TECHNICAL MEMO

To: Mr. Trevor Betcher, Director of Operations
Mr. Glynn Warnica, Manager of Facilities and Grounds
School District 83

Date: October 31, 2019

From: Daniel Watterson, P.Geo. LHG
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WGI Project No. 20-009

Subject: Unknown Odors and Hydrogeological Assessment – Parkview Elementary School

INTRODUCTION and BACKGROUND

Watterson Geoscience Inc. (WGI) understands that excessive odors recently affected the west end of Parkview Elementary School located at 605 Parksville St, Sicamous, BC (the School). Based on the strength and unknown nature of these odors, the school was closed and classes are held at other locations until the situation is resolved.

As part of the School's due diligence, WGI was retained by School District No. 83 (SD83) to assess hydrogeological characteristics at the school property to identify whether shallow groundwater occurrence or changes may have contributed to the odor problem.

WGI understands the School is connected to City water and septic, however an onsite treatment and disposal system (OTDS), consisting of several septic tanks and subsurface infiltration areas, were historically present south of the building. School stormwater is managed using several catch basins which convey water to City storm services and also several dry wells situated within the School grounds.

WGI understands the odors began shortly after significant local storm events which occurred on September 9 and 13, 2019. These events included high volumes of precipitation with subsequent local flooding. The objectional odors occurred immediately after the storm events.

Based on observations made by school district staff, storm runoff ponded on the ground surface around the School to several centimeters in depth, and water flowed out of the storm drains situated south of the school building, indicating the inability of the City's stormwater management system to accept the high volume of runoff.

SITE RECONNAISSANCE

On September 30, 2019 WGI met with Mr. Trevor Betcher, Director of Operations, and Mr. Glynn Warnic, Manager of Facilities and Grounds, on September 30, 2019 to visually assess site conditions and provide initial recommendations regarding the hydrogeological assessment program.

During the site visit, WGI observed the ground surface around the school building for saturated soil, ponded water or staining which is often evidence of excess surface water, poor soil drainage or shallow groundwater. No water was present in the School dry wells, and no evidence of the old OTDS was observed although no information regarding when and how the OTDS was decommissioned was available.

WGI also inspected the crawlspace on the west side of the building for signs of shallow groundwater or water seepage. Most of the crawlspace floor consisted of bare and loose light brown to tan soil with scattered pebbles and remnant construction debris. The soil was dry, with no noticeable odors.

The only signs of water in the crawlspace were numerous areas of white mineralization and dark staining along the concrete foundation wall and floor, where surface water had apparently entered from above and from the seam between wall and floor and subsequently dried. A locally large (about 2 x 3 m) of highly stained dirt floor was observed along the building's west side, where an apparently large volume of surface water had entered around some plywood, ponded and dried.

LOCAL SOIL, GROUNDWATER and WATER SUPPLY CHARACTERISTICS

Based on geological mapping completed by Robert Fulton (1969), overburden at and near Site consists of sand, gravel, and silt alluvium. Online mapping available from the BC Ministry of Environment and Climate Change Strategy (MOE) Water Resources Atlas (WRA) indicates that one (1) well is located within 500 m of the Site. This well (WTN 17679) is situated approximately 175 m northwest of the Site and was drilled in 1962. According to its well record, the well was drilled 28.35 m deep through sand and silt, and was screened in sand with mica. Static water level was measured at 3.05 m below ground surface (m bgs).

The WRA also shows the property to be situated above Aquifer 307 IIA. This aquifer is described as an unconfined sand and gravel aquifer with high vulnerability and moderate productivity, and an average depth to water of 7.32 m below ground surface (bgs). The MOE's aquifer report lists no water quantity or quality concerns.

No ground surface elevations referenced to mean sea level are available for the property. However, based on Google Earth mapping, the ground elevation at the school is approximately 363 m above mean sea level (masl).

TEST PIT INVESTIGATION

On October 4, 2019, at the direction of WGI, Ecoscape Environmental Consultants and Launch Construction excavated five (5) test pits (Figure 1) around the school building perimeter to evaluate soil and shallow groundwater characteristics.

In general, the test pits extended to approximately 2.9 m bgs and encountered interbedded dry to moist brown silt, sand and silty sand with some gravel with abundant organic material above one (1) m bgs. The test pits were left open for several minutes after excavation, however no evidence of groundwater seepage was observed

Although groundwater was not encountered, red-brown soil discoloration (mottling) which is evidence of seasonal oxygenation and saturation, was observed in the test pits generally between 0.5 and 2 m bgs.

These findings confirm the local overburden and aquifer mapping information and suggest the soil is seasonally wetted by winter precipitation with drying during the summer.

DISCUSSION

Although shallow groundwater elevations commonly vary during the seasons, available background soils and groundwater information for the area suggest the water table is sufficiently deep beneath the School property to not affect shallow soil conditions. This information is supported by WGI's field assessment as although the test pits were excavated during the season when groundwater elevations are their lowest, no evidence of permanent shallow groundwater, such as wet soil or gleying, caused by permanent saturation and oxygen-poor conditions, was observed. The available information and observations suggest that under normal conditions the soil beneath the School is seasonally wet, but groundwater is sufficiently deep to not affect soil characteristics beneath the school.

However, it is possible but unlikely the abundant short-term surface runoff during the rain events may have temporarily increased shallow groundwater elevation beneath the building and thereby saturated soil that was historically unsaturated. This possibility is supported by the inability of the local storm system and dry wells to accept the excess runoff causing abundant shallow water throughout the School area. The odors may have resulted from this temporary saturation.

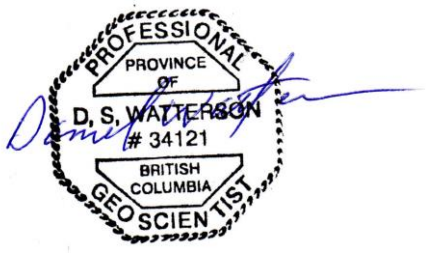
In addition, inadequate sealing between the building structure and underlying concrete foundation walls appears to periodically allow surface-sourced water into the crawl space. The excessive surface water present during the two flooding events may have caused much more than "normal" amounts of surface flow into the crawl space with resulting increased saturation of soil in the crawl space.

Finally, no evidence of the OTDS was observed during WGI's site visit and the odors apparently did not smell of "septic". Given the old infiltration area's distance from the School it is unlikely the historic drain field, even if affected by the excess surface water and possible temporary shallow groundwater, it is unlikely saturation of this area could have caused the odors.

The above hydrogeological assessment is offered to support discussions and refinement.

Respectfully submitted,

Watterson Geoscience Inc.



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REFERENCES

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