that perhaps he didn't fully account for inflation and local conditions. However, this is not the case. The RecEx study assumed an average inflation rate of 2.5% per year and applied a 10% location factor to the pre-eng options and a 7% location factor to the Sprung option. Inflation rates vary by location but a 2.5% is not out of line for a Vancouver Island project over the past 5 years. As there are few large-scale projects built in the Ucluelet/Tofino region, it's difficult to determine what the actual inflation rate would have been for this sub-region so it's possible the rate used was lower than reality, but difficult to verify one way or another. The same applies for the location factor. Without a significant number of local projects of the complexity and size proposed for the arena, location factors are very difficult to determine and the percentages used by RecEx don't seem out of line.

We also questioned RecEx about the differences in the costs for the site services and whether or not McGill had the geotechnical information available to them. They did, and the difficulties with the poor soils was accounted for. Mr. MacLeod did point out that the parking count for the Feasibility Study was limited to 50 stalls whereas the VDA drawings have 68 stalls plus a significant amount of space used for the drop-off zones. Given the poor soils and the necessity to scrape the first several

of feet off the surface to provide the parking this difference will be one of the factors contributing to the cost estimate differences.

Another factor is that the previous pricing was done almost a year ago and inflation for that year hasn't been accounted for. Due to the amount of construction occurring in today's market, inflation rates are anticipated to be between 6 and 7% for 2017.

Also to consider in reviewing the variation in costs is the difference in using a comparison method with an actual design. As Mr. MacLeod pointed out to us, there really aren't any comparable, relatively recent facilities constructed in BC which made comparison costing very difficult. The Ontario facilities are in a different region, with different construction costs and all but one of the BC facilities used in the comparisons are unbuilt and costs assumed were very broad brush. Further to this, the BC examples all have smaller building areas due to smaller program requirements; for instance, 4 full sized change rooms rather than 6, no provision for future Junior B change room and no provision for future mezzanine. In fact, it is for the above reasons this current study was undertaken.

One final point is that this study has a larger program and therefore larger building and costs, than the building anticipated in the RecEx Study. Not only was parking increased but the provision for a Junior B change room, additional storage for an ice covering floor system, provisions for a future mezzanine and future upper level spectator seating all contribute to increased building size and/or complexity. Quite simply, it is a bigger building than previously anticipated and this has cost implications.

It's worth noting the construction cost difference between a pre-eng insulated metal panel system vs. a Sprung Structure is less according to the cost consultant than what has been communicated by Sprung Structures. The cost consultant used figures provided directly by Sprung Structures, and they have estimated other Sprung facilities, so it shouldn't be that they don't understand the building system or have used inappropriate numbers. It is likely that Sprung have made assumptions in regard to other aspects of the building, the quality of the finishes or the refrigeration system for example, that differ from the information the cost consultant used.

Separate to the cost analysis prepared by the consultant team, Bird Construction also provided an estimate through Sprung Structures (refer to Appendix H). The following chart uses these numbers and adds the items not included in their estimate, as noted in their letter, in order to provide a more accurate comparison.



Costs	Bird Construction	With 25% Design Contingency
Construction Proposal Including Builder's Soft Costs	\$8,210,361	\$10,262,951.25
Site Servicing	2,441,900	2,441,900
Professional Fees (8%)	656,829	821,036.10
Owners Insurance and Financing	100,000	100,000
Owner Start Up Costs	<u>437,030</u>	<u>437,030</u>
<b>TOTAL CAPITAL COST</b>	\$11,846,120	\$14,062,917

The Bird estimate is substantially lower than the costs established by the cost consultant and more in line with the RecEx study. There are many factors to consider when comparing to the other estimates.

- There is no breakdown of costs, costs are based on what they would expect on a \$/sq.ft. bases, a Class D estimate. The cost consultant estimate has a complete breakdown, item by item, which will be more accurate, a Class C estimate.
- Being a Class D estimate, Bird will need to confirm their assumptions. They were provided, through Sprung Structures, the drawings but not the full package of information as provided to the cost consultant. As they note, "there are many other considerations with a lot of variables for the Owner that are not included in the budget number". For instance, we assume Bird was not provided with the Geotechnical Report which will have a significant impact on the foundation systems due to the poor soils on the site.
- The cost consultant estimate includes a 10% design contingency within the construction costs which is appropriate for a Class C estimate. These funds allow for some flexibility in the design as the building gets worked out in the development of the final design. There is no design contingency noted in the Bird estimate so we assume it hasn't been included. As a Class D estimate is far less accurate, being based on a \$/sq.ft. rather than a breakdown of quantities, a design contingency of 25% would be appropriate.



## RECOMMENDATIONS

Based on the cost analysis of the design provided by the VDA team, there are a couple of ways forward from here.

1. Accept the cost estimate and pursue funding for a project with construction costs in the \$14 - \$15m range and total capital costs around \$18 - \$19m (in 2017 dollars), as the project designed best meets the needs of the community as communicated by the WCMS to the VDA team.
2. Reduce the program to be closer to what was considered in the Feasibility Study.
  - a. Reduce amount of parking,
  - b. Reduce the number of full size change rooms,
  - c. Remove provisions for future mezzanine level,
  - d. Remove provisions for future seating above change rooms,
  - e. Remove provisions for future Junior B change room,
  - f. Reduce amount of storage and don't consider storage for floor cover system.
3. Reconsider the location for a site which has less costs for site servicing and development.
4. Consider working directly with a contractor through a Design/Build process on the assumption they will be able to deliver a quality project that meets the communities needs for a cost at, or close to, what they claim.

The traditional method, Design/Bid/Build, would be to base construction and capital costs on this study, fundraise according to these costs, once funds are available hire a consultant team to produce Building Permit, Tender and Construction drawings and publicly tender the project. The

low bidder would be awarded the contract and construction would commence. If enough funds can't be raised to move the project forward, consider reducing some of the program requirements to reduce the construction costs. This is the preferred process to maintain control on program spaces and quality.

As two construction companies (VVI Construction with a pre-eng insulated metal panel system and Bird with a Sprung Structure) have indicated they can provide an arena for substantially less than what this report indicates, the best method to achieve a cost-effective arena may be through a Design/Build delivery method. With Design/Build, contractors hire the consultant team directly and produce the design for which they enter into a fixed price contract with the Owner. This puts a lot of the decisions in the hands of the contractor and they are responsible to establish the most cost-effective means to achieve the Owner's goals. Using a Design/Build delivery, total capital costs might be able to be reduced to the range of \$13 - \$15m including construction cost, design contingency, site servicing, professional fees and other soft costs. We know of many projects that end up costing significantly more than the early estimates of contractors due to the schematic nature of the drawings when they first price and therefore recommend anticipating a higher end cost than what the contractors are currently indicating to ensure enough funds are available to see the project through completion.

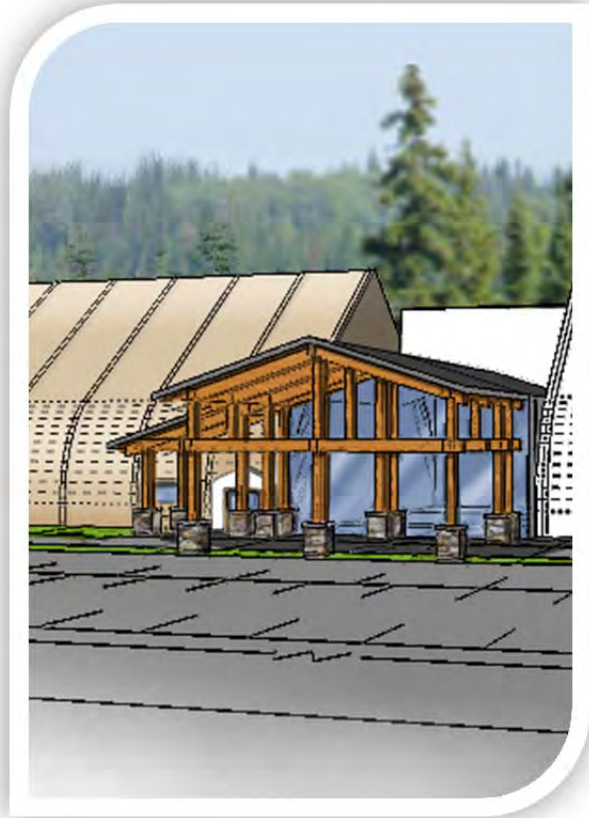
With a competitive Design/Build approach, the structural system could be left to the Contractors to determine in their proposal and the RFP written so that it allowed for either pre-eng with insulated panel or a Sprung Structure and in fact there may be other systems worth consideration. This removes the onus of determining if a Sprung Structure truly is significantly less expensive than other systems from the Owner and their consultant team and puts it on the Contractor to prove in their final bids.

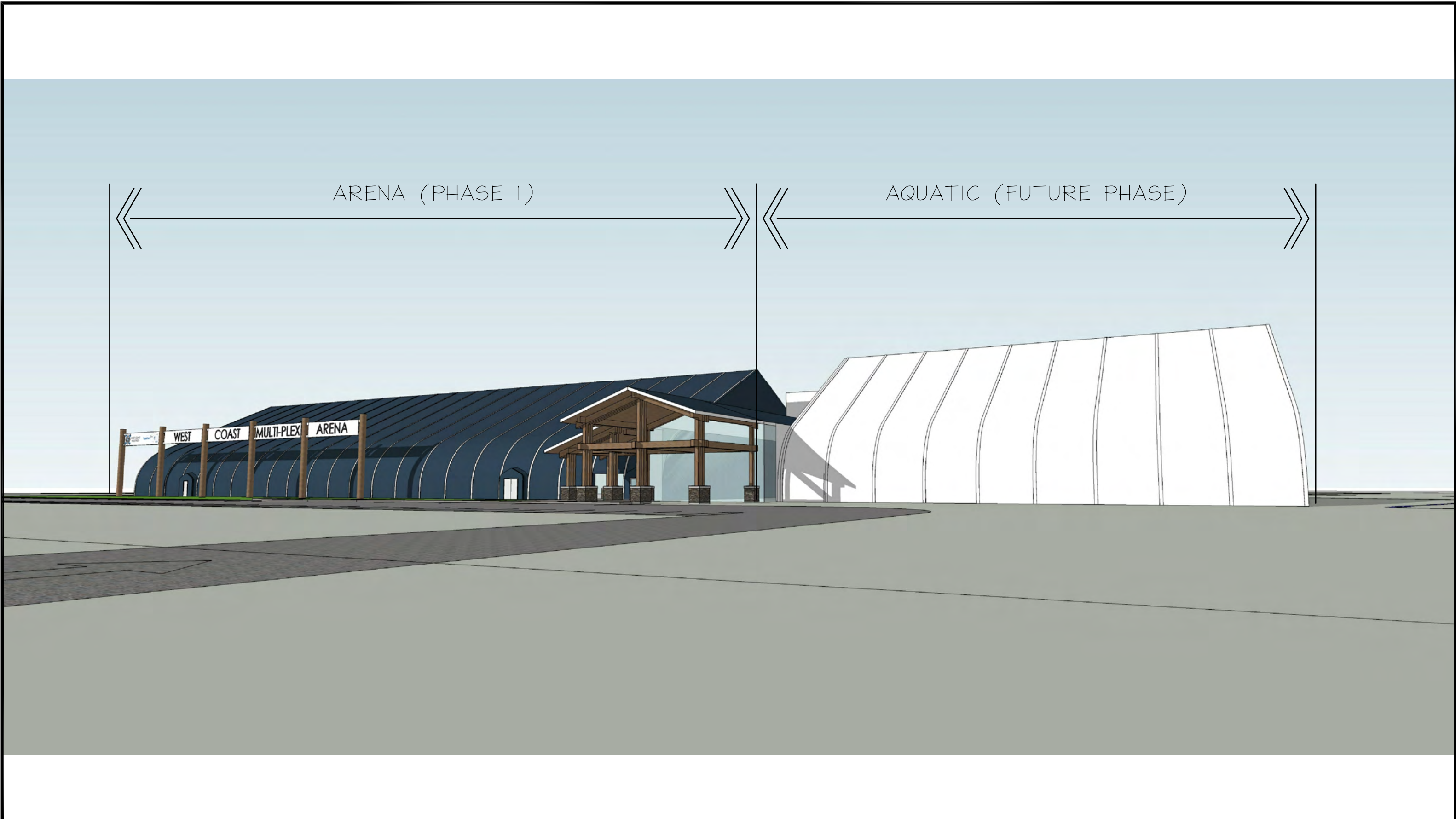
Should a Design/Build approach be selected, a consultant team should be retained by the Owner, referred to as the 'Bridging Consultant Team', to assist in the RFP documents to ensure your needs and programming are accounted for and to review and advise on the submitted bid proposals.

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## APPENDIX A – ARCHITECTURAL DRAWINGS





# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - PERSPECTIVE

TOFINO, B.C.

SCALE: N.T.S. 2017-11

I.F. SCHEMATIC DESIGN  
2017-09-06

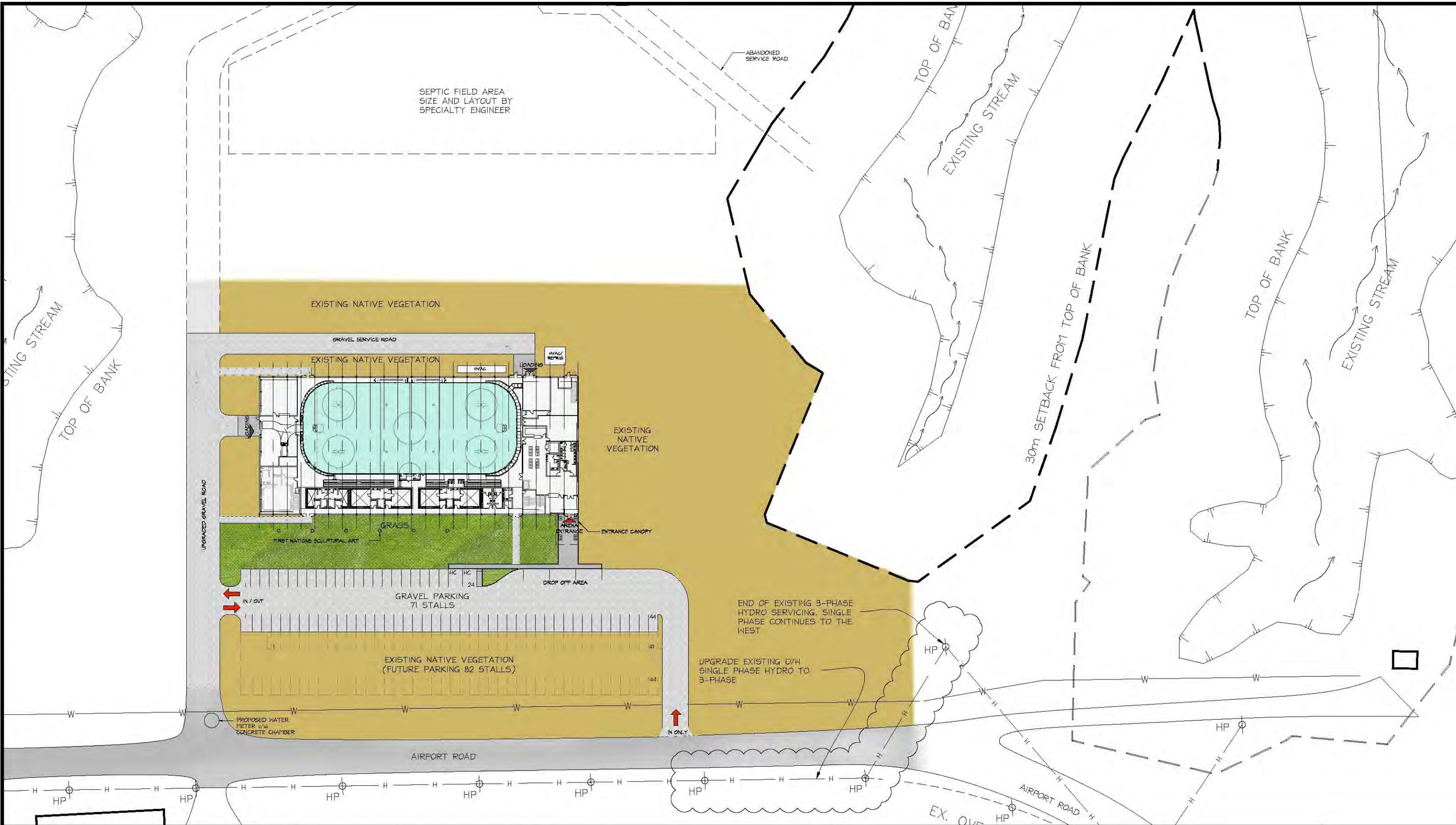
CONSULTANT



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LIMITED  
3388A Tennyson Ave. | Victoria, BC | V8Z 3P6  
T: 250-477-4255 | mail@vda.ca | www.vda.ca

# A1.0



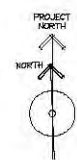


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TOFINO, B.C.

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2017-08-10

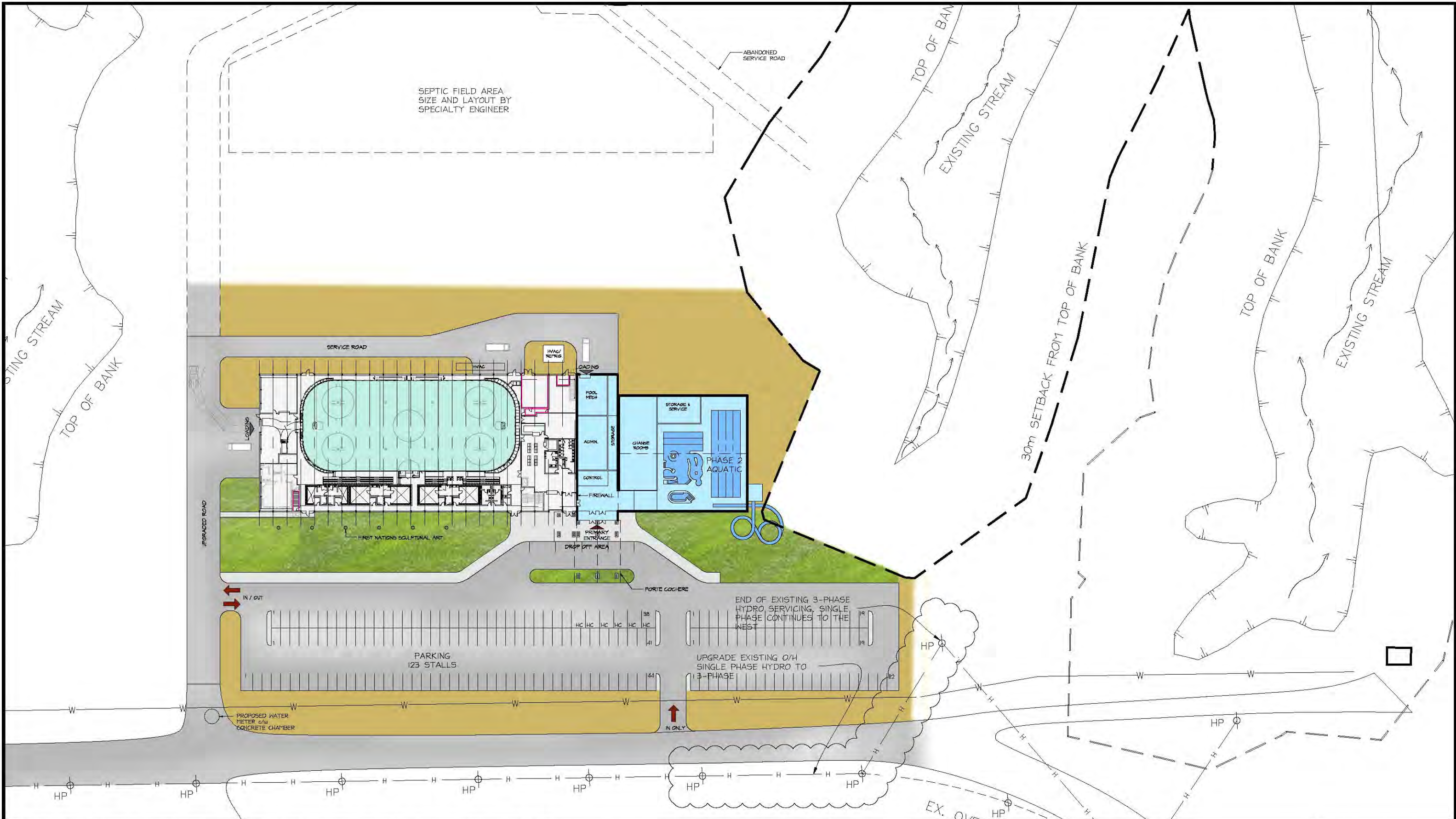


CONSULTANT

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# A1.1





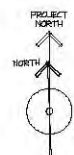
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2017-08-10

TOFINO, B.C.

SCALE: 1:1000

2017-11



CONSULTANT

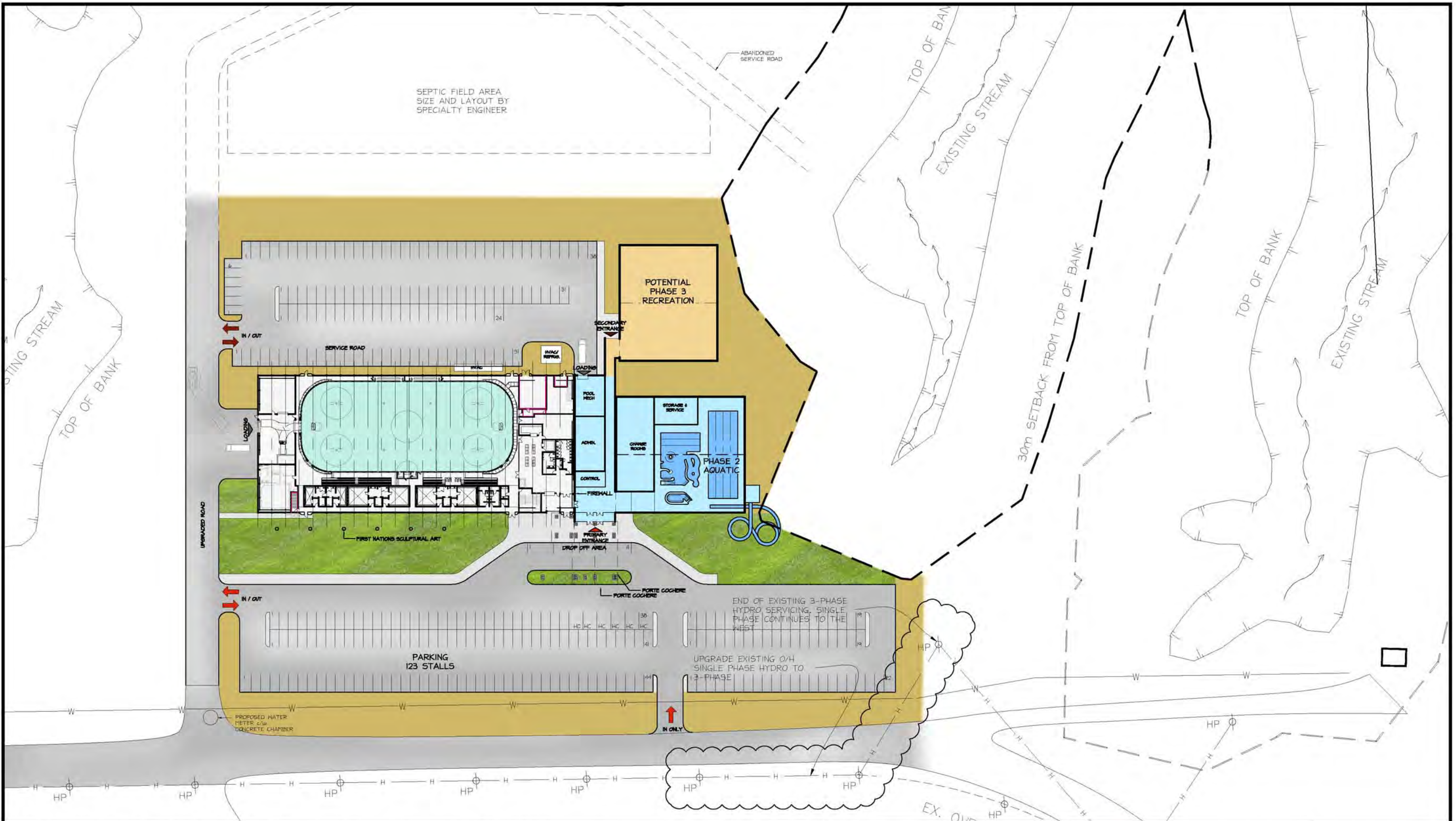


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## A1.2





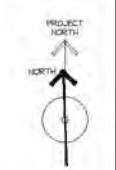
**WEST COAST MULTI-PLEX - ARENA**  
**SPRUNG STRUCTURE - PHASE 3 SITE PLAN**

TOFINO, B.C.

SCALE: 1:1000

2017-11

2017-08-10



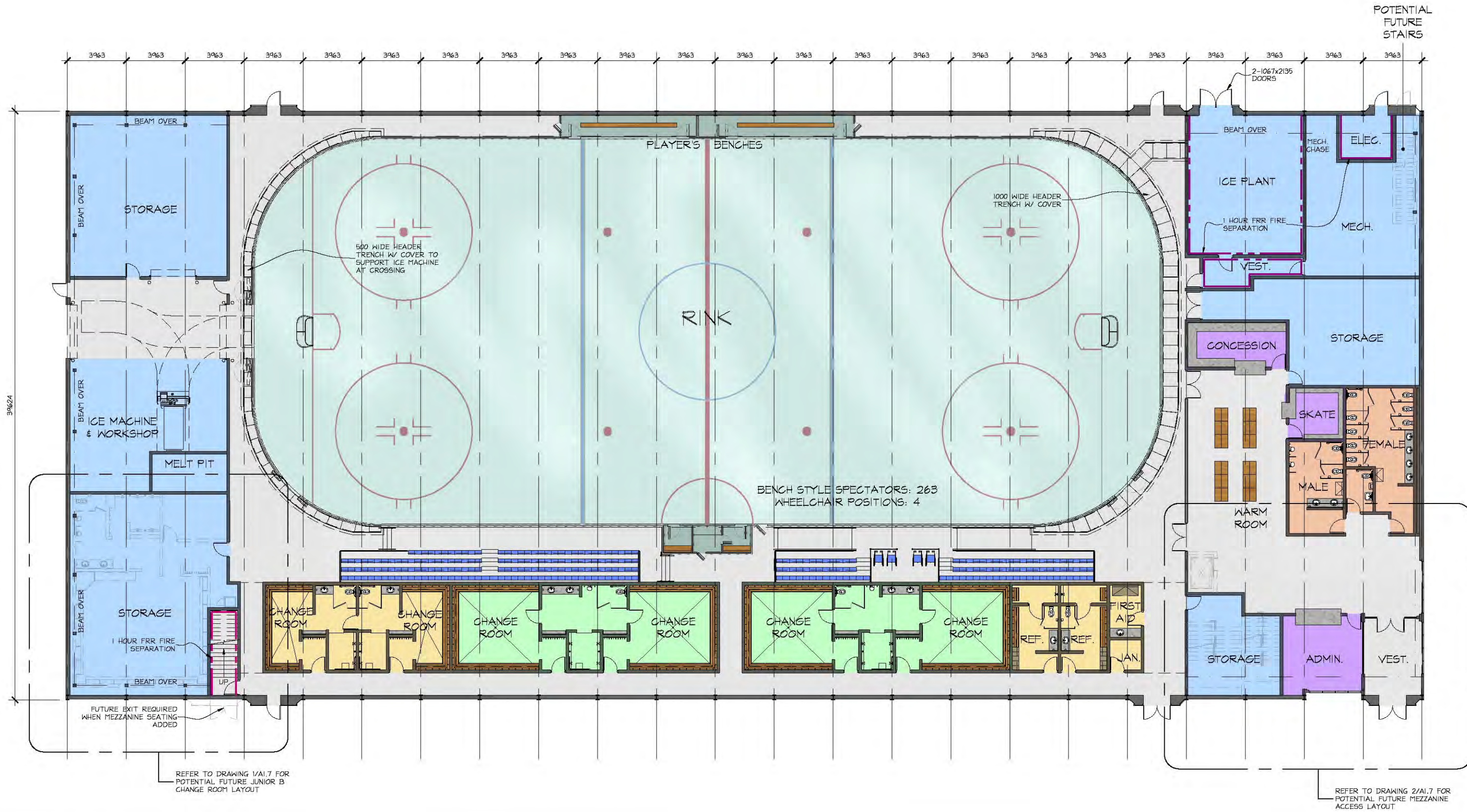
CONSULTANT

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**A1.3**





# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - MAIN LEVEL

TOFINO, B.C.

SCALE: 1:250

2017-11

2017-08-10

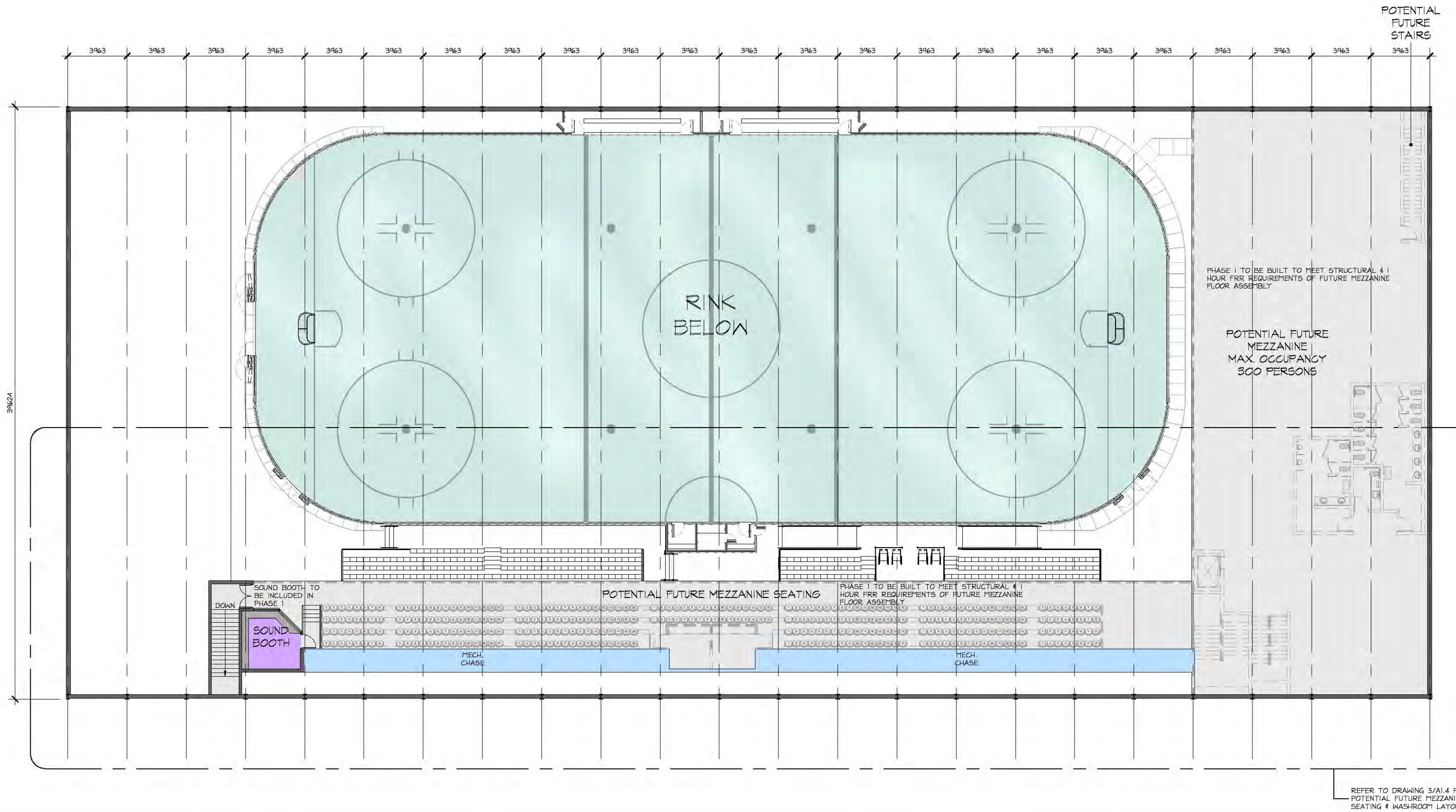


CONSULTANT

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# A1.4





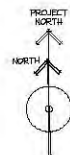
**WEST COAST MULTI-PLEX - ARENA**  
**SPRUNG STRUCTURE - MEZZANINE LEVEL**

2017-08-10

TOFINO, B.C.

SCALE: 1:250

2017-11

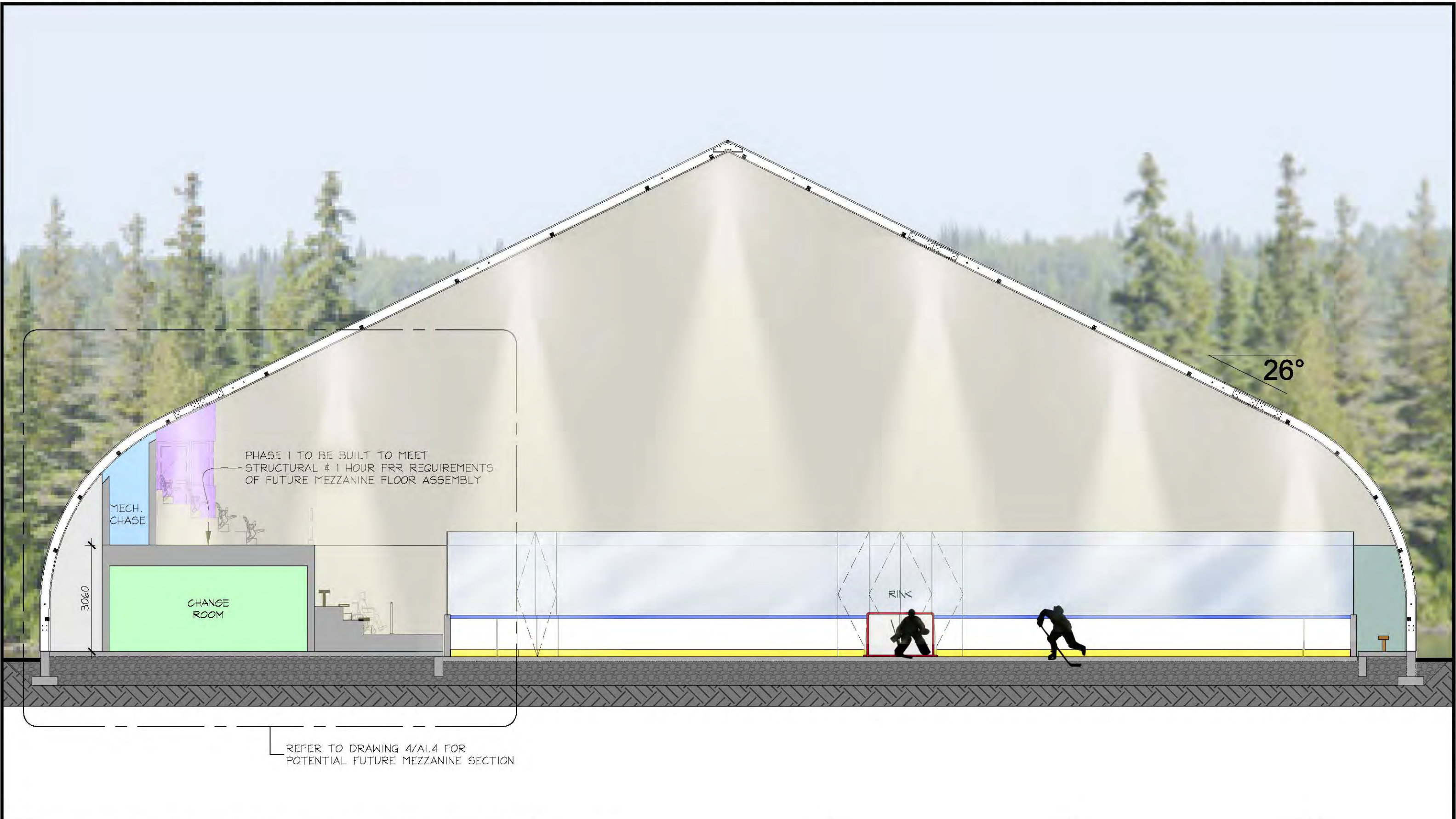


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**A1.5**





**WEST COAST MULTI-PLEX - ARENA**  
**SPRUNG STRUCTURE - SECTION**  
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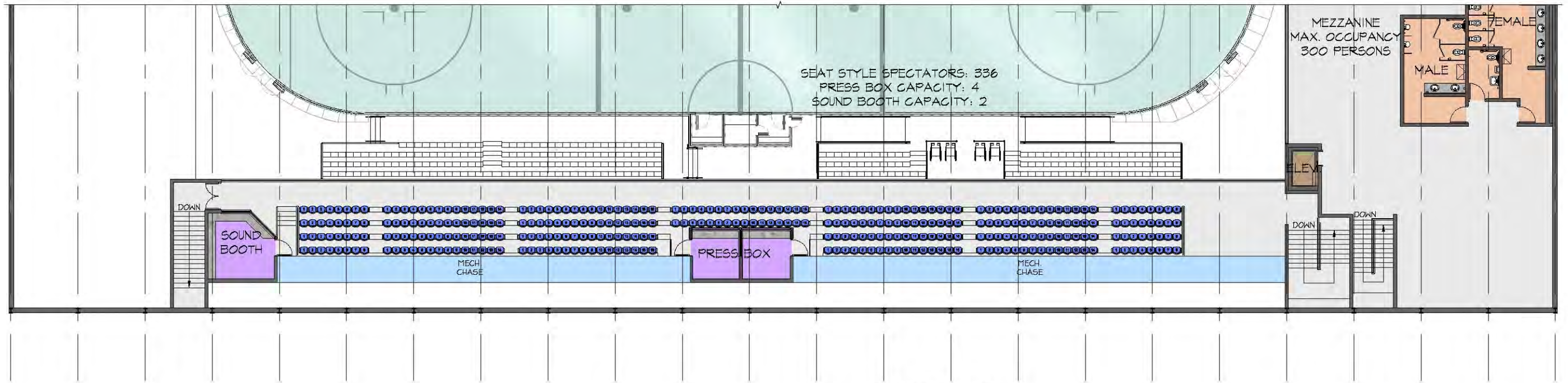
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CONSULTANT

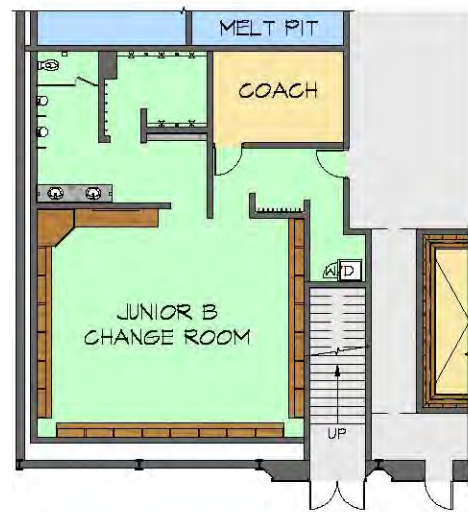
**VDA** | ARCHITECTURE  
 LIMITED  
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 T:250-477-4255 | mail@vda.ca | www.vda.ca

**A1.6**





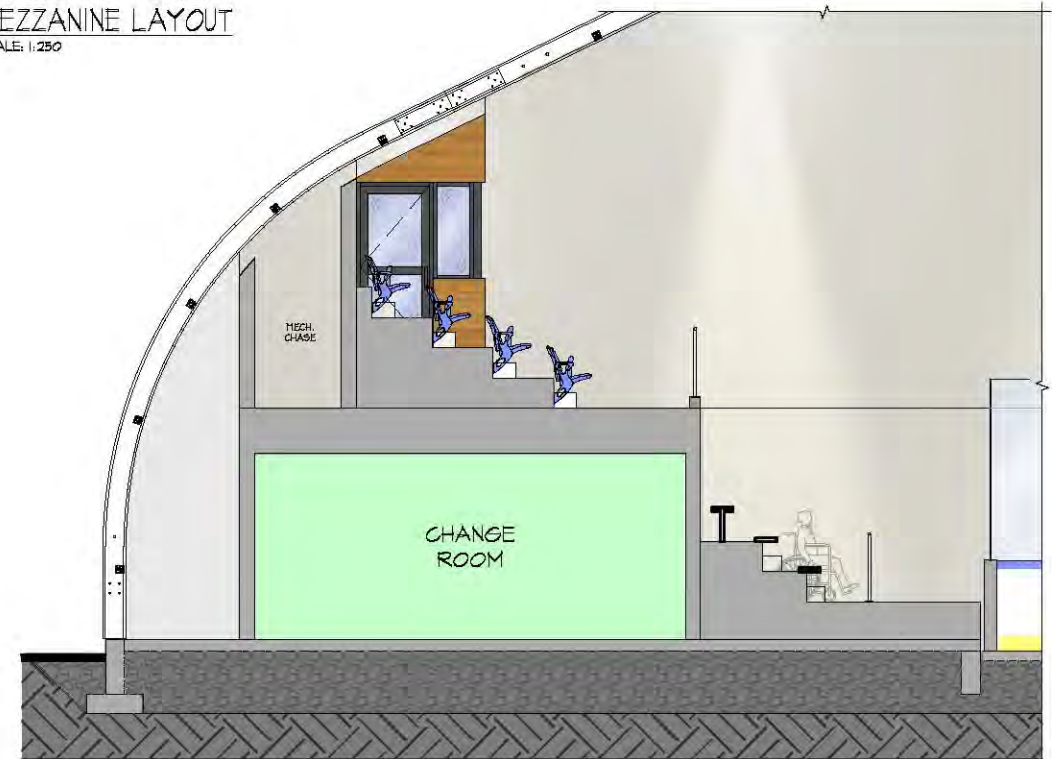
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1 POTENTIAL FUTURE JUNIOR B CHANGE ROOM LAYOUT  
SCALE: 1:250



2 POTENTIAL FUTURE MEZZANINE ACCESS  
SCALE: 1:250



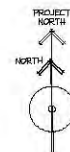
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# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - POTENTIAL FUTURE DEVELOPMENT

TOFINO, B.C.

SCALE: AS SHOWN 2017-11

2017-08-10

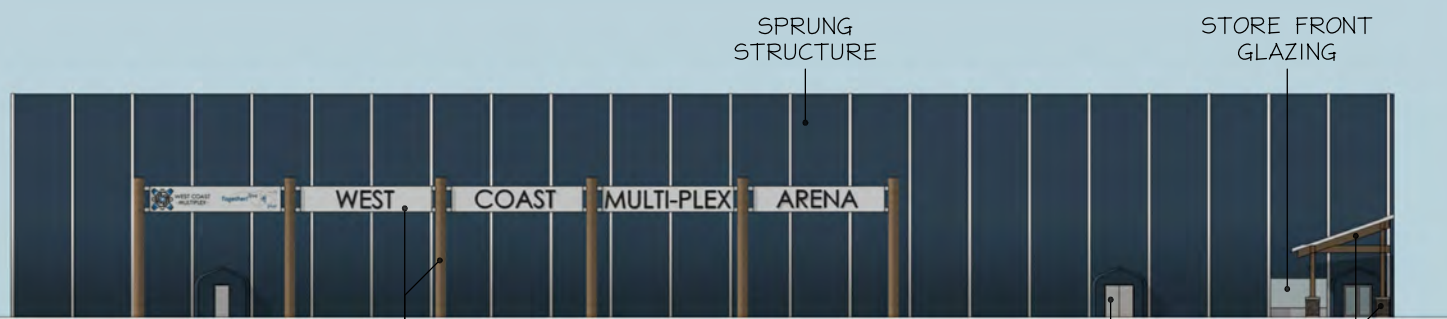


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# A1.7



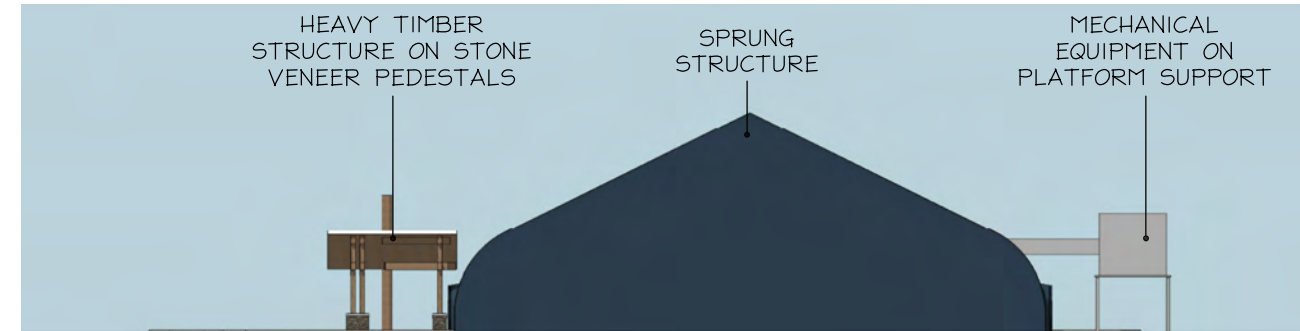


SIGNAGE ON STEEL FRAMING  
ATTACHED TO FIRST  
NATIONS SCULPTURAL ART

1 PHASE I  
SOUTH ELEVATION  
SCALE: 1:500

METAL  
DOOR

HEAVY TIMBER  
STRUCTURE ON STONE  
VENEER PEDESTALS



2 PHASE I  
EAST ELEVATION  
SCALE: 1:500

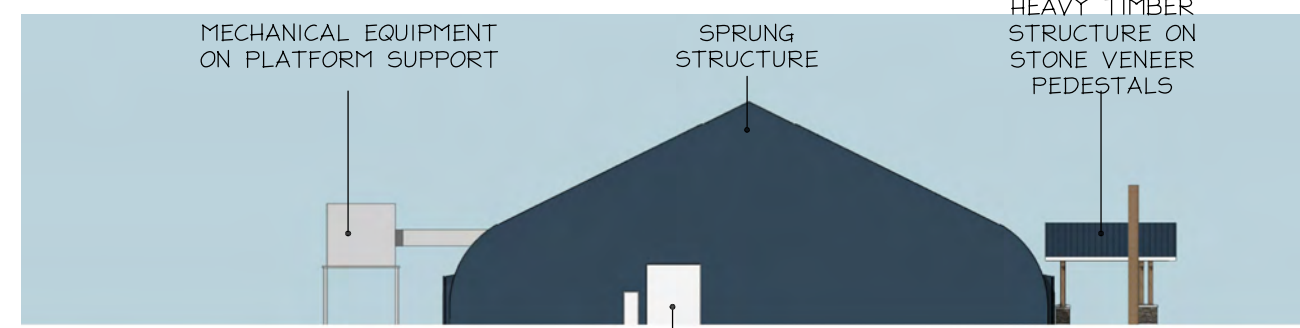
MECHANICAL EQUIPMENT  
ON PLATFORM SUPPORT

SPRUNG  
STRUCTURE



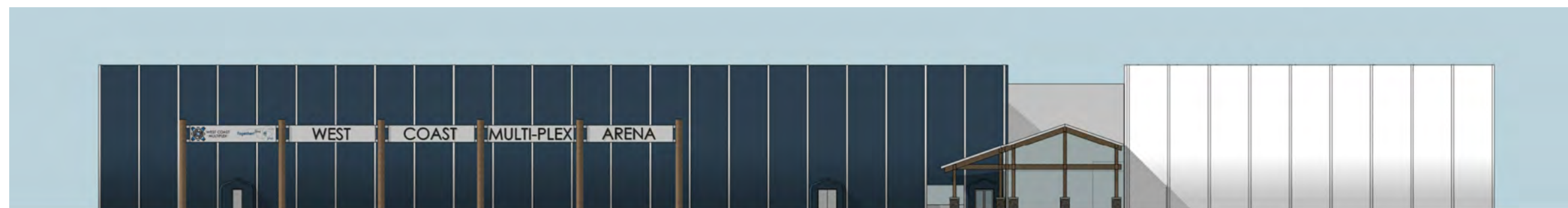
METAL  
DOOR

3 PHASE I  
NORTH ELEVATION  
SCALE: 1:500



OVERHEAD  
METAL DOOR

4 PHASE I  
WEST ELEVATION  
SCALE: 1:500



5 SOUTH ELEVATION  
W/ PHASE 2 POOL  
SCALE: 1:500

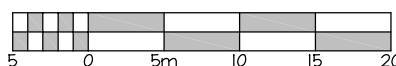
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TOFINO, B.C.

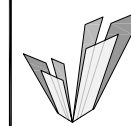
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2017-11

I.F. SCHEMATIC DESIGN  
2017-09-06



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# A1.8

ARENA (PHASE 1)

AQUATIC (FUTURE PHASE)



**WEST COAST MULTI-PLEX - ARENA**  
**PRE-ENG - PERSPECTIVE**

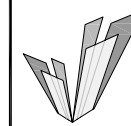
TOFINO, B.C.

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2017-11

I.F. SCHEMATIC DESIGN  
2017-09-06

CONSULTANT



**VDA** | ARCHITECTURE  
LIMITED

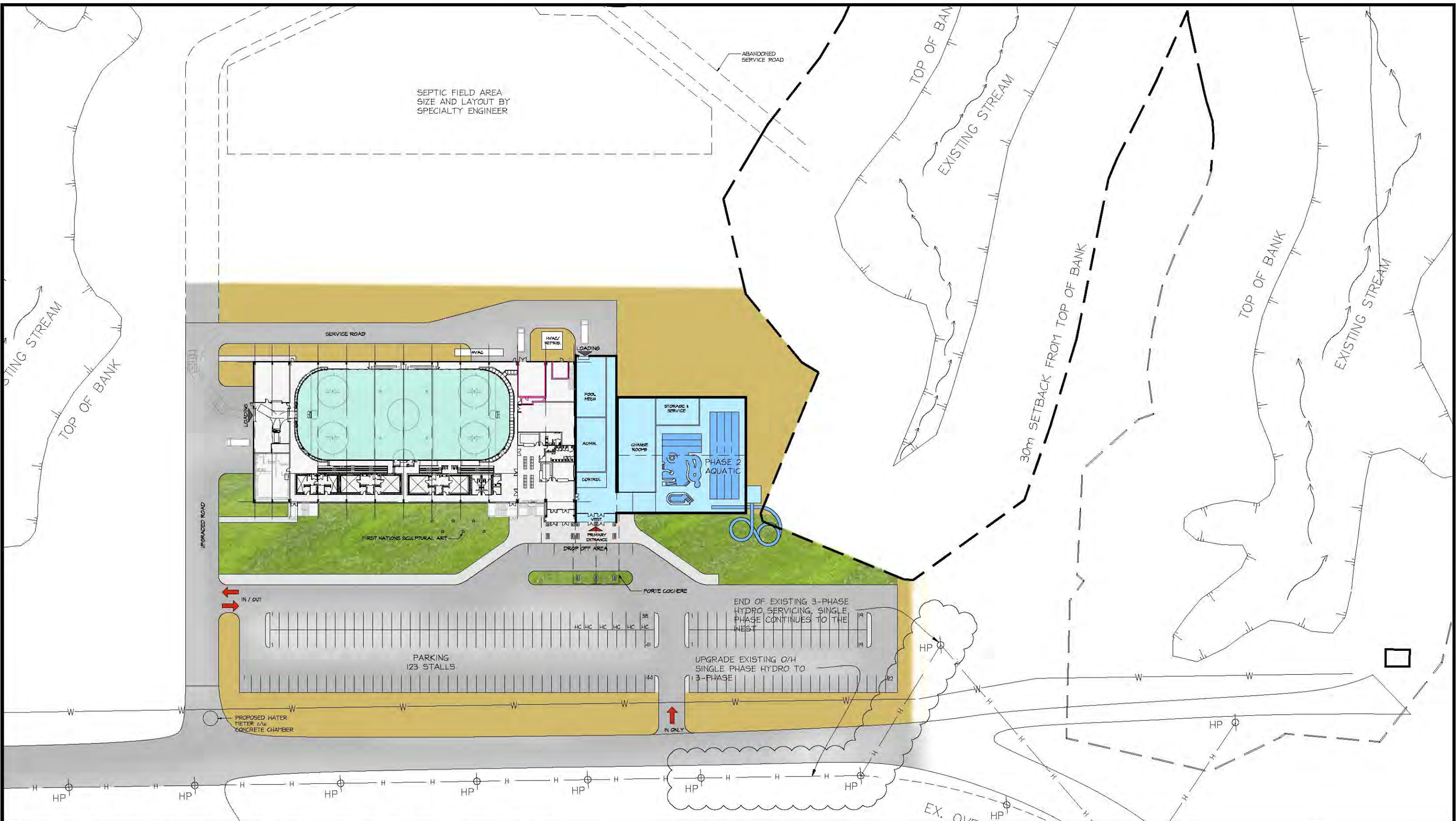
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T: 250-477-4255 | mail@vda.ca | www.vda.ca

**A2.0**









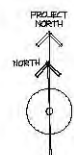
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TOFINO, B.C.

SCALE: 1:1000

2017-11

2017-08-10



CONSULTANT

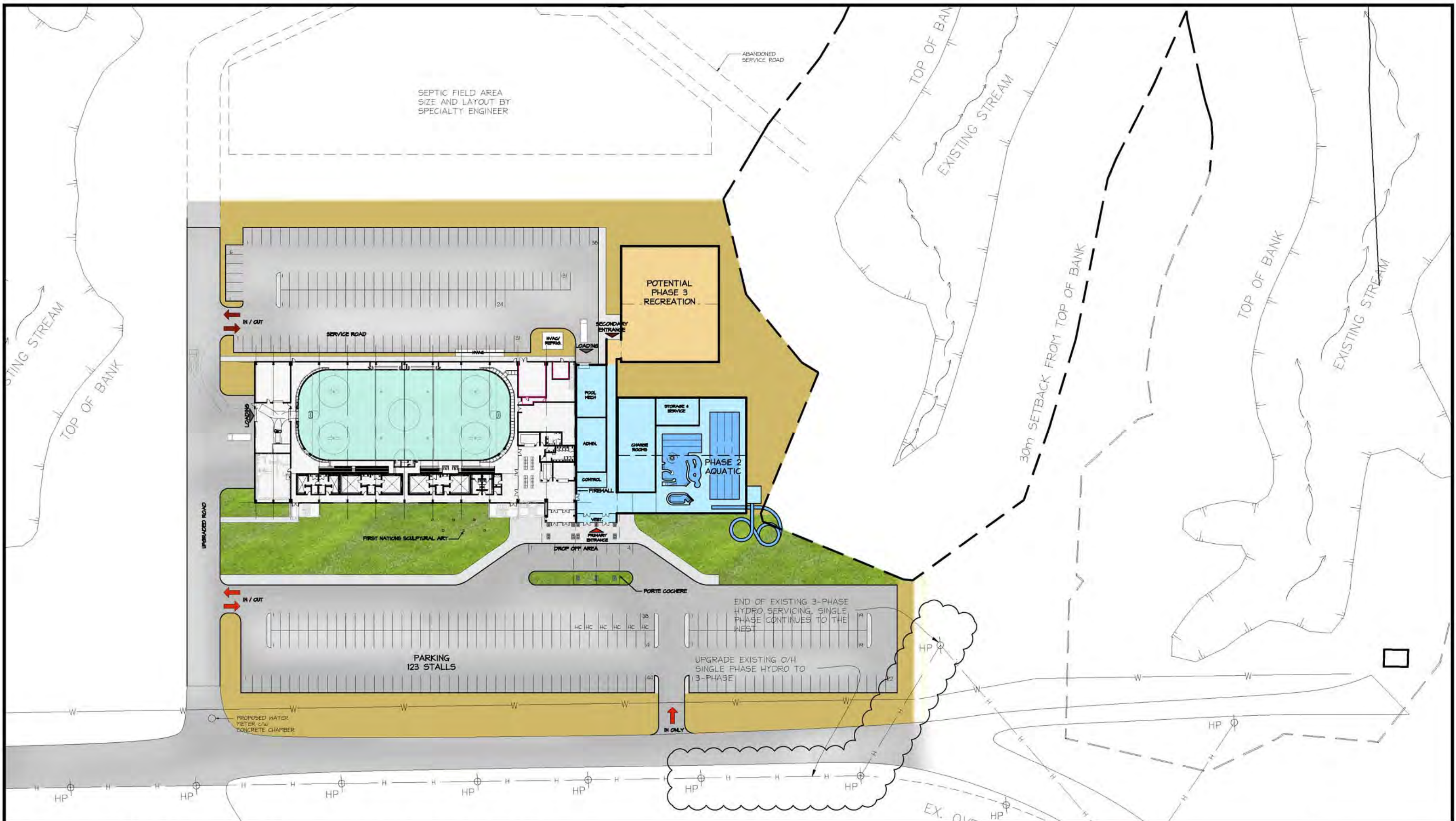


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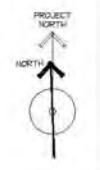
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**WEST COAST MULTI-PLEX - ARENA**  
**PRE-ENG - PHASE 3 SITE PLAN**  
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2017-08-10

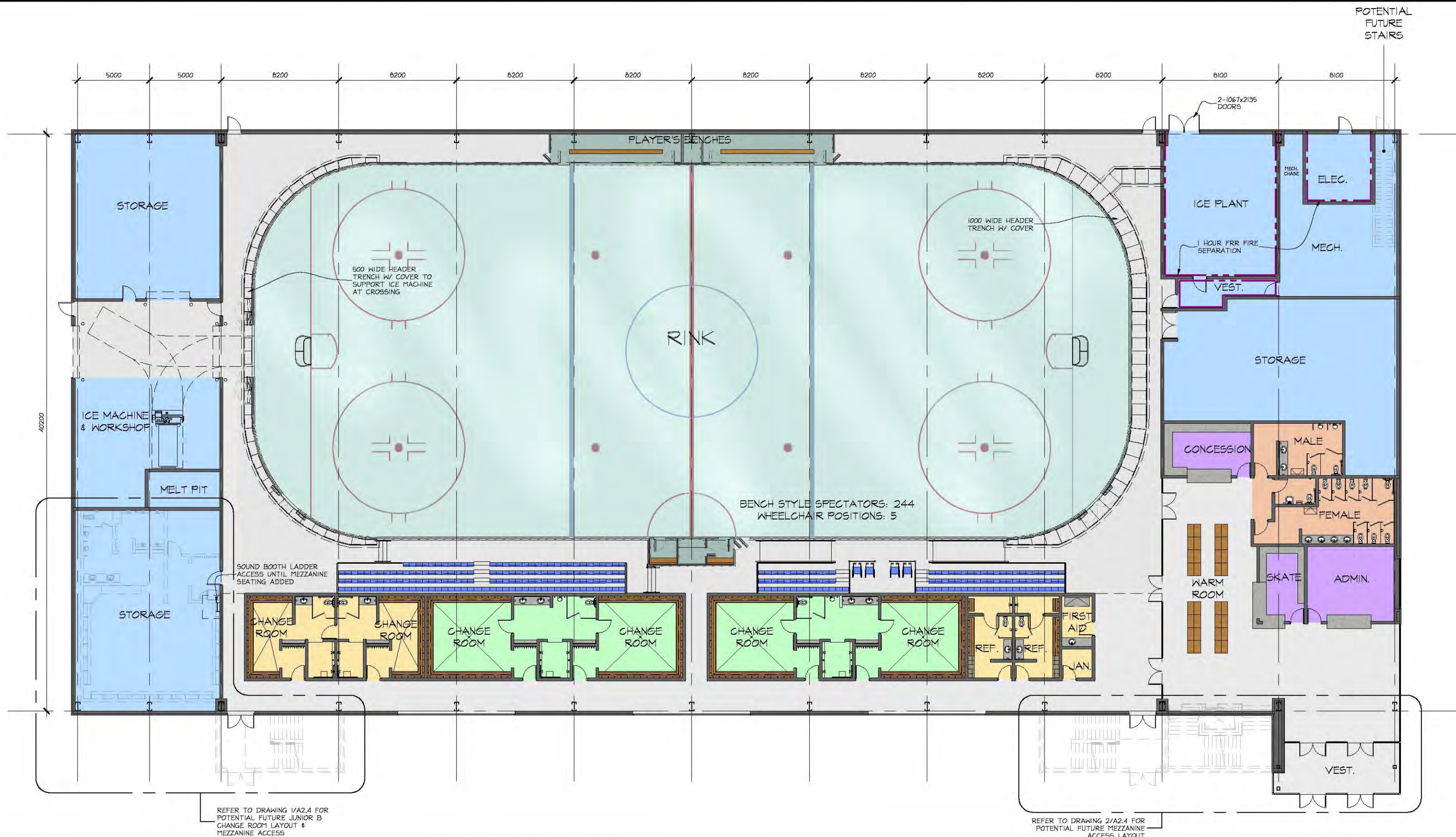


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**A2.3**





REFER TO DRAWING 1/A2.4 FOR POTENTIAL FUTURE JUNIOR B CHANGE ROOM LAYOUT & MEZZANINE ACCESS

REFER TO DRAWING 2/A2.4 FOR POTENTIAL FUTURE MEZZANINE ACCESS LAYOUT

# WEST COAST MULTI-PLEX - ARENA

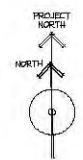
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TOFINO, B.C.

SCALE: 1:250

2017-11

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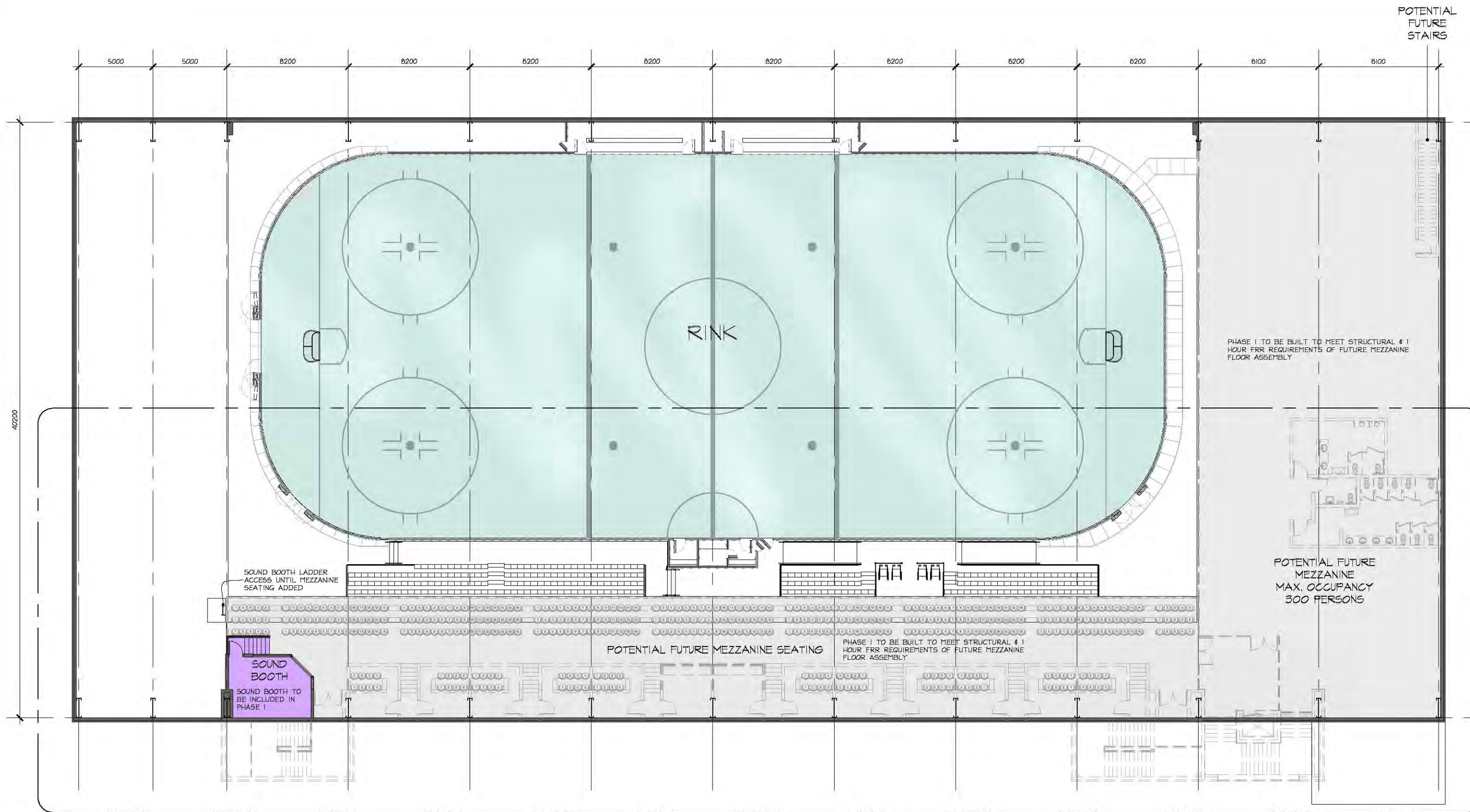


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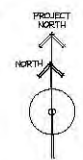
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TOFINO, B.C.

SCALE: 1:250

2017-11

I.F. SCHEMATIC DESIGN  
2017-08-10

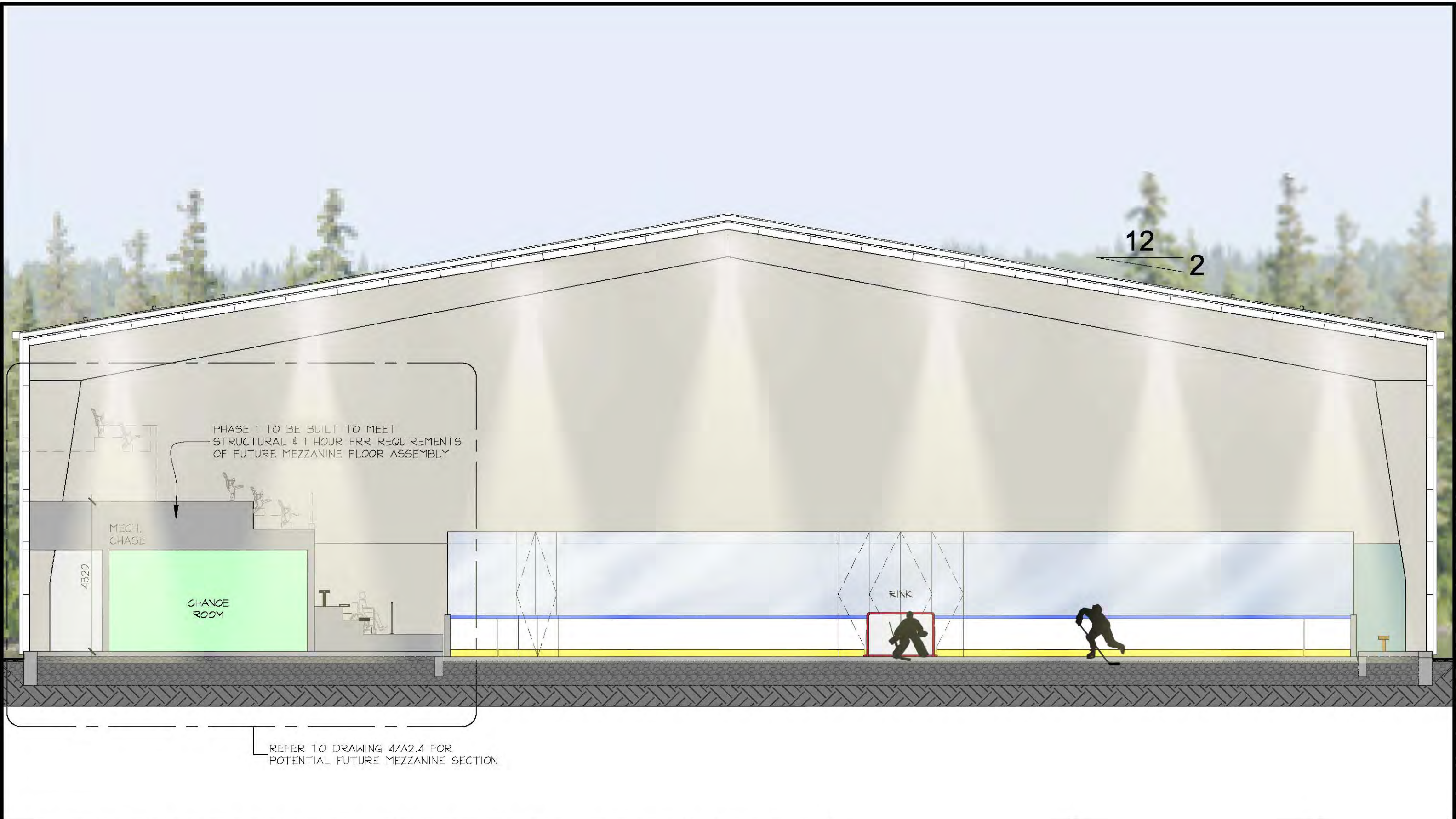


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# A2.5





**WEST COAST MULTI-PLEX - ARENA**  
**PRE-ENG - SECTION**  
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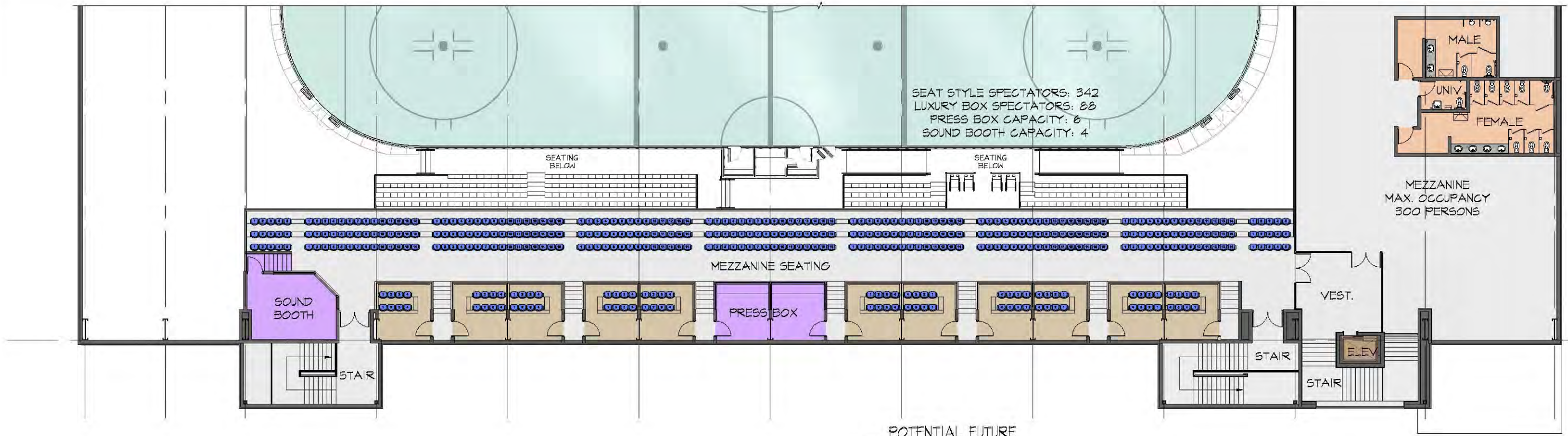
I.F. SCHEMATIC DESIGN  
 2017-08-10

CONSULTANT

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**A2.6**

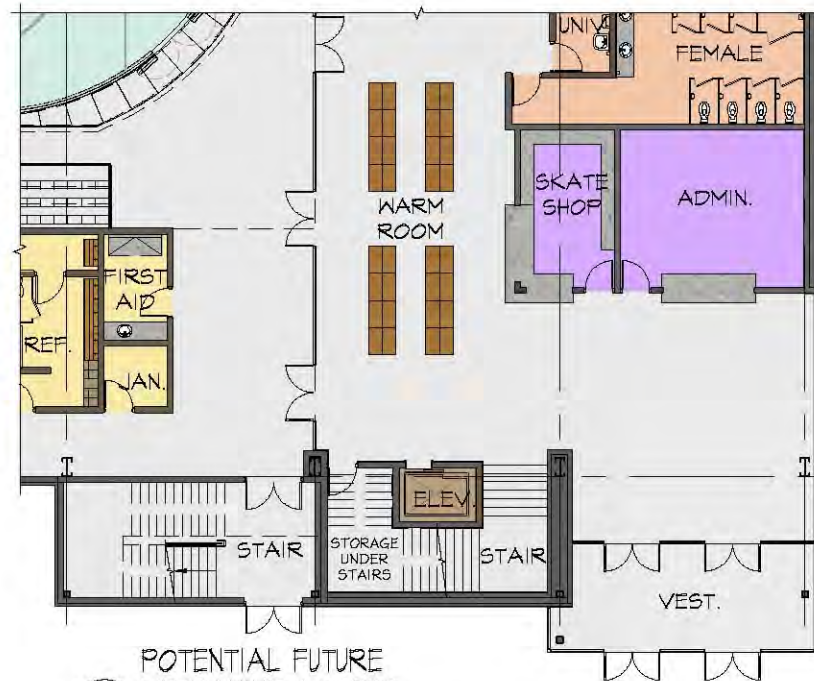




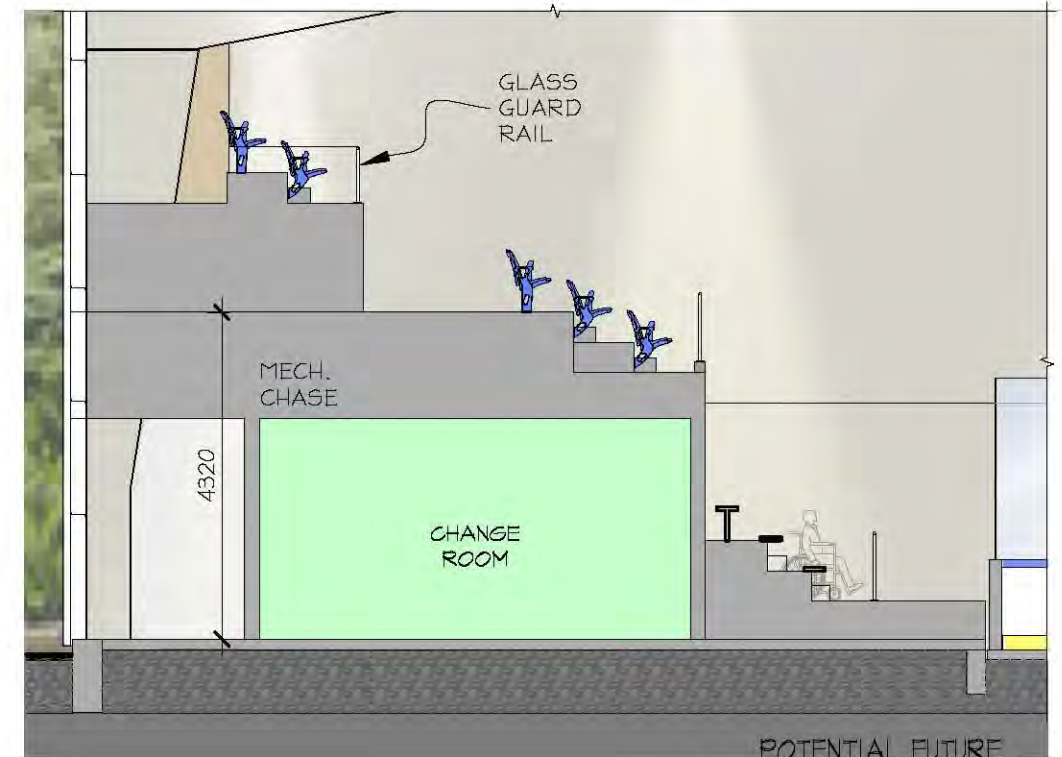
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1 POTENTIAL FUTURE JUNIOR B CHANGE ROOM LAYOUT  
 SCALE: 1:250



2 POTENTIAL FUTURE MEZZANINE ACCESS  
 SCALE: 1:250



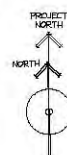
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**WEST COAST MULTI-PLEX - ARENA**  
**PRE-ENG - POTENTIAL FUTURE DEVELOPMENT**

TOFINO, B.C.

SCALE: AS SHOWN 2017-11

I.F. SCHEMATIC DESIGN  
 2017-09-06

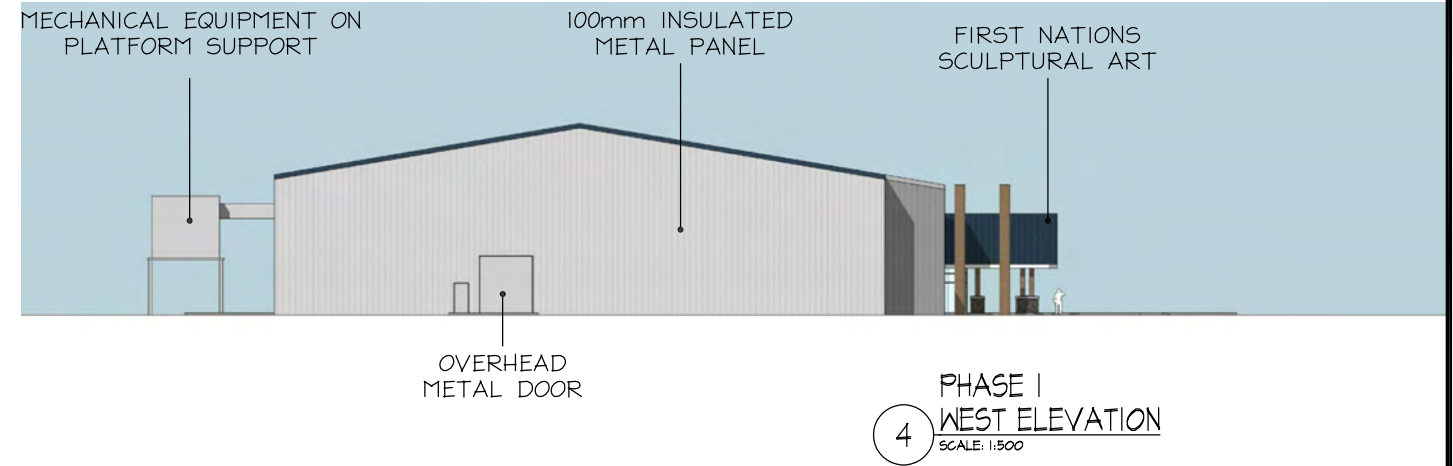
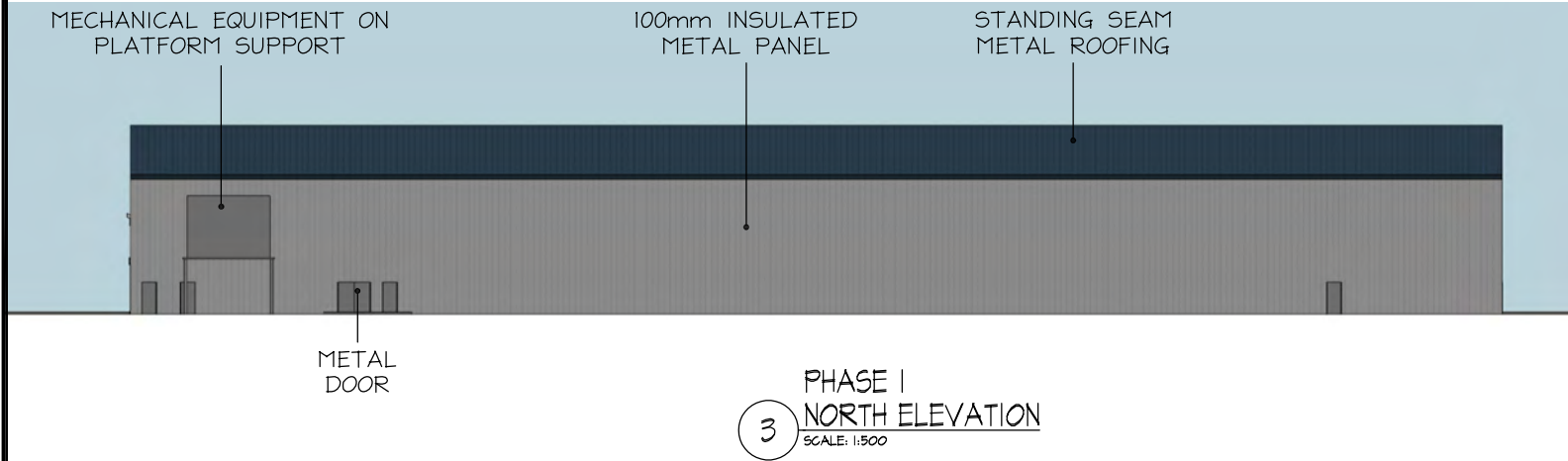
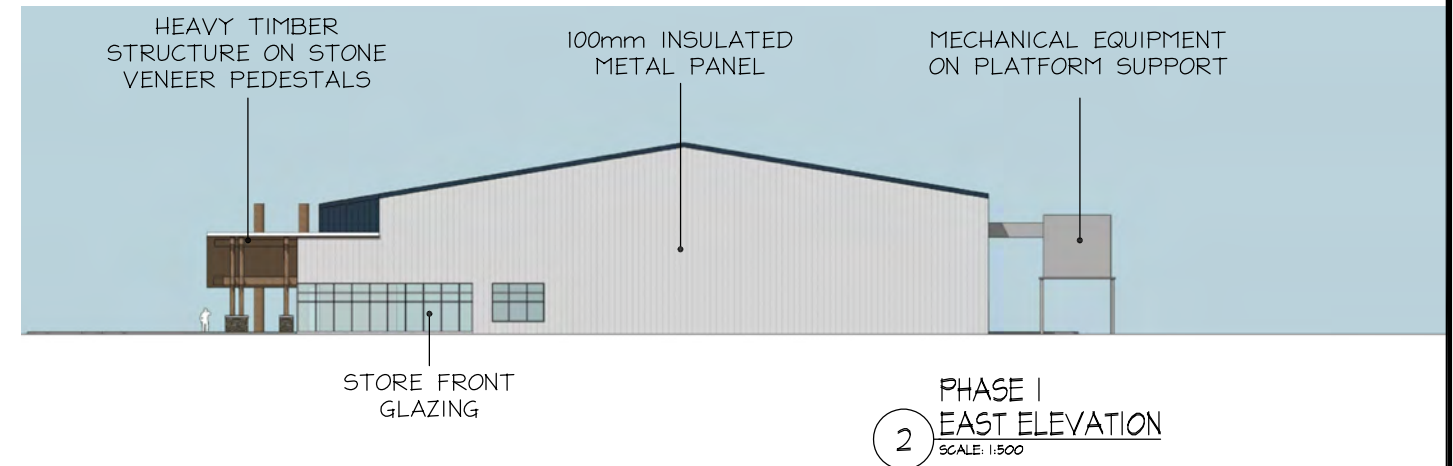
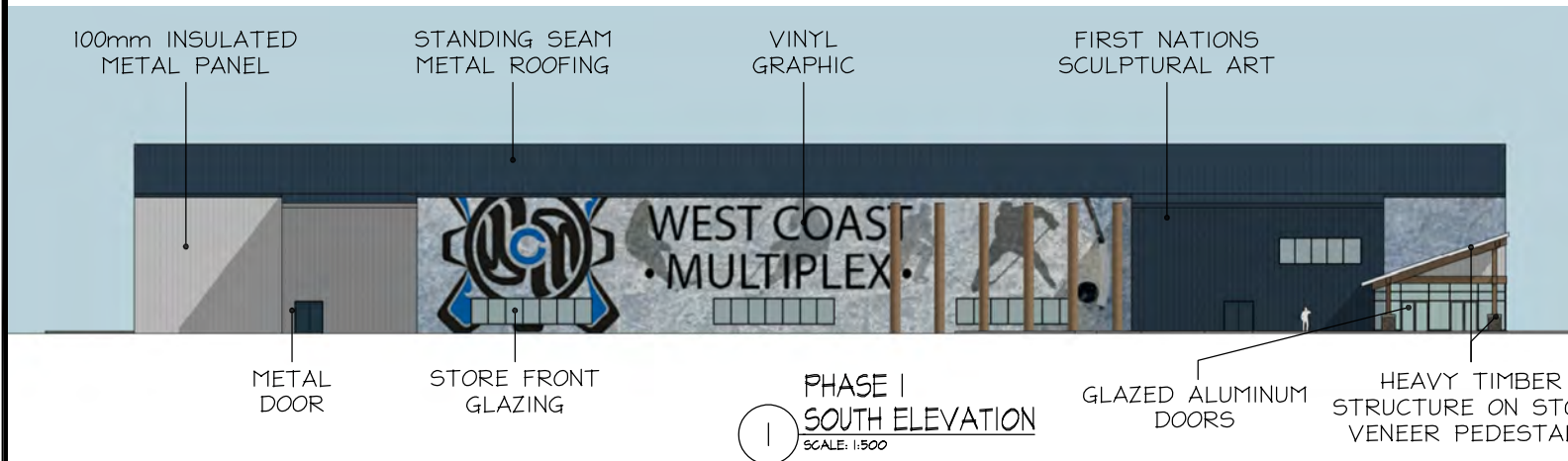


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**A2.7**

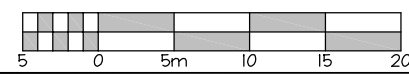




**WEST COAST MULTI-PLEX - ARENA**  
**PRE-ENG - ELEVATIONS**

TOFINO, B.C. SCALE: 1:500 2017-11

I.F. SCHEMATIC DESIGN  
 2017-09-06



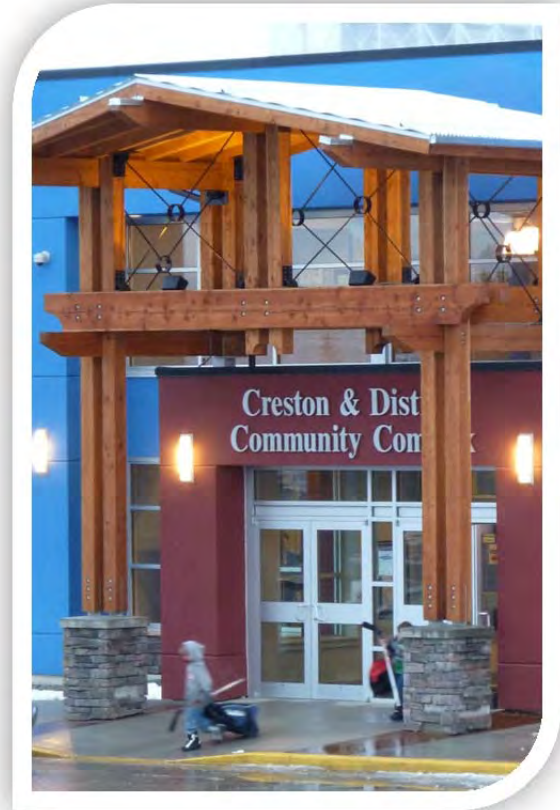
CONSULTANT

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**A2.8**



## APPENDIX B – STRUCTURAL REPORT



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# WEST COAST MULTIPLEX

## Structural Schematic Design Report

Date: October 3, 2017



Prepared For:

Attn: Kevin Klippenstein  
Architect AIBC AAA, MRAIC, LEED® AP

VDA | ARCHITECTURE LIMITED  
3388A Tennyson Avenue  
Victoria  
BC, V8Z 3P6

Prepared by:

Lee Rowley, P.Eng., M.I. Struct. E., MICE., LEED AP  
Principal

Herold Engineering Limited  
3701 Shenton Road  
Nanaimo, BC  
V9T 2H1

Project No.  
0277-007

# Table of Contents

WEST COAST MULTIPLEX .....	1
1.0 General.....	3
2.0 Design Criteria.....	3
3.0 Structural Design Concepts.....	4
3.1 OPTION 1 - Pre-Engineered Steel Frame .....	4
3.2 Option 2 - Pre-Engineered Sprung Building .....	7
3.3 Comparison of Option 1 and Option 2.....	8
3.4 Interior Structures.....	9



## 1.0 General

The proposed project is a multiphase project to create a multifunction recreation complex in Tofino on the West Coast of Vancouver Island. The three phases of development are as follows:

- Phase 1 – Ice Hockey Arena
- Phase 2 – Aquatic Centre
- Phase 3 – Recreation Centre/ Gymnasium.

The focus of this design report is on Phase 1 with the assumption that similar structural solutions will be adopted for future phases.

As part of this report we refer to the Geotechnical Report by Lewkowich Engineering Associates Ltd. (LEA) dated August 4<sup>th</sup>, 2015 for this project. We note that due to the upcoming changes to the BC Building Code we would recommend that this report be updated to reflect the significant changes in seismicity for the West Coast of Vancouver Island.

## 2.0 Design Criteria

We are recommending using the proposed structural design criteria of the 2015 National Building Code of Canada (NBC) which will be adopted in the 2016 British Columbia Code (BCBC). The importance of the 2015 NBC is in the higher seismic values for the West Coast of Vancouver Island.

The following structural design criteria are proposed for this project:

<i>Snowload 1/50</i>	Ss = 1.1 kPa Sr = 0.4 kPa	
<i>Hourly Wind Pressures</i>	1/10 = 0.53 kPa 1/50 = 0.68 kPa	
<i>Seismic Data</i>	Sa (0.2)	1.46
	Sa (0.5)	1.36
	Sa (1.0)	0.891
	Sa (2.0)	0.536
	Sa (5.0)	0.170
	Sa (10.0)	0.060
	PGA	0.695
	PGV	0.945
<i>Geotechnical</i>	Site Class: D Design Bearing Pressure: SLS= 150 kPa ULS = 200kPa	

Note:

Design bearing pressures are given for the Foundation Mat recommended in the Geotechnical Report. It is recommended that LEA should be asked to confirm if there are any changes to their 2015 report as a result of the new code.

### 3.0 Structural Design Concepts

#### Introduction

For Phase 1, two (2) pre-engineered structural framing systems are being considered at this stage of the planning process. A conventional steel framed pre-engineered moment frame system clear spanning the arena or a Sprung structure comprising fabric covered aluminum arches of similar span.

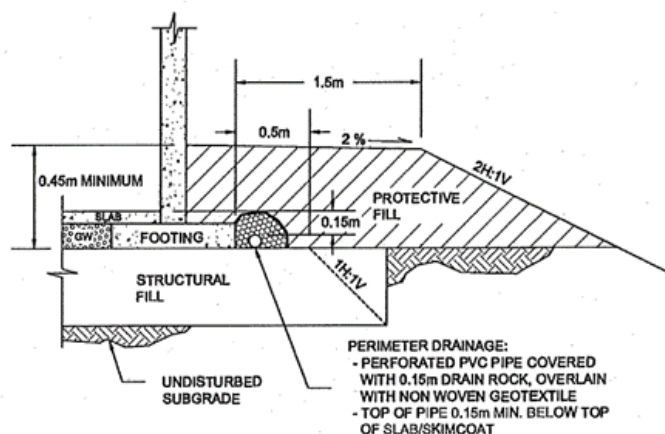
In both options, functional areas are contained within independent structures that include spaces such as change rooms, mechanical and electrical plant rooms etc. The following discusses the two (2) pre-engineered systems and structural options for interior space.

#### 3.1 OPTION 1 - Pre-Engineered Steel Frame

##### STRUCTURAL COMMENTS

##### Foundations

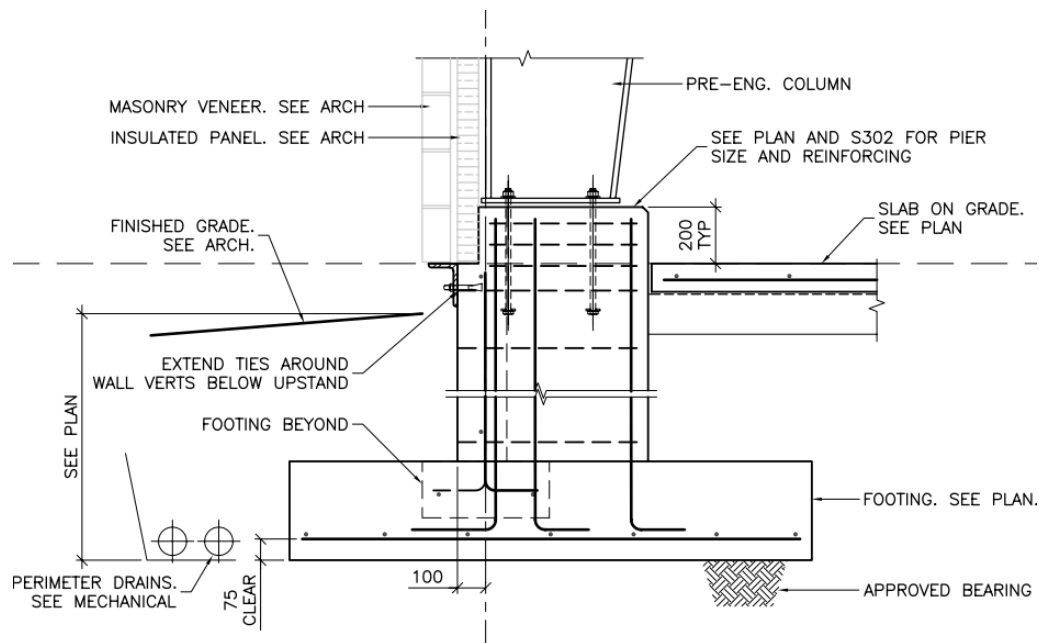
Ground conditions are indicated in the LEA report dated August 4<sup>th</sup> 2015 indicating that a "Foundation Mat" should be constructed below the foundation level to mitigate differential settlements. The diagram below is taken from the report to illustrate the proposal.





Following further clarification of the report we understand “it will be best to remove the uppermost layers to approximately 2.4m to 3.0m, at which depth the composition and consistency of the subgrade improves.” On top of this approved subgrade a 750mm foundation mat is to be constructed to support either the pre-engineered or Sprung foundations. Details of the mat are given in the geotechnical report but summarized as:

- Mirafi HP270 woven geotextile (high-strength/excellent permittivity)
- 600mm thickness of import 75mm minus crushed pit run (placed and compacted in 300mm lifts)
- Second layer of Mirafi HP270 woven geotextile (rotated 90°)
- Minimum 150mm thickness of import 19mm minus crushed base course above second layer of geotextile and below deepest footings



A typical pre-engineered foundation from a previous ice arena we designed is shown. The frames are most often supported off large pad foundations with shallow strip footings in between to form the edge of the slab on grade and support the base of the cladding system.

Note that the foundations may need to be tied into the slab to avoid column spread, however this may not be feasible due to the location of trenches for the ice rink. If this is the case the foundations will need to be designed in order to accommodate this.

### Superstructure

The pre-engineered frame is designed by the supplier of the building. Typically a performance specification both architecturally and structurally is used in order to generate bid documents.

Pre-Engineered steel frames are most efficient when the roof carries the least allowable loading and so a premium is paid for when score boards, heavy mechanical units etc. are hung from the building. Pre-Engineered steel frames can carry such loads by increasing the size and weight of steel sections used.

The pre-engineered frame configuration is typically a moment frame constructed of tapered steel elements which provides resistance to lateral loads across the width of the building and brace frames in the walls providing resistance to lateral loads longitudinally. Bracing elements vary but the most common method used is tie rod system. A typical bay spacing for these frames is in the range of 7m to 9m although this can vary depending on specific conditions such as wind loading, crane loads etc.

The tapered columns eat into the useable floor area around the building and so care must be taken to ensure the functional layout takes this into account. In addition pre-engineered frames can move significantly under wind or seismic loading and so gaps between the main structure and interior elements should be considered to allow for this movement.

Pre-engineered suppliers can incorporate features into their design to facilitate schedule, accomodate future expansions and mitigate certain detailing issues such as seismic gaps. In particular the mezzanine area at the east end of the building could be incorporated into their design. This would help schedule and mitigate the need for seismic gaps between the mezzanine area and the main building, thus saving floor area.

It is understood that structural depths may be an issue with the mezzanine construction. Information such as maximum permitted structural depths could form part of the performance specification if realistic.

Options to limit structural depths could include the use of pre-cast or mass timber drop in panels between steel beams provided by the pre-engineered building manufacturer.

If depths in this area are not a problem then solutions such as wide flange beams or open web steel joists supporting concrete filled metal deck could be used depending on the design by the supplier.



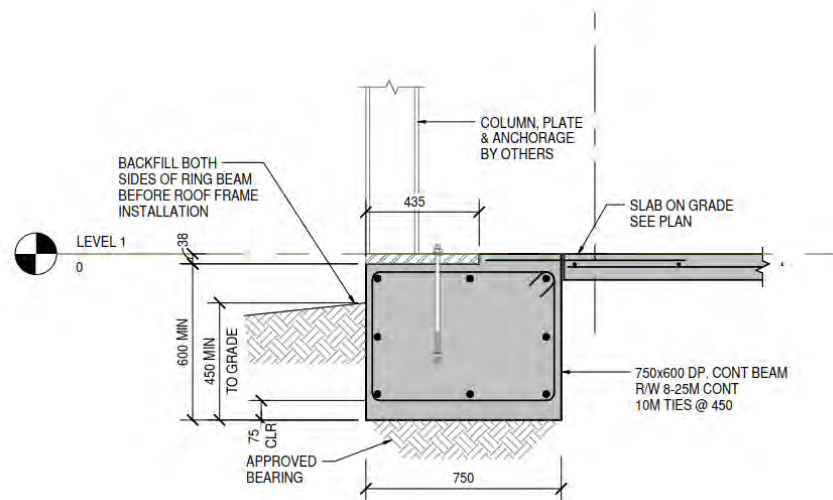
With regards to future expansion, the end frame at the east end where phase 2 would be added on, could be designed to accommodate future expansion and again should be identified in the specification.

### 3.2 Option 2 - Pre-Engineered Sprung Building

#### STRUCTURAL COMMENTS

##### Foundations

Much of the comments relating to the pre-engineered frame apply to the sprung structure however, the foundations for Sprung Structures tend to be much shallower than for a typical pre-engineered steel frame. This is because the frames are at closer centres and are supported on a thickened slab or ring beam tied into the slab.



Note that the slab has to resist column spread in a similar fashion to the pre-engineered steel building. This will need to be considered in the area where the rink is close to the wall of the building on the north side and may result in a thicker slab in this location.

##### Superstructure

The Sprung structure retains most of the features of the pre-engineered steel building however, they are typically a taller structure as they rely on arching of aluminum ribs that span the arena. The taller structure also allows a steeper roof pitch reducing snow loads on the building, as the snow slides off the low friction exterior fabric membrane.

The two wythe (interior membrane and exterior) membrane contains the aluminum ribs that carry the wind and seismic loads. The membrane is also a structural element that stiffens the structural system working combination with the ribs. Also contained in

the membrane structure are cable braces that resist lateral loading longitudinally along the building.

As such primary structural elements are hidden within the wall and so useable floor area can be maximized at the main floor level. This changes when the framing arches inwards and should be considered when laying out mezzanine areas and associated stairs.

As with pre-engineered steel frames Sprung Structures are most efficient when the roof carries the least allowable loading and so a premium is paid for when score boards, heavy mechanical units etc. are hung from the building.

In the case of expansion Sprung structures can accommodate this in their frame design however with regards to mezzanine and other interior structures this tends to be done by others.

A Sprung structure is a proprietary system and so when ordering the building, it is advised to work closely with the company in order to develop the necessary specifications required.

The Sprung structure technical department has detailed design information for all disciplines and so it is recommended that each consultant review this information before beginning their design in order to get the most out of the system.

### 3.3 Comparison of Option 1 and Option 2

A brief list of the structural features of Pre-Engineered Steel Frame and Sprung Structure are as follows:

- Foundations for Sprung Structures are typically shallower
- Sprung Structures have more useable floor area at grade (quickly offset by arching of ribs).
- The tapered columns of Pre-engineered steel frames may reduce usable space at main floor level.
- Pre-Engineered Steel Structures are more configurable.
- More of the interior work can be included in the Pre-Engineered Steel Structure package
- Both types of structures work best when equipment loading hung from the roof is kept to a minimum.
- Both structural systems are suitable for the arena and have been tried and tested for many years in most parts of north America.



### 3.4 Interior Structures

#### Structural Comments

Ice hockey arenas are heavily used buildings and so any exposed structural system should be durable. If not, the structure should be protected from operational damage.

We would recommend the use of masonry for all interior walls for the durability. Due to cost restraints, we have designed wood framed interior structures lined with drywall plywood as an alternative to masonry, in changing room areas. However the potential for building envelope issues is higher with this solution (showers and other wet areas etc) and so masonry is the preferred option.

There should be a gap between the pre-engineered structure and these walls of at least 150mm however this should be confirmed with the building designer as these distances can vary.

These masonry walls will need restraint against seismic loading. In the cases where there is a mezzanine floor planned, the floor itself can provide the needed restraint and should be installed immediately after the walls are completed.

On the south side of the arena above the changing room areas, seating is proposed. It is understood that the structural floor zone is to be kept to a minimum and that the clear span is 5.7m.

Precast concrete panels, cast in place concrete slabs and Comflor are all suitable options to keep the floor depth to the 200mm to 300mm range. Another option is to use mass timber solution such as Nail Lam or CLT that also fit into that range of thickness.

For the main mezzanine area to the east if the the Pre-Engineered Steel Building supplier provides the support structure for the mezzanine then the walls become non-loading bearing. The floor system could be a variety of options including open web steel joists supporting metal deck to be filled at a later date. Wide flange beams could also be provided, if structural depth is an issue, so that pre-cast or mass timber panels can be dropped into provide a floor system.

If the mezzanine structure is to be provided separately then either a post and beam or load bearing masonry structure will be required that is separated from the pre-engineered sytem. Similar floor systems can be adopted including a wood frame solution. However due to the potential uses of a gym a more substantial concrete or mass timber system is recommended for noise and vibration

At the west end of the building there is no proposed mezzanine and so its ceiling could be constructed in pre-engineered timber joists supporting the drywall ceiling. Plywood may need to be added to the top of these joists due to the high seismic loading in the area. As such this may be considered bonus storage space and could be designed accordingly.

If you have any questions, please contact the undersigned.

Prepared by:

HEROLD ENGINEERING LIMITED



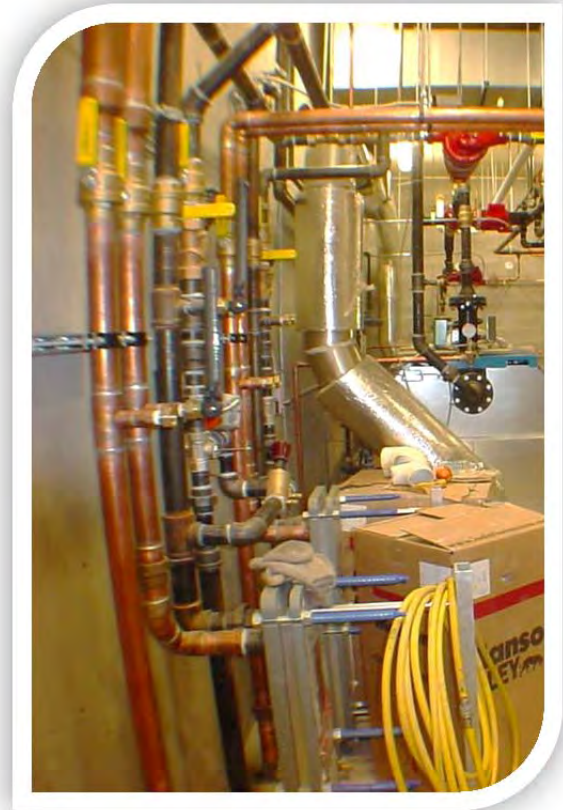
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## APPENDIX C – MECHANICAL REPORT



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# WESTCOAST MULTIPLEX

PROJECT NO.: 001A-036-17

## SCHEMATIC DESIGN REPORT

JULY 31, 2017

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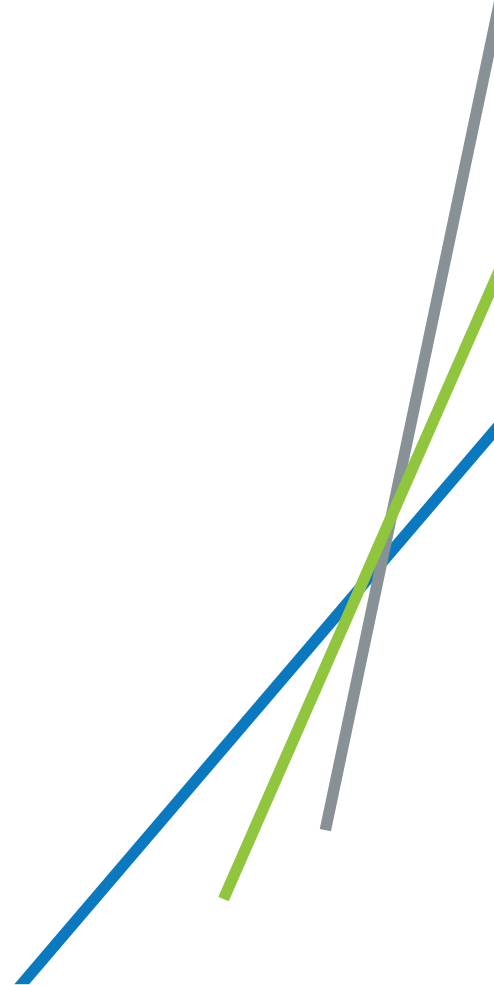
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## 1. INTRODUCTION

The AME Consulting Group, was commissioned by VDA Architecture Ltd. on behalf of the District serving the Towns surrounding Tofino & Ucluelet to produce a mechanical design report for the Proposed new Multi-plex facility. The design will provide recommended systems for the Ice rink. It will also outline mechanical issues from the proposed two structural systems.

The New building is a single storey building, consisting of a 250 seat arena, change rooms, amenity and administrative spaces.

This report details mechanical system options based on the mechanical consultants' experience in recreation design. The material in this report also provides comment on the cost implications for the various solutions and points out overall cost, maintenance cost, and payback periods.

This report has been prepared by the AME Consulting Group for the exclusive use of the District, VDA Architecture Ltd, and the consulting team. The materials in this report reflect the best judgment of the AME Consulting Group with the information made available to them at the time of preparation. Any use of a third party may make of this report, or any reliance on, or decisions made based upon the report, are the responsibility of such third parties. The AME Consulting Group accepts no responsibility for damages suffered by any third party as a result of decisions made or actions taken based upon this report.

### 1.1 Design Criteria

- .1 The design has proposed many sustainable options. These options, along with alternatives, will be life cycled over 20-years to validate the best system selected.
- .2 The following is a list of some of the applicable codes and standards that apply to this design.

### 1.2 Applicable Codes and Standards

- BC Plumbing Code, current edition
- BC Building Code, current edition
- ASHRAE Standard 90.1 – 2010
- Provincial Fire Marshall Regulations
- Applicable NFPA Regulations
- Local Building By-Laws
- American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)
- American Society of Plumbing Engineers (ASPE)
- Sheet Metal Contractors Association of North America (SMACNA)
- CSA Standard C448 Design and Installation of Earth Energy Systems
- CSA Standard B128.1-06/ B128.2-06 Design and installation of non-potable water systems



### 1.3 Design Conditions

- .1 Outdoor Design Conditions: Based upon British Columbia Building Code 2012 Appendix C for Tofino BC

Summer (°C)	Winter (°C)
July 2.5% Design	January 1% Design
Temperature	Temperature
20°C db / 16°C wb	- 4°C

- .2 The following table is the suggested Indoor Design Conditions.

	Summer (°C)	Winter (°C)
Change Rooms	22	20
Warm Room	20	18
Administrative Uses	22	22
Arena Bowl	10	10

- .3 Building Envelope Thermal Analysis

The following building envelope insulation requirements are based on the tables within ASHRAE 90.1 – 2010 for British Columbia : Climate Zone 5.

- Arena is considered as a semi-heated space and shall have a minimum R-14.5 wall and 18 ceiling per ASHRAE 90.1 – 2010. This is based on Roof insulation for Metal building or steel frame wall insulation.
- Remainder of the building structure shall have a minimum R-20 wall and ceiling per ASHRAE 90.1 – 2010. This is based on Roof insulation for Metal building or steel frame wall insulation.

## 2. MAIN SITE SERVICES

- .1 The site will have new storm, fire and water services fed from Airport Road. Sanitary will drain into a septic field currently not designed. Gas and water is coming from the east side of the existing building near the existing mechanical room. Outside of the 1m footprint will be the responsibility of the Civil Engineer. The preliminary analysis of the project indicates that the following plumbing systems and site services are required:
  - .1 New 150mm diameter sanitary sewer @ 1% slope sized for 300 total sanitary fixture units. The service will terminate @ the SW corner of the building to be picked up by Civil.
  - .2 Multiple storm drains discharging @ grade c/w splash pads or bio-swales.
  - .3 New 75mm diameter domestic water, sized for 650 water service fixture units.
  - .4 New 150mm diameter Fire protection water service.
  - .5 The facility does not have natural gas.

## 3. INTERIOR PLUMBING SYSTEMS

### 3.1 Fixtures

- .1 A summary of the proposed Plumbing Fixtures is described below.
  - .1 All fixtures will be commercial grade, CSA approved, made of vitreous china.
  - .2 All public water closets will be low flow, hands free flush valve type.
  - .3 Urinals will be wall hung, low flow, hands free flush valve type.
  - .4 Public lavatories will be all in one wall mounted Terreon solid surface. The unit would come c/w soap dispenser, equipped with single temperature hands free metering type faucets.
  - .5 Changeroom wall mounted Terreon solid surface lavatories will be a hot – cold mix with hands free metering type faucets. By adjusting the valve you can have cold water for bottle filling.
  - .6 Showers will be low flow and equipped with one touch sensor and a thermostatic mixing valve for hot – cold supply. The shower will be housed in a S.S. shroud for pipe and valve access.
  - .7 A hot - cold water Hose-bib will be located in each change room located below the lavatory counter with lockable cover.
  - .8 Non-freeze hose-bibs will also be located around the building. Final layout to be coordinated with owner.
  - .9 Domestic water shall comply to ASHRAE standard 90.1: 2007 (insulation, etc.)

### 3.2 Domestic Cold Water Systems

- .1 A new domestic cold water system will be fed into the mechanical room. The domestic cold water systems will consist of:
  - .1 75mm water entry service, with 50mm water meter, PRV (if required), and premise backflow preventer.
  - .2 Distribution piping system to all fixtures
  - .3 50mm Cold water supply line to Refrigeration room for Ice plant c/w RP type BFP.
  - .4 Heating / cooling plant fill line c/w water meter, PRV and RP type backflow preventer.
  - .5 Arena fill line c/w water meter and reduced pressure backflow preventer

### 3.3 Flood Water Purification

- .1 Incorporating a flood water purification system for ice making can save up to 10% in annual refrigeration costs. Although such systems are not typically installed solely for energy conservation purposes, facilities with high mineral content in their source water can benefit twice with such a product. First, they can improve their ice quality by using pure water which makes harder, faster and clearer ice. Second, the denser ice sheet will be able to transfer heat more easily to the ice made from mineral laden water. This will result allow slightly higher refrigerant temperatures to be used.

### 3.4 Domestic Hot Water Systems

- .1 The domestic hot water will have two separate systems, Ice Resurfacer fill and building hot water, each with a minimum of two thermal storage tanks.
- .2 To achieve the 60°C storage temperature we require a preheat system to heat the domestic hot water up to approximately 40°C then a standalone high pressure heat pump will raise the hot water from 40c to 60c.
- .3 A thermostatic mixing valve within the domestic hot water room will mix the domestic hot water to provide 49°C low temperature supply. The Domestic hot water system would be sized with the assumption that 37°C tempered domestic hot water is supplied to 4 dressing rooms in one hour. We assumed 20 skaters each @ 5 minute shower.
- .4 The Ice Resurfacer system will provide 1000 l of 71°C domestic hot water to fill the Ice resurfacer twice in 1-1/2 hours. This system will have it owns electric booster and storage tanks.



### **3.5 Storm Drainage System**

- .1 For the sprung structure, the roof drainage splashes on grade and is picked up by the civil. For a Pre-Engineer structure the storm drainage system will pick up roof drains and drop down with concealed piping. The number and arrangement of roof drains will be designed to suit the proposed building configurations, and be in conformance with the British Columbia Plumbing Code. The storm drainage system will be piped to city storm drainage systems or alternatively, dumped at grade to exposed splash pads for the civil catch basins to pick up.

### **3.6 Sanitary Waste and Vent Systems**

- .1 A new sanitary drainage system will collect wastewater from all of the building plumbing fixtures and will discharge to a new building septic field. The deepest drainage requirement is at the South West end of the building to pick up the snow melting and header trenches.
- .2 Snow from the ice resurfer will also be stored into a holding tank. Low grade heat will melt the snow and discharge the waste water into the sewer system. Removing of the ice at the end of the year will be completed outdoors. The ice will be cracked then pulled out onto a canvas canopy. The canvas collects the paint while allowing the ice the drain into the storm system. The paint is collected and disposed with in accordance with local codes.

### **3.7 Footing Drainage System**

- .1 The existing building elevation is above grade thus we do not anticipate having footing drains. Subsurface drains below the ice slab with be based on the Refrigeration consultants and Geo-technical Engineers recommendations.

## **4. FIRE PROTECTION SYSTEMS**

### **4.1 General**

- .1 Contractor to provide a sprinkler system in accordance with the British Columbia Building Code, NFPA 13 latest edition, and to the local authority having jurisdiction. It is possible the owner's Insurer may have more stringent requirements; however, the Insurer's requirements have not yet been established.
- .2 A new 150mm fire main will be routed to the mechanical room. The space will house a premise backflow preventer, main tamper switch and zone valves.
- .3 Water supply data is required by providing flow test data on hydrants near the site and should be submitted to the design team.
- .4 The sprinkler contractor shall be responsible for the hydraulic design, layout, supply and installation of all necessary fire protection components for the new facility.
- .5 The contractor shall provide all piping, hangers' supports and devices required to provide a complete operating wet & dry sprinkler system. All sprinkler components shall be in accordance with NFPA 13, latest edition

#### 4.2 Fire Pump:

- .1 At this time we do not anticipate a fire pump. We will require hydrant test data near the site to validate this assumption.

#### 4.3 Building Sprinkler Zoning:

- .1 A zone valve will be provided for each zone and be monitored at the fire alarm panel. Each sprinkler zone will also contain a test and check valve that will be piped to drains within the building. Sprinkler distribution in each zone will be provided to accommodate the architectural floor plans as per the requirements of NFPA 13. We anticipate two zones, Wet Common Area zone and a Dry arena bowl zone.
- .2 Wet sprinklers for all common areas and service spaces – designed to NFPA-13: Light and Ordinary Hazard.
- .3 Arena Bowl: Ordinary Hazard Group 11 dry zone.

#### 4.4 Fire Extinguishers:

- .1 Fire extinguishers shall be provided to the requirements of the National Fire Code, NFPA 10 and the local authorities having jurisdiction.
- .2 Semi- recessed or fully recessed cabinets in drywall or block wall assemblies. Exposed cabinets within block wall and concrete assemblies. Bracket type in mechanical rooms.

### 5. HEATING, VENTILATION AND COOLING SYSTEMS

#### 5.1 Central Heating Plant

- .1 The Central plant will consist of an Air Thermal heat pump and waste heat recovery heat exchanger from Ice Plant. Any excess heat will be returned to the refrigeration plants evaporative condenser.
- .2 The 1<sup>st</sup> stage of heating will come from the Amonia to Hot Water heat exchanger located in the refrigeration room. Excess heat from the compressors will transfer into the low temperature heating loop via plate and frame heat exchanger.
- .3 An Air cooled heat pump will supplement the low temperature loop to provide heating for ventilation and space heat. A water to water heat pump will provide high temperature heating water to the Domestic Hot Water system and Ice Resurfacer flood water.
- .4 The building distribution piping system will consist of a High temperature heating loop and a loop temperature heat pump loop. The high temperature heating loop will provide building domestic hot water heat and Ice Resurfacer flood water.

- .5 The low temperature heat pump loop will provide heating and cooling to the remaining building through hot water heating coils (heating only) or air – water heat pumps. The loop will vary its temperature based on the outside air temperature. As the temperature outside gets cooler the loop acts as a heat source to reject heating from the spaces being air-conditioned. As the outside air gets colder the loop temperature will get hotter thus providing heating water. When the loop temperature becomes too hot the heat pumps lock out and only provide heating water through a hot water coil.
- .6 In the summer if there is excess heat in the loop temperature loop, heat will be rejected to the Ice Plant condenser through the heat recovery heat exchanger.

## 6. VENTILATION SYSTEMS

The building will be divided into 4 Ventilation Zones each served by their own air handling units as follows:

- AHU-1: Change Room Air Handling Unit
- AHU-2: Arena Bowl
- Back of House

### 6.1 Change Rooms (AHU-1)

- .1 For the change rooms, we recommend a dedicated air handling unit with heating coil section, Variable speed supply and return fans, mixing box with 2-position dampers and a heat pipe heat recovery section.
- .2 Occupancy sensors within each space will open a 2-position damper located in the change room and shower area. The supply air will be distributed to the change area. Exhaust will be pulled out of the shower and washroom area. An adjustable time clock through DDC controls will allow the system to ventilate longer than the space being occupied through a purge cycle.

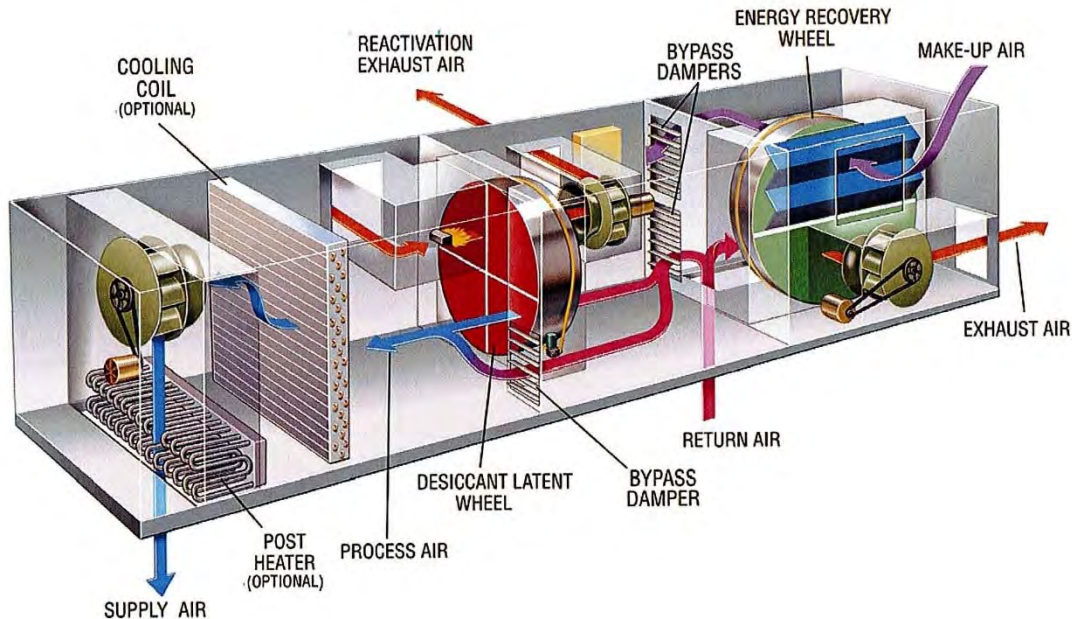
### 6.2 Lobby & Administrative Spaces

- .1 The primary ventilation air will be ducted to the air to water heat pumps via an Heat Recovery Ventilator. The Lobby washroom exhaust will draw air from the lobby and exhaust within the washroom. The air passes through a heat recovery section that will preheat outside air. This preheated air is then ducted to the ceiling mounted heat pumps.
- .2 Individual temperature control will come by water source heat pumps located above ceiling spaces. Water source heat pumps come in various shapes and sizes. The main advantage of the WSHP concept is its ability to add and subtract energy from a common loop. By doing this, the heat collected from zones that require cooling is used to heat the zones that require heating.
- .3 Heat Pumps provide fast acting individual temperature control to allow flexibility in various user groups. (i.e. administration versus lobby)



### 6.3 Arena Bowl

- .1 The arena would have a combination desiccant dehumidifier and CO<sub>2</sub> demand control ventilation.



**Munters Dry-Cool Unit**

- .2 The dehumidifier has two air streams, Supply Air Stream and Reactivation Air Stream.
- .3 The supply air stream controls the space humidity, CO<sub>2</sub> levels and space temperature. The Ventilation or make up air is drawn into the unit through a fresh air damper and supply fan. The amount of fresh air will be controlled based on the space CO<sub>2</sub> levels. CO<sub>2</sub> sensors will be installed in the return air duct. The return air mixes with the fresh air then passes through a DX coil. This cools the air to saturation dew point thus making the desiccant wheel the most efficient. Air passes through the desiccant wheel to remove the remaining moisture, then passes through a heating coil to maintain set point temperature.
- .4 The reactivation air stream dries the desiccant wheel. This process consists of a reactivation fan that pulls outside air through a heating coil then through the desiccant wheel to dry out the wheel. Once it passes through the wheel the process air is exhausted to outdoors.

## 7. EXHAUST SYSTEMS

### 7.1 Refrigeration Plant Exhaust:

- .1 A Two speed up-blast fan will be located on the roof of the refrigeration room. The fan will be controlled by a switch on the entrance wall (low speed) and an ammonia sensor @ the ceiling of the room. An Ammonia detector will be located in the Vestibule. This detector will start the fan on high speed should a leak occur.

## 7.2 Arena Exhaust:

- .1 CO and NOX detectors will be located @ ice surface via a vacuum pump. Air will be drawn from the ice surface to assure no buildup of obnoxious fumes from the ice resurfacing machine. Should this occur wall mounted exhaust fans will energize to purge the space from contaminants.

## 7.3 Ice Resurfacers Exhaust:

- .1 For a propane or gas fired Zamboni CO and NOX detectors will be installed within the room. Based on levels an exhaust fan will purge the space to remove the fumes. A hot water unit heater will provide space heating.

## 8. CONTROL SYSTEMS

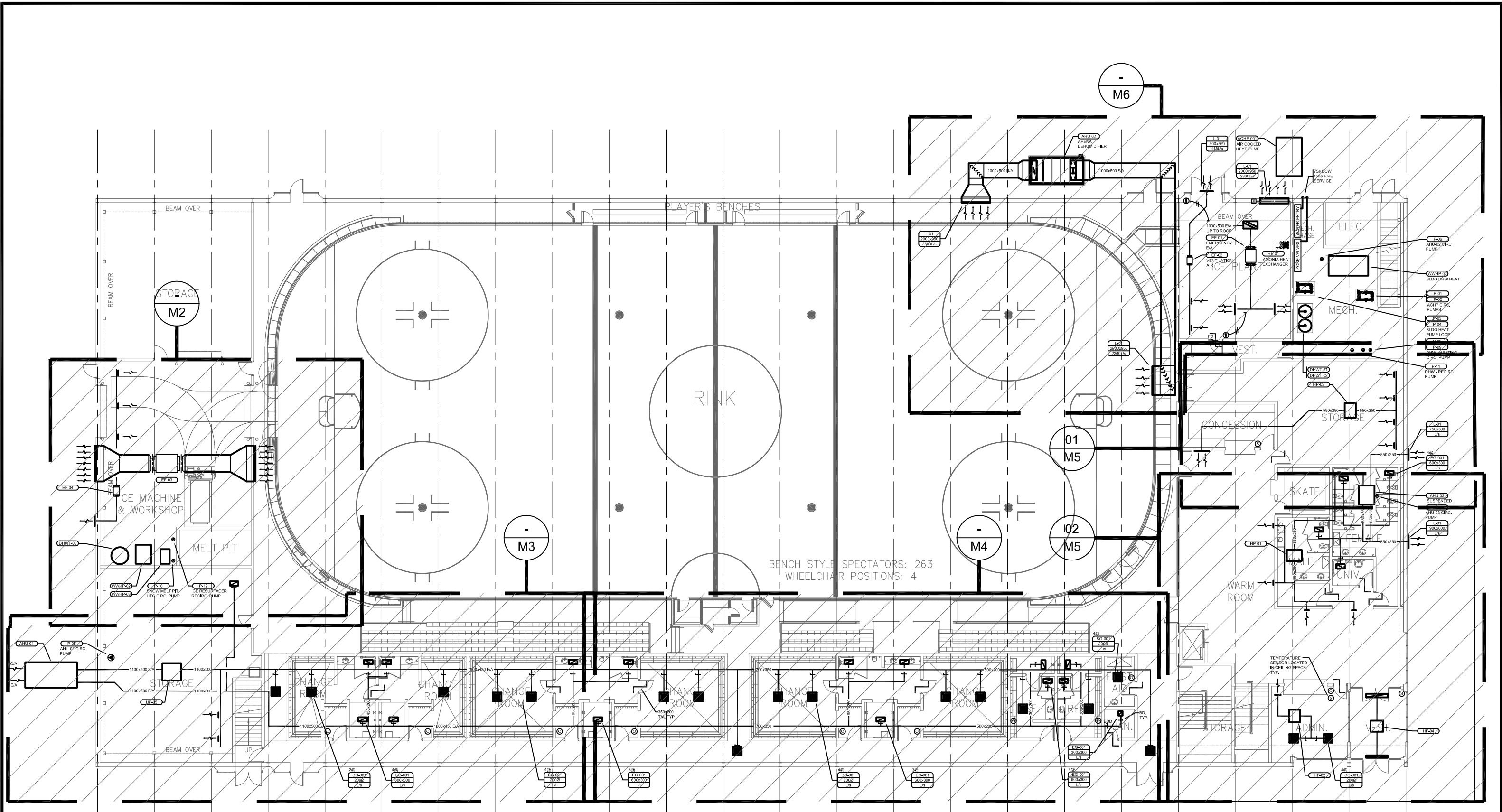
- .1 All major mechanical systems will be equipped with Direct Digital Control (DDC) systems. This will include all equipment located in mechanical Rooms as well as the roof mounted systems. All devices installed into the facility will be completely BACnet compatible, i.e. thermostats, sensors, etc.
- .2 We also recommend, BACnet or some type of DDC interface control for the lighting and refrigeration plant system. This will allow the energy consumption to be monitored and controlled depending on the demand, i.e. if a light is not required in a particular space, then the main control system will turn it off. This load shedding system could significantly reduce the annual energy consumption of the building.
- .3 The refrigeration plant will have its separate software control sequence and will take 1<sup>st</sup> priority in building electrical demand. Large motors will not start when there is a demand for slab cooling. This strategy will reduce demand electrical charges within the facility.
- .4 The majority of the wall mounted space sensors will be installed for zone temperature control including internal occupancy sensors and / or CO2 sensors. Protective covers will be installed on the sensors within the non-supervised rooms.
- .5 Electrical room and mechanical room exhaust fans will be controlled by reverse acting thermostats.
- .6 Shower rooms and other applicable spaces will be equipped with humidity sensors in accordance with the ASHRAE 55 standard.
- .7 Change rooms will be equipped with motion detectors linked back to the Heat Recovery Ventilator units and the by-pass damper. When the rooms are unoccupied, dampers will be open and air will be re-circulated. The recirculation of the air will be used for pre-heating the rooms.
- .8 Heating pumps and air handling units, including natural ventilation supplemental exhaust fans, will be equipped with Variable Speed Drives.

END OF REPORT

**APPENDIX A – DRAWINGS**

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BENCH STYLE SPECTATORS: 263  
WHEELCHAIR POSITIONS: 4

# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - MAIN LEVEL

TOFINO, B.C.

SCALE: 1:250

2017-11



**AME Group**  
consulting mechanical engineers

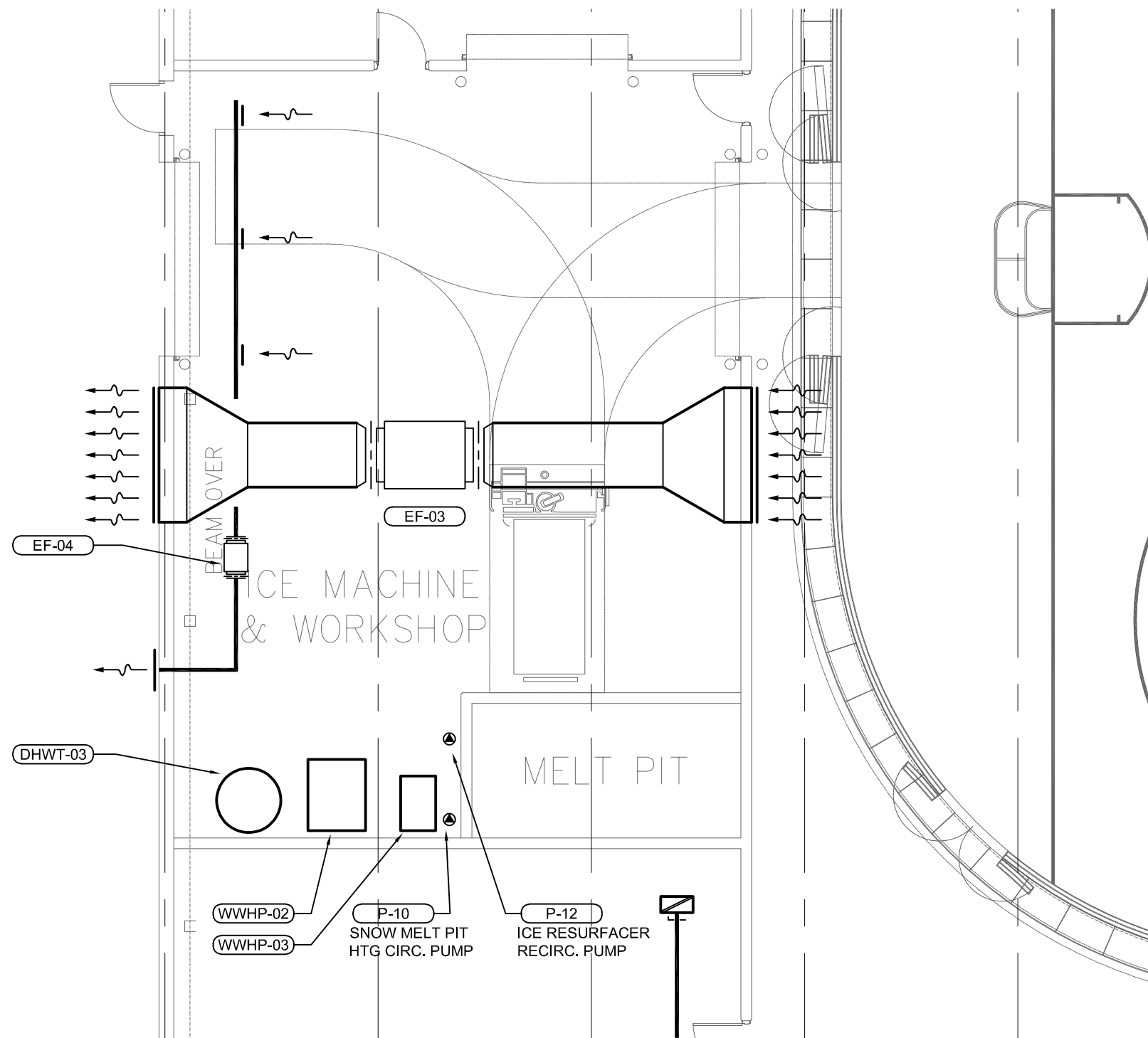
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**VDA | ARCHITECTURE  
LIMITED**

3388A Tennyson Ave. | Victoria, BC | V8Z 3P6  
T:250-477-4255 | mail@vda.ca | www.vda.ca

**M1**



**WEST COAST MULTI-PLEX - ARENA  
SPRUNG STRUCTURE - MAIN LEVEL**

TOFINO, B.C.

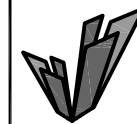
SCALE: 1:100

2017-11



**AME Group**  
consulting mechanical engineers

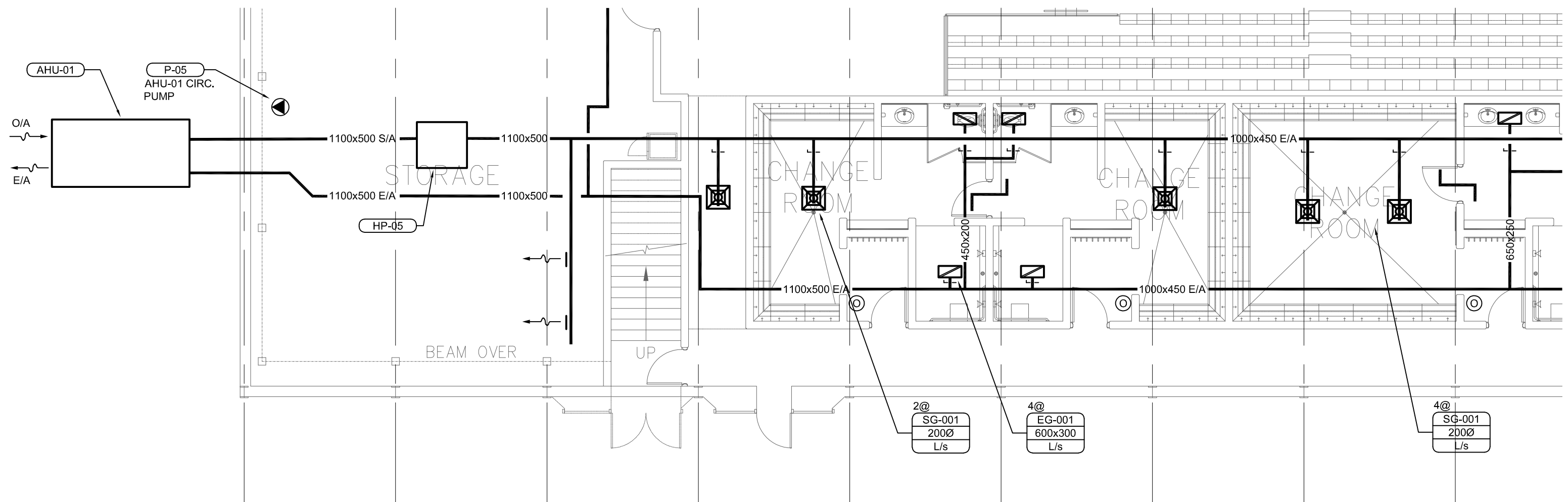
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**M2**



# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - MAIN LEVEL

TOFINO, B.C.

SCALE: 1:100

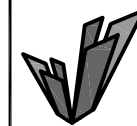
2017-11



**A M E Group**  
consulting mechanical engineers

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CONSULTANT

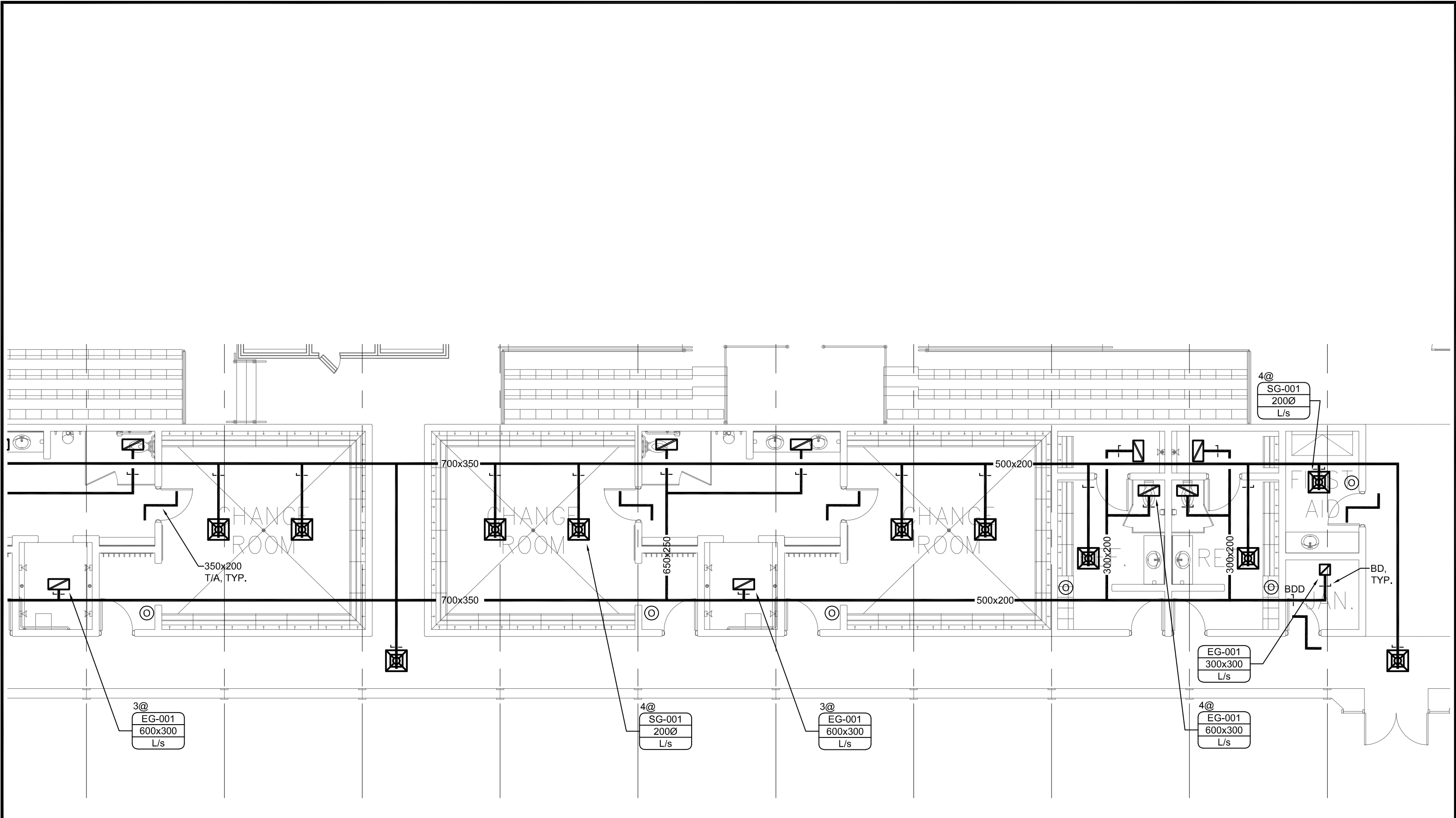


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LIMITED**

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# M3





**WEST COAST MULTI-PLEX - ARENA**  
**SPRUNG STRUCTURE - MAIN LEVEL**  
 TOFINO, B.C.                      SCALE: 1:100                      2017-11



**AME Group**  
 consulting mechanical engineers

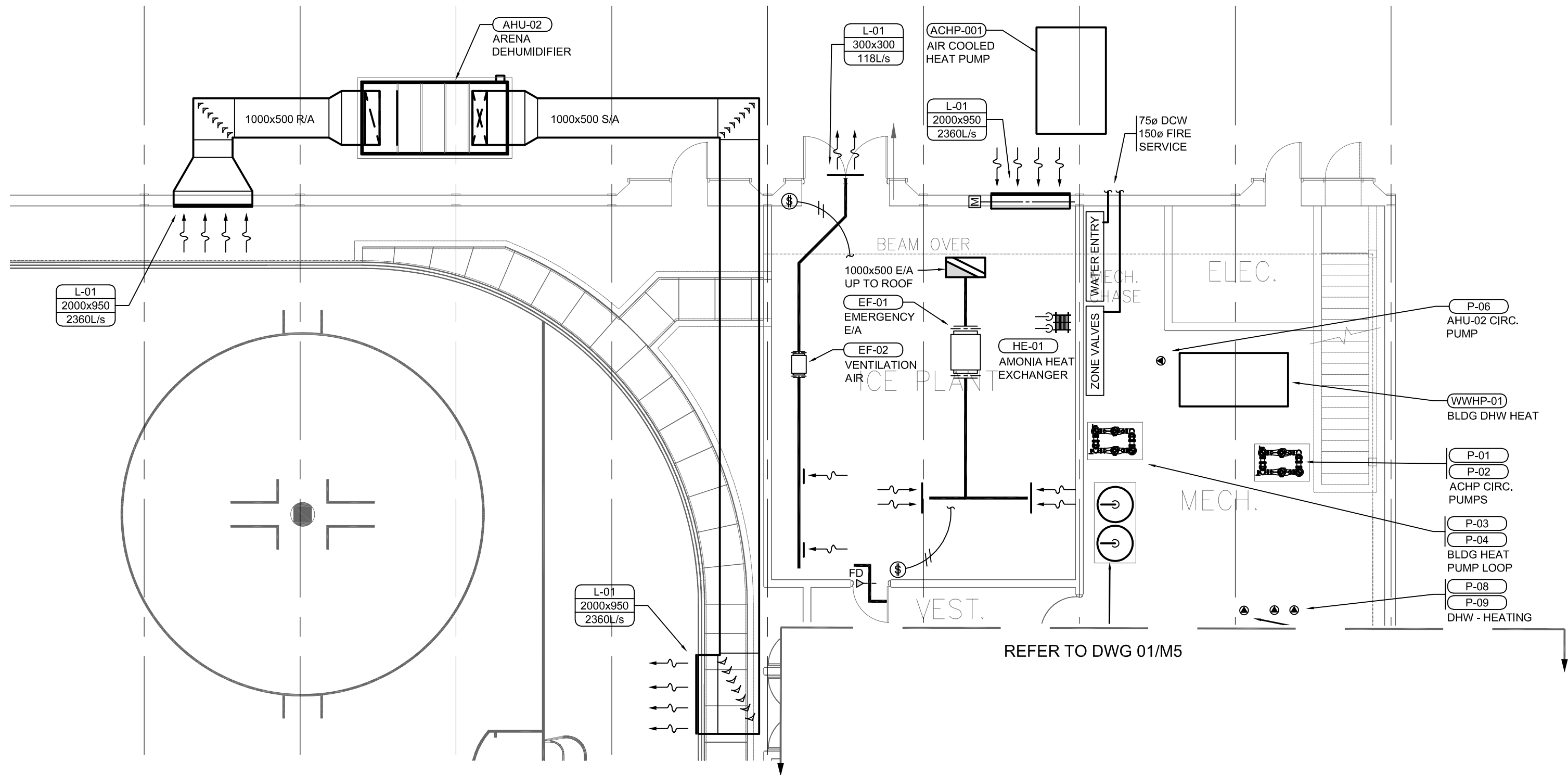
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CONSULTANT

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 T:250-477-4255 | mail@vda.ca | www.vda.ca

**M4**





# WEST COAST MULTI-PLEX - ARENA SPRUNG STRUCTURE - MAIN LEVEL

TOFINO, B.C.

SCALE: 1:100

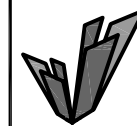
2017-11



**A M E Group**  
consulting mechanical engineers

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CONSULTANT



**VDA | ARCHITECTURE  
LIMITED**

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T:250-477-4255 | mail@vda.ca | www.vda.ca

# M6



## APPENDIX B – EQUIPMENT

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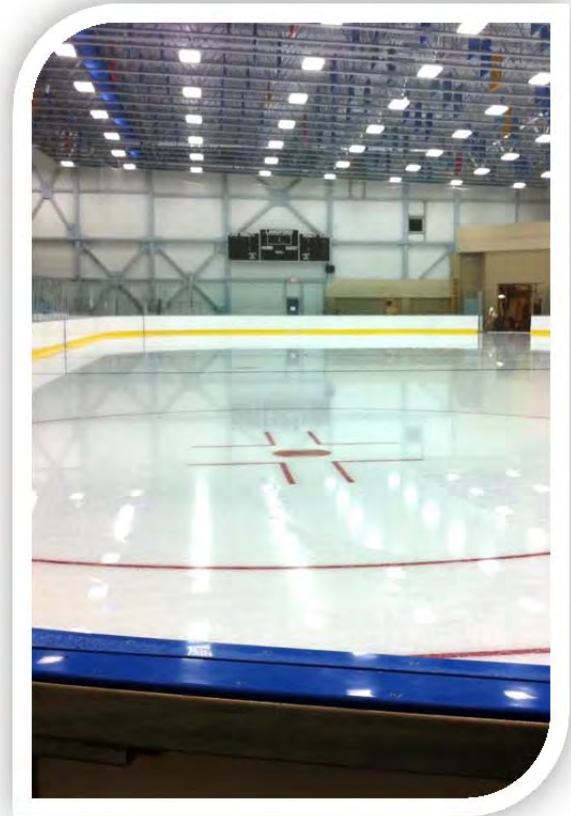
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## APPENDIX D – REFRIGERATION REPORT



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# **BRADLEY REFRIGERATION CONSULTANTS LIMITED**

**PO Box 91177**

**West Vancouver, B.C. V7T 1N6**

Tel: (604) 454-7476

Fax: (604) 925-2571

ericbradley@telus.net

**August 1, 2017**

**VDA ARCHITECTURE LIMITED**

**3388A Tennyson Avenue,**

**Victoria, BC,**

**V8Z 3P6**

**Attention: Mr. Vic Davies, MAIBC**

**Dear Sir,**

**Subject: West Coast Multiplex  
Refrigeration Design Schematic**

The refrigeration plant for the West Coast Multiplex Arena will be a central refrigeration system for the new arena. The primary refrigerant system will be low charge ammonia system using two compressors, a cooling tower, condenser, surge drum - receiver, and brine chiller. The secondary refrigerant side will be calcium chloride brine. The refrigeration plant will be controlled from a central computer system allowing for fully automatic operation and with the ability to manually override the controls.

The arena floor construction will use the latest techniques for building a super flat slab for the best ice quality.

Ammonia is the most commonly used refrigerant in skating and curling rinks in British Columbia. Over 95 percent of these facilities use ammonia as the refrigerant for the following reasons:

- Lowest first cost
- Efficiency of operation
- Lower maintenance costs
- Environmentally friendly – zero ozone depletion

**August 1, 2017**

**Subject: West Coast Multiplex  
Refrigeration Design Schematic**

The following is an outline of the ammonia refrigeration equipment.

- Two compressors
- Cooling tower
- Plate and frame condenser
- One surge drum-receiver
- One plate and frame brine chiller
- One Brine pump c/w variable speed drive
- Underfloor heating system using heat recovery
- Snowmelt heating system using heat recovery
- Hot water preheat system (desuperheater) using heat recovery
- Provision for a 100 percent heat reclaim system
- Independent computer control

Control of the ice surface temperature can be accomplished using several methods:

- Concrete slab sensor
- Brine return sensor
- Ice sensor
- Suction Pressure

All available methods of energy conservation will be included in the design. These include:

- Computer control
- Variable speed drive on the cooling tower fan
- Variable speed drive on the brine pump
- Floating head pressure.
- Oversized heat exchangers

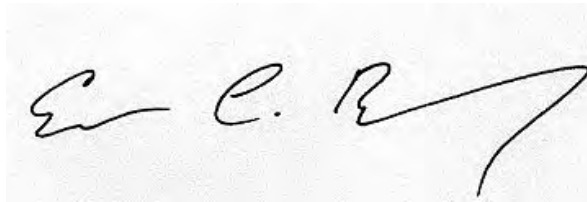
The refrigeration plant will be equipped with heat reclaim exchangers for underfloor heating, snow melting, and building preheating. The heat recovery exchangers (for 100 percent of the waste heat) will be integrated with the mechanical design and cost justified by the operation.

**August 1, 2017**

**Subject: West Coast Multiplex  
Refrigeration Design Schematic**

The refrigeration plant will have a capacity 120 tons of refrigeration at 10 °F, saturated suction temperature and 85 °F saturated discharge temperature, 68 °F wet bulb temperature.

Yours Truly,

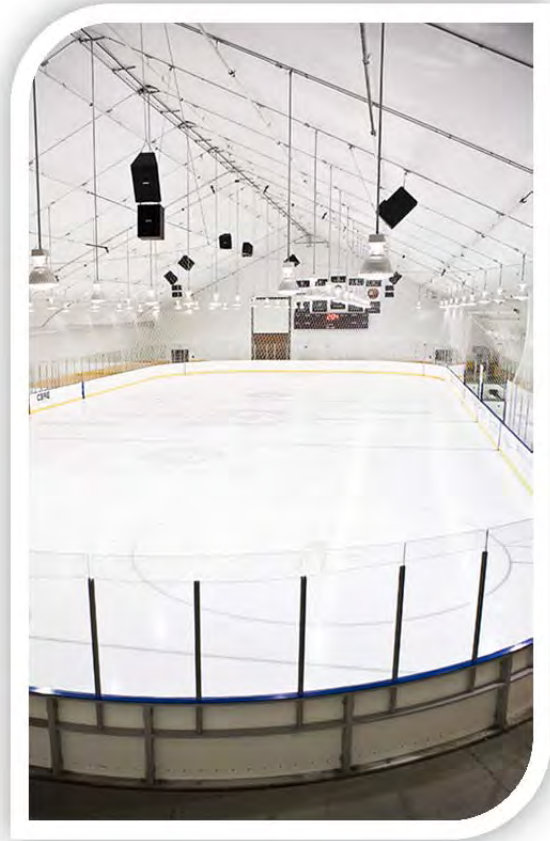
A handwritten signature in black ink, appearing to read "Eric C. Bradley". The signature is fluid and cursive, with a long, sweeping tail on the final letter.

Eric C. Bradley, P. Eng.



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## APPENDIX E – ELECTRICAL REPORT



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Designing A Better Tomorrow

## Schematic Design Report For Westcoast Multiplex

PREPARED FOR:  
**VDA Architecture Ltd**  
3388 Tennyson Ave  
Victoria, BC, V8Z 3P6

AUTHORED BY:  
**Roger Dupuis, P.Eng., LEED AP**

PEER REVIEWED BY:  
**Jay Singh**

SUBMITTED BY:  
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[www.AESEngr.com](http://www.AESEngr.com)

PROJECT NO. 1-17-105  
August 2, 2017



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## 1.0 INTRODUCTION

AES Engineering were retained VDA Architects Ltd as Lead Electrical Engineers for the proposed new Westcoast Multiplex facility located in Tofino, BC.

This report provides electrical technical information for lighting, power distribution, communications infrastructure and sites service, and is meant to provide sufficient information for the preparation of a class C estimate by the Quantity Surveyor. In addition to this report, basic electrical plans are provided showing options for power distribution and basic initial systems layouts.

The building is not considered post-disaster but is of high importance and may be used in the event of a disaster if the building is in a safe to occupy state.

## 2.0 DESIGN CRITERIA

The electrical systems will be designed in accordance and in keeping with the intent of all applicable codes, ordinances, standards and regulations. The following is a list of the applicable codes and regulations that apply to this facility.

### 2.1 APPLICABLE CODES & REGULATIONS

- British Columbia Building Code 2012 (BCBC)
- Local Municipal Codes and Standards
- National Energy Code for Buildings (NECB)
- Provincial Fire Marshall Regulations
- Workers' Compensation Board (WCB) Regulations
- Fire Marshall Act
- Applicable NFPA Regulations
- Canadian Electrical Code 2015 (CEC)
- CSA Standards
- ULC Standards
- IES (Illuminating Engineering Society) Standards

### 2.2 ENERGY EFFICIENCY

NECB provides requirements for power density limits for lighting in buildings in Canada, which have been adopted as part of the BC Building Code. Our design will adhere to this requirement.



## 2.3 DESIGN PARAMETERS

The design parameters shall be as follows:

- The power system shall be designed to address all current future power needs (future aquatics) of the facility, with minimum 25% spare capacity.
- IES standards will be utilized in the design of lighting.

## 3.0 SITE SERVICES

### 3.1 BC HYDRO SERVICE

The main service entering the site will consist of a BC Hydro 25kV primary voltage service originating from a service pole dip from the adjacent street on the south of the proposed facility. The primary voltage service will carry to a new BC Hydro pad mounted transformer located inside the property as indicated on drawing E100.

For the primary service, three 78mm PVC ducts will run from the property line to the new pad mounted transformer and three 103mm PVC ducts will run from the transformer to the main electrical room.

Both primary and secondary service ducts will be embedded in sand and buried at a minimum depth of 900mm below grade.

### 3.2 TELUS AND SHAW CABLE SERVICES

Two 103mm Telus and one 103mm Shaw Cable PVC ducts will run from the property line to the communications room on the basement level. These ducts will terminate on a 19mm thick good-1-side (G1S) plywood backboard painted with white fire retardant paint.

### 3.3 CASH ALLOWANCES

Cash allowances for BC Hydro, Telus and Shaw Cable services to the site are approximately as follows:

1. BC Hydro	\$60,000
2. Telus	\$7,500
3. Shaw Cable	\$5,000
4. Public Address and Sound System	\$100,000



## 4.0 MAIN BUILDING POWER DISTRIBUTION

### 4.1 MAIN ELECTRICAL SERVICE

For the main secondary electrical service, we have provided two options which are indicated on plans. These options are as follows:

#### Option 1

The main electrical service in option 1 is rated 800 amps, 347/600 volts, 3-phase, 4-wire. The main distribution board will consist of a BC Hydro pulling section, an 800 amp main breaker and CT section and two secondary breaker sections with the provision for adding a future third secondary voltage breaker section. The following secondary breakers are anticipated for the main distribution board:

- 200A-3P for a heat pump
- 300A-3P for the ice plant motor control centre
- 150A-3P for the mechanical systems motor control centre and the transformer feeding the 120/208V mechanical equipment panelboard 'M'.
- 200A-3P feeding a 150kVA transformer which feeds a 600A 120/208V CDP panel 'SDA'
- A 90A-3P feeding a transformer and 120/208V panel 'F'
- A 175A-3P feeding the emergency generator auto-transfer switch and power distribution.

In addition, the main distribution will have two spaces for future 200A-3P breakers.

#### Option 2

The main electrical service in option 1 is rated 1200 amps, 347/600 volts, 3-phase, 4-wire. The main distribution board will consist of a BC Hydro pulling section, an 1200 amp main breaker and CT section and two secondary breaker sections with the provision for adding a future third secondary voltage breaker section. The following secondary breakers are anticipated for the main distribution board:

- 200A-3P for a heat pump
- 300A-3P for the ice plant motor control centre
- 150A-3P for the mechanical systems motor control centre and the transformer feeding the 120/208V mechanical equipment panelboard 'M'.
- 200A-3P feeding a 150kVA transformer which feeds a 600A 120/208V CDP panel 'SDA'

- A 90A-3P feeding a transformer and 120/208V panel 'F'
- A 400A-3P feeding the emergency generator auto-transfer switch and power distribution.

In addition, the main distribution will have two spaces for future 200A-3P breakers and two spaces for future 400A-3P breakers.

### Common for Both Options

To provide lower voltage to local circuits such as plugs, small equipment, lighting, and other small loads, step down dry type transformers are proposed. The four transformers proposed are the same for both options and are as follows:

- 45kVA, 600:120/208V for mechanical panel 'M'
- 150kVA, 600:120/208V for CDP panel 'SDA'
- 75kVA, 600:120/208V for panel 'F'
- 75kVA, 600:120/208V for emergency panel 'SED'

## 4.2 MOTOR CONTROLS

Mechanical equipment starters will be located in a central motor control centres in the main mechanical room, where practical. A 600 volt 3-phase and a 120/208 volt 3-phase motor control centre will be provided.

For the ice plant, the ice plant provider will supply and install their own motor control centre. The electrical contractor will supply 300amps of electrical power at 600V 3-phase.

## 4.3 EMERGENCY DIESEL GENERATOR

Two options have been provided for the emergency generator system. In both options, the generator will be located outdoor and will have a sub-base diesel fuel tank and a weatherproof sound attenuated enclosure.

### Option 1

This option provides emergency power for the ice rink facility only without considering a potential future aquatics centre to the building.

A 125kW 347/600 volt diesel fired emergency generator system will be provided for the facility. This unit will be equipped with a sub-base fuel tank providing 48-hours of run time at full load. The approximate fuel consumption for a 125kW generator at full load is 18 gallons per hour. This means a 48-hour tank will have an approximate volume of 436 gallons.



The generator will have a 150A main breaker feeding a main bus, a 150A emergency power breaker and a 100A breaker for connecting a resistive load bank to the generator for load testing.

In the main electrical room, there will be a 200A auto-transfer switch with double bypass switch for emergency power.

### **Option 2**

This option provides emergency power for the ice rink facility and the potential future aquatics centre to the building.

A 150kW 347/600 volt diesel fired emergency generator system will be provided for the facility. This unit will be equipped with a sub-base fuel tank providing 48-hours of run time at full load. The approximate fuel consumption for a 150kW generator at full load is 18 gallons per hour. This means a 48-hour tank will have an approximate volume of 523 gallons.

The generator will have a 200A main breaker feeding a main bus, a 200A emergency power breaker and a 125A breaker for connecting a resistive load bank to the generator for load testing.

In the main electrical room, there will be a 200A auto-transfer switch with double bypass switch for emergency power.

### **Common for Both Options**

Emergency loads will consist of life safety and critical equipment such as emergency lighting, fire alarm, public address, ventilation equipment, telephone and computer servers.

## **5.0 LIGHTING**

### **5.1 INTERIOR LIGHTING**

All interior lighting will be LED with circadian spectrum colour of 3000° Kelvin.

Lighting levels in the ice rink area will be maintained at 60 foot-candles as per IES illuminance recommendations. In addition, ice area lighting will be dimmable so that lighting levels may be slightly reduced to conserve lamp life.

In all other areas of the building, lighting will be LED.

## 5.2 EXTERIOR LIGHTING

The outdoor lighting shall fulfil all exterior illumination requirements at night, while creating a safe environment for pedestrian night traffic. Elimination of light pollution shall be an important aspect of the lighting design.

IES Standards shall be utilized in selection of the type of lighting as well as lighting levels recommended. All exterior lighting will be LED with a circadian colour of 3000° Kelvin, full cut-off and will be controlled by photocell and timer.

The following guidelines shall be utilized in the design of lighting:

- **Functionality:** The lighting system designed shall suit the task and shall create a safe environment.
- **Energy Efficiency:** Energy efficient technologically proven light sources will be utilized to conserve energy.
- **Aesthetics:** The lighting shall enhance the aesthetics of the building and area without compromising the safety.
- **Suitability to Environment:** The luminaires selected shall suit the environment, as well as resist the environmental pressures put on the system.

**Light Pollution:** The outdoor lighting system shall be designed to minimize light spillage to neighbouring areas, avoiding light pollution, and helping local nocturnal life to flourish. Up-lighting used for wall art on the building façade will be in-ground mounted and LED. These lights will be set on an astronomical clock so that it is turned OFF after midnight.

## 5.3 LIGHTING CONTROLS

All lighting shall be controlled manually and/or automatically to ensure energy savings.

The indoor lighting control system shall be flexible and shall allow multiple light levels be achieved in the most of the areas, enabling different uses be carried out in the same space, without wasting energy, and with light levels suitable for the tasks being carried out.

The indoor lighting control system shall consist of Low Voltage Lighting Control System, which can be operated manually or automatically via a programmable system. Small areas shall be fitted with line voltage switches and occupancy/vacancy sensors where required by NECB or ASHRAE.

Considering that daylighting is the most natural and healthy form of light that enhances the work environment, daylighting shall be utilized where it does not interfere with the functionality of space. Where daylighting is acceptable form of light, the artificial lighting system shall be integrated with daylighting to realize energy savings. Daylight sensors shall turn off the lights, when sufficient daylight is available.

To realize further energy savings, occupancy sensors shall be located to control the lighting automatically in intermittent use areas.



If ASHRAE is used in the design of the building, 50% of office receptacles will be automatically controlled using occupancy sensor technology. These receptacles will be clearly labeled for general use.

All outdoor lighting shall be controlled by photoelectric cells, and timers

## 6.0 LIFE SAFETY SYSTEMS

### 6.1 GENERAL

The life safety systems for the facility shall be in accordance with all applicable codes, and ULC standards as a minimum, and shall ensure quick detection, and proper notification and safe evacuation of all occupants from the facility expeditiously at all times. The electrical life safety shall consist of the following:

- ◆ Fire alarm System: Ensuring quick detection, and occupant notification of a fire condition.
- ◆ Exit Lighting: Ensuring all egress routes are properly indicated at all times.

Emergency Lighting System: Ensuring that all egress routes are sufficiently illuminated in the event of an emergency condition, even when utility power supply is interrupted

### 6.2 FIRE ALARM SYSTEM

The fire alarm system will be a 2-stage addressable, fully supervised microprocessor-based system, utilizing digital techniques for data control, and digital/multiplexing techniques for data transmission. The system will be complete with provision for remote monitoring by the existing remote monitoring stations.

The main central control unit (CCU) panel will be located in the main electrical room, which will be conveniently located within the building. A remote annunciator will be installed at the main (firefighters) entry location on the main floor level.

Manual stations, automatic activating fire detectors, sprinkler system flow alarm switches, and supervisory devices shall be located and installed in accordance with Current Building Code Regulations.

Gongs are to be installed in corridors and common areas to provide full audible coverage for the building.

Visual strobe devices to be installed where required in noisy areas.

Complete fire alarm system installation shall be in accordance with CAN/ULC-S524 Standard for the installation of fire alarm systems.

The system shall be verified as per ULC standards.

### 6.3 EMERGENCY AND EXIT LIGHTING

The emergency lighting system will consist of select normal building lighting fixtures connected to emergency power, strategically located to provide illumination levels in accordance with current Building Code requirements.

Exit lighting system is to consist of self-powered 120V/6VDC LED type exit signs installed in accordance with current Building Code requirements. All exit lighting will be green pictogram style.

### 7.0 WIRING METHOD

All wiring for the facility will be copper with the exception of feeders larger than 100 amps for normal power distribution. Feeders for emergency power will be copper.

In the ice rink area, all wiring will be installed in conduit.

In warm dry environment, EMT and AC90 drops to fixtures will be permitted.

### 8.0 ELECTRIC HAND DRYERS

Electric hand dryer will be provided in change rooms and washrooms. Hand dryers proposed are the Dyson Airblade.

### 9.0 DATA/VOICE STRUCTURED WIRING SYSTEM

The Data/Communications system will include Category 6A modular RJ45 wall jacks, each with Category 6A UTP four pair cable runs to Category 6A horizontal field patch panels located in telecommunications rooms on respective floor levels. All horizontal cable links will be tested to Category 6A standards. Flexibility, cost, ease of future revisions, protection of cables, codes, and architecture will be considered in making the final decisions. Individual fiber optic riser cables will be installed from riser field patch panels in each telecommunications room, to the main communications room in the basement. Cross-connects between main incoming data/communications fiber optic service cable termination point and riser cabling patch panels, including electronic switching equipment, will be by owner's forces. In addition, wireless access points will be provided throughout the building which will consist of data jack and 120Volt power, preferably in hidden accessible ceiling space.

Cross-connects between the riser cabling patch panel field and UTP four pair horizontal patch panel field in telecommunications rooms on respective floor levels, including electronic switching equipment, will be by owner's forces.

At each work desk computer station, a minimum of two data jacks will be provided for computer and telephone connection. Printers, copiers, scanning equipment and point of sales will also be provided with data outlet jacks.



Throughout the facility, wireless access points will be provided consisting of a Cat6A outlet jack. It is assumed that wireless routers will be power over ethernet.

For all information TV locations, two CAT6A outlets wired to the building communication system patch panels will be provided. This will provide the ability to convert from two-port data jack to HDMI using an appropriate BALUN if required.

Data and communication wiring will be rated FT4 unless installed in a plenum where it will be rated FT6.

## 10.0 SECURITY SYSTEM

### 10.1 CCTV SYSTEM

Provision for security cameras will be provided including raceways, cabling, outlets and power sources. CCTV cameras are anticipated in the lobby area and building exterior.

Wireless access ports to be installed complete with provision for power connection and Category 6 cables run to respective Telecommunications Room.

### 10.2 ACCESS CONTROLS

A card and FOB reader security access system will be provided to allow controlled access to the facility by staff. This requirement will be further developed as the building design progresses.

## 11.0 PUBLIC ADDRESS AND SOUND SYSTEM

The building will be provided with a public address and sound system consisting of a distributed speaker system, microphones at the main reception, amplifiers, music docking station at the main reception, CD player and other background music devices requested by the owner.

The system will be connected to the fire alarm system and will momentarily silence the fire alarm audible signal if a safety announcement is made. Upon release of the microphone, the fire alarm system will immediately resume its audible signal.



All conduit systems for the public address and sound system will be in the electrical contract. The following will be included in the contract:

- Music for leisure use.
- PA for announcements.
- Sound system conduit in Base Contract.
- Equipment and wiring proposed as a Cash Allowance.
- Sound system will be delivered as a design/building contract

## 12.0 AUDIO-VISUAL SYSTEM

Audio-visual equipment and systems will be provided in multi-purpose spaces and the administration boardroom. AV systems will be further discussed with the owner as the design progresses. For the purposes of costing, the cost consultant shall assume ceiling mounted overhead projectors or short-throw ceiling projects will be specified. From each projector, multiple cables will run to a computer plug-in point in front of the space and from the front of the space to the meeting tables where table locations are stationary.

## 13.0 MECHANICAL EQUIPMENT AND OTHER CONNECTIONS

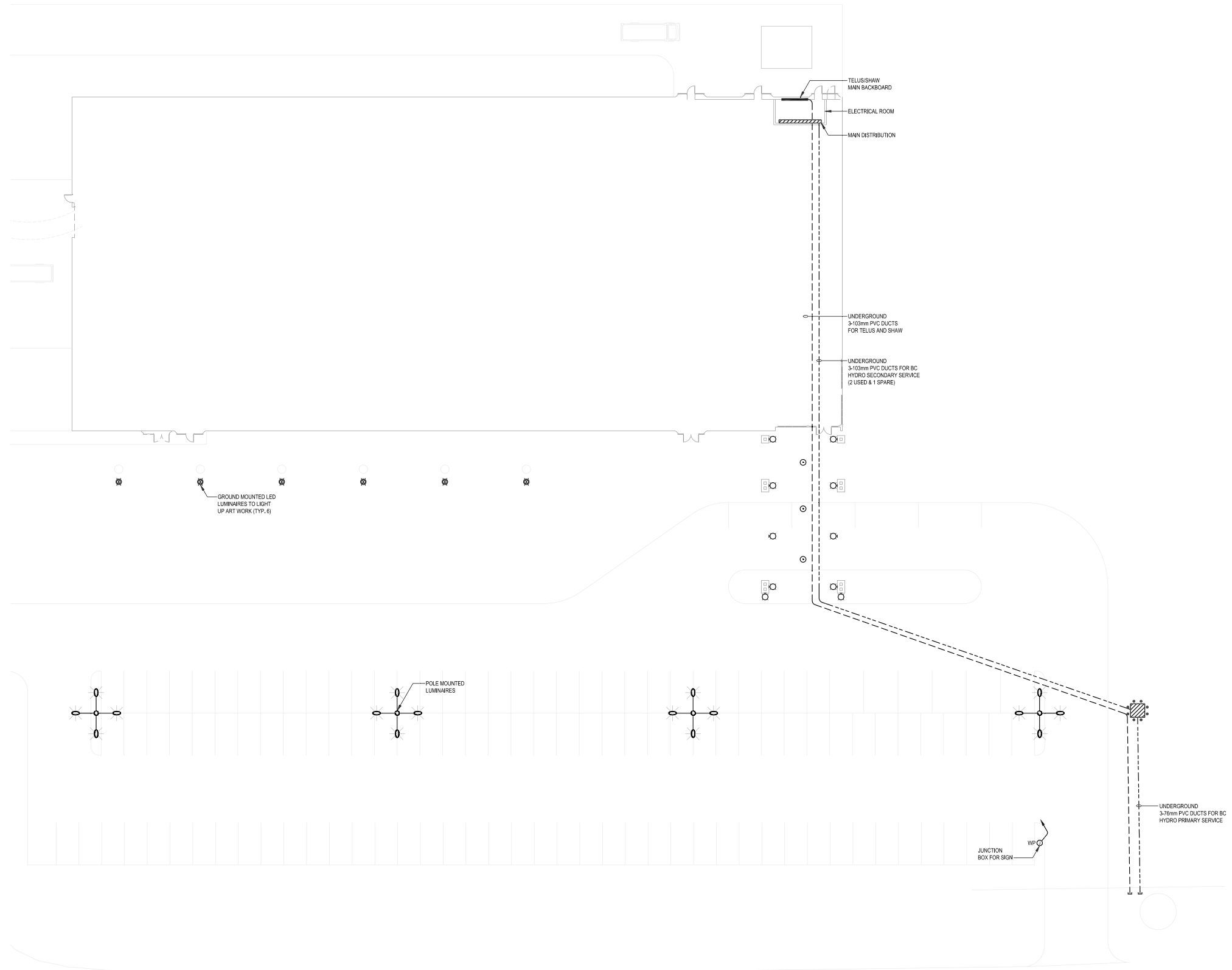
Power shall be supplied to mechanical equipment from Motor Control Centres (MCC) located in mechanical rooms. The starters shall be magnetic starters, with terminal strips in each starter cubicle.

## 14.0 SEISMIC RESTRAINT

All electrical systems will be provided with seismic restraints designed in accordance with the applicable codes and regulations for the Tofino area specified earthquake loads.

**END OF REPORT**





LEGEND OF SYMBOLS	
	WALL MOUNTED LUMINAIRE
	SURFACE MOUNTED LUMINAIRE
	STRIP LIGHT
	PENDANT LUMINAIRE
	INGROUND UPLIGHT
	POLE MOUNTED LUMINAIRE
	DUPLEX RECEPTACLE
	5-20R DUPLEX RECEPTACLE (T-SLOT)
	ABOVE COUNTER 5-20R DUPLEX RECEPTACLE (T-SLOT)
	ABOVE COUNTER GROUND FAULT CIRCUIT INTERRUPTER DUPLEX RECEPTACLE (GFCI)
	COMBINATION TELEPHONE AND DATA OUTLET
	FIRE ALARM PULL STATION
	FIRE ALARM BELL WITH STROBE
	EXIT SIGN - DIRECTION AS INDICATED ON PLANS
	FIRE ALARM ANNUNCIATOR
	FIRE ALARM PULL STATION
	PANEL BOARD

1 SITE PLAN  
E100

AES Engineering Ltd.  
300 - 1815 Blanshard St.  
Victoria, BC V8T 5A4  
info@aesengr.com  
250.381.6121

**AES**  
Designing A Better Tomorrow  
CALGARY | EDMONTON  
VANCOUVER | VICTORIA

No.	DD/MM/YY	Description
1	02/08/17	REVIEW

REVISIONS

No.	DD/MM/YY	Issued for (I.F.)
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ISSUES

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3388A Tennyson Ave | Victoria, BC | V8Z 3P6  
T: 250-477-4255 | mail@vda.ca | www.vda.ca

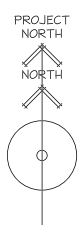
Project  
**WESTCOAST MULTIPLEX  
TOFINO, BC**

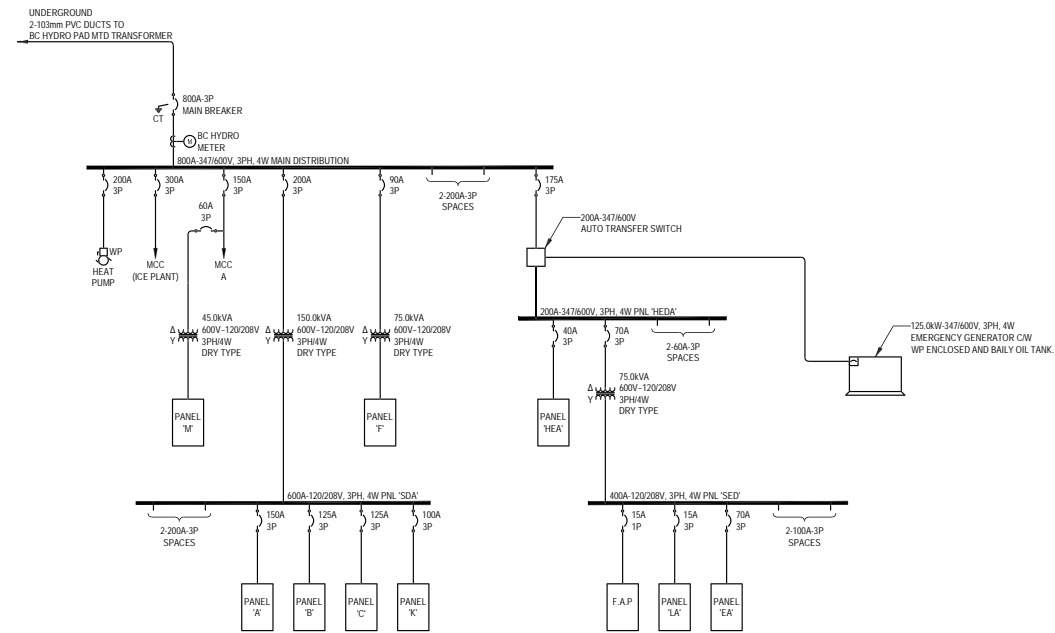
Drawing  
**SITE PLAN  
AND LEGEND**

Scale: AS NOTED Job No. 1-17-105

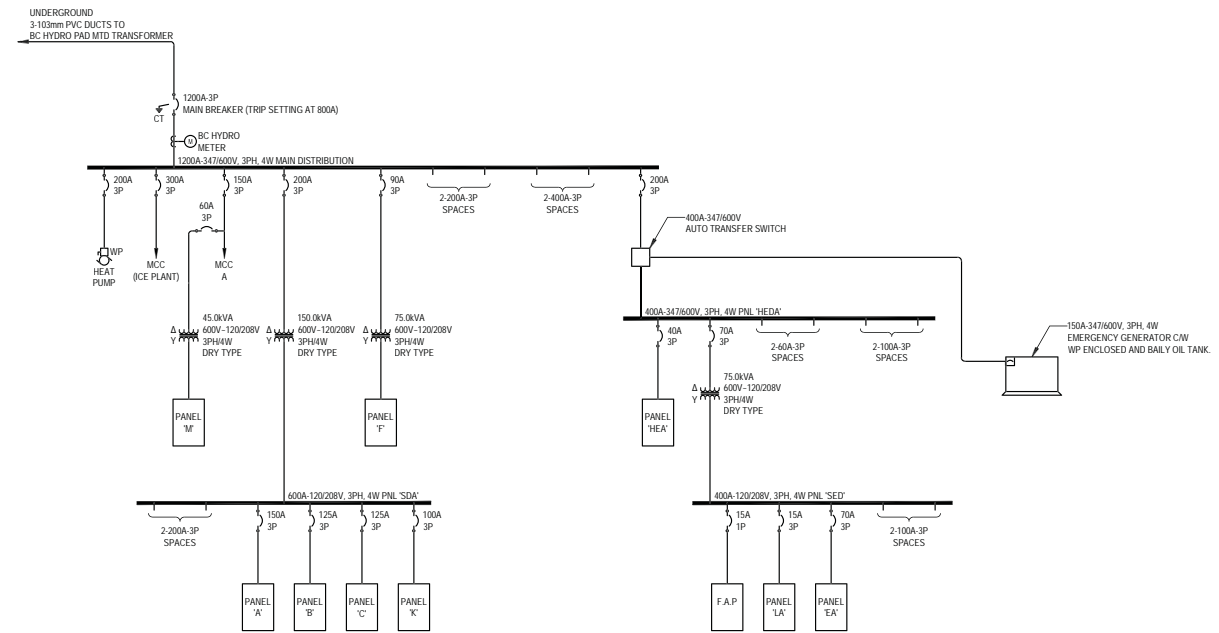
Date: JULY 2017 Dwg. No. Rev. REV

Drawn By: JS/LG E100

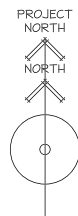




1 SINGLE LINE OPTION 1  
E101 NOT TO SCALE



1 SINGLE LINE OPTION 2  
E101 NOT TO SCALE



No.	DD/MM/YY	Description
1	02/08/17	REVIEW

No.	DD/MM/YY	Issued for (LF.)
ISSUES		

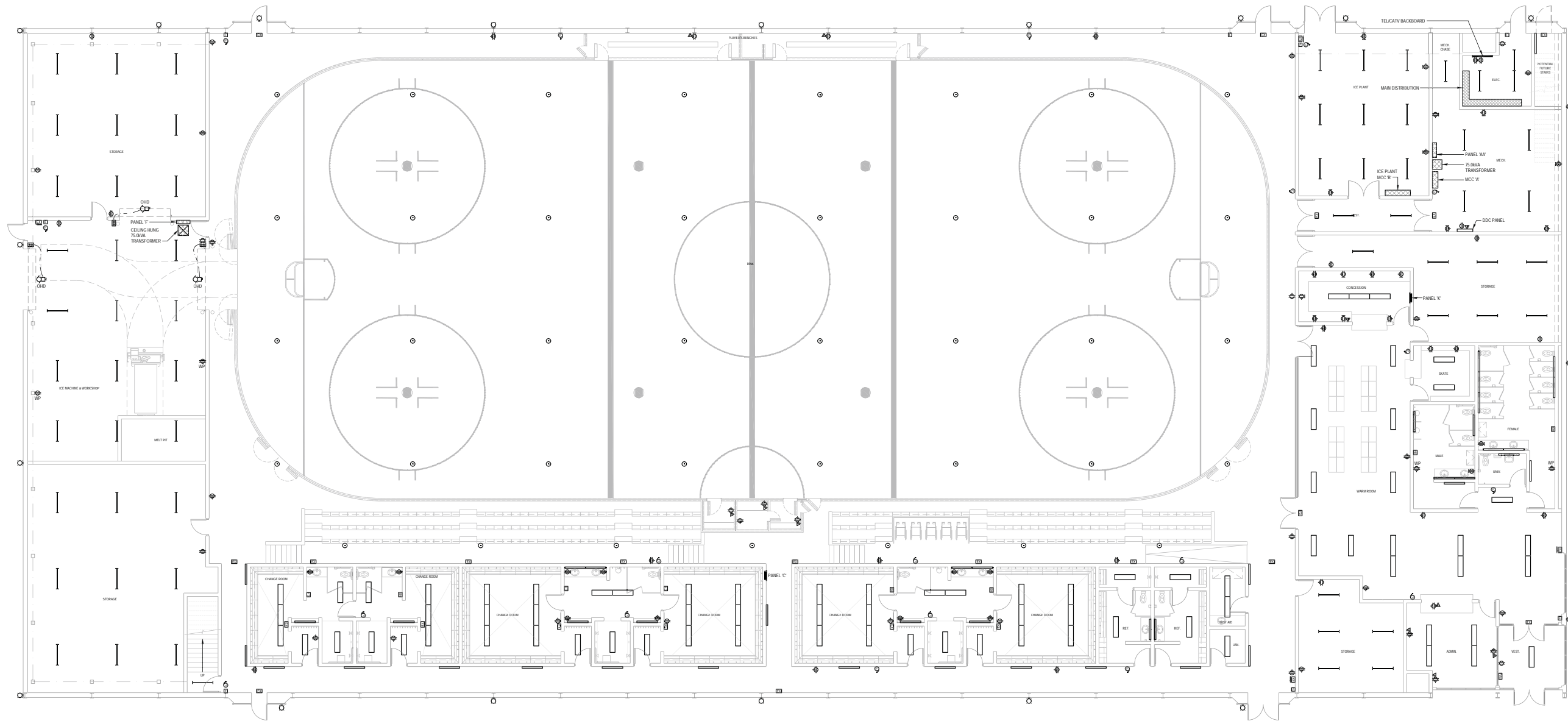
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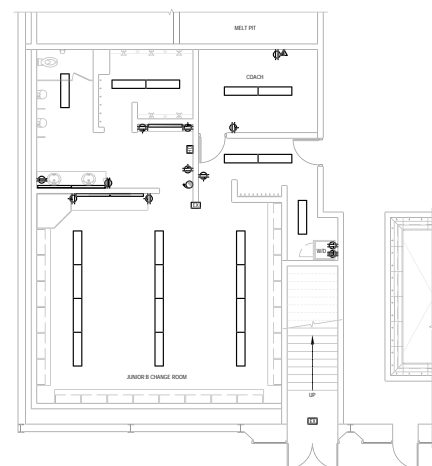
Project  
**WESTCOAST MULTIPLEX TOFINO, BC**

Drawing  
**SINGLE LINE DIAGRAM OPTIONS**

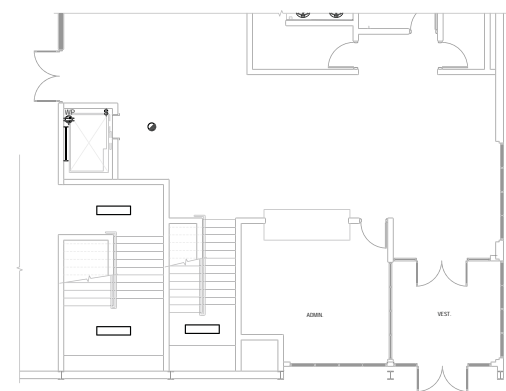
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Date: JULY 2017	Dwg. No. REV
Drawn By: JS/LG	E101



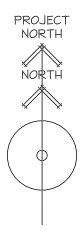
1 MAIN ELECTRICAL LAYOUT  
E200 1:125



2 PARTIAL FUTURE ELECTRICAL LAYOUT  
E200 1:125



3 PARTIAL FUTURE ELECTRICAL LAYOUT  
E200 1:125



No.	DD/MM/YY	Description
1	02/08/17	REVIEW

REVISIONS

No.	DD/MM/YY	Issued for (I.F.)
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ISSUES

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Project  
**WESTCOAST MULTIPLEX TOFINO, BC**

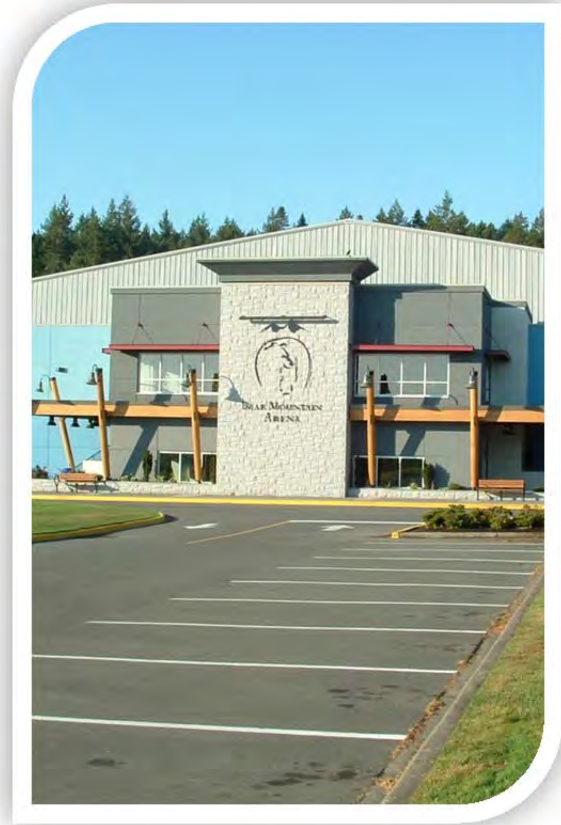
Drawing  
**ELECTRICAL LAYOUT**

Scale: AS NOTED Job No. 1-17-105

Date: JULY 2017 Dwg. No. Rev. REV

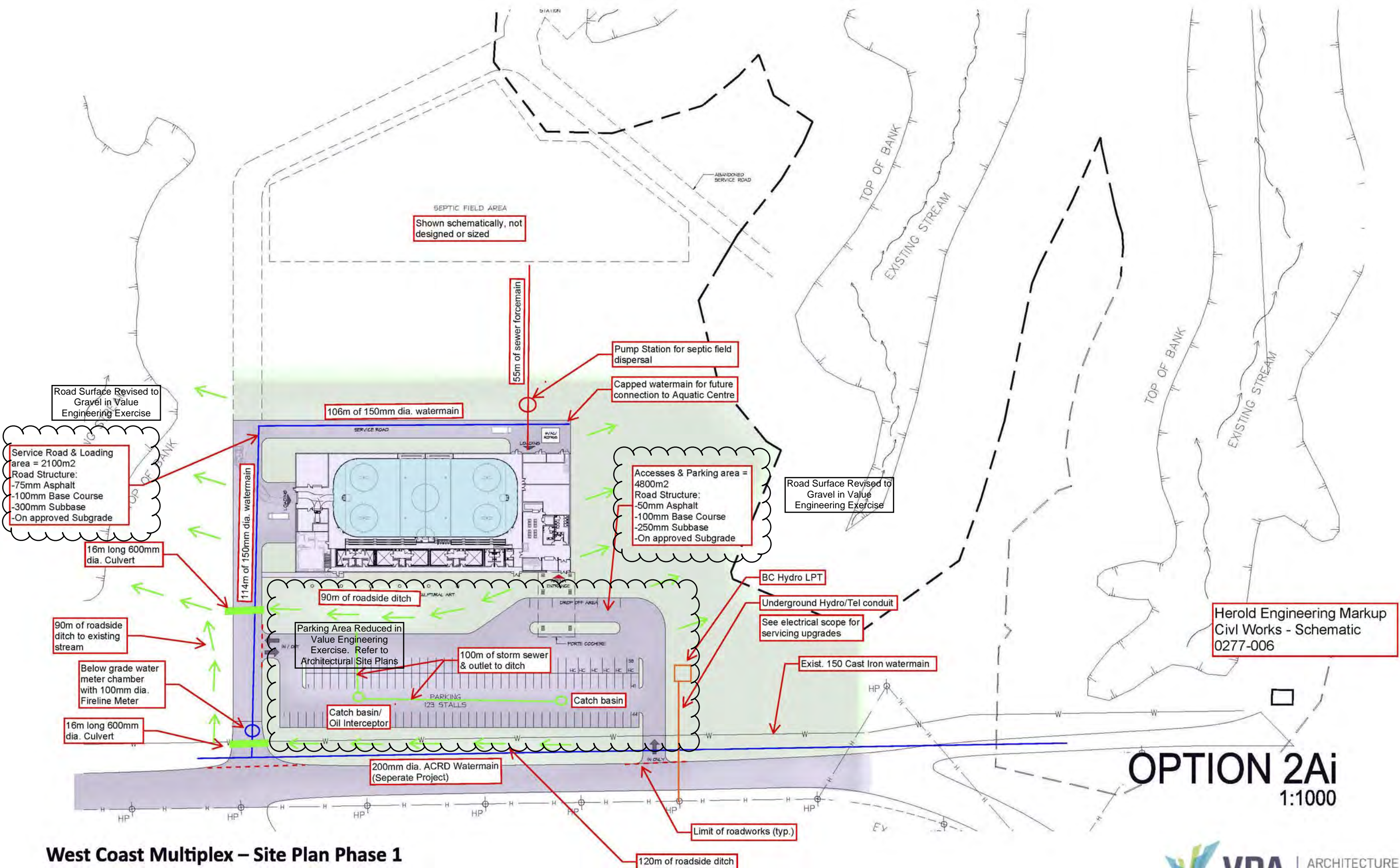
Drawn By: JS/LG **E200**

## APPENDIX F – CIVIL REPORT





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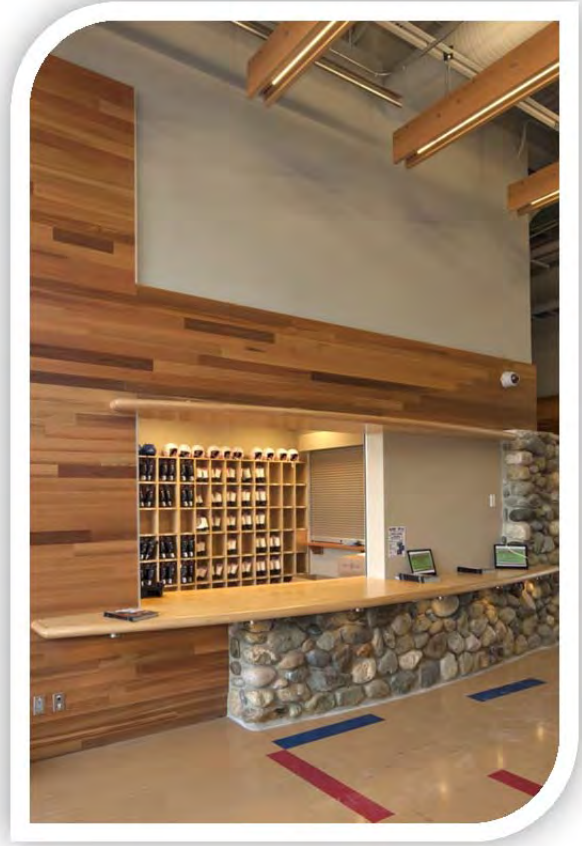


**West Coast Multiplex – Site Plan Phase 1**

July 21, 2017



## APPENDIX G – COST REPORT SUMMARY



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**COST MANAGEMENT REPORT**

*West Coast Multiplex  
Schematic Design Estimate*

REPORT NUMBER 3.0

SEPTEMBER 19, 2017

PREPARED FOR:

*VDA Architecture*

2288 Manitoba St., Vancouver, BC, V5Y 4B5  
T 604 734 3126

**BTY.COM**

*People to count on.  
Knowledge to build with.*



## 1.0 Introduction

### 1.1 Instructions Received

This report has been prepared by BTY Group (“BTY”) at the request of VDA Architecture (the “Client”).

VDA Architecture has appointed BTY to provide a Schematic Design estimate developed for the project at Tofino Airport, Tofino, B.C. (the “Project”). The Project delivery model is yet to be determined, therefore, BTY strongly recommends that estimates are prepared at each of the key design milestones.

Information related to the Project for the purposes of this report was received by BTY on August 10, 2017. Please refer to Section 14.0 for a list of information received in producing this report.

### 1.2 Report Reliance

This report has been prepared in accordance with the scope of our Fee Proposal, dated March 20, 2017 and is subject to the terms of that appointment. This report is for the sole and confidential use and reliance of the Client. BTY Group, Directors, staff or agents do not make any representation or warranty as to the factual accuracy of the information provided to us on behalf of the Client or other third-party consultants or agents. BTY Group will not be liable for the result of any information not received which, if produced, could have materially changed the opinions or conclusions stated in this report. This report shall not be reproduced or distributed to any party without the express permission of BTY Group.

Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the report as a whole. The contents do not provide legal, insurance or tax advice or opinion. Opinions in this report do not advocate for any party and if called upon to give oral or written testimony it will be given on the same assumption.

### 1.3 Contacts

Should you have any queries regarding the content of this report, please do not hesitate to contact either of the following:

**Willie Yeung**  
Senior Cost Consultant  
Tel: 604-734-3126  
Email: willieyeung@bty.com

**Eldon Lau**  
Partner  
Tel: 604-734-3126  
Email: eldonlau@bty.com



## 2.0 *Executive Summary*

### 2.1 **Report Purpose**

The purpose of this report is to provide a realistic estimate of the Project cost based on the information available at the time of writing.

The opinion expressed in this report has been prepared without the benefit of detailed architectural, structural, mechanical and electrical drawings and should, therefore, be considered a Schematic Design (Class C) estimate. Based on the documents reviewed, our estimate should be correct within a range of approximately +/- 15% to 20%.

In order to provide an accurate cost estimate for the Project, BTY Group strongly recommends that a professional Quantity Surveying organization, such as BTY Group, be retained to provide a detailed analysis of any design information produced on behalf of the Client during the remaining stages of design.

### 2.2 **Project Background and Description**

The proposed development is a multiphase project to construct a multifunction recreation complex in Tofino on the west coast of Vancouver Island. The construction will be separated into the following three phases:

- Phase 1 – Ice Hockey Arena
- Phase 2 – Aquatic Centre
- Phase 3 – Recreation Centre

This report is to provide construction cost estimate for Phase 1 only. Cost estimate for the following two options will be provided for consideration:

- Sprung Structure
- Pre-Engineering Structure



### 3.0 Development Cost Summary

The current estimated cost of the project may be summarized as follows:

	Item	Sprung Structure	Pre-Engineering Structure
		\$	\$
A.	Land Cost (Excluded)	0	0
B.	Construction	14,978,700	15,426,100
C.	Allowances	1,497,900	1,542,600
D.	Professional Fees	0	0
E.	Municipal & Connection Fees	0	0
F.	Management & Overhead	0	0
G.	Project Contingency	0	0
H.	Furnishings, Fittings & Equipment	0	0
I.	Financing Costs	0	0
J.	Tax	0	0
	<b>Sub-Total Project Cost</b>	<b>\$ 16,476,600</b>	<b>\$ 16,968,700</b>
K.	Escalation (Excluded)	0	0
	<b>Total Project Cost (August 2017 Dollars)</b>	<b>\$ 16,476,600</b>	<b>\$ 16,968,700</b>

Please note that, where zero dollar values are stated, BTY has excluded these costs and the values should be carried in a separate budget (if applicable).

### 4.0 Basis & Assumptions

The construction estimate is based on the following list of assumptions:

1. Foundation mat 750mm thick will be provided under the building;
2. Unsuitable material average 950mm thick to be removed and backfill with structural fill to other site areas;
3. 16mm plywood sheathing with TJI to mezzanine floor;
4. Concrete block walls to all interior partitions;
5. Refer to Appendix III & IV cost plan for other assumptions.

Please note that BTY is not qualified to act as design consultant. The assumptions in our estimate should be reviewed and corrected by the design team.





## 5.0 Exclusions

The construction estimate includes all direct and indirect construction costs derived from the drawings and other information provided by the Consultants, with the exception of the following:

1. Land costs;
2. Professional fees and disbursements;
3. Planning, administrative and financing costs;
4. Legal fees and agreement costs / conditions;
5. Building permits and development cost charges;
6. Temporary facilities for user groups during construction;
7. Removal of hazardous materials from existing site and building;
8. Loose furnishings and equipment;
9. Unforeseen ground conditions and associated extras;
10. Environmental remediation outside building footprint;
11. Off-site works;
12. Phasing of the works and accelerated schedule;
13. Decanting & moving;
14. Costs associated with "LEED" certification;
15. Project commissioning to be carried out by an independent consultant;
16. Erratic market conditions, such as lack of bidders, proprietary specifications;
17. Cost escalation past August 2017.



## 6.0 Construction Cost Summary

The estimated construction cost of the project may be summarized as follows:

Description	Sprung Structure	Pre-Engineering Structure
	\$	\$
Structural	1,190,000	1,284,600
Architectural	4,140,000	4,429,700
Mechanical	3,804,000	3,842,600
Electrical	1,449,000	1,487,400
General Requirements & Fees	1,587,500	1,656,600
<b>Net Building Cost</b>	<b>\$12,170,500</b>	<b>\$12,700,900</b>
Site Work	2,441,900	2,369,700
Ancillary Work	0	0
General Requirements & Fees	366,300	355,500
<b>Net Construction Cost</b>	<b>\$14,978,700</b>	<b>\$15,426,100</b>
Design Allowance (10%)	1,497,900	1,542,600
Construction Allowance	0	0
<b>Total Construction Cost</b>	<b>\$16,476,600</b>	<b>\$16,968,700</b>
Gross Floor Area (m <sup>2</sup> )	4,794 m <sup>2</sup>	5,095 m <sup>2</sup>
Net Building Cost /m <sup>2</sup>	\$2,539 /m <sup>2</sup>	\$2,493 /m <sup>2</sup>
Net Construction Cost /m <sup>2</sup>	\$3,124 /m <sup>2</sup>	\$3,028 /m <sup>2</sup>
Total Construction Cost /m <sup>2</sup>	\$3,437 /m <sup>2</sup>	\$3,330 /m <sup>2</sup>

## 7.0 Areas

The gross floor area of the project, measured in accordance with the guidelines established by the Canadian Institute of Quantity Surveyors, is:

Location	Sprung Structure	Pre-Engineering Structure
Main Level	3,624 m <sup>2</sup>	3,833 m <sup>2</sup>
Mezzanine Level	1,170 m <sup>2</sup>	1,262 m <sup>2</sup>
<b>Total Gross Floor Area</b>	<b>4,794 m<sup>2</sup></b>	<b>5,095 m<sup>2</sup></b>

## 8.0 Taxes

The estimate includes the Provincial Sales Tax (P.S.T.) where applicable.

The estimate excludes the Goods & Services Tax (G.S.T.).



## 9.0 Project Schedule & Escalation

No cost escalation allowance has been included in this estimate. BTY strongly recommends that the client establish a separate budget to cover the escalation cost from the date of this estimate to the mid-point of construction of the project. Our current projected escalation rates per annum are shown below:

Current BTY Group Forecast	2017	2018	2019
	6% - 7%	5% - 6%	3% - 4%

## 10.0 Pricing

The estimate has been priced at current rates taking into account the size, location and nature of the project. The unit rates utilized are considered competitive for a project of this type, bid under a competitive tender with a minimum of five (5) bids, supported by the requisite number of sub-contractors.

The estimate allows for labour, material, equipment and other input costs at current rates and levels of productivity. It does not take into account extraordinary market conditions, where bidders may be few and may include in their tenders disproportionate contingencies and profit margins.

## 11.0 Risk Mitigation

BTY Group recommends that the Owner, Project Manager and Design Team carefully review this document, including exclusions, inclusions and assumptions, contingencies, escalation and mark-ups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the next design phase.

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

It is recommended that BTY Group design and propose a cost management framework for implementation. This framework would require that a series of further estimates be undertaken at key design stage milestones and a final update estimate be produced which is representative of the completed tender documents, project delivery model and schedule. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. BTY Group is unable to reconcile bid results to any estimate not produced from bid documents including all addenda.



## 12.0 Contingencies

### 12.1 Design Contingency

A design contingency of Ten Percent (10%) has been included in the estimate to cover modifications to the program, drawings and specifications during the design.

### 12.2 Construction Contingency

No construction contingency has been included in this estimate but BTY strongly recommends that the client establish a construction contingency to cover unforeseen costs which may arise during the construction period.

## 13.0 Documents Reviewed

The list below confirms the information that we have reviewed in order to prepare our opinion contained within this report:

	Description	Revised Date
Drawings		
	Architectural Set (18 sheets)	August 10, 2017
	Mechanical Set (6 sheets)	August 8, 2017
	Electrical Set (3 sheets)	August 10, 2017
	Civil Set (1 sheet)	July 21, 2017
A1.1	Sprung Structure - Phase 1 Site Plan	September 6, 2017
A2.1	Pre-Eng - Phase 1 Site Plan	September 6, 2017
Report		
	Geotech Report	August 4, 2015
	Structural Schematic Design Report	July 31, 2017
	Refrigeration Design Schematic	August 1, 2017
	Refrigeration Electrical Loads	July 27, 2017



## APPENDIX H – BIRD CONSTRUCTION ESTIMATE



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Suite 350, 1200 – 59<sup>th</sup> Avenue SE  
Calgary, AB T2H 2M4  
P (403) 319-0470  
F (403) 319-0476

August 30, 2017

Jeaniece Frick  
Sprung Instant Structures Ltd.  
PO Box 62, Maple Leaf Road  
Aldersyde, AB T0L 0A0

**Re: West Coast Multiplex – Tofino Rink Project**

Dear Jeaniece,

Bird has reviewed the provided drawings (F16-1373-R4) as well as the package from VDA Architecture Limited. Based on our local Calgary historical data, we would be comfortable attributing a Class D budget number of \$168 / ft<sup>2</sup> for the project. Our calculations are based on an area of 48,800 ft<sup>2</sup> which results in a cost of \$8,210,361 which includes the supply and install of the Sprung Structure. There are many other considerations with a lot of variables for the Owner that are not included in this budget number such as site work, level of finish, etc. that Bird can provide assistance with.

We are currently engaging with mechanical contractors for more accurate pricing and input that can be incorporated as we move forward.

Bird is interested in meeting with the client and working together with Sprung to further the design and refine the budget. If you have any further questions, please do not hesitate to contact our office.

Yours truly,

Jade Neher, AET, GSC  
Business Development Manager  
Bird Construction  
403.319.0470  
[jade.neher@bird.ca](mailto:jade.neher@bird.ca)

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