Expansion Program: Project Definition Report

Cloverley Elementary School

School District No. 44 (North Vancouver)
November 10, 2022

REVISION HISTORY

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The costing of each option was redacted from the report to protect the competitive nature of bidding. This was necessary to ensure that the School District received the best value from prospective consultants and contractors who are engaged on the project. The financial costs will remain confidential and will not be released.

Appendix A and B have been removed from the report to protect the competitive nature of bidding. This was necessary to ensure that the School District received the best value from prospective consultants and contractors who are engaged on the project. The financial costs will remain confidential and will not be released.

LIST OF APPENDICES

Executive Summary

Summary of Rationale

The Project Definition Report (PDR) examines the most cost effective method to fulfill the need for a new larger school at the former Cloverley Elementary School site. This request for a new school has been the top priority of the Board of Education's Five-Year Capital plan for the last few years. Through consultation with municipal planners, the LRFP estimates more than 17,000 new apartment and townhouse units to be built in North Vancouver over the next 12 years. Forecasts indicate that enrolment in the district will increase over the next twelve years by approximately 1,128 students for 7% net growth. A new Cloverley Elementary School is needed to relieve the current and projected enrolment pressures at Ridgeway Elementary and surrounding schools. With development in the area moving away from single family residential to multi-family developments, the need for a larger school has never been greater.

Expansion Program: Project Definition Report Options Analysis

This PDR proposes building a new two-storey, 60K + 525E capacity school (K-7) with an NLC component on the existing Cloverley Elementary School site. The existing school is beyond its useful life and is not suitable to be reused as was explored and confirmed in the Cloverley Concept Plan. The existing school will need to be demolished and the site will need to be re-graded as required to build a new school building and playfield. The new school will have a total floor area of 4,120 m^2 not including Neighbourhood Learning Centre (NLC). Refer to the Design Aid Sheet in Appendix C for detailed breakdown of the allowable areas.

Based on the Ministry of Education (EDUC) allowable NLC budget for a school of this size and its location, is $3,948,000 (refer to Project Budget Estimate in Appendix A). Based on this budget, it has been determined that the project could accommodate 330 m^2 of multi-purpose space, which during school hours will support academics in indigenous, cultural, and artistic education. Outside of school hours this area can be used to facilitate before and after school care.

The School District will also apply for additional grant funding through the Ministry of Children and Family Development's Childcare BC New Spaces Fund in the Spring/Summer of 2022 with a goal of adding two childcare programs to Cloverley:

- One program to support 25 spaces for children aged 30 months to school age
- One program to support 12 spaces for children under 36 months of age.

The City of North Vancouver (CNV) has also expressed interest in contributing funds to support Cloverley's community benefits. In addition to supplementing childcare funding, the CNV has shown interest in contributing towards an enhanced gymnasium to provide both space and storage for community use and programming (145 m^2).

A larger gymnasium available for use after school hours provides the perfect opportunity for Cloverley Elementary School to create a strong community partnership that benefits the local children, youth, and families. The cost of a larger gymnasium with community storage has not been included in the project budget for NLC but rather estimated separately and submitted within this report for information purposes only. This addition to the project is dependent on CNV financial support

If the project proceeds with a larger gymnasium and community storage, the total floor area of the building will be 4,595 m^2 (taking into account 4,120 m^2 of design space, 330m^2 of NLC and 145 m^2 expanded Gym and associated storage space) which will be the final size of the school as NVSD has no future additions planned for this site.

The base building will be designed to be at least a LEED® Gold equivalent that achieves a minimum of 6 energy efficiency points as mandated by the Ministry of Education.

Four options were explored to build a new school on the existing Cloverley site. All options have the same base building in terms of area, program (including NLC), massing, and height. Options 1, 1a, and 1b are located on the eastern part of the site while Option 2 proposes building on the western part of the site. The recommended project delivery method is Design-Bid-Build for all four options. While all options share the same risks, Option 2 is more susceptible to higher cost in a few risks items due to placement of the building in relation to the issues with the soil on the site and to its slightly longer schedule. The options are as described:

Option 1 – Base Building plus NLC (lowest cost site option)

Option 1 explores placing the building the eastern part of the site where the depth to competent ground or till-like soil is lower than in the middle or western part of the site. This lowers the costs of excavation, foundations, and footings when compared to the other options. The existing school building can be demolished at any phase of the project. The project will take 40.5 months to complete from the start of schematic design.

Option 1a – Base Building plus NLC and GHG reduction (lowest cost site option)

Option 1a has the same building form and location on site as Option 1, with the incorporation of proven envelope improvement and mechanical optimization measures that achieve an 87% GHG reduction for a 3% construction cost premium. The project will take 40.5 months to complete from the start of schematic design.

Option 1b – Base Building plus NLC, GHG reduction and Mass Timber (lowest cost site option)

Option 1b has the same building form and location on site as Option 1, with the incorporation of proven envelope improvement and mechanical optimization measures that achieve an 87% GHG reduction for a 3% construction cost premium. Option 2b incorporates mass timber construction to meet government objective. The project will take 40.5 months to complete from the start of schematic design.

Option 2 – Base Building plus NLC (alternative site option)

Option 2 explores placing the building on the western part of the site. The layout of the floor plans have been slightly adjusted to make best use of the alternative location on site. The existing school building must be demolished prior to construction of the new school which may lead to a longer construction schedule. This adds 3 months to the base schedule for a total of 43.5 months from the start of schematic design. More geotechnical exploration, than in Options 1, 1a and 1b, will be required once the existing school is demolished to confirm the soil condition under the existing school and to establish extent of the potentially liquefiable area of the site.

It is important to note that the City of North Vancouver has leased the east side of the property where Cloverley Park is presently located and has expressed an interest in potentially paying the premium cost differential to construct the school on the alternative/ existing school location provided it is less costly than reinstating a new park on the west side of the property where the existing school is located. CNV noted that a school on the western portion of the site may be more easily accessible from a vehicular and pedestrian perspective but the CNV will collaborate with NVSD to find an approach that minimizes vehicle trips to the site. CNV also notes that in Options 1, 1a and 1b, the building is situated approximately 200 m to the east of Option 2 building location which makes it a block further from the Moodyville neighbourhood for which it will serve. Refer to Preliminary City of North Vancouver Comments in Appendix J.

Expansion Program: Project Definition Report Recommendation

The PDR recommends proceeding with Option 1b of building a new school on the eastern portion of the site. While option 1b is the recommended option, the City of North Vancouver has expressed an interest in potentially paying the cost premium differential to construct the new school on the west side of the property if it is economically viable and less costly than to reinstate a park on the west side of the property. NVSD recognizes the issues CNV brought up regarding building on the east side vs west side and would be willing consider going with their preferred option if the CNV pays for the cost premium differential. Further discussions with the City are required. Option 1b best addresses the climate emergency, current and future space shortfall in the family of schools, and meets the government's objective of "Wood First" while also ensuring the best use of the existing school site asset. The building is able to achieve an 87% GHG reduction for a 3% construction cost premium. The total maximum project cost is [redacted] (including [redacted] in risk reserves and economic adjustment). Refer to Appendix A for the full Project Budget Estimate. It is recommended that the project be delivered through the Design-Bid-Build procurement methodology. The project schedule estimates the delivery period to be approximately 40.5 months from the start of CPFA. Potential project risk are summarized and risk mitigations methods are discussed.

1.0 Needs Rationale

1.1 Long-Range Facilities Plan

The current Long-Range Facilities Plan (LRFP) was prepared in May 2020 and highlights population growth, housing development, a lack of school capacity, and aging facilities as current and future challenges for the NVSD. The LRFP analyzed and prioritized capital and non-capital solutions to these challenges throughout the district. A critical item in the LRFP's emerging elementary plan is to increase the available capacity within the Lower Lonsdale region of the City of North Vancouver (CNV). The LRFP indicates that the existing Brooksbank, Lynnmour, and Ridgeway Elementary Schools are unable to manage the enrolment growth in this region and proposes a new Cloverley Elementary School as the highest priority for the NVSD.

Enrolment

The NVSD expects increases to enrolment at both the elementary and secondary level. Through consultation with municipal planners, the LRFP estimates more than 17,000 new apartment and townhouse units to be built in North Vancouver over the next 12 years. Forecasts indicate that elementary enrolment will increase over the next seven years by approximately 320 students for 3% net growth. Secondary enrolment is estimated to increase over the same period by approximately 600 students for 9% net growth. In aggregate, the increase of 920 students creates 5.7% net growth across the district.

Capacity

The school district's existing facilities do not provide enough capacity for the projected enrolment growth. At the district level, the LRFP forecasts the utilization of elementary schools to grow from the current level of 104% to 108% by 2027 and 110% by 2031. Secondary capacity utilization is forecast to grow from the current level of 97% to 106% by 2027 and 107% by 2031. The impact of this global growth affects various North Vancouver communities differently, and while some facilities have capacity for their local growth, there are many communities that currently exceed capacity and will become increasingly over utilized.

The elementary capacity available within the Lower Lonsdale and Moodyville regions of the CNV is an urgent challenge for the NVSD. The current facilities supporting these regions are Brooksbank, Lynnmour, and Ridgeway elementary schools. These schools currently have a combined utilization of 116%, projected to increase to 130% by 2025 and to 145% by 2031.

Existing Facilities Condition

The existing facilities of the NVSD range in condition from good to poor. Although recent capital projects have addressed all high-risk seismic projects for enrolling schools, the LRFP rates the building condition of more than 62% of the schools as 'poor' or 'deficient'. Further, many sites contain instructional portables and modular buildings. There is a need to reduce the use of portable classrooms through permanent additions, or larger, new replacement schools.

Brooksbank and Lynnmour Elementary schools are rated as being the third and fifth highest priorities for replacement when looking at facility condition only. While Ridgeway is in good condition, the site itself has been severely impacted through the placement of portables. The school has a nine-classroom modular building and an additional two portable classrooms. The combined 11 portable classrooms greatly restrict the outside play area available for students at this school. Brooksbank contains a portable classroom and has no space for further portables.

Emerging Elementary Plan

The LRFP's Emerging Elementary Plan recommends the immediate redevelopment of the former Cloverley Elementary School to provide the much-needed capacity to this region. The schools within this region are over-utilized and are forecasted to see further increased utilization. These schools do not offer district programs that can be relocated, and these sites have no further space for additional portables. Grade reconfigurations and catchment changes are not an option as the adjacent elementary and secondary schools are all over-utilized. This region requires additional capacity to support the ongoing enrolment growth, and the best option for achieving this capacity is a new Cloverley Elementary School.

Community Benefit

The community will benefit from a new Cloverley Elementary School. Currently, there is a vacant structure sitting on the Cloverley property that is in derelict condition. A new school will provide the community with a park for children and a local school within walking distance. The new school creates an opportunity to explore NLC programs. There is demand across North Vancouver for increased childcare centres, and the Cloverley project's NLC space can supply this desirable amenity to the community with its before and after school care program.

1.2 School Capacity, Enrolment, and Utilization

As Cloverley Elementary School will be a new school, there will be a new catchment area created. The creation of this catchment results in some students being relocated from their current school of attendance to Cloverley. Given the continued housing development within the region, the enrolment at Cloverley is expected to continue to grow. It should be noted that the LRFP states that a single new school will not be sufficient to support the continued Lower Lonsdale housing development in the long-term.

Figure 1: Cloverley Elementary School Enrolment Projections with Local Knowledge

			Forecasted Enrolment (does not include international students)									
Facility	Operating Capacity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cloverley (New School 2026)	546	-	-	-	-	-	490	515	540	540	540	540
Utilization		-	-	-	-	-	90%	94%	99%	99%	99%	99%
Surplus/ (Shortfall)		**-**	**-**	**-**	**-**	**-**	**56**	**31**	**6**	**6**	**6**	**6**

1.3 Surrounding Schools Capacities, Enrolments, and Utilization

The initial opening of Cloverley provides for much needed capacity within the region to support the surrounding schools. As the surrounding schools are all over utilized, Cloverley brings the schools back to a manageable enrolment level while providing space to accommodate the continued housing developments in the region for the short-term.

Despite the Cloverley project, enrolment at Lynnmour is expected to continue to climb into unmanageable levels; however, the growth that Lynnmour is experiencing is best supported by other capital project requests within that geographic area. Although Lynnmour Elementary School is near the Cloverley site, it is a part of the adjacent Windsor family of schools which is also constrained. Highway 1 intercepts any opportunities for the ability for students to walk to school safely. As it currently exists, a student would have to walk under the highway on a gravel path which limits accessibality for the neightbourhoods near Lynnmour to use Cloverley. Additionally, the growth caused by the towers going up in the Seylynn area will impact Lynnmour.

Figure 2: Surrounding Schools Enrolment & Utilization with Local Knowledge

Facility		Instructional Portables		Operating Capacity		Actual Enrolment	Forecasted Enrolment (does not include international students)									
School Name	FCI	Current Year (2021)	At Project Completion (2026)	Current Year (2021)	At Project Completion (2026)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Brooksbank	0.73	1	0	387	387	385	386	377	379	370	335	334	330	328	328	336
Utilization						99%	100%	97%	98%	96%	87%	86%	85%	85%	85%	87%
Lynnmour	0.69	0	0	252	252	220	229	237	260	273	241	264	270	309	346	362
Utilization						87%	91%	94%	103%	108%	96%	105%	107%	123%	137%	144%
Ridgeway	0.07	11	0 *	406	406	604	623	629	629	640	368	358	343	363	382	382
Utilization						149%	153%	155%	155%	158%	91%	88%	84%	89%	94%	94%
Cloverley (New School 2026)	0.00	0	0	0	546	0	0	0	0	0	490	515	540	540	540	540
Utilization						0%	0%	0%	0%	0%	90%	94%	99%	99%	99%	99%
Total Enrolment						**1209**	**1238**	**1243**	**1268**	**1283**	**1434**	**1471**	**1483**	**1540**	**1596**	**1620**
Capacity				**1045**	**1591**	**1045**	**1045**	**1045**	**1045**	**1045**	**1591**	**1591**	**1591**	**1591**	**1591**	**1591**
Total Overall Utilization						116%	118%	119%	121%	123%	90%	92%	93%	97%	100%	102%
Surplus/ (Shortfall)						**-164**	**-193**	**-198**	**-223**	**-238**	**157**	**120**	**108**	**51**	**-5**	**-29**

** Note: Some portables from Ridgeway will be repurposed to support childcare initiatives throughout the NVSD*

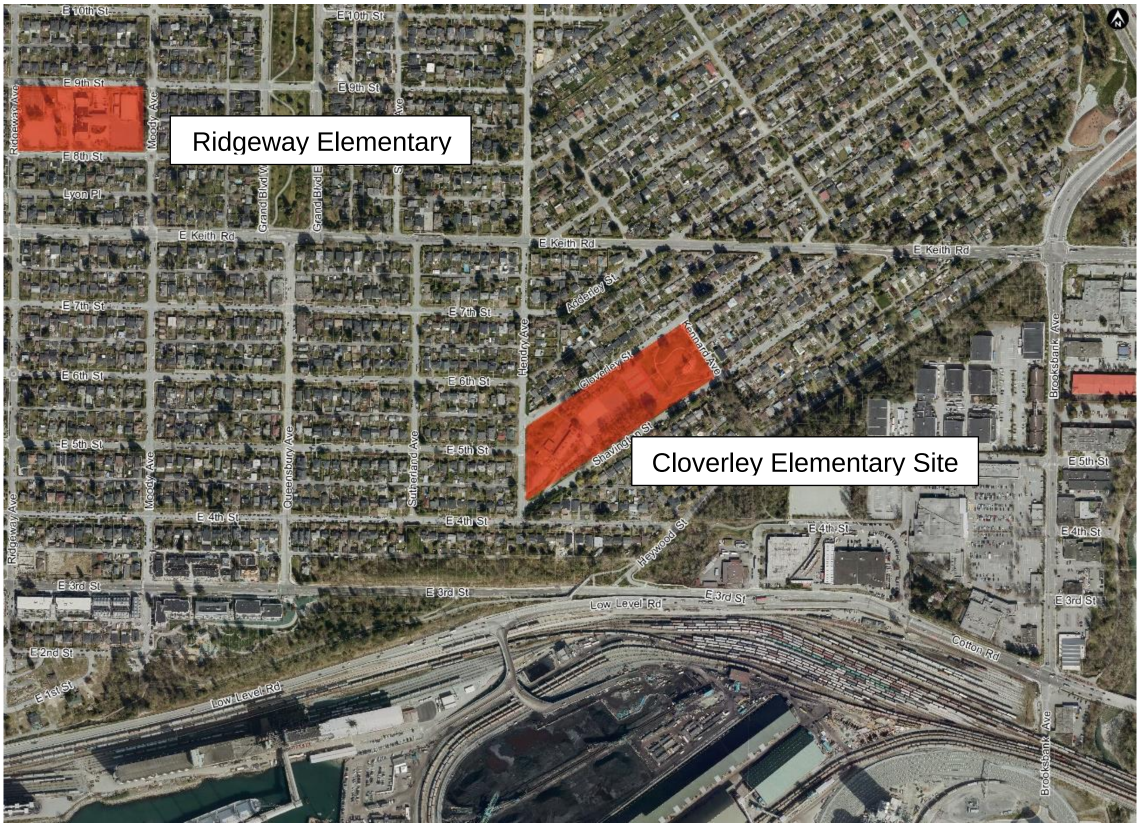
2.0 Project Background

2.1 Background

The former Cloverley Elementary School site is located at 440 Hendry Avenue, North Vancouver in the Moodyville neighbourhood. Cloverley was a public elementary school between 1961 and 1982. Afterwards, it was leased by various organizations until briefly returning to service between 2010 and 2014, while Queen Mary and Ridgeway Elementary Schools were under construction. Since then, the school has remained vacant and is considered beyond its useful life as noted in the 2017 VFA Asset Detail Report. The eastern portion of the site is currently leased to the City of North Vancouver (CNV) as park land. The park is known as Cloverley Park and includes tennis courts, a playground, walking trails, mature trees, lawn, and flat area suitable for outdoor games. The CNV has expressed preference to retain the existing community park amenities on the east side of the property, or alternatively replace the park on the west side of the property depending upon the location of the new school. The site is surrounded on all sides by single family residential houses and sits up on the hill above industrial areas along the waterfront.

The CNV has expressed an interest in potentially paying the cost premium differential to construct the new school on the west side of the property if it is economically viable and less costly than to reinstate a park on the west side of the property. CNV noted that a school on the western portion of the site may be more easily accessible from a vehicular and pedestrian perspective but the CNV will collaborate with NVSD to find an approach that minimizes vehicle trips to the site. CNV also notes that in Option 1, 1a, and 1b, the building is situated approximately 200 m to the east of Option 2 building location which makes it a block further from the Moodyville neighbourhood for which it will serve. Refer to Preliminary City of North Vancouver Comments in Appendix J.

Figure 3: Context Plan



2.2 Facility Condition Index

The existing school is considered beyond its useful life as noted in the Ministry's Capital Asset Management System Database ('VFA'). The 2017 VFA Asset Detail Report generated by the VFA database, reports the existing school building has an FCI of 0.78 and the site has an FCI of 1.05. The total FCI for the asset is 0.82. Please refer to Appendix G for full Asset Detail Report.

2.3 Existing Site

The existing Cloverley Elementary school is located on a 29,663 m^2 (2.966 hectares) slopping site with a southern exposure. The existing school building is located on the west end of the site where the slope down from Cloverley Street is the most severe. It consists of two storeys, with the lower level recessed back into the slope. The upper level meets grade to the north and the lower level has direct access to the outside along the south. A small gym is located in the north-west corner of the school. The site slopes steeply down from Cloverley Street to Shavington Street. There is also a slight cross slope down from Hendry Avenue to Kennard Avenue. The site was graded to create a flat terrace midway between Cloverley Street and Shavington Street. All the site amenities are located on this flat graded portion of the site.

Located to the east of the existing school building is a large gravel playfield bounded by trees to the north and south. There are tennis courts located east of the gravel playfield. The tennis courts have a small retaining wall to the north and south to provide a level surface. To the south of the tennis courts is a small path that connects the gravel playfield to Cloverley Park. Cloverley Park is mostly flat, with slopes to the north and south (approximately 20%). There are some trees, walking paths, and a playground to the east edge of the site. There is an existing play structure located in the park.

The subsurface conditions vary throughout the site. The soil consists of soft to firm silt, followed by compact to dense gravelly sand to sand and gravel, overlaying dense, weathered, till-like material which is generally comprised of sand with variable silt and gravel content. Till-like material was encountered between 3.0 m to 7.6 m depending on the location on site. Refer to the Geotechnical Report in Appendix D for more information.

Currently, vehicular access to the site is located off Hendry Ave and is near the intersection of Hendry and Shavington Street. Vehicle traffic has been an ongoing concern within this neighbourhood as commuters often take shortcuts through this area to avoid congestion on nearby arterial routes. There are traffic barriers on Hendry Ave which partially blocks the south-bound lane from the parking lot access to impede and prevent east-bound commuter traffic flow. There are 28 paved parking stalls in the parking lot with one accessible stall. There is also a gravel access road to the south of the school accessed off Shavington St. The streets around the site are relatively quiet being located in a residential neighbourhood. A few blocks north of the site is Keith Rd E. which is a major roadway that has a TransLink bus route along it and leads to Highway 1. Any delays on the Ironworkers Memorial Bridge typically leads to congestion on major access routes in the North Shore.

Figure 4: Existing Site Aerial

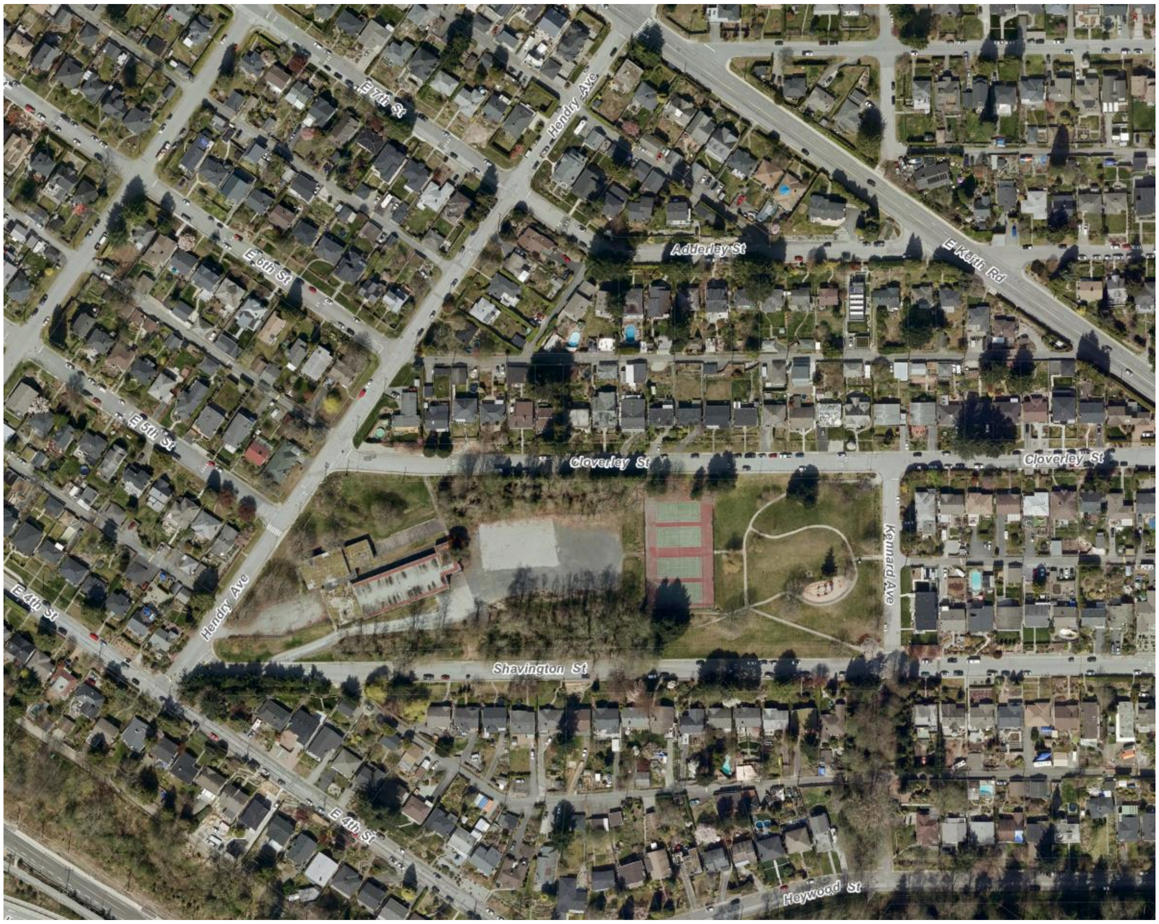


Figure 5: Existing Site Diagram

Figure 6: Existing North-South Site Section

Figure 7: Existing East-West Site Section

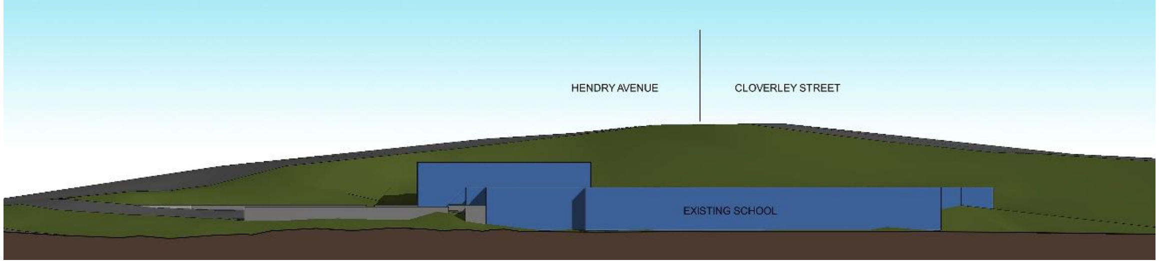


Figure 8: Photo Looking East at the Playground and Cloverley Park

3.0 Expansion Options

The project's primary objectives from the Cloverley Concept Plan were:

- Relieve enrolment pressure at Ridgeway Elementary and its neighbouring school due to current and proposed development within the area.
- The proposed new Cloverley Elementary must address a projected shortage at Ridgeway Elementary alone of more than 300 spaces in the next ten years.
- The project should align with the NVSD's and Province's mandate to reduce the number of portables.
- The project should align with NVSD's vision which promotes walkability to schools by locating them close to the center of the catchment areas.
- The project must provide the best value to the NVSD and the MoE while meeting the other objectives.
- Provided all objectives can be met, the lowest cost and shortest schedule option should be undertaken.

In order to achieve these objectives, the PDR proposes building a new two-storey, 60K + 525E capacity school (K-7) with an NLC component on the existing Cloverley Elementary School site. The existing school is beyond its useful life and is not suitable to be reused as was explored and confirmed in the Cloverley Concept Plan. The proposed new school requires the demolition of the existing school and regrading of the site to build the new building and playfield. A pre-demolition hazardous survey on the existing school building was presented to the NVSD on July 21, 2020. The survey found significant hazardous material in the building. Appropriate hazmat remediation must be done prior to the full demolition of the school. Refer to the survey in Appendix K.

This PDR explores four options to building a new school on the existing site.

- Option 1 – Base building plus NLC (lowest cost building location on site)
- Option 1a – Base building plus NLC and GHG reduction (lowest cost building location on site)
- Option 1b – Base building plus NLC and GHG reduction plus mass timber (lowest cost building location on site)
- Option 2 – Base Building plus NLC (alternate building location on site)

The new school will have a total floor area of 4,120 m^2 not including Neighbourhood Learning Centre (NLC). Refer to the Design Aid Sheet in Appendix C for detailed breakdown of the allowable areas. The NLC could accommodate 330 m^2 of multi-purpose space, which during school hours will support academics in indigenous, cultural, and artistic education. Outside of school hours this area can be used to facilitate before and after school care. The School District will also apply for additional grant funding through the Ministry of Children and Family Development's Childcare BC New Spaces Fund in the Spring/Summer of 2022 with a goal of adding two childcare programs to Cloverley:

- One program to support 25 spaces for children aged 30 months to school age

- One program to support 12 spaces for children under 36 months of age.

The City of North Vancouver (CNV) has also expressed interest in contributing funds to support Cloverley's community benefits. In addition to supplementing childcare funding, the CNV has shown interest in contributing towards an enhanced gymnasium to provide both space and storage for community use and programming (145 m^2). This addition to the project is dependent on CNV financial support. However, if approved, the total floor area of the building could be up to 4,595 m^2 when considering the NLC space and the gym addition.

NVSD has no future capacity expansions or additions planned for this site as the school is not well positioned to handle further capacity expansions in the nearby communities. The base building will be designed to be at least a LEED® Gold equivalent that achieves a minimum of 6 energy efficiency points as mandated by the Ministry of Education. All options will have a 100 m^2 covered play area that is allowed in the district because the region has an annual precipitation exceeding 2000 mm.

The City of North Vancouver has expressed an interest in potentially paying the cost differential/ premium to construct the new school on the west side of the property if it is economically viable and less costly than to reinstate a park on the west side of the property. CNV has noted that a school on the western portion of the site may be more easily accessible from a vehicular and pedestrian perspective, but the CNV will collaborate with NVSD to find an approach that minimizes vehicle trips to the site.

In Options 1, 1a, and 1b, the park and tennis courts will need to be completely removed in order to build the new school. The park and tennis courts could then be partially recreated on the western portion of the site. As the western portion of the site is already being regraded after the demolition of the existing school building, there is an ability for the site to be graded in a way to reduce the number of retaining walls required. In Option 2, the park will need to be heavily modified in order to accommodate the school and the playfield while the existing tennis courts would need to be completely removed and rebuilt. Approximately a third of the existing park would remain after the school, playfield, and new tennis courts are built. In all options, a new tennis court would have a maximum of 3 courts instead of the existing 4 courts. All options will require additional retaining walls but Option 2 would require more than the other options due to placement of building, playfield, and tennis courts leading to higher site development cost. There is a possibility for Option 2 to use approximately the same amount of retaining walls as Options 1, 1a and 1b but it would involve regrading more of the existing park. This may result in very little to none of the existing park remaining. Further exploration would be required in design phase.

For Options 1, 1a, and 1b, the PDR consultant team explored an additional building layout that fronted onto Kennard Avenue. This was to see whether this placement could be more cost effective than the proposed option of building a linear 2-storey school on the existing flat bench on the site. The potential issue with the proposed options is that the building will be half on piles and half on regular foundation systems. There is even a risk contingency item to put the entire building on piles. For the purpose of this PDR, the geotechnical report was a general investigation of the site, and a more extensive geotechnical report will need to be done during design stage. It is not guaranteed that poor soils do not exist along Kennard Ave.

After looking at the site and a number of factors with the PDR consultant team, the following items will incur additional cost if the building were to front Kennard Ave:

- Due to a lack of frontage, the building layout will be dug into the ground at the upper end of the site. The wall holding back the earth is a concrete retaining wall, which will now be inside the building acting as a partial height basement wall. The gymnasium may be a suitable function for this buried space as windows will be limited. However, this complicates the assembly as the upper portion of the gymnasium will be steel. Expensive underground waterproofing measures would be required in a basement wall but would not be needed on retaining wall separate from the building. The seismic mass of the retained ground behind the retaining wall must now also be resisted by the gymnasium seismic systems which requires a more robust seismic system with larger footings. Furthermore, design of the retaining wall will provide more design challenges.

- The building will be proud of the ground near Shavington Street so the grade will need to be built-up and retained by a retaining wall. Overall, there is an approximately 12.0 m elevation change between Cloverley Street and Shavington Street; that is equivalent to the height of a typically three storey school building.

- The school will likely need to be 3 storeys to fit on the Kennard frontage and this brings in a number of costly features:

    - Three storey schools have more area which means more materials overall. It will have more suspended floor than roof compared to a two-storey building and thus more concrete topped deck will be needed instead of just metal deck (if there were more roof). This causes the building to have more mass resulting in larger foundations and additional seismic mass to resist.

    - Structural has found that steel brace bays are only optimal for one to two storey schools. For three storey schools, the columns of the brace bays become too large to fit within typical wall thicknesses which is not ideal for appearance and fireproofing. Structural typically proposes to go to an all cast in place concrete shear wall system for system in three storey schools. However, this also has its own cost and challenges as it means getting the walls built before steel erection begins which adds approximately a month to the schedule. In addition, there is the difficulty of dealing with steel embed plates on the project which adds to the complexity.

It is highly likely that the costs described above will greatly exceed any savings in piling from the bench options. The piling on half the building seems very feasible and it’s unlikely that the entire building will need to be piled. The placement of the school fronting on Kennard Ave makes for a less efficient drop-off and parking design. The driveway can no longer be at the front of the school and will instead be located at the back of the school. From a security standpoint, the drop-off will no longer be visible by the main office which is not ideal. The driveway must now climb up the slope to the site bench from Shavington Street and then back down the slope. This creates more paving and less efficient circulation as well as steeper slopes will likely become problematic in the winter. Additionally, the placement of the playfield could potentially push the parking and drop-off further east which would not be desirable. Further exploration to determine the best location for the playfield would be required. All options include a risk to fully pile the site due to the possibility that the soil may not be suitable to have shallow foundations. Geotechnical noted that soil conditions and depths may vary between the test-hole locations. It is not likely that the building will need to be fully piled but it is definitely possible. An issue that could cause more piles would be if the soil was found to be not suitable for shallow foundations due to deeper stripping depths required to get to acceptable bearing. Another possible issue is if it is found during design that differential settlement or movement of the building on two different foundation systems exceed acceptable tolerances. The risk for more piles is greater on Option 2 as the depths to till-like soil is generally deeper than Options 1, 1a and 1b. Further geotechnical exploration will be required during design to determine the exact locations where piled foundations and shallow foundations can be used.

3.1 Option 1 – Base building plus NLC (lowest cost building location on site)

The base school building consists of 21 regular classrooms and 3 kindergarten classrooms over two storeys. The base building will be designed to a LEED® Gold equivalent that achieves a minimum of 6 energy efficiency points as mandated by the Ministry of Education. The base building is able to achieve 9 energy efficiency points as per the Energy Modelling Report (refer to Appendix E). The new school will have a total floor area of 4,120 m^2 not including Neighbourhood Learning Centre (NLC). The NLC could accommodate 330 m^2 of multi-purpose space, which during school hours will support academics in indigenous, cultural, and artistic education. Outside of school hours this area can be used to facilitate before and after school care. The School District will also apply for additional grant funding through the Ministry of Children and Family Development's Childcare BC New Spaces Fund in the Spring/Summer of 2022 with a goal of adding two childcare programs to Cloverley:

- One program to support 25 spaces for children aged 30 months to school age
- One program to support 12 spaces for children under 36 months of age.

The City of North Vancouver (CNV) has also expressed interest in contributing funds to support Cloverley's community benefits. In addition to supplementing childcare funding, the CNV has shown interest in contributing towards an enhanced gymnasium to provide both space and storage for community use and programming (145 m^2). This addition to the project is dependent on CNV financial support. However, if approved, the total floor area of the building could be up to 4,595 m^2 when considering the NLC space and the gym addition. This will be the final size of the school as NVSD has no future additions planned for this site.

3.1.1 BACKGROUND

Summary of Work

Building Area:	4,120 m^2 plus NLC (330 m^2) plus enlarged gymnasium and community storage (145 m^2)
Capacity:	60K + 525E K-7 nominal capacity, 546 operating capacity
Site Prep Area:	2.9663 hectares
Parking and Loading:	35 stalls, 3 loading (as per City of North Vancouver Bylaws)

Drop off:	12 stalls including drop-off for before and after school care
Other Site Elements:	Playfield, multi-aged play areas, new playgrounds, covered play area

3.1.2 SCOPE OF WORK

In this option, the school building will be located on the eastern portion of the site. Cloverley Park and the tennis courts will need to be demolished and re-graded to accommodate the new building. The entrances at the north-east and south-east corner of the site will be refurbished. This option was graded so that no retaining walls were required but it may end up creating a relatively steep slope on the north side adjacent to the playfield. Further design exploration will be required during design phase which could lead to a small retaining wall or stepped concrete viewing bleachers. Any trees that are removed for regrading or construction purposes will be replaced as per City of North Vancouver bylaws. The existing playground will be removed and returned to the owner. A new playground and play equipment will be installed west of the new school building.

Preparation of the site will include clearing and grubbing of all vegetation in the area of disturbance. All of the topsoil, organic silt, and soft, compressible soils are to be stripped off from the building area. The geotechnical consultants will inspect once site preparation is completed to ensure that it is acceptable for the new building. The existing school building can be demolished at any time in this option. After the building is demolished, the western portion of the site will be re-graded to install a new 45 m by 70 m playfield and to return the site to its natural grading.

Vehicular access to the site will be located off of Kennard Street. The staff parking lot and student drop-off will each have their own entrance off of Kennard Street and will not be connected. The student drop-off drive aisles will exit out to Shavington Street. There will be a total of 35 parking stalls, including two handicap stalls, and 12 drop-off stalls on site.

The structure of the building will be framed with steel columns, beams and open web steel joists. The second level floor will be 100mm concrete topping on 40mm steel decking. The roof will consist of 40mm steel decking. The foundations and level 01 floor slab will vary depending on the soil conditions underneath. The eastern portion of the school from approximately the west exit stair will be built using pad and strip footings with slab on grade while the western portion will be built using structural slab on grade spanning between grade beams which are supported by pile caps. Refer to the structural report in Appendix D for more information regarding the proposed structural systems.

The mechanical systems for the classroom wing will consist of a central ERV with VAV re-heat (displacement ventilation) and perimeter radiator, demand control ventilation, and air economizer. The Kindergarten, Admin, and before and after school care (NLC) will have supplemental cooling from a ductless split system. The gym will have an air handling unit (AHU) hydronic heating/ cooling, demand control ventilation with no heat recovery ventilator and air economizer. Refer to the mechanical report in Appendix D for more information regarding the proposed mechanical systems.

A new 200mm building sanitary sewer line will be provided. All the roof areas will be connected via a network of piping to the storm sewer. The perimeter of the building will have a subsoil drain system that will connect through an interceptor sump to the storm disposal system. Water consumption for the school will be minimized by the use of low water consumption fixtures. The fixtures will be provided in accordance with School District No. 44 standards. The building will have a wet fire protection sprinkler system designed in accordance with NFPA 13. Refer to the mechanical report in Appendix D for more information regarding the proposed plumbing systems.

New utility servicing will be required which includes both BC Hydro power and telecommunications utilities. The new power service to the building will be at three phase 600Y/347v based off of the area of the building and mechanical requirements. A utility pad mounted transformer and underground servicing infrastructure will be required. Power will be distributed through the building through an electrical room on level 01. Area lighting will be designed to meet BCBC minimum requirements, the task level recommended average lighting levels from the Illuminating Engineering Society of North America guidelines, and the energy efficiency requirements of ASHRAE 90.1. All luminaries will be LED. The fire alarm will be designed to comply with the latest BCBC version. Telecommunications structured cabling within the facility will be Category 6 cabling. A communication room will be provided to distribute the telecommunications. Refer to the electrical report in Appendix D for more information regarding the proposed electrical systems.

A new 150mm diameter combined fire and domestic water connection with meter will be required from the existing main on Shavington Street. An onsite fire hydrant will be required if the proposed fire department connection at the entrance is not located within 45m of an existing offsite fire hydrant. A new 300mm diameter storm service connection to the existing 300mm diameter storm main on Shavington Street. Storm water detention and stormwater quality devices will be required as per City of North Vancouver Specifications. A new 200mm diameter sanitary service connection is required and will need to connect to a new 200mm diameter off-site sanitary sewer extension along Shavington Street from Kennard Avenue. The City of North Vancouver requires that roadways adjacent to the proposed site to be upgraded to current standards. Refer to the civil report in Appendix D for more information.

Figure 9: Option 1 Overall Proposed Site Plan

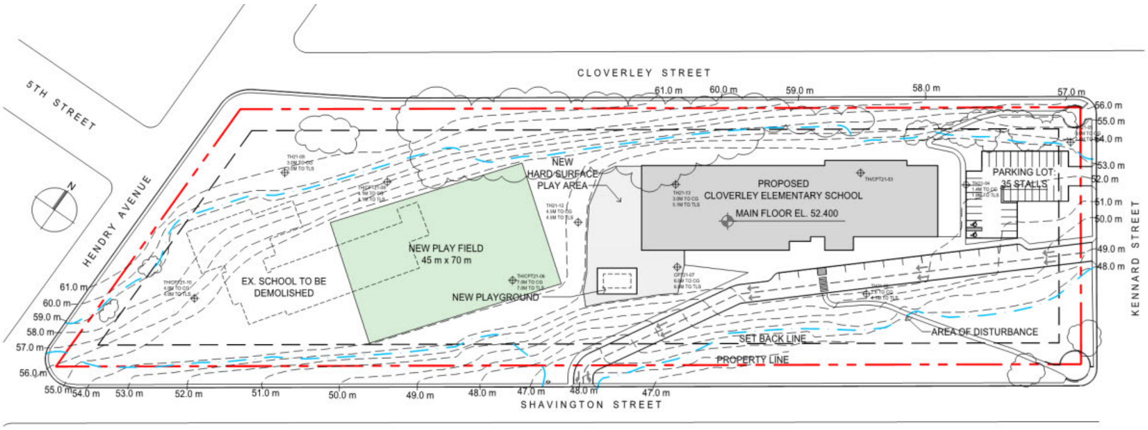


Figure 10: Option 1 Enlarged Proposed Site Plan

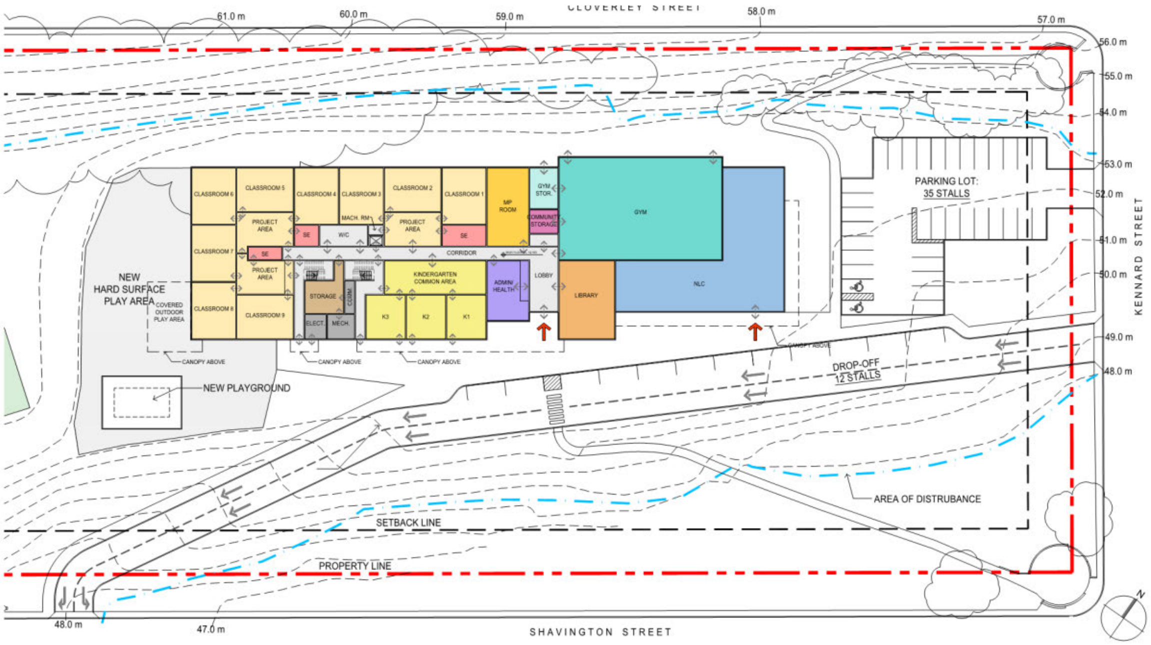


Figure 11: Proposed Level 01 Floor Plan

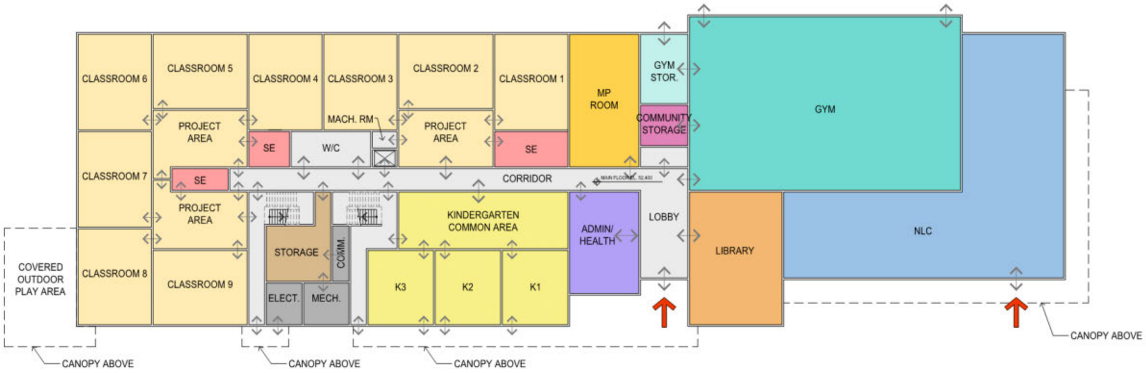


Figure 12: Proposed Level 02 Floor Plan

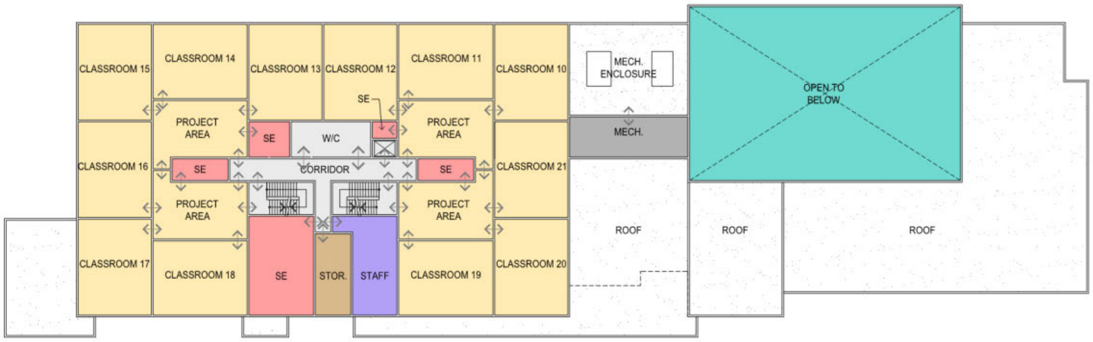


Figure 13: Area Summary

PROGRAM	DAS (m²)	ACTUAL (m²)
REPLACEMENT SCHOOL PROGRAM		
ADMIN/ HEALTH	110	110
GENERAL INSTRUCTION	1680	1680
GENERAL STORAGE	80	80
GYM ACTIVITY	380	380
GYM ANCILLARY	65	65
MEDIA/ TECH.	200	200
MULTIPURPOSE	100	100
SPECIAL ED.	240	240
MECHANICAL	105	105
KINDERGARTEN	270	270
DESIGN SPACE	750	750
OTHER	140	140
SUBTOTAL:	**4120**	**4120**
ADDITIONAL PROGRAMS		
NEIGHBOURHOOD LEARNING CENTRE (NLC)	330	330
COMMUNITY SPACE	0	145
SUBTOTAL:	**330**	**445**
TOTAL AREA	**4450**	**4595**

TOTAL FLOOR AREA	**DAS (m²)**	**ACTUAL (m²)**
LEVEL 01 FLOOR AREA		2924
LEVEL 02 FLOOR AREA		1671
TOTAL AREA:	**4450**	**4595**

3.1.3 PROJECT COST

Capital Cost	Option 1 – Base building plus NLC (lowest cost building location on site)
Capital Cost w/o Risk Reserves	[redacted]
Supplemental Items	[redacted]
Economic Adjustment	[redacted]
Risk Reserves	[redacted]
Capital Cost + Risk Reserves	[redacted]

3.1.4 LIFE CYCLE COSTS

Present Value of Life Cycle Costs	Option 1 – Base building plus NLC (lowest cost building location on site)
Capital Cost + Risk Reserves	[redacted]
Cyclical Renewal Costs (40 years)	[redacted]
Annual Operating and Maintenance Costs (40 years)	[redacted]
Annual Utility/Energy Costs (40 years)	[redacted]
Total Life Cycle Costs (40 years)	[redacted]
Total Life Cycle Costs - Present Value (40 Years)	[redacted]

3.1.5 FACILITY CONDITION INDEX

As this option is a new school, the Facility Condition Index (FCI) is expected to be 0.00.

3.1.6 UTILIZATION

			Forecasted Enrolment (does not include international students)									
Facility	Operating Capacity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cloverley (New School 2026)	546	-	-	-	-	-	490	515	540	540	540	540
Utilization		-	-	-	-	-	90%	94%	99%	99%	99%	99%
Surplus/ (Shortfall)		**-**	**-**	**-**	**-**	**-**	**56**	**31**	**6**	**6**	**6**	**6**

3.1.7 SCHOOL PROGRAM

The new Cloverley Elementary School will be a single-track school with no pre-planned programs.

3.1.8 GENDER-BASED ANALYSIS+

The North Vancouver School District makes ongoing efforts to promote and support inclusion as it relates to sexual orientation and gender identity and expression including efforts to dismantle existing systems and structures that may represent barriers to this area of diversity.

This includes, but is not limited to:

- Increasing visibility and awareness of sexual orientation and gender identity by acknowledging national and international days of recognition (i.e., International Day Against Homophobia, Pride Week, Trans Day of Remembrance, Trans Day of Visibility)
- Increasing visibility and awareness of sexual orientation and gender identity through school announcements, flags and posters in classrooms and throughout school communities
- Making available books and resources that represent diversity in sexual orientation and gender identity and expression
- Increasing awareness of macro/micro aggressions within school communities
- Increasing awareness of heteronormative and gender specific language
- Promoting inclusive language options
- Using gender-neutral language, including pronouns, when acknowledging groups of people
- Building gender-neutral washroom options in new constructions and renovations
- Examining existing and new school activities and events to ensure that they do not reinforce heteronormative expectations and/or gender stereotyping.

District staff take into account various policies, procedures and guidelines in the design of new schools. The Gender-Based Analysis Plus (GBA+) considers how diverse groups of students, employees and members of the community may be impacted and is guided by **Policy# 412 Supporting Sexual Orientation, Gender Identity and Gender Expression** as well as **Policy#409 Multicultural/ Race Relations.** Refer to Appendix F for full policies.

3.1.9 OPTION ADVANTAGES AND DISADVANTAGES

Advantages

- Less complex foundations required for the building.
- Staff parking is separated from drop-off zone.
- Flexibility to demolish the existing school at any stage of the project.
- Location of new playfield is mainly where the existing playfield is located and therefore less grading is required.
- Lowest cost option.

Disadvantages

- Less energy efficient than Options 1a/1b.

3.1.10 PROCUREMENT METHOD

The recommended procurement method for this option would be Design-Bid-Build. Refer to Section 6.2 for a more detailed analysis.

3.1.11 PROJECT RISK ASSESSMENT

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Risk Reserve Costs
a	Hazardous Materials & Remediation	Medium	Low	In addition to pre-demolition hazardous survey done as part of the Concept Plan, further appropriate hazmat remediation must be done prior to the full demolition of the school.	[redacted]
b	Unforeseen Soils Issues – Sloping Site/ Overburden	High	High	Confirm thoroughness of geotechnical reports. Selective building and site investigations during working drawing stage. Include requests for unit rates in tender. Review of historical records and budget cash allowance for tender. Further geotechnical review and soil testing required during working drawing stage.	[redacted]
c	Unforeseen Environmental Issues with Site	Medium	Medium	Review of historical records and budget cash allowance for tender. Thorough review of site during working drawing stage. Hire consultant to review site and provide report on condition of soil.	[redacted]
d	Approval/ permit delays affecting project schedule – construction delay, wet weather costs, etc.	Medium	High	Ensure that there is clear communication between consultant team and contractor to address approval and permit issues in a timely manner as they come up.	[redacted]
e	Trade Shortages, Market Condition, Supply Chain - trades not willing to come to North Shore causing higher tender prices and/or delay to project completion.	High	High	Tender project at a favourable time in the year when trades are looking for more work. Provide adequate time for trades to provide proper bids to	[redacted]

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Risk Reserve Costs
	Contractor unable to get specified material in a timely manner due to shortages caused by COVID and other issues leading to higher prices and/or delay to project completion			general contractors. Ensure that there is clear communication between consultant team and contractor to address supply issues in a timely manner and to order materials so that they are available on site when needed.	[redacted]
f	Unforeseen Construction Delays, Approvals – Allowance for completion date delay due to construction start delay due to building permit issues, tender award issues, etc.	Medium	Medium	Ensure that there is constant and clear communication between consultant team, SD44, and city planning department to address issues required to keep the building permit moving forward.	[redacted]
g	City Building Bylaw & Offsite – on-site, off-site, code, etc.	Medium	Medium	Thorough review of building code and city by-laws during working drawing stage. Meet with City to confirm requirements. Some requirements may include: • District Energy heat recovery plant • Capacity charge and utility premiums if plant must be collocated. • Roads and sidewalks around site to be upgraded to CNV standards Meet with LEC to determine the requirements for the building. Review the building with LEC prior to submitting building for permitting.	[redacted]

3.1.12 SCHEDULE

Milestones	Schedule		Duration (Months)
	Start Date	Finish Date	
CPFA	n/a	March 31, 2023	-
Consultant Procurement	April 3, 2023	May 17, 2023	1.5
Schematic Design/ Design Development	May 18, 2023	September 15, 2023	4
Cost Analysis & Ministry Approval to Proceed	September 18, 2023	October 13, 2023	1
Construction Documents	October 16, 2023	June 14, 2024	8
Tender	June 17, 2024	July 19, 2024	1
Bid Review & Contract Award	July 22, 2024	August 16, 2024	1
Excavation Permit	April 15, 2024	August 16, 2024	4
Permits (Foundation-to-Grade, Building, etc.)	August 19, 2024	April 18, 2025	8
Demolition	August 19, 2024	November 15, 2024	3
Construction	August 19, 2024	August 14, 2022	24
Substantial Completion	n/a	June 15, 2026	-
Owner Supplied Equipment & Furnishings	June 16, 2026	August 14, 2026	2
Final Completion	n/a	August 17, 2026	-
Total			40.5

Note: Shaded Milestones indicated that the milestone is happening concurrently in the schedule. Please refer to start and finish dates.

3.2 Option 1a + Option 1b – Base building plus NLC and GHG reduction (lowest cost site location)

Option 1a responds to provincial green building, energy efficiency, and greenhouse gas (GHG) reduction objectives, and the NVSD's mandate to address the climate emergency.

Option 1b is identical to Option 1a but includes mass timber construction in lieu of the typical steel structure. The manager of building permits at the City of North Vancouver has indicated that they support the use of mass timber. Encapsulated Mass Timber is already accepted in the City of North Vancouver and exposed mass timber can be achieved through alternative solution. The City would be willing to work with the North Vancouver School District and design team to provide an early review of the building in the pre-building permit stage in order to accelerate manufacturing. Wood products and finishes will be used wherever appropriate and feasible. Refer to structural report in Appendix D for a possible mass timber design for the proposed school building. The total mass timber premium cost over the steel structure would be $2,038,969 – refer to Project Budget Estimate in Appendix A.

Using energy modelling, the project team explored cost-effective design alternatives that would contribute to reduced greenhouse gas (GHG) emissions, compared to the Option 1 baseline. The objective was to identify a bundle of improvement measures that would achieve a minimum 50% GHG reduction with a maximum 3% capital cost increase.

The team defined three alternative approaches to meet the performance objectives, each with a different focus, as summarized below.

- Design Alternative 1: Improved thermal envelope, with the incorporation of a very high-performance window system.
- Design Alternative 2: Moderate improvements to envelope, mechanical, and lighting systems, with the incorporation of a fossil fuel free heating system (all-electric building) and a solar PV Array. Design Alternative 3: Minor improvements to envelope and mechanical systems, with the incorporation of a large renewable energy system (solar photovoltaics)

The team selected the second Design Alternative as the basis for Option 1a/1b, as it offered the greatest environmental benefits, reducing GHG emissions by 87%. Option 1a/1b has a construction cost premium of 3% and provides a 5% operating cost reduction, compared to Option 1.

The table below presents a summary of the energy modelling results. Additional information about the energy modelling process, along with detailed inputs and results, is presented in Appendix E.

Performance Comparison of Option 1 and Option 1a/1b

Metric	Unit of Measure	Option 1: Base Building plus NLC	Option1a & 1b: Base Building plus NLC and GHG Reduction (1b includes Mass Timber)
Energy Usage	MWh/year	402	247
Annual Energy Cost	$/year	$40,000	$31,300
Energy Use Intensity (EUI)	KWh/m^2	88	54
GHG Emissions	Tonne Co2e/year	21.0	2.7
	$kgCO_2e/m^2$/year	4.6	0.6
Construction Cost Premium over Option 1	$ (%)	N/A	$900,455 (3%)
GHG Emission Reduction over Option 1	Tonne Co2e/year (%)	N/A	17.6 (87%)

* Annual energy costs and greenhouse gas emissions assume no connection to the Lonsdale Energy district energy system.

3.2.1 BACKGROUND

Same as Option 1. Refer to 3.1.1 Background.

3.2.2 SCOPE OF WORK

Options 1a/1b has the same building form and location on site as Option 1, with the incorporation of a proven envelope improvement and mechanical optimization measures that achieve an 87% GHG reduction in addition to the mass timber construction for Option 1b.

3.2.3 PROJECT COST

Supplementary Building Costs and Fees

Cost	Option 1a - Base Building plus NLC and GHG reduction (lowest cost site)	Option 1b – Base Building plus NLC, GHG reduction and mass timber
Capital Cost w/o Risk Reserves	[redacted]	[redacted]
Supplemental Items	[redacted]	[redacted]
Economic Adjustment	[redacted]	[redacted]
Risk Reserves	[redacted]	[redacted]
Capital Cost + Risk Reserves	[redacted]	[redacted]

3.2.4 LIFE CYCLE COSTS

Capital Costs

Present Value of Life Cycle Costs	Option 1a - Base Building plus Base Building plus NLC and GHG reduction (lowest cost site)	Option 1b – Base Building plus NLC, GHG reduction and mass timber
Capital Cost + Risk Reserves	[redacted]	[redacted]
Cyclical Renewal Costs (40 years)	[redacted]	[redacted]
Annual Operating and Maintenance Costs (40 years)	[redacted]	[redacted]
Annual Utility/Energy Costs (40 years)	[redacted]	[redacted]
Total Life Cycle Costs (40 Years)	[redacted]	[redacted]
Total Life Cycle Costs - Present Value (40 Years)	[redacted]	[redacted]

3.2.5 FACILITY CONDITION INDEX

As this option is a new school, the Facility Condition Index (FCI) is expected to be 0.00.

3.2.6 UTILIZATION

Same as Option 1. Refer to 3.1.6 Utilization

3.2.7 SCHOOL PROGRAM

Same as Option 1. Refer to 3.1.7 School Program

3.2.8 GENDER-BASED ANALYSIS+

Same as Option 1. Refer to 3.1.8 Gender-Based Analysis+

3.2.9 OPTION ADVANTAGES AND DISADVANTAGES

Advantages

- No natural gas connection required
- Lower annual operating costs
- The project is not impacted by the escalating carbon tax
- Less complex foundations required for the building.
- Staff parking is separated from drop-off zone.
- Flexibility to demolish the existing school at any stage of the project.

- Location of new playfield is mainly where the existing playfield is located and therefore less grading is required.

Disadvantages

- Larger electrical service required
- Higher cost than Option 1

3.2.10 PROCUREMENT METHOD

The recommended procurement method for this option would be Design-Bid-Build. Refer to Section 6.2 for a more detailed analysis.

3.2.11 PROJECT RISK ASSESSMENT

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Option 1a Risk Reserve Costs	Option 1b Risk Reserve Costs
a	Hazardous Materials & Remediation	Medium	Low	In addition to pre-demolition hazardous survey done as part of the Concept Plan, further appropriate hazmat remediation must be done prior to the full demolition of the school.	[redacted]	[redacted]
b	Unforeseen Soils Issues – Sloping Site/ Overburden	High	High	Confirm thoroughness of geotechnical reports. Selective building and site investigations during working drawing stage. Include requests for unit rates in tender. Review of historical records and budget cash allowance for tender. Further geotechnical review and soil testing required during working drawing stage.	[redacted]	[redacted]
c	Unforeseen Environmental Issues with Site	Medium	Medium	Review of historical records and budget cash allowance for tender. Thorough review of site during working drawing stage. Hire consultant to review site and provide	[redacted]	[redacted]

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Option 1a Risk Reserve Costs	Option 1b Risk Reserve Costs
				report on condition of soil.	[redacted]	[redacted]
d	Approval/ permit delays affecting project schedule – construction delay, wet weather costs, etc.	Medium	High	Ensure that there is clear communication between consultant team and contractor to address approval and permit issues in a timely manner as they come up.	[redacted]	[redacted]
e	Trade Shortages, Market Condition, Supply Chain - trades not willing to come to North Shore causing higher tender prices and/or delay to project completion. Contractor unable to get specified material in a timely manner due to shortages caused by COVID and other issues leading to higher prices and/or delay to project completion	High	High	Tender project at a favourable time in the year when trades are looking for more work. Provide adequate time for trades to provide proper bids to general contractors. Ensure that there is clear communication between consultant team and contractor to address supply issues in a timely manner and to order materials so that they are available on site when needed.	[redacted]	[redacted]
f	Unforeseen Construction Delays, Approvals – Allowance for completion date delay due to construction start delay due to building permit issues, tender award issues, etc.	Medium	Medium	Ensure that there is constant and clear communication between consultant team, SD44, and city planning department to address issues required to keep the building permit moving forward.	[redacted]	[redacted]
g	City Building Bylaw & Offsite – on-site, off-site, code, etc.	Medium	Medium	Thorough review of building code and city by-laws during working drawing stage. Meet with City to confirm requirements. Some requirements may include:	[redacted]	[redacted]

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Option 1a Risk Reserve Costs	Option 1b Risk Reserve Costs
				• District Energy heat recovery plant • Capacity charge and utility premiums if plant must be collocated. • Roads and sidewalks around site to be upgraded to CNV standards Meet with LEC to determine the requirements for the building. Review the building with LEC prior to submitting building for permitting.	[redacted]	[redacted]
h	Mass Timber Risk – Supply risk and potential project delay	Medium	Medium	Work with the City early in the design process to ensure that they are onboard with the mass timber design and approach. Keep in contact with mass timber manufacturers to ensure that there is supply and availability to provide products for new school.	[redacted]	[redacted]

3.2.12 SCHEDULE

Same as Option 1. Refer to 3.1.12 Schedule. Option 1b carries an additional schedule risk due to the potential for delays in the mass timber design and construction. To ensure that there is no delay, the design team will work with the city early on so that they are on board with the design and approach to mass timber. The team will also engage with mass timber manufacturers during design phase to get their feedback on the design and details. Working with the manufacturers will help ensure that there is availability and supply available in the market for construction of the new school.

3.3 Option 2 – Base building plus NLC (alternate site location)

3.3.1 BACKGROUND

Same as Option 1. Refer to 3.1.1 Background.

3.3.2 SCOPE OF WORK

In Option 2, the base building is the same as Option 1 but is located and oriented at an alternative location on site. The floor plan layout has been adjusted to make best use of the site, but the floor areas and massing remain the same. The school building will be located on the western portion of the site where the existing school and gravel playfield are currently. The existing school building will need to be demolished before construction on the new school can begin. This adds 3 months to the base schedule for a total of 43.5 months from the start of schematic design. After the existing building is demolished, the soil will need to be tested by geotechnical consultants to confirm the depth to competent ground or till-like soil for the new building's foundations.

This option will have the same site preparation methods as Option 1. The tennis courts and a large portion of Cloverley Park will need to be demolished and re-graded to accommodate the new 45 m by 70 m playfield. The entrances at the north-east and south-east corner of the site will be refurbished. Any trees that are removed for regrading or construction purposes will be replaced as per City of North Vancouver bylaws. The existing playground will be removed and returned to owner. New playground and play equipment will be installed east of the new school building.

Vehicular access to the site will be located off of Hendry Avenue and will exit on to Cloverley Street. The staff parking lot is located off of the drop-off drive aisle. There will be a total of 35 parking stalls, including two handicap stalls, and 12 drop-off stalls on site. This option requires that a 1.2m high retaining wall be placed north of the drop-off drive aisle so that the drive aisle and school can be on a relatively flat elevation.

The structure of the building will be the same as Option 1 except for the western half of the school will be built using pad and strip footings with slab on grade while the eastern half will be built using structural slab on grade spanning between grade beams which are supported by pile caps. Refer to the structural report in Appendix D for more information regarding the proposed structural systems.

The mechanical systems will be the same as Option 1. Refer to the mechanical report in Appendix D for more information regarding the proposed mechanical systems.

The plumbing systems will be the same as Option 1. Refer to the mechanical report in Appendix D for more information regarding the proposed plumbing systems.

The electrical systems will be the same as Option 1. Refer to the electrical report in Appendix D for more information regarding the proposed electrical systems.

The civil upgrades will be similar to Option 1. Refer to the civil report in Appendix D for more information.

Figure 14: Option 2 Overall Proposed Site Plan

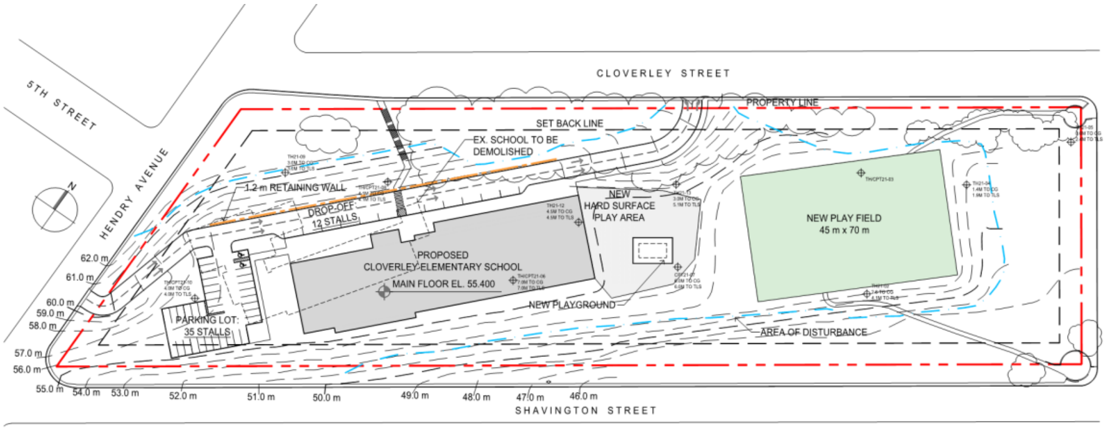


Figure 15: Option 2 Enlarged Proposed Site Plan

3.3.3 PROJECT COST

Supplementary Building Costs and Fees

Cost	Option 2 – Base building plus NLC (alternate site location)
Capital Cost w/o Risk Reserves	[redacted]
Supplemental Items	[redacted]
Economic Adjustment	[redacted]
Risk Reserves	[redacted]
Capital Cost + Risk Reserves	[redacted]

An option 2a (Alternate Site Location plus NLC and GHG reduction) and option 2b (Alternate Site Location plus NLC, GHG reduction and mass timber) were not costed due to the higher overall project cost compared to Option 1 and it would not be recommended to proceed.

3.3.4 LIFE CYCLE COSTS

Capital Cost

Life Cycle Costs	Option 2 – Base building plus NLC (alternate site location)
Capital Cost + Risk Reserves	[redacted]
Cyclical Renewal Costs (40 years)	[redacted]
Annual Operating and Maintenance Costs (40 years)	[redacted]
Annual Utility/Energy Costs (40 years)	[redacted]
Total Life Cycle Costs (40 Years)	[redacted]
Total Life Cycle Costs - Present Value (40 Years)	[redacted]

3.3.5 FACILITY CONDITION INDEX

As this option is a new school, the Facility Condition Index (FCI) is expected to be 0.00.

3.3.6 UTILIZATION

Same as Option 1. Refer to 3.1.6 Utilization

3.3.7 SCHOOL PROGRAM

Same as Option 1. Refer to 3.1.7 School Program

3.3.8 GENDER-BASED ANALYSIS+

Same as Option 1. Refer to 3.1.8 Gender-Based Analysis+

3.3.9 OPTION ADVANTAGES AND DISADVANTAGES

Advantages

- Location of new playfield is mainly where the existing playfield and tennis courts are located and therefore less grading is required.
- A portion of the existing Cloverley Park can remain.
- Closer to city services.
- Easier traffic management.

Disadvantages

- More complex foundation required due to sub-grade conditions
- Less energy efficient than Option 1a/1b
- A 1.2m high retaining wall is required along the drop-off drive aisle.
- Existing building must be demolished prior to construction of new building which can result in significant construction delays if there are any issues with demolition and/or soil not being stable. If the soil is found to not be stable enough for the foundation design, design team will need to the revise the foundation design which will adds to the cost and construction schedule.

3.3.10 PROCUREMENT METHOD

The recommended procurement method for this option would be Design-Bid-Build. Refer to Section 6.2 for a more detailed analysis.

3.3.11 PROJECT RISK ASSESSMENT

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Risk Reserve Costs
a	Hazardous Materials & Remediation	Medium	Low	In addition to pre-demolition hazardous survey done as part of the Concept Plan, further appropriate hazmat remediation must be done prior to the full demolition of the school.	[redacted]
b	Unforeseen Soils Issues – Sloping Site/ Overburden	High	High	Confirm thoroughness of geotechnical reports. Selective building and site investigations during working drawing stage. Include requests for unit rates in tender. Review of historical records and budget cash allowance for tender. Further geotechnical review and soil	[redacted]

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Risk Reserve Costs
				testing required during working drawing stage.	
c	Unforeseen Environmental Issues with Site	Medium	Medium	Review of historical records and budget cash allowance for tender. Thorough review of site during working drawing stage. Hire consultant to review site and provide report on condition of soil.	[redacted]
d	Approval/ permit delays affecting project schedule – construction delay, wet weather costs, etc.	Medium	High	Ensure that there is clear communication between consultant team and contractor to address approval and permit issues in a timely manner as they come up.	[redacted]
e	Trade Shortages, Market Condition, Supply Chain - trades not willing to come to North Shore causing higher tender prices and/or delay to project completion. Contractor unable to get specified material in a timely manner due to shortages caused by COVID and other issues leading to higher prices and/or delay to project completion	High	High	Tender project at a favourable time in the year when trades are looking for more work. Provide adequate time for trades to provide proper bids to general contractors. Ensure that there is clear communication between consultant team and contractor to address supply issues in a timely manner and to order materials so that they are available on site when needed.	[redacted]
f	Unforeseen Construction Delays, Approvals – Allowance for completion date delay due to construction start delay due to building permit issues, tender award issues, etc.	Medium	Medium	Ensure that there is constant and clear communication between consultant team, SD44, and city planning department to address issues required to keep the building permit moving forward.	[redacted]
g	City Building Bylaw & Offsite – on-site, off-site, code, etc.	Medium	Medium	Thorough review of building code and city by-laws during working drawing stage. Meet with City to confirm requirements. Some requirements may include:	[redacted]

Risk #	Risk Description	Probability	Impact	Mitigation Strategy	Risk Reserve Costs
				• District Energy heat recovery plant • Capacity charge and utility premiums if plant must be collocated. • Roads and sidewalks around site to be upgraded to CNV standards Meet with LEC to determine the requirements for the building. Review the building with LEC prior to submitting building for permitting.	

3.3.12 SCHEDULE

Milestones	Schedule		Duration (Months)
	Start Date	Finish Date	
CPFA	n/a	March 31, 2023	-
Consultant Procurement	April 3, 2023	May 17, 2023	1.5
Schematic Design/ Design Development	May 18, 2023	September 15, 2023	4
Cost Analysis & Ministry Approval to Proceed	September 18, 2023	October 13, 2023	1
Construction Documents	October 16, 2023	June 14, 2024	8
Tender	June 17, 2024	July 19, 2024	1
Bid Review & Contract Award	July 22, 2024	August 16, 2024	1
Excavation Permit	April 15, 2024	August 16, 2024	4
Permits (Foundation-to-Grade, Building, etc.)	August 19, 2024	April 18, 2025	8
Demolition	August 19, 2024	November 15, 2024	3
Construction	November 18, 2024	November 20, 2026	24
Substantial Completion	n/a	September 18, 2026	-
Owner Supplied Equipment & Furnishings	September 18, 2026	November 20, 2026	2
Final Completion	n/a	November 23, 2026	-
Total			43.5

Note: Shaded Milestones indicated that the milestone is happening concurrently in the schedule. Please refer to start and finish dates.

4.0 Comparison of Options

4.1 Quantitative Analysis

		Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a – Base Building plus NLC and GHG reduction (lowest cost site location)	Option 1b – Base Building plus NLC, GHG reduction and Mass Timber (lowest cost site location)	Option 2 – Base Building plus NLC (alternate site location)
Area + Capacity	Existing	n/a	n/a	n/a	n/a
Retained Area - m^2		0	0	0	0
New Area - m^2		4,120	4,120	4,120	4,120
NLC Area - m^2		330	330	330	330
Community Area – m^2		145	145	145	145
Total Area (including NLC) - m^2		**4,595**	**4,595**	**4,595**	**4,595**
Capacity (Operating)		546	546	546	546
Utilization	n/a	90%*	90%*	90%*	90%*
Life Cycle Cost					
Capital Cost w/o Risk Reserves		[redacted]	[redacted]	[redacted]	[redacted]
Supplemental Items		[redacted]	[redacted]	[redacted]	[redacted]
Economic Adjustment		[redacted]	[redacted]	[redacted]	[redacted]
Risk Reserves		[redacted]	[redacted]	[redacted]	[redacted]
Capital Cost + Risk Reserves		[redacted]	[redacted]	[redacted]	[redacted]
Cyclical Renewal Costs (40 years)		[redacted]	[redacted]	[redacted]	[redacted]
Annual Operating and Maintenance Costs (40 years)		[redacted]	[redacted]	[redacted]	[redacted]
Annual Utility/Energy Costs (40 years)		[redacted]	[redacted]	[redacted]	[redacted]
Total Life Cycle Costs (40 Years)		[redacted]	[redacted]	[redacted]	[redacted]
Total Life Cycle Costs – Present Value (40 years)		[redacted]	[redacted]	[redacted]	[redacted]
Variance to lowest cost option		[redacted]	[redacted]	[redacted]	[redacted]
Procurement Method		Design-Bid-Build	Design-Bid-Build	Design-Bid-Build	Design-Bid-Build
Total Schedule (months)		40.5	40.5	40.5	43.5
Facility Condition Index (FCI)		0.00	0.00	0.00	0.00

*Projected utilization at school completion in 2026.

4.2 Qualitative Analysis

	Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a and 1b – Base Building plus NLC and GHG reduction (lowest cost site location and Plus Mass Timber construction for 1b)	Option 2 – Base Building plus NLC (alternate site location)
Advantages	• Less complex foundations required for the building. • Staff parking is separated from drop-off zone. • Flexibility to demolish the existing school at any stage of the project. • Location of new playfield is mainly where the existing playfield is located and therefore less grading is required. • Lowest cost option.	• No natural gas connection required • Lower annual operating costs • The project is not impacted by the escalating carbon tax • Less complex foundations required for the building. • Staff parking is separated from drop-off zone. • Flexibility to demolish the existing school at any stage of the project. • Location of new playfield is mainly where the existing playfield is located and therefore less grading is required.	• Location of new playfield is mainly where the existing playfield and tennis courts is located and therefore less grading is required. • A portion of the existing Cloverley Park can remain. • Closer to city services. • Easier traffic management.

	Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a and 1b – Base Building plus NLC and GHG reduction (lowest cost site location and Plus Mass Timber construction for 1b)	Option 2 – Base Building plus NLC (alternate site location)
Disadvantages	• Less energy efficient than Option 1a/1b	• Larger electrical service required • Higher cost than Option 1	• More complex foundation required due to sub-grade conditions • Less energy efficient than Option 1a/1b • A 1.2m high retaining wall is required along the drop-off drive aisle. • Existing building must be demolished prior to construction of new building which can result in significant construction delays if there are any issues with demolition and/or soil not being stable. If the soil is found to not be stable enough for the foundation design, design team will need to the revise the foundation design which will adds to the cost and construction schedule.

4.3 Risk Analysis

Risk #	Risk Description	Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a – Base Building plus NLC and GHG reduction (lowest cost site location)	Option 1b – Base Building plus NLC, GHG reduction and Mass Timber (lowest cost site location)	Option 2 – Base Building plus NLC (alternate site location)
a	Hazardous Materials & Remediation	[redacted]	[redacted]	[redacted]	[redacted]
b	Unforeseen Soils Issues – Sloping Site/ Overburden	[redacted]	[redacted]	[redacted]	[redacted]
c	Unforeseen Environmental Issues with Site	[redacted]	[redacted]	[redacted]	[redacted]

Risk #	Risk Description	Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a – Base Building plus NLC and GHG reduction (lowest cost site location)	Option 1b – Base Building plus NLC, GHG reduction and Mass Timber (lowest cost site location)	Option 2 – Base Building plus NLC (alternate site location)
d	Approval/ permit delays affecting project schedule – construction delay, wet weather costs, etc.	[redacted]	[redacted]	[redacted]	[redacted]
e	Trade Shortages, Market Condition, Supply Chain - trades not willing to come to North Shore causing higher tender prices and/or delay to project completion. Contractor unable to get specified material in a timely manner due to shortages caused by COVID and other issues leading to higher prices and/or delay to project completion	[redacted]	[redacted]	[redacted]	[redacted]
f	Unforeseen Construction Delays, Approvals – Allowance for completion date delay due to construction start delay due to building permit issues, tender award issues, etc.	[redacted]	[redacted]	[redacted]	[redacted]
g	City Building Bylaw & Offsite – on-site, off-site, code, etc.	[redacted]	[redacted]	[redacted]	[redacted]
h	Mass Timber Risk – Supply risk and potential project delay	[redacted]	[redacted]	[redacted]	[redacted]
	Economic Adjustment	[redacted]	[redacted]	[redacted]	[redacted]
	Post-project Completion Audit Allowance	[redacted]	[redacted]	[redacted]	[redacted]
Total Risk Reserve + Escalation Cost		[redacted]	[redacted]	[redacted]	[redacted]

4.4 Life Cycle Costs Analysis

4.4.1 LIFE CYCLE COST

LIFE CYCLE COST ANALYSIS	Option 1 – Base Building plus NLC (lowest cost site location)	Option 1a – Base Building plus NLC and GHG reduction (lowest cost site location)	Option 1b – Base Building plus NLC, GHG reduction and Mass Timber (lowest cost site location	Option 2 – Base Building plus NLC (alternate site location)
Capital Cost w/o Risk Reserves	[redacted]	[redacted]	[redacted]	[redacted]
Supplemental Items	[redacted]	[redacted]	[redacted]	[redacted]
Economic Adjustment	[redacted]	[redacted]	[redacted]	[redacted]
Risk Reserves	[redacted]	[redacted]	[redacted]	[redacted]
Capital Costs + Risk Reserves	[redacted]	[redacted]	[redacted]	[redacted]
Cyclical Renewal Costs (40 years)	[redacted]	[redacted]	[redacted]	[redacted]
Annual Operating and Maintenance Costs (40 years)	[redacted]	[redacted]	[redacted]	[redacted]
Annual Utility/Energy Costs (40 years)	[redacted]	[redacted]	[redacted]	[redacted]
Total Life Cycle Costs (40 Years)	[redacted]	[redacted]	[redacted]	[redacted]
Total Life Cycle Costs –Present Value (40 Years)	[redacted]	[redacted]	[redacted]	[redacted]
Variance to lowest cost option	[redacted]	[redacted]	[redacted]	[redacted]

Refer to Appendix B for the Life Cycle Cost Analysis by the quantity surveyor.

5.0 NEIGHBOURHOOD LEARNING CENTRE (NLC)

5.1 Neighbourhood Learning Centre (NLC)

Cloverley presents an opportunity for the school district to promote strong local partnerships by supporting community needs and provincial priorities. Through NLC funding, the project could accommodate 330 m^2 of multi-purpose space, which during school hours will support academics in indigenous, cultural, and artistic education. Outside of school hours this area can be used to facilitate before and after school care. The School District will also apply for additional grant funding through the Ministry of Children and Family Development's (MCFD) Childcare BC New Spaces Fund in the Spring/Summer of 2022 with a goal of adding two childcare programs to Cloverley:

- One program to support 25 spaces for children aged 30 months to school age
- One program to support 12 spaces for children under 36 months of age.

The City of North Vancouver has expressed interest in contributing funds to support Cloverley's community benefits. In addition to supplementing childcare funding, the CNV has shown interest in contributing towards an enhanced gymnasium to provide both space and storage for community use and programming.

A task force of regulatory bodies (City of North Vancouver (CNV) and District of North Vancouver (DNV)), experienced childcare service providers, licensing agencies (i.e. Vancouver Coastal Health), and organizations with potential available space met from September 2019 to June 2020 to analyze the demand for, access to, supply, and affordability of childcare on the North Shore. The CNV and DNV then each wrote their own separate Action Plans based on this study which were presented and approved at their respective councils in 2020.

The *City of North Vancouver's Child Care Action Plan 2021-2031* states that the existing child (0–12-year-olds) population in the CNV is 6,289 with a total of 1,694 child care spaces in 2019. The child population is projected to grow by 23% by 2030, which is approximately an additional 1,541 children. To maintain a current access rate of approximately 25 spaces for every 100 children 0 to 12 years old, 674 new child care spaces would need to be created in the CNV by 2031 in order to keep up with an increase in demand from the projected growth of the child population. The city's target is to create 1063 new licensed child care spaces over the next 10 years with target average access rates of 33 spaces per 100 children aged 0 to 2, 50 spaces per 100 children aged 3 to 5, and 33 spaces per 100 school-aged children.

In the plan, the CNV was split up into three Child Care Planning Areas: West Planning Area, Central Planning Area, and Eastern Planning Area – refer to figure 14 below. The proposed Cloverley Elementary School is located in the Eastern Planning Area which encompasses the area from St. Georges Avenue to the eastern edge of the CNV. The planning area has the largest population of children out of the three areas with approximately 2,994 children aged 0-12. In 2019, the access rate for child care in the area was 20 spaces per 100 children aged 0 to 2, 48 spaces per 100 children aged 3 to 5, and 9 spaces per 100 school-aged children. The child care access rate is close to the City's average. It is estimated that by 2030, the population of children in the area will grow to approximately 3,673 children which is an increase of 679. Additionally, the *District of North Vancouver's Child Care Action Plan* shows that in the nearby Lower Lynn area, there is a major deficiency in number of child care spaces with only 13 spaces per 100 children aged 0 to 2, 22 spaces per 100 children aged 3 to 5, and 0 spaces per 100 school-aged children.

Figure 16: City of North Vancouver Child Care Planning Areas

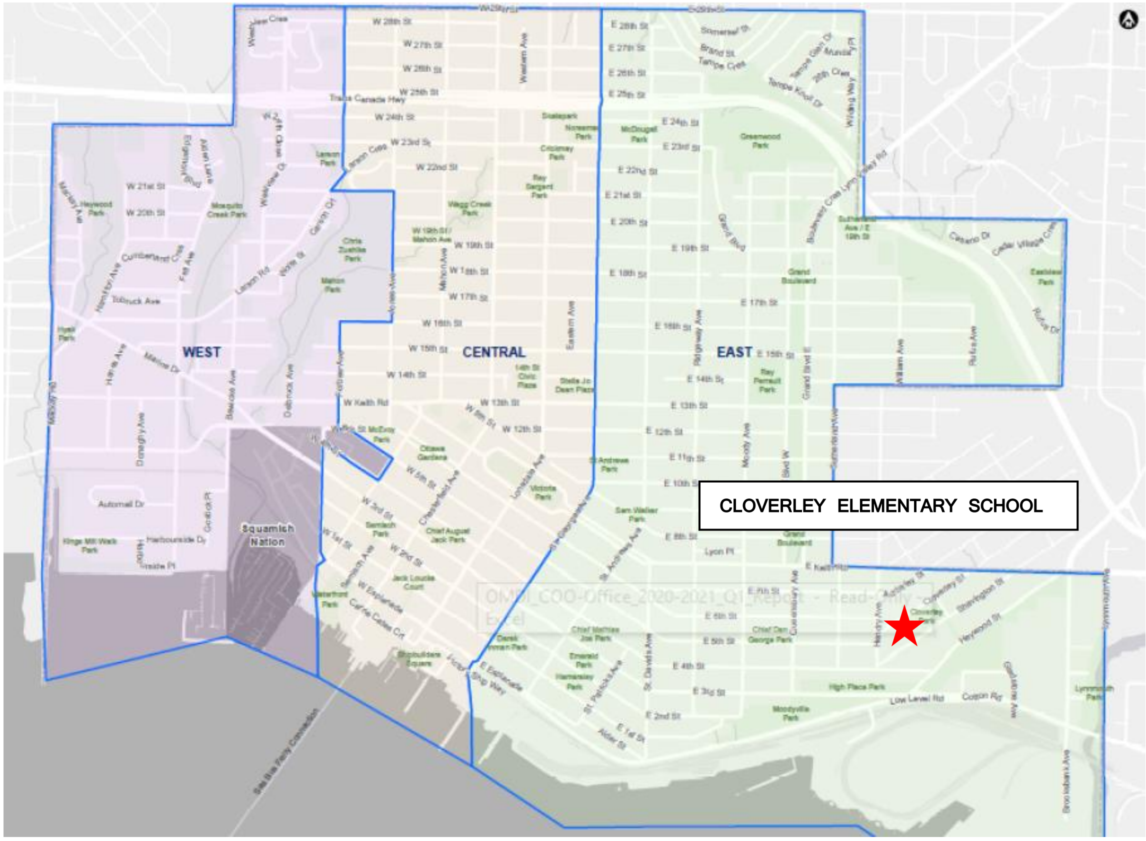


Image is from *City of North Vancouver Child Care Action Plan 2021-2031* found in Appendix H.

With these factors, Cloverley Elementary School is situated in a prime and favourable area for child care as it is surrounded by single-family housing and high child population. It is located between two major transportation routes (Keith Road and 3rd Avenue) which provides adjacency to public transportation within walking distance. As noted in both Child Care Action Plans from the CNV and the DNV, there is a deficiency of child care spaces in this area. The before and after school care program will provide support to parents and foster stronger ties with the local community, while also addressing a need for child care spaces.

If the MCFD grant application is successful, a new child care at Cloverley would also further help alleviate the child care space deficiencies. It allows for children and families already connected to the neighbourhood to stay within their neighbourhood. It would provide additional learning experiences as the children in the 3- to 5-year-old child care programs would have opportunities to see, become comfortable in, and understand the processes, expectations and rules as well as the daily routines of the larger school. This exposure to the elementary school will allow for pre-school aged children to seamlessly transition into elementary school with a pre-developed sense of awareness of school operations and spaces. School-age care offered on site will provide an efficient, recognized, and safe solution to families with working parents at this school. Refer to Appendix H for the *City of North*

Vancouver's Child Care Action Plan 2021-2031 and Appendix I for the *District of North Vancouver's Child Care Action Plan*.

5.2 Funding Relationship

The BC Government's mandated priorities are a major factor to North Vancouver School District's planning of NLC space in new schools. Childcare has been identified by all levels of government as a priority. The NLC space, as funded by the Ministry of Education (EDUC), will be used for before and after school care outside of school hours, and will support academics in indigenous, cultural, and artistic education during school hours. The Ministry of Education (EDUC) allows for a school of this size to have a budget of $2.1 million times the location factor for the NLC component, this results in the total budget being $3,948,000 (refer to Project Budget Estimate in Appendix A.)

The MCFD is potentially able to fund a childcare centre to a maximum of 1.5 million dollars based on the current funding of $40,000 per child space. The City of North Vancouver has expressed willingness to contribute financially as well, however, the amount of this contribution has yet to be determined. The Federal Government has not yet announced financial support for the construction of childcare facilities in the country.

Based on a recent study done by DA Architects + Planners and NVSD, the cost to create a child care in an existing school building is approximately $6600 per square meters. The school district believes that with MCFD funding an additional child care centre can be constructed on the property.

5.3 Management and Operational Relationship

The NVSD has a history of working in close collaboration with local municipalities, community partners, and agencies in the delivery of much-needed child care services for children and families. The NVSD will work to find a suitable licensed operator to the run the before and after school care and child care programs. The operator would be selected in accordance with NVSD Policy 810 – Child Care Programs on Board Property, considers the needs of the community, and comply with guidelines set out in the *City of North Vancouver's Child Care Action Plan 2021-2031*. The vision statement of the NVSD is *"We provide world-class instruction and a rich diversity of engaging programs to inspire success for every student and bring communities together to learn, share and grow."*

6.0 Recommendations

6.1 Recommended Option

The PDR recommends proceeding with Option 1b of building a new school on the eastern portion of the site. While Option1b is the recommended option, the City of North Vancouver has expressed an interest in potentially paying the cost premium differential to construct the new school on the west side of the property if it is economically viable and less costly than to reinstate a park on the west side of the property. NVSD recognizes the issues CNV brought up regarding building on the east side vs west side and would be willing consider going with their preferred option if the CNV pays for the cost premium differential. Further discussions with the City are required. Option 1b best addresses the climate emergency, current and future space shortfall in the family of schools, and meets the government's objective of "Wood First" while also ensuring the best use of the existing school site asset. The building is able to achieve an 87% GHG reduction for a 3% construction cost premium. The total maximum project cost is $[redacted] (including [redacted] in risk reserves and economic adjustment). Refer to Appendix A for the full Project Budget Estimate. It is recommended that the project be delivered through the Design-Bid-Build procurement methodology. The project schedule estimates the delivery period to be approximately 40.5 months from the start of CPFA. Potential project risk are summarized and risk mitigations methods are discussed.

6.2 Procurement Method Analysis

Three procurement project delivery options have been considered: Design-Bid-Build (Stipulated Price Contract), Construction Management, and Design-Build. North Vancouver School District (NVSD) tends to use Design-Bid-Build on new school projects depending on market conditions at the time of pre-tender and the complexity of the project. The NVSD has extensive experience with the traditional Design-Bid-Build procurement strategy (Stipulated Price), especially for simple additions and new schools. The NVSD does not have any recent projects completed with Design-Build. Design-build would be a less favourable approach as it tends to give the School District less day-to-day influence on the design and decision making and could potentially extend the timeline. Construction Management is typically used for more complicated, phased additions and seismic upgrades. See table on next page for a comparison of Design-Bid-Build, Design-Build and Construction Management. Refer to Section 8.0 School District Experience and Capacity which lists the procurement method for recently completed and ongoing projects. With all these factors considered, Design-Bid-Build is the preferred procurement method.

7.0 Implementation Milestones / Cash Flow Projections

	Schedule		
Milestones	Start Date	Finish Date	Duration (Months)
CPFA	n/a	March 31, 2023	-
Consultant Procurement	April 3, 2023	May 17, 2023	1.5
Schematic Design/ Design Development	May 18, 2023	September 15, 2023	4
Cost Analysis & Ministry Approval to Proceed	September 18, 2023	October 13, 2023	1
Construction Documents	October 16, 2023	June 14, 2024	8
Tender	June 17, 2024	July 19, 2024	1
Bid Review & Contract Award	July 22, 2024	August 16, 2024	1
Excavation Permit	April 15, 2024	August 16, 2024	4
Permits (Foundation-to-Grade, Building, etc.)	August 19, 2024	April 18, 2025	8
Demolition	August 19, 2024	November 15, 2024	3
Construction	August 19, 2024	August 14, 2022	24
Substantial Completion	n/a	June 15, 2026	-
Owner Supplied Equipment & Furnishings	June 16, 2026	August 14, 2026	2
Final Completion	n/a	August 17, 2026	-
Total			40.5

Cash Flow Projections:

Funding Source	2022/23	2023/24	2024/25	2025/2026	Total
Capital Plan	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
North Vancouver School District	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

8.0 School District Experience and Capacity

8.1.1 COMPLETED PROJECTS

School Name	Date	Ministry Funding ($ million)	NVSD Funding ($ million)	Final Cost ($ million)	Variance ($ million)	Procurement Method
Windsor Secondary	2017	$ 4.6	$ 0.6	$ 5.6	$ 0.4	Design, Bid, Build
Ross Road	2014	$ 0.0	$ 0.5	$ 0.5	$ 0.0	Design, Bid, Build
Queen Mary	2013	$ 15.7	$ 4.9	$ 20.6	$ 0.0	CM – At Risk
Mountainside	2013	$ 0.0	$ 3.3	$ 3.3	$ 0.0	CM – At Risk
Carson Graham	2012	$ 37.3	$ 0.0	$ 37.3	$ 0.0	CM – At Risk
Education Services Centre	2012	$ 0.0	$ 31.3	$ 31.3	$ 0.0	CM – At Risk
Environmental Learning Centre	2012	$ 0.0	$ 7.7	$ 7.7	$ 0.0	CM – At Risk
Ridgeway Elementary	2011	$ 17.4	$ 3.6	$ 21.0	$ 0.0	CM – At Risk
Carisbrooke	2009	$ 6.0	$ 0.0	$ 6.0	$ 0.0	Design, Bid, Build
Highlands Elementary	2009	$ 12.3	$ 0.0	$ 12.3	$ 0.0	Design, Bid, Build
Total		$ 93.3	$ 51.9	$ 145.6	$ 0.4	

8.1.2 UNIT-RATE COMPARISON

School Name	Project Type	Unit Rates $/m^2
Windsor Secondary	Seismic Upgrade – Renovation	$ 1,396.55
Queen Mary Elementary	Seismic Upgrade – Heritage Restoration – Renovation	$ 2,709.91
Carson Graham Secondary	Replacement	$ 2,833.76
Ridgeway Elementary	Seismic Upgrade – Heritage Restoration – Renovation	$ 2,696.76
Carisbrooke Elementary	Seismic Upgrade	$ 1,371.48
Highlands Elementary	Replacement	$ 2,107.43

8.1.3 ONGOING PROJECTS

School Name	Project Type	Estimated Cost
Argyle Secondary	Replacement	$ 69 Million
Handsworth Secondary	Replacement	$ 70 Million
Mountainside Secondary	Seismic Upgrade	$ 21 Million

9.0 Project Team

School District No. 44

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

PDR Consultant Team

[redacted]	[redacted]
	[redacted]
	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

Appendix C Design Aid Sheet

DESIGN AID SHEET FOR ELEMENTARY SCHOOLS

SCHOOL DISTRICT NO. 44 North Vancouver
LOCATION:
FACILITY NUMBER:
PROJECT NUMBER:

Existing Nom. Capacity	Proposed Nom. Capacity	Proposed Grade Config.	Operating Capacity
0	**60**	Kgn	**57**
0	**525**	Gr 1 - 7	**489**

SCHOOL NAME: **Cloverley Elementary School Replacement**
DATED: 18-Apr-22

This sheet is for use in the design procedures described in Section 2.5 of the Ministry of Education Area Standards (03/99)

PART 1 - BASIC AREAS

SPACE FUNCTION	A - EXIST.	B - ALLOWABLE	C - DEFICIT	D - NEW
ADMIN/HEALTH	**0.00**	110.00	110.00	**110.00**
GEN. INSTRUCTION	**0.00**	1,680.00	1,680.00	**1,680.00**
GEN STORAGE	**0.00**	80.00	80.00	**80.00**
GYM ACTIVITY	**0.00**	380.00	380.00	**380.00**
GYM ANCILLARY	**0.00**	65.00	65.00	**65.00**
MEDIA/TECH CENTRE	**0.00**	200.00	200.00	**200.00**
MULTI-PURPOSE	**0.00**	100.00	100.00	**100.00**
SPECIAL EDUCATION	**0.00**	240.00	240.00	**240.00**
MECHANICAL	**0.00**	105.00	105.00	**105.00**
KINDERGARTEN	**0.00**	330.00	0.00	**330.00**
DESIGN SPACE	**0.00**	690.00	690.00	**690.00**
* OTHER	**0.00**	140.00	140.00	**140.00**
SUB-TOTAL	**0.00**	Bi 4,120.00	4120.00	Di **4,120**

SURPLUS CLASSROOM AREA INCLUDED IN DESIGN SPACE

PART 2 - TOTAL AREAS

	A - EXISITING	D - NEW
TOTAL BASIC AREAS	Ai 0.00	Di **4,120**
		Ei 0
TOTAL GROSS ALLOWABLE AREA:		Fi **4,120**

NOTES:
Kindergarten: (90 m^2 * 3K) + (20 m^2 * 3K) = 330 m^2
Other: Stairs and Elevator

Comments:	**m^2**
ADMIN/HEALTH	110
GEN. INSTRUCTION	1,680

Appendix D Supplementary Information

1. Architectural Drawings by DA Architects + Planners; November 10, 2022
2. Structural Report by Bush, Bohlman & Partners; February 19, 2022
3. Mechanical Report by Integral Group; October 8, 2021
4. Electrical Report by PBX Engineering; March 11, 2022
5. Civil Report by Aplin Martin; March 14, 2022
6. Geotechnical Report by Thurber Engineering; May 25, 2021

EXISTING OVERALL SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:1000 2022.11.10

DA Architects + Planners

North Vancouver
School District
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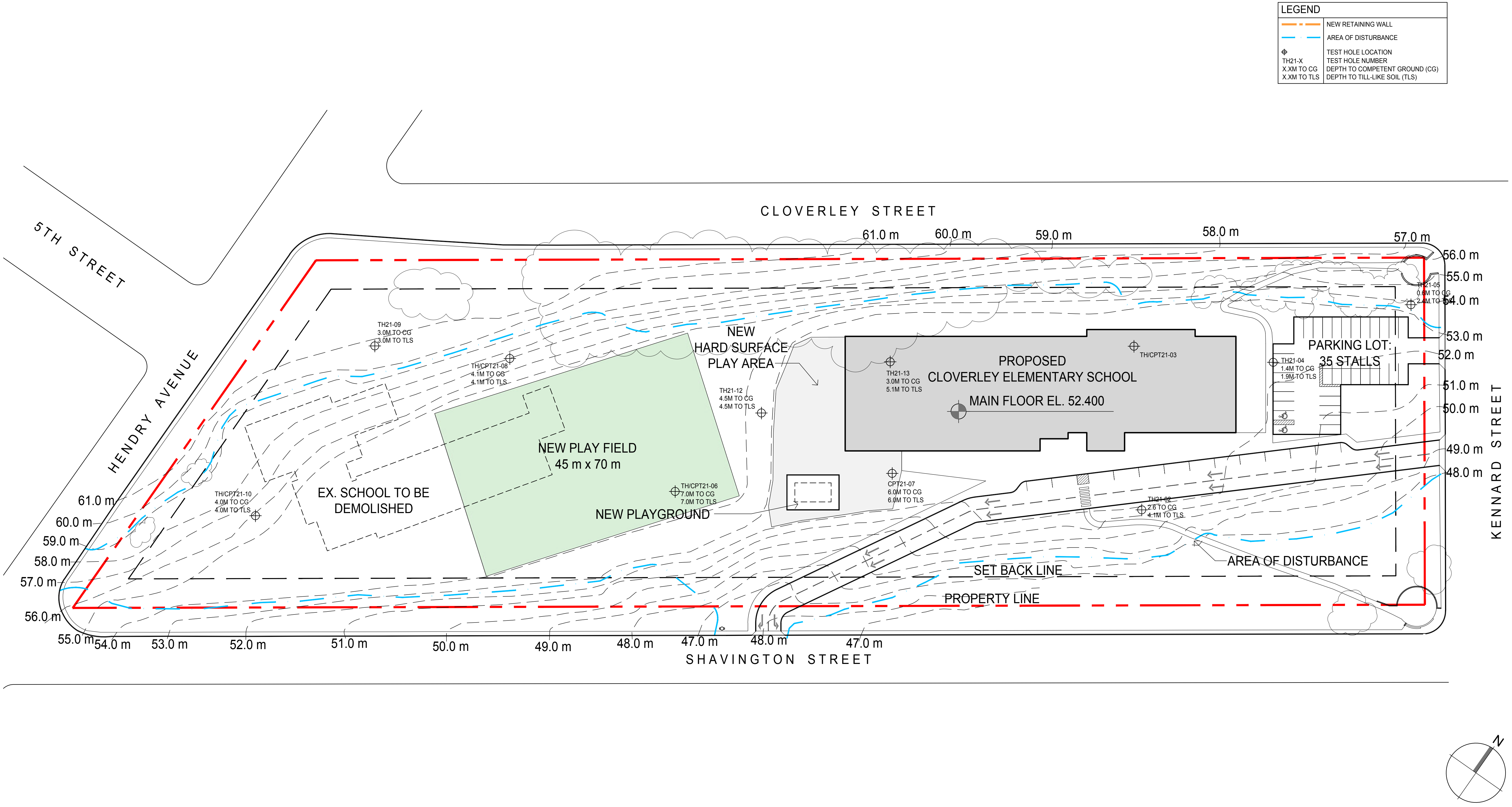

OPTION 1, 1a, & 1b PROPOSED SITE PLAN
CLOVERLEY ELEMENTARY SCHOOL PDR

1:1000 2022.11.10

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North Vancouver School District
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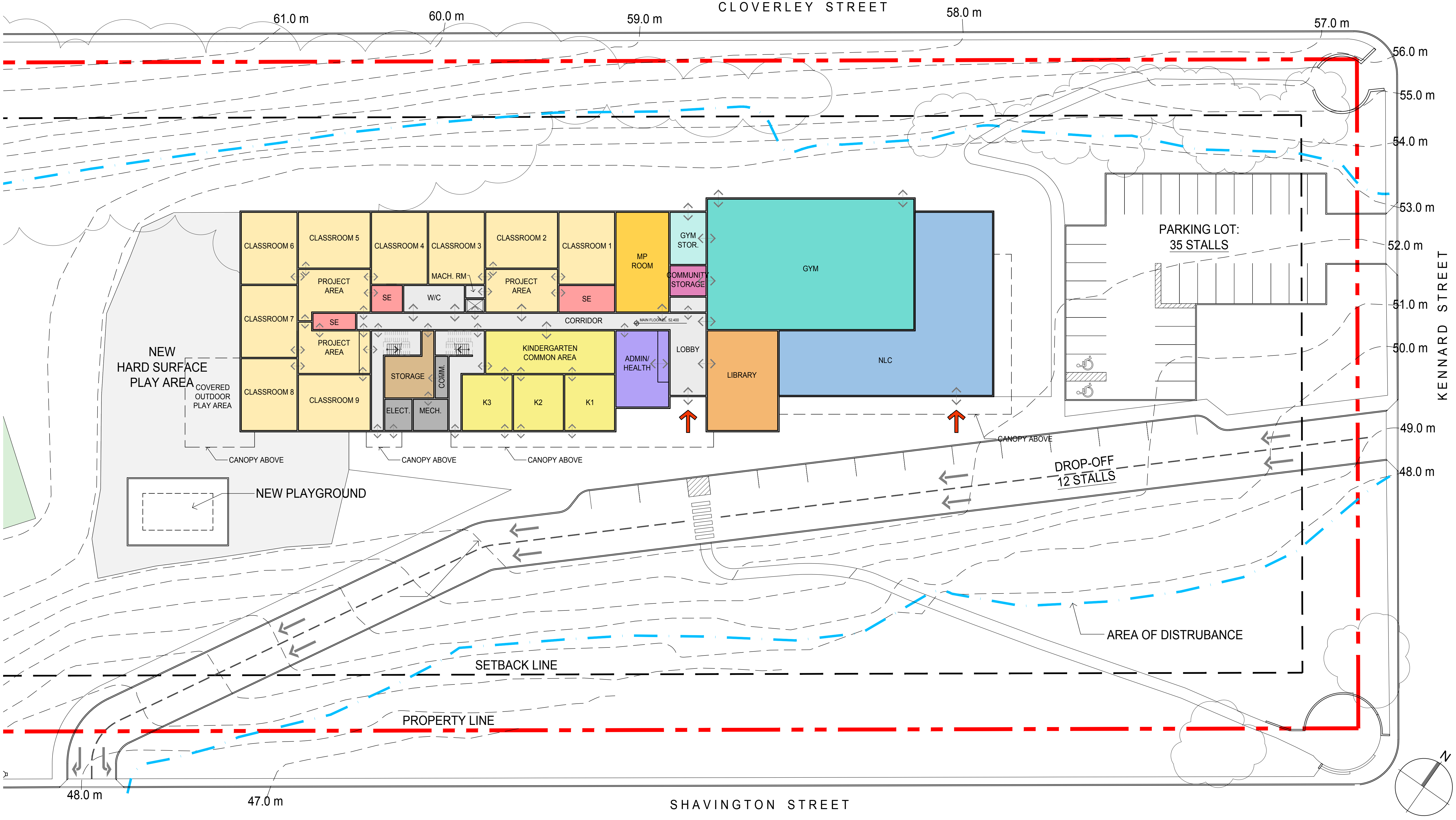

OPTION 1, 1a, & 1b ENLARGED PROPOSED SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:500 2022.11.10

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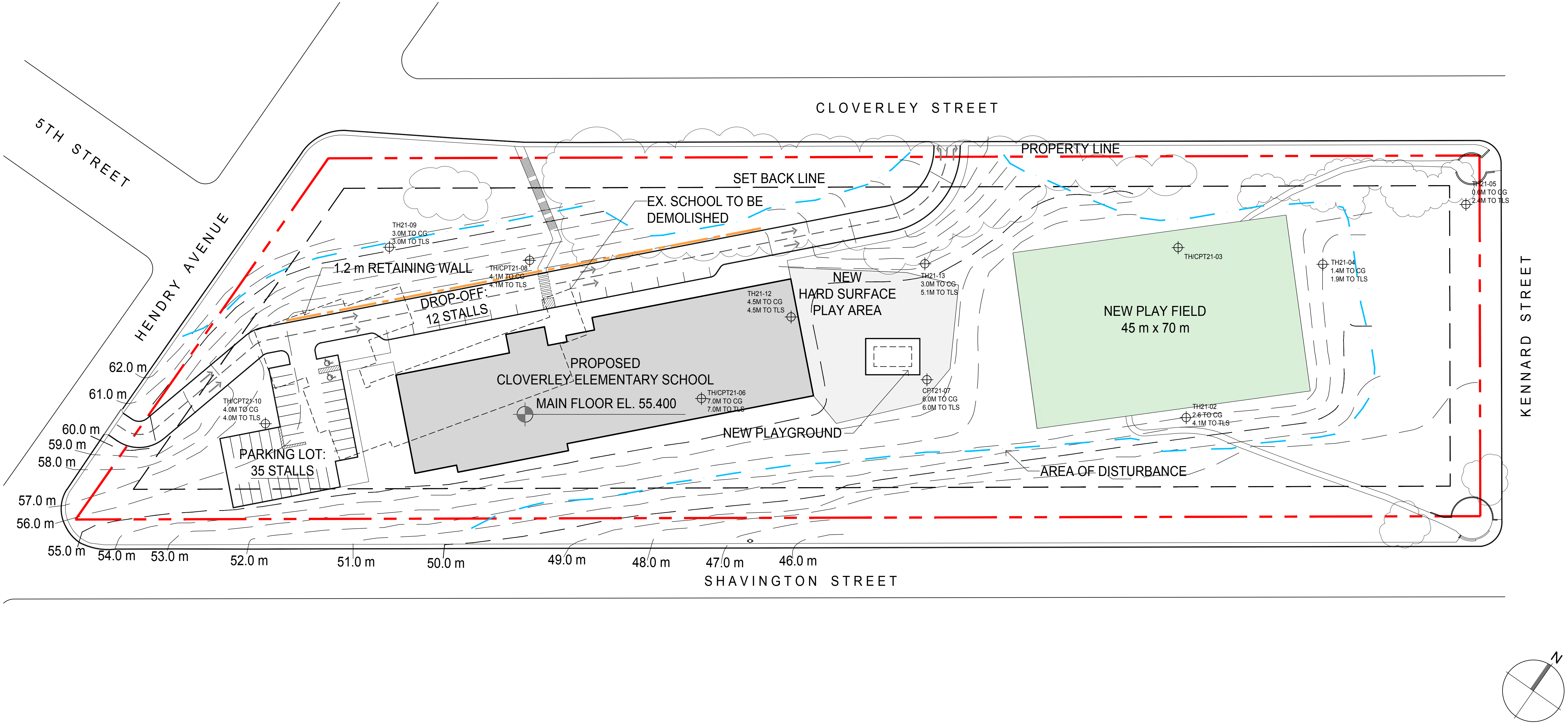
LEGEND	
🟧	NEW RETAINING WALL
🟦	AREA OF DISTURBANCE
⌖	TEST HOLE LOCATION
TH21-X	TEST HOLE NUMBER
X.XM TO CG	DEPTH TO COMPETENT GROUND (CG)
X.XM TO TLS	DEPTH TO TILL-LIKE SOIL (TLS)



OPTION 2 PROPOSED SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:1000 2022.11.10

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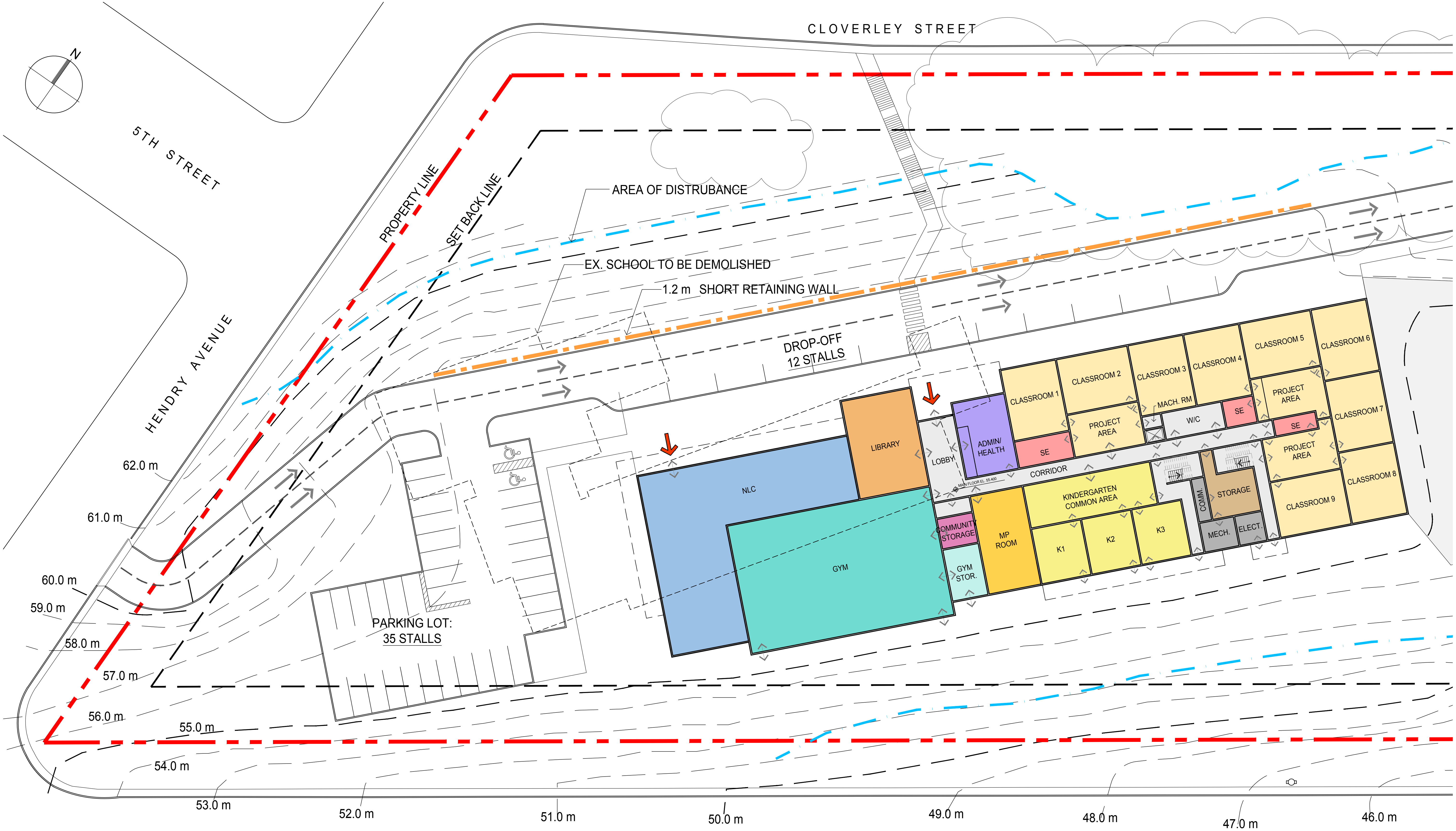

OPTION 2 ENLARGED PROPOSED SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:500 2022.11.10

DA Architects + Planners

North Vancouver School District
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PROGRAM	DAS (m^2)	ACTUAL (m^2)
REPLACEMENT SCHOOL PROGRAM		
ADMIN/ HEALTH	110	110
GENERAL INSTRUCTION	1680	1680
GENERAL STORAGE	80	80
GYM ACTIVITY	380	380
GYM ANCILLARY	65	65
MEDIA/ TECH.	200	200
MULTIPURPOSE	100	100
SPECIAL ED.	240	240
MECHANICAL	105	105
KINDERGARTEN	270	270
DESIGN SPACE	750	750
OTHER	140	140
SUBTOTAL:	**4120**	**4120**
ADDITIONAL PROGRAMS		
NEIGHBOURHOOD LEARNING CENTRE (NLC)	330	330
COMMUNITY SPACE	0	145
SUBTOTAL:	**330**	**445**
TOTAL AREA	**4450**	**4595**

TOTAL FLOOR AREA	**DAS (m^2)**	**ACTUAL (m^2)**
LEVEL 01 FLOOR AREA		2924
LEVEL 02 FLOOR AREA		1671
TOTAL AREA:	**4450**	**4595**

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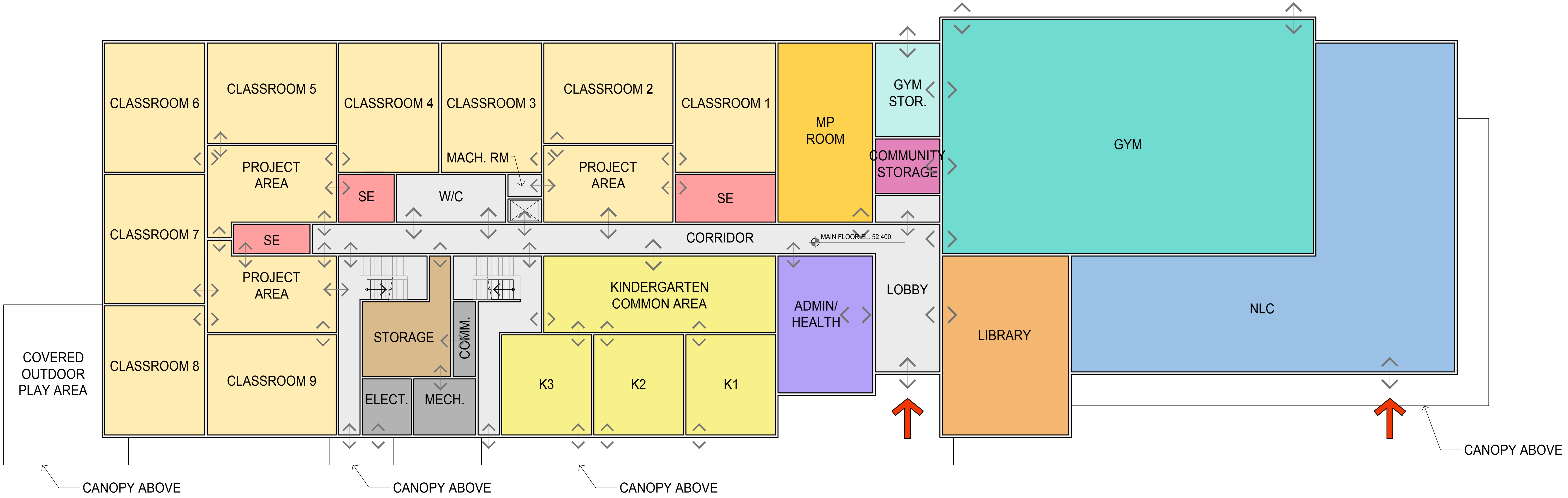
AREA SUMMARY

CLOVERLEY ELEMENTARY SCHOOL PDR

2022.11.10

LEGEND

- 🟪 ADMIN/ HEALTH
- 🟨 GENERAL INSTRUCTION
- 🟫 GENERAL STORAGE
- 🟩 GYM ACTIVITY
- 🟩 GYM ANCILLARY
- 🟧 MEDIA/ TECH.
- 🟨 MULTIPURPOSE
- 🟥 SPECIAL ED.
- ◼ MECHANICAL
- 🟨 KINDERGARTEN
- ⬜ DESIGN SPACE
- 🟦 NLC
- 🟩 OUTDOOR PLAY AREA
- 🟪 COMMUNITY SPACE



LEVEL 01 FLOOR PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:300 2022.11.10

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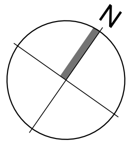
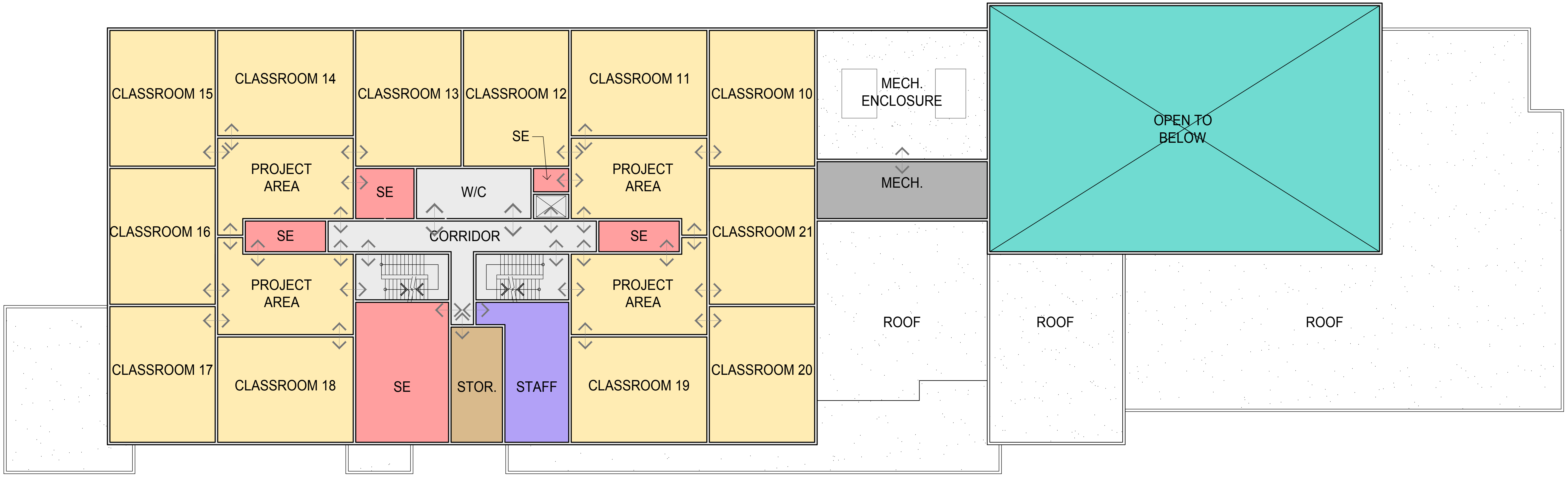


LEGEND

- 🟪 ADMIN/ HEALTH
- 🟨 GENERAL INSTRUCTION
- 🟫 GENERAL STORAGE
- 🟩 GYM ACTIVITY
- 🟩 GYM ANCILLARY
- 🟧 MEDIA/ TECH.
- 🟨 MULTIPURPOSE
- 🟥 SPECIAL ED.
- ⬛ MECHANICAL
- 🟨 KINDERGARTEN
- ⬜ DESIGN SPACE
- 🟦 NLC
- 🟩 OUTDOOR PLAY AREA
- 🟪 COMMUNITY SPACE



LEVEL 02 FLOOR PLAN

CLOVERLEY ELEMENTARY SCHOOL PDR

1:300 2022.11.10

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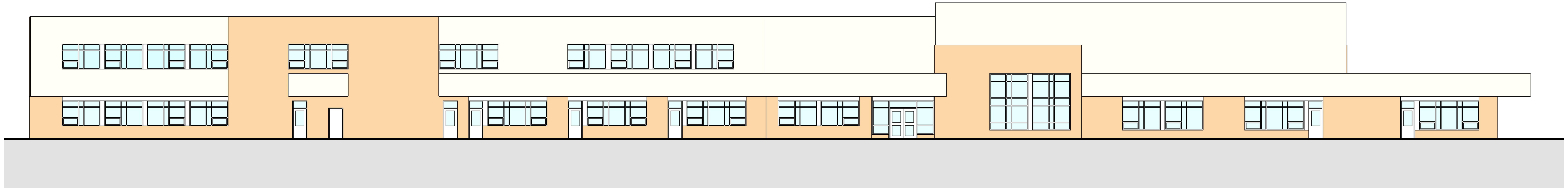
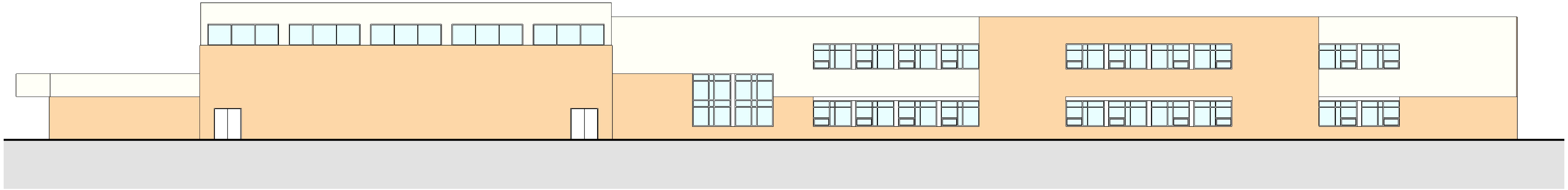


1 SOUTH ELEVATION
-
1:300



2 NORTH ELEVATION
-
1:300

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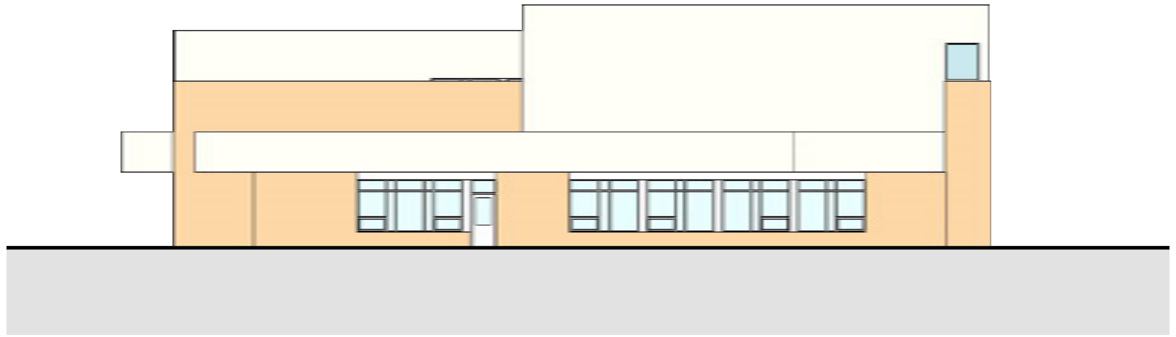
ELEVATIONS

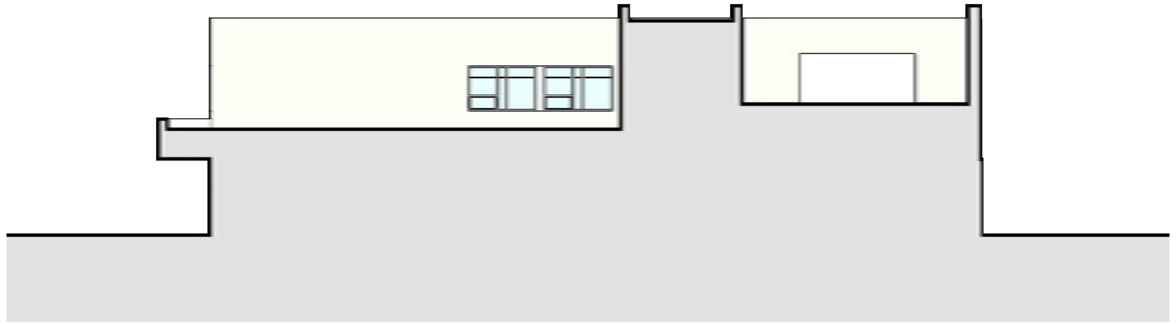
CLOVERLEY ELEMENTARY SCHOOL PDR

1:300 2022.11.10

1 WEST ELEVATION
-
1:300



2 EAST ELEVATION
-
1:300



3 PARTIAL EAST ELEVATION
-
1:300

ELEVATIONS

CLOVERLEY ELEMENTARY SCHOOL PDR

1:300 2022.11.10

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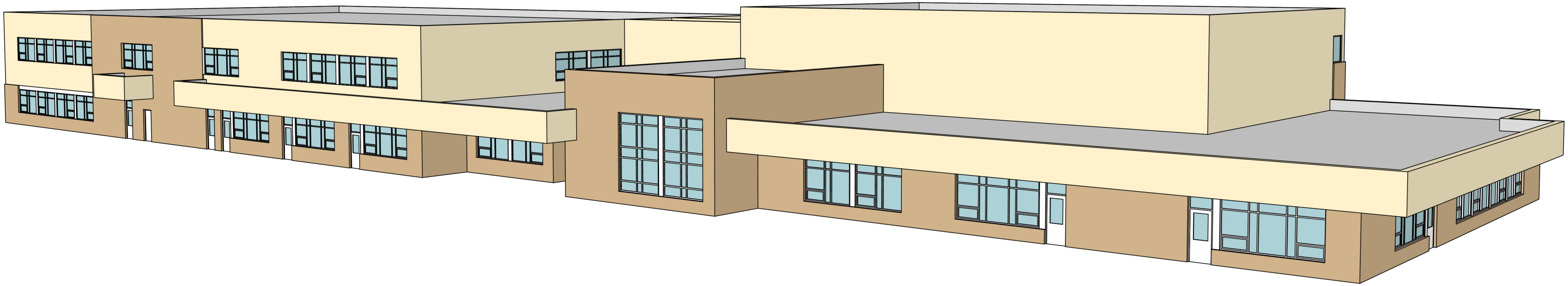

PERSPECTIVE - VIEW FROM EAST

CLOVERLEY ELEMENTARY SCHOOL PDR

NTS 2022.11.10

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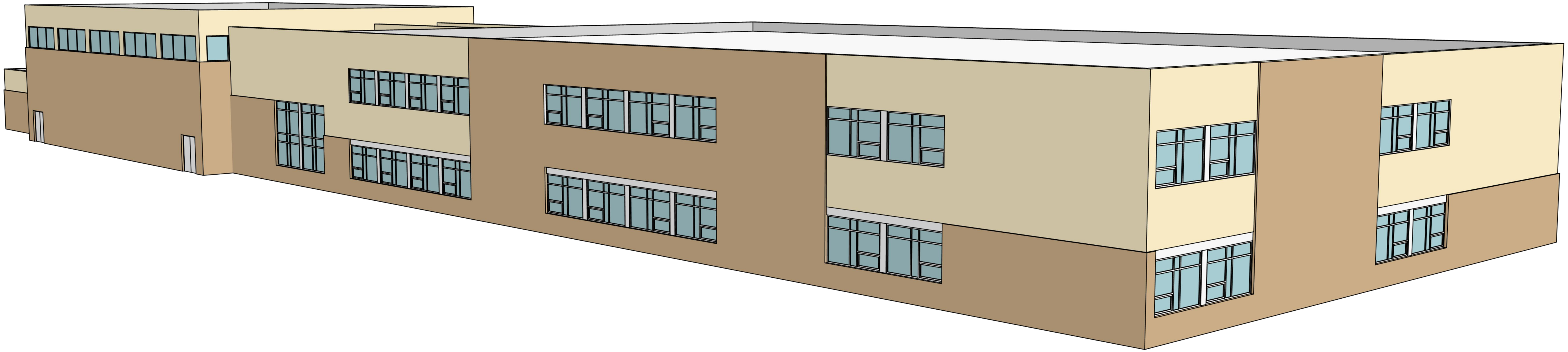

PERSPECTIVE - VIEW FROM WEST

CLOVERLEY ELEMENTARY SCHOOL PDR

NTS 2022.11.10

DA Architects + Planners

North Vancouver School District
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[redacted]
North Vancouver School District No. 44
2121 Lonsdale Ave, North Vancouver, BC V7M 2K6

February 19, 2022
Project Number 8171

Re: Cloverley Elementary Replacement School PDR Structural Report

[redacted]

The existing Cloverley Elementary School is located at 440 Hendry Ave in North Vancouver. The proposed replacement school would be built on the same plot of land. DA Architects have outlined 3 options for locating the replacement school. For this purpose they have used an indicative school, for which we have the following structural parameters:

Item	**Properties**
Number of stories	2
Super-structure	Steel frame
Seismic Force Resisting System	Concentrically braced steel frames
Classroom bay sizes	8m x 10m
Roof construction	40mm Metal deck on OWSJ/Rolled Beams
Suspended floor construction	100mm topping on 40mm deck on OWSJ/Rolled Beams
Ground floor construction	Varies – see below
Typical interior column specified loads (based on a tributary area of 50m^2) not including ground floor	Snow = 156kN; Live = 144kN; Dead = 263kN
Typical exterior column specified loads (based on a tributary area of 40m^2) not including ground floor	Snow = 124kN; Live = 96kN: Dead = 210kN

See SSK-01 in the appendix for proposed part plans for framing in the classroom areas and gymnasium roof.

Geotechnical Investigation

A geotechnical report, dated May 25, 2021, was prepared by Thurber Engineering. The report documented the results of numerous test holes scattered across the entire school site. At each test hole, a depth to competent ground and/or depth to till was provided. The variation in these depths over the site is between 1.4m to 7m. Site Class D is recommended for seismic design.

Two types of foundations were recommended. The first was to use conventional pad and strip footings bearing on either competent ground/till or engineered fill over competent ground/till. For this the allowable bearing pressure was 150kPa (SLS) and the ultimate pressure was 200kPa (ULS). This method could involve considerable excavation to remove the unwanted material above competent ground and then backfill to the desired level.

The second option was to pile the building. Either helical piles or steel pipe piles filled with grout would be acceptable. See SSK-02 the approx. location where piles are recommended due to the depth of excavation required.

Bush, Bohlman & Partners enquired about a third option where the proposed school building would be straddling both the piled zone and the area where conventional footings would be acceptable. In an August 6, 2021 email, Thurber indicated that post-construction settlements could be mitigated between a piled and unpiled areas of the school using pad footings design using an SLS of 50kPa. Thurber has recommended for this third combined option, that additional test holes are completed under the proposed school footprint to better refine the transition between the two areas. This will help refine exactly where the oversized footings are located.

Below is commentary on what would be required for foundation and ground level construction for each option.

Options 1 and 2: East

Structurally options 1 and 2 are the same. The school is situated to the east portion of the property. Depth to competent ground ranges from 1.4 to 6m in depth.

For the shallower depths (east of the piled zone shown in SSK-02) we would recommend excavating down to competent ground and back-filling with engineered fill. Foundations would be conventional pad and strip footings with a slab on grade located min 300mm above top of footing to provide adequate room for below grade services.

For the deeper sections (west of the piled zone shown in SSK-02) we would recommend supporting the building on steel piles. Ground construction would consist of a structural slab on grade, spanning between grade beams which in turn are supported by pile caps. We have assumed factored pile capacities of 600kN for the 305mm diameter grout filled steel piles and 300kN for the 102mm diameter steel helical piles. Both would be embedded into the till. Below grade site services would have to be hung to the underside of the suspended ground slab and the future below grade plumbing modifications would be very costly. Additionally at this location the Thurber Geotechnical report has identified potentially liquefiable soils. This will have to be taken into account in the design of the piled foundation system.

To accommodate the difference in post-construction settlement between the piled and conventional foundation supported systems, we propose one gridline of oversized footings. These footings have been sized for 50kPa SLS, which is only 33% of the bearing pressure to design the other conventional footings.

See SSK-03 for approximate sizes and dimensions for the foundation system.

Option 3: West

Option 3 proposes to locate the new school partially over the footprint of the existing school and extending East, although it lies predominantly on the West side of the site. Depth to competent ground ranges from 3 to 7m below existing grade. Similar to Options 1&2, we would recommend a combination of piles and conventional foundations to support the school, with a line of oversized footings at the transition zone. See the description in Option 1&2 above and SSK-03 for sizing.

Option 3 also requires a site retaining wall to the North of the school. The wall is approximately 125m long and 1.2m in height. For this we will require a 250mm wide cantilever retaining wall with a 1400 wide x 300mm deep footing. See SSK-04 for details.

If you require further clarification, please contact the undersigned.

Sincerely,

[redacted]

[redacted]

EGBC Permit #: 1000651

Mass Timber Option

For mass timber construction, we recommend the following:

Classrooms

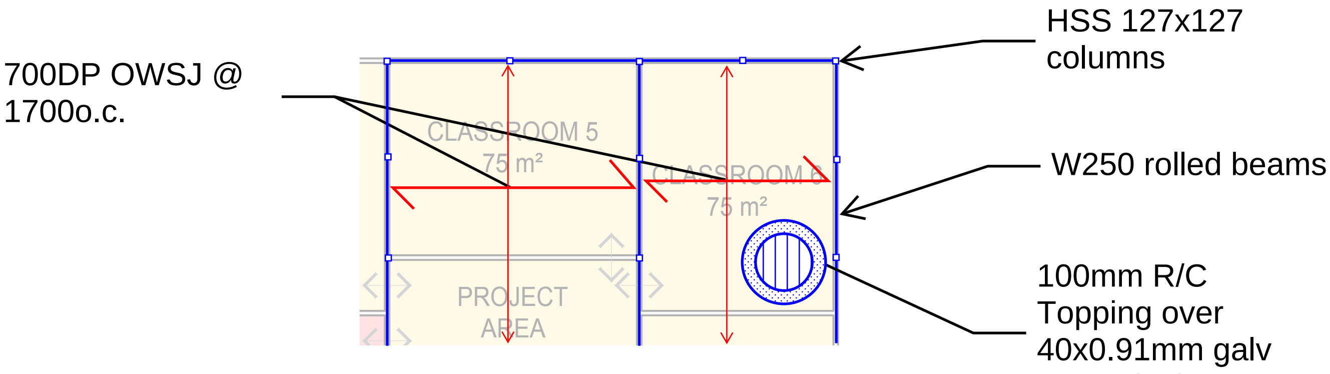
- Roof structure is 19mm plywood over 38x89mm DLT (SPF No 2 or better) spanning approx. 2.4m to 175x494mm Glulam beams D.Fir 24f-E (which span between 8 to 10m approx.)
- Suspended floor is 65mm concrete topping on 19mm plywood over 38x89mm DLT (SPF No. 2 or better) spanning approx. 2.4m to 215x532mm Glulam beams D.Fir 24f-E (which span between 8 to 10m approx.)
- Glulam beams are supported by 215x228 Glulam columns (D.Fir 16c-E). Beams are connected to columns with concealed RICON connectors which is required to meet the fire rating.
- Seismic system will be CLT shearwalls.

Gymnasium

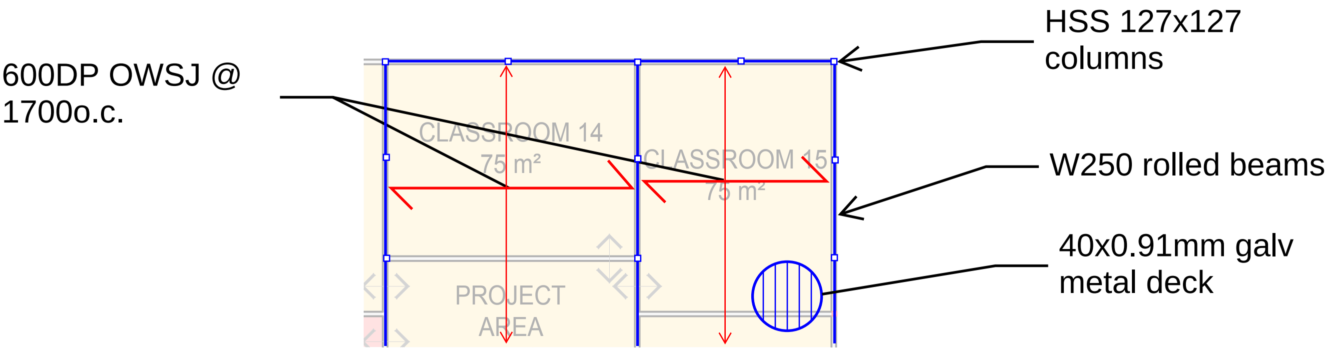
- Roof structure will be 19mm plywood on 38x89 DLT (SPF No 2 or better) spanning approx. 3.6m to 265x1026mm Glulam beams D.Fir 24f-E (which span approx. 18m). Beams in the transverse direction will be steel W250 beams.
- Columns will be HSS 203x203x13mm.
- The seismic system will be braced steel frames.

Foundations

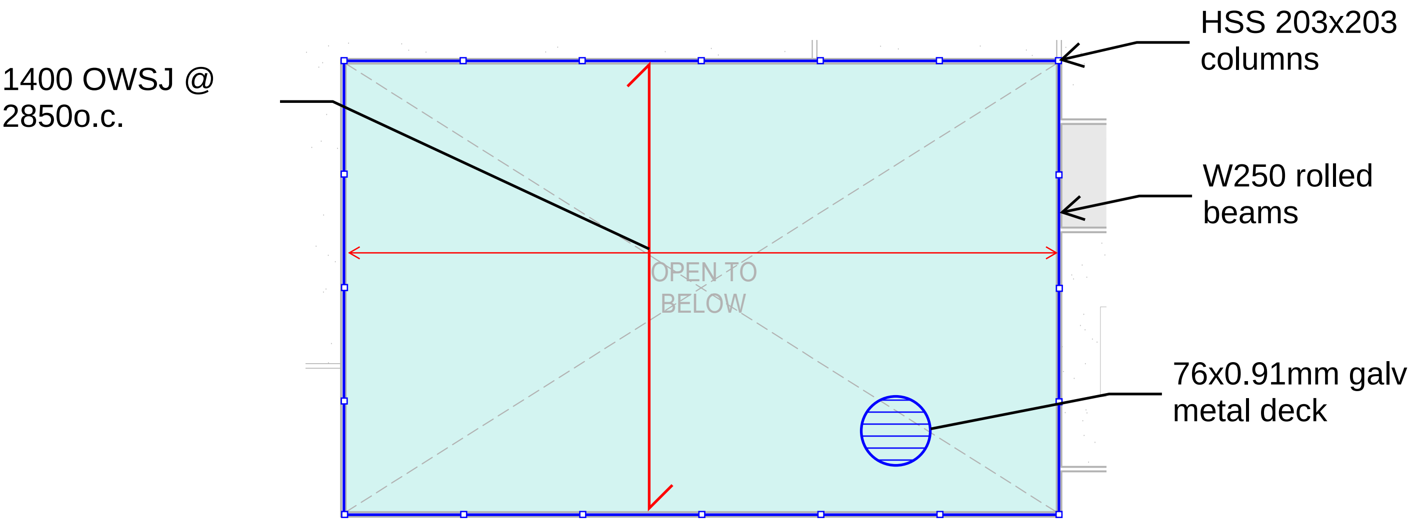
- Costs associated with the mass timber foundation system will be approximately the same as for the structural steel foundation system.



PROPOSED CLASSROOM FLOOR FRAMING



PROPOSED CLASSROOM ROOF FRAMING



PROPOSED GYMNASIUM ROOF FRAMING

BushBohlman &Partners
Consulting Structural Engineers

1550—1500 West Georgia St.
Vancouver, BC V6G 2Z6

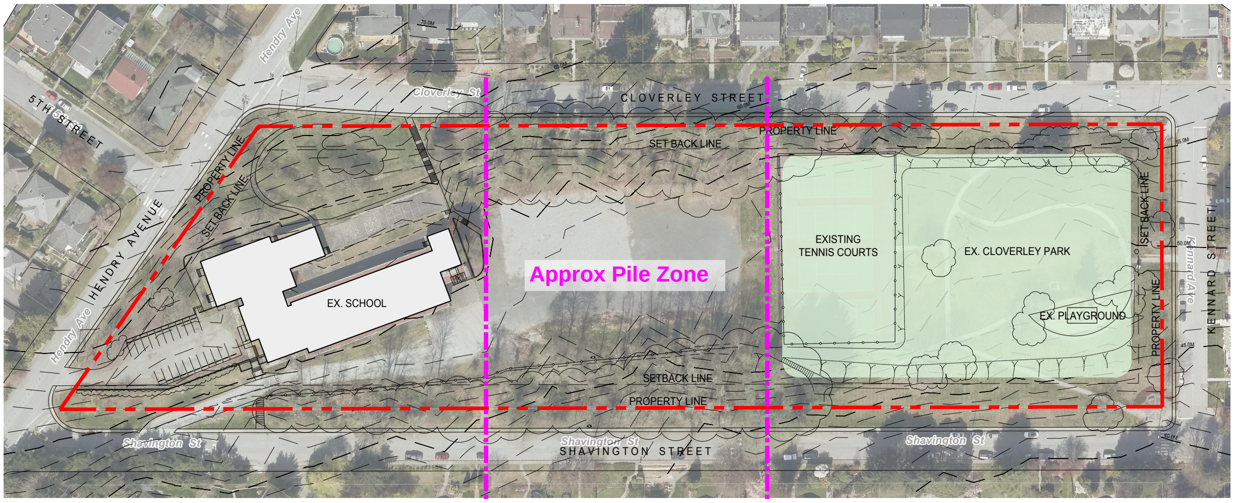
604 688 9861
bushbohlman.com

DATE	SCALE	DRN.	CH'D.	PROJECT No.
2021-07-21	NTS	TW		8171

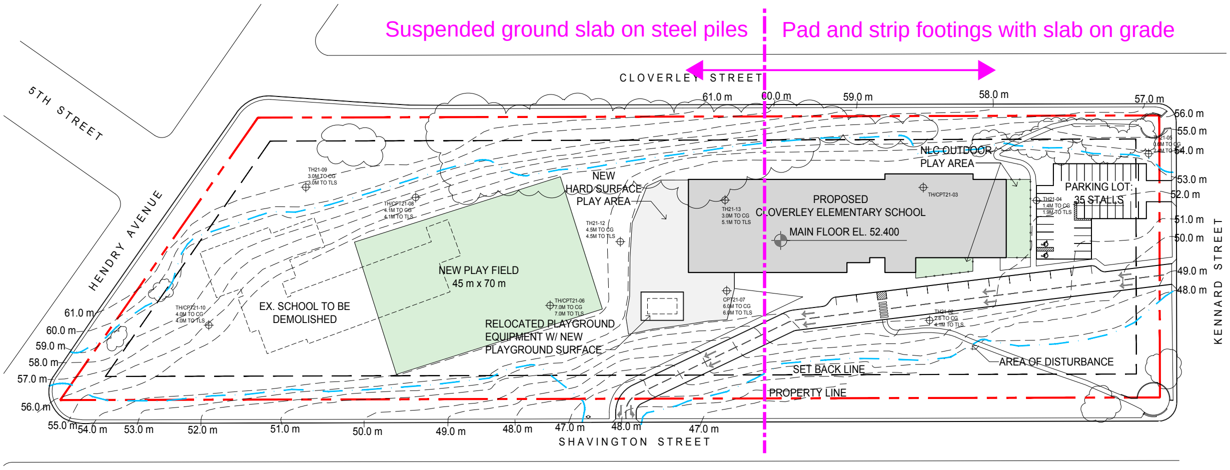
CLOVERLY ELEMENTARY
REPLACEMENT SCHOOL PDR

INDICATIVE ROOF + FLOOR FRAMING FOR ALL OPTIONS

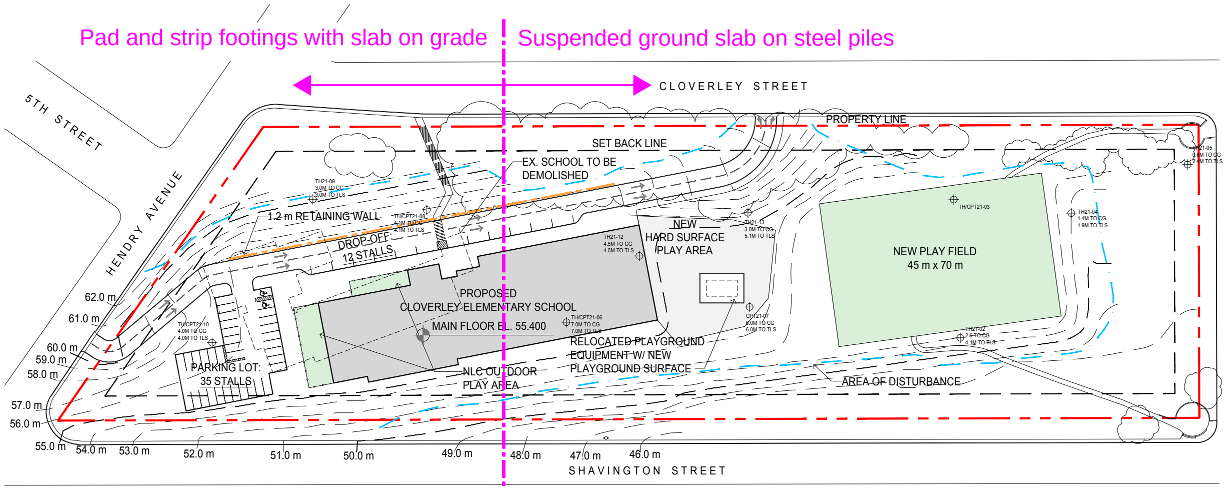
SHEET No.
SSK-01



Existing Site Plan



Options 1 and 2



Option 3

BushBohlman & Partners
Consulting Structural Engineers

1550—1500 West Georgia St.
Vancouver, BC V6G 2Z6

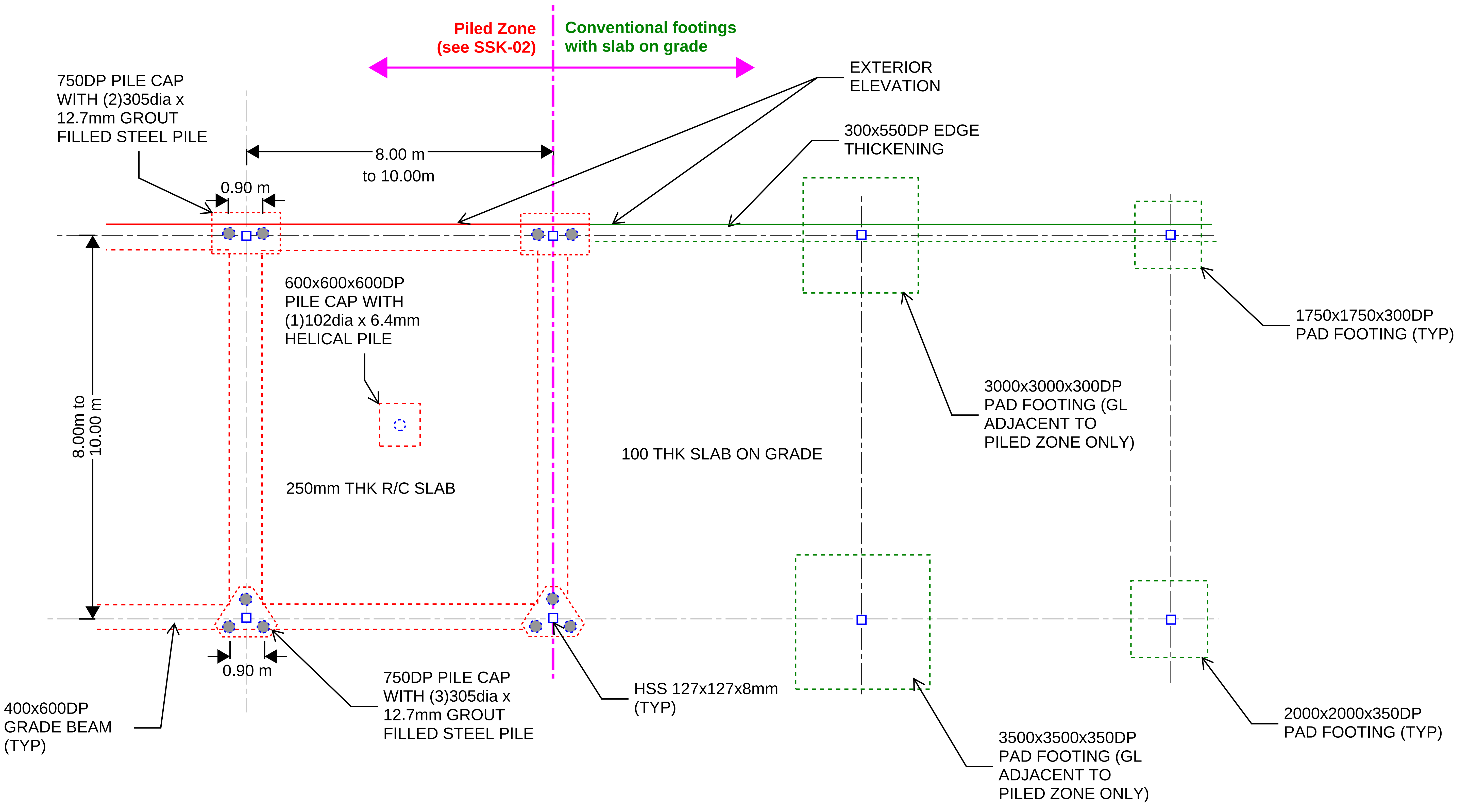
604 688 9861
bushbohlman.com

DATE	SCALE	DRN.	CH'D.	PROJECT No.
2021-08-09	NTS	TW		8171

CLOVERLY ELEMENTARY
REPLACEMENT SCHOOL PDR

APPROXIMATE LOCATION OF PILED
FOUNDATION ZONE

SHEET No.
SSK-02



**BushBohlman
&Partners**
Consulting Structural Engineers

1550—1500 West Georgia St.
Vancouver, BC V6G 2Z6
604 688 9861
bushbohlman.com

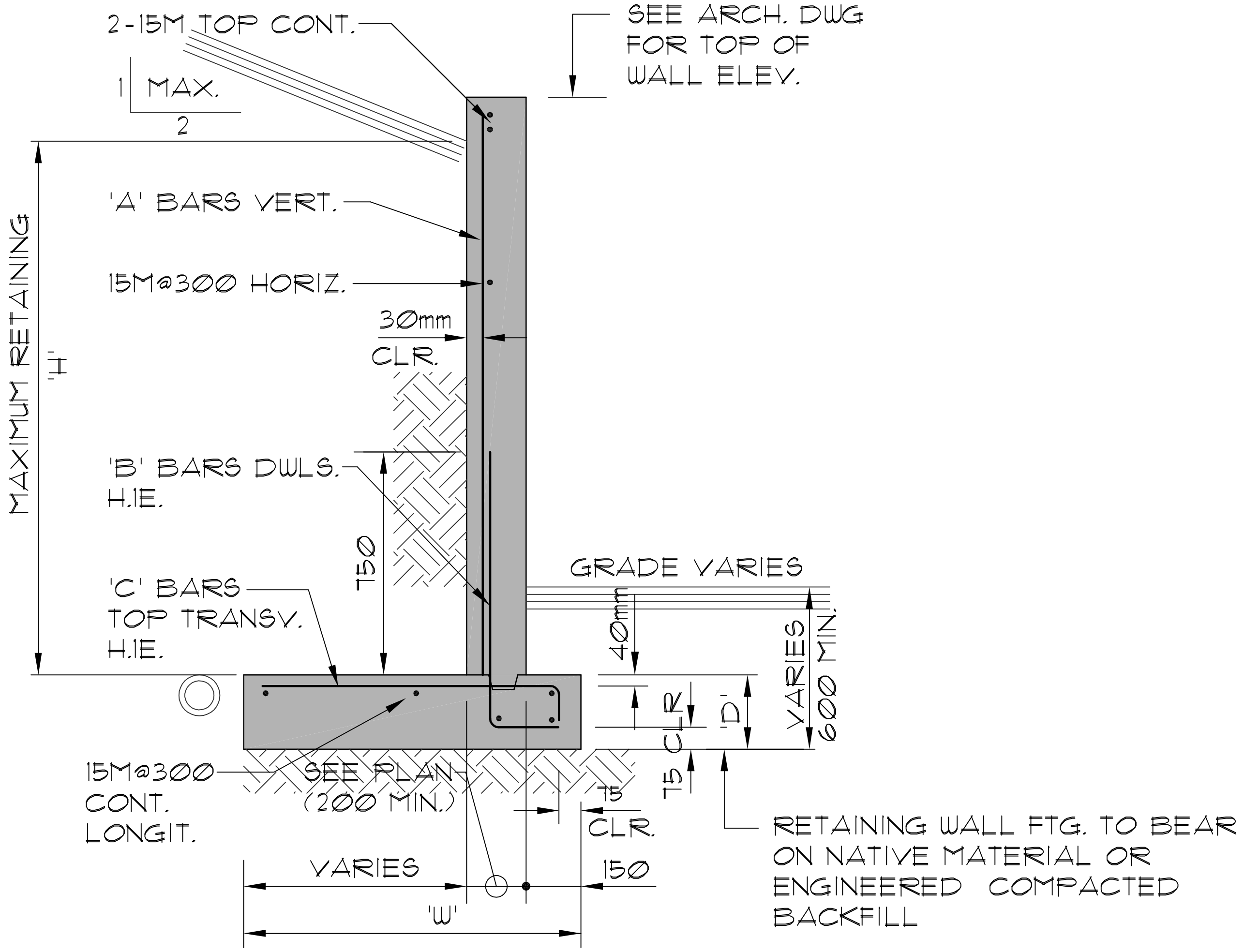
DATE	SCALE	DRN.	CH'D.	PROJECT No.
2021-08-10	NTS	TW		8171

CLOVERLY ELEMENTARY
REPLACEMENT SCHOOL PDR

FOUNDATION INDICATIVE DESIGN FOR ALL
OPTIONS

SHEET No.
SSK-03

MAX. RETAINING 'H'	FTG. WIDTH 'W'	FTG. DEPTH 'D'	BARS 'A'	BARS 'B'	BARS 'C'
1500 < H < 2100	1900	350	15M@200	15M@200	15M@200
900 < H < 1500	1400	300	15M@300	15M@300	15M@300
H < 900	900	250	15M@400	15M@400	15M@400



BushBohlman &Partners
Consulting Structural Engineers

1550—1500 West Georgia St.
Vancouver, BC V6G 2Z6

604 688 9861
bushbohlman.com

DATE	SCALE	DRN.	CH'D.	PROJECT No.
2021-08-09	NTS	TW		8171

CLOVERLY ELEMENTARY
REPLACEMENT SCHOOL PDR

SITE WORKS - TYPICAL CAST IN PLACE
CONCRETE CANTILEVER RETAINING WALL

SHEET No.
SSK-04

North Vancouver School District
the natural place to learn

CLOVERLEY
Elementary School

North Vancouver, BC

PROJECT DEFINITION REPORT
MECHANICAL DESIGN REPORT

October 8, 2021

INTEGRAL
GROUP

PDR - MECHANICAL DESIGN REPORT

1. DESIGN PARAMETERS

The heating and cooling load calculations for the school will be based on the following:
Summer Outdoor Air Temperature (July 2-1/2% -- BCBC+NBC) 26 ºC DB / 19 ºC WB
Winter Outdoor Air Temperature (January 2-1/2% -- BCBC+NBC) -7 ºC

R Values [effective]	Roof R-20	Wall R-15	Glass Double Glazed Low-e

2. HEATING AND VENTILATION SYSTEMS DESCRIPTION

Proposed Mechanical Systems Summary

Mechanical System	Central ERV with VAV reheat (displacement ventilation) and perimeter radiator, demand control ventilation, air economizer Kindergarten/NLC/Admin: Supplemental cooling from ductless split system Gym: AHU hydronic heating/cooling, demand control ventilation (no heat recovery ventilator), air economizer
Heat Recovery Ventilator	Option 1: Standard ERV (sensible effectiveness: 70%) Option 2: Premium ERV (sensible effectiveness: 90%)
Central Plant Heating & Ventilation Plant	Option 1: ASHP (Changeover) w/Condensing Boiler for Peaking - Switchover at 4°C OAT Option 2: ASHP (Changeover) w/Condensing Boiler for Peaking - Switchover at 0°C OAT Option 3: ASHP (Changeover) w/Electric Boiler for Peaking - Switchover at 4°C OAT Option 4 [selected]: ASHP (Changeover) w/Electric Boiler for Peaking - Switchover at 0°C OAT Option 5: GSHP (Changeover) w/Condensing Boiler for Peaking - Switchover at 0°C OAT Option 6: GSHP (Changeover) w/Electric Boiler for Peaking – -Switchover at 0°C OAT

Refer to Energy Modelling Report for performances and GHG emission reduction levels of noted system options.

2.1. HEATING

2.1.1. Boilers

The proposed heating equipment will be installed in the Boiler Room. These boilers will be able to handle 100% of the heating load on the design heating day without requiring the air source heat pump to operate. The boiler plant is designed to allow for sufficient capacity to allow for school operation, under most conditions, with one heating unit shut down for repairs. Heating system expansion tanks shall be ASME rated.

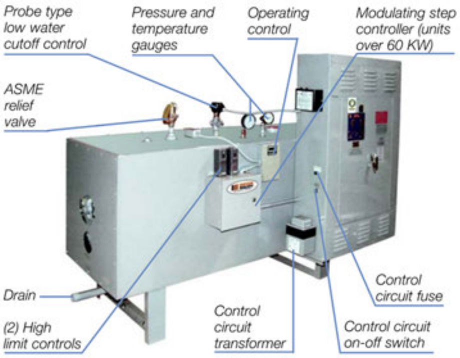
[Options 1&2]

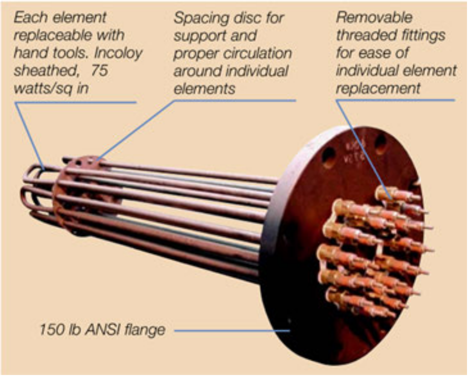
The building heating plant will consist of four high-efficiency, gas fired, condensing boilers IBC model SL40-399G3 or Viessman model Vitodens 200-W B2HA, units. Each boiler is to have a nominal output of 375 MBH [399 MBH input].

[Options 3&4]

The proposed heating equipment will be installed in the Boiler Room. These boilers will be able to handle 100% of the heating load on the design heating day without requiring the air source heat pump to operate.

The building heating plant will consist of two electric boilers Bryan model BE-240 or similar. Each boiler is to have a nominal output of 230kW [786 MBH].





2.1.1. Heat Pumps

[Options 1 to 4]]

Two 50 ton reversible water to water heat pumps [total 100 tons] will be installed to provide heating and cooling for the building systems. These heat pumps will extract heat from the air and transfer it to the ERVs and air handling units as required. When cooling is required they will use the same fluid cooler and piping to reject heat and will supply chilled water to the areas requiring cooling including all of the ERVs.

Refer to Energy Modelling Report for performances and GHG emission reduction levels of noted system options

2.1.2. Pumps

Two circulating pump, each sized for 100% of the design day heating requirement, will be installed in the boiler room to supply heating water to the air handling units, fan coils, perimeter radiation, and miscellaneous heating elements. All secondary pumps will have variable frequency drives to allow variable volume secondary pumping for increased energy savings.

A circulating pump will supply heating or chilled water from each heat pump to the coils installed in the ERVs. The same pump and distribution piping will be used to supply both heating and chilled water to the ERVs, depending upon whether the heat pumps are operating in the heating or cooling mode.

2.1.3. Heating Elements

Heating elements will consist of high mass low temperature perimeter radiation.
Heat at main entrances will be provided by fan coil heaters.

2.1.4. Piping

The secondary piping to the air handling units, fan coils, perimeter radiation and miscellaneous heaters will consist of a two pipe variable flow system. The heating element piping will consist of DDC control valve on the coil return side and a balancing valve with p/t test ports, supply and return side isolation valves. No strainer on heating elements.

Isolation valves will be provided at all heating elements to permit isolation for maintenance purposes.

2.1.5. Chemical Treatment

All heating piping systems will be flushed, chemically cleaned, and treated with corrosion inhibitors to protect the piping, valves and equipment. A chemical pot feeder will be installed in the boiler room to provide a means of adding and maintaining chemical treatment levels. A side stream filter with sight glass and totalizing meter will also be provided. Water samples will be analysed, and reports submitted by the chemical treatment specialist during the first year of operation.

2.1.6. Seismic Restraint

Mechanical equipment and piping will be seismically supported and restrained in accordance with BC Building Code.

2.1.7. Ventilation

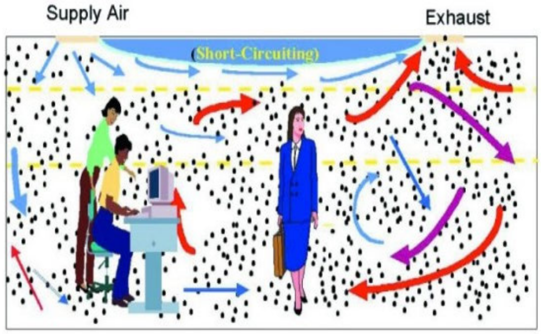
All ventilation air volumes will comply with BCBC 2018 and *ASHRAE* Standard *62*-Ventilation for. Acceptable. Indoor Air Quality.

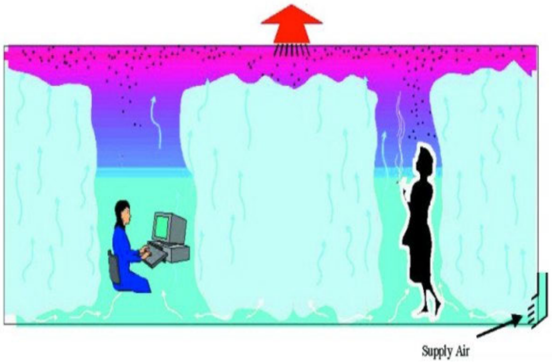
Energy recovery ventilators will supply outdoor air to the various areas of the building. The ERV units will be located on the roof over the spaces they serve.

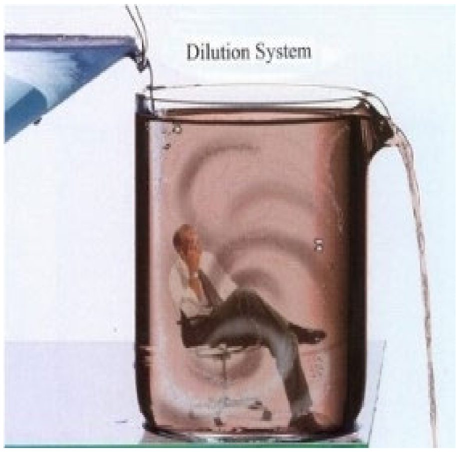
In cooling mode, ERVs shall supply a maximum of 1100 cfm of outdoor air (100 % outdoor air) to each south facing classroom and a maximum of 800 cfm outdoor air (100 % outdoor air) to each north facing classroom. This will be accomplished through the use of displacement diffusers delivering air near floor level.

In heating mode, ERVs shall supply a maximum of 500 cfm to all classrooms [adjustable based upon occupancy and CO_2 levels]. The air will be supplied between 3 and 6 °C [5 and 10 °F] below room temperature [heating and cooling modes].

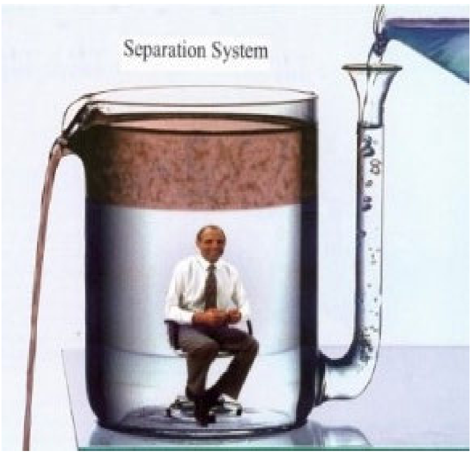
The ventilation design provides both improved indoor air quality and lower energy costs than conventional, overhead, ventilation systems which supply air overhead.



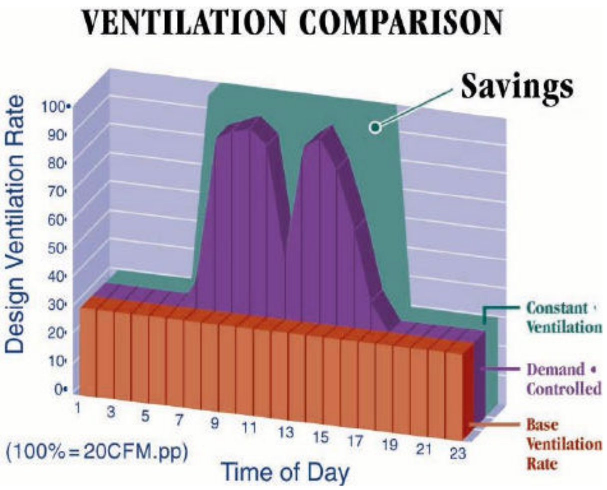




OVERHEAD AIR DISTRIBUTION SYSTEM



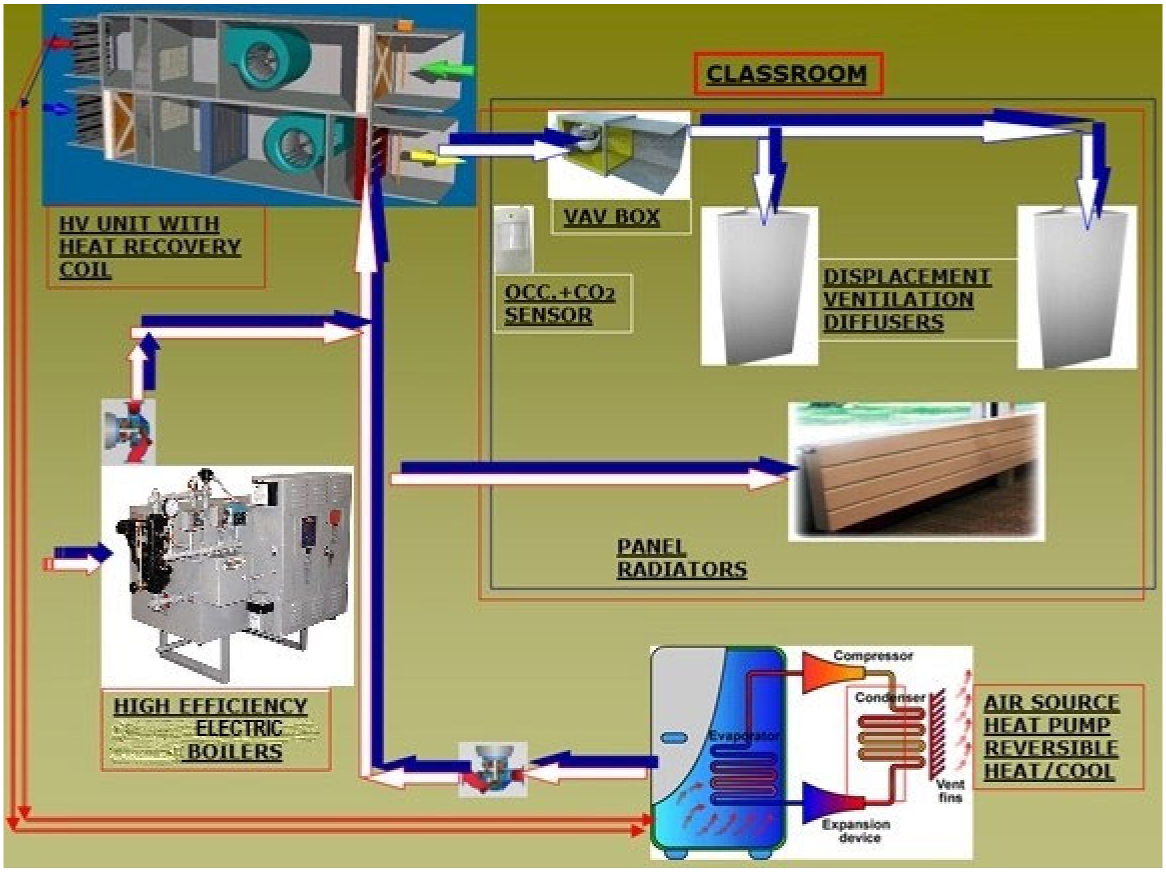
DISPLACEMENT AIR DISTRIBUTION SYSTEM



SAMPLE VENTILATION SAVINGS CHART

Motion detectors shall be installed in all classrooms and major rooms to reduce the outdoor air volumes when the rooms are unoccupied. A variable air volume terminal will be installed for each classroom to control the air volume supplied to the room [controlled by motion and CO_2 sensors].

The corridors shall be used as a return air path from the classrooms back to the ERVs. Air will be transferred from the classrooms to the adjacent ceiling space. Air will then be transferred back to the ERVs through vertical return air ducts.



SYSTEM SCHEMATIC

Spaces with high variation in occupancy [Gymnasium] shall have dedicated air handling units (AHUs). These spaces shall have motion detectors and CO_2 sensors to adjust ventilation volumes in response to occupancy levels.

2.1.8. Relief/Exhaust Air Heat Recovery System

The majority of the washroom exhaust air and the building relief air will be exhausted by the ERVs in order to recover heat. The DDC controls will switch the ERV units when the building is occupied.

Some individual exhaust fans shall be provided for intermittent use, where occupant control is needed (Staff washrooms). Copier room exhaust will be DDC operated and will run continuously when building is in occupied operation mode.

2.2. SUPPLEMENTAL COOLING

Dedicated fan coil units shall be provided to for areas with usage schedules that vary greatly from other school areas [Admin spaces, NLC].

The air source heat pump plant will also provide cooling to the ERV's during warm weather when the outdoor temperature exceeds 18ºC [65ºF]. This amount of cooling is required to enable the effective operation of the displacement ventilation system in the gymnasium areas. It does not constitute full air conditioning. However it will provide a significant amount of cooling.

The cool air supply from the DV system will also increase the thermal stack effect and the natural ventilation capability.

Electrical, Server, and Communication rooms will have dedicated commercial grade ductless mini split system units with condensing units installed on the roof.

2.3. CONTROLS

A direct digital control (DDC) system will be provided. All control dampers and valves will have electronic actuators.

Individual temperature control of the rooms will be provided by varying the heat from the high mass low temperature perimeter radiation.

Tempered air between 18ºC and 20.5ºC [65ºF and 69º F] will be supplied to Gymnasium. Individual temperature control of the remaining rooms will be provided by varying the heat from the perimeter radiation. Controls system will be programmed to control equipment for energy conservation.

Mechanical and Electrical systems will be integrated so that the classroom motion detectors can be utilized for switching lights and intrusion alarm as well as controlling ventilation air volumes.

The software will allow access to monitor and control the mechanical systems via a computer terminal located at the school, or from a remote location via a wide area network.

3. PLUMBING SYSTEMS DESCRIPTIONS

3.1. SANITARY SEWER

A new 150 mm building sanitary sewer line will be provided.

3.2. STORM SEWER

All roof areas will be connected, via a network of piping, to storm sewer. Storm water retention on site may be a design requirement.

3.3. FOOTING DRAIN

The perimeter of the building will have a sub soil drain system, installed at the footing level, and will connect through an interceptor sump to the storm disposal system.

3.4. WATER CONSUMPTION

Water consumption for the school will be minimized by the use of low water consumption fixtures.

3.5. DOMESTIC HOT WATER

Option 1:
Domestic hot water will be heated by a gas fired, high efficiency instantaneous hot water heaters for improved energy efficiency. Water will be stored at 130°F in primary storage tanks to minimize standby losses. Secondary domestic water heater/tank will be installed to provide back-up and serve the building during summer and winter breaks.
A domestic hot water re-circulation pump will cycle to maintain water temperature in the domestic hot water supply main.

Option 2:
Domestic hot water will be heated by Electric tank heaters.

Option 3:
Domestic hot water will be heated by ASHP w/ Gas Boilers.

Option 4:
Domestic hot water will be heated by ASHP w/ Elec. Boiler.

Option 5:
Domestic hot water will be heated by Packaged ASHP.

Refer to Energy Modelling Report for performances and GHG emission reduction levels of different system options

3.6. PLUMBING FIXTURES

All fixtures will be of institutional quality for schools. The plumbing fixtures will be in accordance with the North Vancouver School District standards.

No-touch motion detector-activated plumbing fixtures and accessories are required for washroom faucets, urinal flush valves and water closet flush valves.

Water closets will be floor mounted, flush valve type.

Urinals will be wall mounted, flush valve type.

Floor drains and trap primers will be provided in washrooms and mechanical rooms.

Roof drains will be with dome and ballast guard.

Handicapped plumbing fixtures will be used as required.

Drinking fountains will be combined two compartment type with handicap access and bottle filler as required by School District.

3.7. GAS SERVICE

Natural gas supply for the mechanical systems will be provided. A seismic shutoff valve will be installed. Gas service will be extended from the meter location in accordance with requirements of the BC Gas Safety Branch regulations.

4. FIRE PROTECTION

The school will have a wet fire protection sprinkler system designed in accordance with NFPA 13 and stand pipe system [to be confirmed] designed in accordance with NFPA 14 standard. Sprinklers will be installed in all occupied areas, including exterior covered areas extending 1200 mm or more from the building.

A dry system will be installed for the entrance canopy and other areas that are subject to freezing.

Available water flow and pressures shall be confirmed by the City of North Vancouver and actual flow test.

5. STANDARD OF MATERIALS AND EQUIPMENT

Specified products and approved equivalent manufacturers will be in accordance with the guidelines and standards issued by the School District.

Cloverley Elementary School:

Electrical Project Definition Report

School District No. 44 (North Vancouver)
March 11, 2022

Prepared by:

PBX ENGINEERING

#300 – 131 Water Street
Vancouver, BC
V6B 4M3

REVISION HISTORY

Version Number	Description	Date Modified	Author
0.1	Electrical PDR Draft	August 3, 2021	[redacted]
1.0	Electrical PDR Final	March 11, 2022	[redacted]

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Electrical Systems

Existing Electrical Site Summary

The existing site consists of the former existing Cloverley Elementary School and an existing partially treed and partially paved lot which is bordered by the existing tennis courts and park area.

An analysis of the existing site appears to indicate that the service to the former school was fed from a three-phase pole mounted transformer bank located at the corner of Hendry and Cloverley street. The BC Hydro secondary feed from the transformer bank is run overhead along Hendry street before being dipped down underground to feed the former school's main distribution 'E'.

New Utility Services

All evaluated options will require new utility servicing. The new utility servicing will include both BC Hydro power and telecommunications utilities.

The new power service to the building must be supplied at three phase 600Y/347V, from the initial load calculations based on the area of the new building and preliminary mechanical information, a utility pad mounted transformer and underground servicing infrastructure will be required as the required electrical load will exceed what can be supplied from an overhead mounted transformer bank.

A local BC Hydro designer in the North Vancouver area was consulted and confirmed that, as of the writing of this report, North Vancouver does not have a restriction for secondary supply of 600Y/347V servicing from a PMT (as is sometimes the case elsewhere in the lower mainland).

As per best practices for k-12 secondary schools, new underground telecommunications infrastructure for the new school will be installed to bring utility fibre services to the new school.

This approach will be required regardless of which option 1, 2, or 3 is eventually selected.

Option 1-Base building plus NLC, East

Option 2-Base building plus NLC and GHG reduction

Option 3- Base building plus NLC, West

	Preliminary Base Load	Preliminary Mechanical Load	Total
Option 1	80.362kW	400kW	480.362kW
Option 2	85.517kW	800kW	885.517kW
Option 3	85.517kW	400kW	485.517kW

Refer to Figure 1 for single line diagrams for options 1 & 3 and option 2.

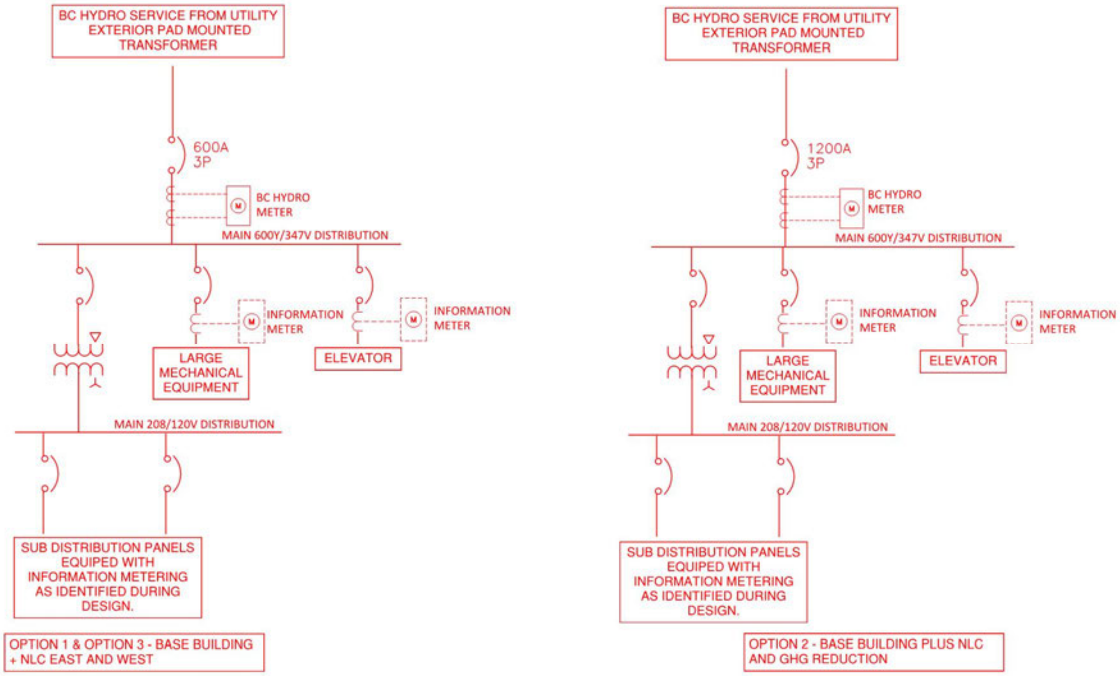


Figure 1: Single Line Diagram Options

Power Distribution

1.1.1 DISTRIBUTION

The new distribution will consist of a main distribution switchboard located in the main electrical room. The new main distribution will feed sub panels located in sub electrical rooms and mechanical spaces in the building. The main distribution will be designed to feed sub panels and major pieces of mechanical equipment. A minimum of 20% spare space should be provided to ensure that future move, adds, and changes are possible without extensive modification of the distribution.

The new main electrical room will also house the main fire alarm panel, lighting control panel, ASHRAE required metering, and telecommunication demarcation.

Refer to Figure 2 for an anticipated main electrical room layout containing the major pieces of equipment with estimated sizes.

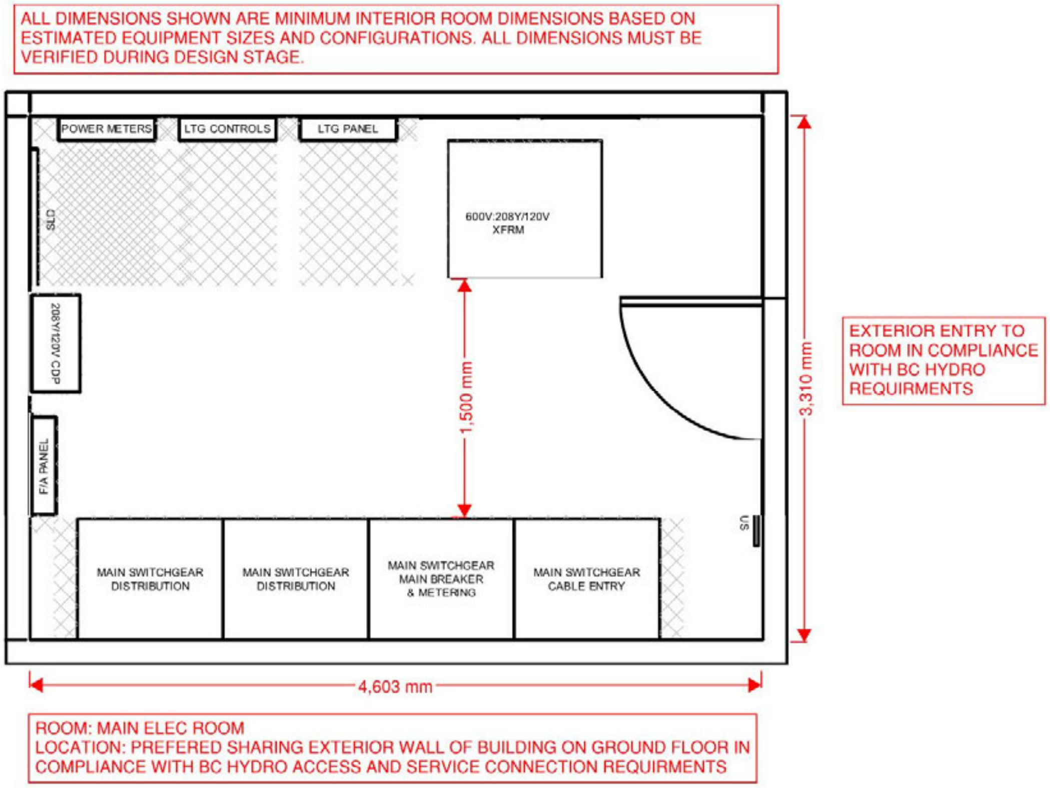


Figure 2: Main Electrical Room

1.1.2 BRANCH CIRCUITING

The branch circuiting will be distributed from sub distribution panels located in local electrical spaces. The branch circuiting will be run in EMT conduits from the sub panels to individual spaces which will then distribute to individual receptacles within the space using AC90 cables. Sub panels to be equipped with 25% space to allow for future move adds and changes.

1.1.3 INFORMATION METERING

The building will contain an owner’s information metering system to comply with ASHRAE 90.1 metering requirements and LEED Point targets. This will include separately metering all mechanical, lighting, and power loads. It is anticipated that granular metering will be achieved through the use of branch-circuit level metering as well as integration of information meters onto select feeders throughout the building power distribution.

Lighting & Lighting Controls

1.1.4 INDOORS

Area lighting will be designed to meet the BCBC minimum requirements, as well as the task level recommended average lighting levels from the Illuminating Engineering Society of North America guidelines and the energy efficiency requirements of ASHRAE 90.1. All luminaires will be of the energy efficient LED type.

Area lighting is highly space dependent. In general, this requires coordination with the architect to coordinate the type and aesthetics of luminaire installation required, however the recommended lighting level criteria is shown in

Table 1 below for the design of lighting within each major space type.

Table 1: Lighting Design Criteria

Space Description	Lighting Level	Uniformity	Criteria Source	Notes
Gymnasium	500 lux	2:1	IES RP-6	Assumed Class IV facility (recreational level activities with no spectator provisions)
Classroom	400 lux	3:1	IESNA Handbook	
Multipurpose	400 lux	3:1	IESNA Handbook	Controls for various lower lighting scenes
Office	400 lux	3:1	ANSI/IES RP-1	
Circulation	50 lux	3:1	IES RP-3	
Atrium/Lobby	150 lux	3:1	IESNA Handbook	Decorative lighting to suit Architectural concept
Service Rooms	200 lux	3:1	IESNA Handbook	

Lighting controls will be designed to comply with the BCBC and ASHRAE 90.1 and meet all required energy efficiency targets. The building lighting controls will be designed as a networked system to help ensure consistency across the building. The main lighting controller will be located in the main electrical room and will be able to interface with the mechanical building management system.

Office area lighting controls will be setup as office area zones. Each zone will have a manual switch to turn the lighting on and vacancy sensors to automatically turn them off once they are unoccupied. Daylight harvesting will be implemented around building perimeter where windows will provide natural light. Zones will be configured based on architectural planning for the anticipated space usage.

Typical classroom area lighting controls will be setup with one lighting zone adjacent/above the main teaching area with at least one other lighting zone for the remainder of the classroom. Both lighting zones will be controlled by manual dimming/off/on dimming stations. This will allow the teacher to adjust lighting as desired during presentations or general teaching activities. Automatic vacancy sensors will be provided to turn lighting off once the classroom is unoccupied.

Gymnasium lighting will be controlled by a manual switch to turn the lighting on and vacancy sensors to automatically turn them off once they are unoccupied. Daylight harvesting will be implemented if applicable, depending on the availability of natural light within the gymnasium spaces.

1.1.5 EXTERIOR

The exterior luminaires will be composed of two types, building mounted luminaires and pole mounted luminaires. All luminaires will be of the energy efficient LED type and will be dark sky compliant. The building mounted luminaires will illuminate the general area surrounding the building. Pole mounted luminaires will be located to illuminate parking areas.

Table 2: Exterior Lighting Design Criteria

Space Description	Lighting Level	Uniformity	Criteria Source	Notes
Parking Lot Area	22 lux	10:1	Worksafe BC 4.65	
Building Entrance	200 lux	N/A	IESNA Handbook	
Building Perimeter (3m transition for safety/security)	50lux	4:1	IESNA Handbook	The extent of security lighting must be coordinated with the school district during design
General Exterior	10 lux	10:1	IESNA Handbook	

Lighting controls will be designed to comply with the BCBC and ASHRAE 90.1 and meet all required energy efficiency targets. The exterior building lighting controls will be designed as part of the networked system. A photocell will be installed on the building to provide a control input for the exterior lighting, along with the integral time clock in the lighting controller. This will allow all of the exterior lighting throughout the building to be controlled based on daylight and time of day conditions as required.

Life Safety Systems

1.1.1 EMERGENCY POWER

An emergency generator is not required for this project based on the base space use requirements set forth in the relevant BC Building and electrical codes. There are certain pieces of equipment or systems that could trigger the requirement for an emergency generator (such as a fire pump) which must be investigated during the detailed design of the project. At this time, it is understood that the emergency power for lighting and fire alarm systems will be supplied by emergency battery packs or a central inverter system. No emergency generator is required.

1.1.2 FIRE ALARM

The fire alarm system will be designed to comply with the BCBC. It will be provided as an addressable Class A system with remote monitoring by a ULC monitoring centre. The main fire alarm control panel will be located in the main electrical room and a remote annunciator will be located at the main fire department entrance to the building.

1.2 Telecommunications

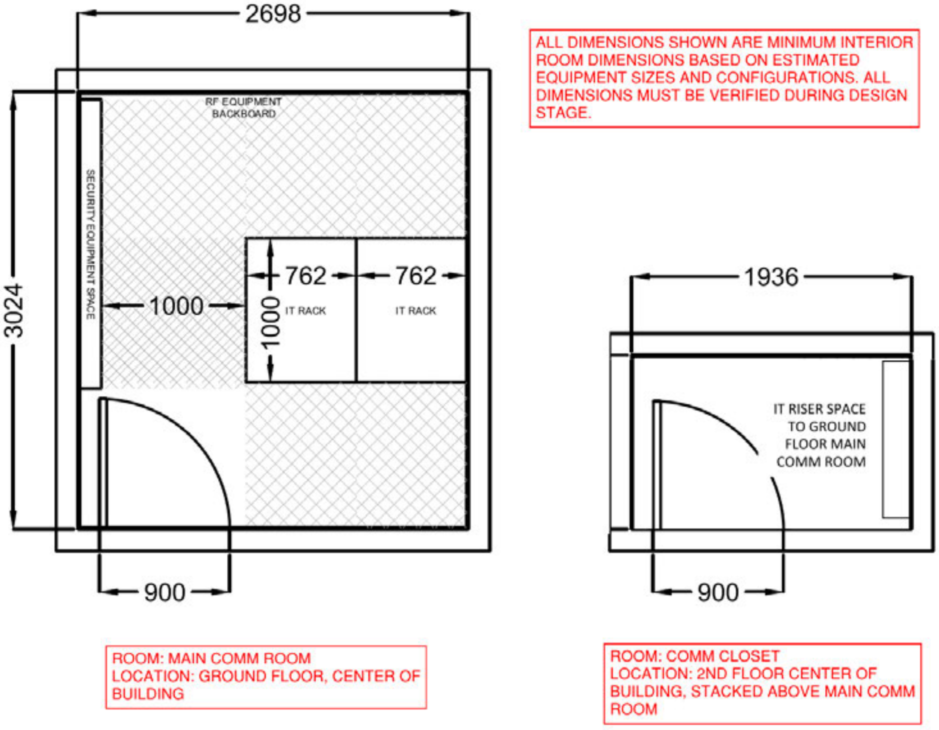
Telecommunications structured cabling within the facility will be Category 6 cabling. Copper cabling has an operational restriction of 100 meters in length for an end-to-end link. In order to allow sufficient distance for patch cords and directional cabling, an individual communication room is generally designed to feed a radius of no more than 70 meters. The proposed building is roughly 100 meters in length, and therefore one centrally located communications room on the ground floor with a smaller termination closet on the second floor stacked above the ground floor room will likely be sufficient to serve the entire building.

Category 6 cabling will normally be provided in EMT conduits through areas with inaccessible ceiling spaces or through EMT or cabletray in accessible ceiling spaces. Individual cables can be fished down walls to the individual outlets.

A communications zone 4 seismically certified equipment rack will be provided in the ground floor communications room to hold active network equipment and patch panels.

A rack mounted uninterruptible power supply (UPS) unit will be provided in the bottom of the communications rack. The UPS will be fed from utility power and will supply power to the active network equipment. This will allow the equipment to shut down properly in the event of a power outage.

Refer to Figure 3 for an anticipated main communication room layout and communication closet layout.



ALL DIMENSIONS SHOWN ARE MINIMUM INTERIOR ROOM DIMENSIONS BASED ON ESTIMATED EQUIPMENT SIZES AND CONFIGURATIONS. ALL DIMENSIONS MUST BE VERIFIED DURING DESIGN STAGE.

ROOM: MAIN COMM ROOM
LOCATION: GROUND FLOOR, CENTER OF BUILDING

ROOM: COMM CLOSET
LOCATION: 2ND FLOOR CENTER OF BUILDING, STACKED ABOVE MAIN COMM ROOM

Figure 3: Main Communication Room & Closet

1.3 Low Tension Systems

1.3.1 AUDIO VISUAL

Audio visual infrastructure will be provided for classrooms to link teaching stations with displays and as coordinated with the school district during the design. It is anticipated that EMT conduit will be required to run interconnecting cables between source and output locations such as teacher stations and display screens. Further, power and data will be required to support the operation of input devices and output devices.

1.3.2 PUBLIC ADDRESS/CLOCK/BELL

A combined public address and bell system will be provided for the facility with a head end unit located in the administration offices as coordinated with the school department staff.

A PA rack to house amplifiers, mixer, and zone paging equipment will be provided in the ground floor communications room. The system will be capable of zoned PA announcement, with time-of-day scheduling for bells and other notification events. An override from the fire alarm system will be provided to ensure that during a fire alarm event, the PA system will be overridden while the fire alarm system is sounding. The PA system will be by Bogen Communications or similar.

An IP clock system will be provided with clocks mounted to locations as coordinated during design and connected to a PoE switch in the PA rack via Category 6 cable. The clock system head-end master clock module will be rack mounted in the PA rack. The clocks and clock system will be by Bogen Communications or similar.

1.3.1 SECURITY

Access Control

The building will be provided with an access control system to secure specific doors as coordinated with the school district. Access control equipment will be mounted on the wall of the telecommunications room. The security system equipment will be by Kantech or similar.

Intrusion Detection

An intrusion detection system will be provided with motion and glass break detectors located at strategic ingress points within the school. A keypad will be provided at the main staff entrance as coordinated with the school district during the design to allow staff to arm and disarm the security system as needed. The intrusion detection equipment will be by DSC or similar.

Safety and Security Cameras

A video surveillance system with IP based cameras and a network video recorder system will be provided. Surveillance cameras will be located to capture key points of entry/exit and as coordinated with the school district. Equipment will be Avigilon or similar.



Cloverley Elementary School
440 Hendry Ave, North Vancouver, BC
Project Definition Report – Civil Engineering Component

AM Project No: 21-5086
March 14, 2022
Aplin & Martin Consultants Ltd.

APLIN MARTIN
ENGINEERING ARCHITECTURE PLANNING SURVEYING

ENGINEERS & GEOSCIENTISTS
BRITISH COLUMBIA

PERMIT TO PRACTICE # 1001018

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APPENDICES

1.0 INTRODUCTION

Aplin & Martin Consultants Ltd. (A&M) was retained by DA Architects + Planners to provide civil engineering design input for the redevelopment of Cloverley Elementary School in North Vancouver, BC. This report provides an overview of existing and proposed civil components as required to complete a new School on the site of the existing facility.

We have reviewed the existing GIS information from the City of North Vancouver, records and documents provided to us, and the general servicing comments from the Director of Planning and Development at the City of North Vancouver. Additionally, we have reviewed the conceptual plan provided from the Architect with respect to civil requirements and have identified the following requirements.

2.0 EXISTING CONDITIONS

The 29,663 m^2 site is bordered by four existing municipal roadways; Hendry Avenue to the west, Cloverley Street to the north, Kennard Avenue to the east, and Shavington Street to the south. The existing Cloverley Elementary school is located on the western half of the site. The existing school is vacant and is considered beyond useful life per the 2017 VFA Asset Detail Report. Modular school structures were previously located to the east of the existing school but have since been removed from the site. The east of the site is occupied by tennis courts and Cloverley Park. The site has a significant slope down from Cloverly Street to Shavington Street, and a minor slope from Hendry Avenue to Kennard Avenue.

There is a paved vehicular access to the site from Hendry Avenue that provides access to a 28-stall paved parking lot. There is an additional gravel access road to the south of the existing school from Shavington Street. This onsite gravel road provides access to an existing gravel play area and the previous location of the modular school building.

Per GIS and as-built information available, the existing site is serviced to the south by several utility connections to Shavington Street that are no longer in use.

There are two water service connections from the 200mm diameter ductile iron watermain on Shavington Street that previously provided service to the site. There is a 50mm diameter water service connection for the existing vacant school, and a 150mm diameter combined water service for the now relocated modular school building. Two existing offsite fire hydrants are located along the property frontage on the north side of Shavington Street. In addition, there is an existing on-site fire hydrant located to the south of the gravel play field area. The City of North Vancouver's initial analysis of the offsite water concluded that the water utility in the area was constructed recently, and upgrades are not likely to be required.

The site is serviced by a single 150mm diameter vitrified clay sanitary service connection that crosses Shavington Street at an angle and connects to an existing sanitary manhole on East 4th Street. The existing sanitary main on East 4th Street is a 150mm diameter vitrified clay pipe. This sanitary service connection was extended onsite to provide service to the modular school buildings. The City of North Vancouver noted that this existing sanitary service connection cannot be reused for the proposed school.

There are two existing storm service connections for the site. The existing school was serviced by a 250mm diameter storm service that crosses Shavington Street at an angle and connects to an existing storm manhole on East 4th Street. The City of North Vancouver noted that this storm connection cannot be reused for the proposed school. The existing offsite storm main along East 4th Street is 375mm diameter concrete pipe conveying storm flows to the east. A second 150mm diameter storm connection provided service to the modular school building. This storm service connects to an existing 250mm diameter concrete storm main running northeast. A network of existing catch basins provide drainage from paved and graveled areas of the site.

The plumbing site plan for the modular school building by MMM Group dated March 27th, 2009, is included for reference as Appendix A.

3.0 PROPOSED EAST CONCEPT – CIVIL REQUIREMENTS

The following civil infrastructure will be required for the proposed school for the west concept option. Please refer to Appendix B Drawing 01 for Preliminary Servicing Plan indicating the proposed civil requirements to service the site with the proposed school located on the east side.

All existing services will be removed within the site and capped at the property line as required upon completion of the civil construction and/ or commissioning of the replacement service.

3.1 WATER

A new 150mm diameter combined fire and domestic water connection, complete with meter, will be required from the existing main on Shavington Street into the new building's mechanical room. An onsite fire hydrant will be required if the proposed fire department connection at the entrance to the facility is not located within 45m of an existing offsite fire hydrant. As the City identified an area of lower pressure in the existing water network, there may be a need to boost sprinkler pressure on the site.

3.2 STORM

A new 300mm diameter storm service connection to the site is proposed from the south side of the new facility to the existing 300mm diameter storm main on Shavington Street. An onsite storm drainage system complete with manholes, catch basins and storm sewers will be required for site drainage.

Stormwater detention and stormwater quality devices will be required per City of North Vancouver specifications. A stormwater detention tank and flow control structure is proposed to the south of the facility. The proposed stormwater source controls for the site shall consume 56mm of rain over a 24-hour period from all impervious building surfaces.

3.3 SANITARY

A new 200mm diameter sanitary service connection is required from the south side of the proposed facility. The proposed service will connect to a new 200mm diameter off-site sanitary sewer extension along Shavington Street that will tie to an existing sanitary manhole located at the intersection of Shavington Street and Kennard Avenue.

3.4 ROADWORKS

The proposed onsite roadway will connect between Kennard Avenue and Shavington Street. Drop-off and parallel parking stalls are proposed in front of the entrance to the facility. A paved parking area consisting of 37 parking stalls shall be located adjacent to the school.

The City of North Vancouver requires the roadways adjacent to the proposed site to be upgraded to current standards. This off-site work could include a proposed sidewalk along the west side of Kennard Avenue and widening or reconfiguration of the existing sidewalks and boulevards around the perimeter of the site. The existing sidewalk along the perimeter of the site is only 1.2m wide, and the City's Subdivision and Development Bylaw requires a width of 1.8m. A new sidewalk would likely be required along the frontage on the west side of Kennard Avenue, as there is currently no existing sidewalk along this roadway. Additionally, new off-site streetlighting may be required.

4.0 PROPOSED WEST CONCEPT – CIVIL REQUIREMENTS

The following civil infrastructure will be required for the proposed school for the east concept option. Please refer to Appendix B Drawing 02 for Preliminary Servicing Plan indicating the proposed civil requirements to service the site with the proposed school located on the west side.

All existing services will be removed within the site and capped at the property line as required upon completion of the civil construction and/ or commissioning of the replacement service.

4.1 WATER

A new 150mm diameter combined fire and domestic water connection, complete with meter, will be required from the existing main on Shavington Street into the new building's mechanical room. An onsite fire hydrant will be required if the proposed fire department connection at the entrance to the facility is not located within 45m of an existing offsite fire hydrant. As the City identified an area of lower pressure in the existing water network, there may be a need to boost sprinkler pressure on the site.

4.2 STORM

A new 300mm diameter storm service connection to the site is proposed from the west side of the new facility to the existing 375mm diameter storm main along Hendry Avenue. An onsite storm drainage system complete with manholes, catch basins and storm sewers will be required for site drainage.

Stormwater detention and stormwater quality devices will be required per City of North Vancouver specifications. A stormwater detention tank and flow control structure are proposed underneath the parking area to the west of the facility. The proposed stormwater source controls for the site shall consume 56mm of rain over a 24-hour period from all impervious building surfaces.

4.3 SANITARY

A new 200mm diameter sanitary service connection is required from the south side of the proposed facility. The proposed service will connect to a new 200mm diameter off-site sanitary sewer extension along Shavington Street that will tie to an existing sanitary manhole located at the intersection of Shavington Street and Kennard Avenue. Per the servicing comments received from the City, the existing sanitary sewer downstream of the connection point to the City's system on Kennard Avenue may require upgrade.

4.4 ROADWORKS

The proposed onsite roadway will connect between Cloverly Street and Hendry Avenue. Drop-off and parallel parking stalls are proposed in front of the entrance to the facility. A paved parking area consisting of 35 parking stalls shall be located adjacent to the school.

The City of North Vancouver requires the roadways adjacent to the proposed site to be upgraded to current standards. This off-site work could include widening or reconfiguration of the existing sidewalks and boulevards around the perimeter of the site. The existing sidewalk along the perimeter of the site is only 1.2m wide, and the City's Subdivision and Development Bylaw requires a width of 1.8m. In addition, new off-site streetlighting may be required.

5.0 CONCLUSION

The waterworks, storm and sanitary servicing, and roadworks requirements to provide service to the new Elementary School have been outlined in this report for both the east and west building siting options.

APPENDIX A

PLUMBING AS-BUILT
SITE PLAN

GENERAL NOTES

1. INSTALLATION OF PLUMBING SYSTEM SHALL BE IN ACCORDANCE WITH B.C. PLUMBING CODE 2006, LOCAL PLUMBING BY-LAW AND THE CONTRACT DOCUMENTS.
2. CONNECTION TO EXISTING GAS METER HEADER SHALL BE COORDINATED WITH TERASEN GAS.
3. FOR DESIGN OF FIRE PROTECTION SYSTEM, REFER TO SPRINKLER ENGINEER'S DRAWINGS.
4. REFER TO ARCHITECTURAL DRAWINGS FOR FINISHED GRADE ELEVATIONS.
5. ALL MATERIALS TO BE NEW AND CSA CERTIFIED.
6. ALL WORK, MATERIAL AND TESTING TO BE IN ACCORDANCE WITH THE CITY OF NORTH VANCOUVER "SUBDIVISION AND DEVELOPMENT BY-LAW". THE MASTER MUNICIPAL SPECIFICATIONS AND STANDARD DETAIL DRAWINGS AND THE BRITISH COLUMBIA PLUMBING CODE.
7. ALL TIE-INS TO EXISTING MAINS TO BE INSTALLED AS DIRECTED BY THE CITY OF NORTH VANCOUVER.
8. CONTRACTORS TO CONTACT TERASEN GAS AT LEAST 48 HOURS PRIOR TO WORKING IN AREAS OF EXISTING GAS MAINS OR SERVICES.
9. ALL WORKS SHALL PASS INSPECTION BY THE ENGINEER AND THE CITY OF NORTH VANCOUVER,
10. IMPORTANT: ALL LOCATION AND ELEVATIONS OF EXISTING UTILITIES AND SERVICES TO BE CONFIRMED BY THE CONTRACTOR IN FIELD PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
11. IMPORTANT: INSPECTION BY ENGINEER IS REQUIRED ON ALL SITE SERVICING. CONTRACTOR TO PROVIDE ENGINEER WITH A MINIMUM OF 24 HOURS NOTICE TO CARRY OUT INSPECTION PRIOR TO BACKFILLING OF ALL CIVIL WORK FACILITIES.
12. CONTRACTOR TO PROVIDE AS BUILT MARKED UP DRAWINGS ON SITE. HE MUST RECORD EACH LOCATION AND ELEVATION OF ALL WORKS AS CONSTRUCTED. AT COMPLETION, THE MARKED UP DRAWINGS MUST BE GIVEN TO THE ENGINEER AS RECORD DRAWINGS.
13. WATER SERVICE PIPE IS TO BE PVC SERIES 150 (AWWA C900) OR APPROVED EQUAL.
14. WATER SERVICE PIPE TO HAVE A MIN. 1000mm COVER.
15. WATER SERVICE SHALL BE TESTED AND PASSED TO APPLICABLE STANDARDS.
16. SANITARY SEWER PIPE 150mm DIA. AND UNDER TO BE PVC SDR 28 AND OVER 150 mm DIA. TO BE PVC SDR35 OR OF APPROVED EQUAL.
17. SANITARY SEWER SHALL BE TESTED AND PASSED TO APPLICABLE STANDARDS.
18. STORM SEWER PIPE 150mm DIA. AND UNDER TO BE PVC SDR 28 AND OVER 150mm DIA. TO BE PVC SDR 35, CONCRETE CLASS 3 OR APPROVED EQUAL.

PLUMBING DRAWING LIST

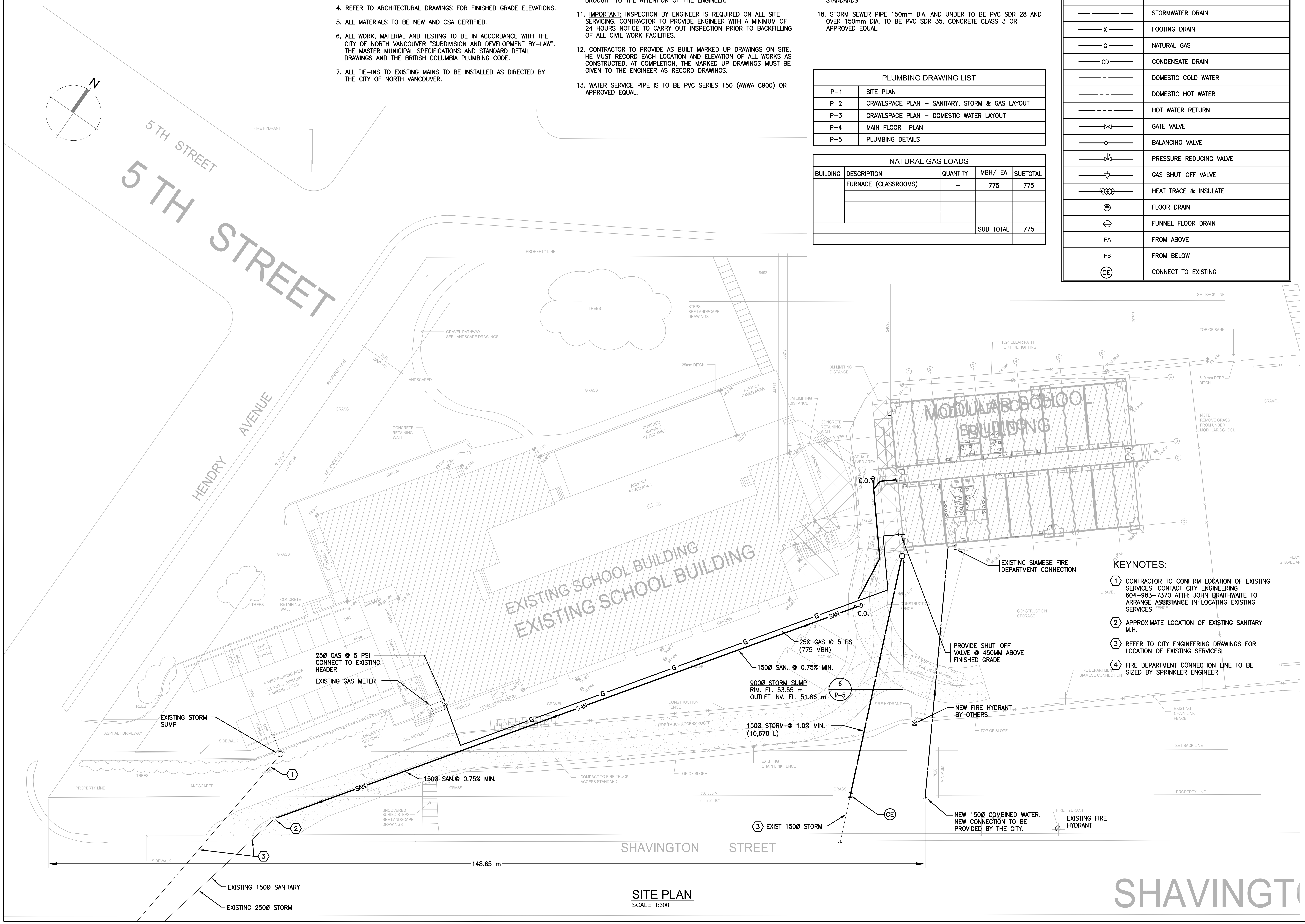
P-1	SITE PLAN
P-2	CRAWLSPACE PLAN – SANITARY, STORM & GAS LAYOUT
P-3	CRAWLSPACE PLAN – DOMESTIC WATER LAYOUT
P-4	MAIN FLOOR PLAN
P-5	PLUMBING DETAILS

NATURAL GAS LOADS

BUILDING	DESCRIPTION	QUANTITY	MBH/ EA	SUBTOTAL
	FURNACE (CLASSROOMS)	–	775	775
			SUB TOTAL	775

PLUMBING LEGEND

SYMBOL	DESCRIPTION
———	EXISTING SERVICE
━━━	SANITARY DRAIN
- - - - -	SANITARY VENT
—— —— ——	STORMWATER DRAIN
—— X ——	FOOTING DRAIN
—— G ——	NATURAL GAS
—— CD ——	CONDENSATE DRAIN
—— - ——	DOMESTIC COLD WATER
—— - - ——	DOMESTIC HOT WATER
—— - - - ——	HOT WATER RETURN
—⋈—	GATE VALVE
—⋈—	BALANCING VALVE
—⋈—	PRESSURE REDUCING VALVE
—▽—	GAS SHUT-OFF VALVE
—ooo—	HEAT TRACE & INSULATE
⊜	FLOOR DRAIN
⊖	FUNNEL FLOOR DRAIN
FA	FROM ABOVE
FB	FROM BELOW
CE	CONNECT TO EXISTING



KEYNOTES:

1. CONTRACTOR TO CONFIRM LOCATION OF EXISTING SERVICES. CONTACT CITY ENGINEERING 604-983-7370 ATTH: JOHN BRAITHWAITE TO ARRANGE ASSISTANCE IN LOCATING EXISTING SERVICES.
2. APPROXIMATE LOCATION OF EXISTING SANITARY M.H.
3. REFER TO CITY ENGINEERING DRAWINGS FOR LOCATION OF EXISTING SERVICES.
4. FIRE DEPARTMENT CONNECTION LINE TO BE SIZED BY SPRINKLER ENGINEER.

SITE PLAN
SCALE: 1:300

KEY PLAN

No.	Description	Date	Dr.
–	ISSUED FOR TENDER	09.04.21	
–	ISSUED FOR BUILDING PERMIT	09.04.13	

Revisions: Read Up

MMM Group Limited
1650 Alberni Street, Unit 200
Vancouver, BC V6G 1A6
t: 604.688.8671
f: 604.688.9760
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MMM GROUP

Ref. No. 50-09-048

DA Architects + Planners
>> 200 - 1014 Homer Street, Vancouver
British Columbia, Canada V6B 2W9
T 604 685 6312
F 604 685 0988
www.da-architects.ca

CLOVERLEY MODULAR
ELEMENTARY SCHOOL

440 HENDRY AVENUE
NORTH VANCOUVER
SCHOOL DISTRICT No.44

Sheet Title
SITE PLAN

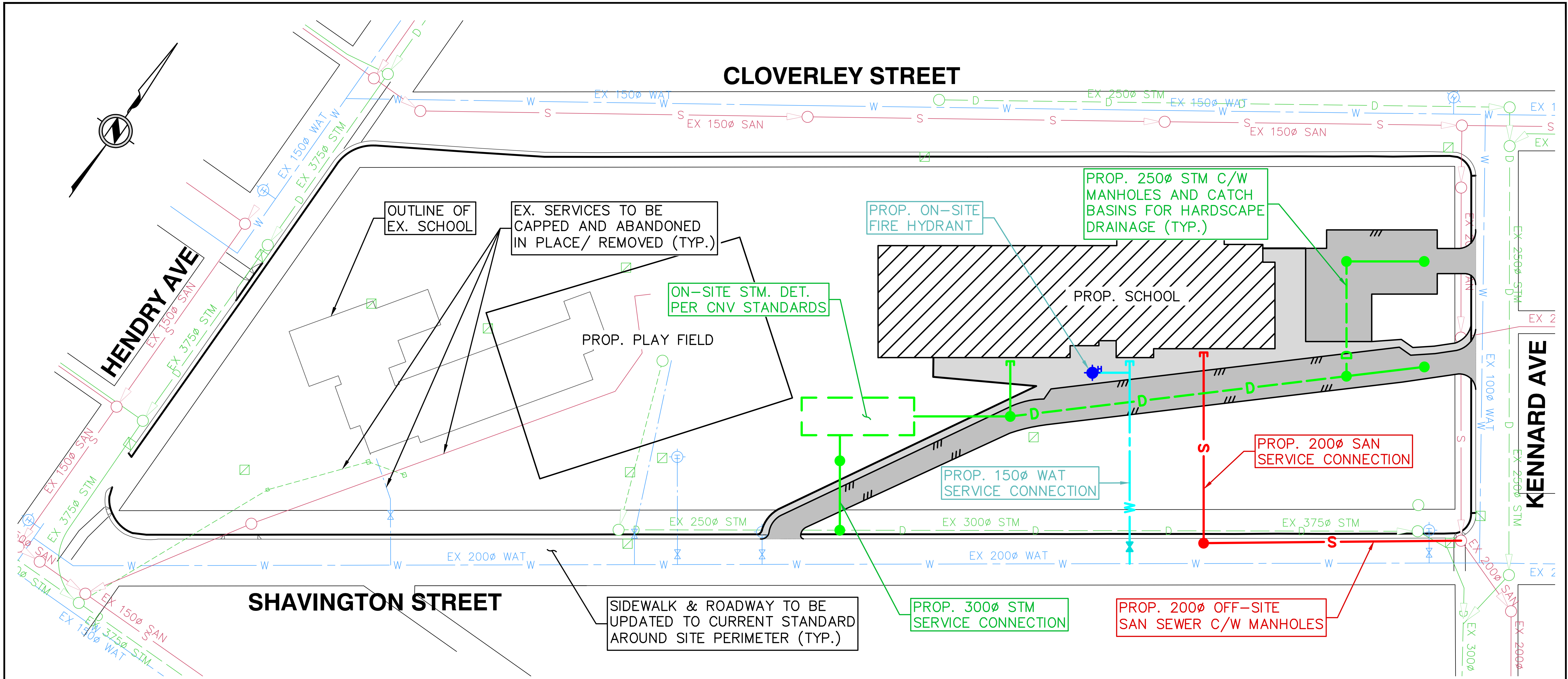
Job No. 2902-100
Scale 1:300
Drawn LS
Checked JK
Approved PO
Date 09.03.27

Sheet No.
P-1
of 5

Revision

APPENDIX B

PRELIMINARY SERVICING DRAWINGS



LEGEND:

●	PROP. MANHOLE	—D—	PROP. STORM SEWER	▨	EX. CATCH BASIN	—W—	EX. WATERMAIN
▨	PROP. CATCH BASIN	—S—	PROP. SANITARY SEWER	═	EX. CURB		
●	PROP. FIRE HYDRANT	—W—	PROP. WATERMAIN	—D—	EX. STORM SEWER		
▒	PROP. ASPHALT ROAD	░	PROP. CONCRETE SIDEWALK	—S—	EX. SANITARY SEWER		

LEGAL DESCRIPTION:

B.M. MONUMENT NO. ELEVATION:
LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP
01	PROJECT DEFINITION REPORT	RBD	TMJS	28.JULY.21	TMJS

APLIN MARTIN
ENGINEERING ARCHITECTURE PLANNING SURVEYING

Aplin & Martin Consultants Ltd.
#1818 – 1177 West Hastings Street Vancouver, B.C. V6E 2K3
Tel: (604) 678-9434, Fax: (604) 597-9061, Email: general@aplinmartin.com

CLIENT:
SCHOOL DISTRICT 44 NORTH VANCOUVER
2121 LONSDALE AVE, NORTH VANCOUVER, BC V7M 2K6
PH. 604-903-3444

PROJECT:
CLOVERLEY ELEMENTARY SCHOOL CONCEPT
400 HENDRY AVE, NORTH VANCOUVER, BC V7L 4C5

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE:
PRELIM. SERVICING CONCEPT
EAST OPTION

PROJECT NO.

SCALE :
HORZ. 1:1000
VERT. N/A

DRAWING NO.

A & M DRAWING NO.
21-5086- 01

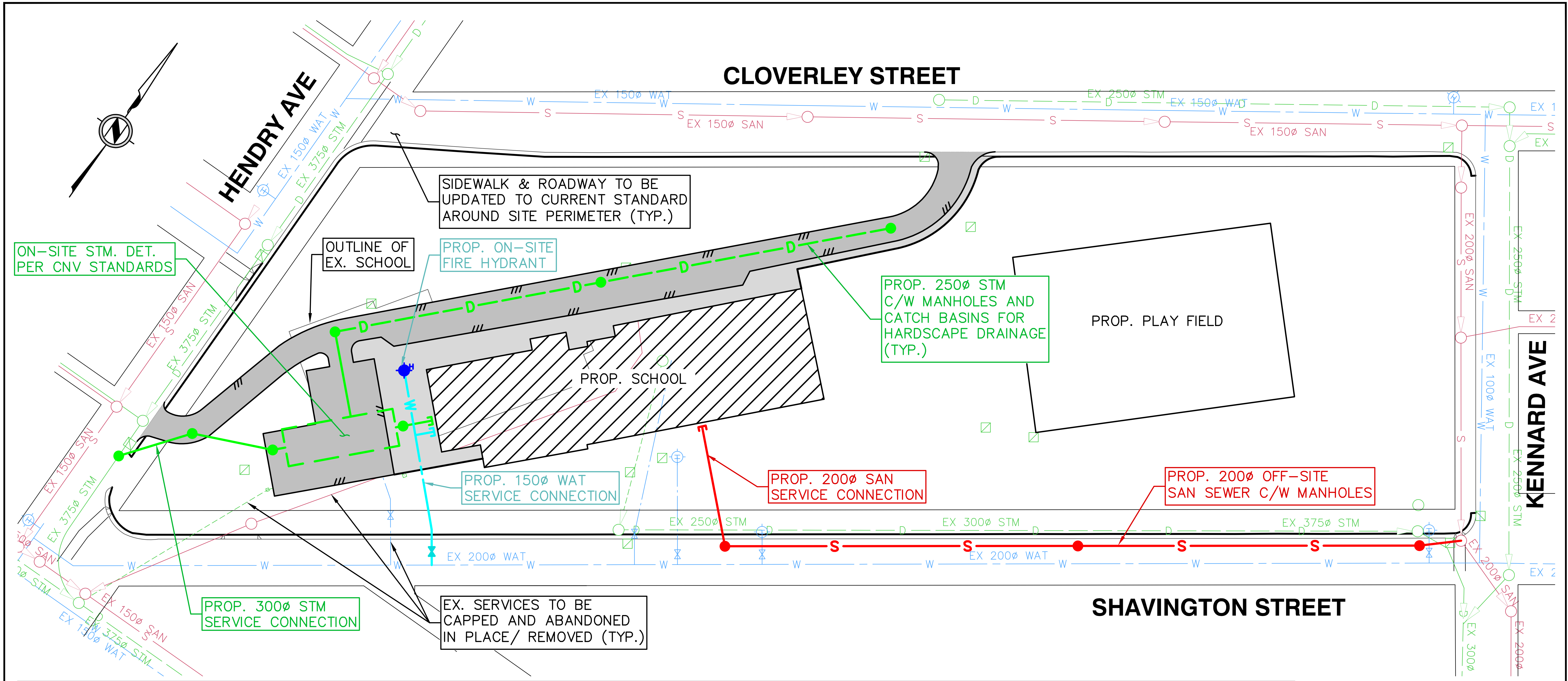
DESIGN: RBD CHECK: TMJS
DRAWN: RBD APPR: TMJS

A & M FILE:
21-5086

DRAWING DATE:
JULY 2021

SHEET NO.
01 OF 02

REV.
01



LEGEND:

● PROP. MANHOLE

▨ PROP. CATCH BASIN

● PROP. FIRE HYDRANT

▨ PROP. ASPHALT ROAD

—D— PROP. STORM SEWER

—S— PROP. SANITARY SEWER

—W— PROP. WATERMAIN

▨ PROP. CONCRETE SIDEWALK

☒ EX. CATCH BASIN

═ EX. CURB

—D— EX. STORM SEWER

—S— EX. SANITARY SEWER

—W— EX. WATERMAIN

LEGAL DESCRIPTION:

B.M. MONUMENT NO. ELEVATION:
LOCATED AT STREET & AVENUE

REV. NO.	DESCRIPTION	DR	CH	DATE	APP
01	PROJECT DEFINITION REPORT	RBD	TMJS	28.JULY.21	TMJS

APLIN MARTIN
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CLIENT:
SCHOOL DISTRICT 44 NORTH VANCOUVER
2121 LONSDALE AVE, NORTH VANCOUVER, BC V7M 2K6
PH. 604-903-3444

PROJECT:
CLOVERLEY ELEMENTARY SCHOOL CONCEPT
400 HENDRY AVE, NORTH VANCOUVER, BC V7L 4C5

The location of existing underground utilities are shown in an approximate way only & have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

TITLE:
PRELIM. SERVICING CONCEPT
WEST OPTION

PROJECT NO.

SCALE :
HORZ. 1:1000
VERT. N/A

DRAWING NO.

A & M DRAWING NO.
21-5086- 02

DESIGN: RBD CHECK: TMJS
DRAWN: RBD APPR: TMJS

A & M FILE:
21-5086

DRAWING DATE:
JULY 2021

SHEET NO.
02 OF 02

REV.
01

Jul 27 2021 – 9:23am M:\VAN\2021\21-5086\DWG\OFFSITE PRODUCTION\21-5086 – 01 – PRELIM SERVICING PLAN – WEST.dwg/WEST RDewar

THURBER ENGINEERING LTD.

May 25, 2021 File: 28847

North Vancouver School District #44
2121 Lonsdale Avenue
North Vancouver, B.C.
V7M 2K6

Attention: [redacted]

440 HENDRY AVENUE, NORTH VANCOUVER, BC.
GEOTECHNICAL REPORT

[redacted]

As requested, Thurber Engineering Ltd. has completed a geotechnical investigation for the possible development of a new school at 440 Hendry Avenue in North Vancouver. This report provides the results of our investigation and geotechnical comments and recommendations for the proposed works.

It is a condition of this letter that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. BACKGROUND

The property at 440 Hendry Avenue in North Vancouver is bounded by Hendry Avenue to the west, Shavington Street to the south, Kennard Avenue to the east, and Cloverley Street to the north. The site is about 7.3 acres in size. The decommissioned Cloverley Elementary School is located on the west side of the property. East of the school building there is a gravel field, tennis courts, and Cloverley Park which is adjacent to Kennard Avenue.

The site slopes at about 20° from Cloverley Street to the grade surrounding the school. There is a generally flat, approximately 50 m wide, bench through the middle portion of the site beyond which there is another slope approximately 20° from school grade to Shavington Street.

2. PREVIOUS WORK

Thurber previously prepared a preliminary geotechnical report and a Phase 1 Environmental Report, both dated June 1, 2020, for the North Vancouver School District #44 (School District). These reports were prepared to assist the School District with their review possible future development options for 440 Hendry Avenue.

3. GEOTECHNICAL INVESTIGATION

Prior to conducting the field investigation, BC One Call and DigShaw were notified to identify utilities in the vicinity of the investigation area. On April 16, 2021 Thurber mobilized to site with

Western Locates to perform a utility sweep to confirm the locations of utilities in the vicinity of the proposed test holes. A representative from the School District was present on site to allow access into the school's mechanical room to provide the locators with a clearer understanding of the orientation of utilities coming in and out of the building.

Thurber retained OnTrack Drilling and the drilling investigation was completed between April 19, 2021 and April 21, 2021. The geotechnical investigation consisted of 6 cone penetration tests (CPT) for seismic liquefaction analysis and 11 solid stem auger test holes profiling the strata and strata density. Three monitoring wells were installed to determine the depth of the groundwater table and the details for each well are provided on the test hole logs. Table 1 provides a summary of the work completed at each location.

Table 1 – Summary of Test Holes

Test Hole Number	Solid Stem Auger	DCPT	CPT	Monitoring Well
TH21-01			Completed	
TH21-02	Completed	Completed		
TH21-03A	Completed			
TH21-03B	Completed		Completed	
TH21-04	Completed	Completed		
TH21-05	Completed	Completed		Installed
TH21-06	Completed		Completed	
TH21-07			Completed	
TH21-08	Completed		Completed	
TH21-09	Completed	Completed		
TH21-10	Completed		Completed	
TH21-11	Completed	Completed		Installed
TH21-12	Completed	Completed		Installed
TH21-13	Completed	Completed		

During the investigation, the soil and groundwater conditions were logged in the field by an experienced geotechnical engineer. Representative disturbed samples were collected and subjected to routine visual classification and moisture content determination in Thurber's laboratory. In addition to the geotechnical sampling, Thurber collected samples for environmental testing from select test holes and depths.

All test holes were backfilled with drill cuttings and sealed with bentonite chips in general accordance with BC groundwater protection regulations. Penetrations through pavement were patched with cold mix asphalt.

Test hole coordinates were obtained by Thurber using a handheld GPS. The approximate test hole locations are shown on Drawing 28847-1.

4. RESULTS OF THE INVESTIGATION

The subsurface conditions encountered during the investigation were consistent with the Geological Survey of Canada's surficial geology maps which indicate that the underlying soils comprise competent till-like soil at or near the ground surface (VCb).

The attached test hole logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized description given below.

In general, the soil profile consisted of soft to firm silt, followed by compact to dense gravelly sand to sand and gravel, overlaying dense, weathered, till-like material generally comprised of sand with variable silt and gravel content. The till-like material was encountered at about 3.0 m below ground surface east of the tennis courts, and at about 6.1 m to 7.6 m west of the tennis courts. At TH21-13, a sand layer was encountered between 4.7 m and 5 m. The density of the sand layer was inferred to be compact.

Test hole refusal depths ranged from 3.1 m to maximum depths of 9.2 m. CPT reached a maximum depth of 6.1 m below ground surface at TH21-06 and refused as shallow as 1.2 m below ground surface at TH21-03.

The water levels in the monitoring wells were measured on May 10, 2021. The depth to water below the ground surface at TH21-05 was 5.55 m, at TH21-11 was 3.85 m, and at TH21-12 was 5.05 m.

5. ENVIRONMENTAL ASSESSMENT

As recommended in our Phase I Environmental Site Assessment (P1ESA) report dated June 1, 2020, we completed opportunistic environmental soil sampling during the geotechnical investigation. Select samples were submitted for laboratory analyses for Potential Contaminants of Concern (PCOCs) related to fill material from unknown sources. The objective was to characterize the soil's environmental quality and classify it for potential future soil relocation or disposal requirements.

5.1 Regulatory Context

In British Columbia, environmental matters pertaining to contaminated sites are within the jurisdiction of the Ministry, pursuant to the *EMA* (SBC 2003, Chapter 53 Assented to October 23, 2003, as amended on July 8, 2004). The key *EMA* regulation relating to the assessment and remediation of contaminated sites is the CSR, BCC Reg. 375/96 OCC 1480/96, including amendments up to BCC Reg. 161/2020, February 1, 2021.

It is understood that the footprint and design of the new school has not yet been determined. To characterize the soil for future excavation and potential off-site relocation purposes, the analytical results were compared to the Agricultural Land Use (AL, generally most stringent), Residential

Low-Density Land Use (RLD), Commercial (CL) and Industrial Land Use (IL). The following site-specific exposure pathways were applied:

- Intake of contaminated soil;
- Toxicity to soil invertebrates and plants;
- Livestock ingesting soil and fodder,
- Major microbial functional impairment,
- Groundwater used for drinking water;
- Groundwater used for livestock watering,
- Groundwater used for livestock watering, and,
- Groundwater flow to surface water used by aquatic life (freshwater and marine).

5.2 Soil Sampling and Field Screening

Environmental soil samples were collected from nine of the solid stem auger test holes (TH21-02, TH21-05, TH21-06, TH21-08 through TH21-13) at maximum depth intervals of 0.9 m. Each sample was then split into a field screening portion and a laboratory analysis portion.

The field screening portion of the sample was placed into a clean plastic bag and allowed to equilibrate to ambient temperature for at least 20 minutes. The vapour concentration in the headspace above the soil sample in the plastic bag was then measured using a Mini-RAE photoionization detector (PID). The maximum headspace vapour concentration for all soil samples was 13.3 parts per million by volume (ppm/v) measured in TH21-08. The headspace readings are shown on the test hole logs. Based on our observations, no visual or olfactory evidence of hydrocarbon impacts was noted.

The laboratory analysis portion of the sample was placed into clean laboratory provided glass containers and placed into a cooler with ice prior to being submitted to CARO Analytics (CARO). All soil samples and containers were handled wearing disposable nitrile gloves and any sampling tools utilized were cleaned with distilled water between uses. Soil samples were selected for analysis based on field observations, the field screening results and to provide general coverage.

5.3 Soil Analytical Program

One sample from each of TH21-08, TH21-09, TH21-11 and TH21-13 (four samples total) were selected for laboratory analytical testing. These test holes were located on the west side of the site where historical fill material was reported to have been placed. The samples were selected from depths ranging between 0.2 m and 1.8 m below ground surface and submitted to CARO for laboratory analysis of Light and Heavy Extractable Petroleum Hydrocarbons (LEPH and HEPH), Polycyclic Aromatic Hydrocarbons (PAH), and metals. Based on the field screening results, none of the samples were analyzed for Volatile Organic Compounds (VOC).

The analytical results are tabulated in the tables appended to this report and compared to the applicable CSR standards. Copies of the laboratory analytical certificates are included in the attachments.

5.4 Soil Results Discussion

Based on the analytical results, there were no PCOC concentrations reported above the AL, RLD, PL, CL or IL land use standards.

6. GEOTECHNICAL RECOMMENDATIONS

6.1 Site Preparation and Grading

Preparation of the site will involve clearing and grubbing of all vegetation, followed by stripping off all topsoil, organic silt and any soft, compressible soils from the building area. The underlying subgrade surface should be inspected by Thurber upon completion of the site preparation to confirm that all compressible materials have been satisfactorily removed from the building areas.

Structural fill should be clean (less than 5% passing the #200 sieve), well graded, minus 75 mm granular material. The material should be placed in maximum 300 mm level lifts and compacted to at least 100% of Standard Proctor maximum dry density (SPMDD) using a large, smooth steel drum, vibratory roller.

6.2 Excavations

Temporary excavation slopes should be carried out in accordance with WorkSafeBC requirements. However, excavations should be prepared at 1H:1V or flatter in loose to compact granular material, and soft to firm fine grained soils.

Any groundwater encountered during completion of the excavation will need to be controlled by surface ditching, sumps, and pumps. All unsupported slopes should be protected from soil erosion by plastic sheeting or other protective materials.

6.3 Subgrade Preparation

Excavation near the subgrade level should be carried out using an excavator equipped with a smooth-edge trimming bucket. The subgrade should be level and free of any wet or loose material. Any pockets of topsoil, debris, or other unsuitable soils should be sub-excavated and replaced by structural fill as discussed in Section 6.1.

The prepared subgrade and all bearing surfaces should be inspected by Thurber to confirm that actual conditions conform to those assumed for design and to provide remedial recommendations, if required. The bearing surfaces must be protected from loosening or softening due to water, foot or machine traffic. Any disturbed material must be removed before placing the footings.

6.4 Foundations

It is our opinion that conventional spread footings are the most suitable foundation system for support of buildings at this site. It is likely that sub-excavation and replacement of the underlying soft to firm silts and clays will be required prior to spread footing construction. The soft to firm silts and clays extend to greater depths towards the south side of the site. Alternate foundation options, such as piles, may be required if the School District chooses not to remove these compressible silt and clay soils.

If the School District plans on constructing structures near the south side of the side consideration should be given to stepping the foundation and building, with higher building grades to the north and lower grades to the south.

6.4.1 Bearing Resistances and Anticipated Settlements

For shallow foundations founded on undisturbed compact native granular soil, or structural fill placed in accordance with Section 6.1, a factored bearing resistance of 200 kPa can be used under ultimate limit state (ULS) loading conditions. The factored bearing resistance under ULS loading conditions has incorporated a geotechnical resistance factor (GRF) of 0.5.

A bearing resistance of 150 kPa can be used for footing design under serviceability limit state (SLS) loading conditions. Settlements under SLS loading conditions are expected to be relatively small (< 25 mm).

The bearing resistances are subject to minimum widths of 450 mm and 600 mm for strip and pad footings, respectively. The footings must have a minimum embedment depth of 450 mm below the adjacent finished grade for frost protection purposes.

Table 2 provides the depths from existing grades where shallow foundations could be founded at each test hole location. The same information is provided in Drawing 28847-2.

Table 2 – Depth to Competent Ground Conditions for Shallow Foundations

Test Hole Number	Depth to Competent Ground (m)	Depth to Till-Like Soils (m)
TH21-01	~3.0	~3.0
TH21-02	2.6	4.1
TH21-03A	1.8	NA
TH21-03B	2.4	NA
TH21-04	1.4	1.9
TH21-05	0.6	2.4
TH21-06	7.0	7.0
TH21-07	~6.0	~6.0
TH21-08	4.1	4.1
TH21-09	3.0	3.0
TH21-10	4.0	4.0
TH21-11	2.3	6.0
TH21-12	4.5	4.5
TH21-13	3.0	5.1

6.4.2 Other Foundation Options

Another foundation option that could be considered is closed-ended driven steel pipe piles. The piles will have to embedded a minimum depth into the competent till-like soils. Driven piles are typically fast to install but may generate high levels of noise and disturbing and potentially damaging vibrations during driving. Alternatively, it may be possible to use non-conventional deep foundations such as helical screw piles.

6.5 Foundation Drainage

A foundation drain consisting of a 150 mm diameter perforated PVC pipe surrounded by at least 150 mm of 19 mm clear crushed gravel wrapped in a non-woven geotextile, would be appropriate for this site. The invert of the drainage system should be at or below the base of the granular fill layer under the slab-on-grade. The perimeter drains should be connected to a suitable point of gravity discharge or a pumped sump.

Within 2 m of a building, the yard grade should be sloped to provide surface drainage away from the building.

6.6 Slab-on-Grade

To provide adequate support for slab-on-grade, any soft materials encountered at the subgrade level should be sub-excavated and replaced with well-compacted fill. The subgrade surface should be compacted to at least 95% SPMDD. Groundwater may be encountered during the sub-excavation and replacement process.

A 150 mm thick layer of compacted granular fill should be provided immediately beneath slab-on-grade areas. The compacted layer of granular material will provide under slab drainage and enable final levelling prior to concrete placement.

Granular material such as minus 19 mm crushed sand and gravel with less than 5% passing the #200 sieve (or less than 0.075 mm) is appropriate as base fill beneath the floor slab. A vapour barrier comprising 6-mil (minimum) polyethylene sheeting should be placed on top of the granular fill. The polyethylene sheets should typically be overlapped a minimum of 0.3 m. Depending on the angularity of the granular fill used and level of traffic on the sheeting, a lightweight non-woven geotextile could be placed on top of the granular fill, prior to the polyethylene sheeting, to reduce the risk of punctures. Well-graded materials have the potential to allow moisture in the soil to rise to the vapour barrier which could result in a damp top surface of the concrete slab, especially where the vapour barrier is punctured or compromised during construction if a non-woven layer is not provided. The minus 19 mm base should be compacted to at least 100% of SPMDD.

6.7 General Backfill

General backfill material, where required, should comprise well graded, clean, free-draining, minus 75 mm pit run gravel with less than 8% passing the #200 sieve (less than 0.075 mm particle size). Backfill should be compacted in maximum 300 mm thick lifts to 95% SPMDD. Completed lifts should be tested to confirm specified compaction is achieved prior to placement of successive lifts.

Where the backfill surface will not be covered by asphalt or concrete, we recommend that the upper 300 mm backfill should be lower permeability material, such as the native silty sand, to prevent direct access of surface runoff into the backfill.

6.8 Underground Services

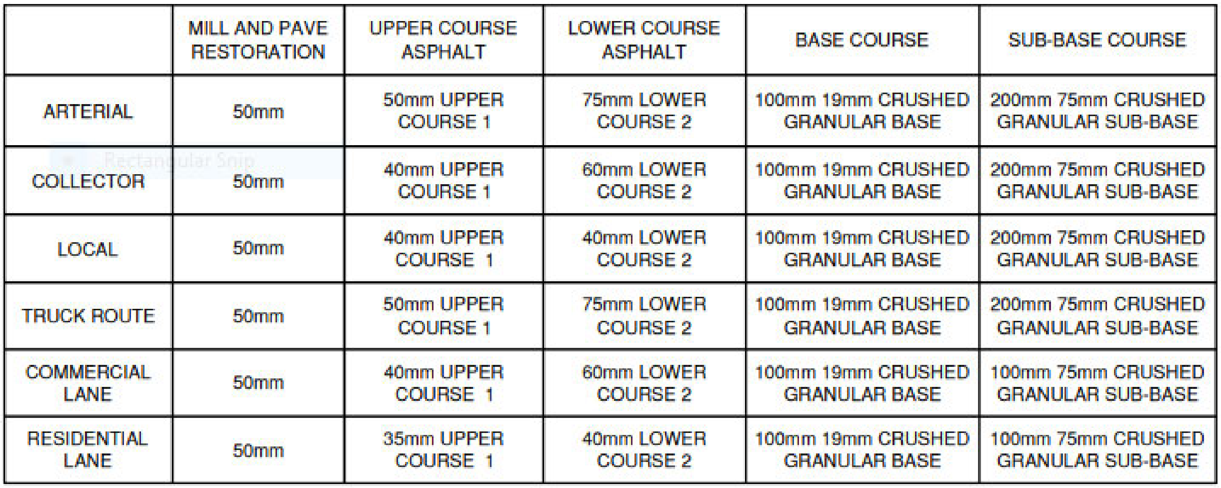
Underground services for buildings and yard areas can be installed using conventional techniques and design details consistent with MMCD and the City of North Vancouver specifications.

Underground services that run parallel to footings should not be located below a line projected downwards from the bottom edge of a footing at 1 horizontal to 1 vertical. Utilities that fall below this line should be relocated or encased in concrete.

6.9 Pavement

The pavement structure should be supported on a competent subgrade such as compact native granular fill or structural fill. The subgrade preparation and the granular base and sub-base layer should extend a minimum of 1.5 m beyond the perimeter of all paved areas. Pavement subgrade preparation and supply, placement and compaction of the pavement structure should be in accordance with specifications provided in the MMCD.

The City of North Vancouver pavement structure, as shown in Figure 1 below, is appropriate for this site.



	MILL AND PAVE RESTORATION	UPPER COURSE ASPHALT	LOWER COURSE ASPHALT	BASE COURSE	SUB-BASE COURSE
ARTERIAL	50mm	50mm UPPER COURSE 1	75mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
COLLECTOR	50mm	40mm UPPER COURSE 1	60mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
LOCAL	50mm	40mm UPPER COURSE 1	40mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
TRUCK ROUTE	50mm	50mm UPPER COURSE 1	75mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
COMMERCIAL LANE	50mm	40mm UPPER COURSE 1	60mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	100mm 75mm CRUSHED GRANULAR SUB-BASE
RESIDENTIAL LANE	50mm	35mm UPPER COURSE 1	40mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	100mm 75mm CRUSHED GRANULAR SUB-BASE

Figure 1 – City of North Vancouver Road Specifications (from Drawing R2S)

6.10 Lateral Pressures and Basement Wall Design

Provided clean granular fill is utilized in the active zone behind walls, lateral earth pressures on walls can be calculated as outlined below.

For active loading (i.e. the wall can move or rotate about 0.002 times the height), static earth pressures can be estimated using a hydrostatic pressure distribution (i.e. triangular) with an equivalent fluid density of 5.6 kN/m³. This is based on K_a = 0.28 and assuming a unit weight of 20 kN/m³ (for granular backfill described above). Lateral surcharge pressures should be added to static earth pressures. The lateral surcharge load can be applied as a rectangular pressure distribution and the pressure can be calculated by multiplying the vertical surcharge pressure by a factor of 0.28 (K_a).

For laterally restrained walls (at-rest conditions), static earth pressures can be estimated using a hydrostatic pressure distribution with an equivalent fluid density of 8.8 kN/m³. This is based on K_o = 0.44 and assuming a unit weight of 20 kN/m³ (for granular backfill described above). To account for compaction and surcharge pressures, the static earth pressures should be taken as the larger of the hydrostatic pressure combined with the lateral surcharge pressure or the hydrostatic pressure combined with the lateral compaction pressure. The lateral surcharge pressure can be calculated by multiplying the vertical surcharge pressure by a factor of 0.44 (K_0).

The compaction pressure can be applied as a 12 kPa uniform pressure distribution. Compaction and surcharge pressures can be applied as rectangular pressure from ground surface to where it intersects the hydrostatic pressure distribution.

The total lateral seismic force for the 1 in 2475 year return period earthquake can be determined by calculating the hydrostatic force using the equivalent fluid densities provided below. Because the location of this force is uncertain, we recommend applying it at 0.5H (i.e., as a uniform load) and at 0.33H (i.e., as a triangular load) from the base of the wall to check for the critical case. For a wall that can move 25 mm to 50 mm, an equivalent fluid density of 4.6 kN/m^3 can be used. For laterally restrained walls, an equivalent fluid density of 5.4 kN/m^3 can be used.

7. SEISMIC ASSESSMENT

As discussed, in Section 3, CPTs were completed to analyze the potential of liquefaction within the site. Our analysis indicates that the majority of the site is at a low risk of liquefaction during a seismic event. However, at CPT21-06 and CPT21-07 there is a possibility of liquefaction. To eliminate the risk of liquefaction we recommend, if structures are placed on the south side of the existing gravel field, that loose material be excavated to expose the native till-like soils, and foundations bear on the native, undisturbed till-like soils.

In consideration of the parameters listed in the BCBC 2018 (Table 4.1.8.4.A), and with the recommendation to remove soft soils, the site is classified as Site Class D.

8. SLOPE STABILITY

As mentioned above, the slopes around the property are generally around 20°. Slopes less than or equal to 20° are generally stable. In addition, the slopes within the property are covered in plant material resulting in a more stable slope due to root systems that reduce the potential for erosion and sloughing from surface water. The surrounding area is also sloped. The general topography slopes from the north west to the south east. Single family houses are located around the property, as shown on the attached figure.

There is a risk of slope instability along sections of the south slope due to the possible presence of liquefiable soils, during a seismic event. However, if structures are located in the area, we recommend removing the suspect soils to eliminate the risk.

9. FUTURE WORK

9.1 Detailed Design

Thurber requests that once the location of the proposed structure(s) is chosen, we have an opportunity to review the locations and provide further comments, if required.

9.2 Recommended Construction reviews

We recommend the following construction reviews be completed by Thurber. This is not exclusive, additional services may be required and requested during construction.

- Site preparation and grading
- Subgrade for footings and slab-on-grade
- Compaction testing of placed backfill

10. CLOSURE

We trust that this proposal provides the necessary information required at this time. Should you have any questions please do not hesitate to contact us.

Yours truly,
Thurber Engineering Ltd.
[redacted]

[redacted] [redacted]

Attachments
Statement of Limitations and Conditions
Test Hole Location Plan
Test Hole Location Plan with Till Depths
Symbols and Terms
Test Hole Logs
Cone Penetration Data
Environmental Analytical Results
Laboratory Analytical Certificates

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

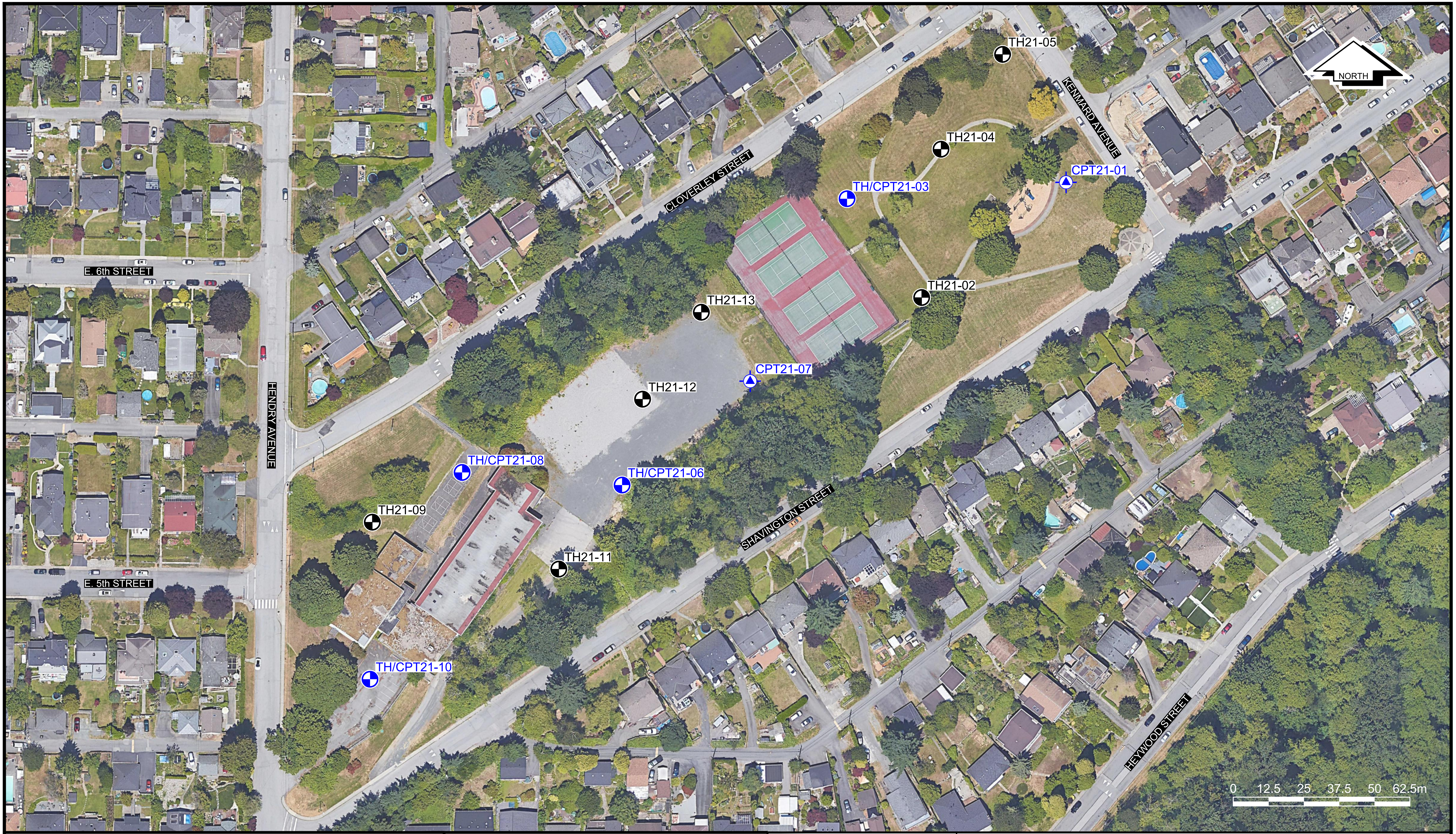
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Plotted: April 23, 2021



LEGEND:

- ◑ TEST HOLE
- ◐ TEST HOLE / CPT
- ▲ CPT

NOTES:

1. AERIAL IMAGE TAKEN FROM GOOGLE EARTH.
2. TEST HOLE LOCATIONS ARE APPROXIMATE.

THURBER ENGINEERING LTD.

NORTH VANCOUVER SCHOOL DISTRICT No. 44

TEST HOLE LOCATION PLAN

CLOVERLEY ELEMENTARY SCHOOL

NORTH VANCOUVER, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
MM	MOM		APRIL 23, 2021	1:1250	28847 -	1	0

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Plotted: April 23, 2021

LEGEND:

◑ TEST HOLE

◑ TEST HOLE / CPT

▲ CPT

NOTES:
1. AERIAL IMAGE TAKEN FROM GOOGLE EARTH.
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TEST HOLE LOCATION PLAN

CLOVERLEY ELEMENTARY SCHOOL

NORTH VANCOUVER, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
MM	MOM		APRIL 23, 2021	1:1250	28847	- 2	0

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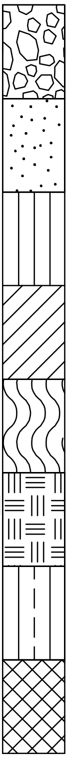
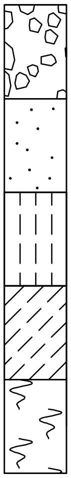
SYMBOLS AND TERMS

FOR SOIL DESCRIPTION AND TEST HOLE LOGS

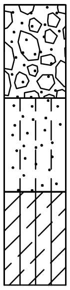
BASIC SOIL SYMBOLS





Predominant Material	Secondary Material
GRAVEL	gravelly to some gravel
SAND	sandy to some sand
SILT	silty to some silt
CLAY	clayey to some clay
PEAT / ORGANICS	some organics
Undifferentiated BEDROCK	
ORGANIC SILT	
FILL / DEBRIS	

SYMBOL VARIATIONS - EXAMPLES (1)



SAND and GRAVEL

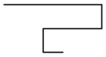
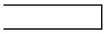
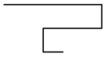
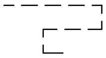
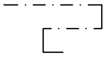
SAND, silty

SILT with some clay

DENSITY OF GRANULAR SOILS	
Description	SPT N (5) (6)
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

PROPORTION OF MINOR COMPONENTS BY WEIGHT (2)	
and	35 - 50%
y / ey	20 - 35%
some	10 - 20%
trace	0 - 10%

CONSISTENCY OF COHESIVE SOILS	
Description	Undrained Shear Strength (kPa) (6)
Very Soft	< 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	> 200

PENETRATION TESTS	
Dynamic Cone Penetration	
Standard Penetration	
Becker Closed Casing	
Becker Open Casing	
Bounce Chamber Pressure	

CLASSIFICATION BY PARTICLE SIZE				
		Size Range (6)		
			U.S. Standard Sieve Size	
Name		(mm)(3)	Retained	Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay)(4)		< 0.075	-	No. 200

(1) Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
(2) Example: SAND, silty, trace of gravel = sand with 20 to 35% silt and up to 10% gravel, by dry weight. Percentages of secondary materials are estimates based on visual and tactile assessment of samples.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits.
(5) SPT N values on test hole logs are uncorrected field values.
(6) Reference Canadian Foundation Engineering Manual 4th Edition, 2006.

THURBER

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-02

LOCATION: See DWG. 28847-1
N 5462069, E 496447 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY:

DEPTH (m)

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed
Plastic Limit ├──┤ Liquid Limit

WATER LEVEL

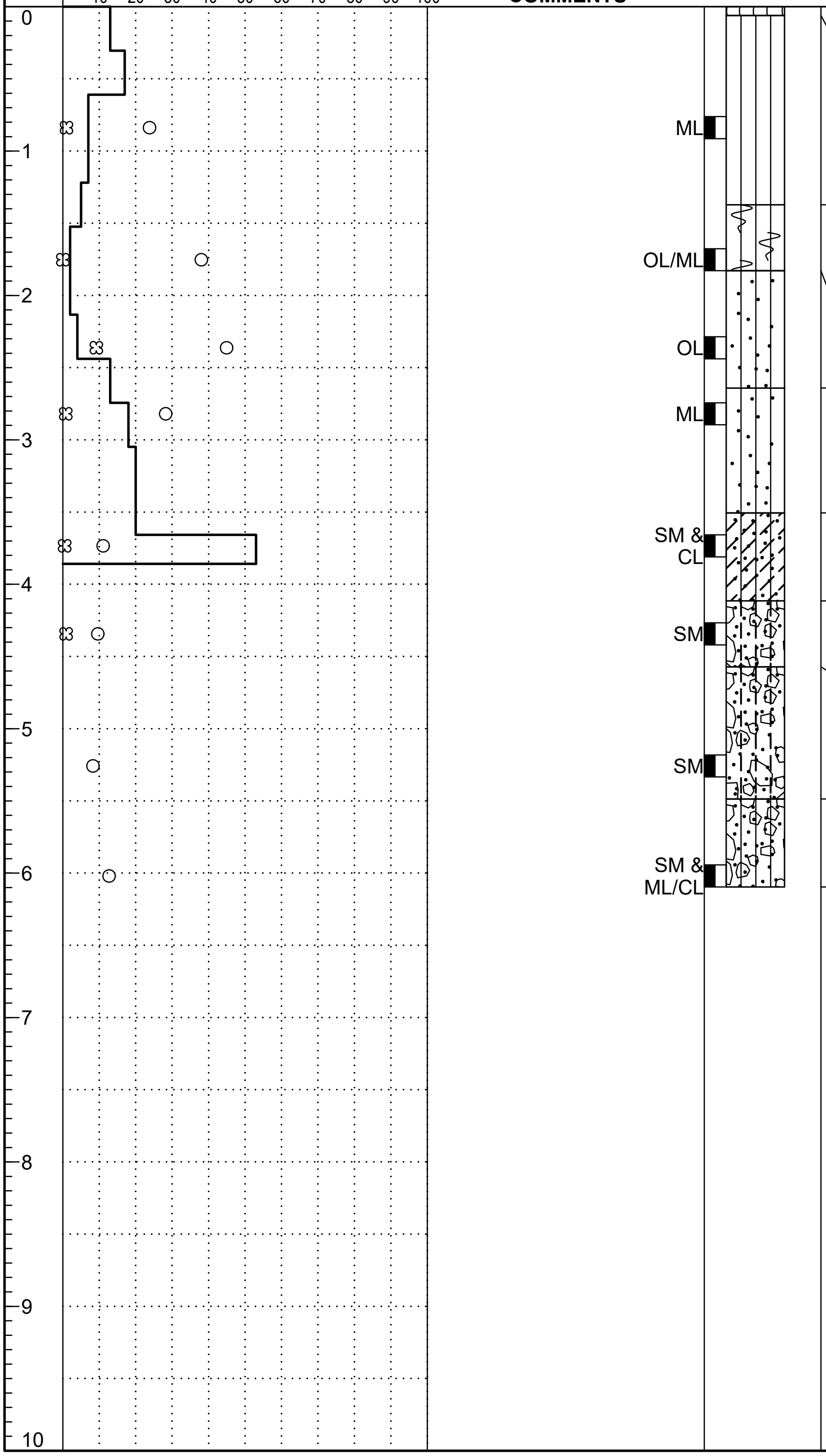
SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
GASTECH reading
PID reading

10 20 30 40 50 60 70 80 90 100 **COMMENTS** SOILS DESCRIPTION



TOPSOIL.

Firm to stiff, grey-brown, friable SILT with some mottling and traces of sand, clay, gravel, asphalt fragments and organics. (Fill)

Soft to firm, grey with dark brown zones, SILT with some organics and mottling, a trace to some organic silt and traces of asphalt fragments, sand and clay. (Fill)

Soft, dark brown, friable SILT with some sand and a trace to some organic silt and organics.

Stiff to very stiff, grey SILT with some sand to sandy, some mottling and a trace of clay.

Compact, mixed zones of brown SAND with some silt and brown-grey SILT with some clay to clayey.
- very dense below 3.7 m depth

Grey, gravelly SAND with some silt to silty and some zones of silt with a trace to some clay and sand. (Till-like)

Grey, silty SAND with some gravel and cobbles. (Till-like)

Mixed zones of brown-grey SAND with some silt to silty and brown-grey SILT with some gravel, a trace to some sand and clay. (Till-like)

Irrigation pipe observed in the side wall of test hole at 1.0 m depth.
End of hole when irrigation piping was observed.
Hole open to 6.0 m depth.
No water observed upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-03A

LOCATION: See DWG. 28847-1
N 5462104, E 496421 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%): ○ Disturbed ● Undisturbed; Plastic Limit, Liquid Limit

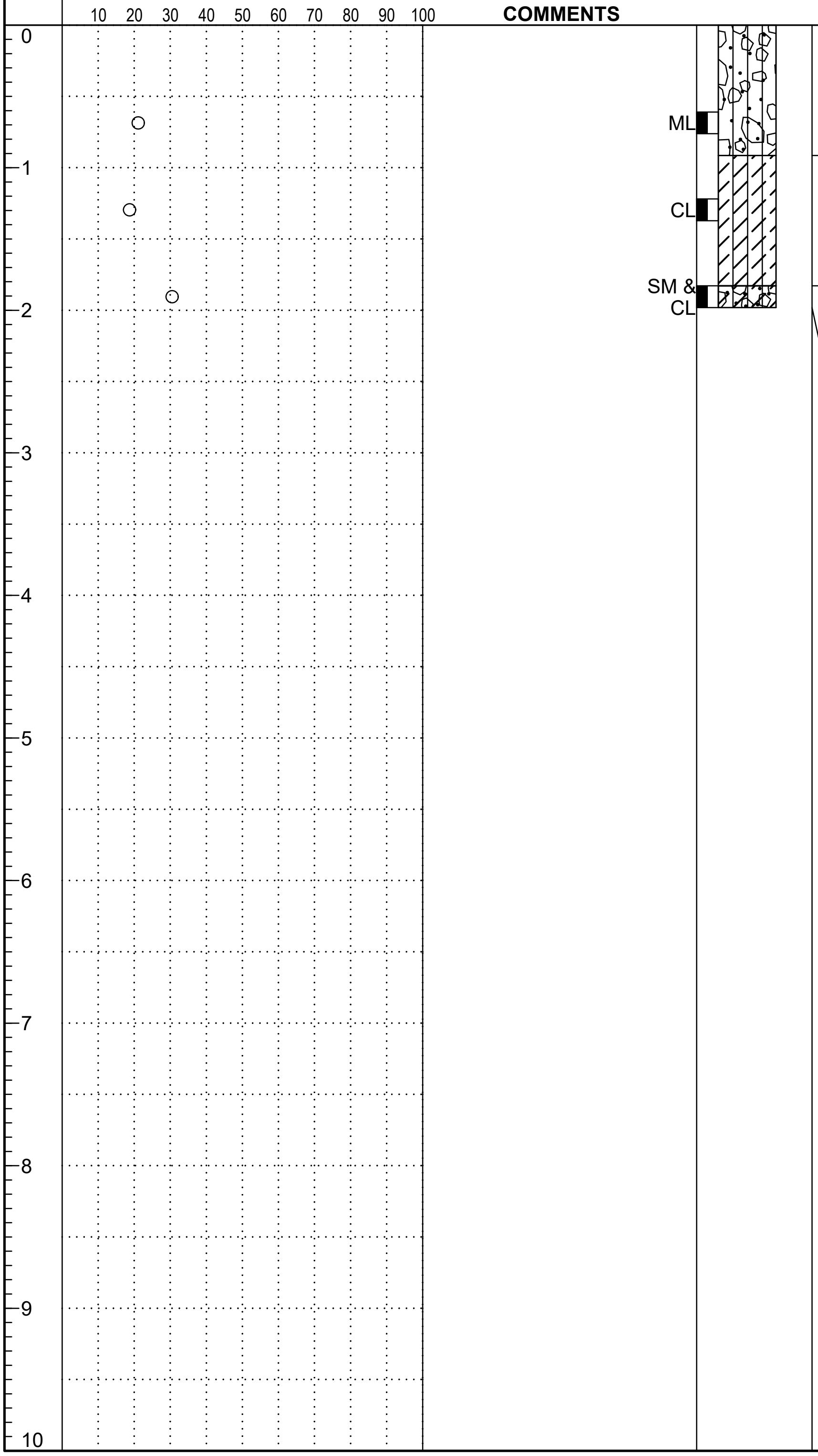
WATER LEVEL

SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded

GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve

SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading



SOILS DESCRIPTION

Brown, gravelly SILT with some sand and traces of clay and organics.

Soft to firm, brown-grey, SILT with some clay to clayey and some oxidation and traces of gravel and organics.

Mixed zones of brown-grey, silty SAND with some gravel and soft-firm SILT with some clay to clayey and traces of sand.

End of hole due to refusal.
Hole open to 2.0 m depth.
No water observed upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. **TH21-03B**

LOCATION: See DWG. 28847-1
N 5462104, E 496423 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed
Plastic Limit ⊢—⊣ Liquid Limit

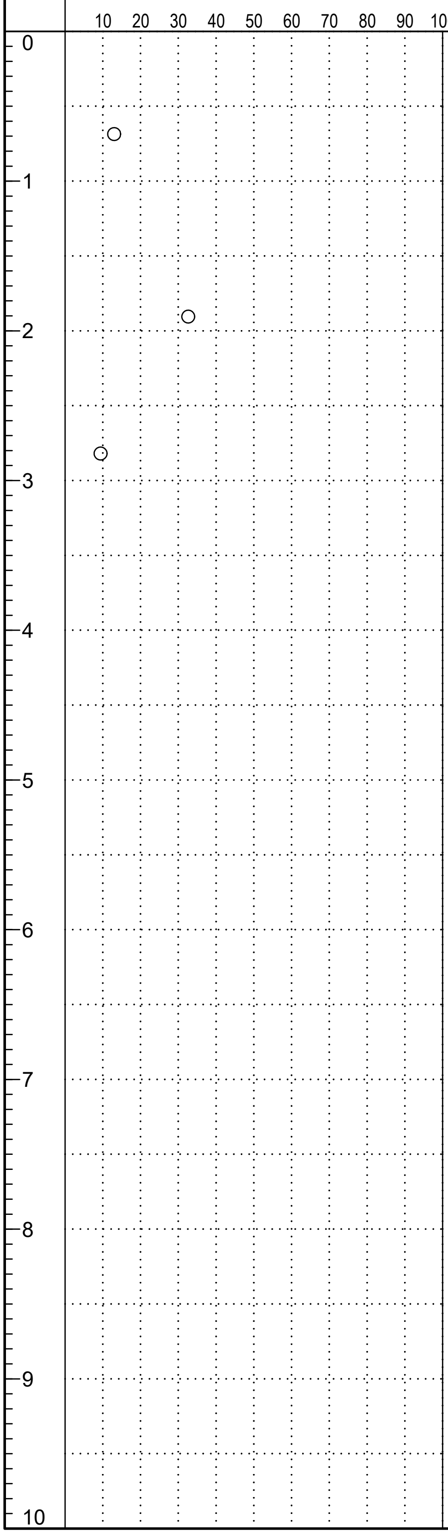
WATER LEVEL

SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

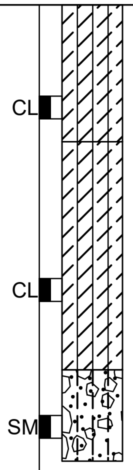
GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
GASTECH reading
PID reading



COMMENTS

Moved approximately 2 m east from TH21-03A.



SOILS DESCRIPTION

DEPTH (m)	SOILS DESCRIPTION
0	Firm, brown-grey, clayey SILT with a trace to some sand and traces of gravel and organics.
0.9	Soft to firm, brown-grey SILT with some clay to clayey, some oxidation and traces of gravel and organics.
2.4	Brown-grey, gravelly SAND with some silt to silty and some zones of firm to soft silt with a trace to some clay and sand.
3.0	End of hole due to refusal. Hole open to 3.0 m depth. No water observed upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-04

LOCATION: See DWG. 28847-1
N 5462122, E 496454 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed
Plastic Limit — Liquid Limit

WATER LEVEL

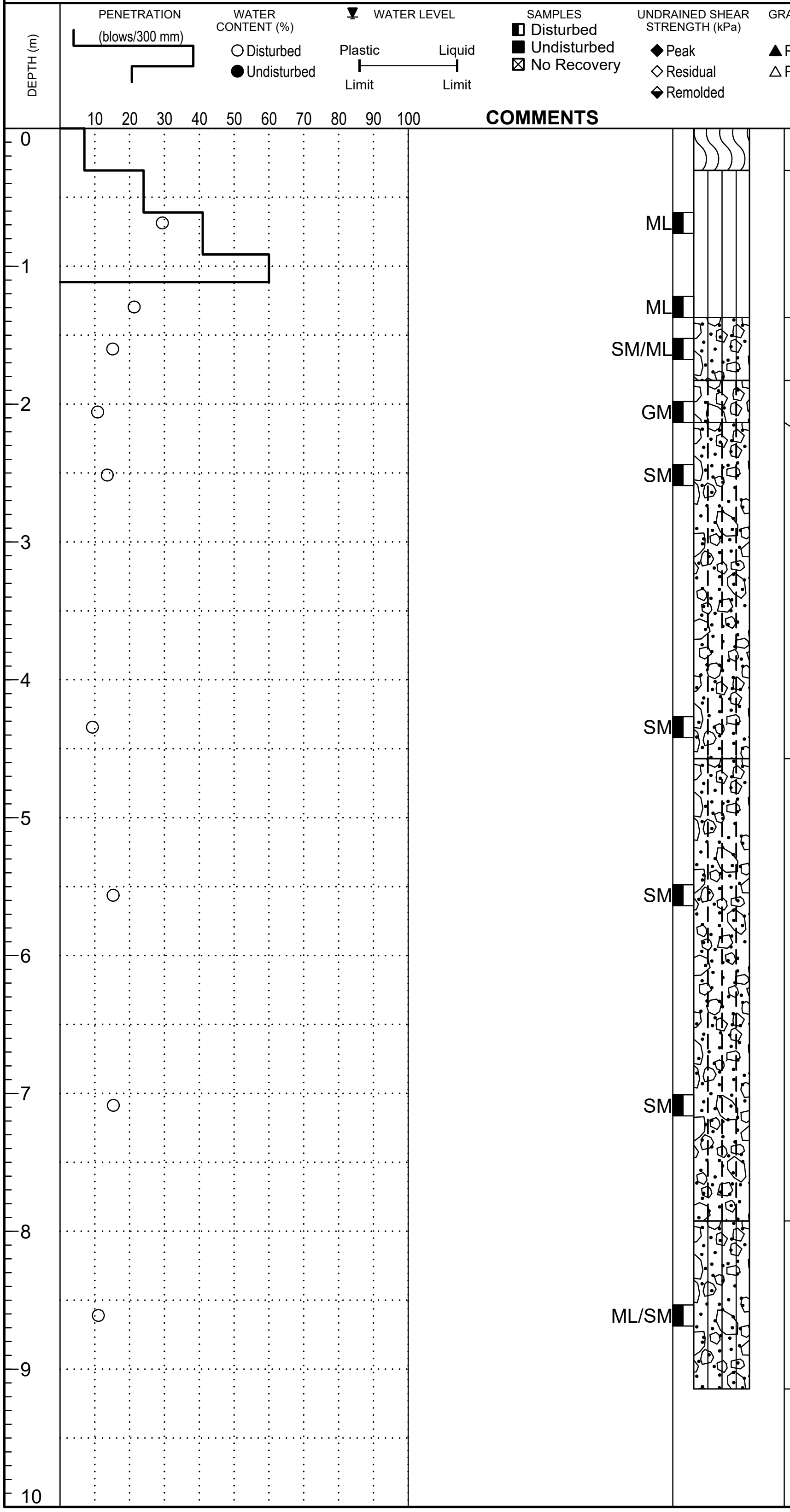
SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
GASTECH reading
PID reading

COMMENTS



SOILS DESCRIPTION

TOPSOIL.

Firm to stiff, grey SILT with some oxidation and traces of sand, organics and clay.

Grey-brown, gravelly SAND and SILT with a trace of clay.

Very dense, grey-brown, sandy GRAVEL with some cobbles and silt and a trace of clay. (Till-like)

Very dense, grey SAND with some silt and gravel. (Till-like)

Dense, grey, silty, gravelly SAND with a trace of cobbles. (Till-like)

Dense, grey, gravelly SILT and SAND with a trace of clay. (Till-like)

End of hole at required depth.
Hole open to 1.6 m depth.
Water observed at 1.8 m depth upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-05

LOCATION: See DWG. 28847-1
N 5462155, E 496476 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

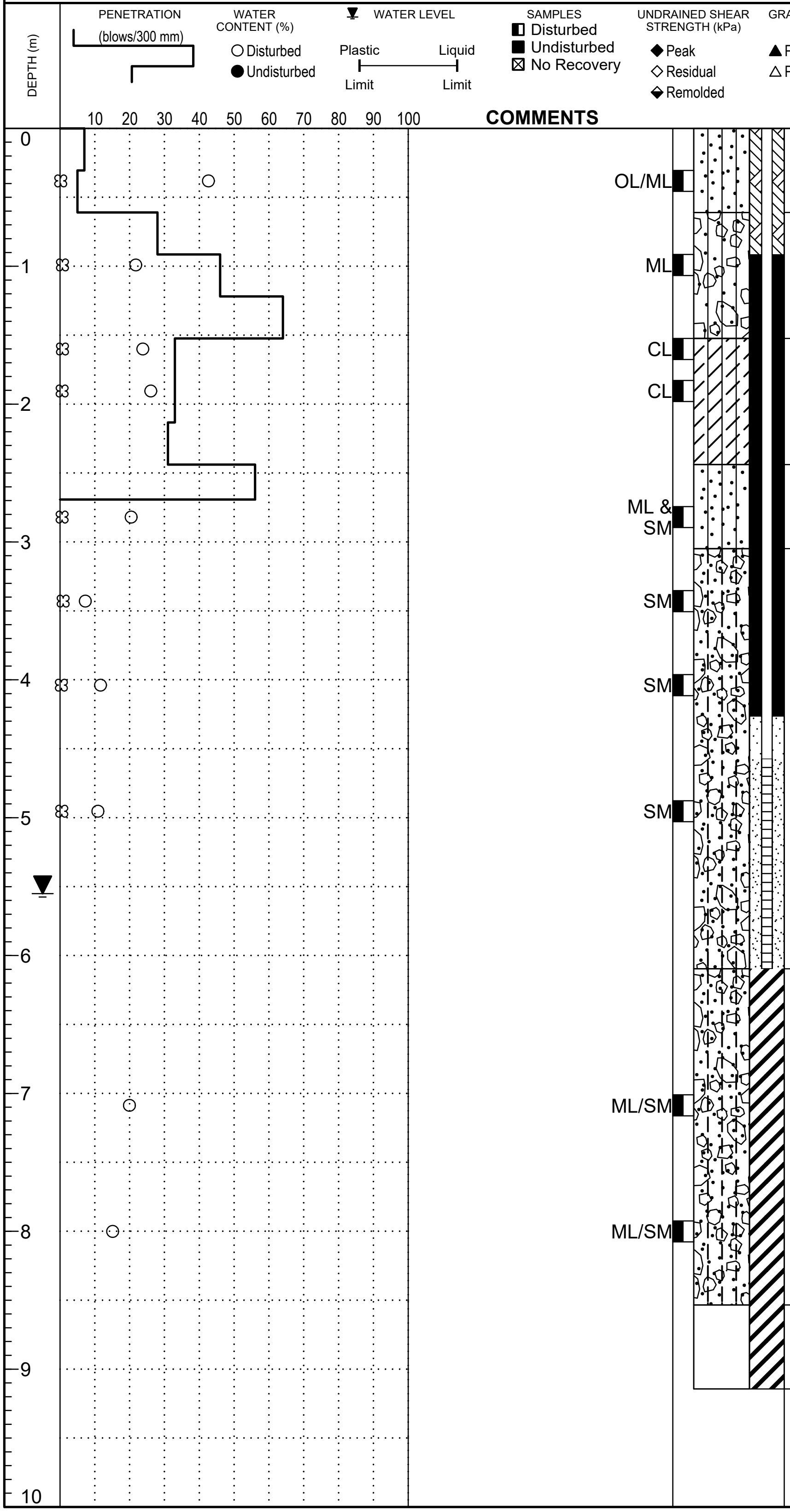
CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY:



SOILS DESCRIPTION

Firm, brown, friable SILT and SAND with traces of organics, clay and organic silt.

Very stiff to hard, brown-grey, friable SILT with some sand and gravel and traces of clay and organics.

Very stiff to hard, grey, clayey SILT with some mottling, a trace to some gravel and traces of sand and organics.

Very dense, zones of brown-grey, silty SAND with a trace to some gravel and firm-soft, grey-brown SILT with a trace to some sand and clay. (Till-like)

Grey, gravelly SAND with some silt to silty and a trace of cobbles. (Till-like)
- zones of mottled, sandy silt with a trace of clay between 3.1 and 3.7 m depth

- no cobbles below 4.0 m depth

Grey, silty SAND with some gravel to gravelly and a trace of cobbles. (Till-like)

No recovery.

End of hole at required depth.
Hole open to 6.1 m depth.
Water observed at 7.9 m depth upon completion of drilling.

LOG OF TEST HOLE (COORD EST) 28847.GPJ THURBER_MOM.GDT 14/5/21- THURBER MOM.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. **TH21-06**

LOCATION: See DWG. 28847-1
N 5462003, E 496341 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed
Plastic Limit ├──┤ Liquid Limit

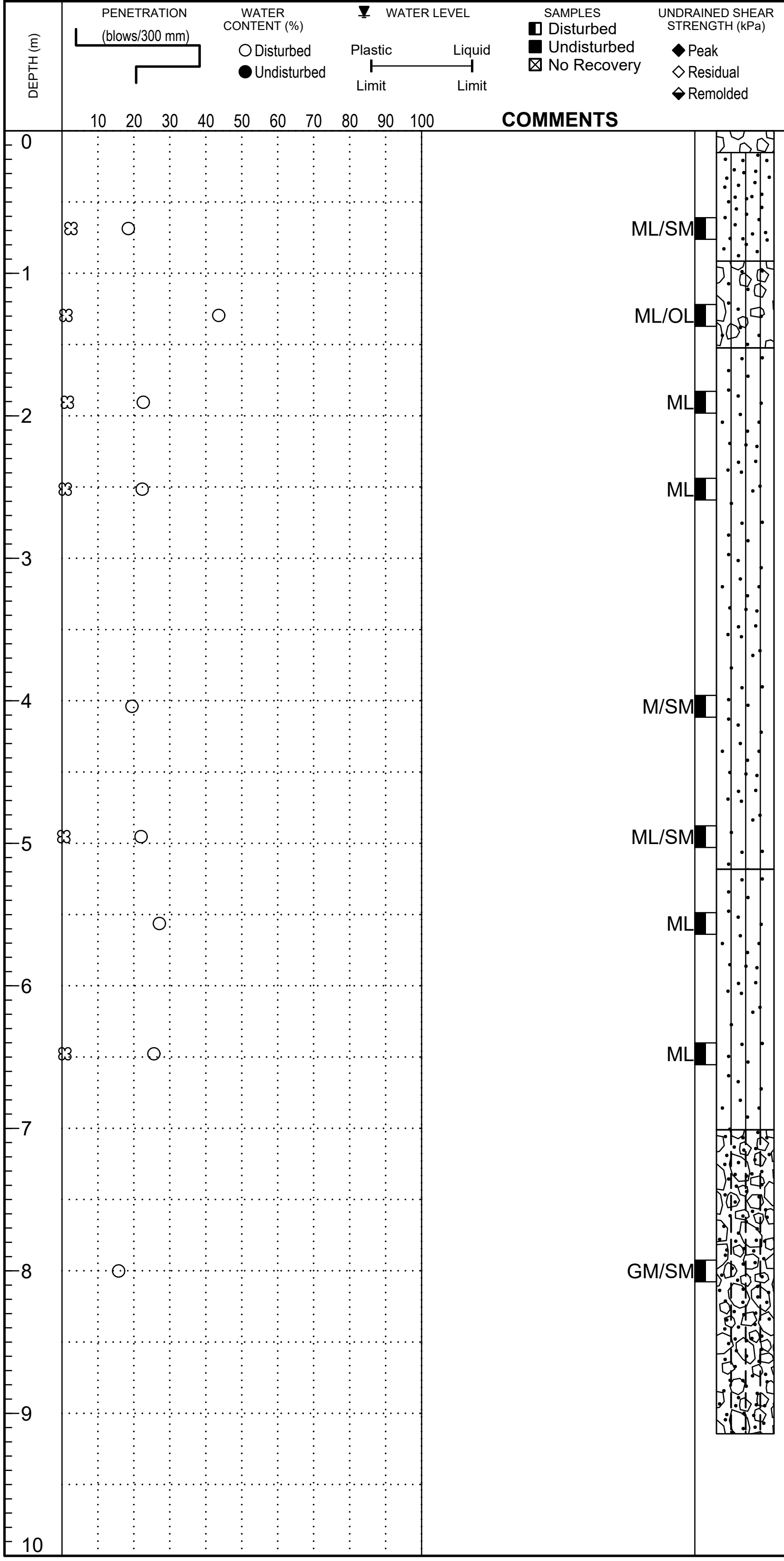
WATER LEVEL

SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
✿ GASTECH reading
✿ PID reading



SOILS DESCRIPTION

ROAD BASE.

Brown SAND and SILT with some oxidation, a trace to some gravel and traces of organics and organic silt.

Soft, dark brown, sandy SILT with some gravel and organics, a trace to some organic silt and a trace of cobbles.

Firm, grey, sandy SILT with some oxidation.
- a trace of organic silt in between 1.5 m and 3.1 m depth

- sand content increases below 2.4 m depth

Very soft, grey SILT with some sand and a trace to some clay.

Dense, grey, silty GRAVEL and SAND. (Till-like)

End of hole at required depth.
Hole open to 6.0 m depth.

DEPTH (m)

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-08

THURBER

LOCATION: See DWG. 28847-1
N 5462007, E 496285 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed
Plastic Limit ├──┤ Liquid Limit

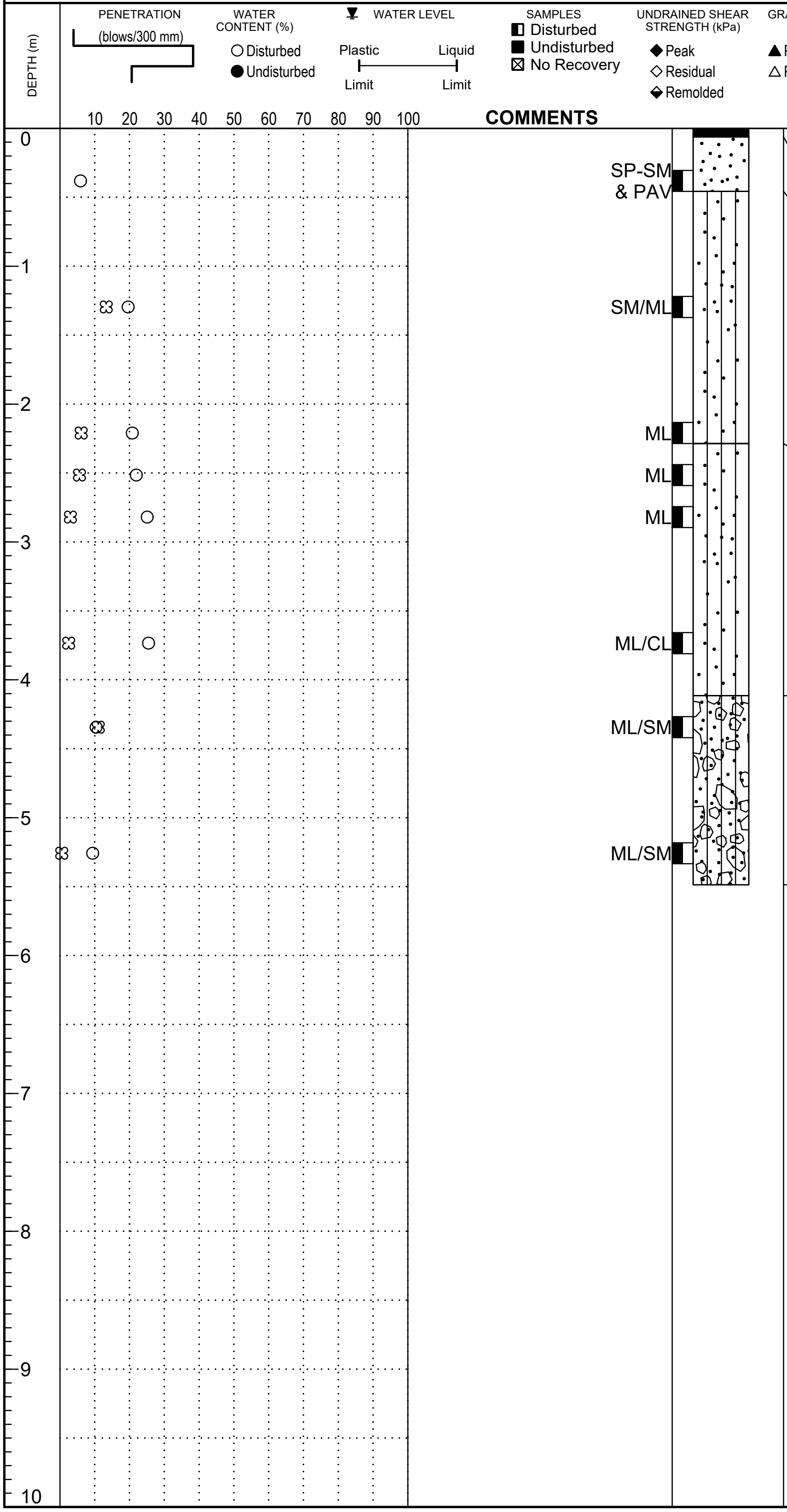
WATER LEVEL

SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
✱ GASTECH reading
✱ PID reading



SOILS DESCRIPTION

Depth (m)	
0	ASPHALT (50 mm thick).
	Loose, brown-black, SAND with a trace of silt and ASPHALT fragments (Fill).
	Firm, brown-grey, sandy SILT with some oxidation and a trace of organics. - seams of sand with some gravel below 2.0 m depth
	Compact, brown-grey SILT with some sand and a trace of clay. - a trace of sand below 2.6 m - sandy and some clay below 3.2 m
	Dense, grey, gravelly SAND and SILT. (Till-like)
	End of hole due to auger refusal. Hole open to 5.2 m depth. No water observed upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-09

LOCATION: See DWG. 28847-1
N 5461990, E 496253 (Est.)

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DATE: April 20, 2021

DRILLING CO.: On-Track Drilling Inc.

FILE NO.: 28847

INSPECTOR: MM

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%) ○ Disturbed ● Undisturbed

Plastic Limit — Liquid Limit

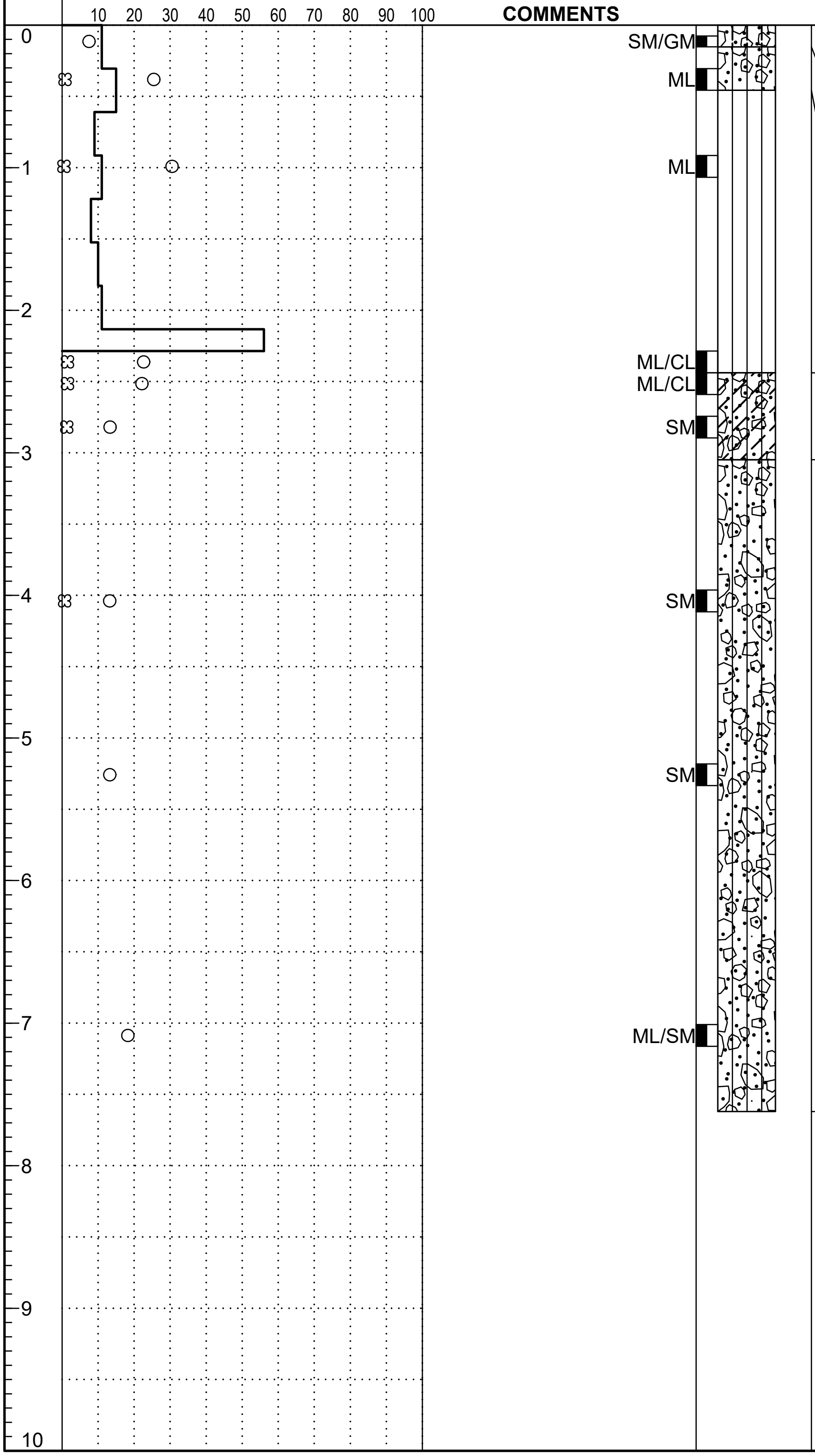
WATER LEVEL

SAMPLES ◧ Disturbed ■ Undisturbed ☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa) ◆ Peak ◇ Residual ◆ Remolded

GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve

SOIL HEADSPACE READING (ppm) ✖ GASTECH reading ✖ PID reading



SOILS DESCRIPTION

Loose to compact, brown SAND and GRAVEL with some silt and a trace of organics.

Loose, dark brown, gravelly SAND and SILT with traces of organics, organic silt and zones of oxidation.

Firm, grey with orange staining SILT with traces of sand, clay and organics.

- seams of sand and gravel below 2.1 m depth

Compact, brown, gravelly SILT and SAND with some clay and oxidation.
- a trace of clay below 2.7 m depth

Dense, grey-brown, gravelly, silty SAND with a trace of clay. (Till-like)

- some gravel below 5.2 m depth

End of hole due to auger refusal.
Hole open to 4.6 m depth.
Water observed 7.6 m depth upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO. **TH21-10**

LOCATION: See DWG. 28847-1
N 5461934, E 496252 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)

WATER CONTENT (%): ○ Disturbed ● Undisturbed; Plastic Limit ├──┤ Liquid Limit

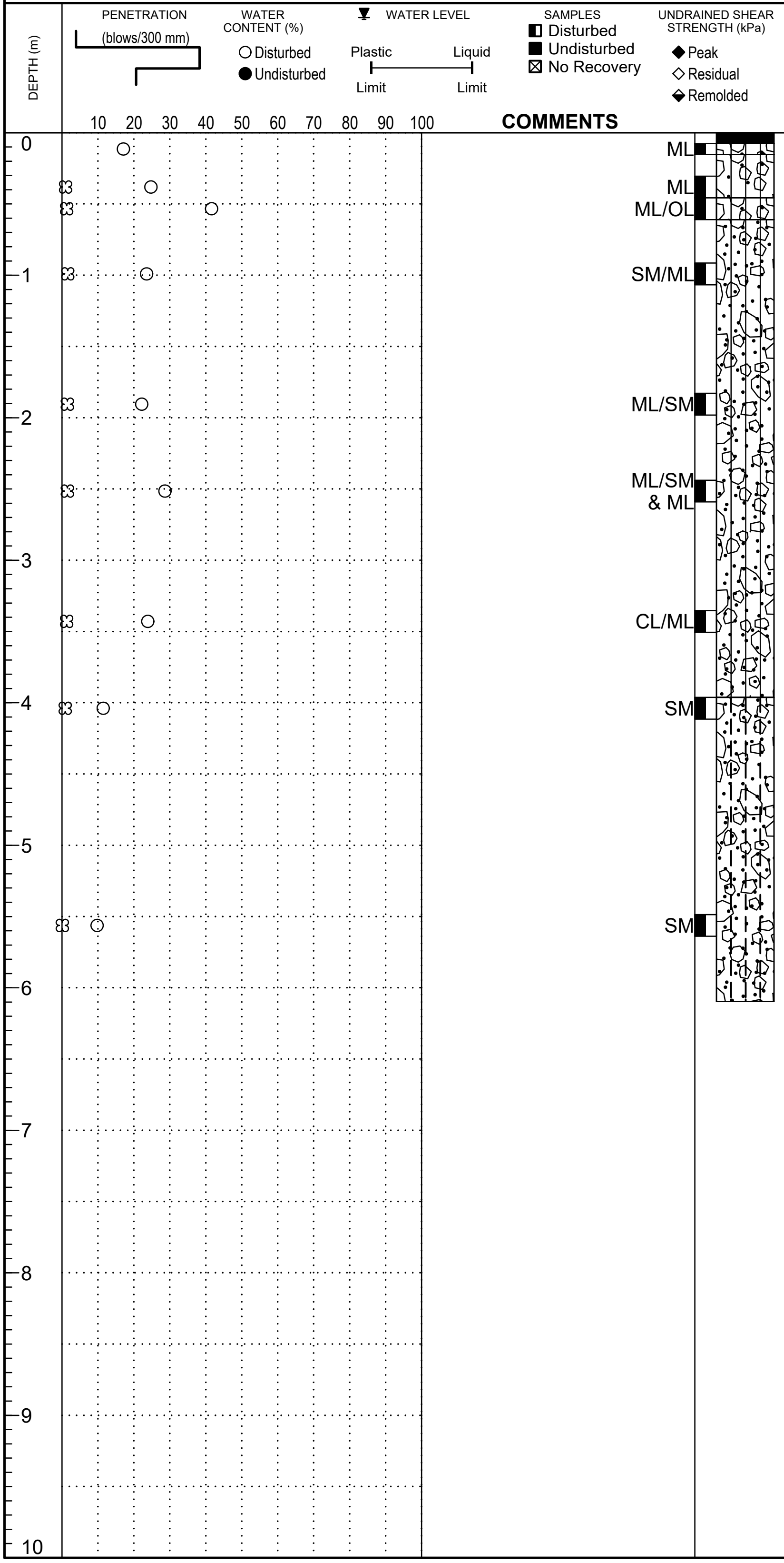
WATER LEVEL

SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ◆ Remolded

GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve

SOIL HEADSPACE READING (ppm): ✱ GASTECH reading ✲ PID reading



SOILS DESCRIPTION

ASPHALT (75 mm thick).

Loose, brown, sandy SILT with some gravel and traces of organics and asphaltic concrete fragments. (Fill)

Firm, dark brown, friable SILT, sandy to some sand, some gravel and oxidation, clay in zones and zones of soft, grey silt.

Soft, black-brown, sandy SILT with some gravel and organic silt and a trace of organics.

Compact, grey-brown SILT and SAND with some gravel.

- a trace of clay below 2.3 m depth

- sandy to some sand and a trace to some clay below 2.6 m depth

Dense, brown-grey, silty SAND with some gravel and a trace of clay. (Till-like)

- very dense below 5.2 m

End of hole at required depth.
Hole open to 1.8 m depth.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-11

LOCATION: See DWG. 28847-1
N 5461973, E 496319 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

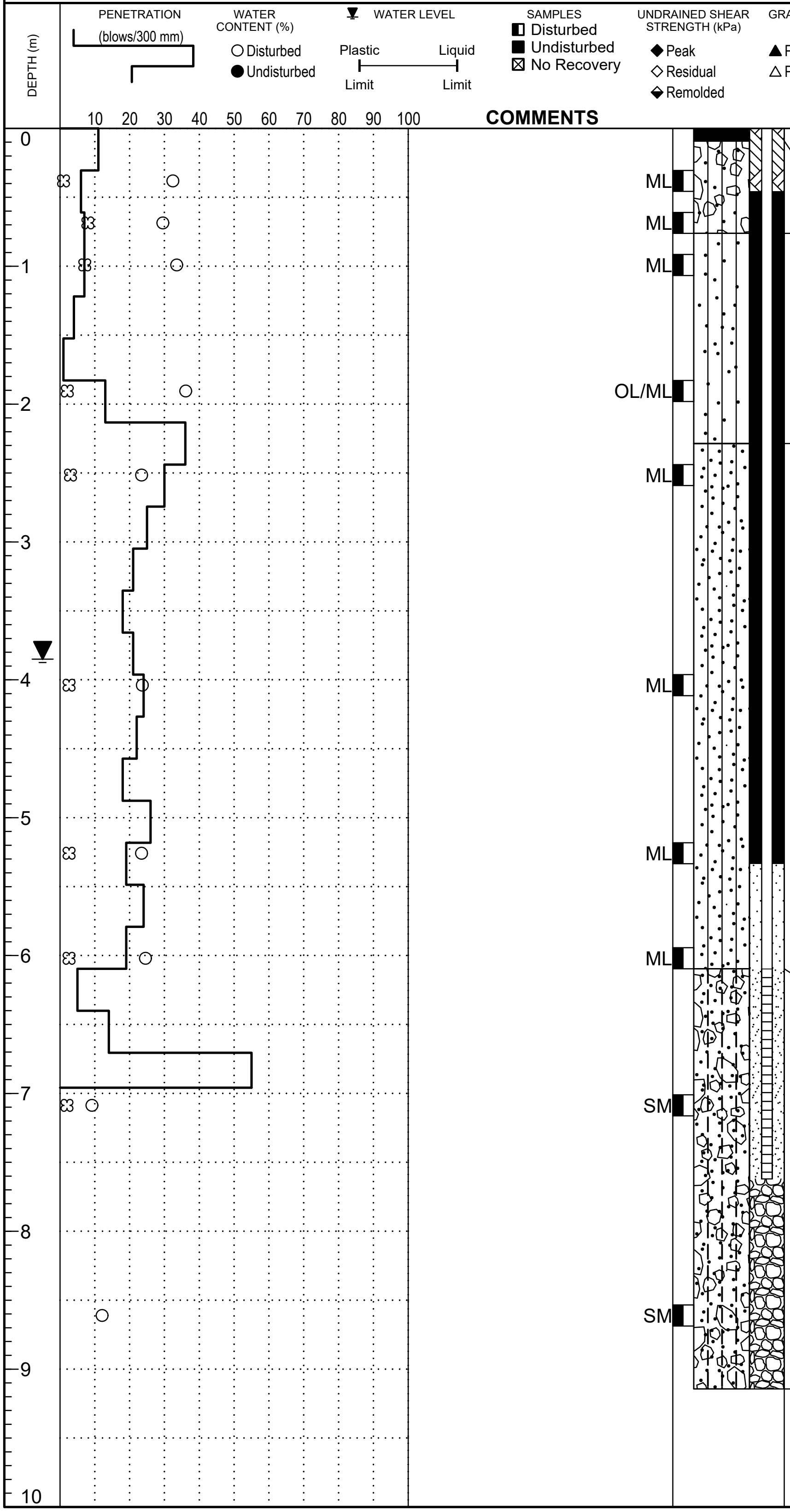
CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021

FILE NO.: 28847

REVIEWED BY:



SOILS DESCRIPTION

DEPTH (m)	
0	ASPHALT (88 mm thick).
	Firm, brown SILT with some sand and gravel and traces of organic silt and asphalt fragments and organics. (Fill)
	Firm, dark brown, sandy SILT with traces of organics, gravel and organic silt.
	- wood pieces and garbage below 1.5 m depth
	Very stiff, grey, sandy SILT to SAND and SILT with a trace of organics and zones of oxidation.
	- some silt and sand zones below 4.6 m depth
	- some sand and a trace of clay below 5.9 m depth
	Dense to very dense, grey, silty SAND with some gravel and cobbles. (Till-like)
	End of hole due to auger refusal. Hole open to 6.1 m depth. Water observed 7.9 m depth upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-12

LOCATION: See DWG. 28847-1
N 5462033, E 496348 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021

FILE NO.: 28847

REVIEWED BY:

DEPTH (m)

PENETRATION (blows/300 mm)

WATER CONTENT (%)
○ Disturbed
● Undisturbed

Plastic Limit ├──┤ Liquid Limit

WATER LEVEL

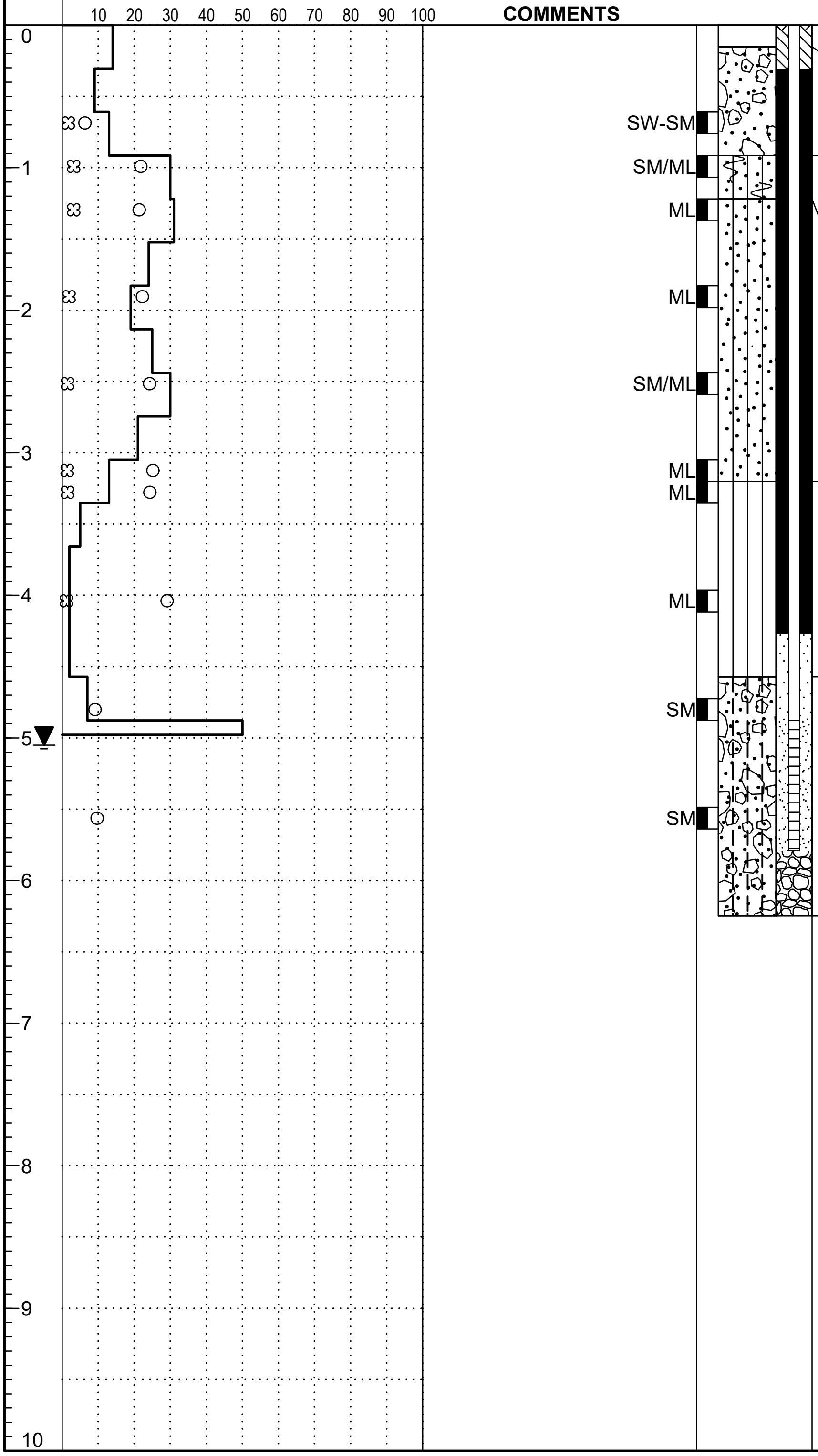
SAMPLES
◧ Disturbed
■ Undisturbed
☒ No Recovery

UNDRAINED SHEAR STRENGTH (kPa)
◆ Peak
◇ Residual
◆ Remolded

GRAIN SIZE (%)
▲ Passing #200 sieve
△ Passing #4 sieve

SOIL HEADSPACE READING (ppm)
✿ GASTECH reading
✿ PID reading

COMMENTS



SOILS DESCRIPTION

Crushed GRAVEL (No recovery).

Compact, grey SAND with some gravel and a trace of silt.

Very stiff to hard, black SILT and SAND with some orange staining and organics and traces of clay and asphalt fragments. (Fill)

Very stiff to hard, grey-brown with orange staining SILT and SAND.
- seams of grey sand between 1.5 and 2.4 m depth

- some clay between 2.4 and 2.7 m depth

Firm, brown SILT with a trace to some clay and sand.

Dense to very dense, grey, silty SAND with some gravel. (Till-like)

- some cobbles below 5.0 m depth

End of hole due to auger refusal.
Hole open to 2.7 m depth.
Water observed at 0.5 m depth upon completion of drilling.

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-13

LOCATION: See DWG. 28847-1
N 5462064, E 496369 (Est.)

TOP OF HOLE ELEV:

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

CLIENT: North Vancouver School District No. 44

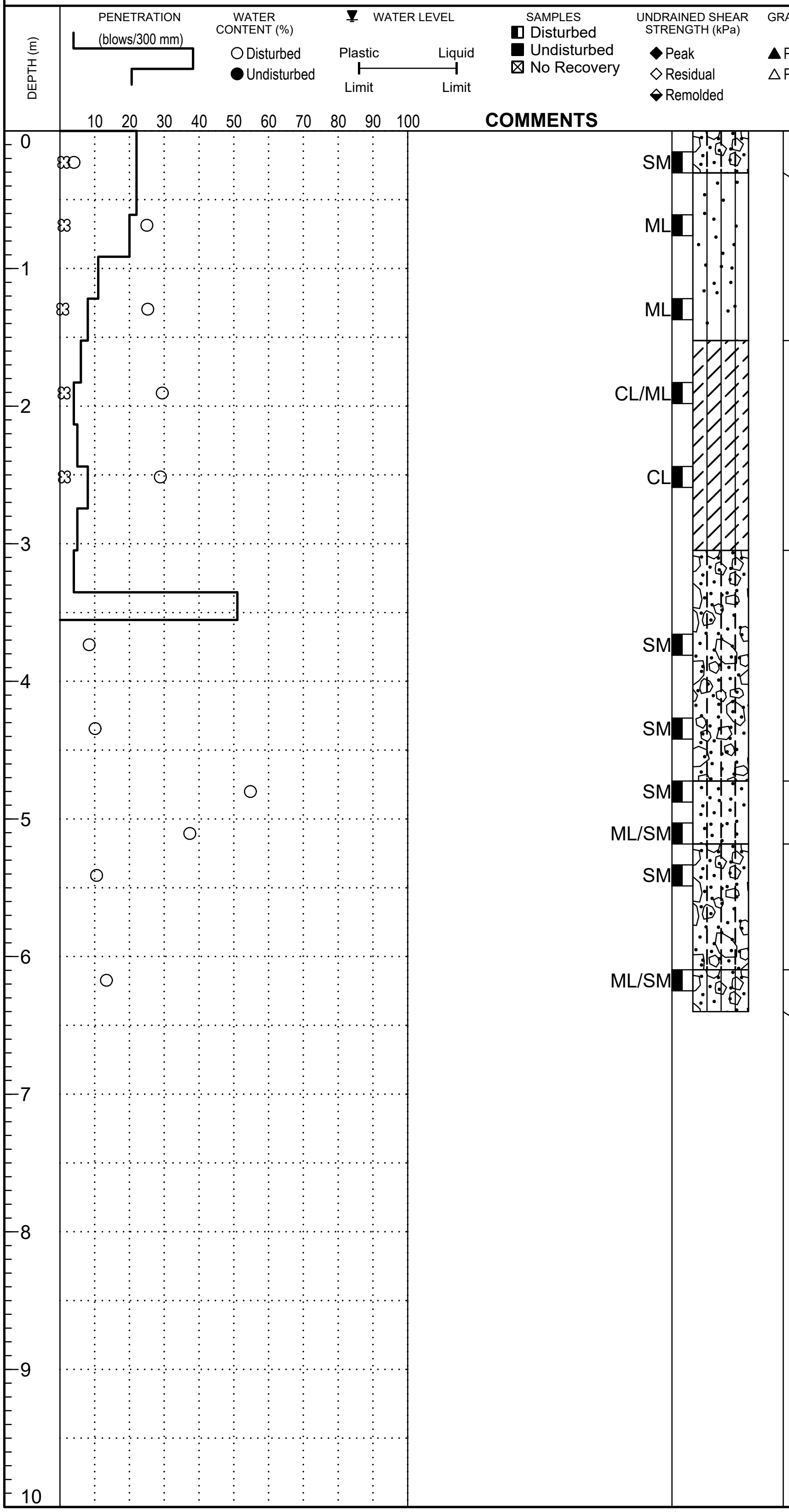
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021

FILE NO.: 28847

REVIEWED BY:

PENETRATION (blows/300 mm)
WATER CONTENT (%): ○ Disturbed ● Undisturbed; Plastic Limit, Liquid Limit
WATER LEVEL
SAMPLES: ◧ Disturbed ■ Undisturbed ☒ No Recovery
UNDRAINED SHEAR STRENGTH (kPa): ◆ Peak ◇ Residual ⬖ Remolded
GRAIN SIZE (%): ▲ Passing #200 sieve △ Passing #4 sieve
SOIL HEADSPACE READING (ppm): ✖ GASTECH reading ✖ PID reading



SOILS DESCRIPTION

Compact, grey with some orange staining, gravelly SAND with some silt and a trace of organics.

Very stiff, grey-brown with some orange staining SILT with some sand to sandy and traces of clay and organics.

- firm below 0.9 m depth

- a trace to some sand and clay below 1.2 m depth

Firm, grey with some orange staining SILT with some clay, a trace to some sand and a trace of organics.

- clayey below 2.4 m depth

Very dense, grey with some orange staining, silty SAND with some gravel.

Grey, silty SAND.

Grey, silty, gravelly SAND. (Till-like)

Very dense, brown SILT and SAND with some gravel. (Till-like)

End of hole due to auger refusal.
Hole open to 6.1 m depth.
Water observed 5.8 m depth upon completion of drilling.

CONE PENETRATION TEST REPORT

Prepared for:

THURBER ENGINEERING LTD.

Site: 440 Hendry Avenue, North Vancouver, BC
Date Drilled: April 19 – 20, 2021

Prepared by:

On Track Drilling
20626 Mufford Crescent
Langley, BC
V2Y 1N8

Phone: 604-523-1200
[redacted]
www.ontrackdrilling.com

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Cone Penetration Testing (CPT) Equipment & Calculated Geotechnical Parameters

On Track Drilling Inc. owns and operates a cone penetration test (CPT) system, supplied by Vertek – A Division of Applied Research and Associates. The Hogentogler electronic system is used with a 10 cm^2, 10 ton cone that records tip resistance, sleeve friction, pore pressure, inclination and temperature at desired intervals chosen by the operator. The cone penetrometers are designed with equal end area friction sleeves, a net end area ratio 0.8 and 60° apex angle on the tip. The cone consists of two strain gauge transducers, with the cone electronics packaged directly behind the transducers. The cone can be stopped at desired depths and dissipation tests can be completed to determine the groundwater pressures.

All testing is performed in accordance with the current ASTM D5778 standards.

The CPT calculations displayed on the plots are based on the measured tip resistance, sleeve friction and pore water pressure recorded at each specified data point. The recorded tip resistance (qc) is corrected for pore pressure effects (qt) and is used for all the calculations.

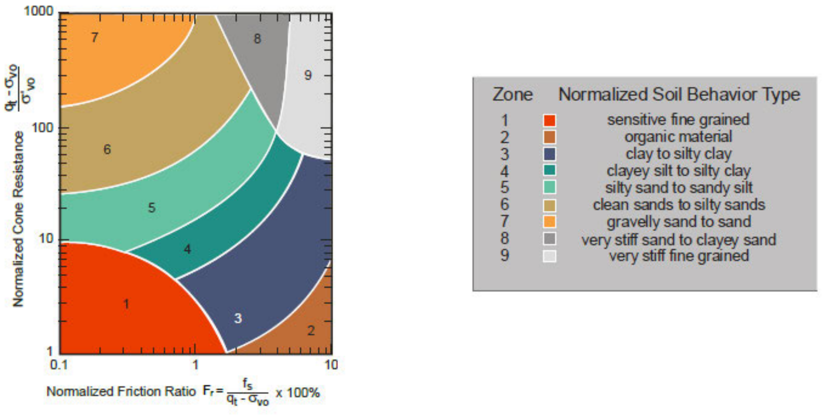
The following empirical correlations have been used to calculate the geotechnical parameters used in the CPT plots:

Corrected cone tip resistance:

$$q_t = q_c + (1\text{-}a) \bullet u2$$

where: q_c = the recorded tip resistance
a = net area ratio for cone (0.8)
u2 = the recorded dynamic pore pressure

Soil Behavior Type (Normalized): based on SBTn Robertson (1990) (Linear normalization)



Zone		Normalized Soil Behavior Type
1	🟥	sensitive fine grained
2	🟫	organic material
3	🟦	clay to silty clay
4	🟩	clayey silt to silty clay
5	🟩	silty sand to sandy silt
6	🟨	clean sands to silty sands
7	🟧	gravelly sand to sand
8	⬛	very stiff sand to clayey sand
9	⬜	very stiff fine grained

Figure 1: Normalized Soil Behavior Type (SBTn) Classification Chart

Undrained Shear Strength (Su):

$$Su = \frac{(q_t - \sigma_v)}{N_{kt}}$$

where: q_t = the corrected tip resistance
σ_v = the effective overburden stress
N_{kt} = cone constant (user selectable)

Standard Penetration Test Correlation $N_{1(60)}$:

$$(N_1)_{60} = C_n N_{60}$$

The SPT N_{60} value corrected for overburden pressure (C_n)

Equivalent SPT N_{60}, (blows/30cm) Lunne et al. (1997) :

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

Over Consolidation Ratio (OCR):

$$OCR = k_{OCR}\ Q_{t1}$$

Only SBTn 1, 2, 3, 4, & 9 (see Lunne et al., 1997)

Shear Wave Velocity (Vs) Testing:

Shear wave velocity measurements can be recorded at desired intervals in conjunction with the cone penetrometer test. The shear waves are typically generated by using a heavy hammer to horizontally strike a beam that is held in place on the ground by a normal force, in this case the outriggers of the drill rig. Two accelerometers mounted directly to the source are used as the contact triggers to initiate the recording of the seismic wave traces. The seismic source is oriented parallel to the axis of the active geophone being used.

The geophones are located 0.2 meters behind the cone tip and the source offset to the cone is recorded for each test.

The velocities of each interval are calculated by choosing a first arrival feature of each recorded wave set and taking the difference in ray path, divided by the time difference between subsequent first arrival times.

All testing is performed in accordance with the current ASTM D7400 standards.

All calculations have been carried out automatically using the software program CPeT-IT v.3.0.3.2. supplied by Geologismiki. The parameters selected are based on current published CPT correlations and are subject to change to reflect the current state of practice. On Track Drilling does not warrant the correctness or the applicability of any of the calculations carried out by the software and does not assume liability for the use of the data in any design or review.

References:

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-12.

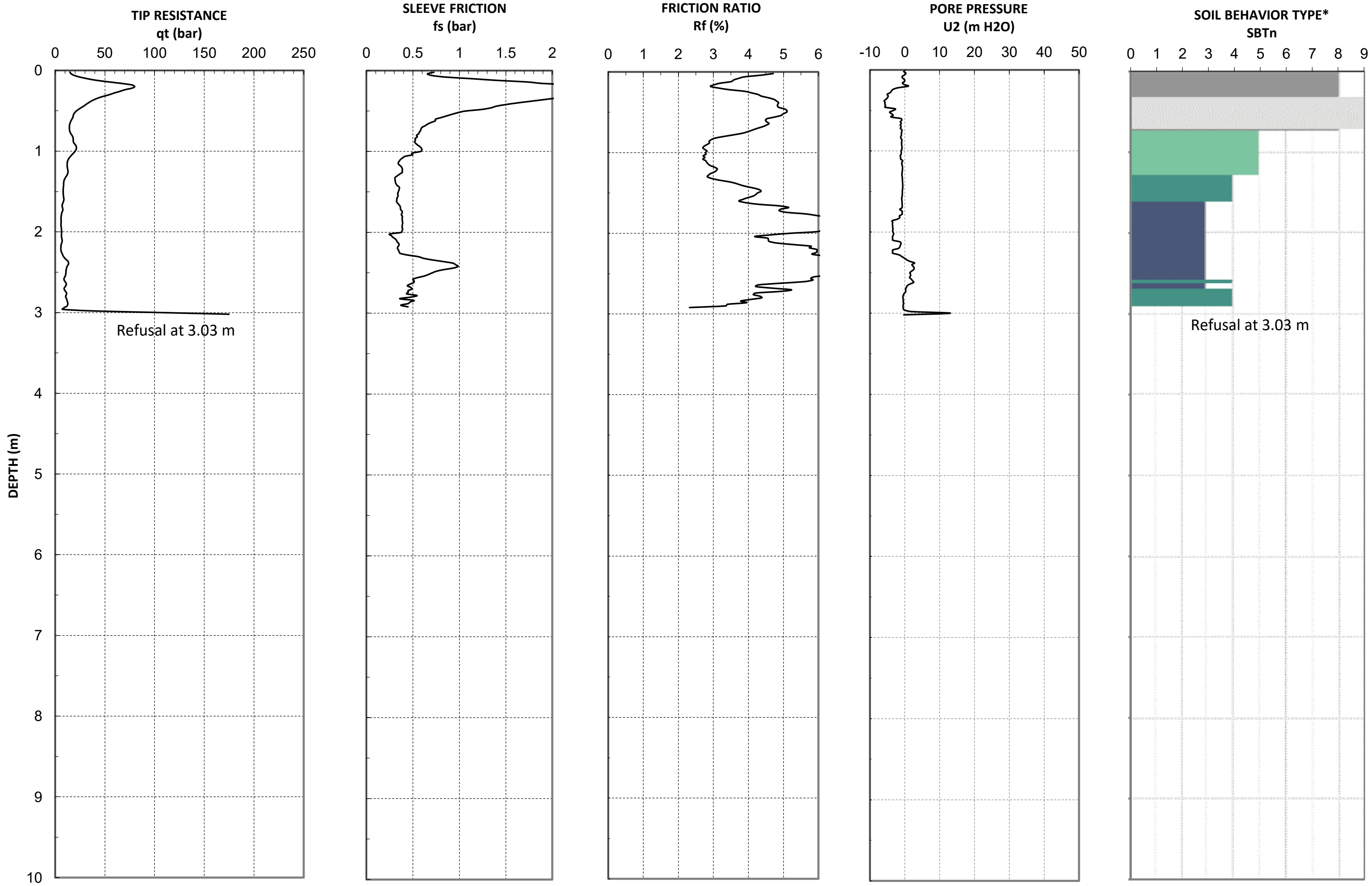
ASTM D7400/D7400M-19, 2019, "Standard Test Methods for Downhole Seismic Testing", ASTM International, West Conshohocken, PA. DOI: 10.1520/D7400_D7400M-19.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158. DOI: 10.1139/T90-014.

Sounding: CPT21-01	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



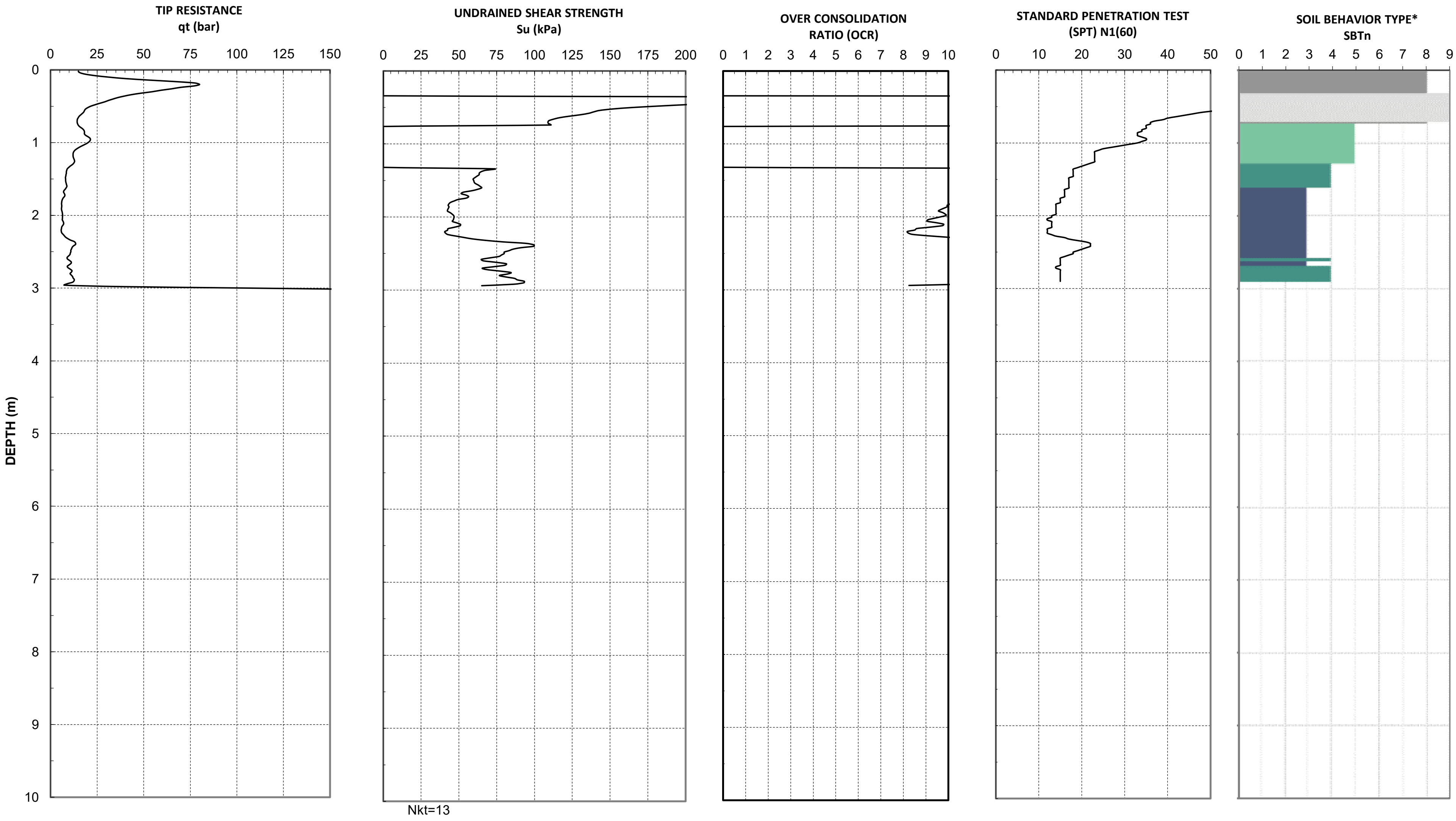
* Based on Robertson et. al 1990

- 🟥 1. Sensitive Fine Grained
- 🟫 2. Organic Material
- 🟦 3. Clay to Silty Clay
- 🟦 4. Clayey Silt to Silty Clay
- 🟩 5. Silty Sand to Sandy Silt
- 🟨 6. Clean Sand to Silty Sand
- 🟧 7. Gravely Sand to Sand
- ⬛ 8. Very Stiff Sand to Clayey Sand
- ⬜ 9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 3.03 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-01	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

🟥 1. Sensitive Fine Grained
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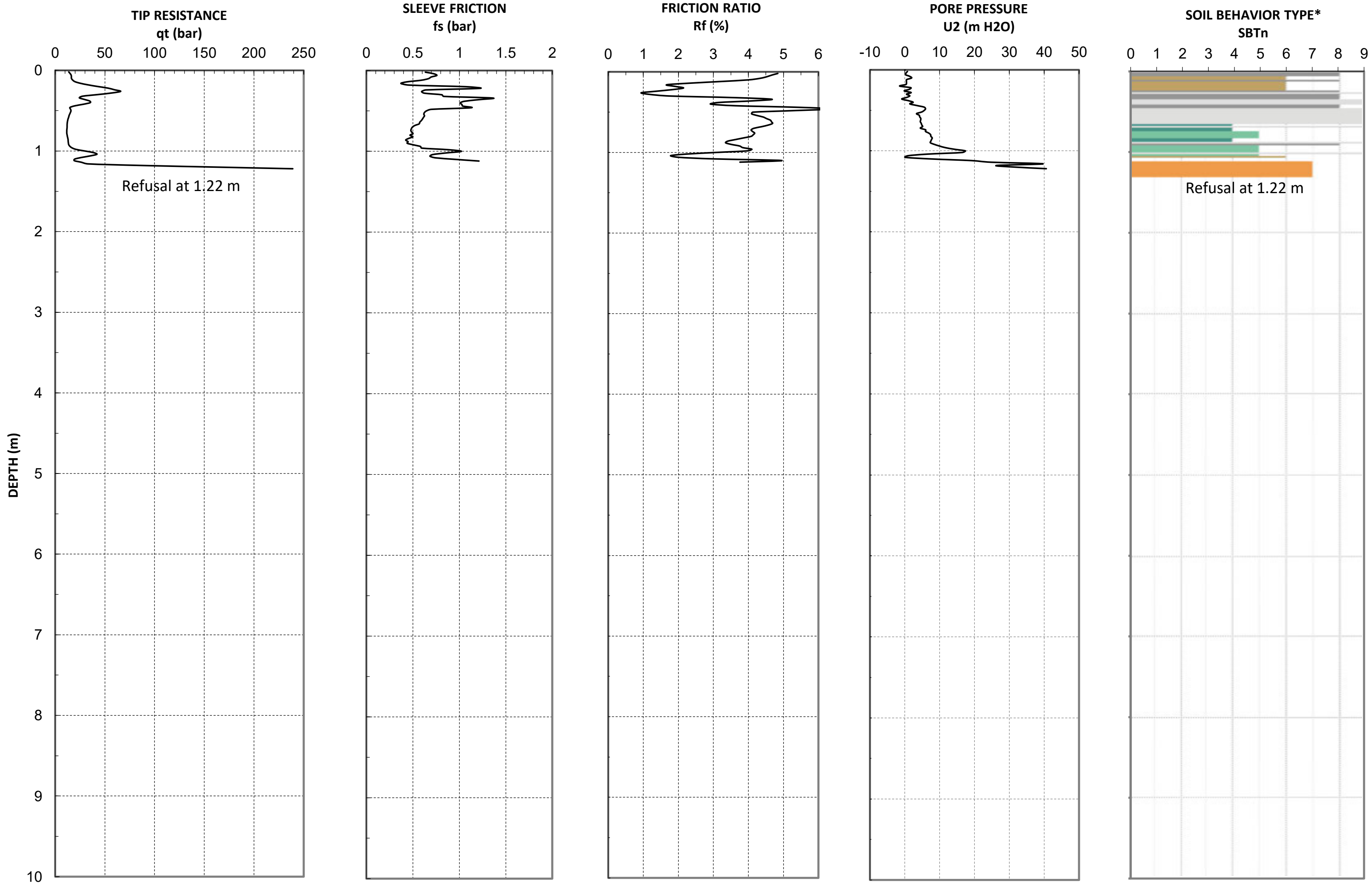
🟦 3. Clay to Silty Clay
🟩 4. Clayey Silt to Silty Clay
🟩 5. Silty Sand to Sandy Silt
🟨 6. Clean Sand to Silty Sand
🟧 7. Gravely Sand to Sand
⬛ 8. Very Stiff Sand to Clayey Sand
⬜ 9. Very Stiff Fine Grained

Sounding: CPT21-03	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



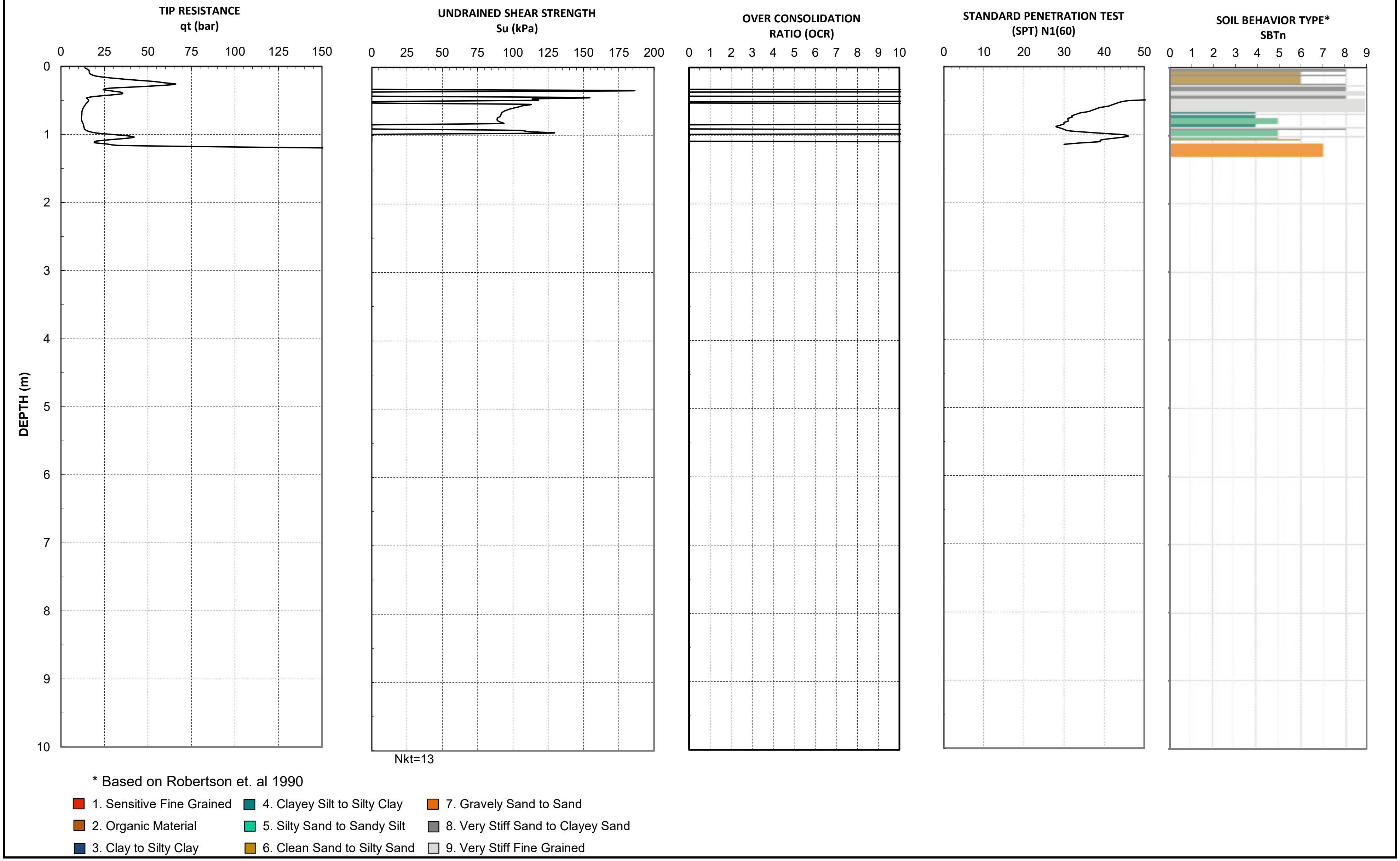
* Based on Robertson et. al 1990

🟥 1. Sensitive Fine Grained
🟫 2. Organic Material
🟦 3. Clay to Silty Clay
🟦 4. Clayey Silt to Silty Clay
🟩 5. Silty Sand to Sandy Silt
🟨 6. Clean Sand to Silty Sand
🟧 7. Gravely Sand to Sand
⬛ 8. Very Stiff Sand to Clayey Sand
⬜ 9. Very Stiff Fine Grained

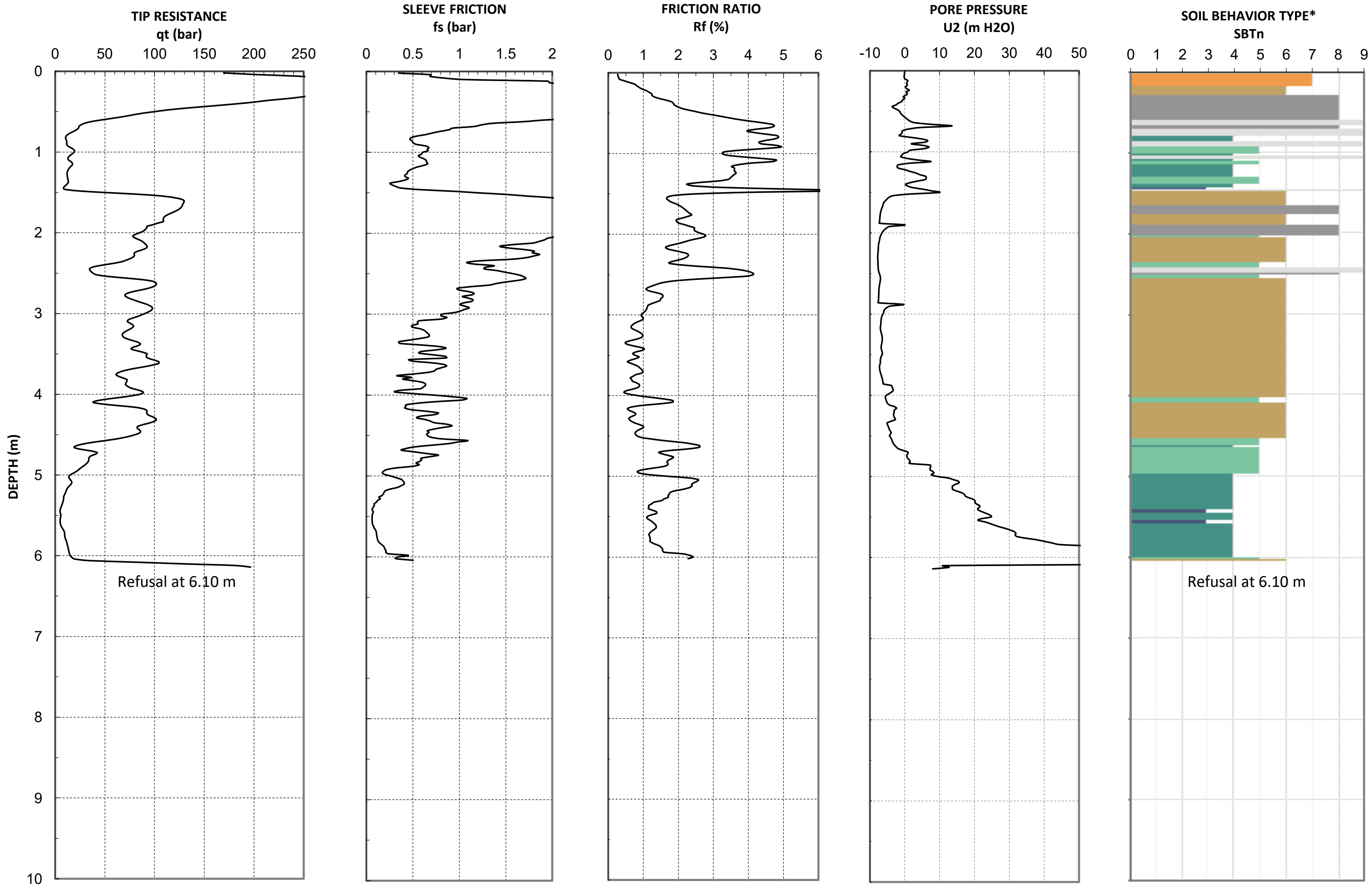
Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 1.22 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-03	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



Sounding: CPT21-06	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

- 🟥 1. Sensitive Fine Grained
- 🟫 2. Organic Material
- 🟦 3. Clay to Silty Clay
- 🟦 4. Clayey Silt to Silty Clay
- 🟩 5. Silty Sand to Sandy Silt
- 🟨 6. Clean Sand to Silty Sand
- 🟧 7. Gravely Sand to Sand
- ⬛ 8. Very Stiff Sand to Clayey Sand
- ⬜ 9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 6.10 m

Cone ID: DDG1522
Operator: ZH

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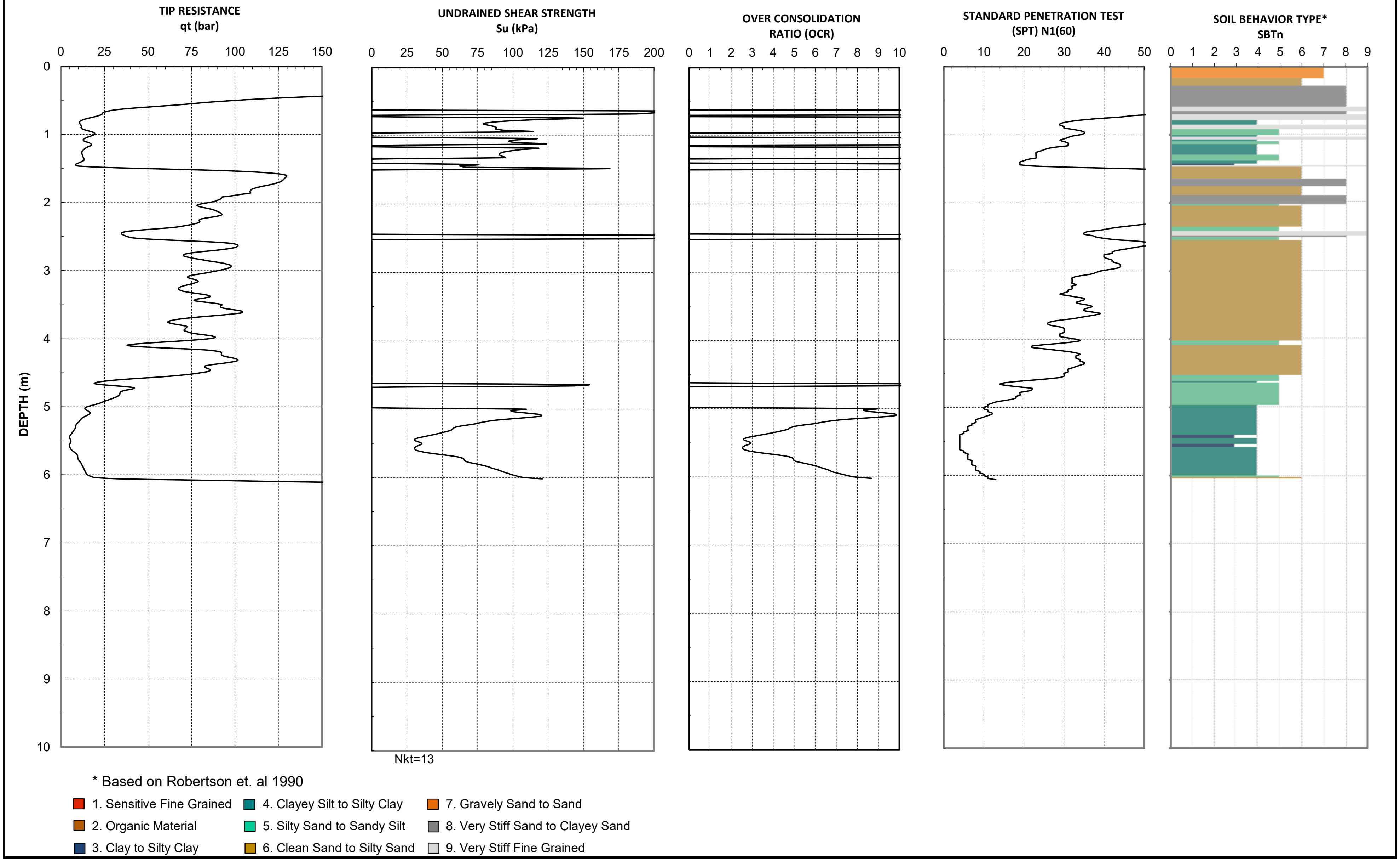
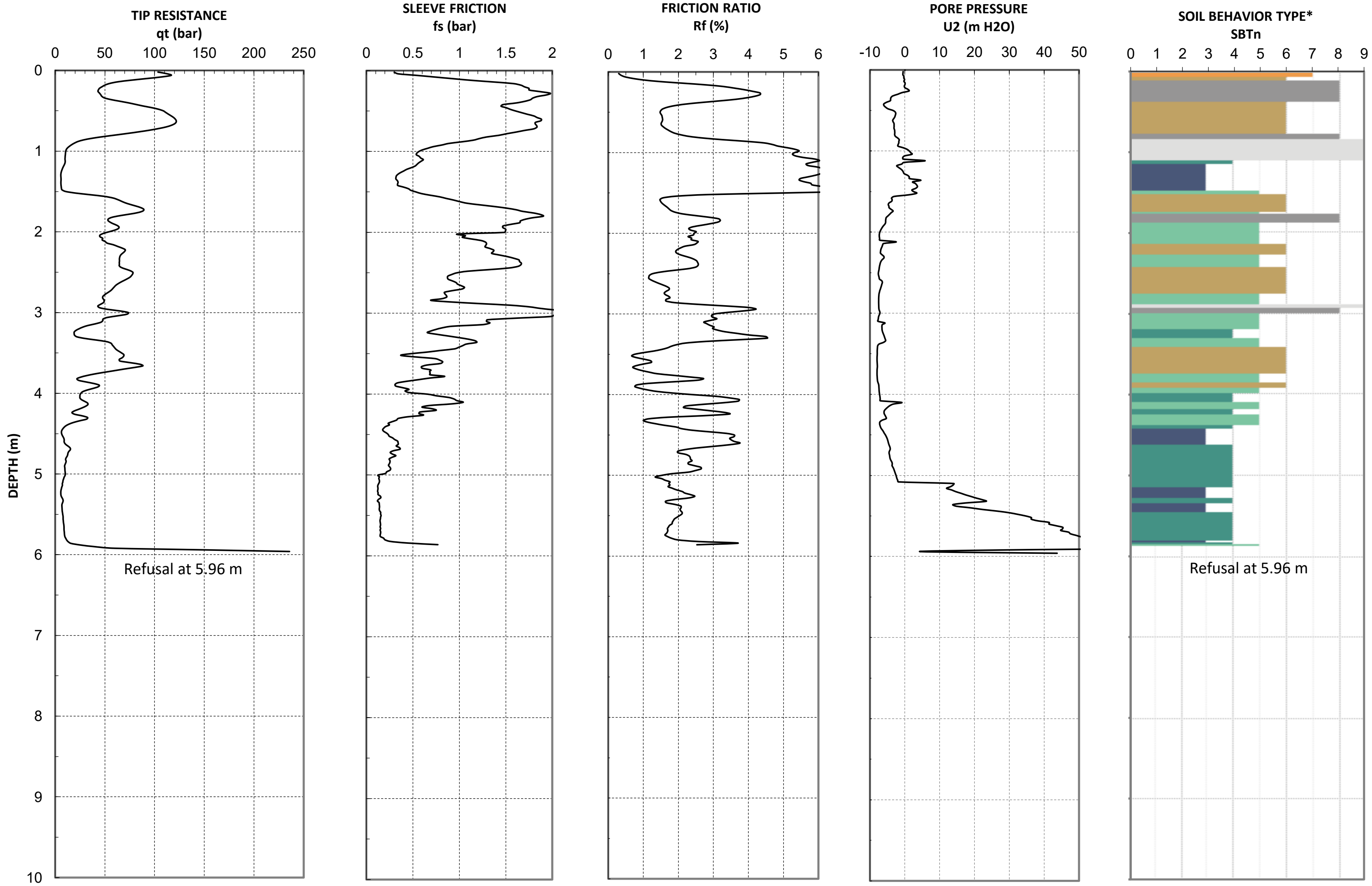
Sounding: CPT21-06	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

ONTRACK
An earthDRILLING Company
SAFETY IS OUR CORE

Sounding: CPT21-07	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

- 🟥 1. Sensitive Fine Grained
- 🟫 2. Organic Material
- 🟦 3. Clay to Silty Clay
- 🟩 4. Clayey Silt to Silty Clay
- 🟩 5. Silty Sand to Sandy Silt
- 🟨 6. Clean Sand to Silty Sand
- 🟧 7. Gravely Sand to Sand
- ⬛ 8. Very Stiff Sand to Clayey Sand
- ⬜ 9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 5.96 m

Cone ID: DDG1522
Operator: ZH

ON TRACK
An earth DRILLING Company
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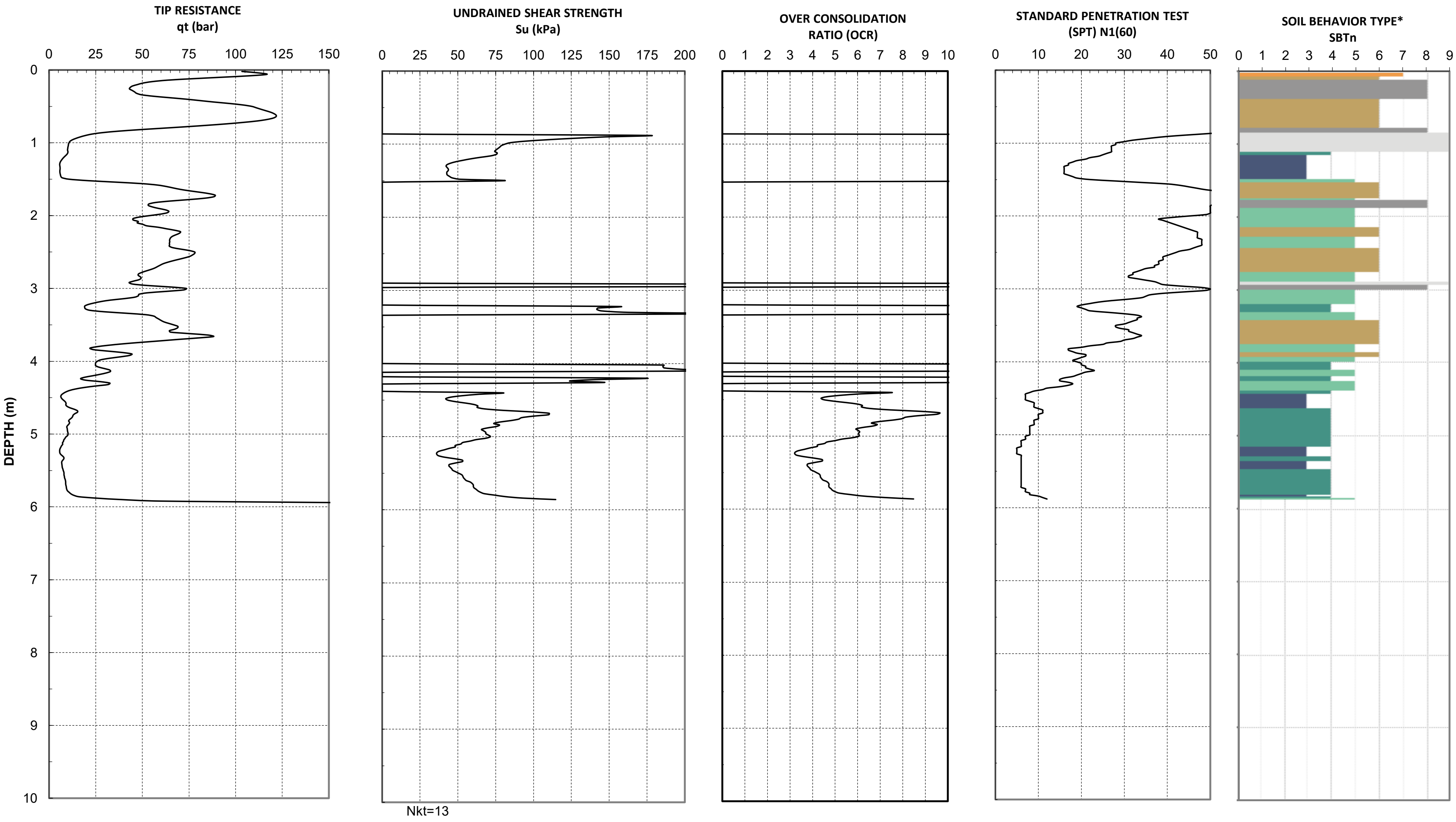
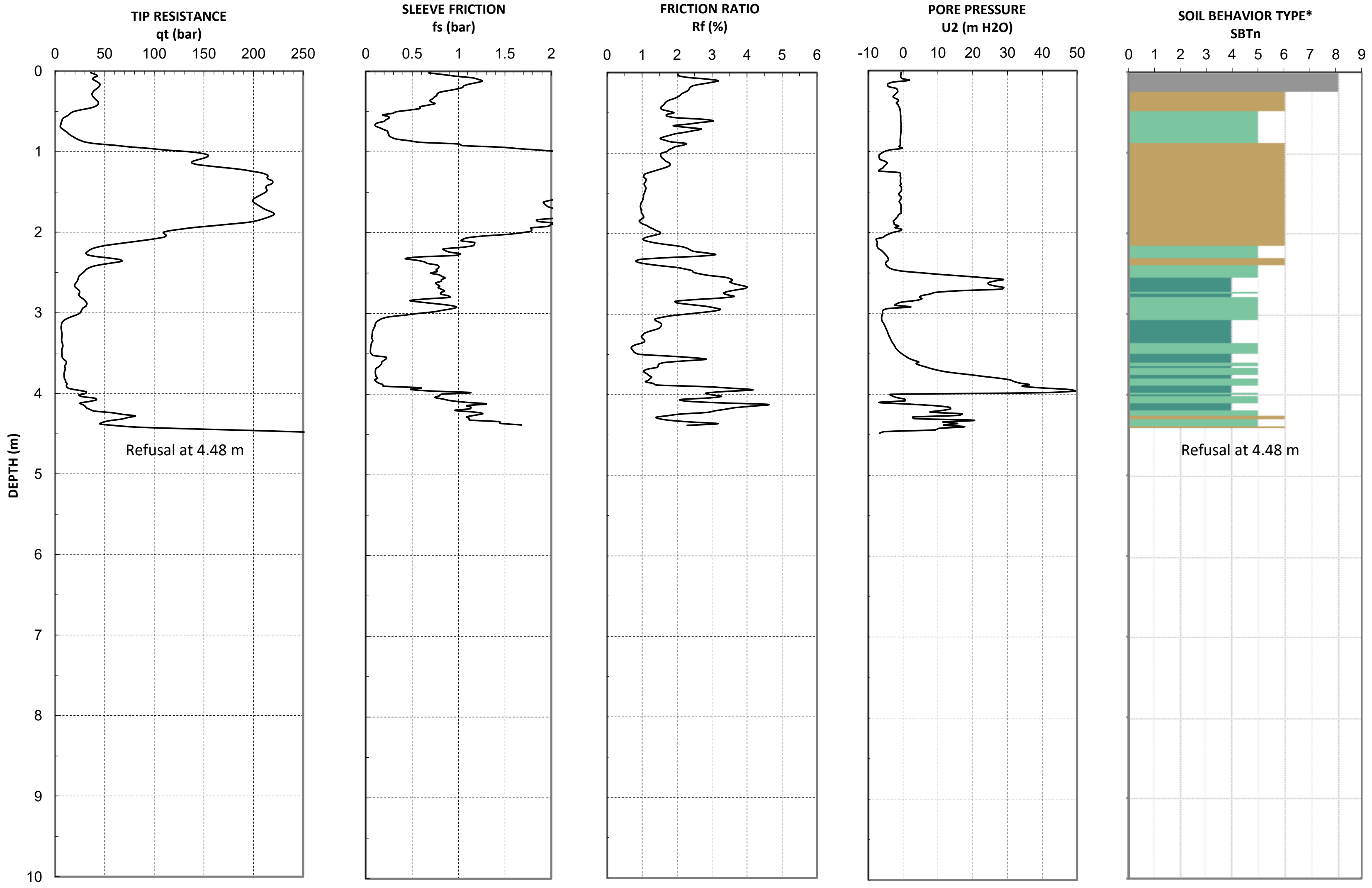
Sounding: CPT21-07	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

🟥 1. Sensitive Fine Grained
🟫 2. Organic Material
🟦 3. Clay to Silty Clay
🟩 4. Clayey Silt to Silty Clay
🟩 5. Silty Sand to Sandy Silt
🟨 6. Clean Sand to Silty Sand
🟧 7. Gravely Sand to Sand
⬛ 8. Very Stiff Sand to Clayey Sand
⬜ 9. Very Stiff Fine Grained

Sounding: CPT21-08	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

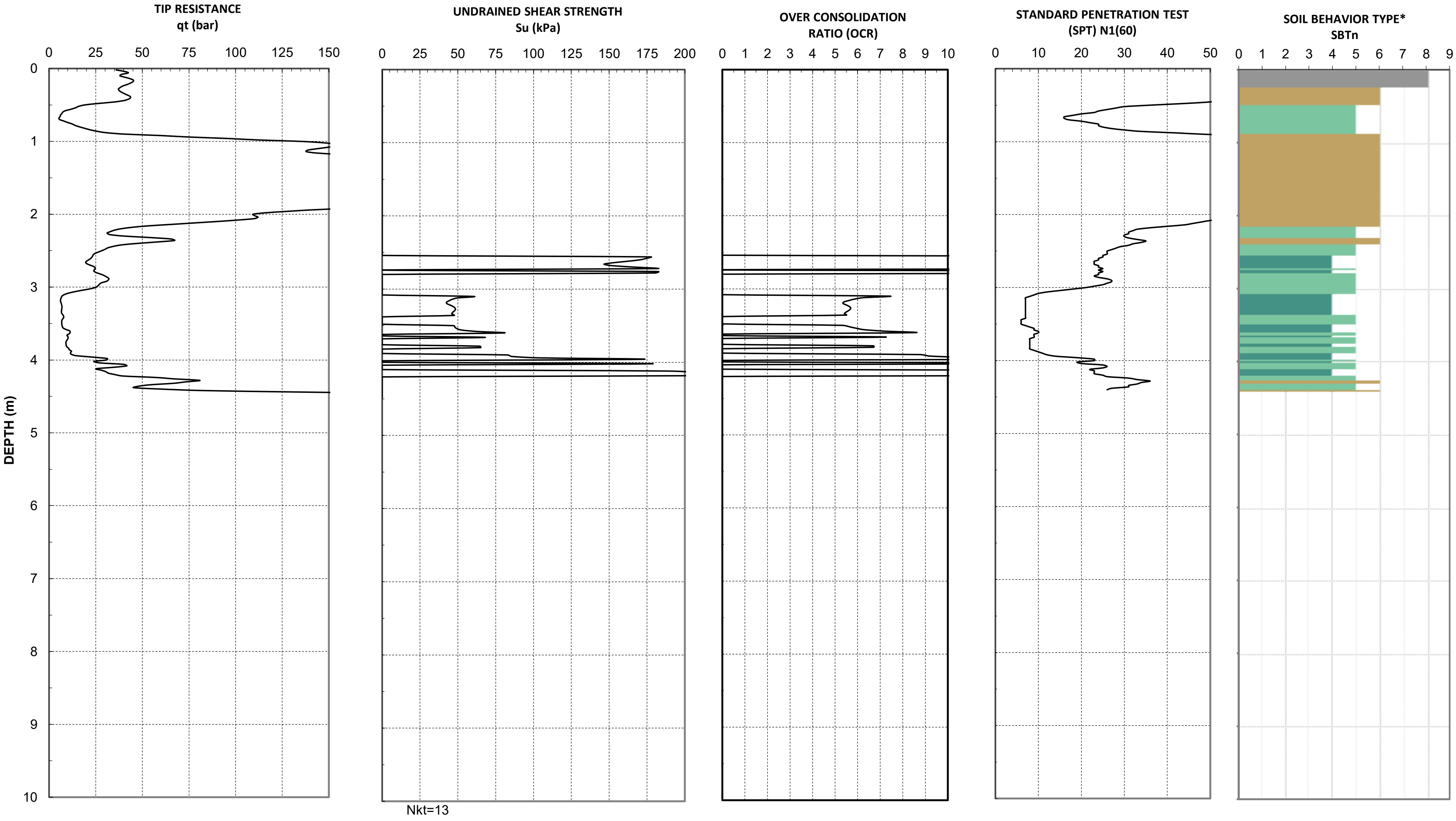
🟥 1. Sensitive Fine Grained
🟫 2. Organic Material
🟦 3. Clay to Silty Clay
🟦 4. Clayey Silt to Silty Clay
🟩 5. Silty Sand to Sandy Silt
🟨 6. Clean Sand to Silty Sand
🟧 7. Gravely Sand to Sand
⬛ 8. Very Stiff Sand to Clayey Sand
⬜ 9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 4.48 m

Cone ID: DDG1522
Operator: ZH

ONTRACK An earth DRILLING Company SAFETY IS OUR CORE

Sounding: CPT21-08	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC

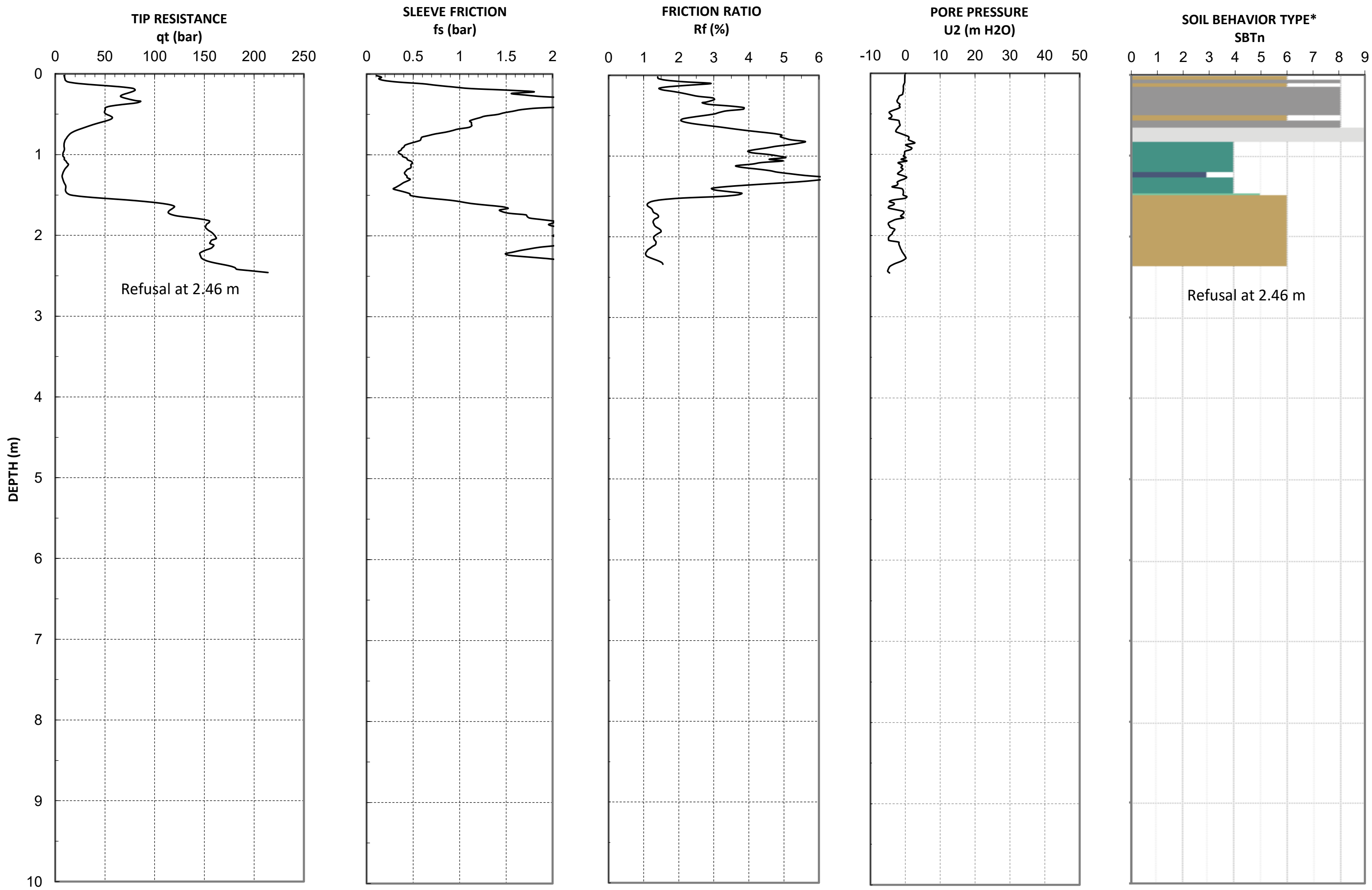


* Based on Robertson et. al 1990

- 🟥 1. Sensitive Fine Grained
- 🟫 2. Organic Material
- 🟦 3. Clay to Silty Clay
- 🟩 4. Clayey Silt to Silty Clay
- 🟩 5. Silty Sand to Sandy Silt
- 🟨 6. Clean Sand to Silty Sand
- 🟧 7. Gravely Sand to Sand
- ⬛ 8. Very Stiff Sand to Clayey Sand
- ⬜ 9. Very Stiff Fine Grained

ON TRACK
An earth DRILLING Company
SAFETY IS OUR CORE

Sounding: CPT21-10
Client: Thurber Engineering Ltd.
20-Apr-2021
Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

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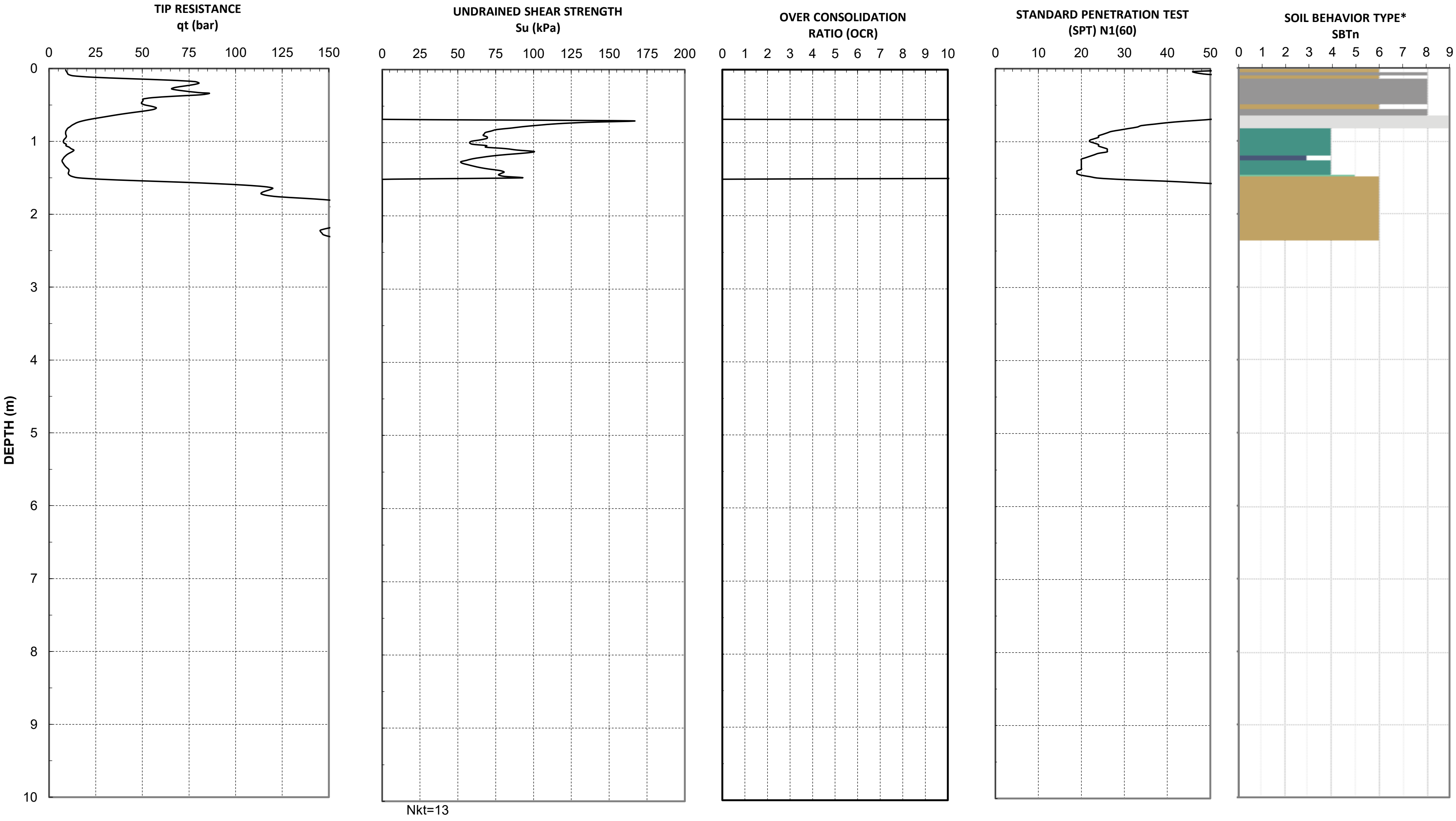
⬛ 8. Very Stiff Sand to Clayey Sand
⬜ 9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 2.46 m

Cone ID: DDG1522
Operator: ZH

ON TRACK
An earth DRILLING Company
SAFETY IS OUR CORE

Sounding: CPT21-10	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

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⬜ 9. Very Stiff Fine Grained

Table 1: Hydrocarbons in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North vancouver School District #44

Sample ID						**TH21-13-04**	**TH21-11-03**	**TH21-08-02**	**TH21-09-02**
Certificate of Analysis	**Soil Standards (µg/g)***					21D2772	21D2772	21D2772	21D2772
Sample Date	**Agricultural (AL)**	**Residential Low Density (RLD)**	**Urban Park (PL)**	**Commercial (CL)**	**Industrial (IL)**	21-Apr-21	21-Apr-21	20-Apr-21	20-Apr-21
Depth of Sample (m)						0.05 - 0.1	0.8 - 0.9	1.1 - 1.2	0.2 - 0.3
Parameters									
Photoionization Detector (ppm)	ns	ns	ns	ns	ns	1.2	7.1	13.3	0.8
EPH (C10-C19)	ns	ns	ns	ns	ns	<50	<50	<50	<50
EPH (C19-C32)	ns	ns	ns	ns	ns	<50	<50	<50	<50
LEPH (C10-C19)	1000	1000	1000	2000	2000	<50	<50	<50	<50
HEPH (C19-C32)	1000	1000	1000	5000	5000	<50	<50	<50	<50
1-Methylnaphthalene	250	250	500	1000	1000	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	60	60	100	950	950	<0.050	<0.050	<0.050	<0.050
Acenaphthene	950	950	2000	15000	15000	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050
Anthracene	2.5	2.5	2.5	30	30	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	5	5	10	30	50	<0.050	<0.050	<0.050	<0.050
Benzo(b+j)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Chrysene	200	200	400	4500	4500	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Fluoranthene	50	50	50	200	200	<0.050	<0.050	<0.050	<0.050
Fluorene	600	600	1000	9500	9500	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Naphthalene	0.6	0.6	0.6	20	20	<0.050	<0.050	<0.050	<0.050
Phenanthrene	0.1	5	5	50	50	<0.050	<0.050	<0.050	<0.050
Pyrene	0.1	10	10	100	100	<0.050	<0.050	<0.050	<0.050
Quinoline	2.5	2.5	4.5	10	10	<0.050	<0.050	<0.050	<0.050

Notes:

Values in µg/g unless otherwise stated.
- = not analyzed, ns = no standard
Dup. = duplicate

XXX.XX	= Exceeds Applicable AL Soil Standard
XXX.XX	= Exceeds Applicable RLD Soil Standard
XXX.XX	= Exceeds Applicable PL Soil Standard
XXX.XX	= Exceeds Applicable CL Soil Standard
XXX.XX	= Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, groundwater used for drinking water and groundwater flow to surface water used by aquatic life (freshwater and/or marine).

PAH = Polycyclic Aromatic Hydrocarbons
EPH$_{10-19}$ = LEPH, uncorrected for PAH
EPH$_{19-32}$ = HEPH, uncorrected for PAH
LEPH = Light Extractable Petroleum Hydrocarbons, corrected for PAH
HEPH = Heavy Extractable Petroleum Hydrocarbons, corrected for PAH

Table 2: Metals in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North vancouver School District #44

Sample ID						**TH21-13-04**	**TH21-11-03**	**TH21-08-02**	**TH21-09-02**
Certificate of Analysis	**Soil Standards (µg/g)***					21D2772	21D2772	21D2772	21D2772
Sample Date	**Agricultural (AL)**	**Residential Low Density (RLD)**	**Urban Park (PL)**	**Commercial (CL)**	**Industrial (IL)**	21-Apr-21	21-Apr-21	20-Apr-21	20-Apr-21
Depth of Sample (m)						0.05 - 0.1	0.8 - 0.9	1.1 - 1.2	0.2 - 0.3
Parameters									
pH	ns	ns	ns	ns	ns	6.51	5.86	5.96	6.18
Aluminum (Al)	40000	40000	40000	250000	250000	20000	17700	11900	18800
Antimony (Sb)	20	20	20	40	40	0.17	0.19	0.11	0.18
Arsenic (As)	10	10	10	10	10	3.21	2.83	2.39	2.54
Barium (Ba)	350	350	350	350	350	82.7	38.9	63.1	47.5
Beryllium (Be)	1-85**	1-85**	1-150**	1-350**	1-350**	0.25	0.22	0.13	0.25
Boron (B)	8500	8500	15000	50000	1000000	<2.0	2	<2.0	<2.0
Cadmium (Cd)	1-10**	1-20**	1-30**	1-50**	1-50**	0.099	0.096	<0.040	0.092
Chromium (Cr)	60	60	60	60	60	20.4	14.2	18.3	15.4
Cobalt (Co)	25	25	25	25	25	10	4.81	4.71	5.29
Copper (Cu)	75-150**	75-150**	75-150**	75-300**	75-300**	32.2	12.1	13.7	14.4
Iron (Fe)	35000	35000	35000	150000	150000	22600	13000	14200	16100
Lead (Pb)	120	120	120	120-150**	120-1000**	5.07	7.63	1.99	5.76
Lithium (Li)	30	30	65	450	450	7.74	5.76	7.95	6.72
Manganese (Mn)	2000	2000	2000	2000	2000	483	179	166	274
Mercury (Hg)	0.6	10	25	75	75	<0.040	0.059	<0.040	0.055
Molybdenum (Mo)	3	15	15	15	15	0.65	0.51	0.32	0.46
Nickel (Ni)	70-150**	70-150**	70-150**	70-250**	70-250**	13.5	7.61	8.38	8.39
Selenium (Se)	1	1	1	1	1	<0.20	0.34	<0.20	0.34
Silver (Ag)	20	20	20	40	40	<0.10	<0.10	<0.10	0.12
Strontium (Sr)	9500	9500	20000	150000	150000	48.8	19.8	26.5	25.2
Thallium (Tl)	2	9	9	25	25	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	5	50	50	300	300	0.34	0.36	<0.20	0.37
Tungsten (W)	15	15	25	200	200	<0.20	<0.20	<0.20	<0.20
Uranium (U)	15	30	30	30	30	0.673	0.456	0.31	0.468
Vanadium (V)	100	100	100	100	100	62	49.5	49.1	48.4
Zinc (Zn)	150-200**	150-200**	150-200**	150-200**	150-200**	49.8	33.9	20	31.8

Notes:

Values in µg/g unless otherwise stated.
- = not analyzed, ns = no standard
Dup. = duplicate
XXX.XX = Exceeds Applicable AL Soil Standard
XXX.XX = Exceeds Applicable RLD Soil Standard
XXX.XX = Exceeds Applicable PL Soil Standard
XXX.XX = Exceeds Applicable CL Soil Standard
XXX.XX = Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, groundwater used for drinking water and groundwater flow to surface water used by aquatic life (freshwater and/or marine).

** Standard is pH dependent

CERTIFICATE OF ANALYSIS

REPORTED TO Thurber Engineering Ltd. (Vancouver)
900 - 1281 West Georgia Street
Vancouver, BC V6E 3J7

ATTENTION [redacted]

PO NUMBER 28847
PROJECT 28847
PROJECT INFO

WORK ORDER 21D2772

RECEIVED / TEMP 2021-04-27 11:30 / 4°C
REPORTED 2021-05-05 13:14
COC NUMBER B102820

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

Work Order Comments:

This is a revised report; please refer to Appendix 3 for details.

If you have any questions or concerns, please contact me at nyipp@caro.ca

Authorized By:

[redacted]

[redacted]

TEST RESULTS

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-13-04 (21D2772-12) | Matrix: Soil | Sampled: 2021-04-21					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*104*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**20.9**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**6.51**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*82*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*94*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*82*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*86*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*86*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**20000**	40	mg/kg dry	2021-05-01	
Antimony	**0.17**	0.10	mg/kg dry	2021-05-01	
Arsenic	**3.21**	0.30	mg/kg dry	2021-05-01	
Barium	**82.7**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.25**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.099**	0.040	mg/kg dry	2021-05-01	

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-13-04 (21D2772-12) | Matrix: Soil | Sampled: 2021-04-21, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**20.4**	1.0	mg/kg dry	2021-05-01	
Cobalt	**10.0**	0.10	mg/kg dry	2021-05-01	
Copper	**32.2**	0.40	mg/kg dry	2021-05-01	
Iron	**22600**	20	mg/kg dry	2021-05-01	
Lead	**5.07**	0.20	mg/kg dry	2021-05-01	
Lithium	**7.74**	0.10	mg/kg dry	2021-05-01	
Manganese	**483**	0.40	mg/kg dry	2021-05-01	
Mercury	< 0.040	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.65**	0.10	mg/kg dry	2021-05-01	
Nickel	**13.5**	0.60	mg/kg dry	2021-05-01	
Selenium	< 0.20	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**48.8**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.34**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.673**	0.050	mg/kg dry	2021-05-01	
Vanadium	**62.0**	1.0	mg/kg dry	2021-05-01	
Zinc	**49.8**	2.0	mg/kg dry	2021-05-01	
TH21-11-03 (21D2772-20) | Matrix: Soil | Sampled: 2021-04-21					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*107*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**19.1**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**5.86**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-11-03 (21D2772-20) | Matrix: Soil | Sampled: 2021-04-21, Continued					
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*83*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*89*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*83*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*82*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*87*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**17700**	40	mg/kg dry	2021-05-01	
Antimony	**0.19**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.83**	0.30	mg/kg dry	2021-05-01	
Barium	**38.9**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.22**	0.10	mg/kg dry	2021-05-01	
Boron	**2.0**	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.096**	0.040	mg/kg dry	2021-05-01	
Chromium	**14.2**	1.0	mg/kg dry	2021-05-01	
Cobalt	**4.81**	0.10	mg/kg dry	2021-05-01	
Copper	**12.1**	0.40	mg/kg dry	2021-05-01	
Iron	**13000**	20	mg/kg dry	2021-05-01	
Lead	**7.63**	0.20	mg/kg dry	2021-05-01	
Lithium	**5.76**	0.10	mg/kg dry	2021-05-01	
Manganese	**179**	0.40	mg/kg dry	2021-05-01	
Mercury	**0.059**	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.51**	0.10	mg/kg dry	2021-05-01	
Nickel	**7.61**	0.60	mg/kg dry	2021-05-01	
Selenium	**0.34**	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**19.8**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.36**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.456**	0.050	mg/kg dry	2021-05-01	
Vanadium	**49.5**	1.0	mg/kg dry	2021-05-01	
Zinc	**33.9**	2.0	mg/kg dry	2021-05-01	

TEST RESULTS

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-08-02 (21D2772-31) | Matrix: Soil | Sampled: 2021-04-20					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*103*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**16.1**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**5.96**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*81*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*88*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*84*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*85*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*85*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**11900**	40	mg/kg dry	2021-05-01	
Antimony	**0.11**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.39**	0.30	mg/kg dry	2021-05-01	
Barium	**63.1**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.13**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	< 0.040	0.040	mg/kg dry	2021-05-01	

TEST RESULTS

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-08-02 (21D2772-31) | Matrix: Soil | Sampled: 2021-04-20, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**18.3**	1.0	mg/kg dry	2021-05-01	
Cobalt	**4.71**	0.10	mg/kg dry	2021-05-01	
Copper	**13.7**	0.40	mg/kg dry	2021-05-01	
Iron	**14200**	20	mg/kg dry	2021-05-01	
Lead	**1.99**	0.20	mg/kg dry	2021-05-01	
Lithium	**7.95**	0.10	mg/kg dry	2021-05-01	
Manganese	**166**	0.40	mg/kg dry	2021-05-01	
Mercury	< 0.040	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.32**	0.10	mg/kg dry	2021-05-01	
Nickel	**8.38**	0.60	mg/kg dry	2021-05-01	
Selenium	< 0.20	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**26.5**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	< 0.20	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.310**	0.050	mg/kg dry	2021-05-01	
Vanadium	**49.1**	1.0	mg/kg dry	2021-05-01	
Zinc	**20.0**	2.0	mg/kg dry	2021-05-01	
TH21-09-02 (21D2772-36) | Matrix: Soil | Sampled: 2021-04-20					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*103*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**21.6**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**6.18**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	

TEST RESULTS

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TH21-09-02 (21D2772-36) | Matrix: Soil | Sampled: 2021-04-20, Continued

Analyte	Result	RL	Units	Analyzed	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*79*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*87*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*79*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*79*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*84*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**18800**	40	mg/kg dry	2021-05-01	
Antimony	**0.18**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.54**	0.30	mg/kg dry	2021-05-01	
Barium	**47.5**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.25**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.092**	0.040	mg/kg dry	2021-05-01	
Chromium	**15.4**	1.0	mg/kg dry	2021-05-01	
Cobalt	**5.29**	0.10	mg/kg dry	2021-05-01	
Copper	**14.4**	0.40	mg/kg dry	2021-05-01	
Iron	**16100**	20	mg/kg dry	2021-05-01	
Lead	**5.76**	0.20	mg/kg dry	2021-05-01	
Lithium	**6.72**	0.10	mg/kg dry	2021-05-01	
Manganese	**274**	0.40	mg/kg dry	2021-05-01	
Mercury	**0.055**	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.46**	0.10	mg/kg dry	2021-05-01	
Nickel	**8.39**	0.60	mg/kg dry	2021-05-01	
Selenium	**0.34**	0.20	mg/kg dry	2021-05-01	
Silver	**0.12**	0.10	mg/kg dry	2021-05-01	
Strontium	**25.2**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.37**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.468**	0.050	mg/kg dry	2021-05-01	
Vanadium	**48.4**	1.0	mg/kg dry	2021-05-01	
Zinc	**31.8**	2.0	mg/kg dry	2021-05-01	

TEST RESULTS

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Sample Qualifiers:

HT1	The sample was prepared and/or analyzed past the recommended holding time.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Analysis Description	Method Ref.	Technique	Accredited	Location
EPH in Soil	EPA 3570* / BCMOE EPHs*	Shaker Extraction (Hexane-Acetone 1:1) / Gas Chromatography (GC-FID)	✓	Richmond
HEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
LEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
Moisture in Soil	ASTM D2974-87*	Gravimetry (Dried at 105C)		N/A
pH in Soil	Carter 16.2 / SM 4500-H+ B (2017)	1:2 Soil/Water Slurry / Electrometry	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Soil	EPA 3570* / EPA 8270D	Shaker Extraction (Hexane-Acetone 1:1) / GC-MSD (SIM)	✓	Richmond
SALM in Soil	BCMOE SALM V.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
% wet	Percent (as received basis)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/kg dry	Milligrams per kilogram (dry weight basis)
pH units	pH < 7 = acidic, ph > 7 = basic
ASTM	ASTM International Test Methods
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B1D2652										
Blank (B1D2652-BLK1)				Prepared: 2021-04-28, Analyzed: 2021-04-28						
EPHs10-19	< 50	50	mg/kg wet							
EPHs19-32	< 50	50	mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	*15.7*		*mg/kg wet*	16.5		*95*	*70-125*			
LCS (B1D2652-BS2)				Prepared: 2021-04-28, Analyzed: 2021-04-28						
EPHs10-19	2300	50	mg/kg wet	2780		82	70-110			
EPHs19-32	3200	50	mg/kg wet	3990		81	70-110			
Surrogate: 2-Methylnonane (EPH/F2-4)	*19.2*		*mg/kg wet*	16.0		*120*	*70-125*			
Reference (B1D2652-SRM1)				Prepared: 2021-04-28, Analyzed: 2021-04-29						
EPHs10-19	2800	75	mg/kg wet	3020		93	65-130			
EPHs19-32	3900	75	mg/kg wet	4330		91	65-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*25.0*		*mg/kg wet*	25.0		*100*	*70-125*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B1D2652										
Blank (B1D2652-BLK1)				Prepared: 2021-04-28, Analyzed: 2021-04-29						
1-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
2-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
Acenaphthene	< 0.050	0.050	mg/kg wet							
Acenaphthylene	< 0.050	0.050	mg/kg wet							
Anthracene	< 0.050	0.050	mg/kg wet							
Benz(a)anthracene	< 0.050	0.050	mg/kg wet							
Benzo(a)pyrene	< 0.050	0.050	mg/kg wet							
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg wet							
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg wet							
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg wet							
Chrysene	< 0.050	0.050	mg/kg wet							
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg wet							
Fluoranthene	< 0.050	0.050	mg/kg wet							
Fluorene	< 0.050	0.050	mg/kg wet							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg wet							
Naphthalene	< 0.050	0.050	mg/kg wet							
Phenanthrene	< 0.050	0.050	mg/kg wet							
Pyrene	< 0.050	0.050	mg/kg wet							
Quinoline	< 0.050	0.050	mg/kg wet							

Polycyclic Aromatic Hydrocarbons (PAH), Batch B1D2652, Continued

Blank (B1D2652-BLK1), Continued Prepared: 2021-04-28, Analyzed: 2021-04-29

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Surrogate: Acenaphthene-d10	*1.30*		*mg/kg wet*	1.66		*79*	*50-122*			
Surrogate: Chrysene-d12	*1.36*		*mg/kg wet*	1.66		*82*	*50-140*			
Surrogate: Naphthalene-d8	*1.30*		*mg/kg wet*	1.66		*78*	*50-140*			
Surrogate: Perylene-d12	*1.31*		*mg/kg wet*	1.66		*79*	*50-140*			
Surrogate: Phenanthrene-d10	*1.35*		*mg/kg wet*	1.66		*81*	*55-119*			

LCS (B1D2652-BS1) Prepared: 2021-04-28, Analyzed: 2021-04-29

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
1-Methylnaphthalene	1.26	0.050	mg/kg wet	1.56		81	67-120			
2-Methylnaphthalene	1.21	0.050	mg/kg wet	1.56		78	71-122			
Acenaphthene	1.19	0.050	mg/kg wet	1.56		76	63-119			
Acenaphthylene	1.23	0.050	mg/kg wet	1.56		79	68-126			
Anthracene	1.25	0.050	mg/kg wet	1.56		80	69-117			
Benz(a)anthracene	1.26	0.050	mg/kg wet	1.56		81	56-127			
Benzo(a)pyrene	1.26	0.050	mg/kg wet	1.56		81	63-116			
Benzo(b+j)fluoranthene	2.59	0.050	mg/kg wet	3.11		83	71-122			
Benzo(g,h,i)perylene	1.01	0.050	mg/kg wet	1.56		65	56-133			
Benzo(k)fluoranthene	1.28	0.050	mg/kg wet	1.56		82	62-131			
Chrysene	1.29	0.050	mg/kg wet	1.56		83	66-132			
Dibenz(a,h)anthracene	1.08	0.050	mg/kg wet	1.56		69	56-119			
Fluoranthene	1.28	0.050	mg/kg wet	1.56		82	72-119			
Fluorene	1.19	0.050	mg/kg wet	1.56		76	62-115			
Indeno(1,2,3-cd)pyrene	0.982	0.050	mg/kg wet	1.56		63	59-118			
Naphthalene	1.22	0.050	mg/kg wet	1.56		78	70-136			
Phenanthrene	1.27	0.050	mg/kg wet	1.56		82	61-124			
Pyrene	1.36	0.050	mg/kg wet	1.56		87	70-119			
Quinoline	1.41	0.050	mg/kg wet	1.56		91	50-125			
Surrogate: Acenaphthene-d10	*1.21*		*mg/kg wet*	1.56		*77*	*50-122*			
Surrogate: Chrysene-d12	*1.22*		*mg/kg wet*	1.56		*78*	*50-140*			
Surrogate: Naphthalene-d8	*1.20*		*mg/kg wet*	1.56		*77*	*50-140*			
Surrogate: Perylene-d12	*1.23*		*mg/kg wet*	1.56		*79*	*50-140*			
Surrogate: Phenanthrene-d10	*1.25*		*mg/kg wet*	1.56		*80*	*55-119*			

Strong Acid Leachable Metals, Batch B1D3011

Blank (B1D3011-BLK1) Prepared: 2021-04-30, Analyzed: 2021-05-01

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Cadmium	< 0.040	0.040	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							
Iron	< 20	20	mg/kg dry							
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	< 0.40	0.40	mg/kg dry							
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							

Strong Acid Leachable Metals, Batch B1D3011, Continued

Blank (B1D3011-BLK1), Continued Prepared: 2021-04-30, Analyzed: 2021-05-01

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							

LCS (B1D3011-BS1) Prepared: 2021-04-30, Analyzed: 2021-05-01

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Antimony	2.04	0.10	mg/kg dry	2.00		102	80-120			
Arsenic	1.86	0.06	mg/kg dry	2.00		93	80-120			
Barium	2.1	1.0	mg/kg dry	1.98		108	80-120			
Beryllium	1.98	0.10	mg/kg dry	1.98		100	80-120			
Boron	2.2	0.4	mg/kg dry	2.00		109	80-120			
Cadmium	1.97	0.040	mg/kg dry	1.99		99	80-120			
Chromium	1.9	1.0	mg/kg dry	1.98		98	80-120			
Cobalt	1.98	0.10	mg/kg dry	1.99		100	80-120			
Copper	1.99	0.40	mg/kg dry	2.00		100	80-120			
Iron	189	4	mg/kg dry	202		94	80-120			
Lead	2.00	0.20	mg/kg dry	1.99		101	80-120			
Lithium	2.07	0.02	mg/kg dry	2.00		104	80-120			
Manganese	1.96	0.08	mg/kg dry	1.99		99	80-120			
Mercury	0.094	0.040	mg/kg dry	0.100		94	80-120			
Molybdenum	1.85	0.10	mg/kg dry	2.00		93	80-120			
Nickel	2.03	0.60	mg/kg dry	2.00		101	80-120			
Selenium	1.95	0.20	mg/kg dry	2.00		98	80-120			
Silver	1.99	0.10	mg/kg dry	2.00		99	80-120			
Strontium	1.87	0.04	mg/kg dry	2.00		93	80-120			
Thallium	2.05	0.02	mg/kg dry	1.99		103	80-120			
Tin	2.10	0.20	mg/kg dry	2.00		105	80-120			
Tungsten	1.99	0.04	mg/kg dry	2.00		99	80-120			
Uranium	2.03	0.010	mg/kg dry	2.00		101	80-120			
Vanadium	2.0	1.0	mg/kg dry	2.00		98	80-120			
Zinc	2.0	2.0	mg/kg dry	2.00		100	80-120			

Reference (B1D3011-SRM1) Prepared: 2021-04-30, Analyzed: 2021-05-01

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum	11300	40	mg/kg dry	11500		98	70-130			
Antimony	0.70	0.10	mg/kg dry	0.724		97	70-130			
Arsenic	81.7	0.30	mg/kg dry	82.1		99	70-130			
Barium	43.3	1.0	mg/kg dry	40.0		108	70-130			
Beryllium	0.36	0.10	mg/kg dry	0.369		96	70-130			
Chromium	63.6	1.0	mg/kg dry	63.1		101	70-130			
Cobalt	10.4	0.10	mg/kg dry	10.4		100	70-130			
Copper	19.5	0.40	mg/kg dry	19.8		99	70-130			
Iron	18300	20	mg/kg dry	20200		91	70-130			
Lead	17.0	0.20	mg/kg dry	17.3		98	70-130			
Manganese	313	0.40	mg/kg dry	315		99	70-130			
Mercury	0.107	0.040	mg/kg dry	0.110		98	70-130			
Molybdenum	0.63	0.10	mg/kg dry	0.619		102	70-130			
Nickel	31.9	0.60	mg/kg dry	31.7		101	70-130			
Silver	1.49	0.10	mg/kg dry	1.75		85	70-130			
Strontium	20.6	0.20	mg/kg dry	20.3		101	70-130			
Uranium	1.18	0.050	mg/kg dry	1.18		100	70-130			
Vanadium	34.6	1.0	mg/kg dry	33.5		103	70-130			
Zinc	37.6	2.0	mg/kg dry	40.2		93	70-130			

APPENDIX 3: REVISION HISTORY

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Sample ID	Changed	Change	Analysis	Analyte(s)
21D2772-	2021-05-05	Project	N/A	N/A
21D2772-12	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-20	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-31	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-36	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene

Appendix E Energy Modelling Report

SD 44 Cloverley Elementary School

PDR - ENERGY MODELLING REPORT

January 19, 2022

North Vancouver
School District
the natural place to learn®

INTEGRAL

Project No.: 152467.000

Issue	**Description**	**Date** (MM.DD.YY)	**Prepared By**	**Signed Off**
1.0	PDR - EM Report	10.07.21	SJY	KL
1.1	PDR - EM Report	01.19.22	SJY	KL

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Project Contact:

[redacted]

Disclaimer

www.integralgroup.com

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1 LIMITING CONDITION

This report has been prepared for North Vancouver School District to provide estimated energy performance of the SD 44 Cloverley Elementary School in support of PDR submission. They are not predictions of actual energy use or cost of the proposed design after construction. Actual experience will differ from these calculations due to the variations such as occupancy, building operation and maintenance, weather, energy use not covered by energy modelling guidelines, changes in energy rates between design of the building and occupancy, and precision of the calculation tool.

2 PROJECT NARRATIVES AND OBJECTIVES

The project is a new 2-storey elementary school, located in North Vancouver, BC. The building consists of classrooms, kindergarten and daycare spaces, administration office and gymnasium, with total modelled floor area of 4,562 m².

The classrooms are conditioned by Central ERV with VAV reheat as well as demand control ventilation via CO_2 sensors. The gymnasium is conditioned by an air handling unit with demand control ventilation via CO_2 sensors.

Energy study was performed at schematic design to support the integrated design approach where different design inputs were evaluated against various sustainability metrics. The evaluated metrics are as follow:

1. Total Energy Use Intensity (TEUI)
2. Greenhouse Gas Emissions Intensity (GHGI)
3. Total Energy Cost Intensity (TECI)
4. Incremental Capital Cost
5. LEEDv4 EAc2 Points

Over 155,500 energy simulations were performed based on the key design inputs below during schematic design.

- Simulation Weather File: CWEC 2016 and CWEC 2050
- Site Orientation: East and West
- Overall Effective Roof R_{IP}-Value: 20, 30, and 40
- Overall Effective Wall R_{IP}-Value: 10, 15, 20 and 25
- Overall Effective Window U_{IP}-Value: 0.25, 0.30, and 0.35
- Overall Effective Window SHGC: 0.25, 0.30 and 0.35
- Window to Wall Ratio: 12%, 17% and 22%
- LPD reduction from NECB 2015: 20% and 30%
- Mechanical Plant Type: ASHP/GSHP with backup gas/electric boiler switched at 0°C/4°C
- Heat Recovery Ventilator Type: Standard HRV (SRE 70%) and Premium HRV (SRE 90%)
- Domestic Hot Water Plant Type: Condensing gas boiler, Electric water heater, ASHP with gas/electric boiler and Packaged ASHP
- Photovoltaic Panels (available range from 0 m² to 2,900 m²)

3 ENERGY MODELLING PROCESS

A parametric energy study at early design stage of the project allowed the design team to determine the optimal balance between capital cost and energy efficiency while meeting the project goals. The visualization tool was also designed to provide decision makers with a rapid, interactive analysis of all options—from building envelope to mechanical systems, and any potential combination of these design features—to meet the project's sustainability targets. Three main steps in the energy modelling process are summarized below:

Step 1: Kickoff meeting with the design team to determine viable design options for the project.

Step 2: Collect all required energy model inputs of the finalized design options from each respective member of the design team (architectural drawings, program layout, design option specifications, etc.). The energy model is constructed using an energy model software, eQuest, based on the collected information from the design team.

Step 3: Perform all possible combinations of the finalized design options with the help of cloud computing to shorten the simulation time. Present the energy modelling results to the design team with the in-house developed presentation platform.

Figure 3.1: Overview of Parametric Energy Study Presentation

IntegralDRIVE

FLOOR AREA: 4,562 m²
LEED VERSION: LEED v4 School
LEED EAc2 POINTS: 8 – 15
TEUI (kWh/m²): 60 – 90
GHGI (kgCO2e/m²): 0.7 – 4.8
TECI ($/m²): $6.90 – $10.59
THERMAL COMFORT (> 25°C): 0 – 368

CLIMATE RESILIENCY
WEATHER FILE
☑ Vancouver 2016
☑ Vancouver 2050

ORIENTATION
SITE ORIENTATION
☑ East
☑ West

ENVELOPE
OVERALL EFFECTIVE ROOF R-VALUE
☑ R-20
☑ R-30
☑ R-40

OVERALL EFFECTIVE WALL R-VALUE
☑ R-10
☑ R-15
☑ R-20
☑ R-25

OVERALL EFFECTIVE GLAZING U-VALUE
☑ U-0.35
☑ U-0.30
☑ U-0.25

OVERALL EFFECTIVE GLAZING SHGC
☑ SHGC-0.25
☑ SHGC-0.30
☑ SHGC-0.35

WINDOW TO WALL RATIO
☑ WWR-12%
☑ WWR-17%
☑ WWR-22%

LIGHTING
INTERIOR LIGHTING POWER DENSITY REDUCTION FROM NECB 2015
☑ 20%
☑ 30%

MECHANICAL
CENTRAL PLANT TYPE
☑ ASHP w/ Cond. Gas Boiler @ 4°C
☑ ASHP w/ Cond. Gas Boiler @ 0°C
☑ ASHP w/ Electric Boiler @ 4°C
☑ ASHP w/ Electric Boiler @ 0°C
☑ GSHP w/ Cond. Gas Boiler @ 0°C
☑ GSHP w/ Electric Boiler @ 0°C

HRV TYPE
☑ Standard
☑ Premium

DOMESTIC HOT WATER PLANT TYPE
☑ Cond. Gas Boiler
☑ Electric Boiler
☑ ASHP w/ Cond. Gas Boiler
☑ ASHP w/ Electric Boiler
☑ Packaged ASHP

RENEWABLES
SOLAR PV AREA TO ROOF RATIO: 0.0%
PV Area: 0 m² (Max: 2,900 m²)
PV Generation EUI: 0.0 kWh/m²
PV Reduction ECI: $0.0/m²
Additional LEED EAc2: 0 Points
Renewables LEED EAc5: 0 Points

UTILITY RATE
ELECTRICITY RATE INCREASE: 1
NATURAL GAS RATE INCREASE: 1

STEP 1: SET BASELINE

School District 44
Cloverley Elementary School

TEUI [kWh/m²] VS GHGI [kgCO2e/m²]

Energy Cost [$/m²] VS LEED EAc2 Points

Design Parameter Filter: Overall Effective Wall R-Value

RESULTS RANGE
LEED EAc2 Points: 8 to 15
TEUI: 60 to 90 kWh/m²
GHGI: 0.7 to 4.8 kgCO2e/m²
TECI: $6.9 to $10.6/m²
Thermal Comfort: 0 to 368 hours
Number of Results: 155,520

	LEED	TEUI	GHGI	TECI	Comfort	Weather File	Site	Roof R-Value	Wall R-Value	Glazing U-Value	Glazing SHGC	WWR	Int. LPD Reduct.	Central Plant Type	DHW Plant Type	HRV Type
BASE DESIGN	9	88	4.6	$8.73	25	Vancouver 2016	East	R-20	R-10	U-0.35	SHGC-0.30	WWR-17%	20%	ASHP w/ Cond. Gas Boiler @ 4°C	Cond. Gas Boiler	Standard

4 RESULTS AND DISCUSSION

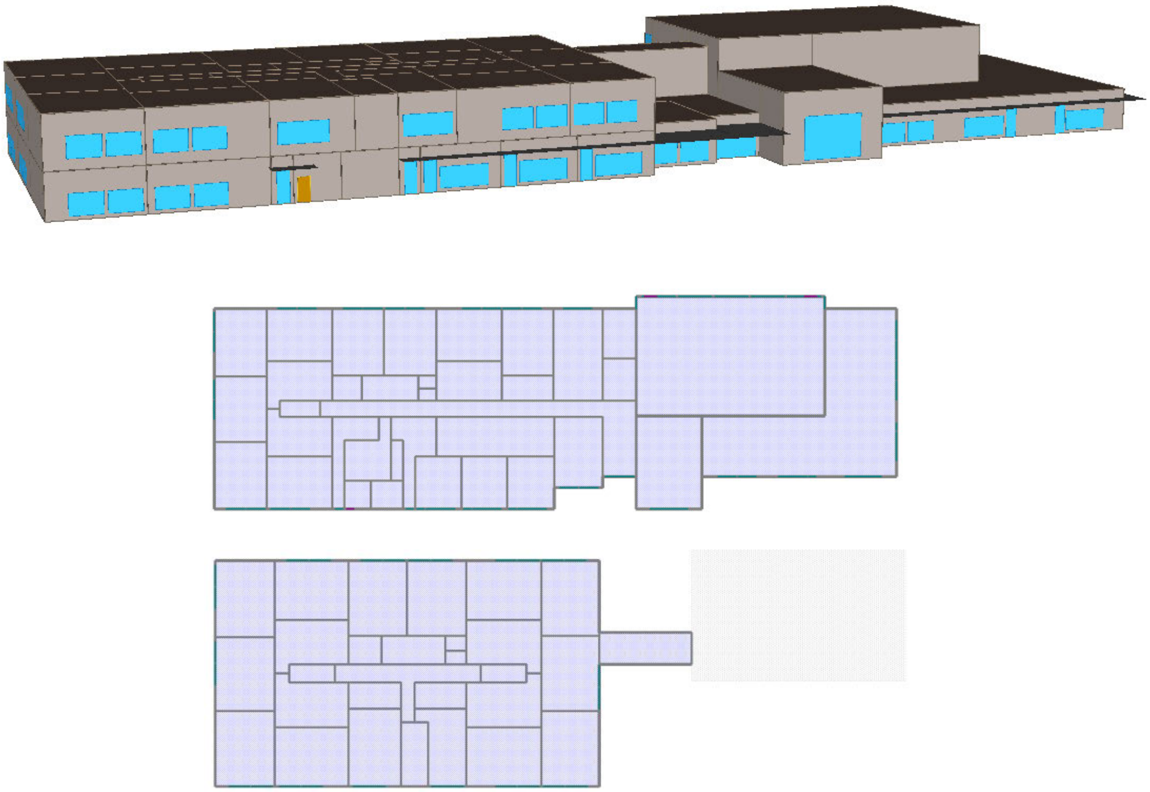
The energy model was developed using eQuest 3.64 building performance simulation software. eQuest conducts hourly building thermal and energy use calculations using 3D model inputs, detailed envelope constructions, internal thermal gains, infiltration air flow, detailed HVAC network inputs, and industry standard hourly weather files. Please refer to Appendix A for more detail model inputs.

The energy model at this stage was developed based on the following information:

- Architectural drawings dated July 21, 2021
- Mechanical design/Electrical/Envelope performance per email coordination
- Capital cost information per JDA's provision dated August 10, 2021
- National Energy Code of Canada for Buildings 2015
- City of Vancouver Energy Modelling Guidelines v2.0

For reference purposes, a 3D rendering of the building as well as 2D floor plans in the energy modelling software are shown below.

Figure 4.1: Energy Model Geometry



4.1 Energy Conservations Measures (ECM) Analysis

The sensitivity analysis was performed based on the parametric energy study results and different ECMs were reviewed by the design team. The Base Design was established to meet LEED Gold targets with most cost-effective design. See below key ECMs that the design team investigated further to derive an enhanced design option which improves overall energy and carbon performance of the project.

Table 4.1: Base Design with ECM List

	Roof	Wall	Glazing	ASHP Backup Boiler Type	DHW Plant Type	Photovoltaic Panels	LPD Reduction from NECB 2015
BASE DESIGN	R_{IP}-20	R_{IP}-10	U_{IP}-0.35	Cond. Gas Boiler at 4°C	Cond. Gas Boiler	None	20%
ECM 1	R_{IP}-40	•	•	•	•	•	•
ECM 2	•	R_{IP}-25	•	•	•	•	•
ECM 3	•	•	U_{IP}-0.30	•	•	•	•
ECM 4	•	•	•	Electric Boiler at 0°C	•	•	•
ECM 5	•	•	•	•	Packaged ASHP	•	•
ECM 6	•	•	•	•	•	536 m^2	•
ECM 7	•	•	•	•	•	•	30%

Table 4.2: Energy and Carbon Performance Summary

	TEUI	GHGI	TECI	Energy Savings [%]	GHG Savings [%]	Energy Cost Savings [%]	Incremental Capital Cost
BASE DESIGN	88	4.6	8.7	-	-	-	-
ECM 1	84	4.2	8.5	5%	9%	2%	$83k
ECM 2	82	4.0	8.3	7%	13%	5%	$104k
ECM 3	87	4.5	8.7	1%	2%	0%	$140k
ECM 4	80	1.9	9.4	9%	59%	-8%	$141k
ECM 5	84	3.6	8.8	5%	22%	-1%	$16k
ECM 6	77	4.5	7.3	13%	3%	16%	$281k
ECM 7	86	4.6	8.4	2%	0%	3%	$123k

TEUI: The sum of all energy used on site, divided by the floor area in kWh/m^2

GHGI: The total greenhouse gas emissions associated with the use of all energy utilities on site in kgCO$_2$e/m^2

TECI: The sum of all energy cost (operating cost) on site, divided by the floor area in $\$/m^2$

4.2 Energy Results

As illustrated in ECM analysis, mechanical central plant ECMs have significant impact on GHG reductions via fuel switching to electricity for space and DHW heating. The design team has incorporated all ECMs to derive GHG Reduction Option which demonstrates 84% improvements in greenhouse gas emissions within 3% of incremental capital cost premium from the Base Design. Please see below table for energy use breakdown for both Base Design and GHG Reduction Option.

Table 4.3: End Use Breakdown

	Source	Base Design (kWh/m²)	GHG Reduction Option (kWh/m²)	% Saving
Lighting	Electricity	25.3	22.1	13%
Misc. Equipment	Electricity	11.3	11.3	0%
Space Heating	Electricity	11.6	12.3	54%
	Natural Gas	15.2	0.0	
Space Cooling	Electricity	4.8	4.8	0.3%
Pump	Electricity	2.8	2.3	16%
Fan	Electricity	11.4	10.5	8%
DHW	Electricity	0.0	2.0	66%
	Natural Gas	5.8	0.0	
Renewables	Electricity	0.0	-11.2	-

Table 4.4: Energy/Carbon/Cost Performance

	Source	Base Design	GHG Reduction Option	% Saving
Total Energy Use [MWh/year]	Electricity	307	247	39%
	Natural Gas	95	0	
	Total	402	247	
***Greenhouse Gas Emissions [tCO_2/year]**	Electricity	3.4	2.7	87%
	Natural Gas	17.7	0.0	
	Total	21.0	2.7	
Total Energy Cost [$/year]	Electricity	36.4 k	31.3 k	22%
	Natural Gas	3.6 k	0	
	Total	40.0 k	31.3 k	

*Emissions factors: 0.011 kgCO$_2$e/kWh for electricity; 0.185 kgCO$_2$e/kWh for natural gas

5 CONCLUSION

Based on the findings from the energy study as well as collaborative feedback from each discipline, the design team has selected a GHG Reduction Option that achieves 87% GHG savings within 3% incremental capital cost premium when compared against the Base Design.

	Base Design	GHG Reduction Option
TEUI (kWh/m²·year)	88	54
GHGI (kgCO$_2$e/m²·year)	4.6	0.6
TECI (\$/m²·year)	8.7	6.9
Incremental Capital Cost (\$)	-	\$889 k
LEED v4 School EAc2 Points	9 Points	14 Points

Please note the energy results presented in this report are strictly based on the assumptions and inputs in Appendix A. As we move into detailed design stage, more refined building massing and design inputs will improve the accuracy of the energy modelling results.

We trust the foregoing provides the information required at this time. Please do not hesitate to contact the undersigned with any questions.

INTEGRAL GROUP

Prepared By:

[redacted]

[redacted]

Reviewed By:

[redacted]

[redacted]

APPENDIX A: ENERGY MODEL INPUT SUMMARY

	Base Design Model Characteristics	GHG Reduction Option
General		
Location	North Vancouver, BC, Canada	
Simulation Weather File	Vancouver 2016 CWEC	
Climate Zone	Climate Zone 4	
Modeling Software	eQuest 3.64	
Building Area	MFA: 4,562 m²	
Hours of Operation	NECB 2015 Table A-8.4.3.2.(1) Schedule D – School	
Envelope Performance		
Overall Roof R-value	R_{IP}-20	R_{IP}-40
Overall Wall R-value	R_{IP}-10	R_{IP}-25
Percentage Glazing	17%	17%
Overall Glass U-value including frame, and Solar Heat Gain Coefficient (SHGC)	U_{IP}-0.35, SHGC-0.30	U_{IP}-0.30, SHGC-0.30
Infiltration	Fixed rate of 0.20 L/s/m² at operating pressure and is applied to the modelled above-ground wall area (i.e. walls and windows)	
Internal Loads		
Occupancy	Classroom: 31 Gym: 165 Others: NECB 2015	
Lighting Power Density (LPD)	20% reduction from NECB 2015 Table 4.2.1.6	30% reduction from NECB 2015 Table 4.2.1.6
Plug-Loads	As per NECB 2015 Table A-8.4.3.2.(2)-B	
Process Loads	Elevator: 3kW	
DHW Consumption	Total: 0.7 gpm	
Mechanical System		
Indoor Design Temperature for Conditioned Areas	Heating: 72°F / Cooling: 75°F	
System Description and Fan Power	Classrooms: Central ERV with VAV reheat • Central ERV: 1.3 W/cfm Kindergarten/NLC/Admin: Central ERV with VAV reheat and split system cooling • Central ERV: 1.3 W/cfm • Ductless split system: 0.1 W/cfm, 3.5 COP Gymnasium: Air handling unit with hydronic heating and cooling • AHU: 1.0 W/cfm (VFD)	

	Base Design Model Characteristics	GHG Reduction Option
Fan Control	Fan runs continuously during occupied hours and cycle on/off to meet the heating/cooling loads during unoccupied hours.	
Air Economizer System	Air economizer with high-limit shutoff temperature of 75°F	
Demand Control Ventilation	Demand control ventilation via CO_2 sensors	
Ventilation	Based on 62-2001 except add. n/62.1-2010 • Classroom: 15 cfm/person • Gymnasium: 20 cfm/person	
Heat Recovery	Central ERV • Sensible eff.: 70%	
Central Plant		
Chilled Water Loop	Air source heat pump • LWT: 44°F / dT: 10°C • Air source heat pump: COP 3.5 (nominal)	Air source heat pump • LWT: 44°F / dT: 10°C • Air source heat pump: COP 3.5 (nominal)
Hot Water Loop	ASHP with condensing gas boiler • LWT: 120F / dT: 20°F • Air source heat pump: COP 3.0 (nominal) • Condensing gas boiler: 96% thermal eff. when OAT < 4°C	ASHP with electric boiler • LWT: 120°F / dT: 20°F • Air source heat pump: COP 3.0 (nominal) • Electric boiler when OAT < 0°C
Domestic Hot Water Loop	Condensing gas boilers • LWT: 140°F, dT: 100°F • 96% thermal eff.	Packaged air source heat pumps • LWT: 140°F, dT: 100°F • ASHP: COP 3.0
Pump	Chilled water loop • 22 W/gpm Hot water loop • 19 W/gpm	Chilled water loop • 22 W/gpm Hot water loop • 19 W/gpm
Renewables		
PV Panels	None	536 m^2 (95.5 kWh/m^2-year)
Utility Rate		
Electricity	BC Hydro Large General Service Conservation Rate (as of April 1, 2021) • Demand Charge: $12.28 per kW • Energy Charge: $0.0603 per kWh	
Natural Gas	FortisBC Energy Inc Rate Schedule 2 (as of July 1, 2021) • Delivery charge per GJ: $3.882 • Storage and Transport per GJ: $1.420 • Cost of gas per GJ: $2.844 • Carbon tax: $45 per tCO2 (as of April 2021)	

Appendix F School District No. 44 Policies #409 and #412

409 Multicultural/Race Relations

Revised: September 25, 2001

Policy

The Board recognizes the growing diversity of cultures in North Vancouver and commits itself to ensure that all aspects of the Board's programs and procedures promote understanding and tolerance for that diversity.

The Board values the unity and diversity of Canadian Society and will therefore promote cultural tolerance and acceptance in all aspects of a student's school experience. In recognition of the cultural diversity of North Vancouver's community, the Board endorses and promotes the concept of active and positive multiculturalism within its schools. In its support of multicultural education, the Board, within the funds available to it, directs the implementation of programs and activities which foster recognition of, and respect for, basic human rights and fundamental freedoms for all, regardless of race, language or religion.

Administrative Procedures

In-Service Education

In-service education of employees should be designed:

- to provide opportunities for in-service programs in human relations, racial/ethnic relations and human rights
- to provide opportunities for staff to develop the skill necessary to relate knowledgeably and sensitively to people of different racial and ethnic origins
- to provide in-service programs for staff on integration of multicultural curriculum materials into existing programs

Curriculum and Learning Resources

Priority should be given:

- to design and implement appropriate school-based experiences to combat racism and prejudice
- to encourage and support the selection and/or development of all types of learning resources which reflect cultural and ethnic diversity and which present an accurate view of racial/ethnic groups

Student Leadership

Significant efforts should be made:

- to encourage and promote opportunities for student directed inquiry into issues of multiculturalism, race relations, and exchange of information and experience among cultural communities
- to develop a program of information exchange and training whereby students will assume leadership responsibilities for promoting and sharing understanding and positive race relations with the larger student population
- to encourage opportunities for experiential learning whereby students will gain first-hand insights into the attitudes, beliefs, and life styles of other racial/ethnic cultural groups

Intercultural Education

Arrangements should be made:

- to encourage intercultural education with and among schools in local, national and international communities
- to encourage field trips, student and teacher exchange, twinning of schools and other forms of cultural racial/ethnic contact

Personnel Practices

School District personnel practices should be reviewed and monitored:

- to confirm and continue personnel practices that guarantee fair and equal access to employment and advancement opportunities for all qualified candidates regardless of the race, colour, religion, or national origin of each employee or applicant for employment
- to encourage applications from minority group members so as to enhance the possibility of developing a work force that is broadly representative of the racial, ethno-cultural, linguistic and religious diversity of the community
- to proactively promote multiculturalism and racial harmony in the workplace through workshops, videos, publications, cultural events and other means
- to make all employees aware of their right to recognize instances of direct or indirect racial discrimination and their right to seek redress where necessary
- to implement conflict resolution and disciplinary strategies that effectively deal with racial, ethno-cultural, linguistic or religious issues in the work place

POLICY 412: SUPPORTING SEXUAL ORIENTATION, GENDER IDENTITY AND GENDER EXPRESSION

ADMINISTRATIVE PROCEDURES

The North Vancouver School District shall make ongoing efforts to promote and support inclusion as it relates to sexual orientation and gender identity and expression including efforts to dismantle existing systems and structures that may represent barriers to this area of diversity.

This shall include, but not be limited to:

- Increasing visibility and awareness of sexual orientation and gender identity by acknowledging national and international days of recognition (i.e., International Day Against Homophobia, Pride Week, Trans Day of Remembrance, Trans Day of Visibility)
- Increasing visibility and awareness of sexual orientation and gender identity through school announcements, flags and posters in classrooms and throughout school communities
- Making available books and resources that represent diversity in sexual orientation and gender identity and expression
- Increasing awareness of macro/micro aggressions within school communities
- Increasing awareness of heteronormative and gender specific language
- Promoting inclusive language options
- Using gender-neutral language, including pronouns, when acknowledging groups of people
- Building gender-neutral washroom options in new constructions and renovations
- Examining existing and new school activities and events to ensure that they do not reinforce heteronormative expectations and/or gender stereotyping.

Additionally, the following administrative procedures will be implemented:

Washrooms/Changerooms:

In the North Vancouver School District, students and staff will be able to choose the washroom and changeroom that aligns with their gender identity and expression. School Administrators shall also ensure that a designated, gender-neutral, single occupancy washroom and changeroom is available. Universal bathroom signage shall be used indicating accessibility for everyone.

Overnight Trips and Accommodations:

School personnel are responsible for making accommodation arrangements for overnight trips. This will include offering students and staff accommodation arrangements that align with their gender identity and expression.

Careful consideration will be given to how arrangements are organized in a way all students and staff feel safe and included.

Reference to these administrative procedures shall be included in all overnight accommodation consent forms.

Appendix G Asset Detail Report

BRITISH
COLUMBIA
Ministry of Education

Asset Detail Report

By Asset Name

Table of Contents

Asset Detail Report

By Asset Name

School District: North Vancouver
Facility: Cloverley Elementary

Asset: CLOVERLEY ELEMENTARY
Asset Number: 104365

Assets are ordered by Asset Name

Currency: CAD

Statistics

FCI Cost:	3,475,939	FCI:	0.78
RI Cost:	3,855,929	RI:	0.86
Total Requirements Cost:	3,855,929		
Current Replacement Value:	4,466,300	Date of most Recent Assessment:	17 Nov 2017

Type	Building		
Area Units	2,507 SM		
Use	Elementary School	Construction Type	Wood Frame
Floors	2	Historical Category	
Address 1	440 HENDRY AVE	City	NORTH VANCOUVER
Address 2	-	State/Province/Region	CANADA
Year Constructed	1961	Zip/Postal Code	V7L 4C5
Year Renovated	-	Architect	-
Ownership	School District Owned	Commission Date	-
		Decommission Date	-

Architectural Inspector:	Ian Tingley	Inspection Date:	17, Nov 2017

Photo

CLOVERLEY ELEMENTARY

Asset Description

ARCHITECTURAL

General

CLOVERLEY ELEMENTARY, No.104365, sits within B.C. Ministry of Education's North Vancouver School District No. 44 and is located at 440 Hendry Ave., North Vancouver, BC. Originally built in 1961 with a total of 2,507 SM. The facility includes: classrooms, a gymnasium, general storage and service rooms, activity rooms, a library, administration services and multi-purpose rooms. At the time of the 2017 assessment the school was not in use.

Substructure

The substructure consists of a reinforced concrete perimeter crawlspace foundation and some basement walls on reinforced concrete strip footings as well as interior foundations and footings. The facility also includes a concrete skim coat at the crawlspace floors with concrete slab on grade at the lower level corridor and classrooms.

Superstructure

The superstructure of the upper floor level consists of conventional load bearing wood frame floor. The roof construction consists of wood joists and wood beams.

Exterior Construction

Exterior walls consist of framed painted wood siding and stucco finish on wood frramed walls. Exterior windows are single glazed wood framed assemblies. Entry doors are glazed / nglazed wood or hollow metal assemblies with associated entry and exit hardware. The roof system consists of an adhered SBS modified roofing membrane system, and a tar and gravel system.

Interior Construction

Interior partitions throughout the facility are comprise wood stud assemblies with plywood,
MDF, or gypsum board finish. Floor finishes include: carpeting, vinyl sheet goods, vinyl composite tile, ceramic tile, quarry tile, and wood strip flooring. Small service or mechanical spaces typically have painted or unpainted concrete floor finishes. The ceiling finishes include adhered or suspended acoustic tile systems, painted gypsum plaster or wallboard. Interior doors consist of painted solid core wood and hollow metal glazed or flush assemblies with interior door hardware consisting of knob.

Hazardous Materials
Hazardous materials, includes asbestos are known to be present in construction materials.

Accessibility
The facility does not fully meet the Requirements for Persons with Disabilities in Section 3.8 of the 2012 British Columbia Building Code.

Occupancy Type
According to the 2012 British Columbia Building Code, Article 3.1.2.1. (1), the facility is classified as an Assembly Group A, Division 2 Occupancy.

MECHANICAL

HVAC

Building hot water for the facility is provided by a gas fired hot water boiler rated at 1260 MBTUH. The hot water is distributed to the hydronic perimeter heating system. The boiler system also includes distribution piping and water circulating pumps. The supply and return water temperatures of the hot water loop are monitored from the building automation system.

Heating for the Cloverley Annex is provided by four (4) 55 MBTUH gas fired warm air condensing furnaces. The conditioned air is supplied to the space via distribution ductwork and diffusers.

The HVAC ventilation system includes multiple exhaust fans serving the classrooms, hallways, janitor's room, offices and restrooms. .

The main school is equipped with a compressor and pneumatic piping for controlling the building HVAC system. The Cloverley Annex is equipped with electric wall-mounted thermostats for regulating the warm air furnaces.

Plumbing

The city water main enters the building via a 2" pipe and is distributed throughout the facility.

The domestic hot water for the entire facility is provided by both a 102 litre (27 gallon) 4500W electric water heater and by a 277 litre (73 gallon) 9000W electric water heater The domestic water is continuously circulated throughout the building by a circulation pump. Hot and cold water is distributed to restroom fixtures, sinks, janitors' closets drinking fountains and other points of use.

The washroom fixtures include vitreous china urinals, water closets and moulded lavatories. The plumbing fixtures also include stainless steel kitchen sinks, a wall mounted utility sink and stainless steel and porcelain drinking fountains.
.
Rain water is removed from the roof via drains equipped with strainers and connected to internal rainwater leaders, which discharge to a municipal main

The building includes a sanitary waste piping system of cast iron piping with gravity discharge to the municipal system.

Fire Protection

The building includes a wet fire sprinkler system with backflow preventer for the boiler room of the main building and for the Cloverley Annex.

Handheld type fire extinguishers are located throughout the building as required.

ELECTRICAL

Electrical Service and Distribution

The main building of Cloverley Elementary is provided with a 400A 120/240V 1PH electrical service. The main disconnect switch feeds a number of branch safety switches which in turn provide electrical power to mechanical loads, panelboards rated at 100Amps and 200Amps, and associated equipment.
The separate building is provided with a 200A 600V 3PH electrical service. The main disconnect switch feeds mechanical loads, panelboards rated at 225Amps, and associated equipment via a 600V-120/208V 112.5kVA transformer.

Lighting

Interior lighting is provided by pendant, surface-mounted and recessed T8 fluorescent fixtures. Exterior lighting is provided by CFL and HID fixtures equipped with a photoelectric device and time clock for light control. The classroom light fixtures in the main building and the hallway light fixtures are not seismically restrained.
Stage lights are provided on the stage in the gymnasium.

Branch Wiring Devices

The branch wiring for this building includes a typical concentration of branch wiring, devices, and utilization equipment.

Fire Alarm System

The facility is provided with a zoned type Simplex 4020 fire alarm system consisting of a main control panel, an annunciator panel located at the entrance, manual pull stations, smoke detectors, heat detectors and audible bell alarms.

Communications and Security

Television and LAN systems are installed in the building.

The building includes a BOGEN MULTICOM-2000 combination public address and Telephone system. It controls the periodic signals as well. The system includes: amplifier, intercom/monitor, volume control, speakers, conduit and shielded wiring. The building also includes Cat3 Wiring and RJ-11 Terminations for telephones.

The gymnasium is equipped with a sound system which includes amplifier, volume control, speakers, conduit and shielded wiring.

The school is equipped with a security system which includes detection devices and keypads.

The building is equipped with a closed circuit television system including a camera at the entrance, control panel, conduit and wiring.

Other Electrical Systems

The school is provided with emergency battery packs with both self-contained and remote heads.

Illuminated exit signs are provided over exit doors and in strategic positions in the corridors to indicate the direction to means of egress.

Requirements

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
Accessible Ramp - Exterior Concrete Renewal	Yes	B1014 - Ramps	Beyond Useful Life	3- Long Term	17 Nov 2025	3,030
Accessible Ramp - Exterior Wood Renewal	Yes	B1014 - Ramps	Beyond Useful Life	1- Immediate	17 Nov 2018	5,533
Boilers HW - Gas Fired - 1000 MBTUH Renewal	Yes	D3020 - Heat Generating Systems	Beyond Useful Life	2- Short Term	17 Nov 2019	75,550
Branch Wiring - Boxes Without Cover/ Exposed Wires	No	D5021 - Branch Wiring Devices	Life Safety	1- Immediate	17 Nov 2018	912
Branch Wiring - Equipment & Devices Renewal	Yes	D5021 - Branch Wiring Devices	Beyond Useful Life	3- Long Term	17 Nov 2023	31,759
Branch Wiring Devices - Insufficient Quantity of Receptacles	No	D5021 - Branch Wiring Devices	Capacity/ Design	4- Recommended		14,752
Branch Wiring Devices - GFCI Not Provided	No	D5021 - Branch Wiring Devices	Building Code	5- Does Not Meet Current Codes / Standards		502
Built-Up-Roof (BUR) Renewal	Yes	B30 - Roofing	Beyond Useful Life	1- Immediate	17 Nov 2017	224,787
Carpeting - Broadloom Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	65,670
Casework - Elementary School Renewal	Yes	E - Equipment and Furnishings	Beyond Useful Life	3- Long Term	17 Nov 2020	193,319
Ceiling Finishes - Suspended ACT Not Seismically Restrained (Corridor)	No		OFC's	6- Non Structural Seismic Vulnerability		1,882
Ceramic Floor Tile Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	3- Long Term	17 Nov 2025	9,516
Combination Public Address, Clock and Private Telephone System Renewal	Yes	D5031 - Public Address and Music Systems	Beyond Useful Life	3- Long Term	17 Nov 2021	114,164
Concealed Spline ACT Renewal	Yes	C3030 - Ceiling Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	243,706
Custodial Sink Renewal	Yes	D2010 -	Beyond Useful	3- Long Term	17 Nov	9,918

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
		Plumbing Fixtures	Life		2020	
Door Assembly - Double Renewal	Yes	B2030 - Exterior Doors	Beyond Useful Life	1- Immediate	17 Nov 2017	48,177
Door Assembly - Single Renewal	Yes	B2030 - Exterior Doors	Beyond Useful Life	1- Immediate	17 Nov 2017	25,233
Drinking Fountains - 1970 Renewal	Yes	D2010 - Plumbing Fixtures	Beyond Useful Life	2- Short Term	17 Nov 2019	5,380
Electrical Conduits - Fire Stopping Not Installed	No	D40 - Fire Protection	Building Code	5- Does Not Meet Current Codes / Standards		581
Emergency Lighting - Aged Renewal	Yes	D5092 - Emergency Light and Power Systems	Beyond Useful Life	1- Immediate	17 Nov 2018	9,986
Emergency Lighting - Upgraded Renewal	Yes	D5092 - Emergency Light and Power Systems	Beyond Useful Life	3- Long Term	17 Nov 2021	9,986
Entrance Doors - Not Accessible	No	B2030 - Exterior Doors	Accessibility	5- Does Not Meet Current Codes / Standards		14,315
Equipment and Furnishings - Library Cabinets and Shelving Not Seismically Restrained	No		OFC's	6- Non Structural Seismic Vulnerability		2,625
Equipment and Furnishings - Roller Fixtures Not Seismically Restrained	No		OFC's	6- Non Structural Seismic Vulnerability		1,310
Exhaust System - General Building Renewal	Yes	D3040 - Distribution Systems	Beyond Useful Life	3- Long Term	17 Nov 2025	29,240
Exit Signs - Aged Renewal	Yes	D5092 - Emergency Light and Power	Beyond Useful Life	1- Immediate	17 Nov 2018	10,747

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
		Systems				
Exit Signs - Egress Doors Missing Illuminated Exit Signs & Pull Stations	No	D5092 - Emergency Light and Power Systems	Life Safety	1- Immediate	17 Nov 2018	5,902
Exit Signs - Upgraded Renewal	Yes	D5092 - Emergency Light and Power Systems	Beyond Useful Life	3- Long Term	17 Nov 2023	14,968
Exterior Stairs - Concrete Renewal	Yes	B1015 - Exterior Stairs and Fire Escapes	Beyond Useful Life	3- Long Term	17 Nov 2021	48,112
Fire Alarm System Renewal	Yes	D5037 - Fire Alarm Systems	Beyond Useful Life	3- Long Term	17 Nov 2021	64,112
Fire Protection - No Sprinkler Coverage	No	D4010 - Sprinklers	Building Code	5- Does Not Meet Current Codes / Standards		90,756
GWB Taped and Finished Renewal	Yes	C3030 - Ceiling Finishes	Beyond Useful Life	3- Long Term	17 Nov 2024	12,943
GWB on Wood Stud Renewal	Yes	C1010 - Partitions	Beyond Useful Life	3- Long Term	17 Nov 2024	89,222
Gym Equipment (Elementary School) Renewal	Yes	E - Equipment and Furnishings	Beyond Useful Life	3- Long Term	17 Nov 2023	26,598
HVAC Pneumatic Controls - 2005 Renewal	Yes	D3060 - Controls and Instrumentation	Beyond Useful Life	3- Long Term	17 Nov 2023	75,422
Handrails and Guardrails Not Code Compliant-Exterior Stairs and Ramps	No	B1014 - Ramps	Code Compliance	5- Does Not Meet Current Codes / Standards		22,958
Hot Water Pipe Distribution System Renewal	Yes	D3040 - Distribution Systems	Beyond Useful Life	3- Long Term	17 Nov 2020	87,091
Impact Resistant Wall Paneling (MDF) Renewal	Yes	C3010 - Wall Finishes	Beyond Useful Life	3- Long Term	17 Nov 2024	27,419
Interior Doors - Hardware Not Accessible	No	C1020 - Interior Doors	Accessibility	5- Does Not Meet Current		61,030

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
				Codes / Standards		
Kitchen Sinks Renewal	Yes	D2010 - Plumbing Fixtures	Beyond Useful Life	3- Long Term	17 Nov 2023	26,835
LAN System Renewal	Yes	D5039 - Local Area Networks	Beyond Useful Life	3- Long Term	17 Nov 2023	116,215
Lifts - Wheelchair Stair Lift Lacking - Accessibility	No	C20 - Stairs	Accessibility	5- Does Not Meet Current Codes / Standards		63,562
Lighting - Exterior Renewal	Yes	D5022 - Lighting Equipment	Beyond Useful Life	3- Long Term	17 Nov 2023	9,685
Main Electrical Service - 400A 120/240V Renewal	Yes	D5012 - Low Tension Service and Dist.	Beyond Useful Life	2- Short Term	17 Nov 2019	15,424
Non-Seismic Luminaire - Hallways	No	D5022 - Lighting Equipment	OFC's	6- Non Structural Seismic Vulnerability		7,864
Non-Seismic Luminaries - Classrooms	No	D5022 - Lighting Equipment	OFC's	6- Non Structural Seismic Vulnerability		44,316
Painted Finish (Exterior Walls) Renewal	Yes	B2010 - Exterior Walls	Beyond Useful Life	1- Immediate	17 Nov 2017	46,532
Painted Finish Renewal	Yes	C3010 - Wall Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	108,181
Panelboards, Feeders, Disconnects Renewal	Yes	D5012 - Low Tension Service and Dist.	Beyond Useful Life	2- Short Term	17 Nov 2019	58,681
Partitions Washrooms (Wood) Renewal	Yes	C1030 - Fittings	Beyond Useful Life	3- Long Term	17 Nov 2020	7,895
Perimeter Heat System - Hydronic Fin Tube Renewal	Yes	D3040 - Distribution Systems	Beyond Useful Life	3- Long Term	17 Nov 2020	166,145
Property Storage not allowed in the Crawl Space	No	C - Interiors	Building Code	5- Does Not Meet Current		5,741

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
				Codes / Standards		
Quarry Tile Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	3- Long Term	17 Nov 2020	9,745
Restroom Fixtures Renewal	Yes	D2010 - Plumbing Fixtures	Beyond Useful Life	2- Short Term	17 Nov 2019	66,181
Roof Drainage - Gravity - Internal Leaders Renewal	Yes	D2040 - Rain Water Drainage	Beyond Useful Life	2- Short Term	17 Nov 2019	68,876
Roof: Lacks Fall Protection Plan	No	B30 - Roofing	Life Safety	1- Immediate	17 Nov 2018	15,544
Sanitary Waste - Gravity Disch Renewal	Yes	D2030 - Sanitary Waste	Beyond Useful Life	3- Long Term	17 Nov 2020	86,548
Security System Renewal	Yes	D5038 - Security and Detection Systems	Beyond Useful Life	3- Long Term	17 Nov 2023	35,337
Skylights - Dome Type Renewal	Yes	B3021 - Glazed Roof Openings	Beyond Useful Life	1- Immediate	17 Nov 2017	1,971
Soffit - Painted Wood Decking Renewal	Yes	B10 - Superstructure	Beyond Useful Life	3- Long Term	17 Nov 2022	2,270
Sound System - Gymnasium - Fixed and Portable Renewal	Yes	D5031 - Public Address and Music Systems	Beyond Useful Life	3- Long Term	17 Nov 2020	19,333
Stair Handrails - Not Code Compliant	No	C20 - Stairs	Building Code	5- Does Not Meet Current Codes / Standards		16,655
Stucco on Framing Renewal	Yes	B2010 - Exterior Walls	Beyond Useful Life	3- Long Term	17 Nov 2021	144,180
Superstructure - Facility Lacks Roof Access	No	B30 - Roofing	Miscellaneous	4- Recommended		4,558
Swinging Doors Wood and Metal Renewal	Yes	C1020 - Interior Doors	Beyond Useful Life	3- Long Term	17 Nov 2023	271,851
Television - Not Seismically Restrained	No		OFC's	6- Non Structural Seismic Vulnerability		212

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
Universal Washroom Lacking	No	C10 - Interior Construction	Accessibility	5- Does Not Meet Current Codes / Standards		26,371
Varnish and Line Painting (Wood Strip Flooring) Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	11,841
Vinyl Composite Tile Standard Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	40,565
Vinyl Sheet Goods Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	3- Long Term	17 Nov 2020	118,581
Washroom Accessories Renewal	Yes	C1030 - Fittings	Beyond Useful Life	1- Immediate	17 Nov 2017	13,633
Water Dist Complete Renewal	Yes	D2020 - Domestic Water Distribution	Beyond Useful Life	3- Long Term	17 Nov 2020	102,817
Water Heater - Elec - Residential - 277 litres - 1990 Renewal	Yes	D2020 - Domestic Water Distribution	Beyond Useful Life	3- Long Term	17 Nov 2020	6,388
Water Ingress at Stucco	No	B2010 - Exterior Walls	Reliability	2- Short Term	17 Nov 2019	17,313
Windows - Wood Renewal	Yes	B2020 - Exterior Windows	Beyond Useful Life	1- Immediate	17 Nov 2017	190,250
Wood Siding on Framing Renewal	Yes	B2010 - Exterior Walls	Beyond Useful Life	1- Immediate	17 Nov 2017	33,769
Wood Strip Flooring Renewal	Yes	C3020 - Floor Finishes	Beyond Useful Life	1- Immediate	17 Nov 2017	94,951
Total						**3,855,929**

Replacement Value Based on System Cost with Overheads

System Costs

System	System Name	Cost
A - Substructure	Foundation Wall and Footings 3600mm - Basement	30,540
A - Substructure	Foundation Wall and Footings - No Basement	42,952
A - Substructure	Foundation Wall and Footings - Crawlspace	278,558
A - Substructure	Concrete Slab-On-Grade	64,704

Asset Detail Report

By Asset Name

System	System Name	Cost
A - Substructure	Concrete Column Footings	52,293
A - Substructure	Concrete Skim Coat (Crawlspace Floor)	35,962
B10 - Superstructure	Flat Roof Assembly - Wood Beams and Decking	439,481
B10 - Superstructure	Floor Assembly - Wood Joists and Subfloor	84,155
B10 - Superstructure	Soffit - Painted Wood Decking	18,159
B1014 - Ramps	Accessible Ramp - Exterior Wood	4,427
B1014 - Ramps	Accessible Ramp - Exterior Concrete	24,239
B1015 - Exterior Stairs and Fire Escapes	Exterior Stairs - Concrete	38,490
B2010 - Exterior Walls	Painted Finish (Exterior Walls)	37,226
B2010 - Exterior Walls	Wood Siding on Framing	61,399
B2010 - Exterior Walls	Stucco on Framing	329,554
B2020 - Exterior Windows	Windows - Wood	152,200
B2030 - Exterior Doors	Door Assembly - Single	20,186
B2030 - Exterior Doors	Door Assembly - Double	38,542
B30 - Roofing	SBS Modified Bitumen Membrane	178,125
B30 - Roofing	Built-Up-Roof (BUR)	179,830
B3021 - Glazed Roof Openings	Skylights - Dome Type	1,577
C1010 - Partitions	GWB on Wood Stud	142,756
C1020 - Interior Doors	Swinging Doors Wood and Metal	217,481
C1030 - Fittings	Partitions Washrooms (Wood)	6,316
C1030 - Fittings	Washroom Accessories	10,906
C20 - Stairs	Stairs Typical	13,306
C3010 - Wall Finishes	Impact Resistant Wall Paneling (MDF)	21,935
C3010 - Wall Finishes	Painted Finish	86,545
C3020 - Floor Finishes	Wood Strip Flooring	75,961
C3020 - Floor Finishes	Vinyl Sheet Goods	94,865
C3020 - Floor Finishes	Ceramic Floor Tile	7,612
C3020 - Floor Finishes	Quarry Tile	7,796
C3020 - Floor Finishes	Varnish and Line Painting (Wood Strip Flooring)	9,473
C3020 - Floor Finishes	Carpeting - Broadloom	52,536
C3020 - Floor Finishes	Vinyl Composite Tile Standard	32,452
C3030 - Ceiling Finishes	GWB Taped and Finished	10,354

System	System Name	Cost
C3030 - Ceiling Finishes	Concealed Spline ACT	194,965
D2010 - Plumbing Fixtures	Custodial Sink	7,934
D2010 - Plumbing Fixtures	Restroom Fixtures	52,945
D2010 - Plumbing Fixtures	Drinking Fountains - 1970	4,304
D2010 - Plumbing Fixtures	Kitchen Sinks	21,468
D2020 - Domestic Water Distribution	Water Dist Complete	91,392
D2020 - Domestic Water Distribution	Water Heater - Elec - Residential - 277 litres - 1990	5,703
D2030 - Sanitary Waste	Sanitary Waste - Gravity Disch	69,239
D2040 - Rain Water Drainage	Roof Drainage - Gravity - Internal Leaders	55,101
D2090 - Other Plumbing Systems	Natural Gas Supply for Bldg	10,899
D3020 - Heat Generating Systems	Boilers HW - Gas Fired - 1000 MBTUH	60,440
D3040 - Distribution Systems	Perimeter Heat System - Hydronic Fin Tube	147,684
D3040 - Distribution Systems	Exhaust System - General Building	23,392
D3040 - Distribution Systems	Hot Water Pipe Distribution System	69,673
D3060 - Controls and Instrumentation	HVAC Pneumatic Controls - 2005	67,042
D40 - Fire Protection	Fire Extinguishers	1,287
D5012 - Low Tension Service and Dist.	Panelboards, Feeders, Disconnects	46,945
D5012 - Low Tension Service and Dist.	Main Electrical Service - 400A 120/240V	12,339
D5021 - Branch Wiring Devices	Branch Wiring - Equipment & Devices	25,407
D5022 - Lighting Equipment	Lighting - Interior	79,283
D5022 - Lighting Equipment	Lighting - Exterior	7,748
D5031 - Public Address and Music Systems	Combination Public Address, Clock and Private Telephone System	91,331
D5031 - Public Address and Music Systems	Sound System - Gymnasium - Fixed and Portable	15,467
D5037 - Fire Alarm Systems	Fire Alarm System	51,290
D5038 - Security and Detection Systems	Security System	28,270
D5039 - Local Area Networks	LAN System	109,379
D5092 - Emergency Light and Power Systems	Exit Signs - Aged	8,598
D5092 - Emergency Light and Power Systems	Emergency Lighting - Aged	7,988
D5092 - Emergency Light and Power Systems	Exit Signs - Upgraded	11,974
D5092 - Emergency Light and Power Systems	Emergency Lighting - Upgraded	7,988
E - Equipment and Furnishings	Casework - Elementary School	154,655

System	System Name	Cost
E - Equipment and Furnishings	Gym Equipment (Elementary School)	21,279
Subtotal		**4,466,300**

Overhead Costs

Description	Cost
	0

Total Replacement Value Based on System Cost with Overheads	4,466,300

Asset Detail Report
By Asset Name

School District: North Vancouver
Facility: Cloverley Elementary

Asset: Site-CLOVERLEY ELEMENTARY
Asset Number: 104365

Assets are ordered by Asset Name

Currency: CAD

Statistics

FCI Cost:	956,173	FCI:	1.05
RI Cost:	956,173	RI:	1.05
Total Requirements Cost:	956,174		
Current Replacement Value:	907,578	Date of most Recent Assessment:	17 Nov 2017

Type	Site Development: Miscellaneous Structures & Furnishings		
Count Units	1 Each		
Site Structure Type			
Address 1	440 HENDRY AVE	City	NORTH VANCOUVER
Address 2	-	State/Province/Region	CANADA
Year Constructed	1961	Zip/Postal Code	V7L 4C5
Year Renovated	-	Architect	-
Ownership	School District Owned	Commission Date	-
		Decommission Date	-

Architectural Inspector:	Ian Tingley	Inspection Date:	17, Nov 2017

Photo

Site-CLOVERLEY ELEMENTARY

Asset Detail Report

By Asset Name

Asset Description

ARCHITECTURAL

CLOVERLEY ELEMENTARY, Site, No.104365, sits within B.C. Ministry of Education's North
Vancouver School District No. 44 and is located at 440 HENDRY AVE, North Vancouver, British Columbia. The sloping site was originally developed in 1961 and comprises an area of 7.33 acres. The site consists of the following development and infrastructure systems:

Concrete Stairs
Timber/gravel Stairs
Gravel Field
Vehicle Asphalt Pavement and Driveway
Chain Link Metal Fencing
Stone Retaining Wall
Concrete Retaining Wall
Asphalt Play Areas
Landscaping

SITE MECHANICAL

Plumbing

The system includes a 3 inch underground main supply line, entering the building and distributed throughout the facility as required.

Storm water drainage system for site includes catch basins, man holes and an 8 inch discharge drainage pipe.

The site includes a sanitary waste piping system, which includes man holes and a 6 inch discharge pipe.

The system includes a 2 inch natural gas main line entering underground and distributed to the facility as required.

Requirements

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
Concrete Retaining Wall 1800mm Renewal	Yes	G2040 - Site Development	Beyond Useful Life	3- Long Term	17 Nov 2023	7,886
Landscaping Renewal	Yes	G2055 - Planting	Beyond Useful Life	3- Long Term	17 Nov 2024	16,658

Requirement Name	Renewal	Prime System	Category	Priority	Action Date	Estimated Cost
Natural Gas Supply Renewal	Yes	G3060 - Fuel Distribution	Beyond Useful Life	3- Long Term	17 Nov 2025	20,667
Parking Lot Asphalt - Vehicle Renewal	Yes	G2020 - Car Parks	Beyond Useful Life	1- Immediate	17 Nov 2017	31,888
Perimeter Fencing/Gate (Chain Link) Renewal	Yes	G2041 - Fences and Gates	Beyond Useful Life	2- Short Term	17 Nov 2019	40,456
Play Area (Asphalt) Renewal	Yes	G2030 - Pedestrian Paving	Beyond Useful Life	3- Long Term	17 Nov 2022	35,443
Re-Top and Grade Gravel Sports Field	No	G2047 - Playing Fields	Reliability	3- Long Term	17 Nov 2022	13,601
Retaining Wall (Stone) Renewal	Yes	G2040 - Site Development	Beyond Useful Life	3- Long Term	17 Nov 2024	266,588
Roadway - Asphalt Paving Renewal	Yes	G2010 - Roadways	Beyond Useful Life	1- Immediate	17 Nov 2017	12,163
Sanitary Waste Discharge Renewal	Yes	G3020 - Sanitary Sewer	Beyond Useful Life	2- Short Term	17 Nov 2019	158,712
Sports Field Pea Gravel Renewal	Yes	G2047 - Playing Fields	Beyond Useful Life	1- Immediate	17 Nov 2017	58,905
Stairs (Concrete) Renewal	Yes	G2030 - Pedestrian Paving	Beyond Useful Life	3- Long Term	17 Nov 2021	76,935
Storm Drainage System Renewal	Yes	G3030 - Storm Sewer	Beyond Useful Life	2- Short Term	17 Nov 2019	85,451
Tree Removal and Trimming Required	No	G2055 - Planting	Life Safety	1- Immediate	17 Nov 2018	31,971
Water Supply Piping Renewal	Yes	G3010 - Water Supply	Beyond Useful Life	2- Short Term	17 Nov 2019	98,850
Total						**956,174**

Replacement Value Based on System Cost with Overheads

System Costs

System	System Name	Cost
G2010 - Roadways	Roadway - Asphalt Paving	19,461
G2020 - Car Parks	Parking Lot Asphalt - Vehicle	51,021
G2030 - Pedestrian Paving	Play Area (Asphalt)	56,708

Asset Detail Report
By Asset Name

System	System Name	Cost
G2030 - Pedestrian Paving	Stairs (Concrete)	61,548
G2040 - Site Development	Concrete Retaining Wall 1800mm	52,575
G2040 - Site Development	Retaining Wall (Stone)	213,270
G2041 - Fences and Gates	Perimeter Fencing/Gate (Chain Link)	32,365
G2047 - Playing Fields	Sports Field Pea Gravel	94,248
G2055 - Planting	Landscaping	26,652
G3010 - Water Supply	Water Supply Piping	87,866
G3020 - Sanitary Sewer	Sanitary Waste Discharge	126,970
G3030 - Storm Sewer	Storm Drainage System	68,361
G3060 - Fuel Distribution	Natural Gas Supply	16,533
Subtotal		**907,578**

Overhead Costs

Description	Cost
	0

Total Replacement Value Based on System Cost with Overheads	**907,578**

Appendix H City of North Vancouver's Child Care Action Plan 2021-2031

THE CITY OF NORTH VANCOUVER

CHILD CARE ACTION PLAN 2021-2031

DECEMBER 2020

ACKNOWLEDGEMENTS

This work has taken place within the ancestral, traditional and unceded territory of the Sḵwx̱wú7mesh (Squamish), and Tsleil-Waututh Nations.

The Child Care Action Plan was facilitated by information, involvement and collaboration from partners and community members. The Project Team would like to recognize and thank the many individuals and organizations who gave their time to provide input, share insights and give ideas for the City's future work and role in child care (for more information see appendices). Thank you to the North Shore Child Care Planning Committee and its members for ongoing support and collaboration.

The Project Team was comprised of consultants from the Social Planning and Research Council of BC (SPARC BC) in collaboration with Sandra Menzer, Barry Forer and John Foster, working with City of North Vancouver staff. The City worked collaboratively with the District of North Vancouver and the District of West Vancouver on the engagement processes, which informed this plan.

The project was funded by a Child Care Planning Grant from the Union of BC Municipalities.

CONTENTS

PLAN HIGHLIGHTS

Child care matters. It is critical for the social and economic well-being of our City, and the creation of a complete community. Quality child care is a key contributor to the economy, labour force participation, gender equality, social inclusion, and poverty reduction. Further, quality child care has a long term benefit on children's development.

The City is a partner with other levels of government, community agencies, child care providers, and the community in the facilitation, creation, and maintenance of a comprehensive child care system that meets children's, families' and the community's need.

VISION

To improve the accessibility, affordability, and quality of child care in the City over the next 10 years by collaborating with partners, creating new spaces, and advocating for the community's needs.

PRIORITIES

- **INCREASING ACCESSIBILTY**
- **IMPROVING AFFORDABILITY**
- **FOCUSING ON QUALITY**
- **STRENGTHENING PARTNERSHIPS**

PRIORITY ACTIONS

1. **Develop a funding strategy with senior government for new spaces**
   Action 1
2. **Leverage the City’s and publicly owned assets for child care**
   Action 4
3. **Achieve the Targets for space creation**
   Targets Section, Action 7
4. **Set direction for achieving new spaces through development**
   Action 9, 10, 11, 12
5. **Build partnership and protocol with the School District around child care**
   Action 13, 32
6. **Work with partners and advocate for the City’s needs and commensurate investments**
   Action 41

STATISTICS

POPULATION

CURRENT (2019)	GROWTH FORCAST (2030)
6,806	**8,347**
CHILDREN 0-12 YEARS	CHILDREN 0-12 YEARS

ABOUT CHILD CARE

84%

OF CHILD CARE FACILITIES STRUGGLE TO FILL STAFF POSITIONS

25%

OF CHILDREN EXPERIENCE ONE OR MORE VULNERABILITIES IN THEIR DEVELOPMENTAL HEALTH

CHILD CARE SPACE ACCESS RATE

INFANT + TODDLER PROGRAMS	3-5 YEAR OLD PROGRAMS	SCHOOL AGE PROGRAMS
20	**43**	**9**
SPACES PER 100 CHILDREN	SPACES PER 100 CHILDREN	SPACES PER 100 CHILDREN

ABOUT THE CHILD CARE ACTION PLAN

SCOPE AND PURPOSE

This Action Plan presents evidence-based and concrete actions to improve child care in the City for the betterment of the community.

This is a 10-year plan that includes targets and actions for the short term (2021 to 2023), medium term (2024 to 2026), and long term (2027 to 2031). With a defined plan and concerted and coordinated efforts, the City and its partners can achieve more accessible, affordable, and higher quality child care. As a local government the City does not have the mandate or resources to fully address the gaps in child care accessibility, affordability, and quality on its own. The mandate for early learning and child care is mostly provincial, with some federal involvement. Support from senior levels of government and strong partnerships with others are needed. This Plan defines the City's priorities and actions to meet local child care needs.

PROCESS

This Plan was informed by a literature review on the components of quality child care systems and programs; a review of promising practices from other jurisdictions, along with a review of the City's current planning framework; and compiling current demographics and child care service information.

The City collaborated with the District of North Vancouver and the District of West Vancouver on the engagement and preparation of the three North Shore municipalities' child care action plans, in recognition of an interconnected child care system and partners across the North Shore, as well as the opportunity to continue to work together on common child care objectives.

The community, stakeholders, and partner engagement informed the City about the needs and opportunities for child care. The process also served to build both knowledge and relationships. The engagement methods are summarized below.

Table 1. Summary of Engagement for Child Care Action Plan

ENGAGEMENT METHOD	INPUT FROM
Surveys	Parents and caregivers (381 responses)
	Child care providers in the City (26 responses)
Interviews with key stakeholders	Community partners (16 interviews)
	First Nations: with Squamish Nation and Tsleil-Waututh Nation representatives
Focus groups / meetings with partners and community	Non-profit service providers (23 participants)
	Underserved population groups (5 meetings)
	North Shore Child Care Planning Committee
	Child Care Early Childhood Educators and employees
	General community meeting
Solutions Workshops	Co-Hosted with District of North Vancouver and involving multiple agencies including School District, North Vancouver Recreation and Culture Commission, Capilano University, Provincial representatives, etc.

Additional information on the creation of the Plan and supporting documents can be found on the City's child care webpage. This includes details on the methodology, key demographic information, an overview of the current child care system in BC, a report on the key research findings, and a list of the stakeholder consultations.

POLICY CONTEXT

The City recognizes that child care is a vital part of a community's social infrastructure. In addition to directly benefiting the children and families using it, child care contributes to society and the broader population by contributing to the local economy and enhancing the overall health and well-being of the entire community.

The City has a robust planning and policy framework for child care, including support in the Official Community Plan, a stand-alone Child Care Policy and Plan (2009), a grant program, a density bonus and community benefits policy which seeks to secure contributions for amenities such as child care, and has included improving access to child care as an objective in the 2018-2022 Council Strategic Plan. This Action Plan replaces the 2009 Child Care Policy and Plan.

In 2018 the Province made a significant shift and commitment to provide new funding towards the building of a universal, high quality, publicly funded child care system for families. While details of the long-term plan to move child care away from the current market system are still unfolding, and a number of initiatives towards increasing access, reducing fees and improving quality have been made, the serious challenges for families in local communities remain. This Plan identifies actions that will enable the City to make a real difference, within the City's resources and mandate.

REGULATION AND POLICY

The City's policy and regulatory tools support child care and facilitate an increase in the number of child care spaces in the community:

- a stand-alone Child Care Policy and Plan (2009) informed this Action Plan, and is superseded by this Plan;
- a Zoning Bylaw that permits child care in all zones, subject to the specific regulations of each zone;
- a grant program for non-profit child care providers for minor capital improvements (Child Care Capital Improvement Fund);
- a Permissive Property Tax Exemption program;
- a Density Bonus and Community Benefits Policy which makes provisions for securing child care facilities through redevelopment – either as built amenities or by utilizing cash-in-lieu contributions to the Civic Amenity Reserve Fund to build child care facilities;
- the inclusion of increased child care accessibility as a priority in the 2018 – 2022 Council Strategic Plan; and,
- the City participates on and has played a leadership role for the North Shore Child Care Planning Committee.

CITY ROLES

The City's role in creating child care can include policy and regulation, and investment of capital and operating funds. The City's and other agencies' roles vary according to the type and ownership of child care facility, as outlined in Table 2.

Table 2. City Roles in Creating Child Care

TYPES OF NEW CHILD CARE FACILITIES	CAPITAL AND OPERATING ARRANGEMENTS
Public or non-profit child care facility on public land	• Built by a public/civic agency (e.g. School District, etc.) or non-profit organization. • Built in a stand-alone building or within a civic facility on public land. • Capital cost is funded by a public / non-profit agency, most likely with financial contribution (grant) from the Province. • Operating cost and responsibility by public / non-profit organization. • Financial contribution from the Province to a public agency may require ownership of facility to be public.
Child care facility, built by a developer as on-site amenity contribution in a new development	• Enabled by a Rezoning / OCP Amendment, through the City's density bonus provisions: Community Benefit Contribution or allowable bonus density. • Built within a residential, commercial or mixed use development. • Capital cost is funded by the City's Community Benefit Contribution funds, and may involve an additional capital investment by Provincial grant or another funder. • Facility ownership and the operational model may vary: could be city-owned or non-profit owned.[1] • Operated by a public or non-profit child care organization
For-profit child care facility	• Built by a for-profit organization. • Enabled by City Official Community Plan land use designation and zoning that permits child care. • Capital cost is funded by a for-profit organization/child care operator, which may receive a financial contribution (grant) from the Province. • Operating cost and responsibility by for-profit child care operator.

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[1] City owned facilities that are funded, in whole or in part, by a provincial grant to the City (New Spaces Fund) require continuous City ownership for at least 15 years.

CURRENT AND FUTURE CHILD CARE NEEDS

The following sections describe the current availability of child care spaces, forecasted population growth, a profile of three child care planning areas, other child care accessibility factors, costs and affordability, quality child care systems, quality child care programs, and auspice. The overall findings are that there are not enough child care spaces (there is a particular shortage of child care spaces for infants and toddler, and school age children), child care is expensive for families, and staffing of child care facilities is challenging,

CHILD CARE AVAILABILITY – A SNAPSHOT

In 2019 there were a total of 1,694 child care spaces in the City, for a total population of 6,289 children aged 0-12. In 2019 there were a total of 1,694 child care spaces. The preschool age group had the most child care spaces per capita, with 43 spaces per 100 children. Availability of infant and toddler (0-2) spaces and school age spaces was much less: 210 spaces in group care for every 100 children aged 0-2, and 0 spaces for every 100 school age (6-12) children.

Table 3. Child Care Spaces by Type

AGE GROUP	NUMBER OF CHILDREN	CHILDCARE TYPE	NUMBER OF SPACES	SPACES PER 100 CHILDREN
0-2 year-olds	1,626	**Group (birth to 36 months)**	328	20
3-5 year-olds	1,593	**Group (30 months to school age)**	687	43 (excluding preschool)[2]
6-12 year-olds	3,587	**Group (school age)**	397	9
General	n/a	**All Others (family, in-home, multi-age)**	282	n/a
TOTAL	**6,806**		**1,694**	**25**

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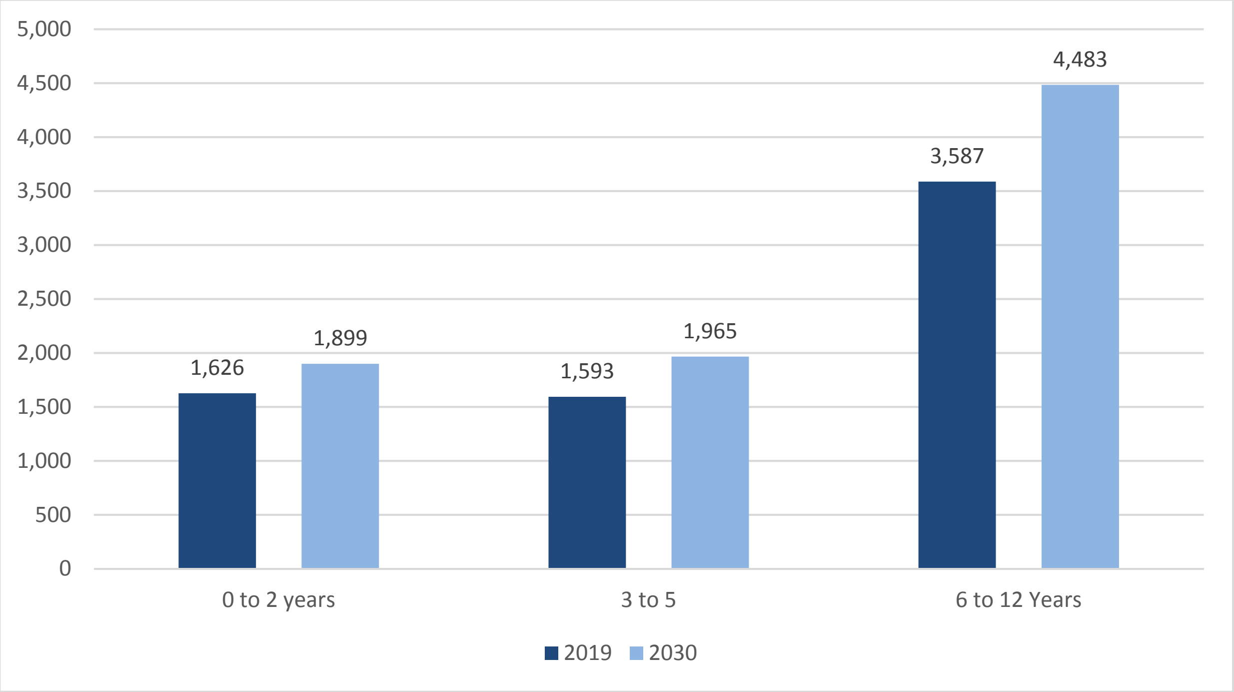
[2] Preschools typically operate on the school-year (September to June). Most preschool programs run from one to four hours a day.

FORECASTED GROWTH OF THE CHILD POPULATION

The child population in the City of North Vancouver is projected to grow by 23% by 2030, which equates to an additional 1,541 children, as shown in Figure 1.

Figure 1. Current and Projected Population, Children 0 to 12 Years



Source: BC Stats Population Estimates for 2019 and Metro Vancouver Population Projection for 2030[3]

To maintain a current access rate of approximately 25 spaces for every 100 children 0 to 12 years old, 674 new child care spaces would need to be created in the City by 2031 in order to keep up with an increase in demand from the projected growth of the child population.

Metro Vancouver population growth estimates are intended to be interpreted at a high level. The City's actual 2030 child population may differ from the estimate for several reasons, which reflect society-wide trends and factors (e.g. birth rate, economic trends) as well as City-specific factors that are not accounted for in broad population estimates (e.g. residential growth, the types of residential housing forms and types that families choose to live in). The City is also working with the School District on forecasting child population, and will continue to monitor, adjust, and update as required.

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[3] *2019 Data: Child population by age groups is based on proportions in 2016 Census data.*

A PROFILE OF THREE CHILD CARE PLANNING AREAS

Three child care planning areas, mapped in Figure 2 below, have been defined to understand current and future child care needs across the City. The table below provides a summary of each area in terms of location within the City, the population, and the child care access rates.

Table 4. Profile of Three Child Care Planning Areas

	WEST PLANNING AREA	CENTRAL PLANNING AREA	EAST PLANNING AREA
Description of Area (see - Figure 2)	From the western edge of the City to Forbes Ave. Adjacent to but does not include Squamish Nation Eslhá7an (Mission Indian Reserve No. 1).	From Forbes Ave to St. Georges Ave.	From St. Georges Ave. to the eastern edge of the City.
2019 Child Population (BC Stats Population Estimate)	1,089 children (0 to 12 years) This represents 16% of the City's child population.	2,654 children (0 to 12 years) This represents 39% of the City's child population.	2,994 children (0 to 12 years) This represents 44% of the City's child population.
2019 Access Rate for Child Care (see Figure 3)	Age 0-2: 34 spaces / 100 children Age 3-5: 55 spaces / 100 children School Age: 8 spaces / 100 children Overall, the access rate is slightly above the City's overall average. Slightly lower rate for school age programs.	Age 0-2: 16 spaces / 100 children Age 3-5: 34 spaces / 100 children School Age: 9 spaces / 100 children Overall, the access rate is below the City average.	Age 0-2: 20 spaces / 100 children Age 3-5: 48 spaces / 100 children School Age: 9 spaces / 100 children Overall, the access rate is close to the City average.
2030 Child Population Estimate (Metro Vancouver Population Estimate)	1,336 children (an increase of 247 children)	3,255 children (an increase of 601 children)	3,673 children (an increase of 679 children)

Figure 2. Child Care Planning Areas

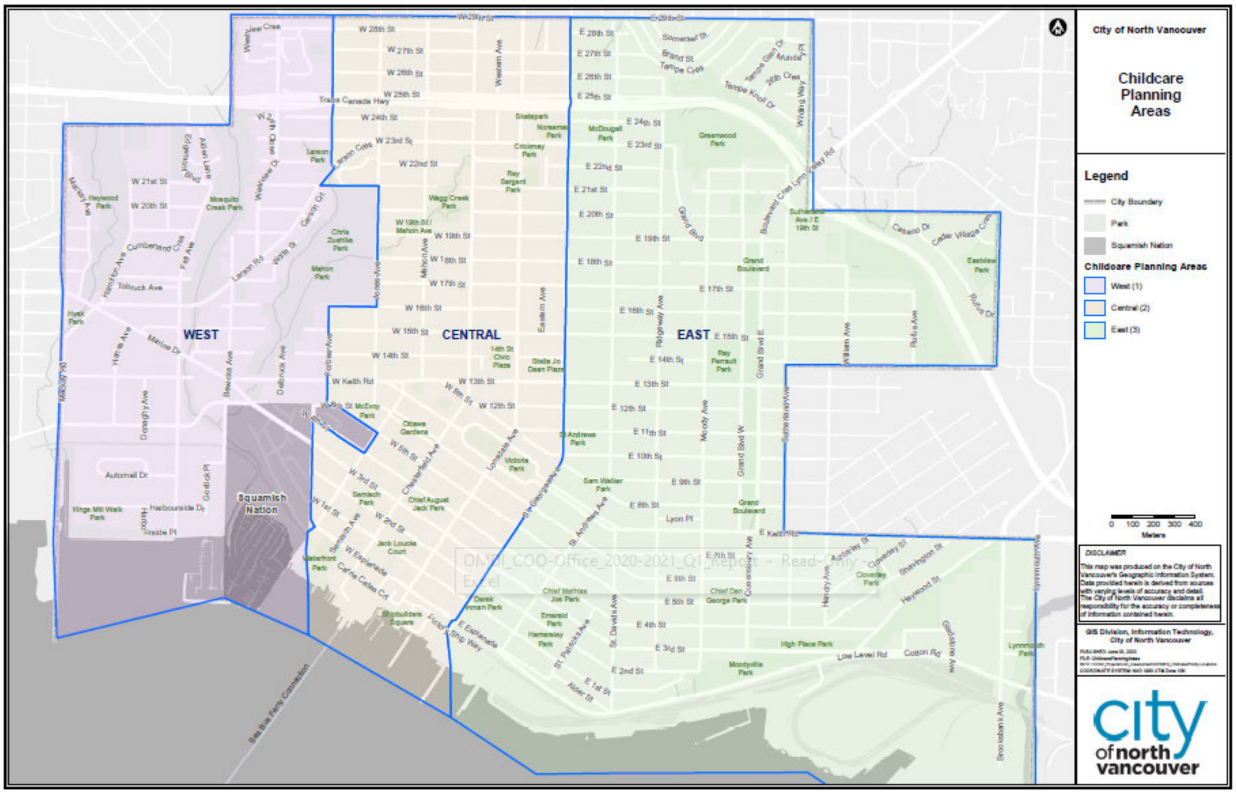
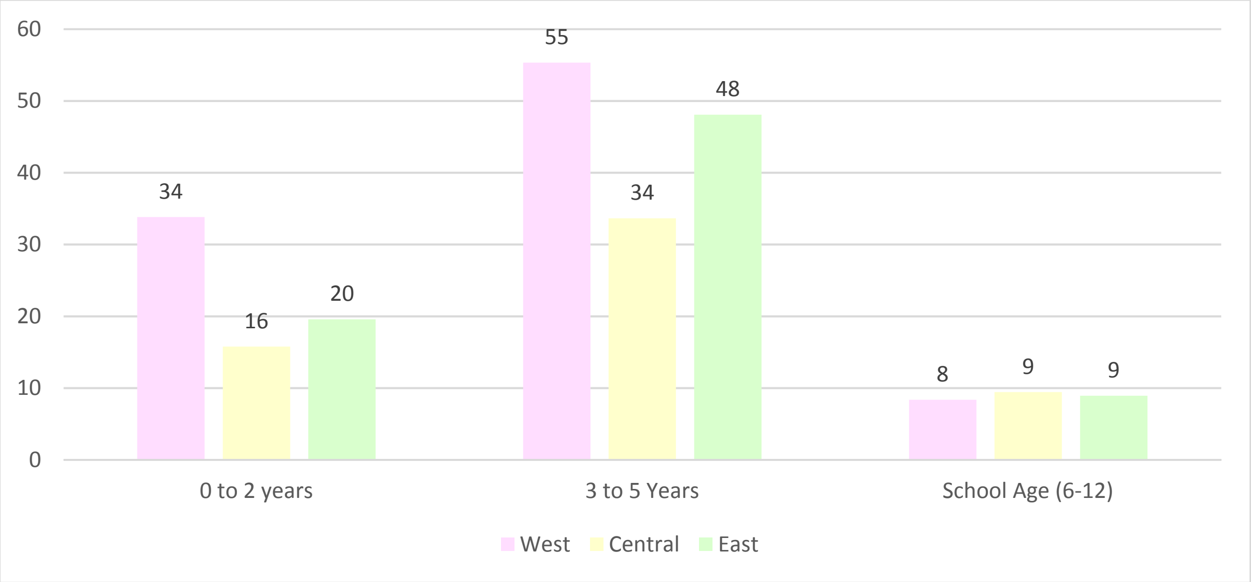


Figure 3. Group Child Care Spaces per Type by Child Care Planning Neighbourhood (2019 Child Care Spaces Inventory and 2019 BC Stats Population Estimate)[4]



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[4] Source: UBCM Child Care Inventory and VCH Child Care Data, and BC Stats Population Estimate for City of North Vancouver. This analysis assumes an equal distribution of children of various ages across the City for the purpose of general analysis.

OTHER CHILD CARE ACCESSIBILITY FACTORS

Access to child care is measured in terms of the number of spaces per 100 children. However, there are a number of other factors and circumstances in families' lives that can significantly affect whether they are able to access child care services and supports, such as families that are newcomers, have lower incomes, and/or are led by single parents. For example, few facilities in the City have non-traditional hours, which is difficult for parents (and especially lone parents) who work non-standard business hours. As well, over 70% of City residents work outside the municipality and therefore may require longer hours of child care service each day to manage work and commuting time.

It is important to note that parents, through recent surveys, identified a desire to have their children in child care in the neighbourhood where they live. To address accessibility challenges, child care that is close to families in their neighbourhood, offers extended hours, and/or other family supports can make a significant difference in families' lives.

Some of the factors and characteristics contributing to families' ability to access child care include the following:

WEST PLANNING AREA

- 22.6% of families in this area are lone parent families (highest of the three areas).
- About 20% of residents' main spoken language at home is not English or French (similar proportion to Central) and 43% of residents in this area are immigrants.
- 32% of homeowners are spending more than 30% of income in shelter (highest of the three areas)
- 11% of residents have an Aboriginal identity (the majority with a Frist Nations identity); a higher proportion than the other two areas.

CENTRAL PLANNING AREA

- 17.7% of families in this area are lone parent families, and family incomes are lower than the other areas. 40% of renters in this area are spending more than 30% of their income on shelter (highest of the three areas).
- Early Development Instrument (EDI) data show that that this area has a higher vulnerability rate than the School District average for kindergarten children.
- 20% of residents' main spoken language at home is a language that is not English or French and 43% of residents are immigrants.

EAST PLANNING AREA

- Early Development Instrument (EDI) data show that part of this area has a higher early childhood vulnerability rate than the School District average for kindergarten children.
- This area has the highest population of children.
- This area has a slightly lower proportion of residents who are immigrants (32%) than the other two areas, as well as a lower proportion of residents (14%) whose main spoken language at home is not English or French.

COSTS AND AFFORDABILITY

In the City of North Vancouver Parent Survey, 58% of respondents indicated that the fees they currently pay for child care are unsustainable. Even though there are now more financial supports provided by the Province of BC to parents, people are still struggling with affordability.

A 2020 survey of child care costs completed by North Shore Community Resources and the North Shore Child Care Resource and Referral Program identified average monthly child care costs, by program type, for the North Shore.

Table 5. North Shore Child Care Costs (2020)

PROGRAM TYPE	INFANT	TODDLER	3-5 YEARS	GROUP MULTI-AGE	SCHOOL AGE
Parent Fees (monthly average)	$1407	$1375	$1190	$1138	$683

Approximately three quarters of facilities have implemented the Provincial Fee Reduction Initiative, which is intended to stabilize fees. However, the survey also found that 59% of facilities have raised fees in the past year.

CHILD CARE WORKFORCE AFFORDABILITY

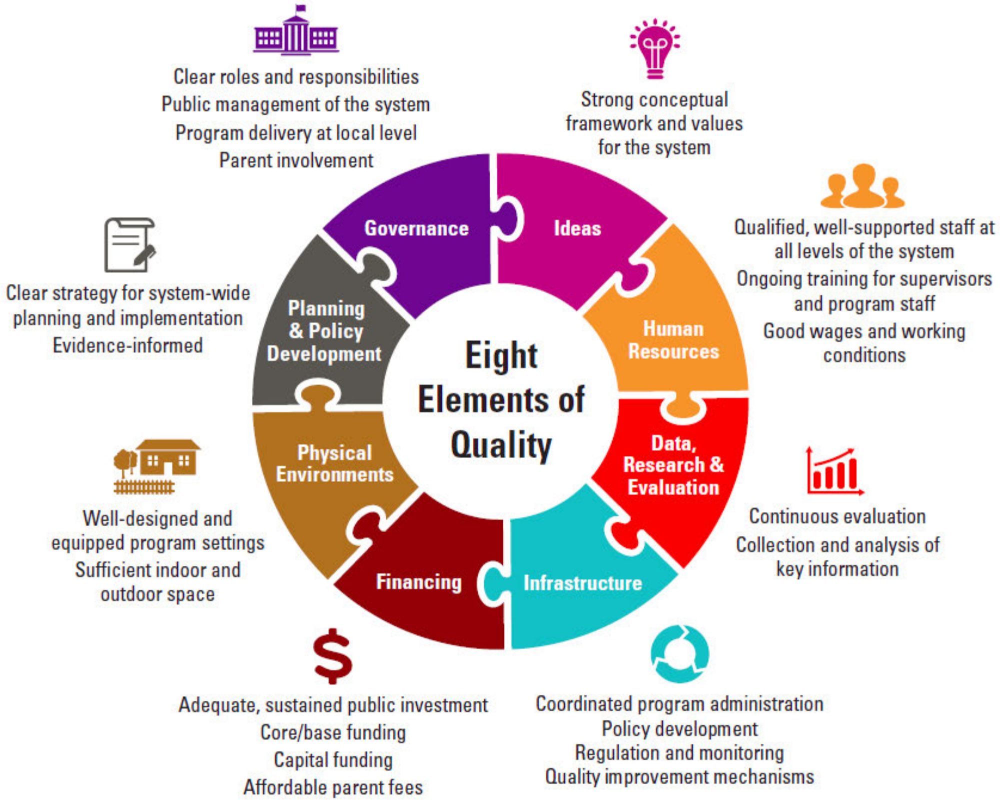
It is important to note that many staff in child care facilities face affordability challenges due to relatively low wages and high cost of living and housing in North Vancouver. The City continues to work with partners to improve this through other initiatives and projects that increase affordable housing options for lower wage earners, improving the transportation network to offer accessible and affordable transportation options, and by advocating to senior governments for increasing child care workers’ wages.

QUALITY CHILD CARE SYSTEMS

The Province of BC has committed to building a universal, publicly funded child care system with a focus on quality, affordability, and accessibility*. Childcare BC: A New Day for Families & Providers in BC* is a provincial plan specifically focused on establishing a holistic child care system and adheres to eight commonly accepted elements of a quality child care system, graphically presented in Figure 4. While the direct mandate and authority to build, monitor and assess a quality child care system is within the Provincial government's scope, the City can ensure that actions and investment decisions are aligned with what research has identified as eight commonly accepted elements of a quality child care system, graphically presented below.

The eight elements are: (1) Ideas, (2) Governance, (3) Infrastructure, (4) Planning and Policy development, (5) Financing, (6) Human Resources, (7) Physical environment, and (8) Data, Research and Evaluation. All elements are interconnected and fit together to create a strong system; individually, each component has a limited impact.

Figure 4. Eight Elements of Quality Child Care



(Source: Martha Friendly and Jane Beach, (2005). Elements of a high quality early learning and child care system. Childcare Resource and Research Unit.)

QUALITY CHILD CARE PROGRAMS

At the program level, reporting of positive relationships between families and providers, among colleagues, and between children and staff is strongly indicative of quality care. Additionally, when staff have higher levels of education and training, feel appreciated, and are well-supported, the quality of care increases. Planned programming and a strong curriculum that is tailored to meet the diverse needs of children further enhances quality. There is also ample evidence that a well-designed indoor/outdoor space is critical to supporting the development of children under five. Child Care providers, with support and guidelines from the Province, are responsible for these aspects of quality child care.

In order to facilitate the quality criteria identified, special attention should be paid to the following considerations regarding staff:

- Staff should have ECE (Early Childhood Education) training;
- At least some staff should have special needs and cultural/ESL skills if required;
- Compensation that is commensurate with the level of training;
- There should be written policies and formal procedures, which give staff a feeling of worth and certainty, such as: job descriptions, contracts, salary schedule, performance reviews, and a staff manual.

AUSPICE

The auspice (which means the financial model / organization type) is critically important to the quality of child care programs. In BC and Canada, three types of child care auspices exist:

1. Non-profit child care services;
2. For-profit child care services; and
3. Publicly operated child care services (i.e. services directly operated by a public entity such as a municipal government or school district).

The City values and recognizes that many for-profit child care centres provide high quality and reliable care to families and the community. Broader research on auspice has consistently demonstrated that non-profit and publicly operated centres perform better on global evaluation scales when compared to for-profit centres. British Columbia studies have found that the reliability of non-profit centres is much higher: non-profit centres are 97 times more likely than for-profit centres to continue long term operation. The Province has prioritized funding for public and non-profit child care, in a long term investment in quality child care.

Across British Columbia about 50% of the child care facilities are operated on a not-for profit or public basis. In the City of North Vancouver, non-profits currently operate about 30% of the total child care spaces. In the table below, for-profit group and multi-age care is also distinguished from family and in-home multi-age care.

Table 6. Child Care Programs and Spaces by Auspice, 2019

SERVICE TYPE AND AUSPICE	NUMBER OF PROGRAMS	NUMBER OF SPACES
Family and in-home multi-age	13 (14.8%)	91 (5.4%)
Group and multi-age: For-profit	52 (59.1%)	1,083 (63.9%)
Group and multi-age: Non-profit	23 (26.1%)	510 (30.7%)
TOTAL	**88 (100%)**	**1,694 (100%)**

Source: Based on data from City of North Vancouver and Vancouver Coastal Health Licensing.

TARGETS FOR CHILD CARE SPACES

Targets for creating additional child care spaces assist with planning and prioritization to meet community needs over the coming years. In addition, the Provincial government has requested local governments that were supported by the Community Child Care Planning Program Grants (including the City) to identify targets as part of the scope of their child care planning activities.

To achieve the targets, local governments require support from senior levels of government, community partners, and others to address service gaps and to create new spaces. Given that the City does not have the mandate or resources to fully address the gaps in child care on its own, support from senior levels of government and strong partnerships with others are needed. This Plan defines the City's priorities and actions to meet child care needs.

CREATING THE TARGETS

Federal and Provincial standards and recommendations do not currently exist to guide the recommended number of child care spaces per capita. The City's targets are informed by research and other jurisdictions' targets and leading practices, and a discussion among key partners about appropriate and meaningful targets for the child care sector in North Vancouver. The key inputs to create the City's targets include:

EXAMPLES FROM ELSEWHERE	EMPLOYMENT RATES	GAPS	GROWTH	TIMEFRAME
European Union targets include: Under 3 years: • 33 spaces per 100 children 3 to 5 years: • 90 spaces per 100 children School Age: • No targets are provided	Employment rates for families, which drive the need for child care spaces and population growth.	A focus on increasing the two age groups with the largest access gaps: • infant / toddler • school age	The number of child care spaces is measured per capita to relate to estimated population growth.	The estimated child population is expected to grow by 23% from 2019 to 2030. Targets are organized into two timeframes to allow for the building of facilities and spaces: • Interim Benchmark (by 2025)

In Quebec Target (Canadian publicly funded system): • 55 spaces per 100 children (average)				• Ten Year Target (by 2031)

THE TARGETS

The City of North Vancouver target is to create 1063 new licensed child care spaces over the next 10 years (by 2031) as follows:

Table 7. Child Care Average Access Rate Targets

PROGRAM TYPE	TARGET FOR AVERAGE ACCESS RATE BY 2031	NUMBER OF SPACES NEEDED TO MEET TARGET BY 2031
Infant and Toddler	33 spaces per 100 children	299 new spaces
Preschool (3-5 year olds)	50 spaces per 100 children	300 new spaces
School age (6-9 year olds)[5]	33 spaces per 100 children	464 new spaces

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[5] Note that the target for School Age Programs includes children aged 6-9 years old (not 6-12 years old). It is recognized that 10-12 year olds can more easily and preferably access other non-licensed opportunities before and after school.

INFANT AND TODDLER PROGRAM TARGETS

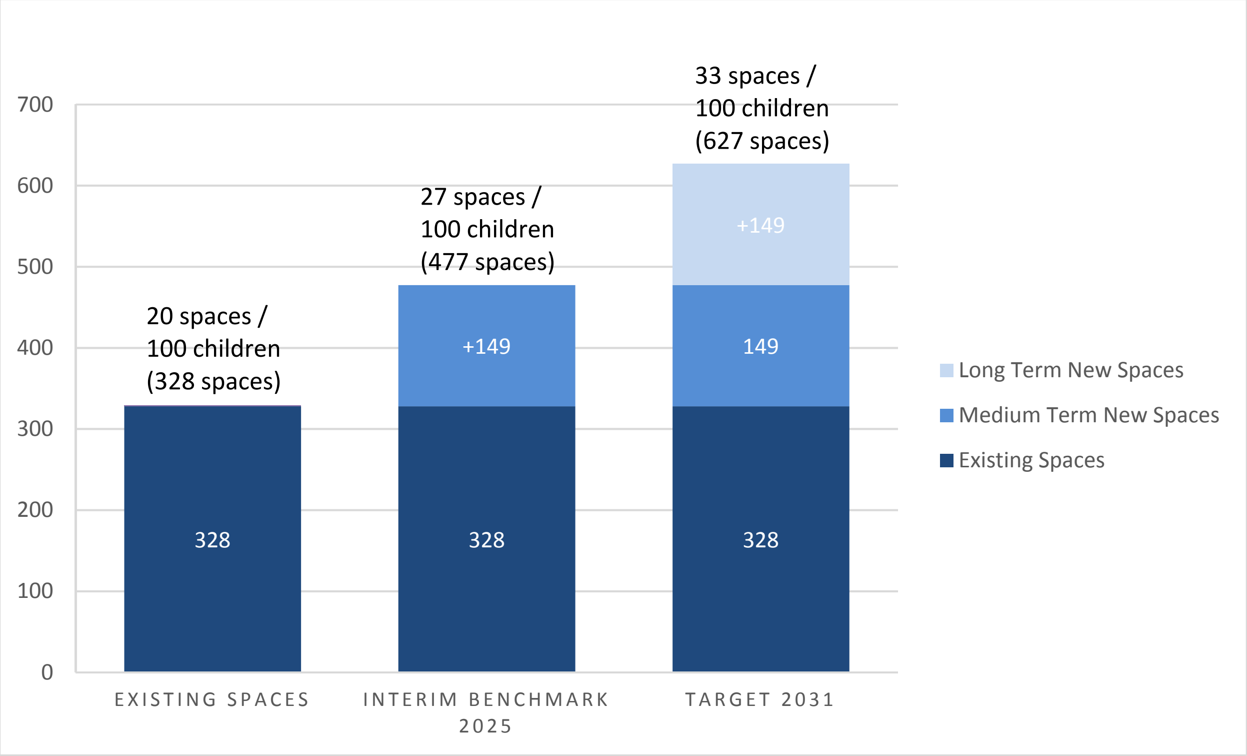
To meet the average access target of 33 spaces per 100 children by 2031, the targets for the infant and toddler programs include:

Table 8. Infant and Toddler Space Targets

YEAR	TARGET SPACES PER 100 CHILDREN
Interim Benchmark 2025	27
Ten Year Target 2031	33

To accomplish the target, two to three 12-space Infant Toddler programs need to be created each year for ten years (25 programs total) for a total of 299 new spaces, to add to the existing 328 spaces in the City. When this goal is accomplished, the total number of infant and toddler spaces by the year 2031 would be 627.

Figure 5: Space Creation Targets for Infant-Toddler Child Care Program by 2031



Note: These targets are developed based on the City of North Vancouver and Metro Vancouver projection that the infant-toddler population will increase by 273 children from 1,626 in 2019 to 1,899 in 2030.

PRESCHOOL AGE (3-5 YEARS) PROGRAM TARGETS

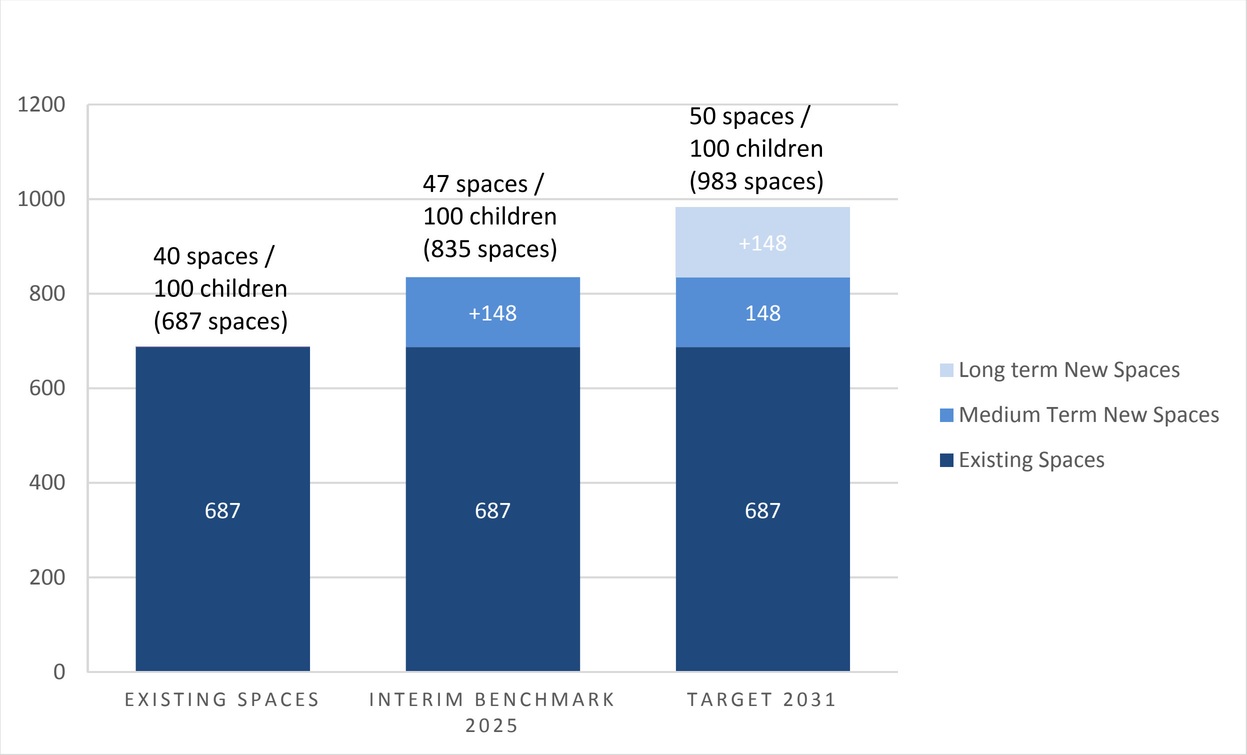
To meet the average access target of 50 spaces per 100 children, the targets for 3 – 5 year programs include:

Table 9. Preschool Age Program Space Targets

TARGET YEAR	TARGET SPACES PER 100 CHILDREN
Interim Benchmark 2025	47
Ten Year Target 2031	50

To accomplish the target, one or more 25-space group programs needs to be created every year for ten years (12 programs total) for a total of 296 new spaces, to add to the existing 687 spaces. The total number of infant and toddler spaces by the year 2030 would be 983.

Figure 6: Space Creation Targets for Preschool Age Child Care Program by 2031



Note: These targets are developed based on the City of North Vancouver and Metro Vancouver projection that the preschooler population will increase by 372 children from 1593 in 2019 to 1965 in 2030.

SCHOOL AGE (AGES 6-9) PROGRAM TARGETS

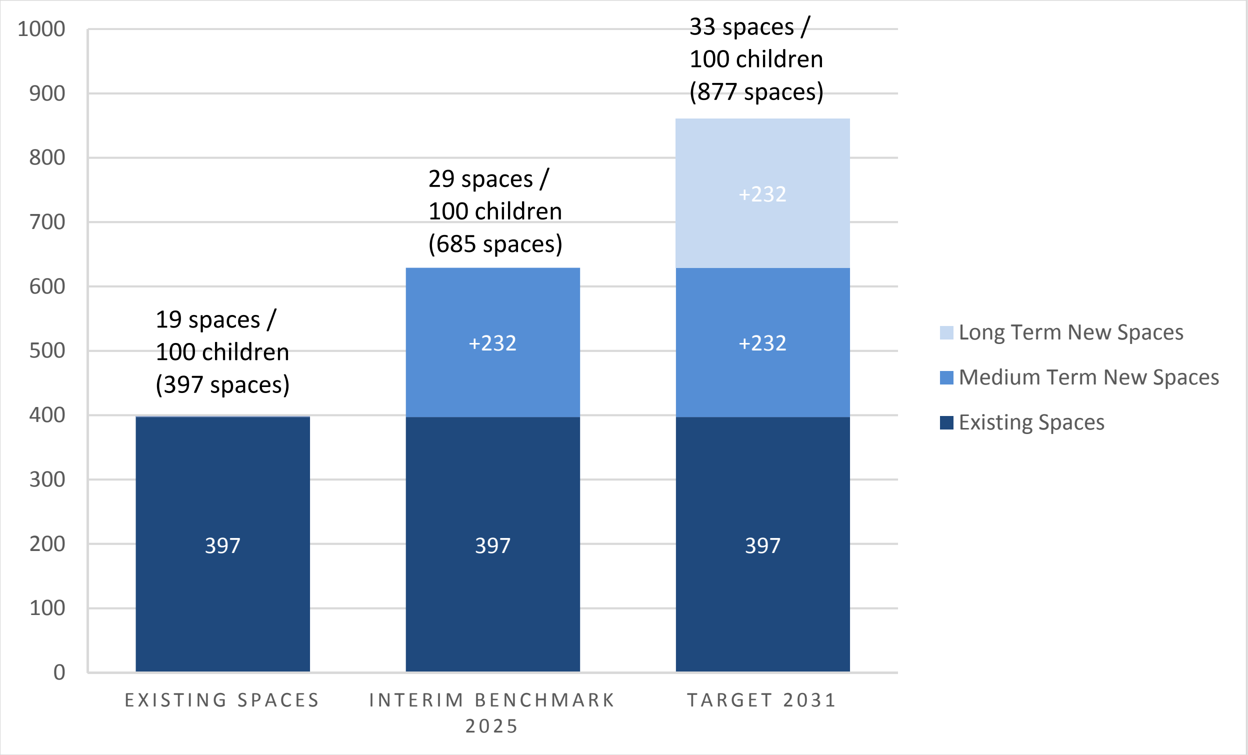
To meet the average access target of 33 spaces per 100 children, the targets for school age programs include:

Table 10. School Age Space Targets

TARGET YEAR	TARGET SPACES PER 100 CHILDREN
Interim Benchmark 2025	29
Ten Year Target 2031	33

To accomplish the target, two 24-space group programs need to be created every year for ten years (20 programs total) for a total of 464 new spaces, to add to the existing 397 spaces.

Figure 7: Space Creation Targets to School Age Children by 2031



Note: These targets are developed based on the City of North Vancouver and Metro Vancouver projection that the school age population will increase by 545 children from 2064 in 2019 to 2609 in 2030. Note that the school age population for the purpose of target-setting includes children 6 to 9 years of age. As noted in the Plan, the needs of children aged 10-12 may be supported by after school programs that are not licensed child care spaces (See Action 14).

CHILD CARE
PRIORITIES AND ACTIONS

This Plan is organized around four priorities:

INCREASING ACCESSIBILTY

- Increasing licensed spaces to meet all families' needs, including underserved families

IMPROVING AFFORDABILITY

- Working to make child care more affordable for families

FOCUSING ON QUALITY

- Advocating for high quality child care

STRENGTHENING PARTNERSHIPS

- Creating intentional collaboration and relationships that strengthen the child care system

In the following sections, the relevance and importance of each of the priorities is outlined, what we learned through the process is highlighted, a summary of key information is provided, and a series of actions is defined, with timeframe and key partners.

PRIORITY 1:
INCREASING ACCESSIBILITY

WHY DOES IT MATTER?

- Families need to be able to find licensed child care spaces that meet their needs.

- All families, especially those who have traditionally been underserved, should have their child care needs met, so that parents can effectively work, learn, and participate in community, ; and so that children can benefit from early childhood learning and development opportunities.

WHAT HAVE WE LEARNED?

Four key issues regarding accessibility of child care in the City are:

- Number of Spaces

  One of the biggest issues is the insufficient number of spaces to meet the demand for child care. The most pressing needs are spaces for infants/toddlers and school age children.

- Location of Spaces

  Child care spaces need to be located close to home/school/transit and in underserved neighbourhoods.

- Who is Able to Use the Spaces

  Underserved population groups such as immigrants, newcomers, lone parents, families with children with special needs, etc. need to be able to access child care services and supports.

- When are the Spaces Available

  Child care options with non-traditional or extended hours are limited.

ACTIONS: INCREASING ACCESSIBILTY

The City has important roles to play in increasing access to child care. While the City does not have a mandate or resources to fully address the gaps in child care accessibility, the City will work to create, coordinate and advocate for child care accessibility. The City will coordinate and facilitate the development of new facilities and spaces, will fine-tune the City's policies and regulations to encourage the delivery of child care through development, and will prioritize and direct child care into priority locations that meet families' needs. The City will also work to address the location and hours of child care facilities so that the services meet the needs of families that face barriers in accessing child care.

The City will also identify opportunities for civic projects, and joint funding opportunities with the Province, to lead the creation of a portion of the child care spaces in the City over the next ten years.

ACTION	TIME FRAME	EXTERNAL PARTNERS
Funding and Partnership for future City Owned Child Care Facilities – Shovel Ready Projects		
1. **Access Provincial capital funding to build child care spaces. Develop a structured partnership with the Province for multiple programs and sites, in order to plan and build shovel-ready projects6 for additional child care spaces in the City that are constructed over multiple years.**	**Short**	**Province, School District, Non-profit operators**
2. Include multi-year project plans for new child care facilities/spaces in the 5-year capital plan process for Council deliberation and prioritization. This includes: • City-initiated facilities to be delivered as civic projects, using the Civic Amenity Reserve Fund; and, • Where possible, in-kind child care spaces that are delivered through development.	Ongoing Short	None
3. Consider targeting a proportion of Civic Amenity Reserve Fund to be allocated to child care that is in balance with the provision of other community amenities and with evolving community needs and priorities.	Medium / Long	None

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[6] In this context a shovel ready project refers to a child care facility project that is at a stage of development for building to begin after detailed design and permits are in place. Conceptual planning is completed and the site is zoned.

4. In an effort to prepare shovel ready child care projects, maintain an inventory of existing publicly owned locations and properties that would meet basic suitability criteria. The inventory would include: **• City assets (buildings and land), that are potential sites for capital redevelopment;** **• Underutilized or vacant spaces or land; and** **• Working with other public and non-profit partners to identify additional spaces and land in 'new builds' and renovations of existing facilities.**	**Short / Medium / Long**	**Vancouver Coastal Health, School District, non-profit child care providers, post-secondary institutions, NVRC, other non-profits**
5. Develop building models/prototypes and high level cost estimates, to facilitate planning for new child care facilities on civic sites.	Short	Developers (consult)
6. Explore innovative models for public and non-profit ownership and operation of child care facilities that achieve feasible reliable long-term operation.	Short / Medium	
Updating City Policies and Regulations		
7. Endorse child care space creation targets in this Plan, to guide and monitor space creation over the next ten years. The targets aim to create new spaces as follows: **• Infant/Toddler: 299 new spaces** **• Preschooler: 300 new spaces** **• School Age: 464 new spaces**	**Ongoing**	**None**
8. Through the Community Well Being Strategy and the next review of the Official Community Plan, strengthen the child care goals and objectives to further this Action Plan.	Medium	Developers, Vancouver Coastal Health, School District, non-profit providers (consult)
9. Ensure that future amendments to the Zoning Bylaw are child care friendly for all types of child care including family and in-home multi-age services. Any future Zoning Bylaw changes should ensure that: • additional barriers are not imposed; • build on existing strengths and proactive focus on quality and safety; • revised bylaw is provided to the child care sector and VCH Licensing Staff for reference; and, • the impacts of the new bylaw are routinely monitored and assessed for impact on child care space creation.	Medium	Child Care providers, applicants, VCH, School District
10. Amend the Density Bonus and Community Benefits Policy to include:	**Short**	**Developers (Consult)**

• Guidelines for residential development applications: **i. For large residential development applications (in the range of 300 or more units) the City will work with the applicant to include on-site child care spaces as a component of the project's amenity contributions.** **ii. For small and medium residential development applications (less than approximately 300 units) the City will consider the feasibility of delivering a child care facility on site based on criteria including: child care need in the area, other priority needs for community amenities, and the suitability of the site and proposed development.** **• Guidelines for the submission of valuation studies for child care facilities that are being proposed as on site amenities.**		
11. Undertake a land economics analysis of City policies and programs to explore incentives to increase child care provision through density bonusing and density transfer for child care provisions.	**Short**	**Developers (Consult)**
Prioritization of Child Care Opportunities – Program Types and Locational Criteria		
12. Direct new spaces to sites that meet the following criteria: **• Areas of the City with lower access rates and growing population;** **• In civic facilities and parks;** **• In new developments (especially residential and commercial) along or near transit corridors;** **• In developments with affordable housing; and,** **• On school properties.** **Include consideration for the provision of child care within strategies and projects for affordable housing and transit expansion/improvement.**	**Short / Medium / Long**	**Child Care Providers, School District, Vancouver Coastal Health, School District, non-profit providers, TransLink, BC Housing,**
13. Work with the North Vancouver School District to create new child care spaces in existing and future schools and school sites.	**Short / Medium / Long**	**North Vancouver School District**
14. Work with other agencies to develop after-school programs that support children aged 10-12 years whose needs are not specifically addressed by school aged licensed child care space.	Medium	NVRC, VCH, parks and library staff, non-profit sector, School District

15. Work with the North Shore Child Care Planning Committee to explore and pilot, with providers, child care that offers longer hours, non-traditional hours, and/or flexible hours.	Medium	Province, VCH, non-profit providers, School District
16. Continue to engage in dialogue with First Nations on the North Shore, focusing on meeting the needs of Indigenous families/children and support high quality and culturally rooted and supportive child care programming.	Medium	First Nations Communities
Planning and Development Process to Enable Child Care		
17. Join Vancouver Coastal Health child care information meetings for potential child care owners and operators who are interested in opening child care centres.	Short	VCH
18. Offer information and guidance for creating child care spaces, in an online portal or other format that is clear, easily found, and is based on the assumption that applicants may have limited prior knowledge of the requirements.	Short / Medium	VCH, Child Care Resource and Referral

PRIORITY 2:
IMPROVING AFFORDABILITY

WHY DOES IT MATTER?

- The cost of child care is unsustainable and unaffordable for many families, which can cause stress, financial strain, and can keep parents from participating in the labour force.

- The unaffordability of child care has disproportionately negative impacts on low income and vulnerable families.

WHAT HAVE WE LEARNED?

Two key issues regarding the affordability of child care in the City are:

- Fees

  Child care is expensive, and fees are a driving factor in the choices families make regarding which program their children will attend, or whether they consider other alternatives. The alternatives may include relatives caring for children full time, or parents opting to care for children full time and not participating in the labour force, or other alternatives.

- Barriers

  Affordability is exacerbated for families who face additional challenges or barriers such as: low income families, families with multiple children, lone parents, recent immigrants, families with children with special needs, foster families, and families in which parents do shift work.

ACTIONS: IMPROVING AFFORDABILITY

The City has limited opportunities to directly affect the cost of child care for families; key tools and responsibility rest with senior levels of government. The City's role is to provide some supports to non-profit operators to help to make their child care operations feasible, so that they can in turn offer more affordable child care fees to families.

ACTION	TIME FRAME	PARTNERS
19. Explore a funding strategy and revised criteria for the Child Care Improvement Fund, which would result in a City grant program that would assist non-profit child care providers with funding facility upgrades/maintenance or extended hours.	Short / Medium	Non-profit providers
20. Lease City-owned child care facility spaces to non-profit child care providers at nominal lease rates.	On-going	Non-profit providers
21. Provide permissive tax exemptions to not-for-profit child care providers, where applicable.	On-going	Non-profit Providers
22. Continue to work with partners to monitor child care fees on the North Shore, to understand changes in affordability and feasibility of child care.	On-going	North Shore Child Care Resource and Referral
23. Advocate to senior governments to reduce the cost of child care, and increase compensation for child care workers.	Short / Medium / Long	NS Child Care Planning Committee, District of West Vancouver, District of North Vancouver, School District

PRIORITY 3:
FOCUSING ON QUALITY

WHY DOES IT MATTER?

- The research is clear that high quality child care is linked to positive child development outcomes for children. More generally, parents dropping off their children at a child care centre each working day want to feel secure knowing their children will receive safe, high-quality care.

WHAT HAVE WE LEARNED?

The Province is moving toward a universal approach to child care, which requires public investment and system wide planning across the province. At a program and facility level in the City, elements of quality include well supported and paid staff, and well designed and equipped facilities. The City's role in quality includes:

- Supporting and creating quality child care program spaces (both indoor and outdoor) in the City.
- Working with partners that provide quality care, which meets children's development needs.
- Working collaboratively with senior government and partners to exemplify the characteristics and outcomes of quality child care system in the City and on the North Shore.

ACTIONS: FOCUSING ON QUALITY

The direct mandate and authority to build, monitor, and assess a quality child care system is within the Provincial government's scope. The City's role in creating quality systems focuses on the quality of facilities and spaces (e.g. referring to guidelines and best practices) and to work with partners that provide quality care.

ACTION	TIME FRAME	PARTNERS
24. Work with child care non-profit operators/partners to: • Lease space for child care facilities in City-owned buildings and properties; • Demonstrate high quality child care services and spaces; and, • Strategize and look for opportunities to increase the number of licensed, non-profit, publicly funded child care spaces in the City.	On-going	Districts of North & West Vancouver, Non-profit providers, School District, Non-Profit Providers
25. Apply the following guidelines to the process of creating new City-owned child care facilities: • Review proposed space for operational feasibility and quality of the child care space prior to approval. • Exceed provincial licensing requirements for the quantity and quality of design for indoor and outdoor space.	Short / Medium	VCH, Non-profit providers, Child Care Planning Committee
26. Explore feasibility and options for creating design guidelines for City-owned child care spaces.	Medium	VCH, Non-profit providers, Child Care Planning Committee
27. Support the Province in its "Early Care and Learning Recruitment and Retention Strategy" initiative through joint advocacy.	Short	Districts of North & West Vancouver, Non-profit providers, School District

PRIORITY 4:
STRENGTHENING PARTNERSHIPS

WHY DOES IT MATTER?

- The child care system involves many parties playing various roles, which requires intentional relationships and collaboration across jurisdictions in order to achieve accessible, affordable, and high quality child care spaces.

WHAT HAVE WE LEARNED?

During the engagement process for this Plan, the theme of partnerships was the most frequently suggested approach to increasing the quality, affordability, and accessibility of child care in the City and on the North Shore:

- Value of Relationships

  The value of stronger ongoing relationships with the First Nations and Indigenous peoples, including incorporating Indigenous perspectives and history in child care planning and curriculum was recognized.

- Opportunities for Collaboration

  Opportunities for collaboration focused on the use of publicly owned land / facilities, such as schools, post-secondary institutions, and hospitals for child care. In addition to public entities, participants also suggested partnerships with senior centres and large employers who might provide facilities on-site for their employees.

- Value of Partnerships

  The value of enhanced partnerships with the neighbouring municipalities and other jurisdictions, such as School District, Health Authority, etc. to work and advocate together for meeting our community’s child care needs.

ACTIONS: STRENGTHENING PARTNERSHIPS

The following actions will help the City to bring focus and attention to the essential relationships and partnerships for a coordinated quality child care system that meets families' needs.

ACTION	TIME FRAME	PARTNERS
Coordinated Child Care Services		
28. Work with the North Shore Child Care Planning Committee and child care agencies to explore the development of a joint interagency role/position focused on meeting space targets on the North Shore, which would facilitate partnerships and engage with Provincial and community partners to meet the North Shore's needs.	Short / Medium	School District, DNV
29. Explore opportunities for child care facilities to include space that incorporates programming/partnerships for family support services.	Medium	NS Child Care Planning Committee, child care operators
30. Explore the feasibility of a centralized child care waitlist or portal on the North Shore, to use existing spaces most efficiently and to simplify communication about space availability.	Medium	DWV, DNV, North Shore CCR&R, Operators, Child Care Committee, School District, Province
Nurturing Partnerships and Building Relationships		
31. Build supportive and learning relationships with First Nations. Support Indigenous perspectives and history in child care, and culturally appropriate and supportive child care in the City.	On-going	First Nations
32. Build partnership and joint planning protocol with the School District around child care to: • **Ensure child care is part of all new school facilities, and renovated school spaces where possible;** • **Facilitate use of school spaces and grounds for school age child care operations where possible;** • **Structure the ongoing communication about child care between the City and School District;** • **Aim to stabilize the existing child care spaces and ensure no net loss of child care space in schools; and,**	**Short / Medium**	**School District**

- **Support the Provincial direction toward an enhanced role for the School District regarding school age child care.**		
33. Continue to work with the North Vancouver Recreation and Culture Commission (NVRC) to plan, where possible, for additional child care spaces and services as part of new building opportunities.	Short / Medium	NVRC
34. Work with non-profit child care providers on partnerships that support them and their child care operations in the City, and consider mechanisms to increase their capacity, feasibility and economy of scale for child care operation on the North Shore.	Short / Medium / Long	Non-Profit Child Care providers
35. Pursue opportunities with employers in the City to participate in creating or providing child care opportunities that would serve their employees' families and community.	Short / Medium / Long	Local employers
36. Enhance the collaboration with the Child Care Resource and Referral Program and other child care sector and community service organizations to: • Bring child care operators and staff together for information sharing, joint training and education; • Inform parents about how to find quality child care and, especially support more vulnerable populations • Provide consistent child care messaging and information for across agencies on the North Shore	On-going	Child care providers, VCH, Community Service Organizations, Child Care Resource and Referral Program
37. With the North Shore Child Care Planning Committee, provide regular briefings to elected officials (municipal and School District) and commit to offer orientation on child care matters after each local election to elected officials.	Short / Medium / Long	NS Child Care Planning Committee
38. With the North Shore Child Care Planning Committee, explore how to maximize the Committee's effectiveness for a systematic approach to child care on the North Shore.	Short / Medium	NS Child Care Planning Committee
39. Recognize and honour the value of child care workers and the child care in our community by supporting Child Care month on an annual basis, requesting and including their input, monitoring child care issues, and considering additional support and partnership opportunities.	On-going	North Shore Child Care Planning Committee, CCR&R
40. Build partnership opportunities with Capilano University Early Childhood Care and Education Program (School of Education and Childhood Studies) faculty and students. Collaboratively explore opportunities to improve child care quality, strategies to recruit and retain ECE employees, and ideas to innovate child care in the City.	Short / Medium	Capilano University

Advocacy		
41. **Advocate to senior governments to provide support to the child care sector and families in the following areas, and other priorities that arise:** • **Ensuring that the needs of City of North Vancouver children are a priority for new spaces in provincial planning and funding;** • **Recruitment and remuneration of ECE's;** • **Increased resources to support children with additional needs and those from more vulnerable populations;** • **Lower fees for families; and,** • **Specific funds are needed to support non-traditional hours of care.**	**Short / Medium**	**DWV, DNV, School Board**

RESOURCES AND REPORTING

RESOURCES

Implementation of the Child Care Action Plan will be driven by the availability of City staff and financial resources to accomplish short, medium, long term, and ongoing actions. The City's inputs toward plan implementation will be complemented and enabled by contributions from and partnerships with other agencies, child care providers, and senior governments. The City will not accomplish all of the actions on its own. Support from senior levels of government and strong partnerships with others are needed, and the actions in this Plan seek to define and confirm their involvement.

Table 11. City Resources Required to Implement the Plan

POLICY DEVELOPMENT	Funds for specialized consulting assistance to inform projects in the Action Plan, such as: o Developing building models / prototypes and high level cost estimates, to facilitate planning for new child care facilities on civic sites (Action 5) o Exploring innovative models for public and non-profit ownership and operation of child care facilities that achieve feasible reliable long-term operation (Action 6) o Amending the Density Bonus and Community Benefits Policy – land economics study (Action 10) o Reviewing potential city-owned child care spaces that are proposed as on site amenity contributions for operational feasibility and quality of child care (Action 24, 25) o Exploring feasibility and options for design guidelines for city-owned child care spaces (Action 26) **Process:** Staff will submit project sheets within the financial plan process, for Council's consideration. Actions that are listed as short-term in the Plan will be submitted with a priority timeline.
FUNDS FOR CAPITAL PROJECTS	City resources are beneficial to securing additional capital funds from the Province. Funds for capital projects to create new child care spaces (Action 2, 3): o In 5 year increments, plan for city-initiated facilities that will be delivered through new development and voluntary developer contributions to the Civic Amenity Reserve Fund. o Consider targeting a proportion of Civic Amenity Reserve Fund to be allocated to child care that is in balance with other community amenities, for Council's consideration in the budget process and with evolving community needs and priorities. **Process:** Staff will include multi-year project plans for new child care facilities/spaces in the 5-year capital plan process for Council deliberation, prioritization, and direction.

COORDINATION	Resources to support a strong and proactive staff role and responsibility in child care, may include: o A facilitator/point person on staff to undertake overall responsibility and coordination of child care may require re-allocation of staff resource or new staffing depending on staff availability and demands. o Project staff to plan and oversee capital development projects for child care. o Staff to lead additional advocacy, relationship and planning with senior government (Action 41); relationship-building with partners including First Nations, School District, North Vancouver Recreation and Culture, Capilano University, and others (multiple actions, including Actions 31-40); and a proactive City role and involvement space creation and partnership development (multiple actions). **Process:** As required, staff will bring forward project sheets within the financial plan process for additional staff resources to support the implementation of the project plan. ***Note:*** *Some of the staff resources for an enhanced staff role in child care can accomplished through re-allocation of existing staff resources and will not require additional requests.*

CITY COST FOR CREATING SPACES

The cost for creating child care spaces varies depending on the type of construction, the context, the type of child care program space, the standard to which it is constructed, and other factors. The City's share of the capital cost for creating new child care spaces also depends on the contributions from senior governments, and will drive the feasibility of proceeding with new facilities.

REPORTING

City of North Vancouver Council will receive reports on the City's progress toward meeting the child care space targets and actions in this Plan. The reports will be aligned with timeframes of the interim benchmarks (2025) and the longer-term implementation (2031) of the Plan.

The City will also regularly receive and provide updates about the child care sector through the North Shore Child Care Planning Committee, School District 44, and other partners and stakeholders.

Staff will bring financial requests and items that require Council direction and approval as they arise or are required.

ADDITIONAL INFORMATION

Additional resources and information to supplement this Child Care Action Plan are available on the City's website, including:

- Glossary of Types of Child Care
- Child Care Action Plan Engagement Summary
- Child Care Action Community Statistical Profile
- Key Findings from Child Care Action Plan Research & Promising Practices
- Summary of Child Care Action Plan Stakeholder Consultation Input

cnv.org

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604 985 7761 / INFO@CNV.ORG

Appendix I District of North Vancouver's Child Care Action Plan

AGENDA INFORMATION

☑ Regular Meeting Date: Dec 7, 2020

☐ Other: Date: ______

TA		
Dept. Manager	GM/ Director	CAO

The District of North Vancouver
REPORT TO COUNCIL

November 25, 2020
File: 10.475.00/000.000

AUTHOR: Tina Atva, Manager of Community Planning
Eirikka Brandson, Community Planner

SUBJECT: **District of North Vancouver Child Care Action Plan**

RECOMMENDATION:

THAT the District of North Vancouver Child Care Action Plan is approved.

REASON FOR REPORT:

At the November 23rd, 2020 Council Workshop, the Committee of Council referred the Draft District of North Vancouver Child Care Action Plan to a Regular Meeting of Council for consideration (**Attachment 1**).

SUMMARY:

Access to quality child care is vital to the well-being of families and children in the District, and is a critical component of a complete community. The District of North Vancouver Child Care Action Plan identifies four goals to enhance child care services in the District over the next ten years:

1. Increasing access to child care;
2. Improving affordability;
3. Focusing on quality; and
4. Strengthening partnerships.

Twenty nine supporting actions complement these goals and provide a comprehensive path forward to address community child care space needs, develop innovative solutions to child care challenges, and strengthen strategic partnerships. Minor formatting edits have been incorporated into the final plan (**Attachment 2**).

Timing/Approval Process:

Council approval of the plan is required by December 31, 2020, to meet the grant requirements from the Union of BC Municipalities.

Financial Impacts:
Actions proposed in the Child Care Action Plan that require funding will be considered through the 2021-2025 financial planning process, and the long-term financial plan review. Several actions in the plan leverage the District's land and building assets, and may have financial implications related to design and construction, potential future staffing costs, and lost revenue from application fees and rental income.

Respectfully submitted,

Tina atva

Tina Atva
Manager of Community Planning

Ek Brandson

Eirikka Brandson
Community Planner

Attachment 1: Report entitled "District of North Vancouver Draft Child Care Action Plan" dated November 3, 2020.

Attachment 2: District of North Vancouver Child Care Action Plan. (Appendices may be found at https://www.dnv.org/community-environment/child-care-action-plan)

REVIEWED WITH:

- ☐ Community Planning ____
- ☐ Development Planning ____
- ☐ Development Engineering ____
- ☐ Utilities ____
- ☐ Engineering Operations ____
- ☐ Parks ____
- ☐ Environment ____
- ☐ Facilities ____
- ☐ Human Resources ____
- ☐ Review and Compliance ____

- ☐ Clerk's Office ____
- ☐ Communications ____
- ☐ Finance ____
- ☐ Fire Services ____
- ☐ ITS ____
- ☐ Solicitor ____
- ☐ GIS ____
- ☐ Real Estate ____
- ☐ Bylaw Services ____
- ☐ Planning ____

External Agencies:

- ☐ Library Board ____
- ☐ NS Health ____
- ☐ RCMP ____
- ☐ NVRC ____
- ☐ Museum & Arch. ____
- ☐ Other: ____

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ATTACHMENT 1

AGENDA INFORMATION

☑ Council Workshop Date: Nov 23, 2020
☐ Finance & Audit Date:
☐ Advisory Oversight Date:
☐ Other: Date:

for
Dept. Manager

GM/ Director

CAO

The District of North Vancouver
REPORT TO COMMITTEE

November 3, 2020
File: 10.4750.00/000.000

AUTHOR: Steve MacIntyre, Community Planner

SUBJECT: **District of North Vancouver Draft Child Care Action Plan**

RECOMMENDATION:

THAT the report entitled "District of North Vancouver Draft Child Care Action Plan" dated November 3, 2020 is received for information;

AND THAT the Committee refers the District of North Vancouver Draft Child Care Action Plan to a Regular Meeting of Council for consideration.

REASON FOR REPORT:

This report presents the Draft Child Care Action Plan ("the Plan") for input from the Council Committee, prior to completing the plan and fulfilling funding requirements for this project.

SUMMARY:

The District of North Vancouver Draft Child Care Action Plan (**Attachment 1**) identifies key issues and recommended actions to meet the District's child care needs to 2030. The Plan is both attached to this report and available online. The draft and Plan appendices may be found at https://www.dnv.org/programs-services/child-care-action-plan. The Plan focuses on four strategic goals, which together aim to improve access and affordability, focus on child care service quality and strengthen partnerships.

The Plan is informed by data, community engagement, and stakeholder collaboration. Recommended actions leverage the District's assets and those of its North Shore partners to deliver on the plan's goals. Actions requiring additional District funds will be considered through the financial planning process.

BACKGROUND:

Building on our OCP objective to provide, facilitate, and support the establishment of child care spaces, the Plan was developed in consultation with parents, guardians, child care providers, and a range of stakeholders and offers short, medium, and long term actions and targets designed to foster child care over the next decade.

Work on the Plan began in 2019, following receipt of a $25,000 UBCM grant and an additional $27,000 allocated in the 2019-2023 Financial Plan Budget. The District of North Vancouver, City of North Vancouver, and District of West Vancouver retained the same consultant to allow for a joint engagement process. This allowed for a coordinated approach to gathering input and developing child care solutions across the North Shore. Following this joint engagement process, it is anticipated that each municipality will develop its own action plan to reflect its unique conditions.

A four-phase work plan was developed to guide the process and is outlined in Table 1, below.

Table 1: Work Plan and Timelines for the Child Care Action Plan

Item	Key Milestone	Target Dates
Pre-phase	Project Initiation and Finalize Work Plan	September 2019 (complete)
Phase 1	Research and Data Collection • Child care space inventory • Review of municipal best practices • Review of facility development application process • Review of regulations and policies	October/November 2019 (complete)
Phase 2	Community Engagement • Preparation of consultation plan • Family engagement • Community partner interviews • Interviews with child care providers • On-line survey of parents and child care providers • Child Care staff workshop • First Nations engagement • Child Care solutions workshop	October 2019 – February 2020 (complete)
Phase 3	Draft Strategy and Action Plan • Identification of draft actions • Council Workshop (March 3, 2020)	January – March 2020 (complete)
Phase 4	Final Strategy and Action Plan Report • Final report from consultant • Council Report and Endorsement of Child Care Strategy and Action Plan	April - present 2020[1]

At the March 3, 2020, Council Workshop, staff provided an overview of work completed to date, and sought feedback on targets and draft actions. The Plan incorporates input

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[1] Phase 4 was originally scheduled for completion in April, 2020, but has been delayed as a result of the COVID-19 pandemic.

received, and reflects the importance of partnerships and a mix of approaches to address child care needs to 2030.

EXISTING POLICY:
Section 6.3 of the District's Official Community Plan outlines policies that address the need for an array of community programs including child care. These policies include:

- 6.3.4: Promote the establishment and maintenance of affordable quality child care services; and
- 6.3.8: Encourage the retention of sufficient space in surplus public facilities (schools, churches, recreation centres) to meet changing community needs (such as adult daycare and child care).

Through the North Shore Congress[2], the Child and Family Friendly Community Charter was developed in 2011 and endorsed by Council the same year. The Charter recognizes the importance of early child development and the need for the members of the Congress to work together to create broad, equitable access to the conditions that help children and families thrive.

The District's Child Care Policy was approved in 1990 and amended in 2008 (**Attachment 3**). The Policy includes a mandate for the District to integrate child care into ongoing planning and development functions, support existing child care services, encourage new initiatives in high need areas, and advocate for provincial and federal action in support of child care. The Policy also recognizes the importance of partnerships with key agencies, including Vancouver Coastal Health and North Vancouver School District #44, in order to establish a comprehensive child care system.

ANALYSIS:
The District does not have enough child care spaces to meet the needs of its families. The existing inventory includes approximately 3,000 spaces. This is comprised of approximately 2,300 group child care spaces and 700 pre-school and family/in-home child care spaces (2019). The projected demand to 2030 is approximately 2,055 additional group child care spaces.

Furthermore, the types of care available are not well matched to the age groups and locational needs of District neighbourhoods. New partnerships and solutions must be developed to secure the land, building spaces, and funding needed to deliver on these needs.

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[2] The North Shore Congress is made up of elected officials from the District of North Vancouver, City of North Vancouver, District of West Vancouver, Bowen Island, Lions Bay, Squamish Nation, Tsleil-Waututh Nation, North Vancouver Board of Education, West Vancouver Board of Education, and the Directors at Vancouver Coastal Health. The Congress meets annually around social issues that impacts residents living/working on the North Shore.

The four goals outlined below take aim at the biggest challenges and opportunities to meet the District's child care needs over the next ten years:

1. Increasing access to child care;
2. Improving affordability;
3. Focusing on aspects of service quality such as staff training and design; and
4. Strengthening partnerships.

The Plan includes a focus on group child care, space targets for different age groupings and addressing demand in key locations. Key actions to meet the four goals include:

- Striving to achieve approximately 2,055 additional group child care spaces in the District by 2030;

- Endorsing space creation targets for each age group, as follows:
    - Infant/toddler (under 3 years): 33 spaces per 100 children (528 new spaces);
    - Pre-schoolers (3-5 years): 50 spaces per 100 children (375 new spaces); and
    - School-aged (6-12 years): 33 spaces per 100 children (1,152 new spaces).

- Prioritizing the creation of new child care spaces in neighbourhoods with the greatest need (e.g. Lynn Valley, Seymour, Lower Lynn, Upper & Lower Capilano);

- Supporting existing, and facilitating the creation of new non-profit and public child care sector spaces (22% of total number of spaces as of 2019);

- Exploring opportunities to further leverage District-owned facilities to support non-profit child care;

- Continuing to work with partners to develop coordinated solutions to child care challenges (e.g., working with School District 44 to facilitate child care);

- Working with the North Vancouver Recreation and Culture Commission (NVRC) in an effort to support the provision of child care spaces, preschool programs and after school care in recreation and culture facilities; and

- Lobbying senior governments for increased funding toward programs that lower costs, improve quality, and expand diversity of child care options (e.g., support non-traditional hours of care).

Actions in the plan are listed as short, medium, long-term or ongoing, based on the complexity, resources, and coordination required for implementation. Staff will track implementation progress, ensure ongoing communication and collaboration with partners, and prepare updates for Council.

Timing/Approval Process:
The Plan is ready for Council's consideration at a Regular Meeting after any additional refinements are made as a result of the workshop discussion. Council's approval of the plan

is required by December 31, 2020, to meet the grant requirements from the Union of BC Municipalities.

Concurrence:
The Plan has been reviewed by Building, Real Estate & Properties, Development Planning, Finance, Facilities, and Parks Departments, School District #44, and the North Vancouver Recreation & Culture Commission.

Financial Impacts:
Actions that are proposed in the Draft Child Care Action Plan requiring funding will be considered through the 2021-2025 financial planning process, and the long-term financial plan review. Several actions in the draft plan would leverage the District's land and building assets, and may have financial implications related to design and construction, potential future staffing costs, and lost revenue from application fees and rental income.

Liability/Risk:
The actions proposed in the draft plan do not expose the District to any particular risk or liability.

Conclusion:
Child care is a vital part of the community's social infrastructure, positively impacting the local economy, and enhancing the overall health and well-being of the entire community.
The Council workshop on November 23, 2020 will provide Mayor and Council the opportunity to provide direction on the final Child Care Action Plan.

Options:

1. THAT the report entitled "District of North Vancouver Draft Child Care Action Plan" dated November 3, 2020 is received for information;

   AND THAT the Committee refers the District of North Vancouver Draft Child Care Action Plan to a Regular Meeting of Council for consideration.

OR

2. Take no further action.

Respectfully submitted,

for Steve MacIntyre
Community Planner

Attachment 1: District of North Vancouver Draft Child Care Action Plan
Attachment 2: District of North Vancouver Child Care Policy (available at
Attachment 3: Presentation on Draft Child Care Action Plan

REVIEWED WITH:

☐ Community Planning
☐ Development Planning
☐ Development Engineering
☐ Utilities
☐ Engineering Operations
☑ Parks
☐ Environment
☑ Facilities
☐ Human Resources
☐ Review and Compliance

☐ Clerk's Office
☐ Communications
☑ Finance
☐ Fire Services
☐ ITS
☐ Solicitor
☐ GIS
☑ Real Estate
☑ Bylaw Services/ BUILDING
☑ Planning

External Agencies:
☐ Library Board
☐ NS Health
☐ RCMP
☑ NVRC
☐ Museum & Arch.
☐ Other:

ATTACHMENT 2

District of North Vancouver
Child Care Action Plan

November 25, 2020

DISTRICT OF
NORTH
VANCOUVER

sparc bc
people. planning. positive change.

CONTENTS

LIST OF TABLES AND FIGURES

APPENDICES:

Available at: https://www.dnv.org/programs-services/child-care-action-plan

Appendix A: Glossary of Types of Childcare
Appendix B: Summary of Stakeholder Consultations
Appendix C: Key Findings from Research & Promising Practices
Appendix D: District of North Vancouver Child Care Action Plan Community Profiles
Appendix E: North Shore Child Care Action Plan Community Engagement Summary

ACKNOWLEDGEMENTS

The District of North Vancouver Child Care Action Plan was prepared by Sandra Menzer, Barry Forer, and John Foster, in collaboration with District staff, and consultants from the Social Planning and Research Council of British Columbia (SPARC BC). The District of North Vancouver would also like to thank the following partners and contributors:

- The North Shore Child Care Planning Committee and its members, including the City of North Vancouver and District of West Vancouver, for ongoing support and collaboration.
- Community members and partners who shared insights and ideas for the District's future work and role in child care

The project was funded, in part, by a Child Care Planning Grant from the Union of BC Municipalities.

1.0 EXECUTIVE SUMMARY

Quality child care is a vital part of a community's social infrastructure, positively impacting the local economy, and enhancing the overall health and well-being of the entire community. Research has confirmed the importance of child care to the economy, gender equality, social inclusion, healthy childhood development and poverty reduction strategies.

The District of North Vancouver does not have enough child care spaces available to meet the needs of its families. The existing inventory of approximately 2,300 full time, group child care spaces in the District (as of 2019) will need to nearly double to meet projected demand of approximately 4,400 spaces by 2030. Furthermore, the types of care available are not well matched to the age groups and locational needs of District neighbourhoods. Finally, there is a significant shortage of licensed non-profit child care operations. New partnerships and solutions must be developed to secure the land, building spaces, and funding needed to deliver on these needs.

The District of North Vancouver Child Care Action Plan identifies four goals to enhance child care services in the District over the next ten years:

1. Increasing access to child care;
2. Improving affordability;
3. Focusing on quality; and
4. Strengthening partnerships.

Twenty-nine supporting actions provide a path toward meeting community child care space needs. Key recommendations focus on increasing the supply and quality of child care, and developing innovative solutions through partnerships. Key actions include:

- Updating the District's existing Child Care Policy to further reinforce that child care is a District priority;
- Striving to achieve approximately 2,055 additional group child care spaces in the District by 2030;
- Endorsing space creation targets for each age group, as follows:
  - Infant/toddler (under 3 years) space target: 528 new spaces (33/100 children);
  - Pre-schoolers (3-5 years) space target : 375 new spaces (50/100 children); and
  - School-aged (6-12 years) space target: 1,152 new spaces (33/100 children)
- Prioritizing the creation of new child care spaces in neighbourhoods with the greatest need (e.g., Lynn Valley, Seymour, Lower Lynn, Upper & Lower Capilano);
- Supporting existing, and facilitating the creation of new non-profit and public child care sector spaces (representing 22% of total number of spaces as of 2019);
- Exploring opportunities to further leverage District-owned facilities to support non-profit child care, including:
  - Developing building models/prototypes, and high level costs to facilitate planning for inclusion of new child care spaces on District sites;
  - Continue leasing District space to non-profit child care providers at below-market and affordable lease rates;
  - Applying guidelines to the process of creating new District-owned child care facilities;
- Continuing to work with partners to develop coordinated solutions to child care challenges;
- Working with the North Vancouver Recreation and Culture Commission (NVRC) to support the provision of child care spaces, pre-school programs and after school scare in recreation and culture facilities; and
- Lobbying senior governments for increased funding overall toward programs that lower costs, improve quality, and expand diversity of child care options (e.g., support non-traditional hours of care).

2.0 INTRODUCTION

2.1 Overview

The District of North Vancouver Child Care Action Plan identifies local child care needs, and recommends actions to achieve strategic goals that address service gaps and improve the child care provision. The plan is informed by a review of the local planning and policy framework, demographic and child care service data, promising practices, and extensive consultation with key stakeholders, including child care operators, parents, caregivers, and other community partners.

In 2019, there were approximately 3,000 licensed child care spaces in the District. This included approximately 2,300 full-time group child care spaces and 700 pre-school and family or in-home child care[1]. In 2016, the District had 12,585 children aged 0-12. The Child Care Action Plan focuses on setting targets for the provision of additional licensed full-time group child care to meet the needs of working parents. These facilities provide care in a group setting to children between the ages of 0-12.

This work is supported by the current provincial government's commitment to provide new funding toward building a universal, high-quality, publicly funded child care system, and supplements the District's existing planning policy and framework for child care.

The plan is organized into four sections:

1. **Introduction** – provides policy context and methodology
2. **Community Profile** – identifies DNV-specific data to inform child care needs
3. **Issues, Goals & Actions** – discusses child care needs, and recommends actions to address them
4. **Implementation, Monitoring and Reporting** – describes how the action plan will be implemented and monitored.

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[1] Appendix A provides a Glossary of Types of Child Care.

2.2 Policy Context

Child care is an integral part of Canada's social infrastructure, and an absolute necessity for many families. Provincial governments have the primary responsibility for developing child care policy and programs, but both the federal and local governments also have strong roles to play, as do other local authorities (e.g. regional health authorities) and child care providers. Figure 1, below, provides a summary of these roles, with additional detail in the following sections.

Figure 1: Government Roles in Supporting Child Care

Federal Government	Provincial Government	Municipal Government	Other
• Financial aid to Provinces and Territories • Direct Child Care funding support to specific population groups (i.e. First Nations, military, newcomers) • Maternity and Parental Benefits through Employment Insurance	• Developing legislation, policy and regulations • Funding supportive programs and services • Providing capital grants • Fee subsidies and program supports for families with low incomes	• Facilitates child care through policy, land use, and other mechanisms	• **Health Authorities:** • regulating and setting minimum standards, • licensing and enforcement • **School Districts:** • options for before and after school care and services • **North Vancouver Recreation and Culture Commission:** • recreational services for kids, childminding, • preschool programs

Federal Government's Role

The Federal Government's primary contribution toward child care comes in the form of financial aid to Provinces and Territories. In 2018, the Federal Government allocated $153 million to the Province of BC for the purpose of enhancing access, affordability, quality, and equity of child care. In addition, the Federal Government committed a further $535 million to provinces and territories in 2019 to build 250,000 new school-age child care spaces, and reduce parent fees Canada-wide over the next four years.

The federal government also provides direct child care funding support to some specific population groups, including First Nations, Canadian military, and immigrants, and maternity and parental benefits through Employment Insurance.

Provincial Government's Role

The Province is responsible for developing legislation, policy and regulations; funding supportive programs and services; providing capital grants; and providing fee subsidies and program supports for families with low incomes.

The current BC government is committed to building a universal, publicly funded child care system that is affordable and available to all families. In 2018, the Provincial government approved *Child Care B.C.*, a 10-year plan, which includes $1.3 billion dollars of investment in the first three years. To date, the Province has completed or begun work on the following:

- Providing funding for Aboriginal Head Start programs to include child care;
- Developed the Child Care Fee Reduction initiative;
- Created the Affordable Child Care Benefit;
- Committed to create 22,000 new spaces by 2021;

- Established Universal Child Care Prototype Sites;
- Distributed Capital funding via Childcare BC New Spaces Fund, and UBCM Community Child Care Space Creation Program; and
- Providing wage increases for early childhood educators.[2]

The province's annual strategic plan, Budget 2020, increased its investment in child care and early learning by announcing the BC Child Opportunity Benefit, which replaces the previous Early Childhood Tax Benefit. Starting in October 2020, families can receive up to $3,600 per year, depending on their income and number of children. In addition, in November 2019, the Province implemented legislative changes that allow school boards to directly operate before and after school care on school property.

Local Government's Role

Provincial legislation does not assign local governments any role, mandate, or resources to meet local communities' child care needs. However, their in-depth understanding of the local context make them crucial to facilitating the establishment of high quality child care in their communities.

The District of North Vancouver has a robust planning and policy framework for child care, which includes:

- Statements and policies in the Official Community Plan regarding social well- being, community services, and amenities;
- A Child Care Policy that articulates actions to be undertaken by various District departments, and mandates and responsibilities of District partners in creating and sustaining child care in the community;
- Zoning provisions which accommodate child care in all zones within the District;
- A Community Amenity Contribution Policy, which may be used for securing child care facilities or facility improvements through new development;
- A Child Care Grant Program to assist non-profit child care operators;
- Child care facilities in District-owned buildings.

In addition, the District participates on and has played a leadership role for the North Shore Child Care Planning Committee, which promotes collaborative planning for child care issues on the North Shore. Other members include:

- City of North Vancouver;
- District of West Vancouver;
- School Districts 44 and 45;
- North Shore Child Care Resource and Referral Program;
- North Vancouver Recreation Commission;
- North Shore Vancouver Coastal Health; and
- Child care providers and other community partners.

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[2] For more information about these and other initiatives, please refer to the information provided on the Government of British Columbia's website at https://www2.gov.bc.ca/gov/content/family-social-supports/caring-for-young-children

Other Key Players

Several other parties are involved with the planning, development, support, and operation of child care. Examples include First Nations, regional health authorities, child care providers and operators, non-profit organizations, parents, and the broader community.

Vancouver Coastal Health (VCH) plays a key role in regulating child care facilities and ensuring minimum standards are met through their licensing and enforcement programs, which protect and promote the health, safety and well-being of children in licensed child care facilities. Licensed child care facilities must comply with licensing regulations that include health and safety requirements, staff training, staff-to-child ratio, space and equipment and more.

The North Vancouver School District (School District 44) provides comprehensive educational programs, including leasing space for before and after school programs and child care programs. These programs are delivered by licensed providers on school grounds throughout the school district in locations where space is available.

The North Vancouver Recreation Commission (NVRC) provides recreation services and facilities on behalf of the City and District of North Vancouver, including child-minding services at recreation centres for participants in their programs, pre-school programs, and a wide array of recreation services for children. Additional information on these key partners is provided throughout this report.

2.3 Methodological Components and Key Findings

The Child Care Action Plan draws on international research, promising practices, local data, and community stakeholder. The following section provides an overview of the methodological components and key findings which provide the basis for the actions recommended to improve child care in the District.

Key findings are discussed further in Section 4.0 Issues, Goals, & Actions, and provide the rational basis for many of the recommended actions in the plan.

Literature Review

The literature review explored elements and indicators of quality early learning and child care systems, identifying core needs, and opportunities for municipal governments and their partners to more effectively support the delivery of child care. A review of "promising practices," identified a variety of strategies being used to plan for and provide quality child care in other BC municipalities, and across Canada. These include:

- Providing municipal building space (rent-free, reduced lease, or market lease);
- Supporting a child care website or link with information to assist both child care operators and interested parents;
- Providing recreation services that complement licensed child care systems;
- Partnering with school districts to increase the number of before and after school child care spaces on school property; and
- Building partnerships to support collaboration between municipalities and school districts, local organizations, and the provincial government.

Additional findings from the literature review appear in Section 4: Issues, Goals, and Actions. The full literature review, including key findings and discussion of promising practices is provided in Appendix B: Key Findings from Research & Promising Practices.

Local Data

The following community data was collected and analyzed to identify current and future needs in the District of North Vancouver:

- Current and projected population to 2030;
- An inventory of existing child care spaces (2019);
- Child vulnerability indicators;
- Auspice (i.e., for-profit, non-profit, family in-home); and
- Median family incomes of families with children under age six (including lone female families).

Section 3 (Community Profile) presents key data pertaining to child care needs in the District. More comprehensive community data is provided in Appendix C: District of North Vancouver Child Care Action Plan Community Profile.

Stakeholder Consultations

Community engagement was a major component in the development of this plan. Input was collected through the following outreach and consultation efforts, which sought to improve understanding of local child care needs, and develop solutions:

- Child care operators and parent/caregiver surveys (completed in 2019);
- Interviews and focus groups with community partners, First Nations partners, child care providers, District Staff and vulnerable populations; and
- Two "Solutions" workshops in collaboration with the City of North Vancouver (36 participants) and one child care provider workshop (23 participants)

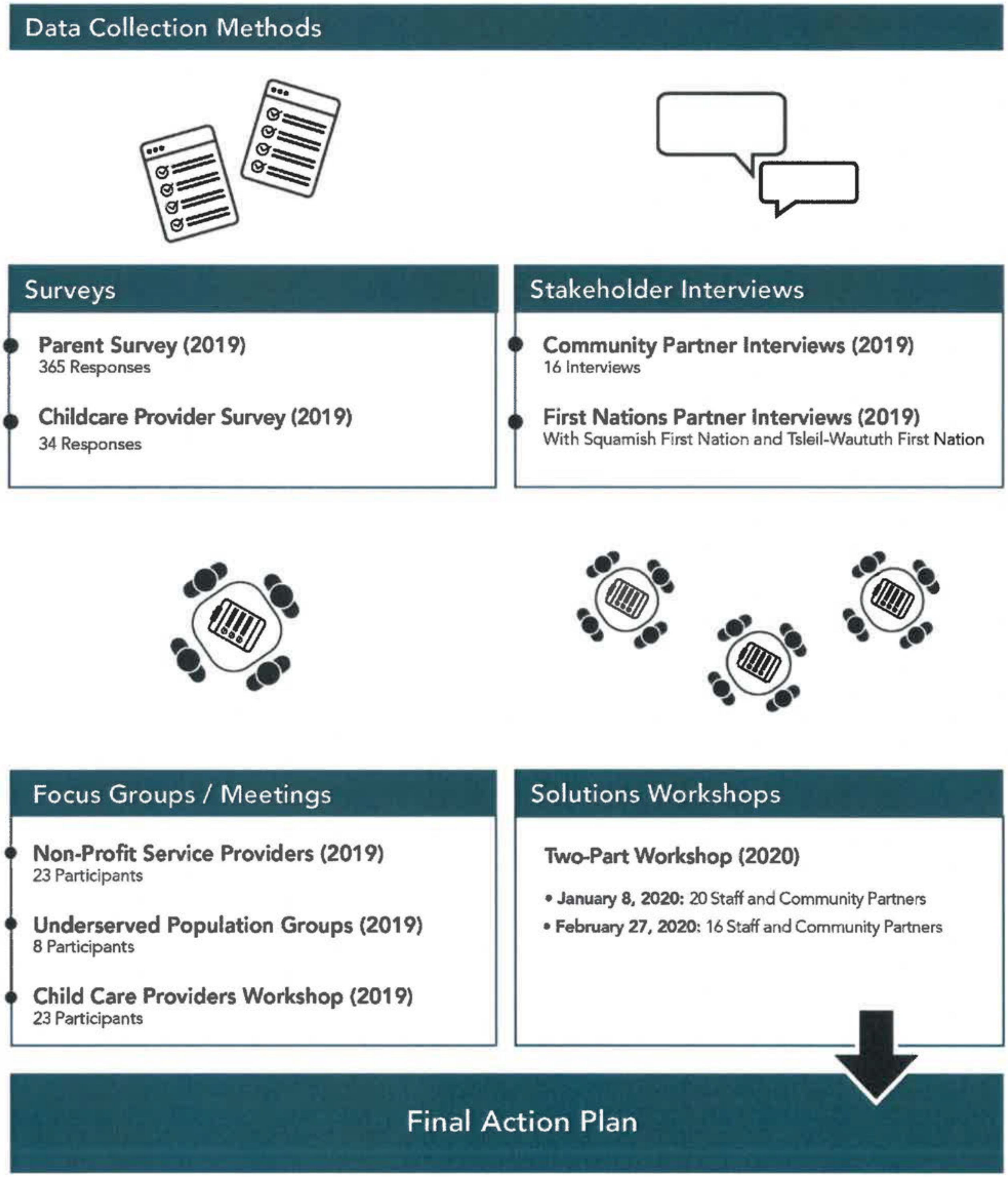
Figure 2, below, provides a snapshot of the broad engagement that was undertaken as part of this plan. While the input from stakeholder consultation was extensive and broad, some of the key findings were:

- Long waitlists make it difficult to find child care that meets the expectations of parents and is geographically located close to home;
- Very few child care operators offer flexible hours of operation to accommodate needs for longer hours, part-time, evenings and weekends;
- Many child care operators are unable to attract or retain qualified staff, especially to care for children under the age of three, and children with special needs;
- Language barriers are common as there are high numbers of non-English speaking families in the District;
- High child care costs present a challenge, particularly for single parents;
- Child care operators often have trouble finding suitable and affordable sites to operate from;
- Solutions workshop participants advocated using public partnerships to provide financial stability and to develop and maintain child care spaces.

> *The waitlist for the child care program at my catchment school is so long that I cannot consider that school as being a place where my child will go. I will have to take her out of catchment to find a school where there is a before and after school child care spot for her. – North Shore Parent, 2019 Parent Survey*

See Appendix D: Stakeholder Consultations for an overview of community engagement.

Figure 2: Public Engagement Summary



Data Collection Methods

Surveys

- **Parent Survey (2019)**
  365 Responses
- **Childcare Provider Survey (2019)**
  34 Responses

Stakeholder Interviews

- **Community Partner Interviews (2019)**
  16 Interviews
- **First Nations Partner Interviews (2019)**
  With Squamish First Nation and Tsleil-Waututh First Nation

Focus Groups / Meetings

- **Non-Profit Service Providers (2019)**
  23 Participants
- **Underserved Population Groups (2019)**
  8 Participants
- **Child Care Providers Workshop (2019)**
  23 Participants

Solutions Workshops

Two-Part Workshop (2020)

- **January 8, 2020:** 20 Staff and Community Partners
- **February 27, 2020:** 16 Staff and Community Partners

Final Action Plan

3.0 COMMUNITY PROFILE

This section provides information about the current state of child care in the District of North Vancouver, by providing local community data, including overall statistics, and some specifics on child care availability, needs and priorities. It also highlights information and commentary from the engagement processes in the areas of access, affordability, quality, and partnerships.

3.1 Current and Projected Population of Children Aged 0-12 Years

In 2016 there was 12,585 children aged 0-12 in the District of North Vancouver (Table 1).

Table 1: Child Population by Child Care Age Group in the District of North Vancouver, 2016

Age Group	# of children	% age of all children 0-12
0-2 -year-olds (infant/toddler)	2,240	18%
3-5 year olds (pre-school age)	2,815	22%
6-12-year-olds (school age)	7,530	60%
Total (0-12 years)	12,585	n/a

Source: Statistics Canada (2016)

In 2030, the time horizon for this Child Care Action Plan, this number is projected to decrease to 11,904[3]. Only children aged 0-2 are projected to increase in this time frame, by 538. Children aged 6-12 are projected to decrease by 1,013 and children aged 3-5 by 206 (Figure 3).

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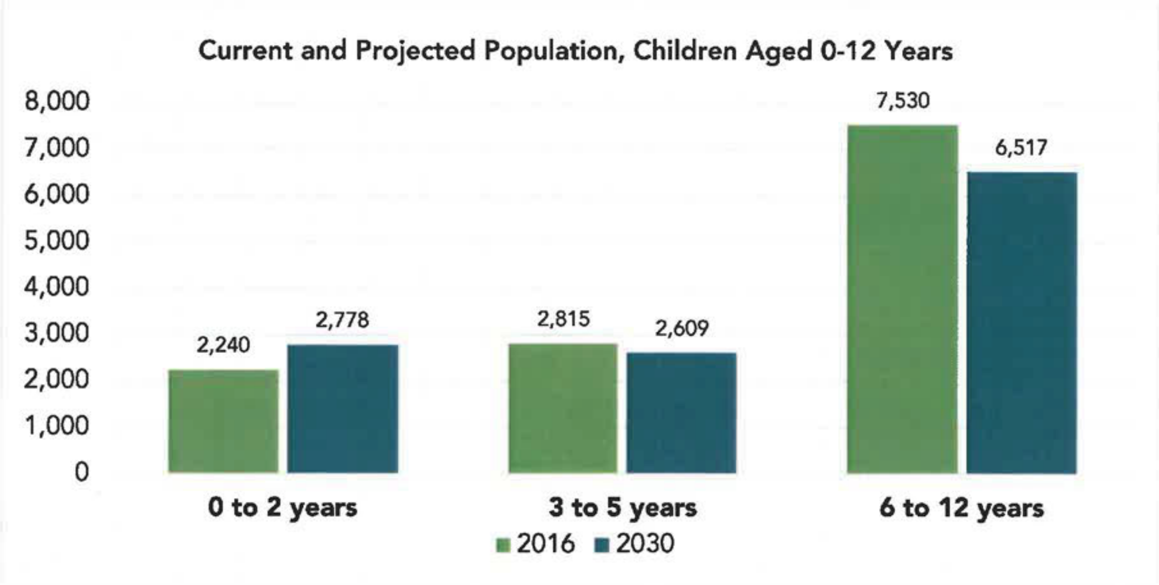
[3] **Source:** Metro Vancouver, 2020

Figure 3: Current and Projected Population, Children Aged 0-12 Years, District of North Vancouver



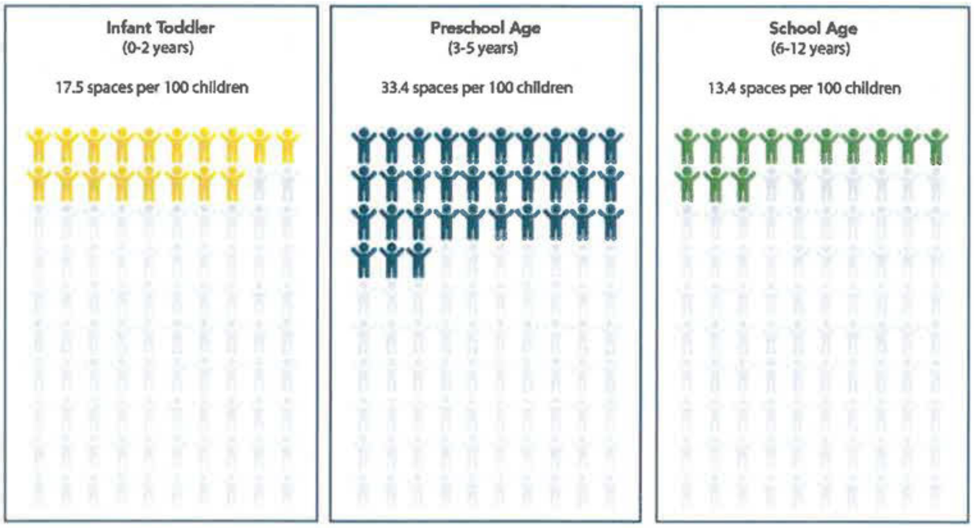
Source: Statistics Canada (2016), and Metro Vancouver (2019)

3.2 Child Care Spaces

In 2019, there were approximately 3,000 licensed child care spaces in the District. This included approximately 2,300 full-time group child care spaces and 700 pre-school and family or in-home child care. Approximately 75% of the spaces are provided in group settings.

Child care spaces are divided into three age groupings: infant toddler (0-2 years old); pre-school age (3-5 years old); and school aged (6-12 years old). Figure 4 shows the District's current ratio of child care spaces per 100 children in each age of these age cohorts.

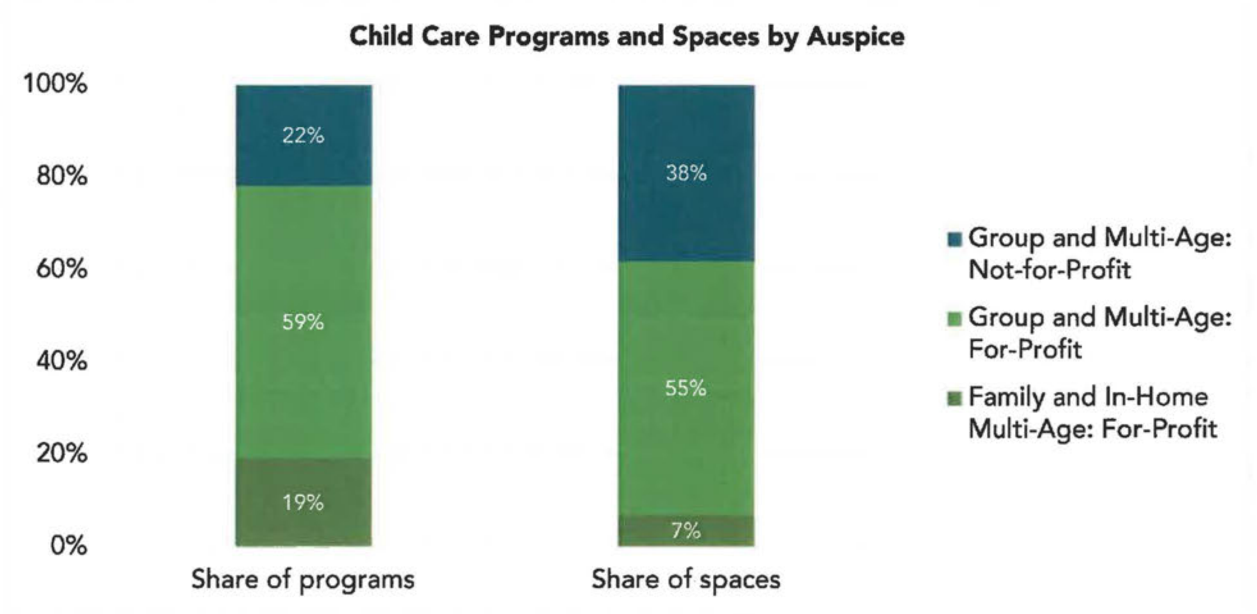
Figure 4: Group Child Care Ratios by Age Cohorts, District of North Vancouver, 2019



Source: Statistics Canada (2016), and Vancouver Coastal Health (2019).

Table 5, below, shows the breakdown of child care programs and spaces in the District by auspice (e.g. who operates and manages programs). Approximately 22% of child care programs are operated by not-for-profit providers, while 78% are managed by for-profit operators. In terms of child care spaces, approximately 38% are managed by not-for-profit operators, while 62% are managed by for-profit operators.

Figure 5: Child Care Programs and Spaces by Auspice, District of North Vancouver



Source: UBCM Child Care Inventory (2019)

Across British Columbia about 50% of the child care facilities are operated on a non-profit or public basis. The District is below this average, with non-profits operating 22% of programs (Table 2).

Table 2: Child Care Programs and Spaces by Auspice, 2019[4]

Service Type and Auspice	Number of Programs	Number of Spaces
Family and In-Home Multi-Age: For Profit	30 (19%)	212 (7%)
Group and Multi-Age: For-Profit	92 (59%)	1,688 (55%)
Group and multi-age: Non-profit	34 (22%)	1,167 (38%)
Total	156	3,067

Source: District of North Vancouver and Vancouver Coastal Health Licensing.

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[4] While the research distinguishes for-profit, non-profit, and public auspice, we felt it was also important to distinguish for-profit group and multi-age care from family and in-home multi-age care

3.3 Child Vulnerability

Child vulnerability and well-being of children on the North Shore are measured using two indices developed by the Human Early Learning Partnership (HELP) at the University of British Columbia (UBC):

1. The Early Development Instrument (EDI), which surveys kindergarten children; and
2. The Middle Years Development Instrument (MDI), which surveys children in Grades 4-7.

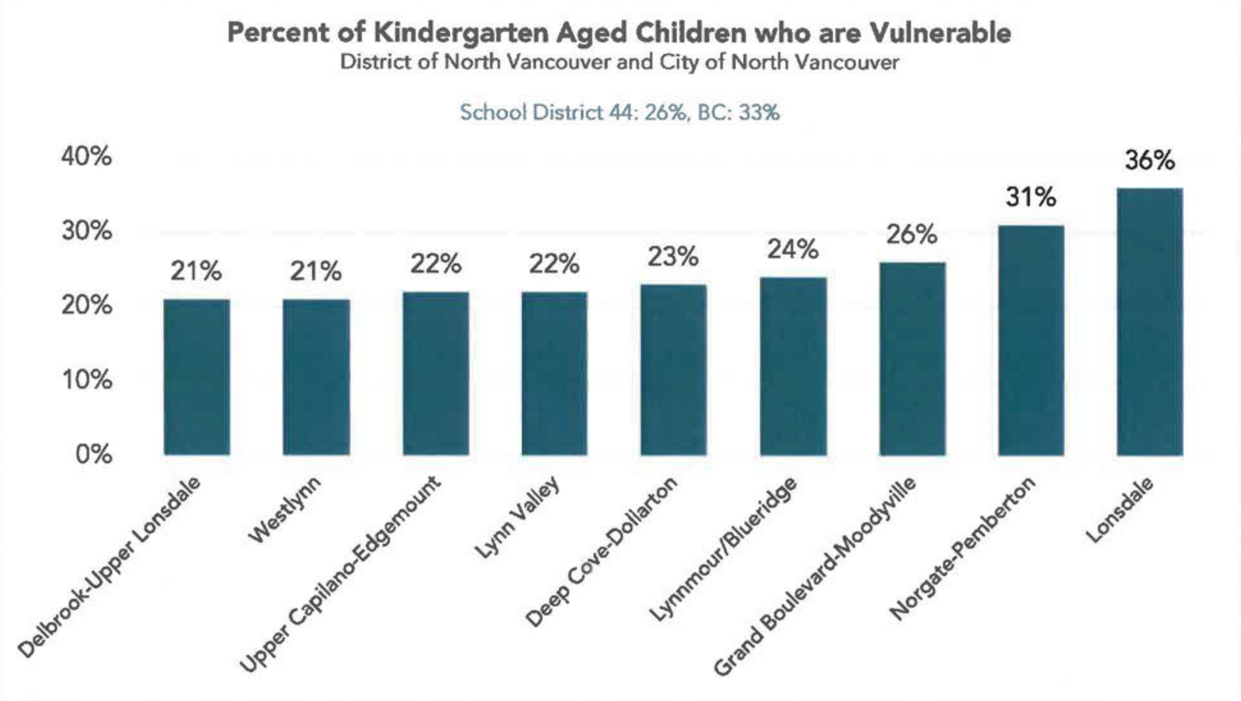
The EDI identifies vulnerable children as those who, without additional support and care, are more likely to experience challenges in their school years and beyond. EDI is measured along five scales: Physical Health & Well-Being, Social Competence, Emotional Maturity, Language & Cognitive Development, and Communication Skills & General Knowledge.

The MDI results are summarized in two indices: the Well-Being Index and the Asset Index. The MDI Well-Being Index combines measures of Optimism, Happiness, Self-Esteem, Absence of Sadness, and General Health to provide a holistic summary of children's mental and physical health. Index scores are reported by three categories: high well-being or thriving, medium well-being, and low well-being.

A complete description of both instruments and findings from the EDI and MDI can be found at http://earlylearning.ubc.ca.

2019 EDI survey results indicate 26% of children in North Vancouver (School District 44) are considered vulnerable. While this is lower than the average scores for BC as a whole (33%), it is concerning that one in four kindergarten children on the North Shore are in need of additional support and care. Within North Vancouver, vulnerability scores were lower in District of North Vancouver neighbourhoods than in the City of North Vancouver, as shown in Figure 6.

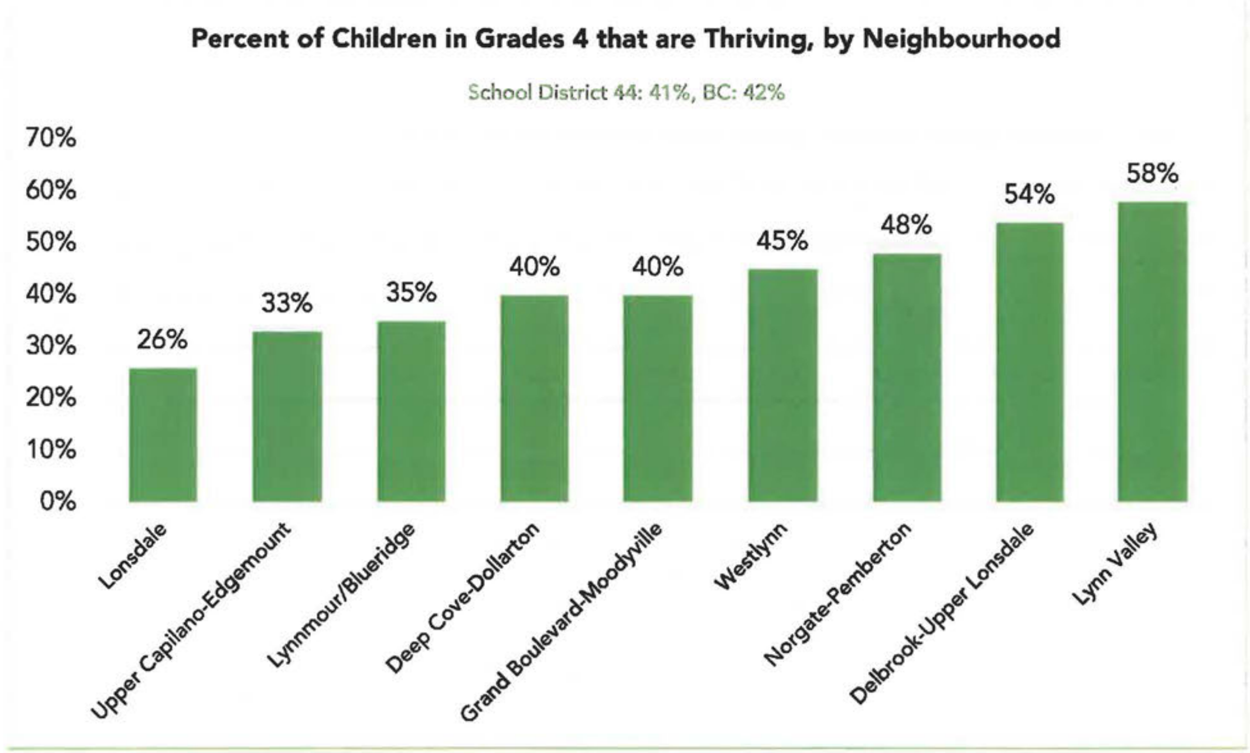
Figure 6: Percent of Kindergarten Aged Children who are Vulnerable, by Neighbourhood



Source: Early Development Instrument (EDI) Wave 7 (2019)

MDI measures of Grade 4 children in North Vancouver from the 2018/19 school year showed 41% of North Vancouver fourth graders as thriving, versus 42% for the province as a whole. The scores varied widely among North Vancouver neighbourhoods, from 26% in Lonsdale to 58% in Lynn Valley.

Figure 7: Percent of Children in Grade 4 that are Thriving, by Neighbourhood

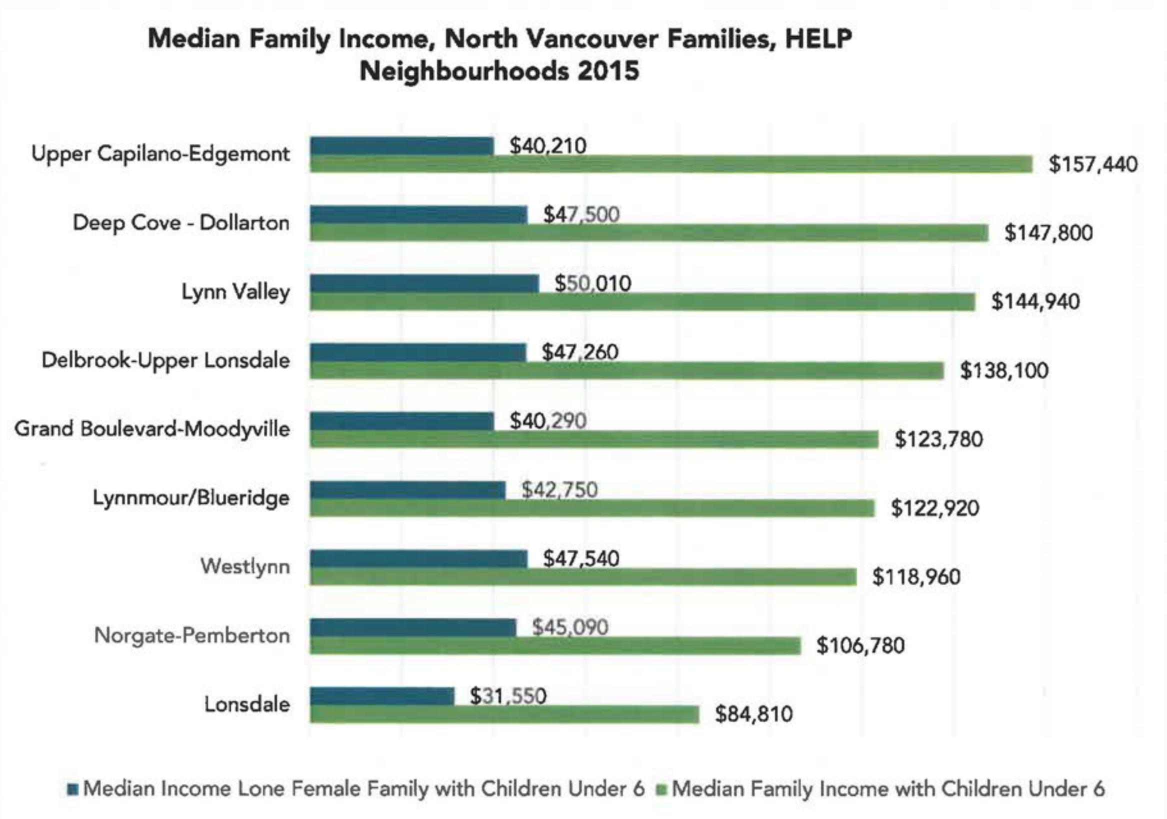


Source: Middle Years Development Index (2018/2019)

3.4 Child Care Costs

Child care costs can be a driver of poverty, and tend to have greater impacts on lone parent families. In the District, median family incomes for lone female parent families with children under six ranges from less than half to nearly one fifth of the median family income in some neighbourhoods. As part of their work in tracking child vulnerability in BC, HELP provides income data for school catchment areas.

Figure 8: Median Family Income, North Vancouver Families, HELP Neighbourhoods 2015



Source: Human Early Learning Program, 2015

A 2018 survey of child care costs identified average monthly child care costs, by facility type and age group, for the North Shore as shown in Table 3.

Table 3: North Shore Child Care Costs (2018)[5]

Facility Type	Infant	Toddler	3-5 Years	School Age
Family Child Care	Not Provided	$1100	$1059	Not Provided
Group Child Care	$1149	$1039	$949	$547

Source: North Shore Resources and the North Shore Child Care Resource and Referral Service

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[5] This survey was conducted prior to the Province's child care fee reduction initiative being implemented, which has a direct impact on monthly fees. As such, these numbers likely do not accurately reflect the current cost of child care in the District of North Vancouver.

4.0 ISSUES, GOALS, AND ACTIONS

This section presents key issues and recommended actions to achieve four strategic goals:

1. Increase access to child care;
2. Improve affordability;
3. Focus on quality; and
4. Strengthen partnerships.

Key issues related to each goal are identified and discussed below in the context of current and future community needs, as indicated by local data and through community consultation. These are followed by specific actions intended to improve the provision of child care in the District.

Many of the recommended actions build on existing process and guidance already embedded in the District's existing Child Care Policy, which is foundational to the Child Care Action Plan. Recommended actions include updates to the Child Care Policy to bolster existing work and further support child care as a priority for the District.

4.1 Goal 1: Increase Access to Child Care

The first goal works toward ensuring all families can access child care. Major issues affecting access to child care in the District include:

- Lack of spaces;
- Location of spaces; and
- Hours of operation.

Lack of Spaces

Lack of available child care spaces is a national problem that is more acute within BC and the Lower Mainland, where just over 18 spaces per 100 children are provided. Table 4, below, compares the ratio of child care spaces per 100 children at national, provincial, and regional levels.[6]

Table 4: Comparison of Child Care Spaces per 100 Children

	Canada	BC	Metro Vancouver
Child care spaces per 100 children	27	18	18

Source: Metro Vancouver

The pre-school age group (3-5 year-olds) had the most child care spaces per capita, with 34 spaces per 100 children as shown in Table 5. In contrast, there were 18 spaces per 100 infant/toddlers (aged 0-2), and 14 spaces per 100 school-aged children (aged 6-12).

Table 5: Child Care Spaces by Type in the District of North Vancouver (2019)

Age Group	# of children	% age of all children 0-12	Childcare type	Number of Spaces	Spaces per 100 children
0-2 -year-olds	2240	18%	Group (birth to 36 months)	393	18
3-5 year olds	2815	22%	Group (30 months to school age)	940	34 (excluding pre-school)[7]
6-12-year-olds	7530	60%	Group (school age)	1,010	14
General	n/a	n/a	All others (including preschool)	724	n/a
Total 0-12 years	12,585	n/a	Total Child Care Spaces	3,067	

Source: District of North Vancouver Child Care Inventory (2019) and Stats Canada (2016)

Current and Projected Population

Projections for infant/toddlers are expected to increase by 538 kids to 2030. This suggests a greater need for infant/toddler spaces in the future. Existing shortages in pre-school and school-aged populations also mean that additional spaces are needed to serve these groups, despite projected population declines in these cohorts.

Space Needs and Targets

Identifying clear targets for the provision of new child care spaces will allow the District to better estimate and plan for the allocation of resources needed to meet future community child care needs. In the absence of Federal or Provincial direction on space targets, or widely accepted standards, District staff worked with the consultant and local partners to develop targets which take into account projected population growth and family employment rates.

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[6] Child care space numbers are rounded up

[7] Preschools typically operate on the school-year (September to June). Most preschool programs run from one to four hours a day

As a result, approximately 2,055 new licensed spaces are recommended over the next 10 years[8]. These would be divided between the three child care service age groups, as follows:

- Infant/toddler (under 3 years) space target: 528 new spaces (33/100 children);
- Pre-schoolers (3-5 years) space target : 375 new spaces (50/100 children); and
- School-aged (6-12 years) space target: 1,152 new spaces (33/100 children)

The above targets are based on a 2030 population projection for school aged children in the entire District. They may thus be used as both district-wide and neighbourhood level planning tools.

Detailed space creation targets, including interim targets, are provided in Section 5: Implementation.

Table 6 provides a breakdown of the child care space needs by age group.

Table 6: 2030 Child Care Space Needs by Age Group

Age Group	Existing spaces	Existing spaces/ children	Population (2030)	2030 Targets (spaces/children)	needed spaces	Total spaces (2030)
0-2 (infant/toddler)	393	18/100	2,778	33/100	528	921
3-5 (pre-school)	940	34/100	2,609	50/100	375	1,315
6-12 (school-age)	1,010	14/100	6,517	33/100	1,152	2,192
Total	2,343		11,904		2,055	4,398

Location of Spaces

The provision of day care spaces near populations that rely on these services is an important indicator of access to child care. This is confirmed by surveyed parents who identified a preference to have child care facilities close to home.

Analysis of the distribution of existing day care spaces in the District revealed the following:

- There are limited infant-toddler group child care spaces in the two most populated neighbourhoods, Lynn Valley (8 spaces per 100 children) and Seymour (7 spaces per 100 children). By contrast, Lower Capilano has 57 spaces per 100 children;
- The ratio of available school-age care spaces to children is low in all neighbourhoods, ranging from 0/100 in Lower Lynn to 24/100 in North Lonsdale-Delbrook. However, Maplewood has 54 spaces per 100 school-aged children; and
- On average, District neighbourhoods have good numbers of group child care spaces for children aged 30 months to school age, ranging from 20/100 in Seymour to 107/100 in Maplewood, with an average of 33 spaces per 100 children. This is consistent with the pattern across Metro Vancouver and BC, where pre-school spaces are generally more abundant.

Table 7 presents the number of group child care spaces versus the number of children (by age group) in each planning neighbourhood[9]. This provides a baseline estimate of where additional spaces may be most needed. Maps 1, 2, and 3 reflect this data.

The following table and maps provide a snapshot of how each neighbourhood measures up against 2030 space targets. This may be useful, in combination with future growth and development projections in determining where additional spaces might be pursued.

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[8] An additional 320 child care spaces are currently in the planning or development review process.

[9] "Planning neighbourhoods" consolidate smaller neighbourhoods into larger planning areas.

Table 7: Spaces per Type by Neighbourhood

Area	Group Child Care: Infant-Toddler (under 3 years old)			Group Child Care: Pre-School (2.5 years to school age)			Group Child Care: School Age (6 to 12 years)		
	# children	# spaces	Spaces per 100	# children	# spaces	Spaces per 100	# children	# spaces	Spaces per 100
Lower Capilano	210	119	57	230	181	79	580	57	10
Lower Lynn	90	12	13	115	25	22	300	-	0
Lynn Valley	675	52	8	820	231	29	1920	227	12
Lynnmour / Inter-River	115	36	31	125	64	51	275	30	11
Maplewood	75	24	32	60	64	107	190	103	54
North Lonsdale - Delbrook	250	84	34	290	129	45	915	220	24
Seymour	525	36	7	730	146	20	1910	252	13
Upper Capilano	300	30	10	445	100	23	1440	121	8
Total	2240	393	18	2815	940	33	7530	1,010	13

Source: District of North Vancouver Child Care Inventory (2019), and Statistics Canada (2016)

Infant/Toddler Space Needs

By 2030, the number of infant/toddler population is projected to increase by 538, to 2,778 across the District. As shown in Map 1, North Lonsdale-Delbrook and Lower Capilano are better served with spaces in this age category.

Lynn Valley, Seymour, Lower Lynn, and Upper Capilano are currently not well supplied with infant/toddler spaces. To meet the 2030 target of 33 spaces per 100 children, more spaces will be needed.

Lynnmour/Inter-River and Maplewood fall just below the target, with 31 and 32 spaces per 100 children, respectively.

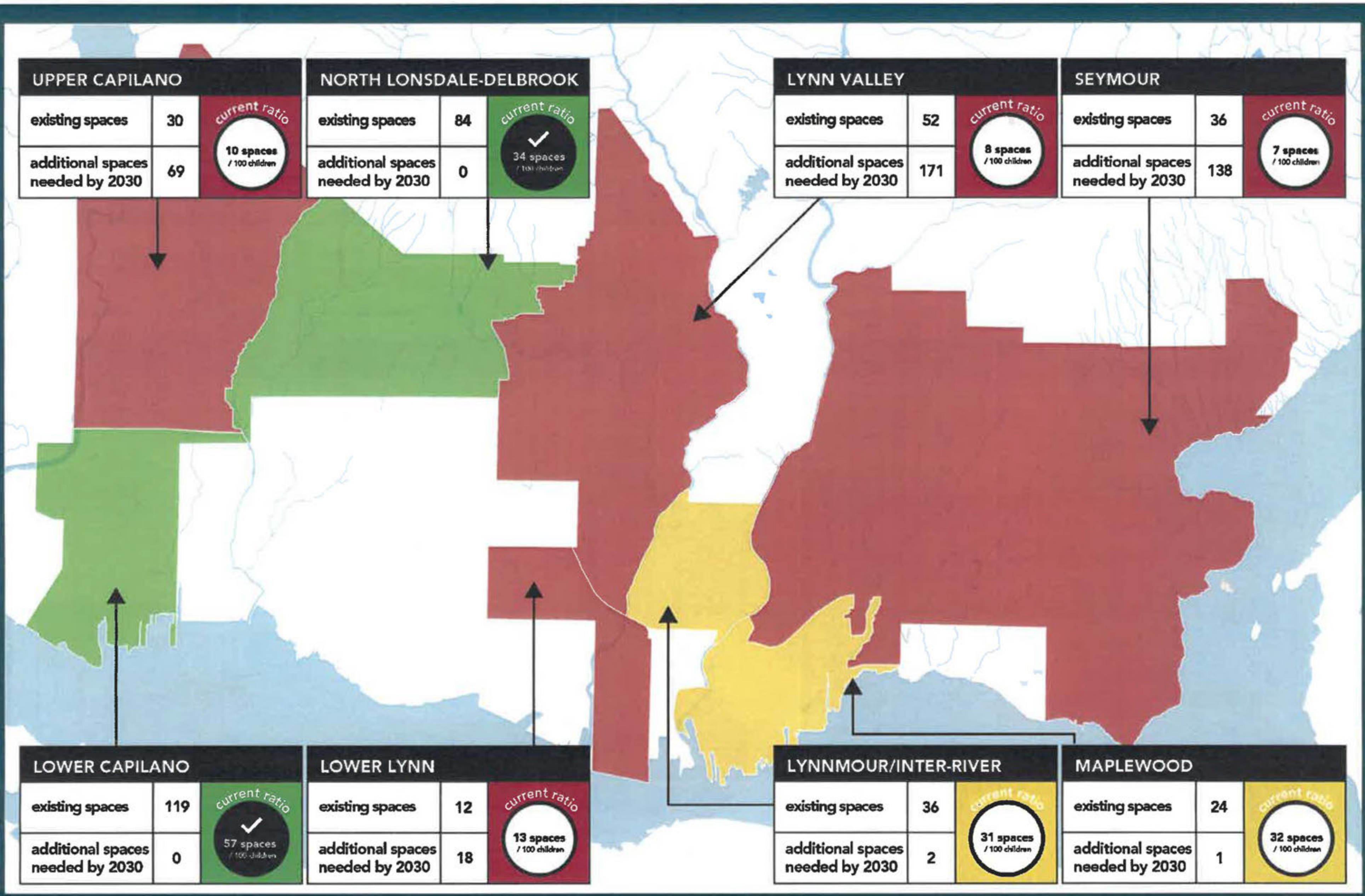
Pre-School Space Needs

The number of pre-school aged children in the District is expected to decline by 206, to 2,609 children by 2030. As shown in Map 2, Lower Capilano, Lynnmour/Inter-River, and Maplewood currently have spaces that would meet anticipated future demand in this age cohort to 2030. North Lonsdale-Delbrook is near the target, with 44 spaces per 100 children.

Upper Capilano, Lower Lynn, Lynn Valley, and Seymour are under-served; each having around half the number of spaces needed to meet 2030 targets of 50 spaces per 100 children.

School-Aged Space Needs

The number of school-aged children in the District is expected to decline by 1,013, to 6,517 children by 2030. As shown in Map 3, only Maplewood currently has enough spaces that would meet the targeted ratio of 33 spaces per 100 children in this age group. All other neighbourhoods would be significantly underserved.



UPPER CAPILANO

existing spaces	30	current ratio 10 spaces / 100 children
additional spaces needed by 2030	69	

NORTH LONSDALE-DELBROOK

existing spaces	84	current ratio ✓ 34 spaces / 100 children
additional spaces needed by 2030	0	

LYNN VALLEY

existing spaces	52	current ratio 8 spaces / 100 children
additional spaces needed by 2030	171	

SEYMOUR

existing spaces	36	current ratio 7 spaces / 100 children
additional spaces needed by 2030	138	

LOWER CAPILANO

existing spaces	119	current ratio ✓ 57 spaces / 100 children
additional spaces needed by 2030	0	

LOWER LYNN

existing spaces	12	current ratio 13 spaces / 100 children
additional spaces needed by 2030	18	

LYNNMOUR/INTER-RIVER

existing spaces	36	current ratio 31 spaces / 100 children
additional spaces needed by 2030	2	

MAPLEWOOD

existing spaces	24	current ratio 32 spaces / 100 children
additional spaces needed by 2030	1	

Map 1:

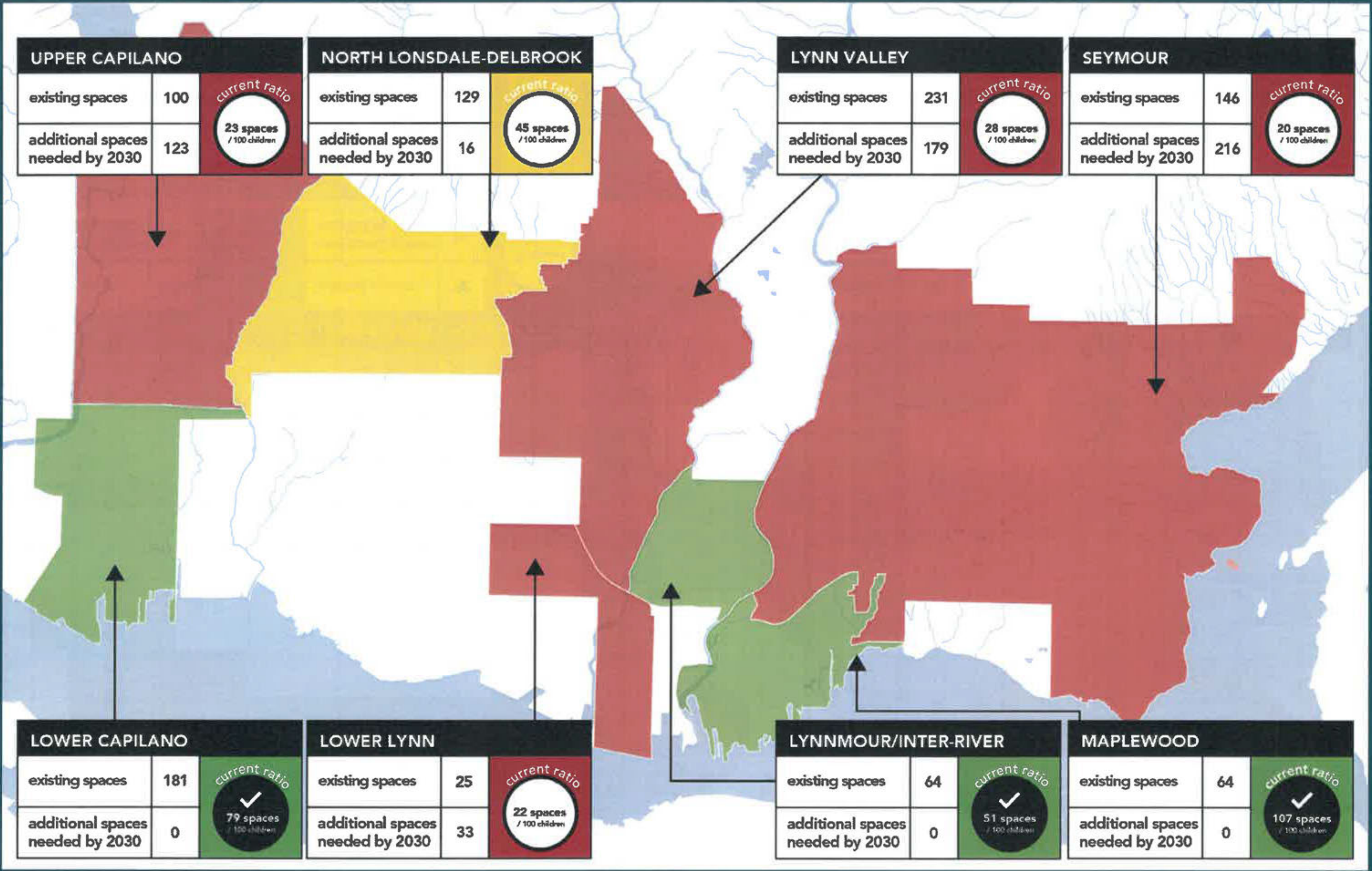
Existing and Projected Child Care Spaces and Targets by Neighbourhood (Infant/Toddlers, Age 0 to 2)

District of North Vancouver Childcare Inventory (2019)

DISTRICT-WIDE TARGET : 33 SPACES / 100 CHILDREN

LEGEND

🔴	Neighbourhood Does Not Meet 2030 Target for Age Group (0 spaces / 100 children to 30 spaces / 100 children)
🟡	Neighbourhood Is Nearing 2030 Target for Age Group (30 spaces / 100 children to 33 spaces / 100 children)
🟢	Neighbourhood Exceeds 2030 Target for Age Group (greater than 33 spaces / 100 children)



UPPER CAPILANO

existing spaces	100	current ratio 23 spaces / 100 children
additional spaces needed by 2030	123	

NORTH LONSDALE-DELBROOK

existing spaces	129	current ratio 45 spaces / 100 children
additional spaces needed by 2030	16	

LYNN VALLEY

existing spaces	231	current ratio 28 spaces / 100 children
additional spaces needed by 2030	179	

SEYMOUR

existing spaces	146	current ratio 20 spaces / 100 children
additional spaces needed by 2030	216	

LOWER CAPILANO

existing spaces	181	current ratio ✓ 79 spaces / 100 children
additional spaces needed by 2030	0	

LOWER LYNN

existing spaces	25	current ratio 22 spaces / 100 children
additional spaces needed by 2030	33	

LYNNMOUR/INTER-RIVER

existing spaces	64	current ratio ✓ 51 spaces / 100 children
additional spaces needed by 2030	0	

MAPLEWOOD

existing spaces	64	current ratio ✓ 107 spaces / 100 children
additional spaces needed by 2030	0	

Map 2:

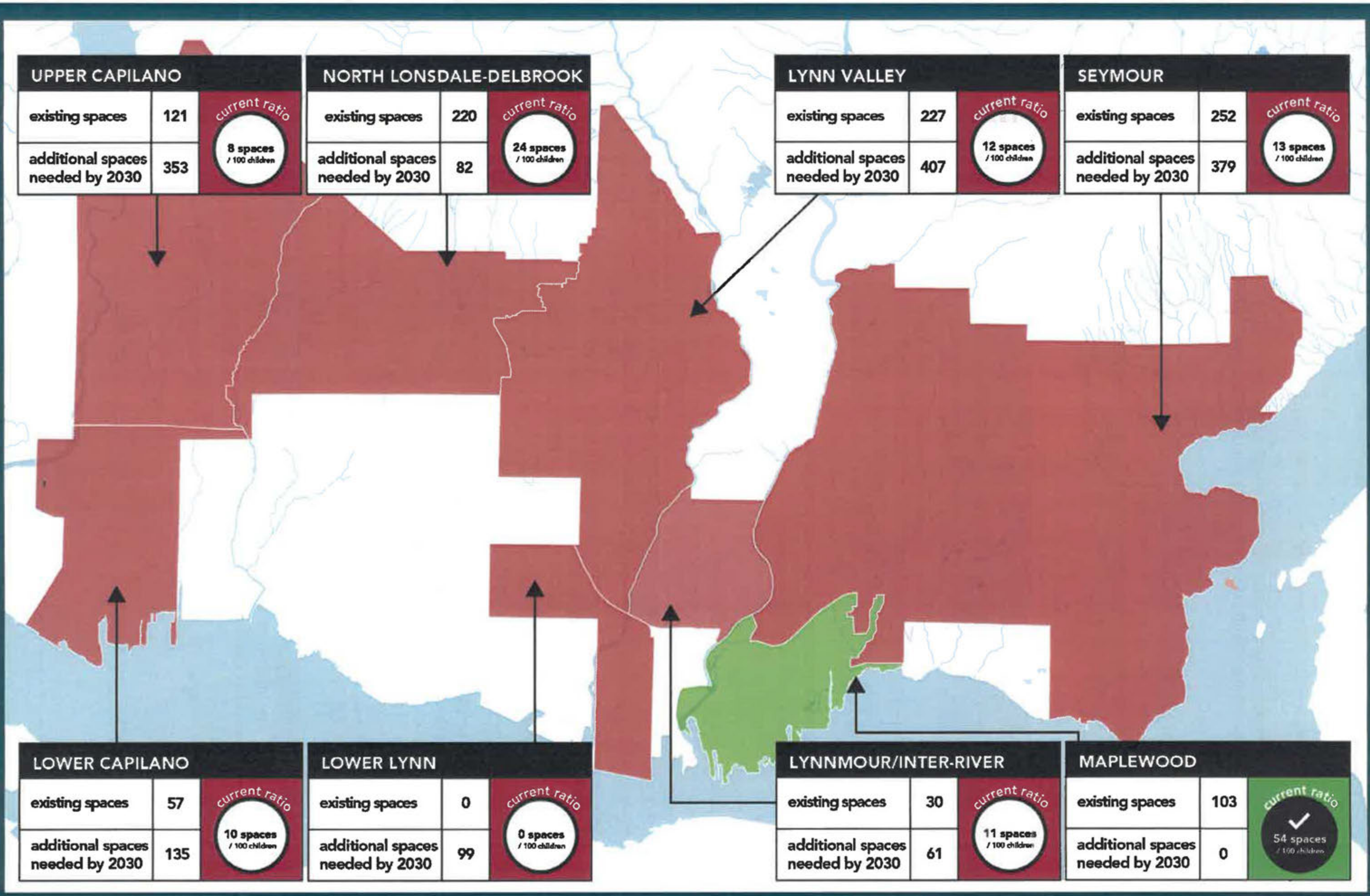
Existing and Projected Child Care Spaces and Targets by Neighbourhood (Pre-School, Age 3 to 5)

District of North Vancouver Childcare Inventory (2019)

DISTRICT-WIDE TARGET : 50 SPACES / 100 CHILDREN

LEGEND

🟥	Neighbourhood Does Not Meet 2030 Target for Age Group (0 spaces / 100 children to 45 spaces / 100 children)
🟨	Neighbourhood Is Nearing 2030 Target for Age Group (45 spaces / 100 children to 50 spaces / 100 children)
🟩	Neighbourhood Exceeds 2030 Target for Age Group (greater than 50 spaces / 100 children)



UPPER CAPILANO

existing spaces	121	current ratio 8 spaces / 100 children
additional spaces needed by 2030	353	

NORTH LONSDALE-DELBROOK

existing spaces	220	current ratio 24 spaces / 100 children
additional spaces needed by 2030	82	

LYNN VALLEY

existing spaces	227	current ratio 12 spaces / 100 children
additional spaces needed by 2030	407	

SEYMOUR

existing spaces	252	current ratio 13 spaces / 100 children
additional spaces needed by 2030	379	

LOWER CAPILANO

existing spaces	57	current ratio 10 spaces / 100 children
additional spaces needed by 2030	135	

LOWER LYNN

existing spaces	0	current ratio 0 spaces / 100 children
additional spaces needed by 2030	99	

LYNNMOUR/INTER-RIVER

existing spaces	30	current ratio 11 spaces / 100 children
additional spaces needed by 2030	61	

MAPLEWOOD

existing spaces	103	current ratio ✓ 54 spaces / 100 children
additional spaces needed by 2030	0	

Map 3:

Existing and Projected Child Care Spaces and Targets by Neighbourhood (School-Age, Age 6-12)

District of North Vancouver Childcare Inventory (2019)

DISTRICT-WIDE TARGET : 33 SPACES / 100 CHILDREN

LEGEND

🟥 Neighbourhood Does Not Meet 2030 Target for Age Group
(0 spaces / 100 children to 30 spaces / 100 children)

🟨 Neighbourhood Is Nearing 2030 Target for Age Group
(30 spaces / 100 children to 33 spaces / 100 children)

🟩 Neighbourhood Exceeds 2030 Target for Age Group
(greater than 33 spaces / 100 children)

Hours of Operation

Over 75% of District residents work outside the municipality and may require longer hours of child care service each day. Very few facilities have non-traditional hours, which poses challenges for parents who work non-standard hours.

Recommended Actions to Improve Access to Child Care

The 15 actions in Table 8 are recommended to address the issues described above to improve access to child care. Each of the following actions are categorized as short, medium, long-range or on-going, and accompanied by external partners who may be involved in the work.

Table 8: Recommended Actions to Improve Access to Child Care

Recommended Actions to Improve Access to Child Care	Time frame	External Partners
Policy		
1. **Update the Child Care Policy to include additional supporting language:** • A stronger commitment to 'quality', including consideration of design requirements that exceed the Provincial regulation minimums for District- owned or facilitated spaces; • Investigate a statement that encourages locating child care in civic facilities and parks, with appropriate conditions, and consideration of opportunities to add child care to projects involving replacement, major renovation or construction of a District Facility.	Short	None
2. **Endorse the following space creation targets to help guide child care planning efforts** and achieve **approximately 2,055 new group child spaces by 2030:** • **Infant/toddler (under 3 years): 33/100 children (528 new spaces);** • **Pre-schoolers (3-5 years): 50/100 children (375 new spaces); and** • **School-aged (6-12 years): 33/100 children (1,152 new spaces)**	Short/ Medium/ Long	Child Care Providers, School District, NVRC, Developers
3. **Continue to explore opportunities to prioritize child care as a part of new developments in the town and village centres, and as part of new affordable housing developments.**	Ongoing	Developers, BC Housing, Non-profit housing and service providers
4. **Continue to leverage District assets by including child care in new or expanded civic facilities or parks, as possible and with appropriate conditions.**	Ongoing	None
District Tools & Resources		
5. **Consider the benefits of dedicating one District staff position as the point person for child care,** including: • Assisting applicants with District processes; • Coordinating and exploring partnerships and opportunities for expansion of child care service with municipal projects, and external partners, including SD44, CNV, BC Housing.	Short/ Medium	None

Recommended Action to Improve Access to Child Care	Time Frame	External Partners
District Tools & Resources		
6. **Create an inventory of District assets and other public or underutilized spaces that could be repurposed or developed for child care.**	Short/ Medium	Vancouver Coastal Health, School District, non-profit child care providers, post-secondary institutions and other not-for-profits
7. **Improve the District's child care webpage by providing concise and easy to use information for prospective child care operators and families looking for child care. This would include:** • **Relevant policies, regulations and by-laws;** • Links to external and senior government resources.	Short	None
8. **Develop building models and high level cost estimates to facilitate new child care on District sites and response to grant opportunities.**	Short	None
Regulatory & Processing Changes		
9. **Review relevant District Bylaws to ensure child care provisions are coordinated and aligned.** • This will include a review of parking regulations which were identified as a barrier to establishing new facilities	Short	Child care providers, Vancouver Coastal Health.
10. **Put non-profit child care applications at the front of the queue for processing.**	Short	None
New Programs		
11. **Collaborate with external partners to explore additional after-school programs** to support children aged 10-12 whose needs are not specifically addressed by school aged licenced child care spaces.	Medium	VCH, North Vancouver District Public Library staff, NVRC, non-profit sector, School District
12. **Collaborate with external partners to explore offering longer hours, non-traditional hours, and/or flexible hours.**	Medium	Province, VCH, Non-profit providers, **with the North Shore Child Care Planning Committee**
Collaboration & Partnerships		
13. **Continue dialogue with First Nations on the North Shore, focusing on meeting the needs of Indigenous families and children.**	**Ongoing**	**Squamish Nation and Tsleil-Waututh Nation**
14. **Work with the NVRC in an effort to support the provision of child care spaces, preschool programs, and after school care in recreation and culture facilities.**	**Medium/ Long**	**NVRC**
15. **Look for opportunities to access Provincial Capital funding to build child care spaces.**	Short/ Medium	**Province, NRCC, Non-profit operators**

4.2 Goal 2: Improve Affordability

Child care is expensive, and is often the determining factor in many families' child care enrolment decisions. Child care costs can be a driver of poverty, and typically have greater impact on lone parents, low income families, families with multiple children, recent immigrants, families with children with special needs, foster families, and families where parents do shift work.

Stakeholder feedback received as part of the Child Care Action Plan community engagement process confirmed affordability is a major concern among District parents and caregivers. For people who are single parents, are immigrants/newcomers or have children with special needs, the challenges associated with finding and paying for child care are exacerbated.

> *"If I choose daycare I choose poverty. If I don't' work I choose poverty. I can't get ahead." – North Shore Parent, 2019 Parent Survey*

Single parents noted that it is very difficult to stay out of poverty while trying to pay for child care. Respondents mentioned reliance on a line of credit, living in crowded spaces [to save on rent], and relying on families or informal care to support their child care needs. The child care subsidy and income assistance from the Province helps, but it typically is not enough to meet the actual need.

Child care providers also identified affordability challenges, including lack of affordable sites to operate from, lack of income to afford paying good wages to high-quality staff or staff with the skills to support children with special needs.

Recommended Actions to Improve Affordability

The following actions are intended to improve child care affordability:

Table 9: Recommended Actions to Improve Affordability

Recommended Actions to Improve Affordability	Time Frame	Partners
1. **Consider reducing or waiving application fees for non-profit child care providers.**	Short	None
2. **Continue to lease safe and suitable District space to non-profit child care providers at below-market and affordable lease rates** (such as $1/year).	Ongoing	Non-profit providers
3. **Continue to deliver the current Child Care Grant Program,** which provides grants to non-profit child care providers to assist them with facility improvements, flexible/non-traditional hours and out-of-school care.	Ongoing	Non-profit providers
4. **Continue to lobby senior governments for increased funding for child care, and increased remuneration for child care workers.**	Ongoing	NS Child Care Committee

4.3 Goal 3: Focus on Quality

High quality child care is linked to positive outcomes for children, while poor quality care can have negative long-term effects. One of the greatest challenges for parents, in addition to the basic lack of available spaces close to home, is the lack of quality services.

Child care providers cite a limited supply of qualified staff as a major challenge to providing high quality care. Staff with training and skills to work with children with special needs and with children under three years old are in especially short supply.

> *"I am broken hearted because I want my son to be safe but I don't think he always is…" – North Shore Parent, 2019 Parent Survey*

Elements of Quality Child Care Systems
Eight elements are associated with quality child care systems:

1. **Ideas.** Strong conceptual framework and values for the system;
2. **Governance.** Clear roles and responsibilities; public management of the system; program delivery at local level; and parent involvement;
3. **Infrastructure.** Coordinated program administration; policy development; regulation and monitoring; and quality improvement mechanisms;
4. **Planning and policy development.** Clear strategy for system-wide planning and implementation; and evidence-informed;
5. **Financing.** Adequate, sustained public investment; core/base funding; Capital funding; and affordable parent fees;
6. **Human resources.** Qualified, well-supported staff at all levels of the system; ongoing training for supervisors and program staff; and good wages and working conditions;
7. **Physical environment.** Well-designed and equipped program settings; and sufficient indoor and outdoor spaces; and
8. **Data, research, and evaluation.** Continuous evaluation; and collection and analysis of key information. [10]

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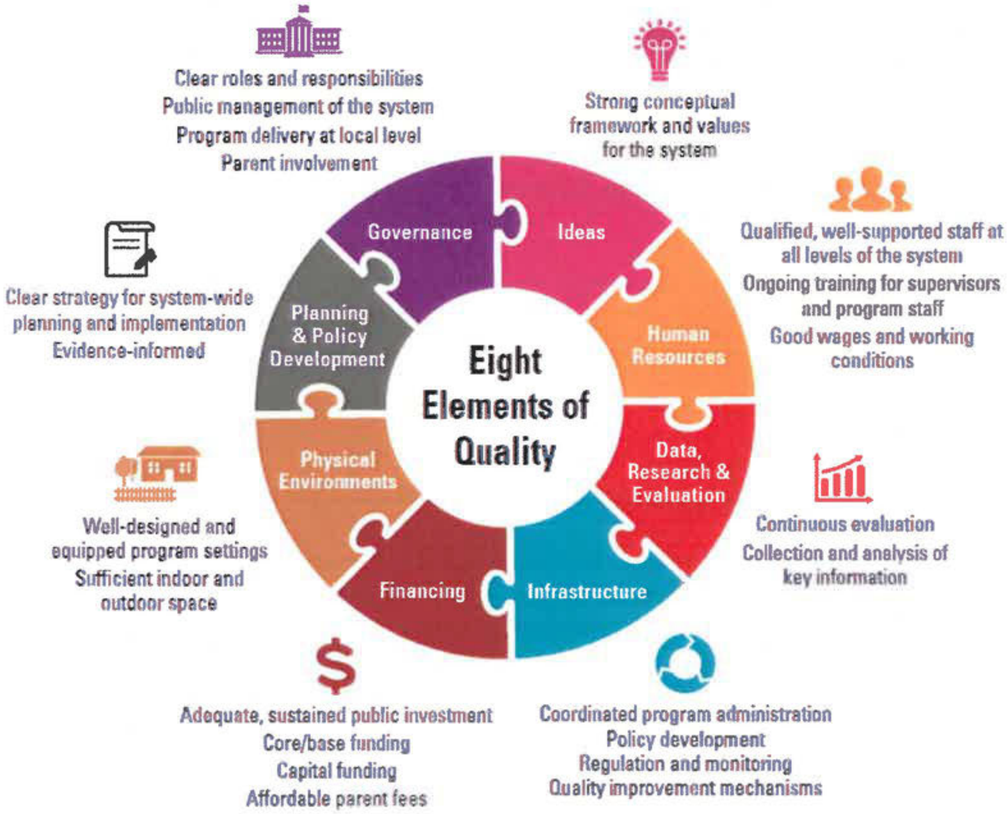
[10] Friendly, M., & Beach, J. (2005). High quality early learning and child care system. *Child Resource and Research Unit, 1-8.*

Figure 9: Eight Elements of a Quality Child Care System



Source: Martha Friendly and Jane Beach, (2005). Elements of a high quality learning and child care system.

Indicators of Quality Child Care Programs

The following indicators are supportive of quality child care provision at the program level:

- Reporting of positive relationships – between families and providers, among colleagues, and between children and staff;
- Staff have higher levels of education and training, feel appreciated, and are well-supported;
- Planned programming and a strong curriculum that is tailored to meet the diverse needs of children; and
- Well-designed indoor/outdoor space is critical to supporting the development of children under five.

In order to facilitate the quality criteria identified, special attention should be paid to staff:

- Staff should have ECE (Early Childhood Education) training;
- At least some staff should have special needs and cultural/ESL skills if required;
- Wages should be decent and commensurate with the level of training;
- There should be written policies and formal procedures which give staff a feeling of worth and certainty, such as: job descriptions, contracts, salary schedule, performance reviews, and a staff manual.

Child Care Auspice (For-Profit vs. Non-Profit & Public Operators)

Child care auspice is critically important to the quality of child care programs. In BC (and Canada), we have three types of child care auspices:

1. Non-profit;
2. For-profit; and
3. Publicly operated (i.e. services directly operated by a public entity such as a local government or school district).

For-profit child care centres consistently perform lower on global evaluation scales compared to non-profit and publicly operated centres. Research has shown that some for-profits provide less teaching support, lower salary schedules, fewer staff policies, limited job performance appraisals, and limited grievance procedures, compared to non-profit centres. In British Columbia, for-profit centres have been found to be more likely to close than non-profit centres. These factors can contribute to lower workplace morale and high staff turnover, negatively impacting quality of care.

Recommended Actions to Focus on Quality

The following actions will assist in promoting and influencing the quality of child care:

Table 10: Recommended Actions to Focus on Quality

Recommended Actions to Focus on Quality	Time Frame	Partners
1. **Support the Province in its "Early Care and Learning Recruitment and Retention Strategy" initiative through joint advocacy.**	Short	City of North Vancouver, District of West Vancouver, Non-profit providers, School District
2. **Apply the following guidelines when creating new child care facilities on District-owned land:** • Operation by a non-profit child care provider; • Location, space and design expectations which meet or exceed minimum Provincial standards for indoor and outdoor space; • Consider shared facilities where there may be synergies between other services and infrastructure.	Short/ Medium	VCH, Non-profit providers, Child Care Planning Committee
3. **Increase the number of licensed, non-profit, publicly funded child care operations** in the District through incentives noted above (e.g. reduced fees, priority processing, etc.) and other recruitment strategies.	Long	Province, Non-profit providers

4.4 Goal 4: Strengthen Partnerships

Providing high quality child care requires collaboration between many parties. Joint advocacy is needed around child care needs on the North Shore to senior levels of government.

Stakeholder engagement identified several partnership opportunities for the District to explore:

- Partner with the School District, post-secondary institutions, and hospitals to explore potential use of public lands and facilities to create more child care spaces.
- Partner with seniors centres and large employers to provide on-site child care facilities for their employees.
- Partner with neighbouring municipalities, the School District, and health authorities to lobby senior governments for expanded child care commitments (particularly financial).
- Partner with neighbouring cities and jurisdictions to facilitate coordinated approaches to child care delivery.
- Develop stronger relationships with Squamish and Tsleil-Waututh Nations, including incorporating Indigenous perspectives and history in child care planning and curriculum.

Recommended Actions to Strengthen Partnerships

The following actions can be taken to pursue effective partnerships and collaboration:

Table 11: Recommended Actions to Strengthen Partnerships

Recommended Actions to Strengthen Partnerships	Time Frame	Partners
1. **Explore development of a joint inter-agency role/position (involving the City of North Vancouver) that focuses on meeting space targets, facilitating partnerships, and engaging with Provincial and community partners in North Vancouver.**	Short	District of West Vancouver, City of North Vancouver
2. **Support SD44 to explore child care space as part of all new construction and major refurbishment projects.**	Short/Medium	School District
3. **Continue to lobby senior governments to provide support** in the following areas: • Provincial planning and funding for new spaces to meet North Shore needs; • Increased early childhood educator (ECE) recruitment and remuneration; • Lower child care costs; • Specific funding for non-traditional house of care; and • Increased resources to support children with additional needs through the Supported Child Development.	Short/Medium	District of West Vancouver, City of North Vancouver, School District
4. **Enhance collaboration with the North Shore Child Care Resource and Referral Program and other community service organizations** to: • Bring child care operators and staff together for information sharing, joint training and education; and • Provide more information for parents (especially targeting vulnerable families) about how to access child care, and how the system works.	Short/Medium	Non-profit providers, Health, Community Organizations
5. **Participate in joint child care development information meetings on a regular basis with Vancouver Coastal Health for people who are interested in opening child care centres.**	Short	VCH

6. Continue to participate on initiatives that build awareness of child care issues. • This may include briefings with the North Shore Child Care Planning Committee and elected officials (municipal and School District), and an orientation on child care matters after each local election.	Medium	NS Child Care Planning Committee
7. Explore the feasibility of a centralized child care waitlist for the North Shore.	Medium	District of West Vancouver, City of North Vancouver, North Shore CCR&R, Child Care Operators, Child Care Committee

5.0 IMPLEMENTATION, MONITORING AND REPORTING

Implementation of the Child Care Plan's recommended actions should be pursued to ensure ongoing progress on multiple fronts. The District should continue to work with its North Shore partners through the North Shore Child Care Planning Committee to identify areas where on-going collaboration would be most effective. These may include joint initiatives such as lobbying, information-sharing, collection and evaluation of data, and preparation of a regional annual report. The Committee should include representation from all public partners as well as community agencies and child care operators.

5.1 Implementation

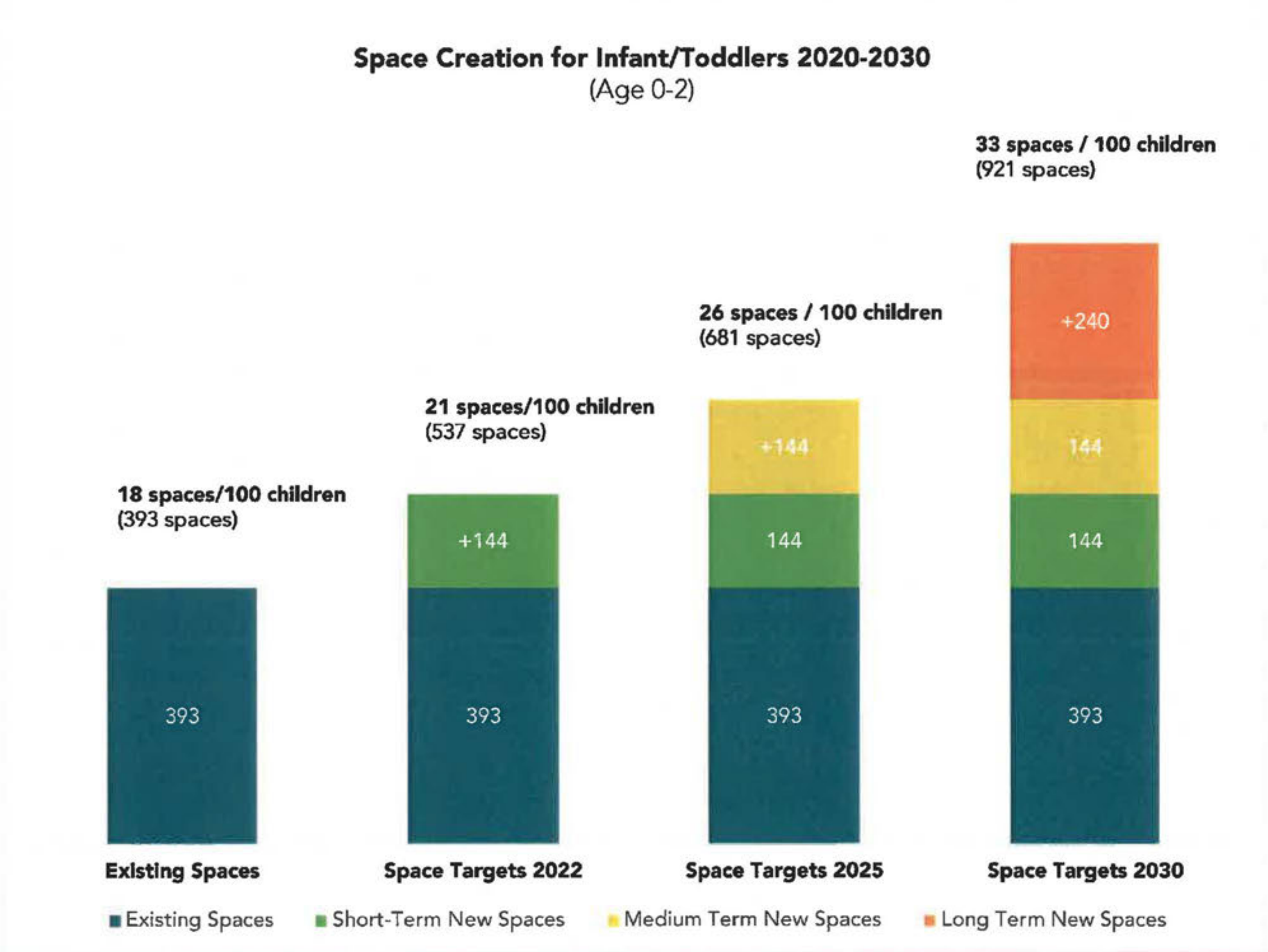
Space Delivery Targets

New child care spaces will be gradually rolled out to align with projected population growth. The following schedules include short- medium- and long-term targets for the delivery of new child care spaces in the District over the next ten years. They are divided into three categories: infant/toddlers, pre-school, and school-age.

Infant/Toddler Targets

A target of 33 child care spaces per 100 infant/toddlers is recommended by 2030. This will result in an additional 528 spaces. To achieve this, approximately four to five additional 12-space infant toddler programs would be required every year for ten years (or 44 new programs). Interim space targets are 21 child care spaces per 100 (21/100) of infant/toddler population by 2022, and 26 per 100 by 2025 (Figure 10).

Figure 10: Infant/Toddler Space Creation Targets[11]



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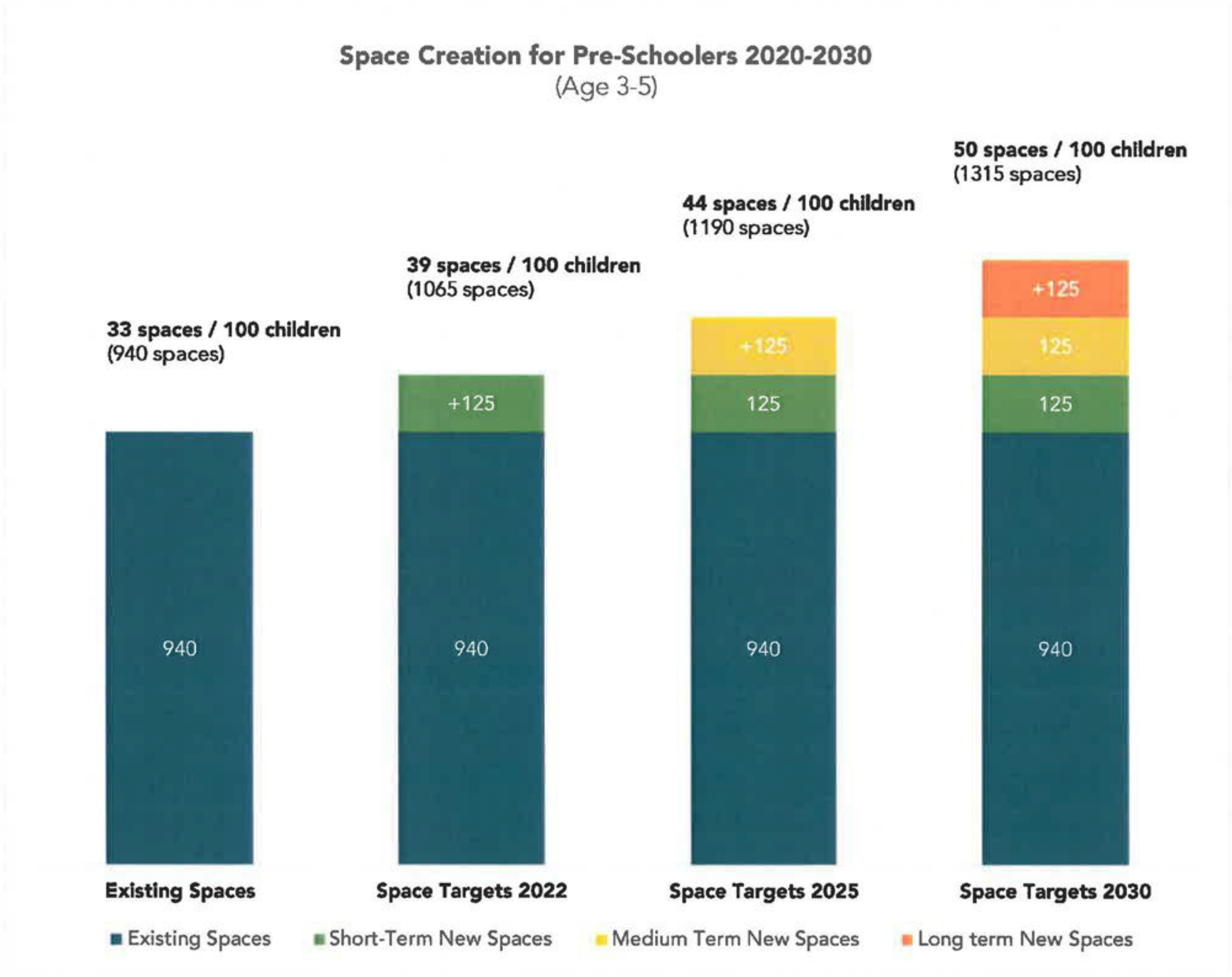
[11] These targets are developed based on the District of North Vancouver and Metro Vancouver projection that the infant-toddler population will increase by 538 children from 2,240 in 2016 to 2,778 in 2030.

Pre-School Targets

A target of 50 spaces per 100 pre-school aged children is recommended by 2030. This will result in an additional 375 spaces. To achieve this, approximately one to two 25-space pre-school age programs would be required every year for ten years (or 15 new programs). Interim space targets are 39 child care spaces per 100 of pre-school population by 2022, and 44 per 100 by 2025 (Figure 11).

Figure 11: Pre-School Space Creation Targets[12]



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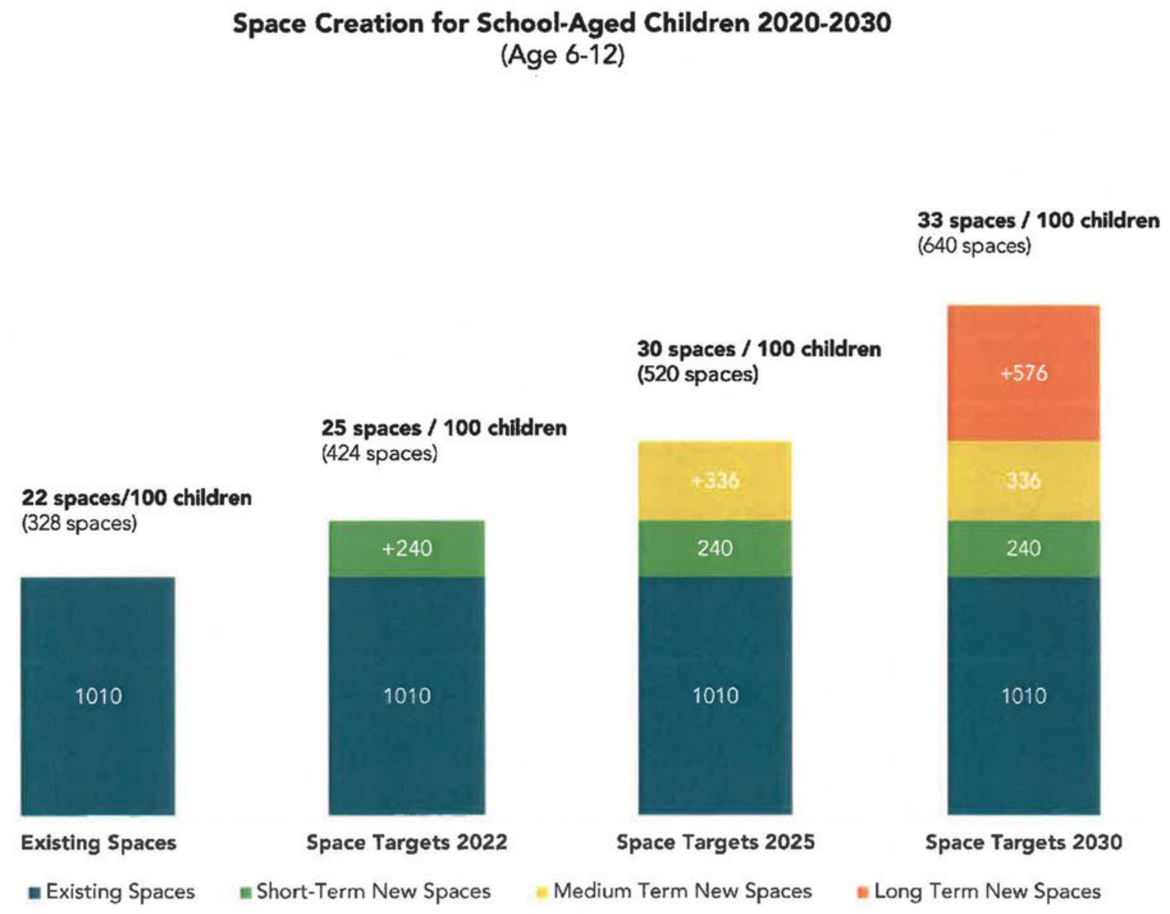
[12] These targets are developed based on the District of North Vancouver and Metro Vancouver projection that the pre-schooler population will decrease by 274 children from 2815 in 2016 to 2609 in 2030.

School-Aged Targets

A space target of 33 spaces per 100 school-age children is recommended by 2030. This will result in 1,152 additional spaces. To achieve this, approximately four to five 24-space school age programs would be required every year for ten years (or 48 new programs). Interim targets are to accommodate 18 child care spaces per 100 school-aged children by 2022, and 23 per 100 by 2025 (Figure 12).

Figure 12: School Age Space Creation Targets[13]



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[13] These targets are developed based on the District of North Vancouver and Metro Vancouver projection that the school age population will decrease by 1,013 children from 7,530 in 2016 to 6,517 in 2030.

5.2 Child Care Policy Updates

The District's current Child Care Policy (2008) should be updated to provide additional guidance and support for actions recommended in this plan. Updates to the Child Care Policy should include:

- A set of guiding principles and values (i.e., a universal approach with additional resources directed to families facing the greatest barriers to access);
- A strong statement that encourages child care development and ensures that child care needs are considered in all its strategies (e.g., housing, health, transit);
- A clear commitment to support the non-profit and public child care sector, referencing the literature on research, and the Province's child care space funding program that requires municipalities to either directly operate or engage in a partnership with non-profit providers; and
- A stronger commitment to 'quality', including consideration of design requirements that exceed the Provincial regulation minimums for District owned or facilitated spaces.

5.3 Progress Reports

Progress reports to the District Council will document successes, failures, and learnings, with recommendations for necessary changes. These reports may be used to support annual budget requests needed to implement many of the recommended actions in this plan.

Progress reports should be widely shared with the District's partners, the child care provider community, and other levels of government following Council consideration.

5.4 Conclusion

Quality child care is a vital part of the District of North Vancouver's social network and positively impacts the overall health and well-being of the community. The District of North Vancouver's Child Care Action plan builds on the Official Community Plan goal of promoting the establishment and maintenance of affordable quality child care services in the District. The Plan's four goal areas of increasing access to child care, improving affordability, focusing on quality, and strengthening partnerships all contribute towards enhancing the provision of child care services over the next 10 years. Ongoing monitoring and reporting on the implementation of this plan will allow us to assess our progress towards achieving the goals and identify opportunities to modify the plan as needs change over time.

DISTRICT OF
NORTH
VANCOUVER

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North Vancouver, BC, V7N 4N5
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Appendix J Preliminary City of North Vancouver Comments

city of north vancouver

PLANNING DEPARTMENT
CITY OF NORTH VANCOUVER
141 WEST 14TH STREET
NORTH VANCOUVER
BC / CANADA / V7M 1H9

T 604 983 7357
F 604 985 0576
PLANNING@CNV.ORG
CNV.ORG

Memo

TO: [redacted]

From: [redacted]

DATE: June 23, 2021

RE: CLOVERLEY SCHOOL SITING OPTIONS PRELIMINARY CNV COMMENTS

Please find below preliminary comments on the three site plan options for a new Cloverley elementary schools (drawings dated June 3rd, 2021). Note that this is not a City review and is intended only to assist in the further development of the school concept and that the City looks forward to continuing to work with the School District and reviewing a submission at a later date.

General Servicing Comments

- Our initial analysis indicates the water utility in the area is new and there is not likely to be expansion required.

- This is an identified area of lower pressure (based on modeling) and there may be a need to boost sprinkler pressure on site.

- Regarding sanitary and storm sewers, the site could be serviced to Hendry (west) or Shavington (east). Existing sewer mains on Hendry are 150mm and may be too small for the proposed connection. If it is too small, a new sewer would be required from Kennard to the southeast corner of the site; this would be an extension of approximately 170m which translates to approximately a $250,000-$300,000 item.

- Storm sewer could accommodate a 250mm connection, and on-site stormwater management would be required. Existing service locations crossing Shavington Street cannot be re-used and a more conventional servicing would be a goal.

- The City's Subdivision and Development Control Bylaw requires the road be upgraded to current standards around the perimeter of the site (ie. sidewalk, boulevard, lighting, etc)

Siting Options and Configuration

- All three of the proposed school siting options appear to be feasible.
- However, staff note that Option 3 is nearly 200 m east of the Option 1 siting, putting the school a block further from the City's growing Moodyvile neighbourhood, which it will serve.

- Staff look forward to further discussions regarding the future of the on-site public open space ("Cloverely Park") in any of the options.
- The City is interested in ensuring the loss of matures trees is minimized: this appears to be possible in It appears to be possible in each of the proposed siting options.

Neighbourhood Learning Centre Space

- We look forward to further discussing options for an NLC space on site: City priorities for the area include before and after school care (per the City's Child Care Strategy) and/or general purpose recreation space available to the community.
- The City is interested in discussing possibilities for expanding the NLC space beyond the 10% provision through City contributions or other partnerships.
- Exploring on-site urban agriculture opportunities would also be consistent with City initiatives.

Green School Approach

- The City's Hydronic Energy Service Bylaw requires all new developments over 1,000 m2 to connect to Lonsdale Energy Corporation (LEC) and be serviced by hydronic heat. The school site is located relatively far from the existing LEC distribution network. LEC is interested in further discussing with the School District alternative approaches to the site which could include waste heat capture or other low carbon approaches.

Transportation

- The additional trips generated by the new school in the Cloverley area have the potential to exacerbate significant existing challenges and are likely to require changes to vehicle circulation patterns. Staff would like to meet and discuss transportation management planning and options as early in the School District's process as possible to ensure time is provided for planning, budgeting and implementing any required changes to neighbourhood traffic patterns.

- The western configuration of the school may be more easily accessible from a vehicular and pedestrian perspective.

- The City encourages and looks forward to collaborating further on an approach that minimizes vehicle trips to the site.

cc. [redacted]
[redacted]

Appendix K Pre-Demolition Hazardous Materials Survey

Cloverley Elementary

440 Hendry Avenue, North Vancouver, BC

Pre-Demolition Hazardous Materials Survey

Prepared For:
SD44 North Vancouver District
2121 Lonsdale Avenue
North Vancouver, BC V7M 2K6

Prepared by:
Kinetic OHS Services Ltd.
#202 – 1520 Barrow Street
North Vancouver, BC
604-988-0099

Project Reference: 6479-MD-R1
Report Date: July 21, 2020

Table of Contents

1.0 Introduction

Kinetic OHS Services Ltd. has performed a pre-demolition hazardous materials survey of Cloverley Elementary located at 440 Hendry Avenue, North Vancouver, BC. The survey was performed on June 5 & 10, 2020.

2.0 Scope of Work

The scope of the hazardous materials survey encompassed all accessible areas of the building. An intrusive survey was performed to identify hazardous materials such as asbestos, lead, mercury, PCBs, refrigerants, and toxic, flammable or explosive materials to meet Part 20.112 of the WorkSafeBC OH&S Regulation.

Reasonable attempts were made to inspect areas such as pipe chases, subfloors, and wall panels for concealed asbestos materials without disturbing suspect asbestos containing materials.

3.0 Methodology

A thorough room by room inspection was conducted in all accessible areas of the school to inspect for hazardous materials. Representative samples of asbestos materials were collected for identification. The survey was performed by Kinetic OHS personnel Mehdi Dastyari, AHERA Building Inspector and Ramin Aghvami, AHERA Building Inspector who both meet the definition of a Qualified Person as outlined in Part 6 of the WorkSafeBC OH&S Regulation.

Asbestos
Representative samples of materials suspected of containing asbestos were collected and submitted for asbestos analysis. The samples were submitted to Kinetic's in-house laboratory and analyzed in accordance with NIOSH 9002 (Asbestos (bulk) by PLM) analytical method.

Lead Paint/Coatings
Samples of lead paint applied to major building surfaces were collected for lead analysis. The samples were submitted to Bureau Veritas Laboratories in Burnaby for analysis using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) methodology.

Mould Spores
Air sampling was performed with the use of a Buck BioAire Pump and Allergenco D spore trap air sample cassettes. The use of the air sample cassette allows for the rapid collection of viable and non-viable specimens which are collected on a small slide with an adhesive collection media. Elevated levels of fungal spores may indicate that fungi have colonized on building materials. An outdoor (background) air sample was collected to compare against the indoor samples.

4.0 Site Description

The site consists of an original school and gymnasium structure. The school was vacant and the windows were covered with plywood at the time the survey was performed.

Table 1 provides a description of the site.

Table 1: Site Description

Building Use	Public School
Vacant or Occupied?	Vacant
Construction Date	Not Known
Size of Building	~36,000 ft^2
Number of Levels	2 (with Crawlspaces)
Interior Structure/Framing	Wood
Exterior Building Finish	Stucco, Wood
Roofing Material	Asphalt Membrane, Tar & Gravel
Attic Insulation	No Attic
Heating/Cooling System	Hot Water Radiant (Boiler System)
Interior Flooring Materials	Sheet Vinyl Flooring, Carpet, Ceramic Tile, Vinyl Floor Tile, Hardwood
Interior Wall/Ceiling Finishes	Plaster, Drywall, Wood Panels, Ceiling Tile
Window Manufacturing Date	Not Indicated on Windows (Wood & Aluminium Windows)
Detached Structures	None

4.1 Rooms/Areas Not Inspected

The interior of the water tube boiler in the Boiler Room was not accessible for inspection. Energized boiler systems (e.g. electrical & natural gas) must be locked out before it can be opened for inspection and sampling.

5.0 Survey Results

A total of 95 representative asbestos bulk samples and 9 lead paint samples were collected for analysis during this assessment. Mould sampling was also performed to determine the extent of contamination and if the building was safe to under without respiratory protection. Table 2 summarizes the asbestos containing materials that are confirmed to be present. Table 3 summarizes the materials that are suspected to contain asbestos and must be removed if the material is disturbed or impacted by the work. This information was compiled using the data collected from our inspection and the data extrapolated from the bulk sample results. Refer to Appendix A for the asbestos bulk sample analytical results, Appendix B for lead sample analytical results, Appendix C for photos from our inspection, and Appendix D for the sample locations.

5.1 Asbestos Containing Materials

The WorkSafeBC definition of an asbestos containing material is a manufactured article or other material, other than vermiculite insulation, that is determined to contain at least 0.5% asbestos. Vermiculite insulation that contains trace levels of asbestos is considered to contain asbestos.

The results indicated that a variety of asbestos containing materials were identified in the building. The materials identified as asbestos are summarized in Table 1 and confirmed non-asbestos containing materials are summarized in Table 2.

Table 2: Summary of Confirmed Asbestos Containing Materials

Asbestos Containing Material Identified	Locations	Approx. Quantity[1]
Cement Wall Board	• 1st Floor - Storage Rooms 117 & 118 (115A & 116A) • 1st Floor Boys & Girls Washrooms (115 & 116) • Basement Boys & Girls Washrooms (004 & 005)	600 ft^2
Drywall Joint Compound	• 1st Floor - Art Activity Room 112 (110-11-112) – All Drywall • 1st Floor - Boy's Washroom 116 (113) – Walls & Ceiling • 1st Floor - Classroom #3 (117) – All Drywall Walls • 1st Floor - Classroom #4 (118) - All Drywall Walls • 1st Floor - Classroom #5 (119) - All Drywall Walls & Ceiling • 1st Floor - Classroom #6 (120) - All Drywall Walls • 1st Floor - Classroom #7 (120) – All Drywall Walls • 1st Floor - Classroom #8 (122) – All Drywall Walls • 1st Floor - General Office (102,103,104) – W. & N. Wall • 1st Floor - Girls and Boys Washrooms (115, 116) – N. Walls • 1st Floor - Room 127 (123) - All Drywall Walls • 1st Floor - Room 138 (125) – All Drywall Walls • 1st Floor - Room 140 (125A, 125B) – All Drywall Walls • 1st Floor - Rooms 133 to 137 (124 A to 124 G) – All Walls • 1st Floor - Staff Room 142 (129)– South & North Wall • 1st Floor - Storage Room (132) – Walls & Ceiling	~30,000 ft^2

Table 2: Summary of Confirmed Asbestos Containing Materials (Cont.)

Asbestos Containing Material Identified	Locations	Approx. Quantity[1]
Drywall Joint Compound (Cont.)	• 1st Floor - Storage Rooms 117 & 118 (115A & 116A) – All Walls/Ceilings (Asbestos Joint Compound Identified on Plaster) • 1st Floor - West Common Hallway –Ceiling • Basement - Classroom #1 (008A & 008) – All drywall Walls • Basement - Classroom #2 (007) – South and East Drywall Walls • Basement - Classroom 009 – South and East Drywall Walls • Basement - Classroom 010 – South and East Drywall Walls • Basement - Crawlspace (Storage Space North Side of Corridor 001) – All Drywall Walls/Ceiling Finishes (Unpainted Drywall) • Basement - Custodian Room (002) – East Drywall Wall	-
Duct Mastic (Silver)	• 1st Floor – Crawlspace Below Gymnasium • Basement – Crawlspace Beside Washrooms 004 & 005 (Ductwork is likely to be present in concealed ceiling and floor spaces in the building. If required, expose ceiling and floor cavities to locate ductwork and remove mastic as necessary.)	~200 Linear Feet Observed
Gaskets	• Basement – Boiler Room (003) – Around Exhaust Flange Above Rear Boiler Door • Basement – Boiler Room (003) – Around Front Boiler Door • Basement – Boiler Room (003) – Around Rear Boiler Door • All gaskets on mechanical pipe systems are to be treated as asbestos.	>4
Pipe Elbow & Fitting Insulation	• Basement – Storage Room 006 • Basement – Northwest Crawlspace • Basement – East End Crawlspace (Asbestos pipe elbows/fittings may also be present in concealed ceiling and floor spaces in the building. If required, expose ceiling and floor cavities to locate pipe chases and remove insulation as necessary.)	~50 Elbows & Fittings
Pipe Insulation (Straight Run)	• Basement – East End Crawlspace	~20 Linear Feet
Sink Undercoating	• Classroom #6 (120) • Classroom 138 (125) • Room 134 (124) • Staff Room 142 (129)	4 Sinks
Vinyl Floor Tile (9"x9" Taupe with White & Brown Lines)	• 1st Floor - Storage Room 115 (114) • Basement – Classroom 010 • Basement – Corridor 001 • Basement - Custodian Room 002 • Stairwell 011 & 006	~ 3,000 ft^2

Table 2: Summary of Confirmed Asbestos Containing Materials (Cont.)

Asbestos Containing Material Identified	Locations	Approx. Quantity[1]
Vinyl Floor Tile (Grey)	• 1st Floor - Northwest Common Hallway Outside Storage Rooms 115A & 116A – Beneath Grey Sheet Vinyl Flooring	~ 300 ft^2
Vinyl Floor Tile	• Basement – Rooms 007, 008, 009 (Beneath 12"x12" Tiles)	~ 2,600 ft^2
Window Glazing Mastic (Between glazing and interior frames) & Window Putty (on exterior frames)	• All Exterior Windows (Wood Frames)	~140 Windows
Window Glazing Mastic	• All Exit Door Windows • General Office 102 & 103 – Interior Wood Windows	~4 Doors / 2 Windows
Bell & Spigot Housings (Treat as Asbestos)	• Basement – Custodian Storage – Room 002 • Basement – Low Height Storage Space – West End • Crawlspaces – Basement • Crawlspaces – Below Gym • Exterior – North Side – Exterior Gymnasium	~100 housings

1. Quantity indicated is only an estimate and is not to be used for cost estimating or unit rate pricing.

Table 3: Summary of Suspect Asbestos Containing Materials (May be Present)

Location	Suspect Asbestos Containing Materials (May be Present)
In Concealed Wall & Ceiling Spaces (May be Present)	Vermiculite Insulation (May be Present - Treat as Asbestos if Present)
Fire Doors	Insulation Between Panels (May be Present - Treat as Asbestos if Present)
Boiler Room – Interior of Water Tube Boiler	Interior Materials

5.1.1 Asbestos Cement Products

Asbestos Use Locations
Asbestos containing cement wall board was identified in the washrooms on the 1st Floor and the Basement (Rooms: 115, 116, 004, 005), as well as Storage Rooms 117 & 118 (115A & 116A).

Risk Assessment
The asbestos cement wall boards are non-friable unless they are disturbed. Identified cement boards were observed to be in good condition with a low potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb asbestos containing cement boards. If asbestos cement boards are to be removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.2 Boilers/Furnaces

Asbestos Use Locations
A large water tube boiler was identified in the Boiler Room (003) located in the Basement. Asbestos containing gaskets were identified on the boiler exhaust flange and on both ends of the boiler.

The boiler interior was not accessible at the time of this survey. Interior boiler insulation and refractory bricks, if present, should be assumed to contain asbestos unless samples are collected to indicate otherwise.

The refractory brick on the kiln was identified as non-asbestos.

Risk Assessment
Asbestos containing boiler materials were noted to be friable. These materials were observed to be in poor condition with a moderate potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb asbestos containing boiler materials. The removal of the asbestos containing boiler materials must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.3 Cast Iron Bell & Spigot Housings

Asbestos Use Locations
Cast iron bell & spigot housings were observed in the following locations:

- Basement – Custodian Storage – Room 002
- Basement – Low Height Storage Space – West End
- Crawlspaces – Basement
- Crawlspaces – Below Gym
- Exterior – North Side – Exterior Gymnasium

Cast iron bell & spigot housings are suspected of containing asbestos and may also be present on the drain pipes/vents in concealed wall and ceiling spaces. Asbestos was commonly used as packing compound around the bell housings; however, the sampling of the packing compound requires the dismantling of the housing to gain access to the material. Therefore, all bell & spigot housings are presumed to contain asbestos.

Risk Assessment
The cast iron bell & spigot housings were observed to be in good condition with a low potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb suspect asbestos containing cast iron bell and spigot housing. If cast iron bell and spigot housing are to be removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.4 Caulking:

Asbestos Use Locations
No asbestos containing caulking was identified in the building.

Three (3) samples of different caulking were collected from the flashing on the roof and all samples were determined to be non-asbestos.

5.1.5 Ceiling Tiles

Asbestos Use Locations
No asbestos containing ceiling tiles were identified in the school.

Three (3) samples of 2'x4' ceiling tiles were collected from Room 140 (125A) located on the 1st floor. All samples were determined to be non-asbestos. Cellulose ceiling tiles (12"x12") were observed in various interior rooms and do not contain asbestos

5.1.6 Coatings

Asbestos Use Locations
The black coating applied to the concrete foundation in the crawlspace was identified as non-asbestos.

5.1.7 Construction Paper

Asbestos Use Locations
No asbestos containing construction paper was identified in the building.

A sample of the construction paper located behind exterior stucco finishes was collected and was determined to be non-asbestos.

A sample of the construction paper was collected from the crawlspace under the wood structure and was determined to be non-asbestos.

5.1.8 Drywall Joint Compound

Asbestos Use Locations
A mixture of asbestos and non-asbestos drywall joint compound was identified in the building. A total of 14 representative samples of the drywall joint compound were collected from various areas of the building and 6 samples were determined to be asbestos. All drywall should be treated as asbestos unless areas specific samples are collected for confirmation

No drywall joint compound was observed on the drywall located beneath the 12”x12” cellulose ceiling tiles and wood wall panels.

Refer to Table 2 to locate the locations of asbestos-containing drywall walls and ceilings.

Risk Assessment
Asbestos containing drywall joint compound is non-friable unless it is disturbed. Drywall materials were observed to be in good condition with a moderate potential for disturbance.

Recommendations
Since all of the drywall finishes were similar in appearance, Kinetic OHS was unable to visually differentiate asbestos containing from the non-asbestos containing finishes; therefore, all drywall taping compound in areas identified as asbestos must be assumed to contain asbestos unless additional samples are collected from every wall/ceiling for confirmation.

Do not remove, cut, damage or disturb asbestos or suspect asbestos containing drywall. If asbestos containing drywall is removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.9 Duct Mastic

Asbestos Use Locations
Historic asbestos results & survey (refer to Appendix E) had identified the presence of asbestos containing duct mastic to be present in the building. Ductwork with asbestos containing silver/grey duct mastic was only observed in the crawlspaces located beneath the Gymnasium and Washrooms 004 & 005. Asbestos containing silver/grey duct mastic may be present in concealed wall and ceiling spaces in other areas of the building.

Non-asbestos grey duct mastic was identified in Room 140 (125A). Three (3) samples were collected and all samples were determined to be non-asbestos.

Risk Assessment
The asbestos duct mastic is a non-friable material and was observed to be in good condition with a low potential for disturbance.

Recommendations
The asbestos duct mastic is a non-friable material and does not present a health hazard to building occupants as long as the material is in good condition and remains undisturbed. This material can remain and be managed in place if it will not be impacted by the proposed work. The removal of the asbestos duct mastic must be performed using a minimum of Moderate Risk work procedures.

5.1.10 Duct Tape

Asbestos Use Locations
No duct tape was observed in the accessible areas of the building.

5.1.11 Fire Doors

Asbestos Use Locations
Older steel or wood fire doors may contain asbestos insulation between the panels; however, accessing this material is usually not possible without damaging the panels. We were not able to inspect the interior insulation of the fire doors for asbestos.

Wood fire doors suspected of containing asbestos were observed in the following areas of the building:

- 1st Floor – Corridor 101 – West & East Exit Doors
- 1st Floor – Northwest Common Hallway – East Exit Door
- Basement - Boiler Room (003)
- Basement – Corridor 001 – East Exit Door
- East and West Stairwells – 1st Floor & Basement – Four (4) Doors

Risk Assessment
The asbestos insulation used inside of fire doors is usually a friable product and is sealed within the door cavity. The fire doors in the building were observed to be in good condition with a low potential for disturbance.

Recommendations
All Wood fire doors should be assumed to contain asbestos and be handled and disposed of as asbestos waste if impacted by the proposed work.

5.1.12 Firestop

Asbestos Use Locations
No asbestos containing firestop was identified in the building.

Two (2) samples of different firestop were collected from the areas which were inspected and all samples were determined to be non-asbestos.

5.1.13 Flooring – Vinyl Baseboard

Asbestos Use Locations
No asbestos containing vinyl baseboard material was identified in the building.

Two (2) representative samples of the Brown and Black vinyl baseboard were collected from the areas inspected and both samples were determined to be non-asbestos.

5.1.14 Flooring – Vinyl Floor Tile

Asbestos Use Locations
Asbestos containing vinyl floor tiles were identified in the following locations:

- 1st Floor - Hallway outside storage 115A & 116A – Beneath Sheet Vinyl Flooring
- 1st Floor - Storage Room 115 (114) - 9”x9” Taupe with White & Brown Lines
- Basement – Classroom 010 - 9”x9” Taupe with White & Brown Lines
- Basement – Corridor 001 - 9”x9” Taupe with White & Brown Lines
- Basement - Custodian Room 002 - 9”x9” Taupe with White & Brown Lines
- Basement – Rooms 007, 008, and 009 – Beneath 12”x12” Vinyl Floor Tiles
- Stairwell 011 & 006 - 9”x9” Taupe with White & Brown Lines

If similar vinyl flooring materials are encountered elsewhere in the building, they must be treated as asbestos.

Representative samples of the black flooring mastic applied to the underside vinyl floor tiles were collected and all samples were determined to be non-asbestos.

Risk Assessment
Asbestos vinyl floor tiles are considered to be non-friable materials; however, this material can become friable if damaged or is in poor condition. The asbestos vinyl floor tiles observed in the building were noted to be in good condition with a low potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb asbestos or suspect asbestos vinyl floor tiles. If asbestos flooring materials are removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.15 Flooring –Sheet Vinyl Flooring

Asbestos Use Locations
No asbestos containing sheet vinyl flooring materials were identified in the building.

Three (3) different types of sheet vinyl flooring (linoleum) materials were collected and all were determined to be non-asbestos.

5.1.16 Gaskets

Asbestos Use Locations
Asbestos containing gaskets were identified on the large boiler in the Boiler Room (003) – Refer to Section 5.1.2. Asbestos containing gaskets may also be present in mechanical pipe systems such as valves and flanges. Accessing the gasket for sampling was not possible without separating the flanges; therefore; all gaskets are assumed to contain asbestos until samples are collected for verification.

Risk Assessment
Asbestos gaskets are non-friable products when new, but can become friable when subject to heat. Since the gaskets are not normally exposed, they are assumed to be in good condition with a low potential for disturbance.

Recommendations
In-place asbestos containing gaskets do not present a health hazard to building occupants as long as the material is in good condition and remains undisturbed. Maintenance personnel and contractors should disassemble mechanical systems with caution. If gaskets suspected of containing asbestos are encountered, a sample of the material should be collected and submitted for asbestos identification before proceeding any further with the work.

5.1.17 Mastic

Asbestos Use Locations
No asbestos containing mastic was identified in the building.

Representative samples of the black mastic applied to the chimney flashing of the roof was collected and was determined to be non-asbestos.

5.1.18 Mechanical Insulation

Asbestos Use Locations
Historic asbestos results & survey (refer to Appendix E) had identified the presence of asbestos containing pipe insulation and mudded elbows/fittings with insulating cement to be present in the building.

Asbestos containing pipe elbows and fittings were identified in crawlspace beneath the 1st Floor Corridor and in the crawlspaces on the northwest side and east end of the Basement. Also, there is a potential for older or decommissioned service pipes in inaccessible ceiling or wall cavities to contain asbestos.

Asbestos containing pipe insulation (on straight pipe run) was identified in the east end crawlspace in the Basement.

Risk Assessment
Asbestos containing pipe insulation on elbows/fittings are friable products. The asbestos fibres bound within these materials can be readily released if disturbed. The asbestos pipe insulation was observed to be in good condition with a low potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb asbestos containing pipe insulation. If asbestos containing pipe insulation is removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.19 Mortar:

Asbestos Use Locations
No asbestos containing mortar was identified in and outside the building. Three (3) representative samples of brick mortar were collected from the chimney located in the Boiler Room (003). All samples were determined to be non-asbestos containing.

5.1.20 Plaster

Asbestos Use Locations

No asbestos containing plaster finishes were identified in the building. The plaster materials were observed in only a few rooms in the building. Five (5) representative samples were collected from various plaster walls were collected and all samples were determined to be non-asbestos.

Note: Asbestos containing patching compound was applied to the north wall in Storage Room 116A located on 1st Floor. Therefore, only the plaster finishes in Storage Room 116A must be treated as asbestos containing.

5.1.21 Putty

Asbestos Use Locations

No asbestos containing putty was identified in the building. Three (3) samples of grey putty applied around the conduit penetration on south wall in Room 145 (133) were collected and were determined to be non-asbestos.

5.1.22 Roofing Material

Asbestos Use Locations

No asbestos containing roofing materials were identified on the roof of the building. Six (6) representative samples of the torch-on roof membrane and tar & gravel roofs were collected from all roof sections and all samples were determined to be non-asbestos.

The black tar on pipes & exhaust vents was determined to be non-asbestos.

5.1.23 Sink Undercoating

Asbestos Use Locations

Asbestos sink undercoating was identified in the following locations:

- Classroom #6 (120)
- Classroom 138 (125)
- Room 134 (124)
- Staff Room 142 (129)

Risk Assessment

Asbestos containing undercoating is a non-friable product. The asbestos fibres bound within the coating cannot be readily released. The asbestos containing undercoating applied to the sinks were observed to be in good condition with a low potential for disturbance.

Recommendations

Do not damage or dispose sinks with asbestos containing sink undercoating. Removal and disposal of asbestos containing sink undercoating must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.1.24 Spray Insulation

Asbestos Use Locations

No spray insulation was observed in the building.

5.1.25 Stucco

Asbestos Use Locations

No asbestos containing stucco was identified on the exterior of the building. Seven (7) representative samples of exterior stucco were collected and all samples were determined to be non-asbestos.

5.1.26 Tanks & Vessels

Asbestos Use Locations

No asbestos insulated tanks or vessels were identified in the building.

5.1.27 Textiles

Asbestos Use Locations

No asbestos containing textile materials were observed in the building.

5.1.28 Texture Coat

Asbestos Use Locations

No texture coat materials were observed in the building

5.1.29 Vermiculite Insulation

Asbestos Use Locations
Based on the age of the structure, there is a potential for asbestos containing vermiculite or vermiculite debris to be present in concealed wall/ceiling cavities.

Recommendations
Remove wall/ceiling finishes with caution. If vermiculite is observed, stop work and contact asbestos abatement contractor.

5.1.30 Window Glazing Mastic

Asbestos Use Locations
Asbestos containing window glazing mastic was identified between the window glazing and interior frames on some of the perimeter windows and on the exit door windows in the building. Since most of the windows were similar in appearance and the mastic on all windows were black, all perimeter windows and exit doors with window glazing mastic must be presumed to contain asbestos.

Risk Assessment
Asbestos containing window glazing mastic is a non-friable product. The asbestos fibres bound within the putty cannot be readily released. The asbestos containing window glazing putty was observed to be in good condition with a low potential for disturbance.

Recommendations
All windows and exit door windows with window glazing mastic must be removed by a qualified abatement contractor prior to demolition or disturbance, using a minimum of Moderate Risk work procedures.

5.1.31 Window Putty

Asbestos Use Locations
Five (5) samples of window putty were collected from the exterior windows. Two (2) out of 5 were determined to be asbestos-containing. Since most of the windows were similar in appearance and the putty on all windows was white, all window putty must be assumed to contain asbestos.

Risk Assessment
Asbestos containing window putty is a non-friable product. The asbestos containing window putty was observed to be in fair condition with a low potential for disturbance.

Recommendations
Do not remove, cut, damage or disturb asbestos containing window putty. If exterior windows are to be removed or disturbed, the work must be performed by an asbestos abatement contractor or asbestos trained workers using the appropriate asbestos abatement control measures and procedures.

5.2 Lead

Lead is classified as a probable human carcinogen and the ALARA principal applies to ensure worker exposure levels to lead are kept as low as reasonably achievable. WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating, but relies on a qualified person to perform a risk assessment to determine the control measures required to minimize worker exposure to lead.

The Canadian Paint and Coatings Association restricted lead in consumer paints to 600 mg/kg in 1991. Low lead content paint (considered to be between 90 to 600 mg/kg) may be present in paints from 1991 up to 2010 when lead in consumer paints was officially banned in Canada. The ban only applies to consumer paints/coatings and lead may still be present in paints and coatings of non-consumer products. Lead was also commonly used for waste drain vent pipes on the roof of buildings.

Lead vent pipes were observed on the roof of the building. Ceramic tiles with glazing suspected of containing lead were observed in various areas of the building. A variety of paint colours were observed on the interior and exterior surfaces of the structure.

Based on the age of the structure, there is a potential for the paint to contain lead and samples were collected for confirmation. A summary of lead containing materials is summarized in Table 4 and the lead analytical results are located in Appendix D.

Table 4: Lead Summary Results

Sample Number	Location	Material	Lead Concentration (mg/kg)[1,2]	Approx. Quantity[3]	Control Measures Required
-	Roof	Lead Roof Vent Pipes	-	12 items	**YES**
6479-L1	**1st Floor – Classroom #6 (120) – On Wood Window Trim**	**Light Grey Paint**	**2,000**	**2,700 ft²** **(All Window/ Door Trim)**	**YES**
6479-L2	**1st Floor – General Office (102,103,104) – North End – On North Plaster Wall**	**Off White Paint**	**1,220**	**3,000 ft²** **(All Plaster Walls)**	**YES**
6479-L3	**1st Floor – Gymnasium – On Wood Walls**	**Off White Paint**	**905**	**10,000 ft²** **(All Wood Walls)**	**YES**
6479-L4	**Basement – Classroom #1 (008A-008) – South Wall – On Drywall**	**Blue Paint**	**1,020**	**30,000 ft².** **(All Drywall)**	**YES**

Table 4: Lead Summary Results (cont.)

Sample Number	Location	Material	Lead Concentration (mg/kg)[1,2]	Approx. Quantity[3]	Control Measures Required
6479-L5	Basement – Boys Washroom (005) – On Wood Wall	Off White	48.3	-	NO
6479-L6	Basement – Boys Washroom (005) – On Floor	Red Ceramic Glazing	<2.0	-	NO
6479-L7	**Exterior – West Side – On Wood Siding**	**Beige Paint**	**<u>2,090</u>**	**~10,000 ft^2**	**YES**
6479-L8	**Exterior – South Side – On Stucco**	**Beige Paint**	**<u>114</u>**	**~15,000 ft^2**	**YES**
6479-L9	**Exterior – East Side – On Window Trim**	**Grey paint**	**<u>723</u>**	**2,700 ft^2** **(All Window/ Door Trim)**	**YES**

[1] "**<u>Bold & Underline</u>**" = Lead was identified and a risk assessment/workplace control measures should be implemented for concentrations exceeding 90 mg/kg (90 ppm).

[2] WorkSafeBC recommends that workplace controls be used during any removal or disturbance of paint containing more than 90 mg/kg lead. Surface Coating Materials Regulation (Canada) defines a lead paint or coating to contain over 90 mg/kg of lead.

[3] Quantity indicated is only an estimate and is not to be used for cost estimating or unit rate pricing.

5.3 Mercury

Mercury can be found self-contained capsules in controls switches such as thermostats and pressure switches. Small concentrations of mercury can be in all fluorescent light bulbs/tubes and High Intensity Discharge (HID) bulbs such as mercury vapour, metal halide, or high-pressure sodium.

Items containing mercury were identified on the property and are summarized in Table 5.

Table 5: Mercury Containing Items

Location	Item	Approx. Quantity[1]
Throughout Building	Fluorescent light tubes	~500
Boiler Room (003)	Gauges	~3

[1] Quantity is only an estimate and is not to be used for cost estimating or unit rate pricing.

5.4 Polychlorinated Biphenyls (PCBs)

PCBs were commonly used in the capacitors found in the ballasts of fluorescent light fixtures and HID light ballasts manufactured prior to 1980. Ballasts suspected of containing PCBs are located in the items identified in Table 5 located in Section 5.3.

5.5 Refrigerants

Refrigerants containing Ozone-Depleting Substances (ODS) and Halocarbons can be found in refrigerators, commercial refrigeration units, and air conditioners. Items that may contain refrigerants are summarized in Table 6.

Table 6: Items Containing Refrigerants

Location	Item	Approx. Quantity[1]
None Identified	N/A	N/A

1 Quantity is only an estimate and is not to be used for cost estimating or unit rate pricing.

5.6 Toxic, Flammable or Explosive Materials

Chemicals and paints were observed in various areas of the building. The items observed during our inspection are summarized in Table 7.

Table 7: Toxic, Flammable or Explosive Materials

Location	Item	Approx. Quantity[1]
Custodian Storage Rooms	Household cleaning chemicals	50 items
Classroom #6 (120) – Under Sink	Paint cans/containers	10 items

5.7 Mould

Mould growth was observed on various interior building materials in the building. The roof of the gymnasium was noted to be leaking resulting in interior water damage, wood rot and mould growth. Mould growth was observed on the surfaces of the following locations:

- 1st Floor - Art Activity (110, 111, 112) – On walls/ceilings & floor
- 1st Floor – Classroom #3 (117) - On ceiling tiles, carpet & window sill
- 1st Floor – Classroom #6 (120) – On ceiling tiles
- 1st Floor - Gymnasium – On walls & ceilings
- 1st Floor – Storage 115 – On wood panels & ceiling
- Basement – Classroom #2 (007) – On ceiling tiles
- Basement – Corridor – On ceiling tiles
- Basement – Custodian 002 – On vinyl floor tiles

There is high potential for mould growth to be present in concealed or inaccessible locations such as wall cavities, ceiling cavities and sub-floors.

Ten (10) spore trap samples were collected indoors and 1 background spore trap sample was collected outdoors. A total sampling volume of 75 litres was collected for each sample (15 litres per minute for duration of 5 minutes). The cassettes were submitted to EMSL in Burnaby, BC for analysis.

Indoor spore trap samples were collected from the Gymnasium, corridor outside gymnasium, Fine Art Room 110, Classroom #3 on 1st floor, 1st floor corridor, Classroom 010 in Basement, Low Height Storage in Basement, Basement corridor (2 samples), and Classroom 008 in the Basement. One background spore trap sample was collected outdoors by the front school entrance in the parking lot. The weather on the day of the sampling was noted to be sunny with clear skies.

The total airborne fungal spore counts indoors ranged from 3,140 to 36,190 Count/m^3 and the spore count recorded outdoors was 11,010 Count/m^3 (refer to Table 8 for a summary of the results, Appendix D for site photos & Appendix F for the laboratory analytical results).

Table 8 – Fungal Spore Results

Fungal Species	**6479-S1 Gymnasium (Count/m³)**	**6479-S2 Corridor o/s Gym (Count/m³)**	**6479-S3 Fine Arts 110 (Count/m³)**	**6479-S4 Classroom #3 (Count/m³)**	**6479-S5 1st Floor Corridor (Count/m³)**	**6479-S6 Classroom 010 (Count/m³)**
Alternaria (Ulocladium)	10	-	-	-	-	-
Ascospores	300	300	200	300	100	300
Aspergillus/Penicillium	**1300**	**2300**	**6530**	**32400**	**940**	**810**
Basidiospores	7250	3500	3200	3200	3100	1900
Chaetomium	**10**	-	-	-	-	-
Cladosporium	**680**	300	**900**	90	100	100
Ganoderma	40	90	40	100	90	40
Myxomycetes	40	-	-	-	-	-
Stachybotrys/Memnoniella	**90**	**-**	**10**	**100**	-	-
Total Spores	**9,720**	**6,490**	**10,880**	**36,190**	**4,330**	**3150**

Fungal Species	**6479-S7 Basement Corridor (Count/m³)**	**6479-S8 Low Height Storage (Count/m³)**	**6479-S9 Classroom 008 (Count/m³)**	**6479-S10 Basement Corridor (Count/m³)**	**6479-S11 Outdoors (Count/m³)**
Alternaria (Ulocladium)	-	-	-	-	100
Ascospores	100	200	200	300	600
Aspergillus/Penicillium	**900**	200	**600**	**770**	40
Basidiospores	2600	3200	2100	2600	9600
Chaetomium	-	-	-	-	-
Cladosporium	90	10	200	470	300
Ganoderma	90	40	40	300	300
Myxomycetes	-	-	-	40	40
Stachybotrys/Memnoniella	-	-	-	-	-
Total Spores	**3,780**	**3,650**	**3,140**	**4,480**	**11,010**

Notes:

"-" = Less than the laboratory detection limit of 1 fungal spore or structure

"**Bold & Underline**" = Elevated spore concentration

6.0 Conclusions & Recommendations

6.1 Asbestos

All confirmed and suspect asbestos containing materials identified in Tables 2 & 3 must be removed and disposed of as asbestos waste prior to demolition or disturbance as per WorkSafeBC Regulation Part 20.112. Materials suspected of containing asbestos must be treated as asbestos unless samples of the material are collected for confirmation.

Please keep a copy of this report at the site during the work.

All identified asbestos containing materials are considered to be friable or can potentially be friable when removed or disturbed. An experienced hazardous materials contractor must be retained to remove the asbestos containing materials. The hazardous materials contractor is required to file a Notice of Project for asbestos with WorkSafeBC 48 hours prior the start of the work. The contractor is also required to submit a copy of their work procedures and conduct a Risk Assessment to determine the most appropriate method of removing the asbestos materials without exposing others to undue risk.

Air monitoring should be performed for moderate risk asbestos abatement work in occupied buildings and air monitoring is mandatory for all high risk asbestos abatement work.

Concealed Materials

The contractor must be aware of the potential for unidentified asbestos materials to be encountered in concealed or inaccessible locations during the demolition phase of the work (e.g. double layer drywall, concealed textured finishes, flooring materials beneath subfloors/existing flooring, materials in concealed ceiling/wall cavities, etc). All workers should be informed of this fact. If materials which have not been sampled, missed during the survey or if materials suspected of containing asbestos are encountered and were not identified in this report, do not disturb or damage the material. Isolate the work area and contact Kinetic OHS for additional sampling or confirmation.

6.2 Lead

6.2.1 Lead Materials

Lead vent pipes were observed on the roof. Remove and handle the material with protective gloves and recycle/dispose of lead materials in accordance with the BC Ministry of Environment Regulations.

6.2.2 Lead Paint & Coatings

Eight (8) major paint colours on the structure were collected for lead analysis. Seven (7) out of the 8 paint samples were determined to have lead in concentrations exceeding 90 mg/kg; therefore,

Kinetic OHS considers the majority of the paints on building material surfaces to consist of lead-based paints and control measures are required when disturbing the paints/coatings.
One (1) sample of the red ceramic tile glazing was collected for lead analysis. The glazing was determined to be less than 90 mg/kg; therefore, no lead control measures are required when disturbing the material.

When heavy duty equipment (such as an excavator) is used to demolish the structure, both the equipment operator and the worker performing dust control (with water), should wear respirators equipped with P100 filters.

WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating and requires that a risk assessment be performed to determine the control measures and PPE required to perform the task safely. On Page 57 of the *Safe Work Practices for Handling Lead* publication (2017), WorkSafeBC provides an example stating that one should "use appropriate workplace controls during the removal or disturbance of any paint containing more than 90 mg/kg lead if vulnerable people are (or will be) present. These individuals could include pregnant women (or those trying to become pregnant), older workers, and children. The employer has a responsibility to protect all people who could be harmed by any lead released during the work."

For hot work, the paint must be removed a minimum of 4 inches on either side of the cut line or where welding takes place. The removal of the paint must be performed by lead trained workers using the appropriate PPE and safe work procedures. Although the paint has been removed, WorkSafeBC still classifies "the welding, burning or cutting of surfaces from which lead-containing coasting have been removed" as a Low-Moderate Risk activity.

The removal or disturbance of lead paint or coatings must be performed in accordance with Part 6 of the WorkSafeBC Occupational Health & Safety Regulation (including the associated guidelines) and the WorkSafeBC publication "*Safe Work Practices for Handling Lead*". Only workers with lead training should perform this task. Some of the items to note are as follows:

- Perform a Risk Assessment to determine the most appropriate control measures and personal protective equipment required to perform the task safely.
- File a Notice of Project (NOP) – Hazardous Substances at least 48 hours prior to the start of work for activities which significantly disturb lead-containing materials (e.g. exposure to airborne lead above one-half of the exposure limit). According to WorkSafeBC, Low-Risk and some Low-Moderate and Moderate-Risk work activities may not require the submission of an NOP as these work activities are not expected to result in elevated airborne lead levels. Low-Risk work activities include applying lead-containing paint with a brush or roller, installing or removing sheet metal that contains lead, operating an excavator (within the cab) during building demolition, transporting sealed containers of lead waste. Manually demolishing lead-painted plaster walls or building components using a sledgehammer or similar tool is a Moderate-Risk activity.
- Some of the control methods used should include the use of respirators equipped with P100 filters, disposable coveralls with head and foot covering, HEPA negative air filtration units and poly barriers for dust control, water spray, and appropriate worker decontamination/wash down procedures.

- Air monitoring should be performed at the beginning (first shift) of the lead abatement activity unless objective air monitoring data is available.
- Place lead waste in seal bags or drums. Do not pour water used for lead cleanup into sink, drains or onto the ground. Following federal Transportation of Dangerous Goods Act and BC Ministry of Environment regulations when transporting and disposing of lead waste.

Toxicity Characteristic Leaching Procedure (TCLP) testing was not performed as part of this survey. Lead leachate (TCLP) testing may be required to classify the materials as Special Waste or non-regulated (regular) waste. The acceptable level for non-regulated disposal of lead-containing paint is less than 5 mg/L. Metal that will be recycled typically does not require TCLP testing.

6.3. Mercury

Carefully remove the mercury containing items identified in Table 5 slated for removal and place them in a secure location for disposal. Do not damage these items. Items with mercury must be recycled/disposed in accordance with the BC Ministry of Environment Regulations.

6.4 PCBs

The light fixtures identified in Table 5 may contain PCBs within the ballasts. Prior to the removal or demolition of these fixtures, the ballasts must be inspected for PCBs. The light fixtures must be de-energized, the ballasts removed from the fixtures and stored in a secure area for inspection. The *"Identification of Lamp Ballasts Containing PCBs"* document published by Environment Canada is commonly used to identify PCB ballasts. Newer ballasts will normally have "NO PCBs" indicated on the ballast label. If any of the light ballasts are determined to be PCB-containing, they must be disposed of in accordance with the BC Ministry of Environment Regulations.

6.5 Refrigerants

All items containing refrigerants slated for disposal must be removed from the site and brought to a facility for recycling/disposal or the refrigerant can be drained from the equipment by a refrigeration contractor. These items must be disposed of in accordance with the BC Ministry of Environment Regulations, specifically, the Ozone-Depleting Substances and Halocarbons Regulations. Refrigerators in good operating condition can be reused.

6.7 Toxic, Flammable and Explosive Materials

Any toxic, flammable or explosive materials remaining in the areas undergoing renovations must be removed to a safe location or be disposed of by a hazardous waste disposal contractor. Ensure the labels on the containers are intact and ensure the required personal protective equipment (PPE) is worn when handling the materials.

6.8 Mould

Discussion

Airborne mould spores can be found indoors and outdoors. Mould grows on organic substances in the presence of moisture and oxygen. Mould can grow indoors on water damaged building materials such as wood, drywall, paper, carpets, insulation, and ceiling tiles. While it is impossible to eliminate all mould spores in the indoor environments, the presence of elevated mould spores is an indication that there is mould growing on indoor substrates which requires remediation.

There are no airborne fungal spore exposure limits established by any regulatory agency, but only guideline limits. In addition, the relationship between indoor mould spore levels and health effects has not been quantified. Based on industry guidelines, research studies, information from the industrial hygiene community, and our experience, we highlight the results as being elevated when guideline limits are exceeded or when mould spore concentrations indoors are higher than the outdoor levels for sensitive individuals. The results of the spore trap samples determined the indoor concentration of various species of mould spores to exceed the outdoor concentration. Listed in Table 9 are the mould species determined to be elevated indoors, their natural habitat and suitable substrates in indoor environment.

Table 9 – Mould Species Information

Mould Species	Natural Habitat	Suitable Substrates Indoors
Aspergillus/Penicillium	Plant debris, seed, cereal crop	Prevalent in water damaged building materials, house dust, fabrics, leather, wallpaper, wallpaper glue
Basidiospores	Forest floors, lawns, plants	Wood products, carpets, foods, plywood, walls and wallpapers
Chaetomium	Dung, Seeds, Soil, Straw	Paper, Sheetrock, Wallpaper
Cladosporium	Dead plant matter, straw, soil, woody plants	Fiberglass duct liner, paint, textiles, water damaged building materials
Stachybotrys/Memnoniella	Decaying plant materials and soil	Water damaged building materials such as: ceiling tiles, gypsum board, insulation backing, sheet rock, and wall paper.

It must be noted that *Stachybotrys/Memnoniella* species produce mycotoxins which are capable of causing adverse respiratory and other symptoms. Any Stachybotrys spores found indoors is unacceptable and may is an indicator that water impacted/damaged building materials may be present.

The City of New York and U.S. EPA has guidelines for mould remediation in schools and commercial buildings. While BC does not have such guidelines, WorkSafeBC has general guidelines on performing mould assessment and remediation. Mould remediation is usually required when a mould assessment (visual and air sampling) performed by a qualified person identifies a mould contamination/growth indoors resulting in elevated exposure to building occupants and potential to cause health effects. The New York City guidelines also outline the same process for remediation where an individual trained in mould investigation identifies a mould contamination issue via visual inspection and environment sampling. Mould remediation involves the clean-up of mould and removal of moisture and source of water ingress. The goal of mould remediation is not to create a sterile environment, but rather return the area as closely as possible to the pre-damaged condition. The methods and work procedures for mould remediation are determined by the remediation contractor in accordance with industry standard and regulatory guidelines (WorkSafeBC and others referenced).

Conclusions & Recommendations

Mould growth was observed in various areas of the building and remediation is required to remove mould present on surfaces and to remove wood rot and water damaged building finishes before the building is re-occupied.

The results of the spore trap air samples collected indoors indicated elevated levels of *Aspergillus/Penicillium, Chaetomium, Cladosporium* and *Stachybotrys* in the areas which spore trap air samples were collected from. Fungal growth was observed on the ceiling and wall surfaces of all areas where elevated levels of spores were recorded. Individuals who have a sensitivity to fungal spores may encounter adverse health effects at these levels. The results indicated elevated levels of airborne mould spores in the following areas that were tested:

- Gymnasium (*Aspergillus/Penicillium, Chaetomium, Cladosporium & Stachybotrys/Memnoniella* spores)
- Corridor outside of Gymnasium (*Aspergillus/Penicillium* spores)
- Fine Arts 110 (*Aspergillus/Penicillium, Cladosporium & Stachybotrys/Memnoniella* spores)
- Classroom #3 (*Aspergillus/Penicillium & Stachybotrys/Memnoniella* spores)
- 1st Floor Corridor (*Aspergillus/Penicillium* spores)
- Classroom 010 (*Aspergillus/Penicillium* spores)
- Basement Corridor (*Aspergillus/Penicillium* spores)
- Classroom 008 (*Aspergillus/Penicillium* spores)
- Basement Corridor (*Aspergillus/Penicillium* spores)

Elevated levels of *Aspergillus/Penicillium & Cladosporium* spores and the presence of *Chaetomium* and *Stachybotrys* spores are usually markers of indoor growth and the presence of water damaged building materials.

The following are recommendations based on the air sample results and our site observations:

- Restrict the entry of building as substantial fungal growth was observed in various areas of the building. Workers entering these areas should wear a minimum of a N95 respirator.
- Retain the services of a reputable and experienced mould contractor to perform all fungal remedial work if the building will be re-occupied.
- Remove all wall and ceiling finishes with mould growth at least 1 foot away from the fringe of mould growth. Ensure that an enclosure is constructed to isolate the work area and the work area is placed under negative pressure using a HEPA negative air unit.
- Ensure all building materials affected by the work are tested for asbestos and lead-based paint.
- Inspect the backside of the exposed walls for further mould growth and remove as necessary.
- Removal mould growth on exposed wood surfaces by sanding or wire brushing with the use of a HEPA vacuum.
- HEPA vacuum the wall cavity and all exposed surfaces.
- Spray all remediated surfaces with a biocide or mould inhibitor
- Perform air clearance sampling to ensure spore levels are not elevated.

6.9 Other Hazardous Materials

Crystalline silica may be present in building materials such as concrete, brick, mortar, drywall and other similar building materials. Wear proper respiratory protection and use dust suppression techniques (e.g. water spray or local exhaust) when disturbing these materials.

Smoke detectors observed in the building are likely to contain very small amounts of ionizing radioactive components. Remove all smoke detectors slated for removal and dispose in accordance with the BC Ministry of Environment Regulations and guidelines.

7.0 Limitations

This report has been prepared to determine the locations of hazardous materials prior to the disturbance or demolition. The use of this document for any other purpose is at the sole risk of the user.

The contents of this report were based on a site assessment conducted by qualified Kinetic OHS personnel. The survey did not include for the investigation of subsurface tanks or contamination. Reasonable attempts were to identify concealed asbestos containing materials without disturbing suspect asbestos containing materials. Hazardous materials may remain unidentified in inaccessible or concealed areas which may be exposed during the demolition phase of the project.

Thank you for having Kinetic OHS conduct this work for you. Please contact us if you have any questions regarding the report or if we can provide you with further assistance for this project. Kinetic OHS can also provide the following services:

- Asbestos Air Monitoring & Inspection Services
- Asbestos Management Surveys
- City of Vancouver Qualified Professional (QP) Submissions
- Lead Air Monitoring & Sampling
- Mould/Fungal Sampling & Assessments
- Worker Exposure Monitoring for Chemicals, Dust, Fumes, Gases & Noise

Sincerely,

Kinetic OHS Services Ltd.

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File Reference: 6479-MD-R1 - SD44 - Cloverley Elem - Pre-Demo HMS-Jul21.docx

Appendix A

Asbestos Analysis Results

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44**
SITE ADDRESS: **Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 5 & 10, 2020**

COLLECTED BY: **MD/RA**
BULK ANALYST: **KS / KG**
DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-1	Room 145 (133)	White paint	None Detected		Non-fibrous 100%
	West Wall	White chalky cement	None Detected		Non-fibrous 100%
		Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Plaster**				
6479-2	Room 145 (133)	Grey putty	None Detected		Synthetic 10%, Cellulose 2%, Non-fibrous 88%
	South Wall – Around Penetration				
	Below Duct				
Material:	**Putty**				
6479-3	Room 145 (133)	Grey mastic	None Detected		Fibreglass 2%, Synthetic 1%, Non-fibrous 97%
	Grey				
	Duct				
Material:	**Mastic**				
6479-4	Room 145 (133)	White paint	None Detected		Non-fibrous 100%
	South Side	Grey putty	None Detected		Synthetic 1%, Non-fibrous 99%
	Exterior Window	Wood	None Detected		Cellulose 100%
Material:	**Putty**				
6479-5	Room 145 (133)	Beige vinyl	None Detected		Non-fibrous 100%
	Top Layer	Black mastic	None Detected		Cellulose 1%, Non-fibrous 99%
	12"x12" – Beige				
Material:	**Vinyl Floor Tile & Mastic**				
6479-6	Room 145 (133)	Black mastic	None Detected		Cellulose 3%, Synthetic 1%, Non-fibrous 96%
	Bottom Layer	Light brown vinyl	None Detected		Cellulose 30%, Non-fibrous 70%
	Brown	Brown mesh	None Detected		Cellulose 90%, Non-fibrous 10%
Material:	**Sheet Vinyl Flooring**				

Analyzed in accordance with NIOSH Method 9002 – Asbestos (Bulk) by PLM and supplemented with EPA/600/R-93/116 Test Method (excluding point count)

ASBESTOS BULK SAMPLE RESULTS

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DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-7	Room 132 (Drawing)	Green paint	None Detected		Non-fibrous 100%
	East Wall	Grey chalky mix	**Chrysotile**	**2%**	Cellulose 1%, Non-fibrous 97%
		Beige chalky mix	None Detected		Cellulose 2%, Non-fibrous 98%
Material:	**Drywall Joint Compound**				
6479-8	Room 132 (Drawing)	Light brown vinyl	None Detected		Cellulose 50%, Non-fibrous 50%
	Light Beige with Brown Shades				
Material:	**Sheet Vinyl Flooring**				
6479-9	Staff Room - 142 (129)	Silver undercoating	**Chrysotile**	**3%**	Non-fibrous 97%
	Silver				
Material:	**Sink Undercoating**				
6479-10	Room 142 (129) – Staff Room	Black mastic	None Detected		Synthetic 1%, Non-fibrous 99%
	South Exterior				
Material:	**Window Glazing Mastic**				
6479-11	Girls' Washroom (115)	White paint	None Detected		Non-fibrous 100%
	On Lower Walls	Beige fibrous layer	**Chrysotile**	**30%**	Non-fibrous 70%
		Grey fibrous layer	**Chrysotile**	**20%**	Non-fibrous 80%
Material:	**Cement Board**				
6479-12	Room 140 (125A)	White paint	None Detected		Non-fibrous 100%
	Ceiling	Beige fibrous mat	None Detected		Cellulose 40%, Mineral wool 40%, Non-fibrous 20%
	2'x4' Pinholes + Long Fissures				
Material:	**Ceiling Tile**				

ASBESTOS BULK SAMPLE RESULTS

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COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-13	Classroom #3 (117)	White paint	None Detected		Non-fibrous 100%
	West Wall	Grey chalky mix	**Chrysotile**	**3%**	Non-fibrous 97%
		Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-14	Room 135 (124 E)	Beige paint	None Detected		Non-fibrous 100%
	West Wall	White chalky mix	None Detected		Non-fibrous 100%
		Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-15	Room 137 (124G)	Red firestop	None Detected		Non-fibrous 100%
	Storage				
	Around Wire Conduits (Red)				
Material:	**Firestop**				
6479-16	Room 124B	White paint	None Detected		Non-fibrous 100%
	South Wall	Grey chalky mix	**Chrysotile**	**2%**	Cellulose 1%, Non-fibrous 97%
		Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-17	Classroom #5 (119)	Black mastic	**Chrysotile**	**5%**	Non-fibrous 95%
	North Side				
Material:	**Window Glazing Mastic**				
6479-18	Classroom #5 (119)	Yellow paint	None Detected		Non-fibrous 100%
	East Wall	White chalky mix	None Detected		Non-fibrous 100%
		White mesh	None Detected		Fibreglass 100%
Material:	**Drywall Joint Compound**	Wood	None Detected		Cellulose 100%

ASBESTOS BULK SAMPLE RESULTS

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DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-19	Classroom #7 (120)	White paint	None Detected		Non-fibrous 100%
	East Wall	White chalky mix	None Detected		Non-fibrous 100%
		Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-20	Classroom #7 (120)	Grey mastic	**Chrysotile**	**1%**	Cellulose 3%, Non-fibrous 96%
	East Side	Black mastic	None Detected		Cellulose 3%, Synthetic 2%, Non-fibrous 95%
		Wood	None Detected		Cellulose 100%
Material:	**Window Glazing Mastic**				
6479-21	West Common Hallway	Light brown vinyl	None Detected		Cellulose 50%, Non-fibrous 50%
	Brown	Brown mesh	None Detected		Cellulose 100%
Material:	**Sheet Vinyl Flooring**				
6479-22	West Common Hallway	Grey vinyl	None Detected		Cellulose 40%, Non-fibrous 60%
	Grey	Brown adhesive	None Detected		Cellulose 100%
Material:	**Sheet Vinyl Flooring**				
6479-23	West Common Hallway	Grey vinyl	**Chrysotile**	**1%**	Non-fibrous 99%
	Under Sheet Vinyl Flooring	Trace black mastic	None Detected		Non-fibrous 100%
	Grey				
Material:	**Vinyl Floor Tile**				
6479-24	West Common Hallway	White paint	None Detected		Non-fibrous 100%
	Ceiling	White chalky mix	None Detected		Non-fibrous 100%
	Upper	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				

ASBESTOS BULK SAMPLE RESULTS

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Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-25	Office (102,103,104)	Light grey paint	None Detected		Non-fibrous 100%
	Main Office	White chalky cement	None Detected		Non-fibrous 100%
	South Wall	Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Plaster**				
6479-26	Office (102,103,104)	Yellow adhesive	None Detected		Cellulose 3%, Synthetic 1%, Non-fibrous 96%
	North End Office	White vinyl	None Detected		Non-fibrous 100%
	Under Carpet	Black mastic	None Detected		Cellulose 1%, Synthetic 1%, Non-fibrous 98%
Material:	**Vinyl Floor Tile**				
6479-27	Office (102,103,104)	White paint	None Detected		Non-fibrous 100%
	Main Office	Black mastic	**Chrysotile**	**10%**	Non-fibrous 90%
	East Interior Wood Window				
Material:	**Window Glazing Mastic**				
6479-28	Room 115 (114)	Beige vinyl	**Chrysotile**	**2%**	Non-fibrous 98%
	9"x9" Taupe	Black mastic	None Detected		Non-fibrous 100%
Material:	**Vinyl Floor Tile**				
6479-29	Room 105 (105)	Thin green vinyl	None Detected		Non-fibrous 100%
	12"x12" Green	Grey vinyl	None Detected		Non-fibrous 100%
Material:	**Vinyl Floor Tile**				
6479-30	Room 112 (110,111,112)	Grey paint	None Detected		Non-fibrous 100%
	Main Common Office	Dark brown vinyl	None Detected		Non-fibrous 100%
	Brown (Painted Grey)	Yellow adhesive	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Vinyl Baseboard**				

ASBESTOS BULK SAMPLE RESULTS

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DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-31	Room 112 (110,111,112)	Grey paint	None Detected		Non-fibrous 100%
	Main Common Office	White chalky mix	None Detected		Cellulose 1%, Non-fibrous 99%
	East Wall	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-32	Basement	Black & brown mix	None Detected		Non-fibrous 100%
	Boiler Room (003)	Yellow fibrous mix	None Detected		Fibreglass 90%, Cellulose 1%, Non-fibrous 9%
	On Boiler				
Material:	**Insulation**				
6479-33	Basement	Grey fibrous mix	**Chrysotile**	**30%**	Fibreglass 30%, Non-fibrous 40%
	Boiler Room (003)				
	Around Back Boiler Door				
Material:	**Gasket**				
6479-34	Basement, Boiler Room (003)	Loose grey fibrous mix	**Chrysotile**	**50%**	Fibreglass 10%, Non-fibrous 40%
	Above Back Boiler Door				
	On Closed End Pipe				
Material:	**Gasket**				
6479-35	Basement	Dark grey fibrous layer	**Chrysotile**	**30%**	Synthetic 5%, Non-fibrous 65%
	Boiler Room (003)				
	Front Boiler Door				
Material:	**Gasket**				
6479-36	Basement	Off white chalky layer	None Detected		Synthetic 2%, Cellulose 1%, Non-fibrous 97%
	Boiler Room (003)	White mesh	None Detected		Synthetic 90%, Non-fibrous 10%
	On Pipe by Boiler	Dark brown fibrous layer	None Detected		Mineral wool 95%, Non-fibrous 5%
		Black layer	None Detected		Fibreglass 10%, Cellulose 5%, Non-fibrous 85%
		Foil	None Detected		Non-fibrous 100%
Material:	**Pipe Insulation**	Beige fibrous layer	None Detected		Cellulose 100%

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44
SITE ADDRESS: Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-37	Basement	Foil	None Detected		Non-fibrous 100%
	Boiler Room (003)	Beige paper	None Detected		Cellulose 100%
	South Pipe	Beige mesh	None Detected		Synthetic 90%, Non-fibrous 10%
		White layer	None Detected		Non-fibrous 100%
Material:	**Pipe Insulation**	Yellow fibrous mix	None Detected		Fibreglass 90%, Cellulose 5%, Non-fibrous 5%
6479-38	Basement	Beige chalky layer	None Detected		Non-fibrous 100%
	Boiler Room (003)				
	On Top of Kiln				
Material:	**Refractory Brick**				
6479-39	Basement	Grey cement mix	None Detected		Non-fibrous 100%
	Boiler Room (003)				
	Chimney, Around Penetration				
Material:	**Firestop**				
6479-40	Basement	Grey cement mix	None Detected		Non-fibrous 100%
	Boiler Room (003)				
	Chimney, Between Bricks				
Material:	**Mortar**				
6479-41	Basement	Grey cement mix	None Detected		Non-fibrous 100%
	Boiler Room (003)				
	Chimney, Between Bricks				
Material:	**Mortar**				
6479-42	Basement	Grey cement mix	None Detected		Non-fibrous 100%
	Boiler Room (003)				
	Chimney, Between Bricks				
Material:	**Mortar**				

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44**
SITE ADDRESS: **Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 5 & 10, 2020**

COLLECTED BY: **MD/RA**
BULK ANALYST: **KS / KG**
DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-43	Basement	Grey & beige vinyl	**Chrysotile**	**3%**	Non-fibrous 97%
	Room 010	Black mastic	None Detected		Non-fibrous 100%
	9"x9" Light Beige + Brown Shades				
Material:	**Vinyl Floor Tile**				
6479-44	Basement	Blue paint	None Detected		Non-fibrous 100%
	Room 010	Grey chalky mix	**Chrysotile**	**2%**	Cellulose 1%, Non-fibrous 97%
	East Wall	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**	Gypsum with mica	None Detected		Fibreglass 10%, Non-fibrous 90%
6479-45	Basement	Yellow adhesive	None Detected		Cellulose 10%, Synthetic 5%, Non-fibrous 85%
	Room 009	White vinyl	None Detected		Non-fibrous 100%
	12"x12" Light Grey	Black adhesive	None Detected		Cellulose 3%, Synthetic 3%, Non-fibrous 94%
Material:	**Vinyl Floor Tile**				
6479-46	Basement	Blue paint	None Detected		Non-fibrous 100%
	Room 009	Beige chalky mix	None Detected		Cellulose 1%, Non-fibrous 99%
	South Wall	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-47	Basement	Blue paint	None Detected		Non-fibrous 100%
	Classroom #1 (008A-008)	Grey chalky mix	**Chrysotile**	**2%**	Cellulose 1%, Non-fibrous 97%
	South Wall	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-48	Basement	Blue vinyl	None Detected		Non-fibrous 100%
	Classroom #2 (007)	White vinyl	None Detected		Non-fibrous 100%
	12"x12" Dark Blue				
Material:	**Vinyl Floor Tile**				

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44**
SITE ADDRESS: **Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 5 & 10, 2020**

COLLECTED BY: **MD/RA**
BULK ANALYST: **KS / KG**
DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-49	Basement	White paint	None Detected		Non-fibrous 100%
	Classroom #2 - 007	Black vinyl	None Detected		Non-fibrous 100%
		Blue & black paint	None Detected		Non-fibrous 100%
Material:	**Vinyl Baseboard**	Off white adhesive	None Detected		Non-fibrous 100%
6479-50	Basement	Beige vinyl	**Chrysotile**	**3%**	Non-fibrous 97%
	Common Hallway	Black mastic	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Vinyl Floor Tile & Mastic**				
6479-51	Basement	Black mastic	**Chrysotile**	**5%**	Non-fibrous 95%
	Common Hallway				
	South End				
Material:	**Window Glazing Mastic**				
6479-52	Basement	Cream paint	None Detected		Non-fibrous 100%
	Room 002	Grey chalky mix	**Chrysotile**	**2%**	Cellulose 2%, Non-fibrous 96%
	East Wall	Paper	None Detected		Cellulose 100%
Material:	**Drywall Joint Compound**				
6479-53	Basement	Yellow paint	None Detected		Non-fibrous 100%
	Stairwell	White chalky cement	None Detected		Non-fibrous 100%
	East Wall	Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Plaster**				
6479-54	Basement	Off white paint	None Detected		Non-fibrous 100%
	Boys' Washroom	White chalky cement	None Detected		Non-fibrous 100%
	East Wall	Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Plaster**				

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44
SITE ADDRESS: Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-55	Basement	White chalky mix	None Detected		Cellulose 2%, Non-fibrous 98%
	Crawlspace / Storage	Paper	None Detected		Cellulose 100%
	Ceiling	Gypsum	None Detected		Cellulose 3%, Fibreglass 2%, Non-fibrous 95%
Material:	**Drywall Joint Compound**				
6479-56	Basement	White chalky mix	None Detected		Cellulose 1%, Non-fibrous 99%
	Crawlspace / Storage	Paper	None Detected		Cellulose 100%
	South Wall				
Material:	**Drywall Joint Compound**				
6479-57	Basement	Black coating	None Detected		Cellulose 1%, Non-fibrous 99%
	Crawlspace / Storage				
	On Concrete Foundation				
Material:	**Black Coating**				
6479-58	Basement	Foil	None Detected		Non-fibrous 100%
	Crawlspace / Storage	Grey adhesive	None Detected		Non-fibrous 100%
	On Thick Pipe	Black fibrous layer	None Detected		Cellulose 70%, Fibreglass 10%, Non-fibrous 20%
Material:	**Insulation**	Orange fibrous mat	None Detected		Fibreglass 98%, Non-fibrous 2%
6479-59	Exterior	Grey paint	None Detected		Non-fibrous 100%
	South Side	Trace white layer	None Detected		Non-fibrous 100%
	Lower	Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%
Material:	**Stucco**				
6479-60	Exterior	Grey paint	None Detected		Non-fibrous 100%
	South Side	Grey cement mix	None Detected		Non-fibrous 100%
	Lower				
Material:	**Stucco**				

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44
SITE ADDRESS: Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-61	Exterior	Dark brown fibrous layer	None Detected		Cellulose 10%, Non-fibrous 90%
	South Side	White fibrous layer	None Detected		Cellulose 97%, Non-fibrous 3%
	Under Stucco				
Material:	**Construction Paper**				
6479-62	Exterior	Light grey paint	None Detected		Non-fibrous 100%
	East Side	Grey cement mix	None Detected		Non-fibrous 100%
	By Exit Door				
Material:	**Stucco**				
6479-63	Exterior	Light blue paint	None Detected		Non-fibrous 100%
	North Side	Grey cement mix	None Detected		Non-fibrous 100%
	East end				
Material:	**Stucco**				
6479-64	Exterior	White cement mix	None Detected		Non-fibrous 100%
	North Side	Grey cement mix	None Detected		Non-fibrous 100%
	Hallway Door				
Material:	**Stucco**				
6479-65	Exterior	Off white paint	None Detected		Non-fibrous 100%
	North Side	Grey cement mix	None Detected		Non-fibrous 100%
	Gym				
Material:	**Stucco**				
6479-66	Exterior	Light blue & beige paint	None Detected		Non-fibrous 100%
	West Side	White cement mix	None Detected		Non-fibrous 100%
	Gym	Grey cement mix	None Detected		Non-fibrous 100%
Material:	**Stucco**				

Analyzed in accordance with NIOSH Method 9002 – Asbestos (Bulk) by PLM and supplemented with EPA/600/R-93/116 Test Method (excluding point count)

AIHA Proficiency Analytical Testing Programs, LLC
BAPAT Lab #213222

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44**
SITE ADDRESS: **Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 5 & 10, 2020**

COLLECTED BY: **MD/RA**
BULK ANALYST: **KS / KG**
DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-67	Southwest Roof	Black tar	None Detected		Cellulose 3%, Non-fibrous 97%
		Black fibrous layer 1	None Detected		Cellulose 10%, Non-fibrous 90%
		Black fibrous layer 2	None Detected		Cellulose 15%, Non-fibrous 85%
Material:	**Membrane**				
6479-68	East Roof	Grey pebble layer	None Detected		Non-fibrous 100%
	West Side	Black fibrous layer	None Detected		Synthetic 10%, Non-fibrous 90%
		Black tar	None Detected		Non-fibrous 100%
		Black fibrous layer	None Detected		Fibreglass 15%, Non-fibrous 85%
		Black tar	None Detected		Non-fibrous 100%
Material:	**Membrane**	Brown fibrous layer	None Detected		Cellulose 100%
6479-69	East Roof	Grey pebble layer	None Detected		Non-fibrous 100%
	East Side	Black fibrous layer	None Detected		Cellulose 5%, Non-fibrous 95%
		Black tar	None Detected		Non-fibrous 100%
Material:	**Membrane**	Brown fibrous layer	None Detected		Cellulose 100%
6479-70	West Centre Roof	Black tar	None Detected		Cellulose 1%, Non-fibrous 99%
		Black layer	None Detected		Non-fibrous 100%
		Grey fibrous layer	None Detected		Cellulose 95%, Non-fibrous 5%
		White foam	None Detected		Non-fibrous 100%
Material:	**Tar & Gravel**	Brown fibrous layer	None Detected		Cellulose 80%, Non-fibrous 20%
6479-71	Northeast Roof	Black tar	None Detected		Non-fibrous 100%
		Black layer	None Detected		Cellulose 3%, Non-fibrous 97%
		Black fibrous layer	None Detected		Cellulose 30%, Non-fibrous 70%
Material:	**Membrane**	Trace wood fibres	None Detected		Cellulose 100%
6479-72	Northwest Roof	Black tar	None Detected		Non-fibrous 100%
	Gym	Black fibrous layer	None Detected		Cellulose 30%, Non-fibrous 70%
		Black tar	None Detected		Non-fibrous 100%
Material:	**Membrane**	Black fibrous layer	None Detected		Cellulose 30%, Non-fibrous 70%

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44**
SITE ADDRESS: **Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 5 & 10, 2020**

COLLECTED BY: **MD/RA**
BULK ANALYST: **KS / KG**
DATE ANALYZED: **June 16, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-73	Southwest Roof On Flashing Black **Material:** **Tar**	Black tar	None Detected		Non-fibrous 100%
6479-74	Southwest Roof Chimney Flashing **Material:** **Mastic**	Grey paint	None Detected		Non-fibrous 100%
		Black mastic	None Detected		Non-fibrous 100%
6479-75	Southwest Roof Chimney Flashing **Material:** **Mastic**	Grey paint	None Detected		Non-fibrous 100%
		Black mastic	None Detected		Synthetic 3%, Non-fibrous 97%
6479-76	Southwest Roof Chimney Flashing **Material:** **Mastic**	Grey paint	None Detected		Non-fibrous 100%
		Black mastic	None Detected		Synthetic 3%, Non-fibrous 97%
6479-77	Southwest Roof On Vent Pipes Black **Material:** **Tar**	Blue / grey paint	None Detected		Non-fibrous 100%
		Black tar	None Detected		Non-fibrous 100%
6479-78	East Roof Flashing **Material:** **Caulking**	Clear caulking	None Detected		Non-fibrous 100%

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44
SITE ADDRESS: Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-79	East Roof Vent Pipe Black **Material:** **Tar**	Black tar	None Detected		Cellulose 1%, Non-fibrous 99%
6479-80	West Centre Roof Flashing **Material:** **Caulking**	Black layer	None Detected		Non-fibrous 100%
		Grey caulking	None Detected		Non-fibrous 100%
6479-81	Northeast Roof West Flashing **Material:** **Caulking**	Black layer	None Detected		Non-fibrous 100%
		Soft white caulking	None Detected		Non-fibrous 100%
6479-82	Northeast Roof On Exhaust Vent Black **Material:** **Tar**	Black tar	None Detected		Non-fibrous 100%
6479-83	Exterior West Side Upper **Material:** **Window Putty**	Black paint	None Detected		Non-fibrous 100%
		White putty	None Detected		Non-fibrous 100%
		Trace wood	None Detected		Cellulose 100%
6479-84	Exterior South Side Lower **Material:** **Window Putty**	White putty	None Detected		Non-fibrous 100%

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44
SITE ADDRESS: Cloverley Elementary - 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 5 & 10, 2020

COLLECTED BY: MD/RA
BULK ANALYST: KS / KG
DATE ANALYZED: June 16, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-85	Exterior	Black paint	None Detected		Non-fibrous 100%
	North Side	White putty	None Detected		Non-fibrous 100%
	East End				
Material:	**Window Putty**				
6479-86	Exterior	Black paint	None Detected		Non-fibrous 100%
	North Side	White putty	**Chrysotile**	**1%**	Non-fibrous 99%
	Centre				
Material:	**Window Putty**				
6479-87	Exterior	Black paint	None Detected		Non-fibrous 100%
	North Building	White putty	**Chrysotile**	**1%**	Non-fibrous 99%
	Southeast Window				
Material:	**Window Putty**				
6479-88	1st Floor	White paint	None Detected		Non-fibrous 100%
	Storage 116A	White chalky mix	None Detected		Non-fibrous 100%
	North Wall	Paint	None Detected		Non-fibrous 100%
		Grey chalky mix	**Chrysotile**	**1%**	Non-fibrous 99%
		Paint	None Detected		Non-fibrous 100%
		White chalky cement	None Detected		Non-fibrous 100%
Material:	**DJC on Plaster**	Grey cement mix	None Detected		Cellulose 1%, Non-fibrous 99%

Total Number of Samples: 88

Samples Collected By: Kinetic OHS

Final Report Reviewed by: Karen Soothill, Analyst

Notes:

- "*None Detected*" means no asbestos fibres observed or detected in the sample.
- Six regulated forms of asbestos are: Chrysotile, Amosite, Crocidolite, Actinolite, Tremolite and Anthophyllite. Samples highlighted in "**YELLOW**" contain asbestos.
- Definition of "asbestos containing material" is any material that contains 0.5% or greater of asbestos (refer to Part 6, Section 6.1 of the WorkSafeBC Occupational Health & Safety Regulation for further information). Vermiculite containing materials are defined as asbestos containing if any asbestos is detected.
- Limit of Detection is less than 1% using NIOSH 9002 and supplemented with EPA/600/R-93/116 as required (excluding point count).
- Samples with less than 1% asbestos are recommended for 400-point count plus gravimetric reduction or 1,000-point count.
- All samples will be disposed of 30 days after submittal unless samples are requested for return upon receipt of the results.

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: **6479-MD**
CLIENT: **SD44 – North Vancouver District**
SITE ADDRESS: **440 Hendry Avenue, North Vancouver, BC**
DATE COLLECTED: **June 18, 2020**

COLLECTED BY: **RA**
BULK ANALYST: **KS**
DATE ANALYZED: **June 18, 2020**

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-89	Room 145 (133) On Duct Grey	Grey mastic	None Detected		Synthetic 1%, Non-fibrous 99%
Material:	**Duct Mastic**				
6479-90	Room 145 (133) On Duct Grey	Grey mastic	None Detected		Synthetic 1%, Non-fibrous 99%
Material:	**Duct Mastic**				
6479-91	Room 145 (133) South Wall Around Penetration Below Duct	Grey putty	None Detected		Synthetic 10%, Non-fibrous 90%
Material:	**Putty**				
6479-92	Room 145 (133) South Wall Around Penetration Below Duct	Grey putty	None Detected		Synthetic 10%, Non-fibrous 90%
Material:	**Putty**				
6479-93	Room 140 (125A & 125B) Ceiling 2'x4' Pinholes + Long Fissures	White paint Beige fibrous mat	None Detected None Detected		Non-fibrous 100% Cellulose 40%, Mineral wool 40%, Non-fibrous 20%
Material:	**Ceiling Tile**				
6479-94	Room 140 (125A & 125B) Ceiling 2'x4' Pinholes + Long Fissures	White paint Beige fibrous mat	None Detected None Detected		Non-fibrous 100% Cellulose 40%, Mineral wool 40%, Non-fibrous 20%
Material:	**Ceiling Tile**				

Analyzed in accordance with NIOSH Method 9002 – Asbestos (Bulk) by PLM and supplemented with EPA/600/R-93/116 Test Method (excluding point count)

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44 – North Vancouver District
SITE ADDRESS: 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 18, 2020

COLLECTED BY: RA
BULK ANALYST: KS
DATE ANALYZED: June 18, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres

Total Number of Samples: 6

Samples Collected By: Kinetic OHS

Final Report Reviewed by: Karen Soothill, Analyst

Notes:

- "*None Detected*" means no asbestos fibres observed or detected in the sample.
- Six regulated forms of asbestos are: Chrysotile, Amosite, Crocidolite, Actinolite, Tremolite and Anthophyllite. Samples highlighted in "**YELLOW**" contain asbestos.
- Definition of "asbestos containing material" is any material that contains 0.5% or greater of asbestos (refer to Part 6, Section 6.1 of the WorkSafeBC Occupational Health & Safety Regulation for further information). Vermiculite containing materials are defined as asbestos containing if any asbestos is detected.
- Limit of Detection is less than 1% using NIOSH 9002 and supplemented with EPA/600/R-93/116 as required (excluding point count).
- Samples with less than 1% asbestos are recommended for 400-point count plus gravimetric reduction or 1,000-point count.
- All samples will be disposed of 30 days after submittal unless samples are requested for return upon receipt of the results.

ASBESTOS BULK SAMPLE RESULTS

KINETIC PROJECT NO.: 6479-MD
CLIENT: SD44 – North Vancouver School District
SITE ADDRESS: 440 Hendry Avenue, North Vancouver, BC
DATE COLLECTED: June 25, 2020

COLLECTED BY: RA
BULK ANALYST: KS
DATE ANALYZED: June 26, 2020

Sample ID	Sample Description	Layer	Asbestos Type	%	Other Fibres
6479-95	Under Gym In between Wood Posts	Black fibrous mat	None Detected		Cellulose 70%, Non-fibrous 30%
		Black tar	None Detected		Cellulose 2%, Non-fibrous 98%
Material:	**Construction Paper**				

Total Number of Samples: 1

Samples Collected By: **Kinetic OHS**

Final Report Reviewed by: **Karen Soothill, Analyst**

Notes:

- "*None Detected*" means no asbestos fibres observed or detected in the sample.
- Six regulated forms of asbestos are: Chrysotile, Amosite, Crocidolite, Actinolite, Tremolite and Anthophyllite. Samples highlighted in "**YELLOW**" contain asbestos.
- Definition of "asbestos containing material" is any material that contains 0.5% or greater of asbestos (refer to Part 6, Section 6.1 of the WorkSafeBC Occupational Health & Safety Regulation for further information). Vermiculite containing materials are defined as asbestos containing if any asbestos is detected.
- Limit of Detection is less than 1% using NIOSH 9002 and supplemented with EPA/600/R-93/116 as required (excluding point count).
- Samples with less than 1% asbestos are recommended for 400-point count plus gravimetric reduction or 1,000-point count.
- All samples will be disposed of 30 days after submittal unless samples are requested for return upon receipt of the results.

Appendix B

Lead Paint Results

Your C.O.C. #: G148657

[redacted]

KINETIC OHS SERVICES LTD.
#202 – 1520 Barrow Street
NORTH VANCOUVER, BC
CANADA V7J 1B7

Report Date: 2020/06/12
Report #: R2889672
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C038895
Received: 2020/06/08, 17:05

Sample Matrix: Paint
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by ICP-AES (acid extr. solid)	8	2020/06/12	2020/06/12	BBY7SOP-00018	EPA 6010d m

Sample Matrix: Solid
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by ICP-AES (acid extr. solid)	1	2020/06/12	2020/06/12	BBY7SOP-00018	EPA 6010d m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your C.O.C. #: G148657

[redacted]
KINETIC OHS SERVICES LTD.
#202 – 1520 Barrow Street
NORTH VANCOUVER, BC
CANADA V7J 1B7

Report Date: 2020/06/12
Report #: R2889672
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C038895
Received: 2020/06/08, 17:05

Encryption Key

AUTHORIZED REPORT
RAPPORT AUTORISÉ

Bureau Veritas Laboratories
12 Jun 2020 12:34:35

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Customer Solutions, Western Canada Customer Experience Team
Email: customersolutionswest@bvlabs.com
Phone# (604) 734 7276
==

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ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

BV Labs ID		XW9080		
Sampling Date		2020/06/05		
COC Number		G148657		
	UNITS	**6479-L6**	**RDL**	**QC Batch**
Total Metals by ICP				
Total Lead (Pb)	mg/kg	<2.0	2.0	9882633

RDL = Reportable Detection Limit

LEAD IN PAINT CHIPS (PAINT)

BV Labs ID		XW9075	XW9076		XW9077		XW9078		XW9079		
Sampling Date		2020/06/05	2020/06/05		2020/06/05		2020/06/05		2020/06/05		
COC Number		G148657	G148657		G148657		G148657		G148657		
	UNITS	**6479-L1**	**6479-L2**	**RDL**	**6479-L3**	**RDL**	**6479-L4**	**RDL**	**6479-L5**	**RDL**	**QC Batch**
Total Metals by ICP											
Total Lead (Pb)	mg/kg	2000	1220	2.0	905	6.0	1020	2.0	48.3	4.0	9882633
RDL = Reportable Detection Limit											

BV Labs ID		XW9081	XW9082	XW9083		
Sampling Date		2020/06/05	2020/06/05	2020/06/05		
COC Number		G148657	G148657	G148657		
	UNITS	**6479-L7**	**6479-L8**	**6479-L9**	**RDL**	**QC Batch**
Total Metals by ICP						
Total Lead (Pb)	mg/kg	2090	114	723	2.0	9882633
RDL = Reportable Detection Limit						

GENERAL COMMENTS

LEAD IN PAINT CHIPS (PAINT) Comments

Sample XW9077 [6479-L3] Elements by ICP-AES (acid extr. solid): Detection limits raised based on sample weight used for analysis.
Sample XW9079 [6479-L5] Elements by ICP-AES (acid extr. solid): Detection limits raised based on sample weight used for analysis.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9882633	Total Lead (Pb)	2020/06/12	97	75 - 125	<2.0	mg/kg	13	40	104	70 - 130

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU VERITAS

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Toll Free (833) 282-5227
Victoria: 851 Viewfield Road, Unit 1, Victoria, BC V9A 4V2 Toll Free (833) 282-5227
bvlabs.com

CHAIN OF CUSTODY RECORD

G 148657

Page 1 of 1

Invoice Information

Company: Kinetic OHS Services
Contact Name: [redacted]
Address:
Phone/Fax:
Email: r.
Copies:

Report Information (if differs from invoice)

Company: Same
Contact Name:
Address:
PC:
Phone/Fax:
Email:
Copies:

Project Information

Quotation
P.O. #/AFE#:
Project #:
Site Location:
Site #:
Sampled By: [redacted]

Turnaround Time (TAT) Required

☑ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days
☐ 1 Day ☐ 3-4 Days

Date Required:
Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID	
Seal Present	NA			
Seal Intact			Temp	NA
Cooling Media				
	YES	NO	Cooler ID	
Seal Present				
Seal Intact			Temp	
Cooling Media				
	YES	NO	Cooler ID	
Seal Present				
Seal Intact			Temp	
Cooling Media				

Depot Reception

Analysis Requested

- # of Containers
- ☐ BTEXS / VPH ☐ VOC / BTEXS / VPH ☐ MTBE
- ☐ BTEX F1 ☐ VOC / BTEX / F1
- ☐ PAH ☐ LEPH / HEPH / PAH
- ☐ EPH ☐ TEH ☐ F2 - F4
- ☐ Dissolved Metals ☐ Filtered? ☐ Preserved?
- ☐ Dissolved Mercury ☐ Filtered? ☐ Preserved?
- ☐ Total Metals ☐ Field Preserved?
- ☐ Total Mercury ☐ Field Preserved?
- ☐ Chloride ☐ Fluoride ☐ Sulphate
- ☐ TSS ☐ TDS ☐ BOD ☐ COD
- ☐ pH ☐ Conductivity ☐ Alkalinity
- ☐ Nitrite ☐ Nitrate ☐ Ammonia
- Lead in Paint / glazing
- HOLD - DO NOT ANALYZE

Regulatory Criteria

☐ BC CSR
☐ YK CSR
☐ CCME
☐ Drinking Water
☐ BC Water Quality
☐ Other

	Sample Identification	Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	Lead in Paint / glazing	Special Instructions
1	6479-L1	20 20[illegible]/06/05		Paint	✓	
2	6479-L2	〃		〃	✓	
3	6479-L3	〃		〃	✓	
4	6479-L4	〃		〃	✓	
5	6479-L5	〃		〃	✓	
6	6479-L6	〃		glazing → solid	✓	
7	6479-L7	〃		Paint	✓	
8	6479-L8	〃		〃	✓	
9	6479-L9	〃		〃	✓	
10						

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):
[redacted]	2020/06/08	15:00	[redacted]	2020/06/08	17:05

C038895_COC

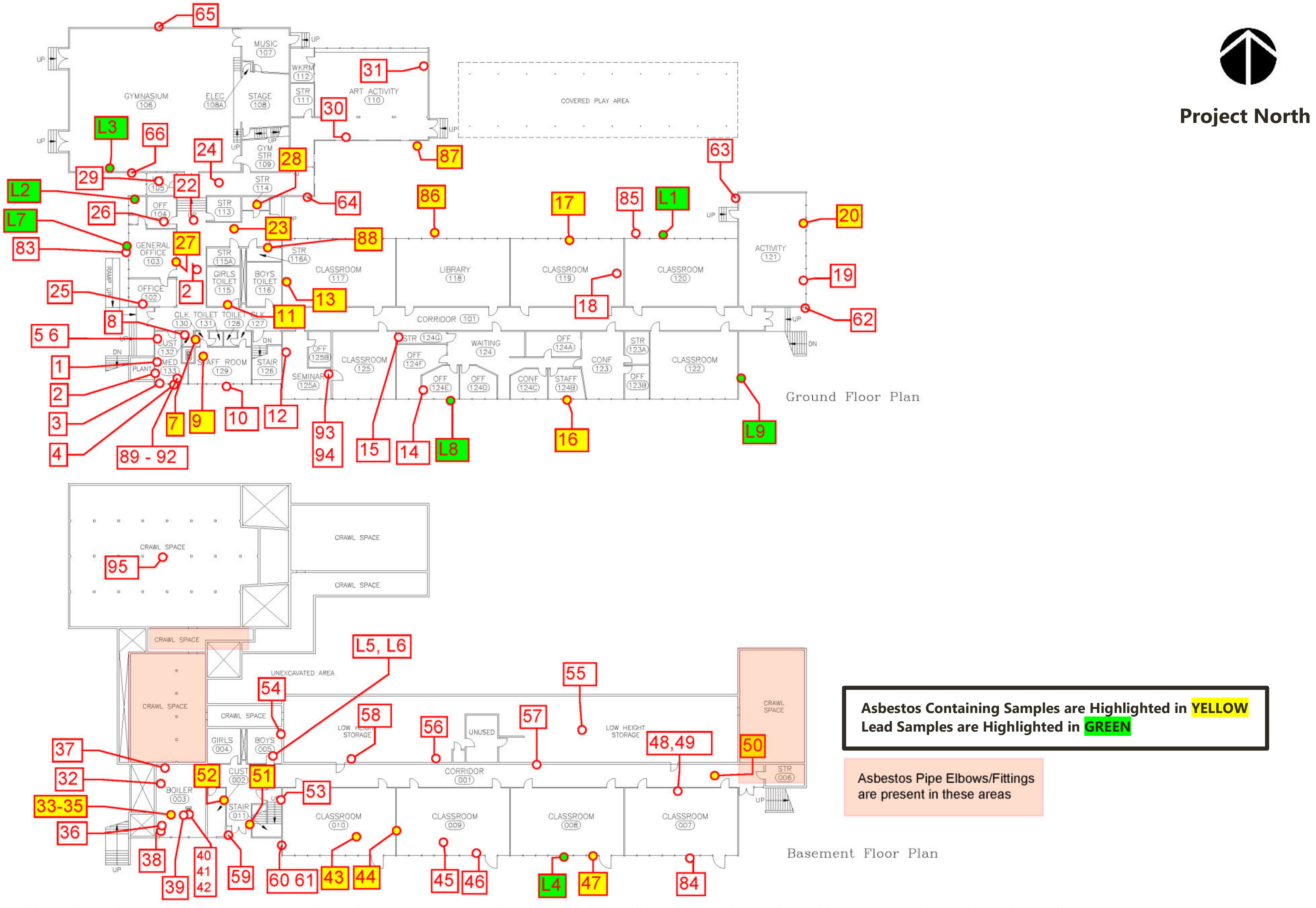
COC-1020

Bureau Veritas Shaping a World of Trust©

00077/13

Appendix C

Sample Locations & Floor Plans

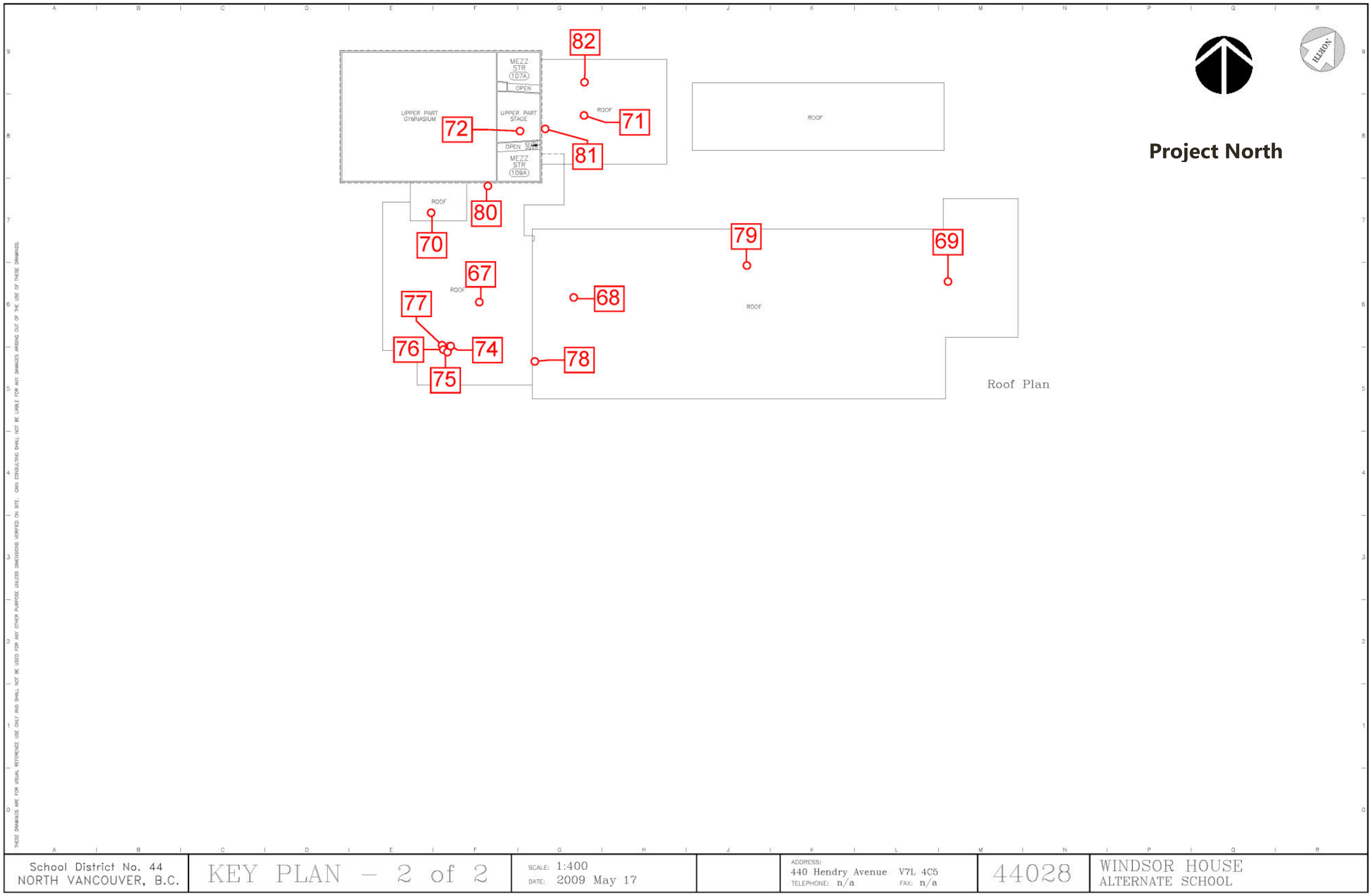


Asbestos Containing Samples are Highlighted in YELLOW
Lead Samples are Highlighted in GREEN

Asbestos Pipe Elbows/Fittings are present in these areas

Project No: 6479-MD	Scale: Not to Scale	Title: Asbestos & Lead Sample Locations
Date: July 3, 2020	Drawn By: RA	Site: Cloverley Elementary School

Kinetic
OHS Services



Project No: 6479-MD	Scale: Not to Scale	Title: Asbestos & Lead Sample Locations
Date: July 3, 2020	Drawn By: RA	Site: Cloverley Elementary School - Roof

Kinetic
OHS Services

Appendix D

Photographs

Photo 1 Location: Typical Washrooms

Description: Asbestos Containing Cement Wall Board

Photo 2 Location: 1st Floor – Room 138 (125) – Kitchenette

Description: Asbestos Containing Sink Undercoating

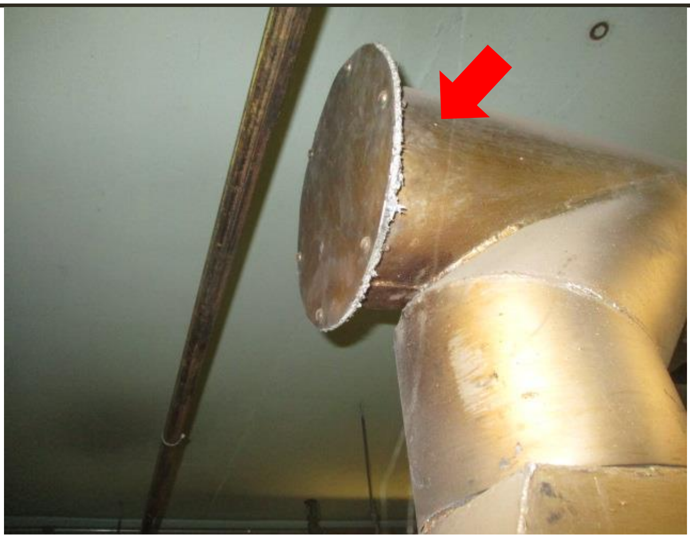


Photo 3 Location: Basement – Boiler Room 003

Description: Asbestos Containing Gasket on Exhaust

Photo 4 Location: Basement – Boiler Room 003

Description: Asbestos Containing Gasket Between Boiler Door & Boiler

Photo 5 Location: Basement – Custodian Room 002

Description: Asbestos Containing 9”x9” Vinyl Floor Tile

Photo 6 Location: Basement – Corridor

Description: Asbestos Containing 9”x9” Vinyl Floor Tile

Photo 7 Location: Basement – Crawlspace

Description: Suspect Asbestos Containing Bell & Spigot (Typical)

Photo 8 Location: Basement – East Side Crawlspace

Description: Asbestos Containing Pipe Insulation

Photo 9 Location: Typical Interior Window

Description: Asbestos Window Glazing Mastic

Photo 10 Location: Typical Ceiling

Description: Drywall Ceiling (Unfinished) Above Ceiling Tiles

Photo 11 Location: Basement – Boiler Room 003

Description: Asbestos Containing Gasket on Burner End

Photo 12 Location: Basement – Classroom 002

Description: Asbestos Containing 9”x9” Vinyl Floor Tile

Photo 13 Location: Basement – Corridor 001

Description: Asbestos Containing 9”x9” Vinyl Floor Tile

Photo 14 Location: Low Height Storage in Basement

Description: Drywall Joint Compound (Treat as asbestos)

Photo 15 Location: Crawlspace

Description: Non Asbestos Containing Pipe Insulation (Fibreglass)

Photo 16 Location: Typical Exterior Window

Description: Asbestos Window Putty

Photo 17	Location: Roof
Description: Non-Asbestos Roof Membrane	

Photo 18	Location: Roof
Description: Non-Asbestos Tar & Gravel	

Photo 19	Location: Crawlspace Below Gymnasium
Description: Asbestos Containing Duct Mastic (Silver)	

Photo 20	Location: Crawlspace Below Gymnasium
Description: Asbestos Containing Pipe Elbows & Fittings	

Photo 21	Location Crawlspace
Description: Bell & Spigot Housings (Typical)	

Photo 22	Location: Gymnasium
Description: Water Damage to Wall & Ceiling	

Photo 23	Location: Gymnasium
Description: Mould Growth on Walls & Water Damage	

Photo 24	Location: 1st Floor – Classroom #3 (117)
Description: Mould Growth on Cellulose Ceiling Tiles	

Photo 25	Location 1st Floor – Classroom #2
Description: Water Damage on Cellulose Ceiling Tiles	

Photo 26	Location: Basement – Corridor
Description: Water Damage on Cellulose Ceiling Tiles	

Photo 27	Location: 1st Floor – Fine Arts (110)
Description: Water Damage/Leaks	

Photo 28	Location: 1st Floor – Fine Arts (110)
Description: Water Stains on Cellulose Ceiling Tiles	

Appendix E

Asbestos Assessment Update Report (2005)

Pacific

file: Cloverley.

Environmental Consulting &
Occupational Hygiene Services
(Vancouver)

18 August 2005

School District #44 (North Vancouver)
721 Chesterfield Avenue
North Vancouver, BC
V7M 2M5

Attention: **Mr. Gord Kinney, Occupational Health & Safety Manager**

Reference: **Cloverley Elementary – Asbestos Assessment Update Report (2005)**

Dear Sir,

As requested, the following report updates the information contained in the original Assessment of Asbestos Containing Materials report prepared by ACM Services Ltd. in 1990.

1.0 Introduction

Cloverley Elementary is located at 440 Hendry Avenue, North Vancouver, BC. Since the Assessment of Asbestos Containing Materials report was completed in 1990, renovations and the removal of asbestos containing materials have taken place over the intervening years. Some of the asbestos containing materials removed were catalogued and some were not.

This report will attempt to identify all remaining exposed and accessible asbestos containing materials currently in the school as of July 2005, with the exception of drywall, plaster, stucco, mastic, putty and roofing materials.

Representative samples of drywall joint compound material were not collected for asbestos identification due to the complex nature of renovations that have occurred, making the identification of all remaining original construction materials very difficult. Two random samples of drywall joint compound were collected from the school for inventory purposes.

2.0 The Asbestos Hazard Assessment Process

This assessment is confined to the potential hazard posed by asbestos containing materials, determined by polarized light microscopy, to be present in the materials sampled.

> *Please note that the definition of an asbestos containing material that requires special handling in accordance with regulatory requirements is one which has one percent (1%) or greater asbestos content.*

This assessment was as comprehensive as it could be with all accessible locations inspected. However, since the school is still in operation, a destructive survey was not performed. Typically, a non-destructive survey will be able to identify approximately 90% of the asbestos containing materials present.

Samples of suspected asbestos containing building materials that have not been previously identified were collected and analyzed at the laboratories of Pacific Environmental in accordance with the WCB 0205 Analytical Method. All bulk sample results pertaining to this school are located in Appendix B.

Samples of roofing materials were not collected as the building is in use and the collection of the sample may affect the integrity of the roof membrane. Samples of the roofing material should be collected for identification when the roof is replaced or is disturbed during renovation, demolition or repair work.

3.0 Asbestos Assessment Results

Asbestos containing materials were identified in this school and all of the materials were observed to be in good condition.

.1 Asbestos Containing Materials Identified

A variety of asbestos containing materials were identified in this school. Table 1 lists the materials that were identified as asbestos containing and the minimum Workers' Compensation Board of BC (WCB-BC) work procedures required for asbestos abatement.

Table 1: Asbestos Inventory & Removal Methods

Asbestos Materials Identified	Asbestos Removal Method
9" Beige Floor Tile 12" Blue Floor Tile 12" White Floor Tile	Moderate Risk
Asbestos Cement Panels	Moderate Risk
Boiler Exhaust Gaskets	Moderate Risk
Drywall Joint Compound	Moderate Risk
Duct Mastic	Moderate Risk
Duct Expansion Joint Material	Moderate Risk
Mudded Elbows/Fittings	Moderate Risk
Pipe Insulation	Moderate Risk

.2 Locations of Asbestos Containing Materials

Detailed results of this asbestos assessment are tabulated in a table format, using existing Building Key Plan drawings for reference, in Appendix A. The Location Reference Numbers in the tables corresponds to the numbers located on Building Key Plan #99071 (October 21, 1992). The results of this assessment are shown in a table format for quick reference, which identifies the location and the asbestos materials present in each area.

Please note that drywall, plaster, stucco, mastic, putty and roofing materials were not identified in this report. Asbestos containing drywall joint compound is likely to be present in any building constructed prior to 1980, but is dependent on the era of construction and the renovation work performed over the years. Materials present under carpeted areas or in inaccessible areas were also not identified.

4.0 Conclusions/Recommendations

The asbestos containing materials identified in the school do not pose a health risk to staff or students as long as the materials remain in good condition and are not disturbed. With the exception of the crawlspace, all remaining asbestos containing materials identified were noted to be in good condition with no remedial action required.

.1 Crawlspace

A single crawlspace encompasses the entire school and a portion of the crawlspace was identified as being contaminated with asbestos. Entry into the crawlspace can be gained from the two wall hatches located on the Basement Level or from two floor hatches located on the Main Floor. No asbestos containing materials or debris was observed in the Low Height Storage Area. The location of the asbestos contaminated crawlspaces have been identified below:

Location of Crawlspace	Asbestos Materials Present In the Crawlspace
Crawlspace – North & South of the Low Height Storage Area	Mudded Elbows/Fittings Asbestos Pipe Insulation Asbestos Debris on Crawlspace Floor Grey Mastic on Ductwork

The presence of asbestos debris on the crawlspace floor poses a health hazard to employees entering the space without wearing the proper personal protective equipment. We recommend that access to the crawlspace areas North & South of the Low Height Storage Area be restricted to all persons by appropriate signage and entry into the crawlspaces will require employees to wear a half-mask respirator equipped with P100 filter cartridges and disposal Tyvek (or similar) disposable coveralls.

Remediation of the contaminated crawlspace areas should be performed as soon as possible by vacuuming all surfaces and spraying the area with an encapsulating agent. All asbestos pipe insulation in the crawlspace should also be removed and reinsulated with fibreglass.

.2 Drywall/Plaster Materials

Drywall and plaster are used extensively throughout the school and may contain asbestos depending on the era of renovations and construction. Many bulk samples would have to be collected and analyzed to be able to identify the walls and ceilings that contain asbestos. The two drywall joint compound samples that were randomly collected were both identified as non-asbestos. However, asbestos containing drywall joint compound may be present in other areas of the school.

We recommend that all drywall and plaster materials in the building be treated as asbestos containing unless labelled otherwise. Should it become necessary to undertake work on any drywall or plaster components, maintenance staff or contractors will either, collect and send a sample of the material for analysis or use appropriate asbestos work procedures for the work.

.3 Concealed Materials

Materials such as pipe insulation and mastics may be present in inaccessible wall and ceiling spaces and asbestos containing flooring materials may be present beneath sub-floors and carpeted areas of the school. If materials suspected of containing asbestos are observed and are not listed in Appendix A, samples should be collected for confirmation or the material shall be treated as asbestos containing.

.4 Asbestos Exposure Control Plan

An Asbestos Exposure Control Plan (AECP) must be developed and maintained to ensure all outside contractors, custodial, maintenance and staff employees are aware of the asbestos containing materials present in the building prior to performing any work. The WCB Occupational Health & Safety Regulations, Sections 5.54 & 6.3, requires the AECP to consist of the following elements:

- Statement of purpose and responsibilities
- Risk identification, assessment and control
- Education and training
- Written work procedures, when required
- Hygiene facilities and decontamination procedures, when required
- Health monitoring, when required
- Documentation, when required
- Annual inspections

An Asbestos Operations and Management Program (AOMP) should also be developed as an integral part of the AECP and should consist of the following components:

- Designate a person to oversee the program and to ensure the asbestos inventory is kept current
- Review the Program at least annually
- Worker awareness and training
- Work procedures for maintenance personnel to deal with all asbestos containing materials present in the building
- Procedures to notify outside workers/contractors
- Development of a respirator program for maintenance workers

- Labelling Program
- Implement program for the phased removal of all friable asbestos products
- Ensure a copy of this Report be available in a central location of the school (preferably the Custodian's Office).

.5 Conducting Risk Assessments Prior to Renovation or Asbestos Removal/Repair Work

Before any renovation or asbestos repair/removal work is undertaken, the WCB of BC Regulations requires a risk assessment to be conducted, by a qualified person, of the asbestos containing materials identified within this report. This is referenced in the WCB Regulations, Section 6.6, and reads as follows:

> 6.6 (1) The employer must ensure that a risk assessment is conducted by a qualified person on asbestos-containing material identified in the inventory, with due regard for the condition of the materials, its friability, accessibility and likelihood of damage, and the potential for fibre release and exposure of workers.
>
> (2) The employer must ensure that a risk assessment has been conducted by a qualified person before any demolition, alteration, or repair of machinery, equipment, or structures where asbestos may be disturbed.
>
> (3) *Before work involving asbestos takes place, the* employer must ensure that a qualified person assesses the work activity and classifies it as a low, moderate, or high risk activity.
>
> (4) The qualified person referenced in subsections (1) and (3) must be an occupational health and safety professional with experience in the practice of occupational hygiene as it relates to asbestos management.

6.0 Statement of Qualifications

Pacific Environmental Consulting and Occupational Hygiene Services (Vancouver) has been providing consulting services in the environmental and industrial hygiene fields, since 1990. Our services include Hazardous Material Assessments, Air Monitoring for Contaminants in Air, Environmental Site Assessments, and Environmental Project Management. Our industrial hygiene expertise ensures that our projects will be performed in accordance with the Workers' Compensation Board Industrial Health and Safety Regulations. Our staff includes the following:

- Professional Engineer
- Certified Industrial Hygienist (CIH)
- Canadian Registered Safety Professional (CRSP)
- Hydrologist and Geophysicist
- Environmental Technicians
- Occupational Health and Safety Technicians

Pacific Environmental Consulting and Occupational Hygiene Services (Vancouver) carries Environmental Professional Liability Insurance to protect clients to which we provide professional services.

Thank you for having Pacific Environmental perform this work for you. Should you have any questions, please contact us at your earliest convenience.

Yours truly,

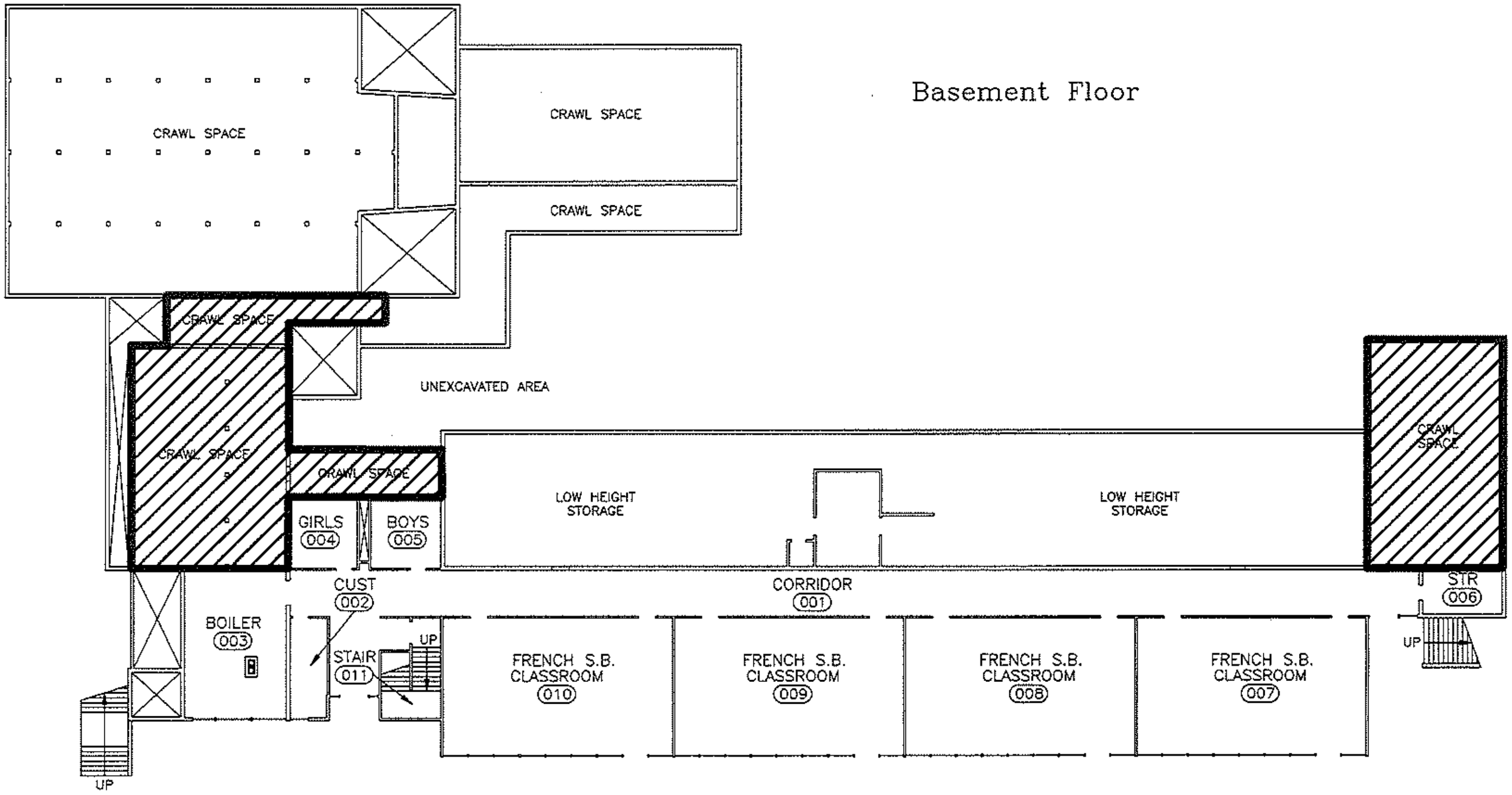
Harvey Wong, AScT, ROHT, Sr. Technologist

Ref: 5907-R02hw

▨ Crawlspace Areas are contaminated with asbestos fibres.

DO NOT ENTER THESE AREAS

Basement Floor



School District No. 44 NORTH VANCOUVER, B.C.	KEY PLAN – 1 of 1	SCALE: Not to scale DATE: 2005 AUGUST 24		ADDRESS: 440 Hendry Avenue V7L 4C5 TELEPHONE: N/A FAX: N/A	99071	CLOVERLEY ELEMENTARY SCHOOL	1 of 1

Drawing Location Reference Number	Location	Asbestos Containing Materials Present *	Comments
Exterior	Soffits	• None*	
Exterior	Covered Play Area Ceiling	• None*	
Crawlspace	Crawlspace beneath Gymnasium (106-109) & Activity Room (110-112)	• Grey Mastic on Ductwork beneath the Gymnasium	• Asbestos piping not present in these areas; however, these areas lead to the contaminated crawlspace areas.
Crawlspace	Crawlspace – North & South of the Low Height Storage Area	• Mudded Elbows/Fittings • Asbestos Pipe Insulation (Magblock) • Asbestos Debris on Crawlspace Floor	• **Do Not Enter Crawlspace Without Proper Respiratory Protection and Protective Clothing**
001	Corridor	• 9" Beige Floor Tile	
002	Custodian	• 9" Beige Floor Tile	
003	Boiler Room	• Asbestos Gasket on Boiler Exhaust	
004	Girls Washroom	• Asbestos Cement Panels on Walls	
005	Boys Washroom	• Asbestos Cement Panels on Walls	

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- **Drywall/Plaster/Stucco**
- **Mastic/Putty Compounds**
- **Roofing Materials**
- **Materials under carpeted areas**
- **Materials in inaccessible or concealed wall/ceiling spaces**

Drawing Location Reference Number	**Location**	**Asbestos Containing Materials Present ***	**Comments**
006	Storage	• Mudded Elbows/Fittings	
007	Classroom	• 12" Blue Floor Tile • 12" White Floor Tile	
008	*Classroom*	• *None**	• Carpet present.
009	Classroom	• 9" Beige Floor Tile	
010	Classroom	• 9" Beige Floor Tile	
011	Stairwell	• 9" Beige Floor Tile	
101	Corridor	• None*	
102	Office	• None*	• Carpet present.
103	Office	• None*	• Carpet present.
103A	*(Room indicated on plan not present.)*		
104	Office	• None*	• New 12" White Tile
105	Kitchen	• None*	• *New 12" Green Floor Tile*

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- **Drywall/Plaster/Stucco**
- **Mastic/Putty Compounds**
- ***Roofing Materials***
- **Materials under carpeted areas**
- **Materials in inaccessible or concealed wall/ceiling spaces**

Drawing Location Reference Number	Location	Asbestos Containing Materials Present *	Comments
106	Gymnasium	• None*	
107	Gym Storage	• None*	• Carpet present.
107	Gym Storage – Mechanical Room	• Mudded Elbows/Fittings • Asbestos Duct Expansion Joints on ductwork	
107A	Gym Storage – Mezzanine	• None*	
108	Gym Stage	• None*	
108	Beneath Gym Stage	• None*	
109	Gym Storage	• None*	• Carpet present.
110	Activity	• None*	
111	Storage	• None*	
112	Workroom	• None*	
113	Storage	• None*	
114	Storage	• 9" Beige Floor Tile	

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- **Drywall/Plaster/Stucco**
- **Mastic/Putty Compounds**
- **Roofing Materials**
- **Materials under carpeted areas**
- **Materials in inaccessible or concealed wall/ceiling spaces**

Drawing Location Reference Number	Location	Asbestos Containing Materials Present *	Comments
115	Girls Toilet	• Asbestos Cement Panels on Walls	
115	Girls Toilet – Storage Room	• Asbestos Cement Panels on Walls	
116	Boys Toilet	• Asbestos Cement Panels on Walls	
116	Boys Toilet – Storage Room	• None	
117	Classroom	• None*	• Carpet present.
119	Classroom	• None*	• Carpet present.
120A	Classroom	• None*	• Carpet present.
120B	Classroom	• None*	
121	Classroom	• None*	• Carpet present.
122	Classroom	• None*	• Carpet present.
123	LAC	• None*	
123A	Storage	• None*	• Carpet present.

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- ***Drywall/Plaster/Stucco***
- **Mastic/Putty Compounds**
- **Roofing Materials**
- ***Materials under carpeted areas***
- **Materials in inaccessible or concealed wall/ceiling spaces**

Drawing Location Reference Number	Location	Asbestos Containing Materials Present *	Comments
123B	Office	• None*	• White Floor Levelling Compound is non-asbestos.
124	Office	• None*	• Carpet present.
124A	Office	• None*	• Carpet present.
124B	Office	• None*	• Carpet present.
124C	Office	• None*	• Carpet present.
124D	Office	• None*	• Carpet present.
124E	Office	• None*	• Carpet present.
124F	Office	• None*	• Carpet present.
124G	Storage	• None*	• Carpet present.
125	Classroom	• None*	• Carpet present.
126	Stairwell	• None*	
127	Cloakroom	• None*	• Carpet present.

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- **Drywall/Plaster/Stucco**
- **Mastic/Putty Compounds**
- **Roofing Materials**
- **Materials under carpeted areas**
- **Materials in inaccessible or concealed wall/ceiling spaces**

Drawing Location Reference Number	Location	Asbestos Containing Materials Present *	Comments
128	Toilet	• None*	
129	*Staff Room*	• None*	• *Carpet present.*
130	Cloakroom	• None*	• Carpet present.
131	Toilet	• None*	
132	Custodian	• None*	
133	Medical Room	• None*	• New 12" White Floor Tile

*** This list does not include for materials containing or are suspected of containing asbestos in the following materials/areas:**

- **Drywall/Plaster/Stucco**
- **Mastic/Putty Compounds**
- **Roofing Materials**
- **Materials under carpeted areas**
- **Materials in inaccessible or concealed wall/ceiling spaces**

Asbestos Bulk Sample Screen Results

Project Number: 5907

Client Name: **SD#44 (North Vancouver)**

NO.	DATE	SAMPLE INFORMATION				MATERIAL TYPE	*ASBESTOS PRESENT**
1	19-Aug-2005	Cloverley Elementary	Gym Fan Room (107)			Elbow Mud	Yes Chrysotile (60-70%)
2	19-Aug-2005	Cloverley Elementary	Storage Room (114)			9" Beige Floor Tile (1)	Yes Chrysotile (1-10%)
3	19-Aug-2005	Cloverley Elementary	Storage Room (123B)			White Floor Leveling Comp	No
4	19-Aug-2005	Cloverley Elementary	CR (125)			2'x4' Ceiling Tile	No
5	19-Aug-2005	Cloverley Elementary	Corridor (001)			9" Beige Floor Tile (2)	Yes Chrysotile (1-10%)
6	19-Aug-2005	Cloverley Elementary	Boiler Room (003)	Boiler Exhaust		Gasket Material	Yes Chrysotile (70-80%)
7	*19-Aug-2005*	*Cloverley Elementary*	*Low Height Storage Area*	*Storage Room Walls*		*Drywall Joint Compound*	*No*
8	19-Aug-2005	Cloverley Elementary	Crawlspace	Beneath CR (121)		Debris on Floor	Yes Amosite (70-80%)
9	*19-Aug-2005*	*Cloverley Elementary*	*Crawlspace*	*Beneath CR (121)*		*Elbow Mud*	*Yes* *Chrysotile (60-70%)* *Amosite (10-20%)*
10	19-Aug-2005	Cloverley Elementary	Crawlspace	Beneath Main Office (102)		Debris on Floor	Yes Amosite (70-80%)
11	19-Aug-2005	Cloverley Elementary	Crawlspace	Beneath Gym (106)	On Ductwork	Grey Duct Mastic	Yes Chrysotile (20-30%)
12	19-Aug-2005	Cloverley Elementary	Crawlspace	Beneath CR (123)	Swept Pile of Debris	Construction Debris	No
13	19-Aug-2005	Cloverley Elementary	CR (124C)	Outside Wall		Drywall Joint Compound	No
14	19-Aug-2005	Cloverley Elementary	CR (007)			12" Blue & White Tiles	Yes Chrysotile (1-10%)

Total Number of Samples: 14

---

* No = None Detected or <1% Asbestos present in the sample.

Appendix F

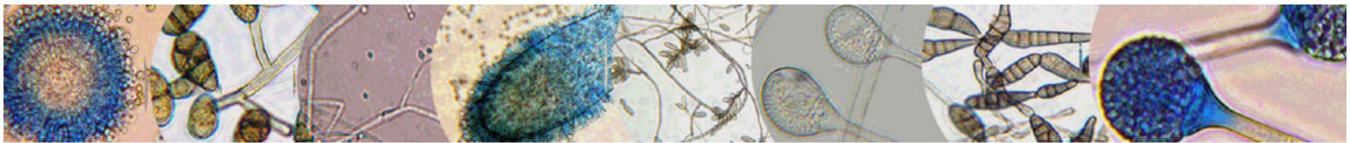
Mould Analysis Results

EXPANDED FUNGAL REPORT ™

Prepared Exclusively For

Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7
Phone:604-988-0099

Report Date:	**6/15/2020**
Project:	**6479-MD**
EMSL Canada Orde	**692001284**



Attn: Mehdi
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

Proj: 6479-MD

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

1. Description of Analysis

Analytical Laboratory

EMSL Canada Inc. (EMSL Canada) is a nationwide, full service, analytical testing laboratory network providing Asbestos, Mold, Indoor Air Quality, Microbiological, Environmental, Chemical, Forensic, Materials, Industrial Hygiene and Mechanical Testing services. Ranked as the premier independently owned environmental testing laboratory in the nation, EMSL Canada puts analytical quality as its top priority. This is assured by our high quality personnel, including experienced microbiologists with graduate degrees. Our quality system is based on internationally accepted criteria for competence (ISO/IEC 17025).

EMSL Canada is an in independent laboratory that performed the analysis of these samples . EMSL Canada did not conduct the sampling or site investigation for this report . The samples referenced herein were analyzed under strict quality control procedures using state-of-the-art microbiological methods. The analytical methods used and the data presented are scientifically and legally defensible

The laboratory data is provided in compliance with the ISO 17025 standard for the particular test(s) requested, including any associated limitations for the methods employed. These data are intended for use by professionals having knowledge of the testing methods necessary to interpret them accurately.

Attn: Mehdi
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EMSL Order: 692001284
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Analyzed: 6/15/2020

Proj: 6479-MD

Air Samples - Spore traps:

Spore traps are commercially available sampling devices that capture airborne particles on an adhesive slide. Air is pulled through the device using a vacuum pump. Spores, as well as other airborne particles, are impacted on the collection adhesive. Using spore trap collection methods has inherent limitations. These collection methods are biased towards larger spore sizes.

The analysis for total spore counts is a direct microscopic examination and does not include culturing or growing the fungi. Therefore, the results include both viable and non-viable spores. Some fungal groups produce similar spore types that cannot be distinguished by direct microscopic examination alone (i.e., *Aspergillus/Penicillium*, and others). Other spore types may lack distinguishing features that aid in their identification. These types are grouped into larger categories such as Ascospores or Basidiospores.

Fungal spores are identified and grouped by morphological characteristics including color, shape, septation, ornamentation, and fruiting structures (if present) which are compared to published mycological identification keys and texts. EMSL Canada reports provide spore counts per cubic meter of air to three significant figures. Please note that each spore category is reported to three significant figures. Due to rounding and the application of three significant figures the sum of the individual spore numbers may not equal the total spore count on the report. EMSL Canada does not maintain responsibility for final volume concentrations (counts/m3) since this volume is provided by the field collector and can not be verified by EMSL Canada.

EMSL Canada analyzes spore traps using phase contrast microscopy. There is a wide choice of collection devices (Air-O-Cell, Micro-5, Burkhard, etc.) on the market. Differences in analytical method may exist between spore trap devices.

Spore trap results are reported in spores per cubic meter of air. Due to the other airborne particles collected with the spores, EMSL Canada reports a background particle density. Background density is an indication of overall particulate matter present on the sample (i.e. dust in the air). High background concentrations may obscure spores such as the *Penicillium/Aspergillus* group. The rating system is from 1-5 with 1 = 1 - 25% of the background obscured by material, 2 = 26 - 50%, 3 = 51 - 75%, 4 = 76% - 99%, 5 = 100% or overloaded. A background rating of 4 or higher should be regarded as a minimum count since the actual concentrations may be higher than those reported. EMSL Canada will not be held responsible for overloading of samples. Sample volumes are left to the discretion of the company or persons conducting the fieldwork.

Skin fragment density is the percentage of skin cells making up the total background material, 1 = 1 - 25%, 2 = 26 - 50%, 3 = 51 - 75%, 4 = 76-100%. Skin fragment density is considered an indication of the general cleanliness in the area sampled. It has been estimated that up to 90% of household dust consists of dead skin cells.

Attn: Mehdi
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EMSL Order:	692001284
Customer ID:	55KOHS42
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Analyzed:	6/15/2020

Proj: 6479-MD

2. Analytical Results

See attached data reports and charts.

Attn: Mehdi
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Test Report: Allergenco-D(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	**692001284-0001**			**692001284-0002**			**692001284-0003**		
Client Sample ID:	**6479-S1**			**6479-S2**			**6479-S3**		
Volume (L):	**75**			**75**			**75**		
Sample Location:	**GYM - NORTH END**			**CORRIDOR O/S GYM**			**FINE ARTS BESIDE GYM**		
Spore Types	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total
Alternaria (Ulocladium)	1*	10*	0.1	-	-	-	-	-	-
Ascospores	6	300	3.1	6	300	4.6	5	200	1.8
Aspergillus/Penicillium	31	1300	13.4	53	2300	35.4	153	6530	60
Basidiospores	170	7250	74.6	82	3500	53.9	75	3200	29.4
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	1*	10*	0.1	-	-	-	-	-	-
Cladosporium	16	680	7	6	300	4.6	21	900	8.3
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	1	40	0.4	2	90	1.4	1	40	0.4
Myxomycetes++	1	40	0.4	-	-	-	-	-	-
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	-	-	-	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	2	90	0.9	-	-	-	1*	10*	0.1
Unidentifiable Spores	-	-	-	-	-	-	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Oidium	-	-	-	-	-	-	-	-	-
Total Fungi	**229**	**9720**	**100**	**149**	**6490**	**100**	**256**	**10880**	**100**
Hyphal Fragment	-	-	-	-	-	-	-	-	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	2*	30*	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	43	-	-	43	-	-	43	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	3	-	-	2	-	-	1	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	3	-	-	2	-	-	2	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.

No discernable field blank was submitted with this group of samples.

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

High levels of background particulate can obscure spores and other particulates, leading to underestimation. Background levels of 5 indicate an overloading of background particulates, prohibiting accurate detection and quantification. Present = Spores detected on overloaded samples. Results are not blank corrected unless otherwise noted. The detection limit is equal to one fungal spore, structure, pollen, fiber particle or insect fragment. "*" Denotes particles found at 300X. "-" Denotes not detected. Due to method stopping rules, raw counts in excess of 100 are extrapolated based on the percentage analyzed. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity of the result, it will be noted on the report.
Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 06/15/2020 16:33:53

Attn: Mehdi
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Test Report: Allergenco-D(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	**692001284-0004**			**692001284-0005**			**692001284-0006**		
Client Sample ID:	**6479-S4**			**6479-S5**			**6479-S6**		
Volume (L):	**75**			**75**			**75**		
Sample Location:	**CLASSROOM #3**			**CORRIDOR, EAST END**			BASEMENT, CLASSROOM ACROSS WASHROOM		
Spore Types	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-	-	-	-
Ascospores	7	300	0.8	3	100	2.3	7	300	9.5
Aspergillus/Penicillium	760	32400	89.5	22	940	21.7	19	810	25.7
Basidiospores	75	3200	8.8	72	3100	71.6	45	1900	60.3
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	2	90	0.2	3	100	2.3	3	100	3.2
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	3	100	0.3	2	90	2.1	1	40	1.3
Myxomycetes++	-	-	-	-	-	-	-	-	-
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	-	-	-	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	3	100	0.3	-	-	-	-	-	-
Unidentifiable Spores	-	-	-	-	-	-	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Oidium	-	-	-	-	-	-	-	-	-
Total Fungi	**850**	**36190**	**100**	**102**	**4330**	**100**	**75**	**3150**	**100**
Hyphal Fragment	1	40	-	-	-	-	-	-	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	3*	40*	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	43	-	-	43	-	-	43	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	2	-	-	3	-	-	2	-
Fibrous Particulate (1-4)	-	1	-	-	1	-	-	1	-
Background (1-5)	-	3	-	-	2	-	-	2	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.

No discernable field blank was submitted with this group of samples.

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

High levels of background particulate can obscure spores and other particulates, leading to underestimation. Background levels of 5 indicate an overloading of background particulates, prohibiting accurate detection and quantification. Present = Spores detected on overloaded samples. Results are not blank corrected unless otherwise noted. The detection limit is equal to one fungal spore, structure, pollen, fiber particle or insect fragment. "*" Denotes particles found at 300X. "-" Denotes not detected. Due to method stopping rules, raw counts in excess of 100 are extrapolated based on the percentage analyzed. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity of the result, it will be noted on the report.
Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 06/15/2020 16:33:53

This report has been prepared by EMSL Canada Inc. at the request of and for the exclusive use of the client named in this report.
Completely read the important terms, conditions, and limitations that apply to this report.

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EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
Phone: (604) 757-3158 Fax: (604) 757-4731 Web: http://www.EMSL.com Email:vancouverlab@EMSL.com

Attn: Mehdi
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Test Report: Allergenco-D(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	**692001284-0007**			**692001284-0008**			**692001284-0009**		
Client Sample ID:	**6479-S7**			**6479-S8**			**6479-S9**		
Volume (L):	**75**			**75**			**75**		
Sample Location:	**BASEMENT CORRIDOR, CENTRE**			**CRAWLSPACE STORAGE**			**BASEMENT - CLASSROOM #2**		
Spore Types	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total
Alternaria (Ulocladium)	-	-	-	-	-	-	-	-	-
Ascospores	3	100	2.6	5	200	5.5	4	200	6.4
Aspergillus/Penicillium	21	900	23.8	4	200	5.5	14	600	19.1
Basidiospores	62	2600	68.8	74	3200	87.7	49	2100	66.9
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	2	90	2.4	1*	10*	0.3	5	200	6.4
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	2	90	2.4	1	40	1.1	1	40	1.3
Myxomycetes++	-	-	-	-	-	-	-	-	-
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	-	-	-	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	-	-	-	-	-	-	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Oidium	-	-	-	-	-	-	-	-	-
Total Fungi	**90**	**3780**	**100**	**85**	**3650**	**100**	**73**	**3140**	**100**
Hyphal Fragment	-	-	-	-	-	-	-	-	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	-	-	-	-	-	-
Analyt. Sensitivity 600x	-	43	-	-	43	-	-	43	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	13*	-
Skin Fragments (1-4)	-	3	-	-	1	-	-	2	-
Fibrous Particulate (1-4)	-	2	-	-	1	-	-	1	-
Background (1-5)	-	3	-	-	1	-	-	2	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.

No discernable field blank was submitted with this group of samples.

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

Initial report from: 06/15/2020 16:33:53

EMSL Canada Inc.
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EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Test Report: Allergenco-D(™) Analysis of Fungal Spores & Particulates by Optical Microscopy (Methods MICRO-SOP-201, ASTM D7391)

Lab Sample Number:	**692001284-0010**			**692001284-0011**					
Client Sample ID:	**6479-S10**			**6479-S11**					
Volume (L):	**75**			**75**					
Sample Location:	**BASEMENT - CORRIDOR, EAST END**			**OUTSIDE - WEST SIDE**					
Spore Types	Raw Count	Count/m³	% of Total	Raw Count	Count/m³	% of Total	-	-	-
Alternaria (Ulocladium)	-	-	-	3	100	0.9	-	-	-
Ascospores	6	300	6.7	14	600	5.4	-	-	-
Aspergillus/Penicillium	18	770	17.2	1	40	0.4	-	-	-
Basidiospores	60	2600	58	225	9600	87.2	-	-	-
Bipolaris++	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-
Cladosporium	11	470	10.5	7	300	2.7	-	-	-
Curvularia	-	-	-	-	-	-	-	-	-
Epicoccum	-	-	-	-	-	-	-	-	-
Fusarium	-	-	-	-	-	-	-	-	-
Ganoderma	6	300	6.7	7	300	2.7	-	-	-
Myxomycetes++	1	40	0.9	1	40	0.4	-	-	-
Pithomyces++	-	-	-	-	-	-	-	-	-
Rust	-	-	-	-	-	-	-	-	-
Scopulariopsis/Microascus	-	-	-	-	-	-	-	-	-
Stachybotrys/Memnoniella	-	-	-	-	-	-	-	-	-
Unidentifiable Spores	-	-	-	-	-	-	-	-	-
Zygomycetes	-	-	-	-	-	-	-	-	-
Oidium	-	-	-	2*	30*	0.3	-	-	-
Total Fungi	**102**	**4480**	**100**	**260**	**11010**	**100**	-	-	-
Hyphal Fragment	-	-	-	-	-	-	-	-	-
Insect Fragment	-	-	-	-	-	-	-	-	-
Pollen	-	-	-	3	100	-	-	-	-
Analyt. Sensitivity 600x	-	43	-	-	43	-	-	-	-
Analyt. Sensitivity 300x	-	13*	-	-	13*	-	-	-	-
Skin Fragments (1-4)	-	3	-	-	2	-	-	-	-
Fibrous Particulate (1-4)	-	2	-	-	1	-	-	-	-
Background (1-5)	-	3	-	-	2	-	-	-	-

++ Includes other spores with similar morphology; see EMSL's fungal glossary for each specific category.

No discernable field blank was submitted with this group of samples.

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

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Initial report from: 06/15/2020 16:33:53

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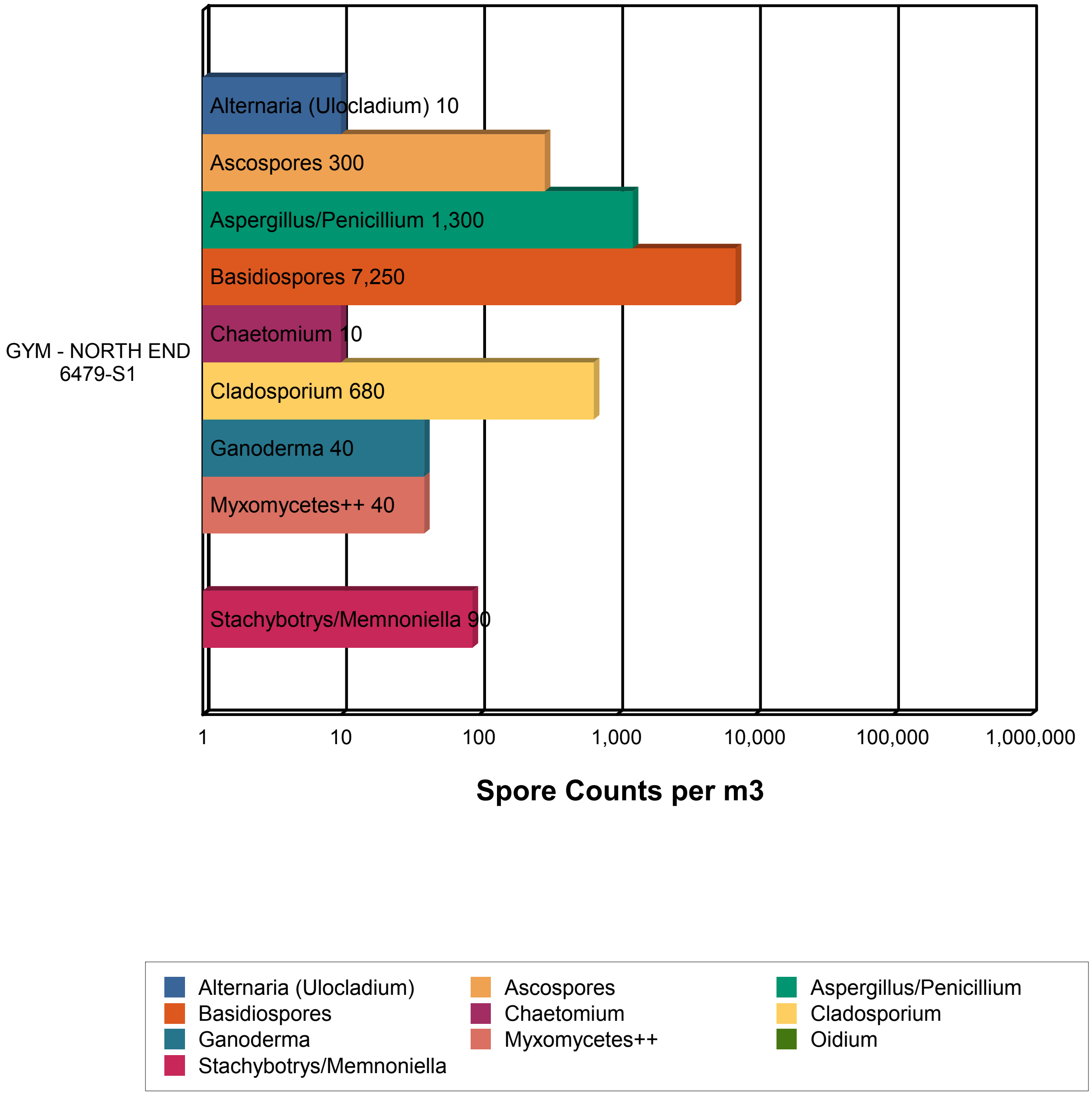
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Spore Trap Report: Total Counts



* The chart is displayed using a logarithmic scale. Bar size is not directly proportional to the number of spores.

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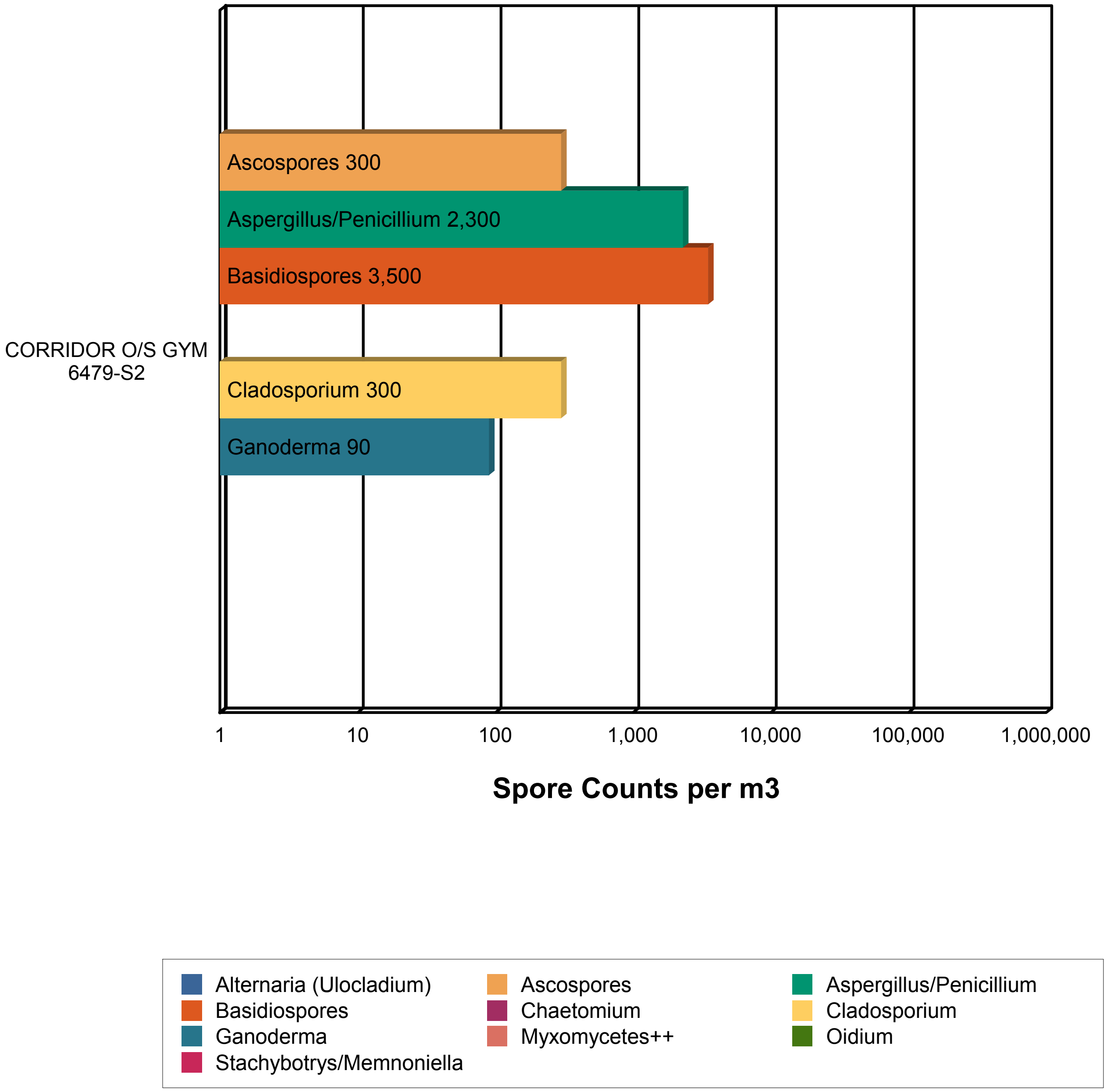
Spore Trap Report: Total Counts



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North Vancouver, BC V7J 1B7

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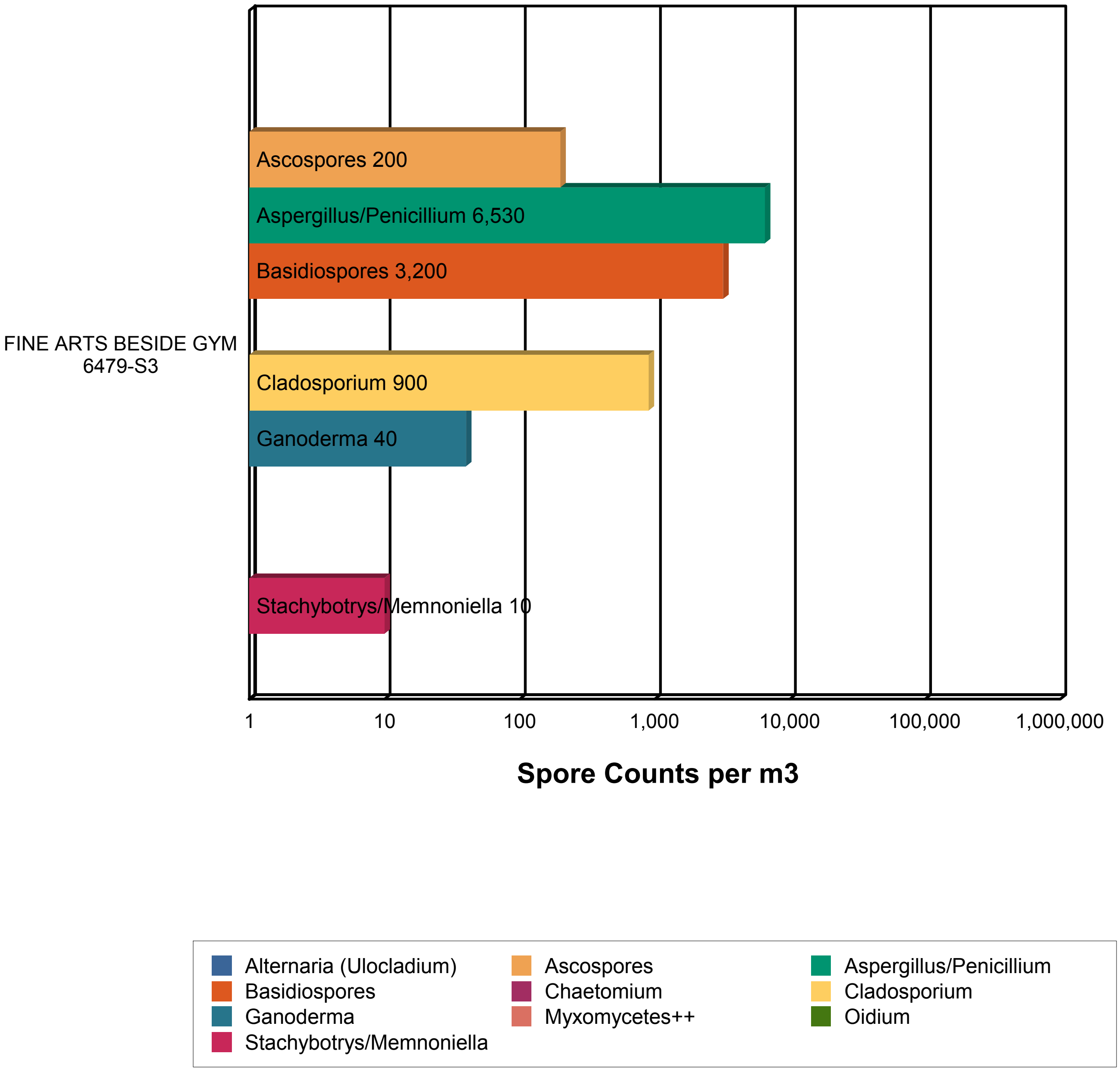
Spore Trap Report: Total Counts



* The chart is displayed using a logarithmic scale. Bar size is not directly proportional to the number of spores.

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North Vancouver, BC V7J 1B7

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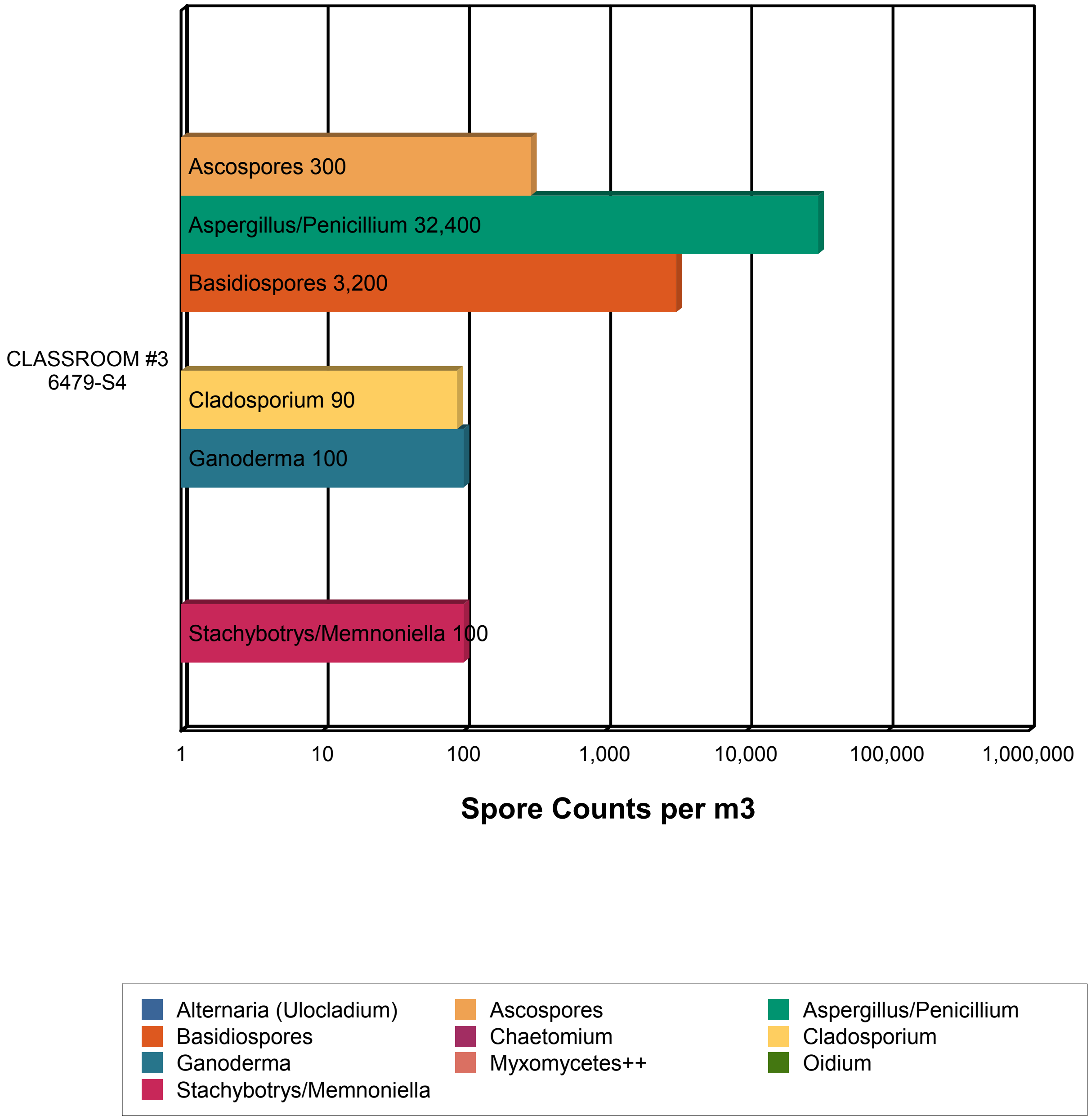
Spore Trap Report: Total Counts



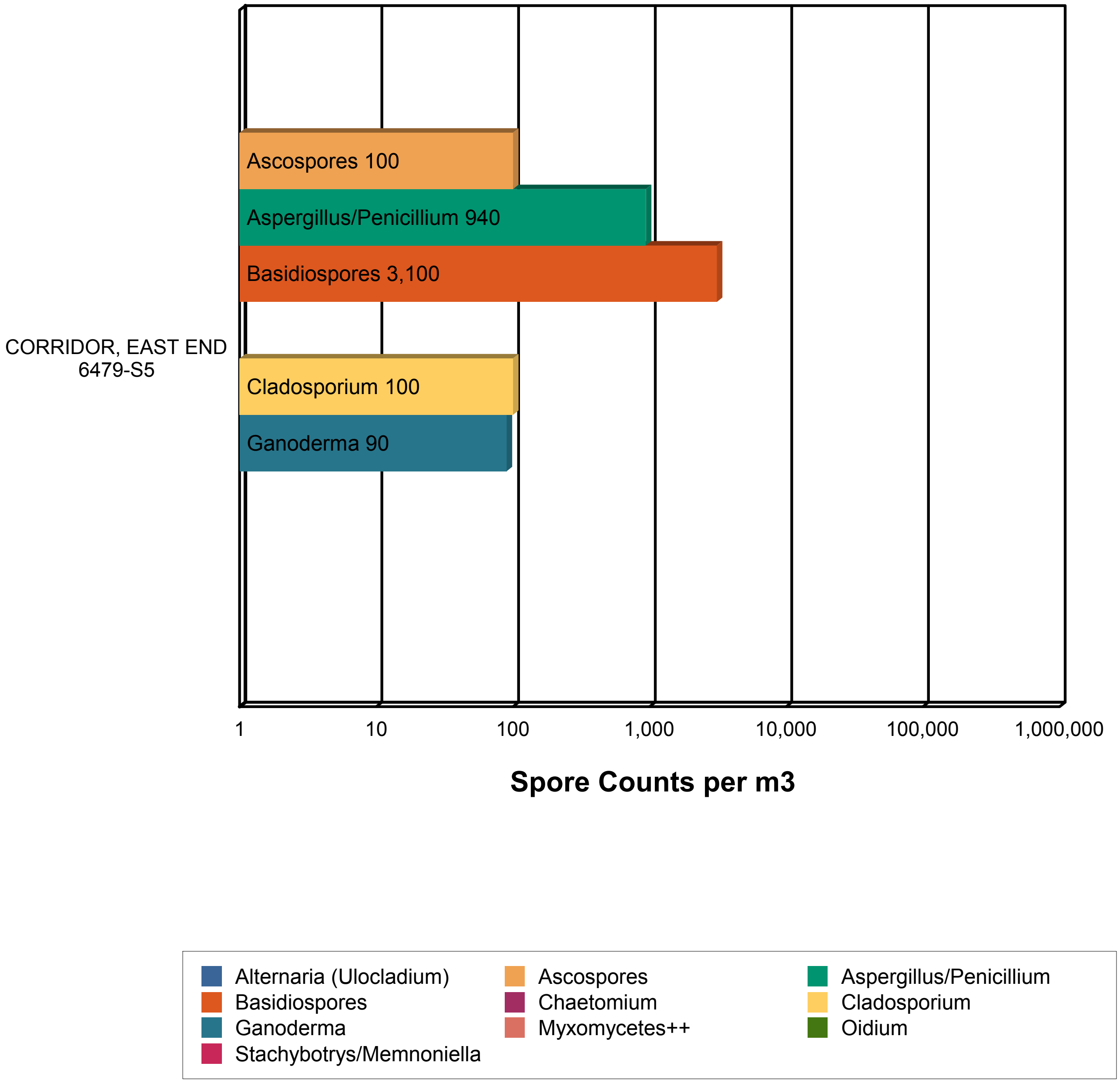
* The chart is displayed using a logarithmic scale. Bar size is not directly proportional to the number of spores.

Attn: Mehdi
Kinetic OHS Services LTD
#202-1520 Barrow St
North Vancouver, BC V7J 1B7

EMSL Order: 692001284
Customer ID: 55KOHS42
Collected: 6/05/2020
Received: 6/08/2020
Analyzed: 6/15/2020

Proj: 6479-MD

Spore Trap Report: Total Counts



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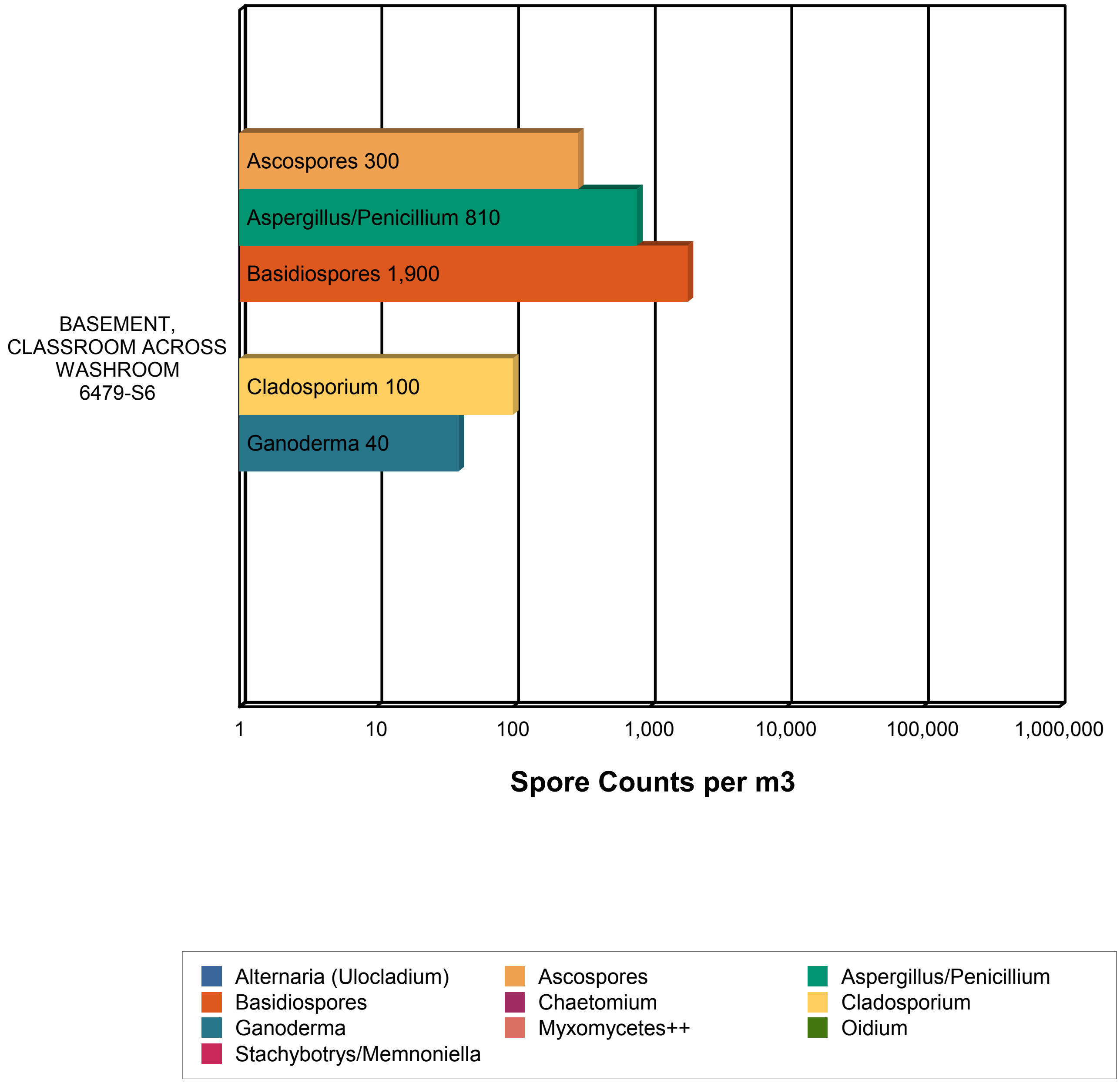

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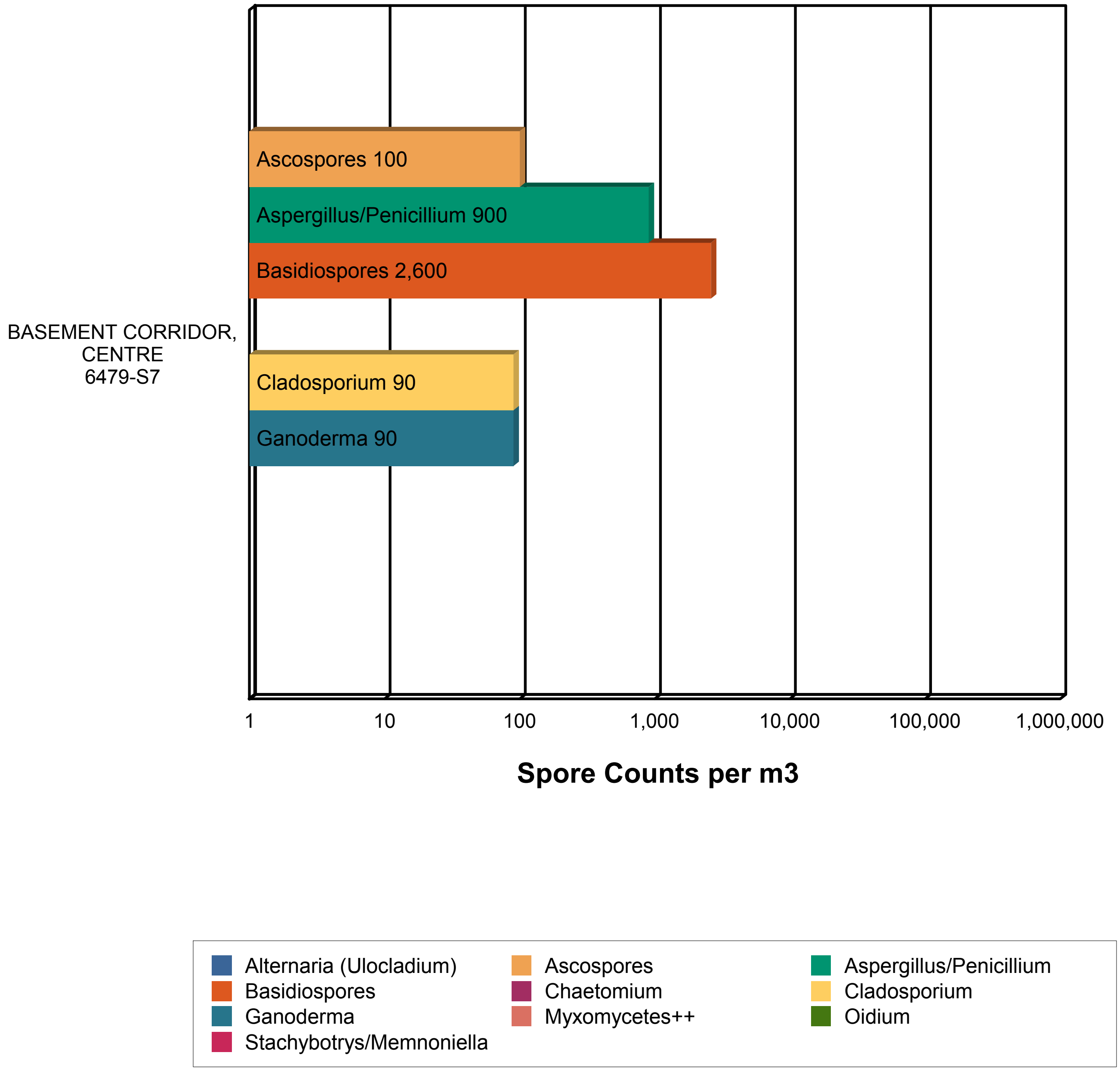

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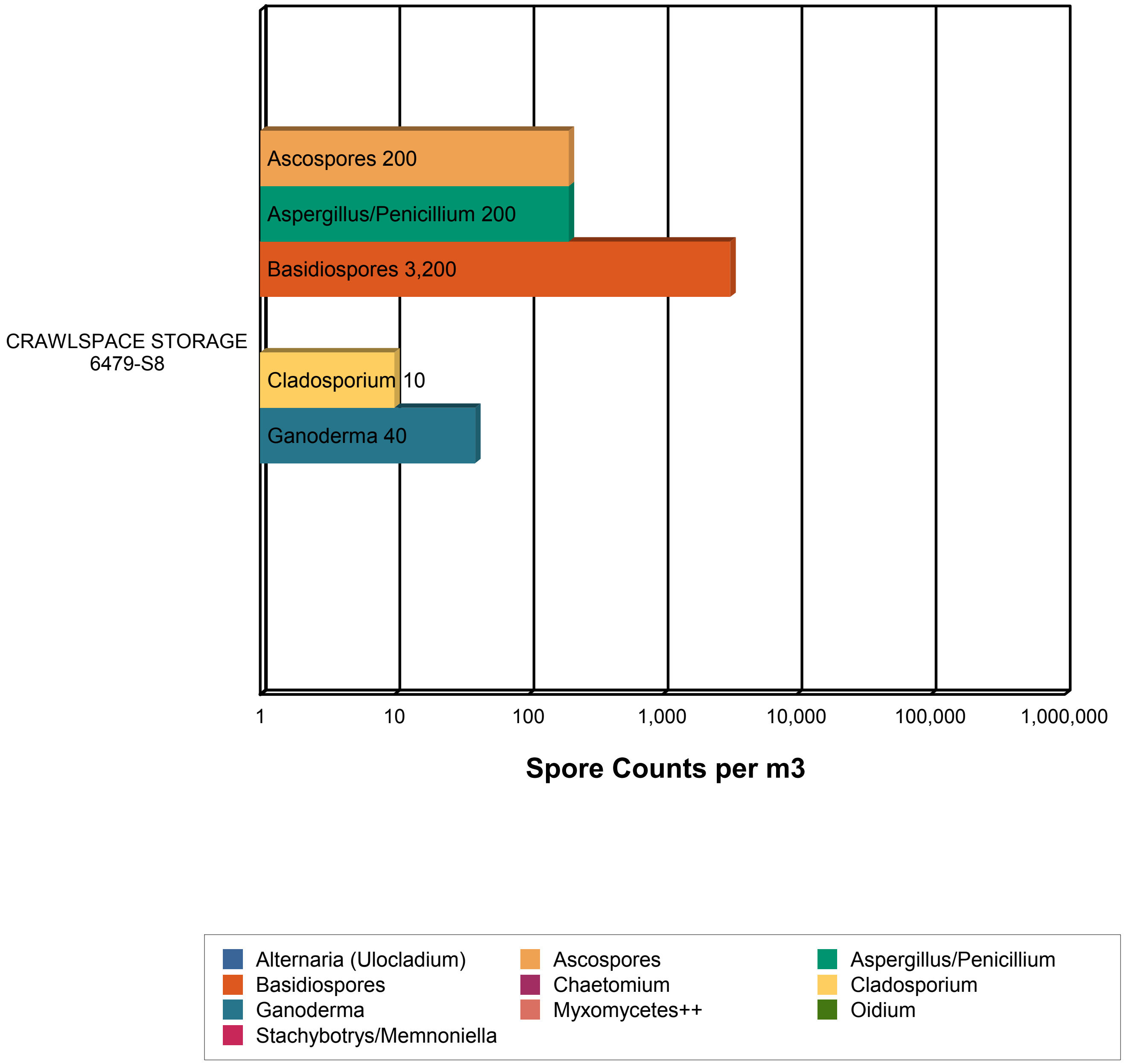

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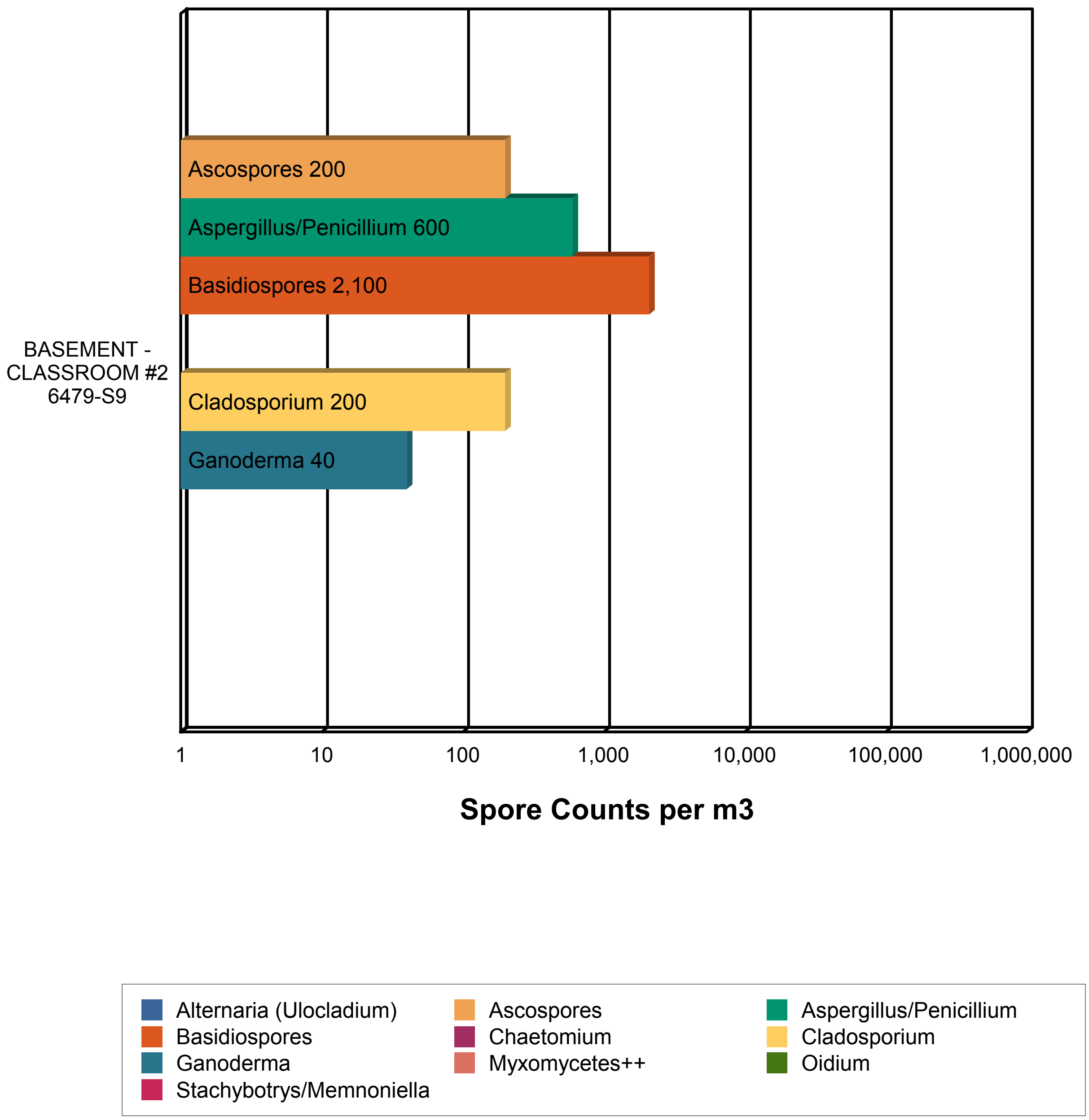

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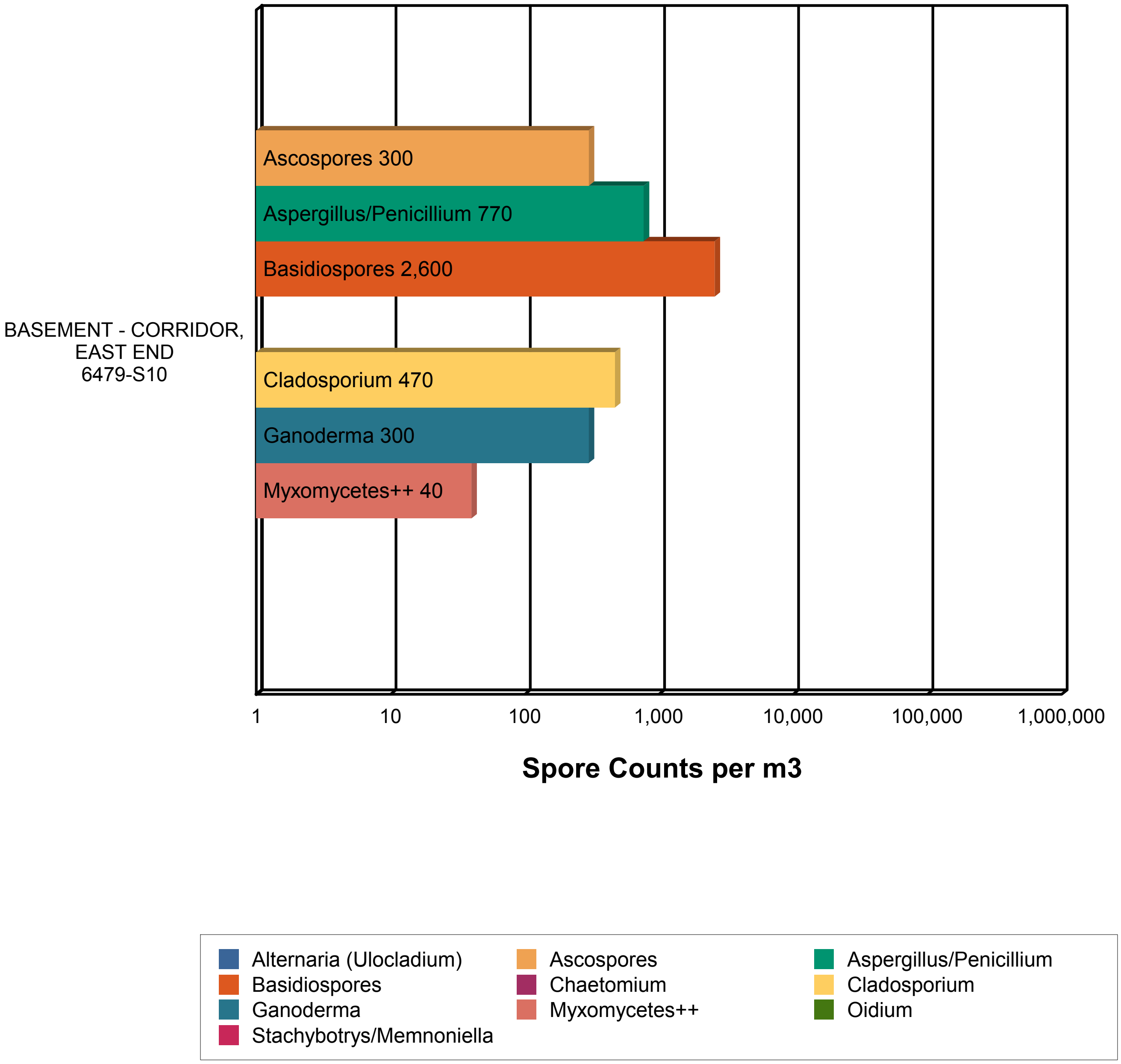

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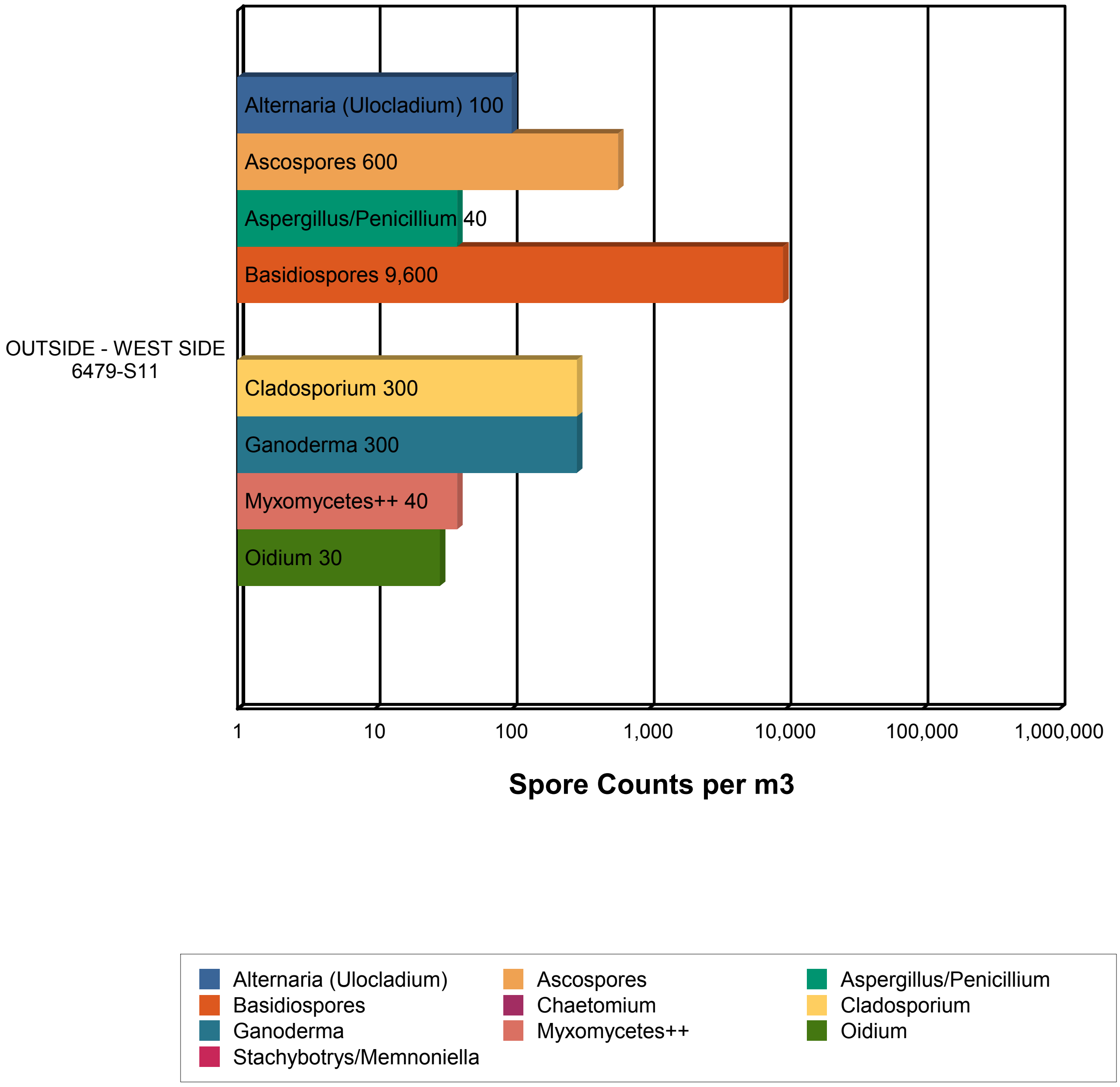

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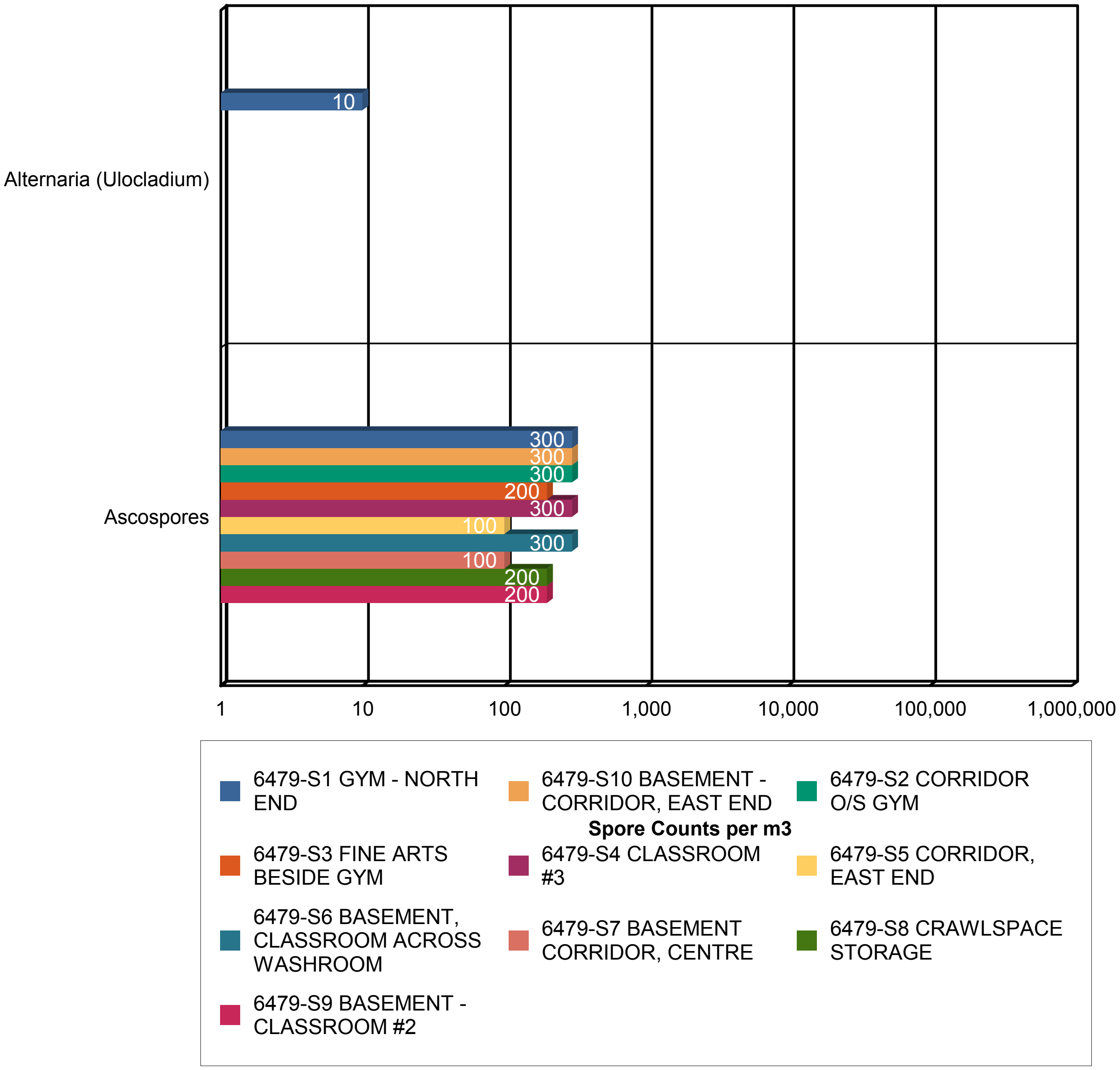

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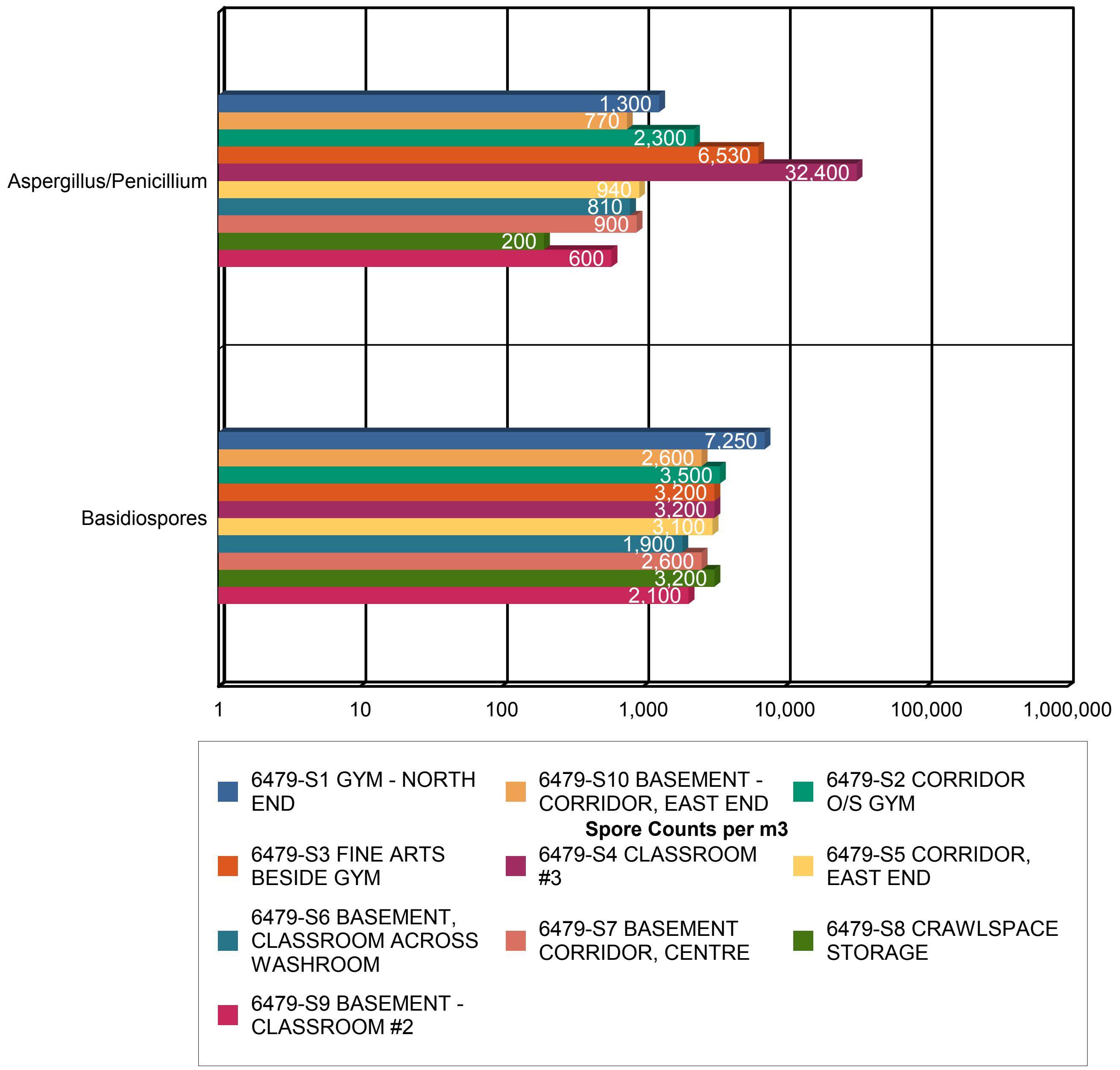

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Completely read the important terms, conditions, and limitations that apply to this report.
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Test Report EXMold-2.1.0.0 Printed: 6/15/2020 04:33:53PM
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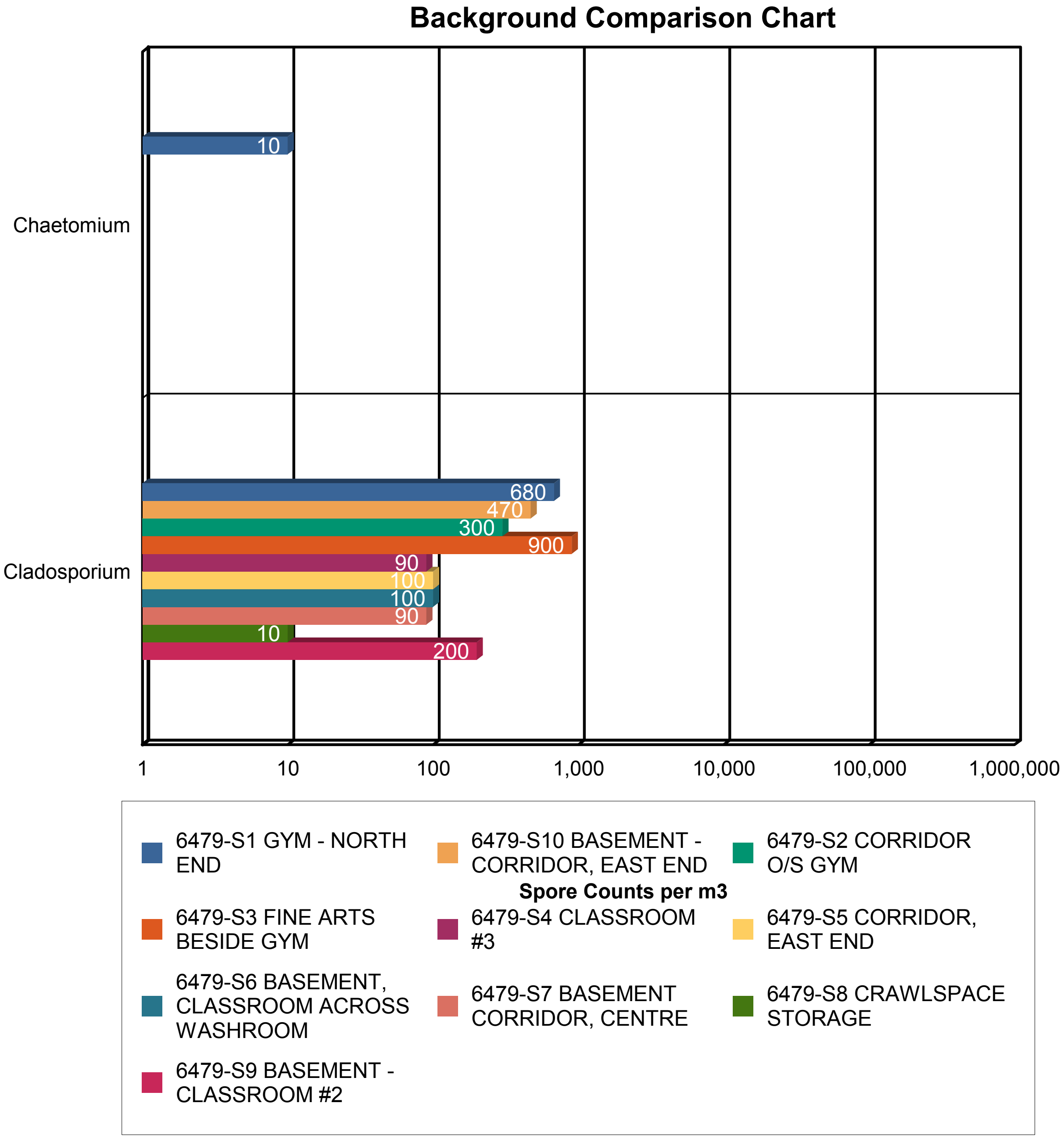

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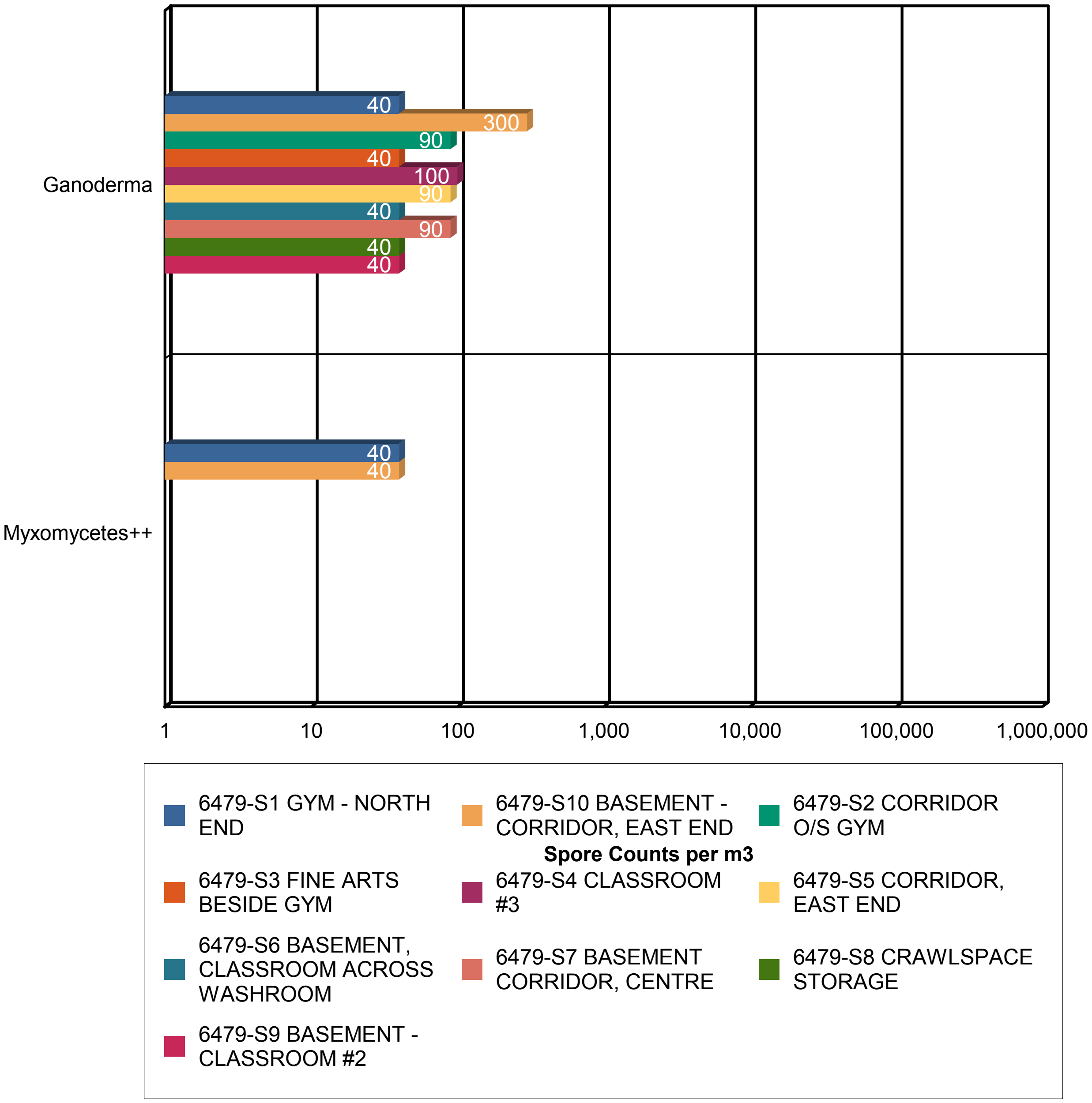

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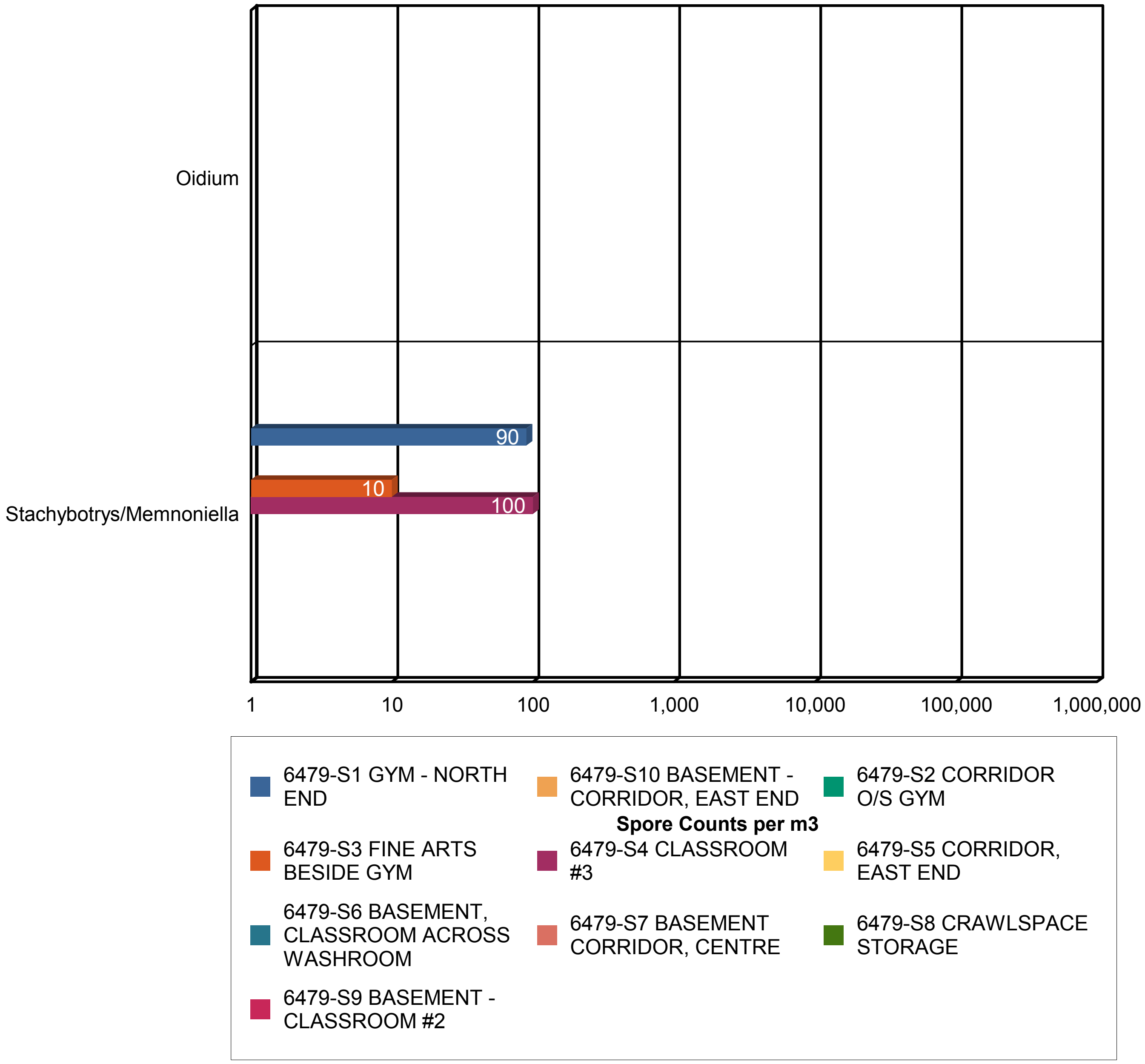

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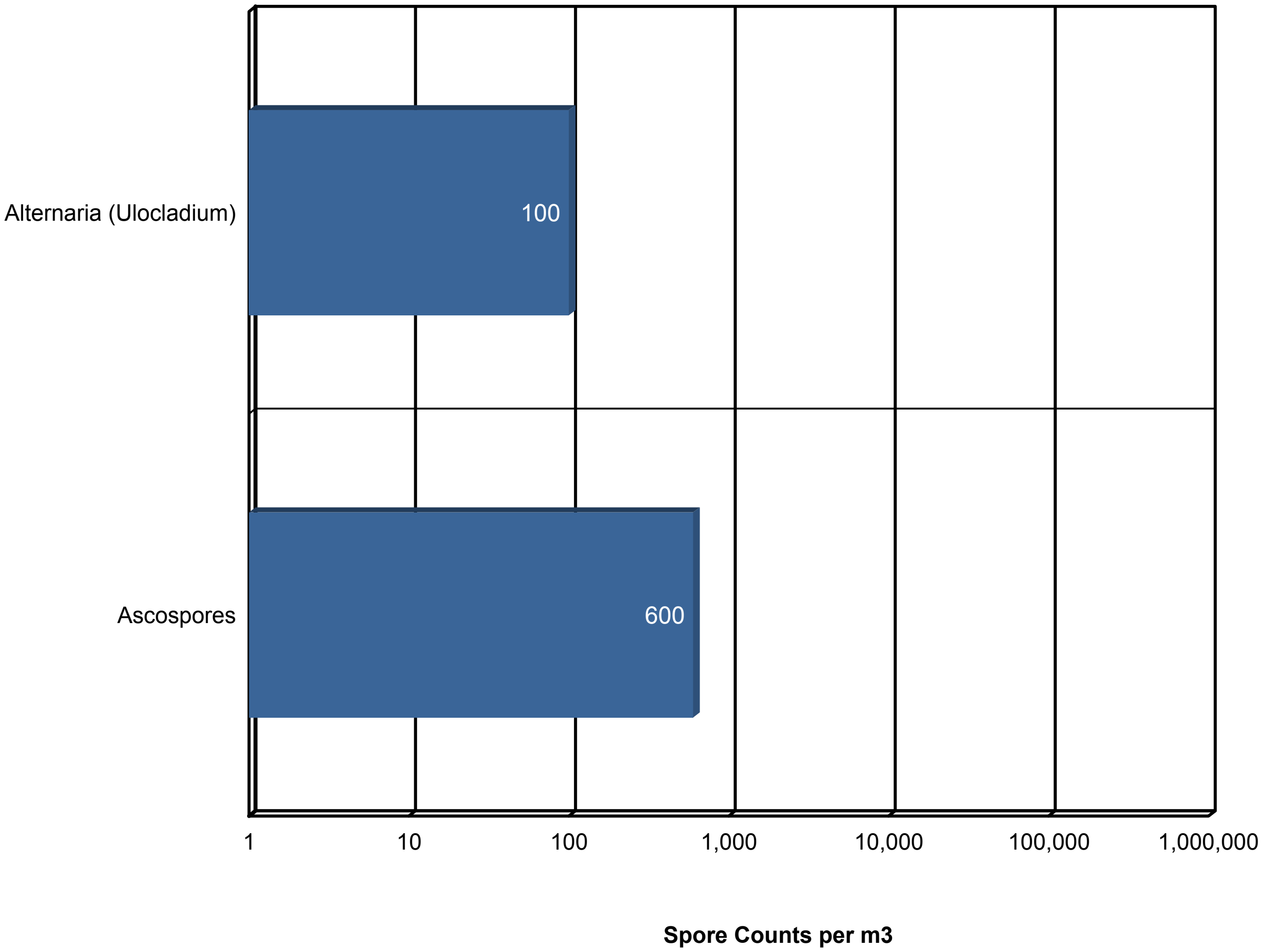

🟦 6479-S11 OUTSIDE - WEST SIDE

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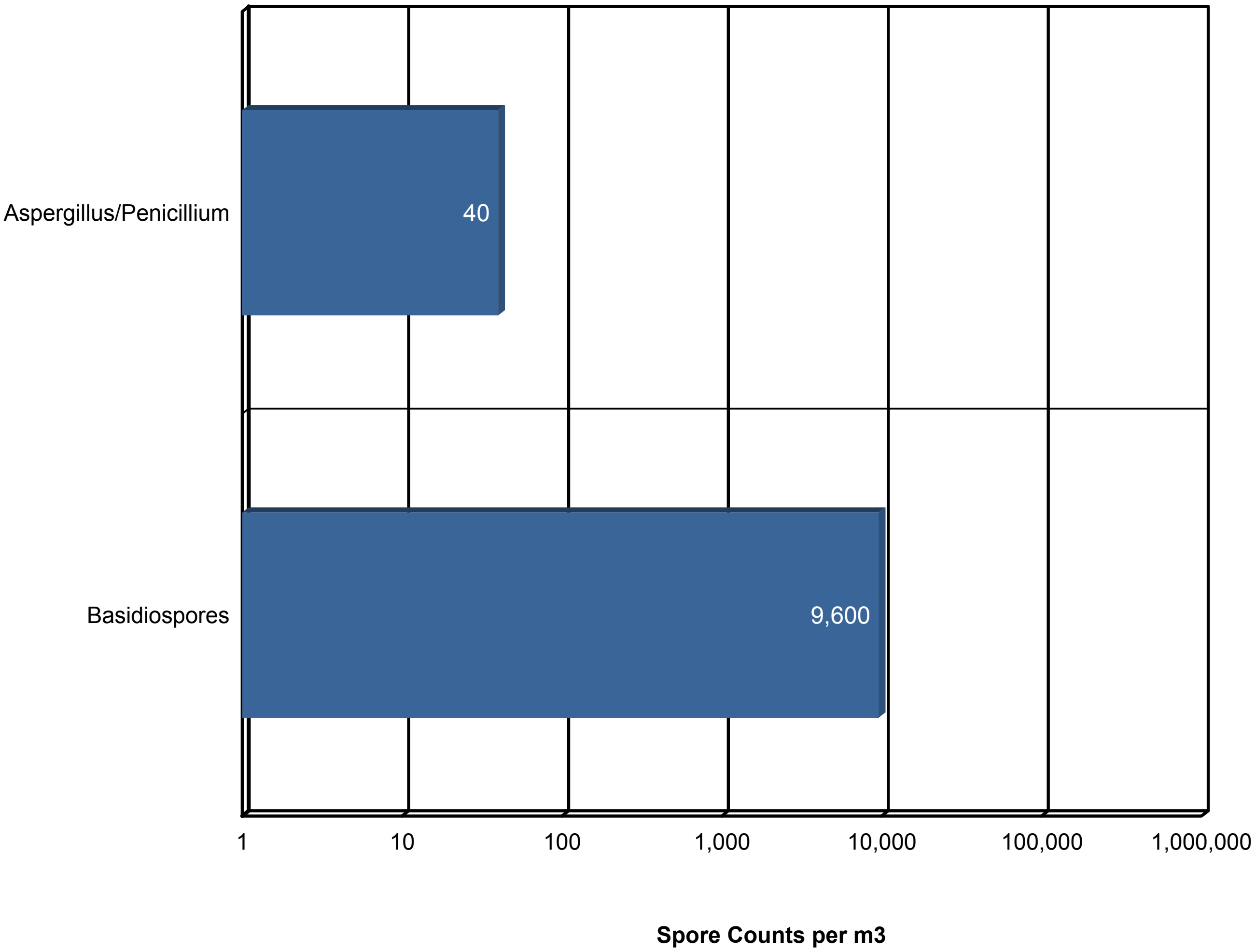

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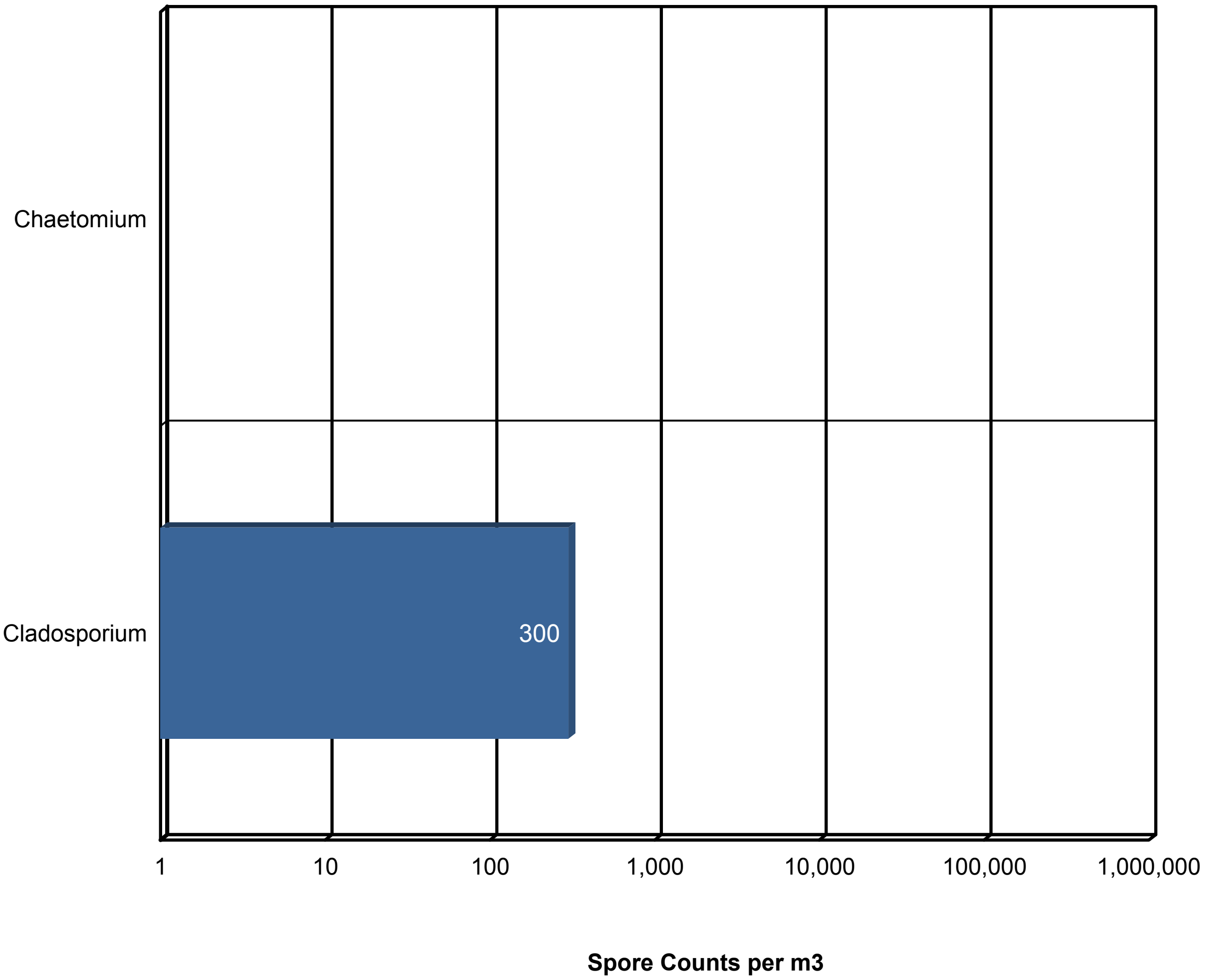

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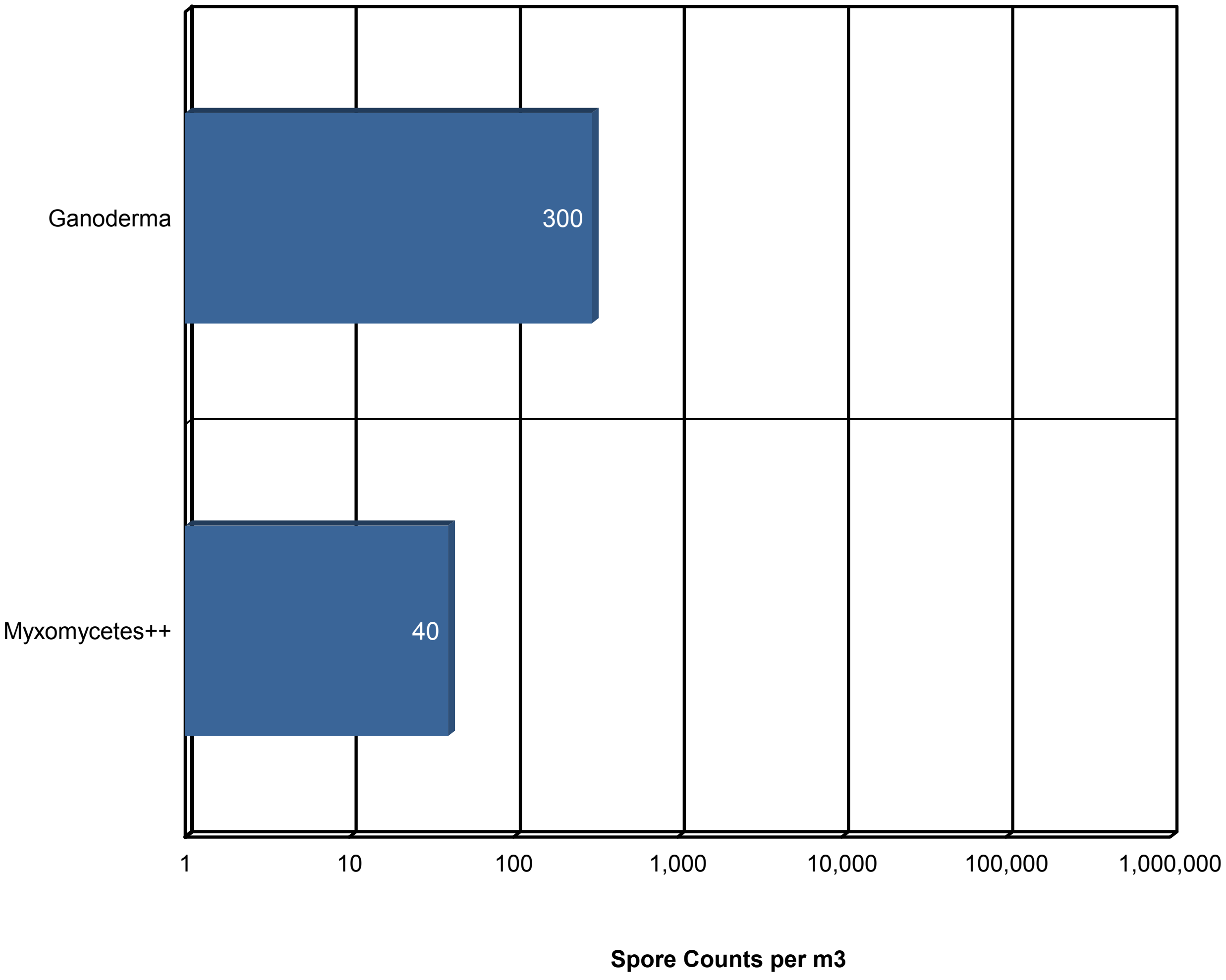

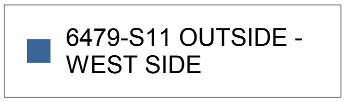

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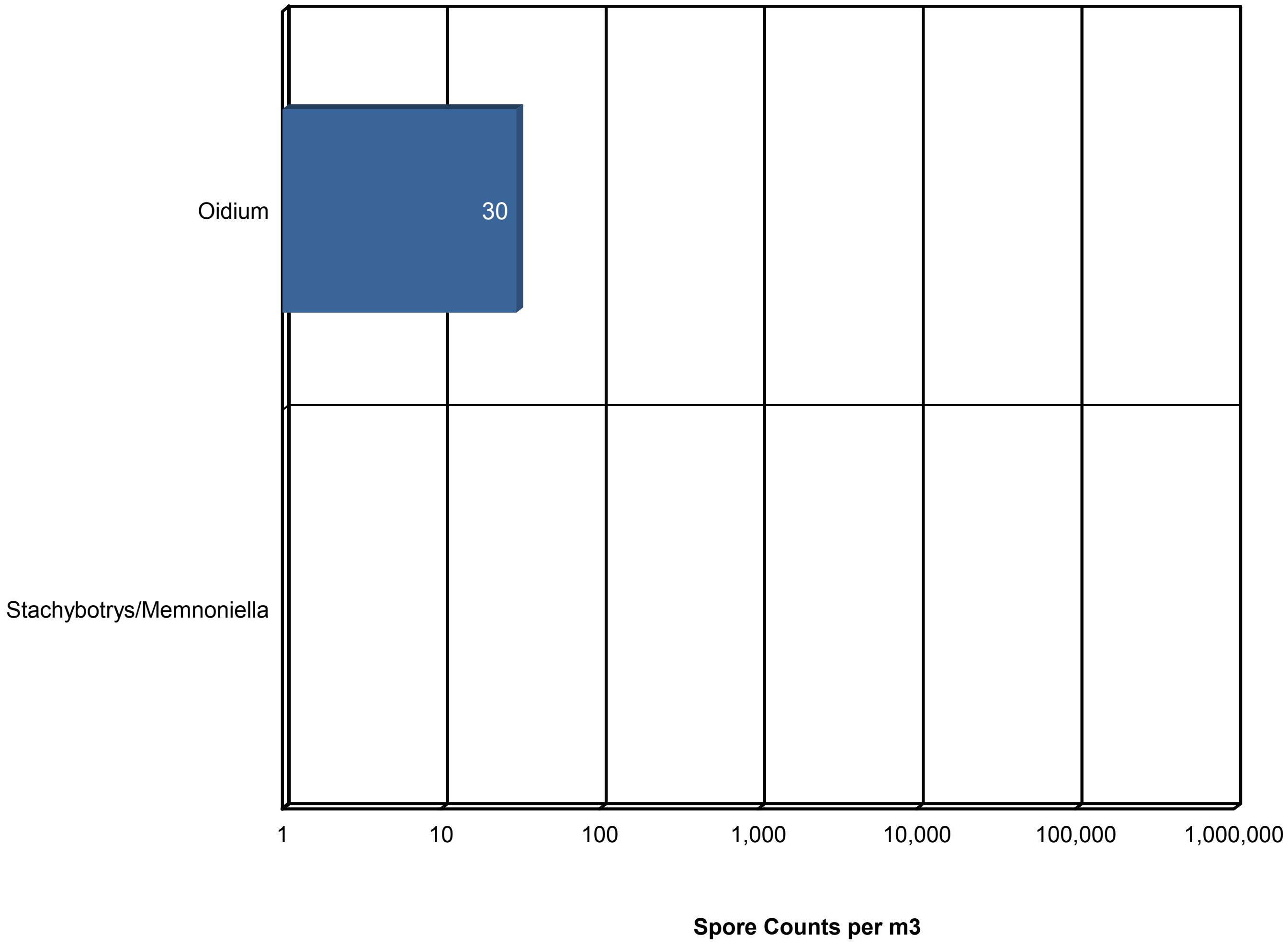

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3. Understanding the Results

EMSL Canada Inc. is an independent laboratory, providing unbiased and scientifically valid results. These data represent only a portion of an overall IAQ investigation. Visual information and environmental conditions measured during the site assessment (humidity, moisture readings, etc.) are crucial to any final interpretation of the results. Many factors impact the final results; therefore, result interpretation should only be conducted by qualified individuals. The American Conference of Governmental Industrial Hygienists (ACGIH) has published a good reference book covering sampling and data interpretation. It is entitled, Bioaerosols: Assessment and Control, 1999.

Fungal spores are found everywhere. Whether or not symptoms develop in people exposed to fungi depends on the nature of the fungal material (e.g., allergenic, toxic, or infectious), the exposure level, and the susceptibility of exposed persons. Susceptibility varies with the genetic predisposition (e.g., allergic reactions do not always occur in all individuals), age, pre-existing medical conditions (e.g., diabetes, cancer, or chronic lung conditions), use of immunosuppressive drugs, and concurrent exposures. These reasons make it difficult to identify dose/response relationships that are required to establish “safe” or “unsafe” levels (i.e., permissible exposure limits).

It is generally accepted in the industry that indoor fungal growth is undesirable and inappropriate, necessitating removal or other appropriate remedial actions. The New York City guidelines and EPA guidelines for mold remediation in schools and commercial buildings define the conditions warranting mold remediation. Always remember that water is the key. Preventing water damage or water condensation will prevent mold growth.

This report is not intended to provide medical advice or advice concerning the relative safety of an occupied space. Always consult an occupational or environmental health physician who has experience addressing indoor air contaminants if you have any questions.

4. Glossary of Fungi

ALTERNARIA(ULOCLADIUM)

Natural Habitat	Common saprobe and pathogen of plants. Typically found on plant tissue, decaying wood, and foods. Soil . Air outdoors.
Suitable Substrates in the Indoor Environment	Indoors near condensation (window frames, showers), House dust (in carpets, and air). Also colonizes building supplies, computer disks, cosmetics, leather, optical instruments, paper, sewage, stone monuments, textiles, wood pulp, and jet fuel
Water Activity	Aw =0.85-0.88 (water damage indicator)
Mode of Dissemination	Wind
Allergic Potential	Type I allergies (hay fever, asthma), Type III (hypersensitivity pneumonitis)
Potential or Opportunistic Pathogens	Phaeohyphomycosis {causing cystic granulomas in the skin and subcutaneous tissue}. In immunocompetent patients, Alternaria colonizes the paranasal sinuses, leading to chronic hypertrophic sinusitis
Industrial Uses	Biocontrol of weed plants ·Biocontrol fungal plant pathogens.
Potential Toxins Produced	Alternariol (AOH) . Alternariol monomethylether (AME). Tenuazonic acid (TeA). Altenuene (ALT). Altertoxins (ATX)
Other Comments	Many species of Ulocladium have been renamed as Alternaria. Alternaria spores are one of the most common and potent indoor and outdoor airborne allergens. Additionally, Alternaria sensitization has been determined to be one of the most important factors in the onset of childhood asthma. Synergy with Cladosporium or Ulocladium may increase the severity of symptoms
References	Alternaria redefined. J. Woudenberg et al., Studies in Mycology. Volume 75, June 2013, Pages 171-212

ASCOSPORES

Natural Habitat	Everywhere in nature.
Suitable Substrates in the Indoor Environment	Depends on genus and species.
Water Activity	Depends on genus and species.
Mode of Dissemination	Forcible ejection or passive release and dissemination by wind or insects.
Allergic Potential	Depends on genus and species.
Potential or Opportunistic Pathogens	Depends on genus and species.
Industrial Uses	Depends on genus and species.
Potential Toxins Produced	Depends on genus and species.
Other Comments	Ascospores are the result of sexual reproduction and produced in a saclike structure called an ascus. All ascospores belong to members of the Phylum Ascomycota, which encompasses a plethora of genera worldwide.

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ASPERGILLUS/PENICILLIUM

Natural Habitat	Plant debris ·Seed ·Cereal crops
Suitable Substrates in the Indoor Environment	Grows on a wide range of substrates indoors ·Prevalent in water damaged buildings ·Foods (blue mold on cereals, fruits, vegetables, dried foods) ·House dust ·Fabrics ·Leather ·Wallpaper ·Wallpaper glue
Water Activity	Aw=0.75-0.94
Mode of Dissemination	Wind ·Insects
Allergic Potential	Type I (hay fever, asthma) ·Type III (hypersensitivity)
Potential or Opportunistic Pathogens	Possible depending on the species.
Industrial Uses	Many depending on the species
Potential Toxins Produced	Possible depending on the species.
Other Comments	Spores of Aspergillus and Penicillium (including others such as Acremonium, Talaromyces, and Paecilomyces) are small and spherical with few distinguishing characteristics. They cannot be differentiated or speciated by non-viable impaction sampling methods. Some species with very small spores may be undercounted in samples with high background debris.

BASIDIOSPORES

Natural Habitat	Forest floors. Lawns .Plants (saprobes or pathogens depending on genus)
Suitable Substrates in the Indoor Environment	Depends on genus. Wood products
Water Activity	Unknown.
Mode of Dissemination	Forcible ejection. Wind currents.
Allergic Potential	Type I allergies (hay fever, asthma) . Type III (hypersensitivity pneumonitis)
Potential or Opportunistic Pathogens	Depends on genus.
Industrial Uses	Edible mushrooms are used in the food industry.
Potential Toxins Produced	Amanitins. monomethyl-hydrazine. muscarine. ibotenic acid. psilocybin.
Other Comments	Basidiospores are the result of sexual reproduction and formed on a structure called the basidium. Basidiospores belong to the members of the Phylum Basidiomycota, which includes mushrooms, shelf fungi, rusts, and smuts.

CHAETOMIUM

Natural Habitat	Dung. Seeds. Soil. Straw.
Suitable Substrates in the Indoor Environment	Paper. Sheetrock. Wallpaper.
Water Activity	Aw=0.84-0.89.
Mode of Dissemination	Wind. Insects. Water splash.
Allergic Potential	Type I (asthma and hay fever).
Potential or Opportunistic Pathogens	Onychomycosis. C. perlucidum recognized as a new agent of cerebral phaeohyphomycosis.
Industrial Uses	Cellulase production, Textile testing.
Potential Toxins Produced	Chaetomin. Chaetoglobosins A,B,D and F are produced by Chaetomium globosum. Sterigmatocystin is produced by rare species

CLADOSPORIUM

Natural Habitat	Dead plant matter. Straw. Soil. Woody plants
Suitable Substrates in the Indoor Environment	Fiberglass duct liner. Paint. Textiles. Found in high concentration in water-damaged building materials.
Water Activity	Aw 0.84-0.88
Mode of Dissemination	Air
Allergic Potential	Type I (asthma and hay fever).
Potential or Opportunistic Pathogens	Edema. keratitis. onychomycosis. pulmonary infections. Sinusitis.
Industrial Uses	Produces 10 antigens.
Potential Toxins Produced	Cladosporin and Emodin.

GANODERMA

Natural Habitat	Grows on conifers and hardwoods worldwide, causing white rot, root rot, and stem rot.
Suitable Substrates in the Indoor Environment	Unknown.
Water Activity	Unknown.
Mode of Dissemination	Wind.
Allergic Potential	Ganoderma species are known to cause allergies in people on a worldwide scale.
Potential or Opportunistic Pathogens	Unknown.
Industrial Uses	Biopulping of wood for the paper industry. Potential medicinal use due to: 1. Inhibition of Ras dependent cell transformation, 2. Antifibrotic activity, 3. Immunomodulating activity, 4. Free-radicle scavenging
Potential Toxins Produced	Unknown.
Other Comments	Used in traditional Chinese medicine as an herbal supplement. It is also known as a "shelf fungus" because the fruiting body forms a stalk-less shelf on the sides of trees and logs. It is sometimes called “artists conk” because when you scratch the white pores of the fruiting body, the white rubs away and exposes the brown hyphae underneath. Thus, pictures can be produced on the fruiting body.
Reference	References: Craig, R.L., Levetin, E. 2000. Multi-year study of Ganoderma aerobiology. Aerobiologia 16: 75-81. http://www.pfc.forestry.ca/diseases/CTD/Group/Heart/heart6_e.html

MYXOMYCETES++

Natural Habitat	Decaying logs, Dead leaves , Dung , Lawns , Mulched flower beds, Lawns
Suitable Substrates in the Indoor Environment	Rotting lumber
Free moisture required for mold growth	Unknown
Mode of Dissemination	Insects, Water, Wind
Allergic Potential	Type I
Potential or Opportunistic Pathogens	Unknown
Industrial Uses	
Other Comments	Includes Myxomycetes, Smut, and Periconia.

STACHYBOTRYS/MEMNONIELLA

Natural Habitat	Decaying plant materials and Soil.
Suitable Substrates in the Indoor Environment	Water damaged building materials such as: ceiling tiles, gypsum board, insulation backing, sheet rock, and wall paper. Paper. Textiles.
Water Activity	Aw=0.94
Mode of Dissemination	Insects, Water, and Wind
Allergic Potential	Type I (hay fever, asthma)
Potential or Opportunistic Pathogens	Unknown.
Industrial Uses	Unknown.
Potential Toxins Produced	Mycotoxins produced by Stachybotrys include Roridin A, Roridin E, Roridin H, Roridin L-2, Satratoxin G, Satratoxin H, Isosatratoxin F, Verucarin A, Verucarin J, and Verrucariol.
Other Comments	Stachybotrys and Memnoniella are closely related and many Memnoniella species have been renamed under Stachybotrys. Mycologists are continuing to debate whether Stachybotrys and Memnoniella should be grouped or split apart (see references below). Stachybotrys may play a role in the development of sick building syndrome. The presence of this fungus can be significant due to its ability to produce mycotoxins. Exposure to the toxins can occur through inhalation, ingestion, or skin exposure.
References	Generic hyper-diversity in Stachybotriaceae. L. Lombard et al., Persoonia 36, 2016: 156–246. Overview of Stachybotrys (Memnoniella) and current species status. Y. Wang et al., Fungal Diversity, 2015: DOI: 10.1007/s13225-014-0319-0.

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5. References and Informational Links

Books

- Bioaerosols: Assessment and Control. Janet Macher, Ed., American Conference of Governmental Industrial Hygienists, Cincinnati, OH 1999.

- Exposure Guidelines for Residential Indoor Air Quality. Environmental Health Directorate, Health Protection Branch, Health Canada, Ottawa, Ontario, 1989.

- Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Health Canada, Ottawa, Ontario, 2004.

- IICRC: S500 Standard and Reference Guide for Professional Water Damage Restoration. 3rd Edition, Institute of Inspection, Cleaning, and Restoration Certification, Vancouver, WA, 2006

  IICRC: S520 Standard and Reference Guide for Professional Mold Remediation. 1st Edition, Institute of Inspection, Cleaning, and Restoration Certification, Vancouver, WA, 2004

- Field Guide for the Determination of Biological Contaminants in Environmental Samples. 2nd Edition, American Industrial Hygiene Association, 2005.

Consumer Links

Read the full text of AIHA’s "The Facts About Mold" consumer brochure.
<http://www.aiha.org/get-involved/VolunteerGroups/Documents/BiosafetyVG-FactsAbout%20MoldDecember2011.pdf>

The Occupational Safety and Health Administration (OSHA)
http://www.osha.gov/SLTC/molds/index.html

CDC Mold Facts
http://www.cdc.gov/mold/faqs.htm

CDC Stachybotrys - Questions and answers on Stachybotrys chartarum and other molds
http://www.cdc.gov/mold/stachy.htm

IOM, NAS: Clearing the Air: Asthma and Indoor Air Exposures
https://www.epa.gov/indoor-air-quality-iaq/should-you-have-air-ducts-your-home-cleaned

National Library of Medicine-Mold website
http://www.nlm.nih.gov/medlineplus/molds.html

California Department of Health Services (CADOHS)
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Mold.aspx

Minnesota Department of Health
http://www.health.state.mn.us/divs/eh/indoorair/mold/index.html

New York City Department of Health and Mental Hygiene
https://www1.nyc.gov/site/doh/health/health-topics/mold.page

EPA

H.R.: The United States Toxic Mold Safety and Protection Act

"Should You Have the Air Ducts in Your Home Cleaned?"
<http://www.epa.gov/iaq/pubs/airduct.html>

General information about molds and actions that can be taken to clean up or prevent a mold problem.
<http://www.epa.gov/asthma/molds.html>

“A Brief Guide to Mold, Moisture, and Your Home” - Includes basic information on mold, cleanup guidelines, and moisture and mold prevention
http://www.epa.gov/mold/moldguide.html

“Mold Remediation in Schools and Commercial Buildings” - Information on remediation in schools and commercial property, references for potential mold and moisture remediators.
https://www.epa.gov/mold/mold-remediation-schools-and-commercial-buildings-guide

FEMA

“Homes That Were Flooded May Harbor Mold Problems” - Information and tips for cleaning mold.
http://www.fema.gov/news-release/homes-were-flooded-may-harbor-mold-problems

“Dealing With Mold & Mildew in Your Flood Damaged Home.
http://www.fema.gov/pdf/rebuild/recover/fema_mold_brochure_english.pdf

6. Important Terms, Conditions, and Limitations

A. Sample Retention

Samples analyzed by EMSL Canada will be retained for 60 days after analysis date Storage beyond this period is available for a fee with written request prior to the initial 30 day period. Samples containing hazardous/toxic substances which require special handling will be returned to the client immediately. EMSL Canadareserves the right to charge a sample disposal fee or return samples to the client.

B. Change Orders and Cancellation

All changes in the scope of work or turnaround time requested by the client after sample acceptance must be made in writing and confirmed in writing by EMSL Canada. If requested changes result in a change in cost the client must accept payment responsibility. In the event work is cancelled by a client, EMSL Canada will complete work in progress and invoice for work completed to the point of cancellation notice. EMSL Canada is not responsible for. holding times that are exceeded due to such changes.

C. Warranty

EMSL Canada warrants to its clients that all services provided hereunder shall be performed in accordance with established and recognized analytical testing procedures and with reasonable care in accordance with applicable federal, state and local laws. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied. EMSL Canada disclaims any other warranties, express or implied, including a warranty of fitness for particular purpose and warranty of merchantability.

D. Limits of Liability

In no event shall EMSL Canada be liable for indirect, special, consequential, or incidental damages, including, but not limited to, damages for loss of profit or goodwill regardless of the negligence (either sole or concurrent) of EMSL Canada and whether EMSL Canada has been informed of the possibility of such damages, arising out of or in connection with EMSL Canada’s services thereunder or the delivery, use, reliance upon or interpretation of test results by client or any third party. We accept no legal responsibility for the purposes for which the client uses the test results. EMSL Canada will not be held responsible for the improper selection of sampling devices even if we supply the device to the user. The user of the sampling device has the sole responsibility to select the proper sampler and sampling conditions to insure that a valid sample is taken for analysis. Any resampling performed will be at the sole discretion of EMSL Canada, the cost of which shall be limited to the reasonable value of the original sample delivery group (SDG) samples. In no event shall EMSL Canada be liable to a client or any third party, whether based upon theories of tort, contract or any other legal or equitable theory, in excess of the amount paid to EMSL Canada by client thereunder.

E. Indemnification

Client shall indemnify EMSL Canada and its officers, directors and employees and hold each of them harmless for any liability, expense or cost, including reasonable attorney's fees, incurred by reason of any third party claim in connection with EMSL Canada services, the test result data or its use by client