MR. IAN ARKLIE

SHALLOW GROUNDWATER

AT

LOT 103, PLAN 59737

SECTION 27, BLOCK 5 NORTH, R1W, N.W.D.

PACIFIC HYDROLOGY CONSULTANTS LTD.

October 5, 1983

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October 5, 1983

Mr. Ian Arklie
15774 - 102B Avenue
Surrey, B.C. V3R 7S5

Subject: Shallow Groundwater at Lot 103, Plan 59737, Section 27, Block 5 North, R1W, N.W.D.

Dear Sir:

This is further to our discussion (Mr. & Mrs. Arklie, Badry, Livingston) on September 20 at your residence on 102B Avenue in Surrey. We understand that the situation is as follows:

1. Your house is new, as are all the other houses in the subdivision on 102B Avenue. You have lived there since February 1982.

2. You recently noticed that the carpet in the living room along the east wall of the house was wet along a line where the wall of the house meets the floor.

3. The house is constructed without a basement. The wall footings are about 1 m below ground surface. The area within the outside walls of the house was excavated approximately to the elevation of the footings. This interior area was then brought up to floor elevation by filling with sand. The concrete floor slab of the house was poured on top of this sand. The depth of the footings has been confirmed by your excavations along the outside walls and the presence of the sand has been confirmed by cutting a hole in the concrete footing wall about $\frac{1}{2}$ m below the level of the house floor. All of the houses in the subdivision are constructed in the same way.

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4. The house is surrounded by a drain which is joined to the storm sewer on 102B Avenue. The drain is at the elevation of the footings. Your recent excavations indicate that the drain is properly constructed. You have demonstrated, by supplying water to openings in the drain pipe with a garden hose, that the drain is not blocked and that water flows in both directions to the storm sewer from the high point located along the east wall of the house.

5. After noticing the moisture in the carpet and at the bottom of the wall, you lifted the carpet along the wall. This discloses a continuous vertical open crack in the concrete floor where it joins the wall. Examinations of the edges of the floor in other places in the house show a similar crack but no moisture problem.

6. The furnace in your house is above floor level. Heating ducts, consisting of sheet metal pipes, pass below the floor slab; the bottom of the ducts is about 30 cm below the floor. You have not observed water or moisture in a duct at an opening in the living room in the problem area.

7. Your observations during the summer indicate that the moisture problem is more acute during rainy weather. You also note a "swampy" smell in the living room at these times.

8. You have dug a small hole in the lawn near the back of your lot. At the time of our visit, the water level was about 10 cm below surface. When water is removed from the hole it fills up to static level over night. A small evergreen tree at this site died during the summer.

9. As far as you know, other residents of the subdivision have not had problems with excessive moisture in their homes.

10. Your recent excavations, as well as other evidence, shows that the area is underlain by till. The presence of ponded water in the bush behind your house and the general appearance of the bush indicate that the water table in the area is probably close to surface throughout most of the year.

Background information used in preparation of this letter includes:

1. Surficial Geology New Westminster, Map 1484A, Geological

Survey of Canada, 1980.

2. Water Well Location Maps 33 and 34 of the Lower Fraser Valley District.

3. A visit to the site.

Discussion

We believe that the shallow groundwater conditions in the area are caused by natural groundwater discharge. The area represents the discharge end of a groundwater flow system with a recharge area up the gentle slope to the west. The length of the system, according to the topographic map, is 1 km or more; the slope of the ground surface is about 0.025. Because of the low gradient and the low premeability of the till, the velocity of groundwater flow is very low. Under these conditions, the rate of discharge tends to be very nearly constant throughout the year. The depth of the water table, however, probably fluctuates in response to changes in evapotranspiration, and to rainfall which tends to recharge the permeable soil layer of about 1 m thickness.

The fact that the area has a natural shallow water table does not explain what is happening at your house. We would expect that the properly constructed drain around the house would maintain the water table at the level of the footings in and around the house. One possible explanation is that the footing, which is in a trench cut into the till, may tend to isolate the area directly under the floor from the drain. In addition, there may be a local feature such as a fissure or a lens of gravel in the till under the house; such a feature may bring more water into the area.

No matter what conditions exist under the house, it is not likely that the entire area of the sand fill becomes saturated up to the bottom of the floor. Such water would appear in the heating duct and would probably appear in other parts of the house. Capillary rise of water in the sand is not likely to be great but could be as much as 60 cm if the sand is dirty and fine. However, even if the water rose to the top of the sand by capillary action, it would not be able to move further (for example through the crack in the concrete) because capillary water is under negative pressure.

A possible explanation is that water moves by capillary action laterally from near-surface wet soil into concrete of the footing wall and then through the concrete by capillary action into the carpet. This can occur if:

1. Fine-grained soil is in direct contact with the concrete of the wall at a location above the top of the drain.
2. There is no protective layer of asphalt or other material on the outside of the concrete.
3. The concrete is locally permeable, perhaps because of entrapped air or for some other reason.
4. The carpet is in direct contact with the concrete.
5. The capillarity of the carpet is high enough so that water can flow into it from the concrete.

This possible explanation may account for the local nature of the condition and also for the fact that the condition seems to be more noticeable during and following rain. It is also possible that the concrete could be taking water from the sand fill on the inside of the foundation or even directly from the footing; however, such a situation would tend to be steady rather than episodic.

Most good quality concrete has extremely low permeability and would not transmit enough water by capillary action to cause the problem.

As we discussed during our meeting, it should be possible for you to carry out further steps in an investigation. These would be helpful in eliminating certain of the causes mentioned in this letter. Among others, we suggested:

1. Excavating several holes in your yard with a hand auger to determine the depth to the water table. This would do much to show whether the drain around the house is working properly. Regular measurements of the depth to water would be helpful in showing the effects of weather.

2. Observing the depth to water in the sand under the house, perhaps by installing a tube or other casing in the sand by way of the hole in the floor in the living room.

We have sent to Victoria for the logs of several drilled wells in the vicinity of the subdivision. These should show the thickness of the till in the area.

Please call if you have any questions about this letter or if you wish to borrow our auger.

Yours truly,
PACIFIC HYDROLOGY CONSULTANTS LTD.

E. Livingston

E. Livingston, P.Eng.

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