

WELL DRILLING ADVISORY: Flowing artesian conditions



Kelowna, BC



Flowing artesian conditions exist in the Lower Mission Creek area of Kelowna, BC.

Well drillers and home owners should be aware of potential complications and costs of flowing artesian wells.



Where do they occur?

The Mission Creek area in Kelowna is an area of known flowing artesian conditions. The area is located south of Highway 97 (Harvey Ave), and in the vicinity of Mission Creek, KLO Rd, and Benvoulin Rd (see Figure 1).

What is a flowing artesian well?

Flowing artesian wells occur when a well is drilled into an aquifer¹ under pressure, causing the water level in the well to rise above the ground surface and flow over the top of the well casing.

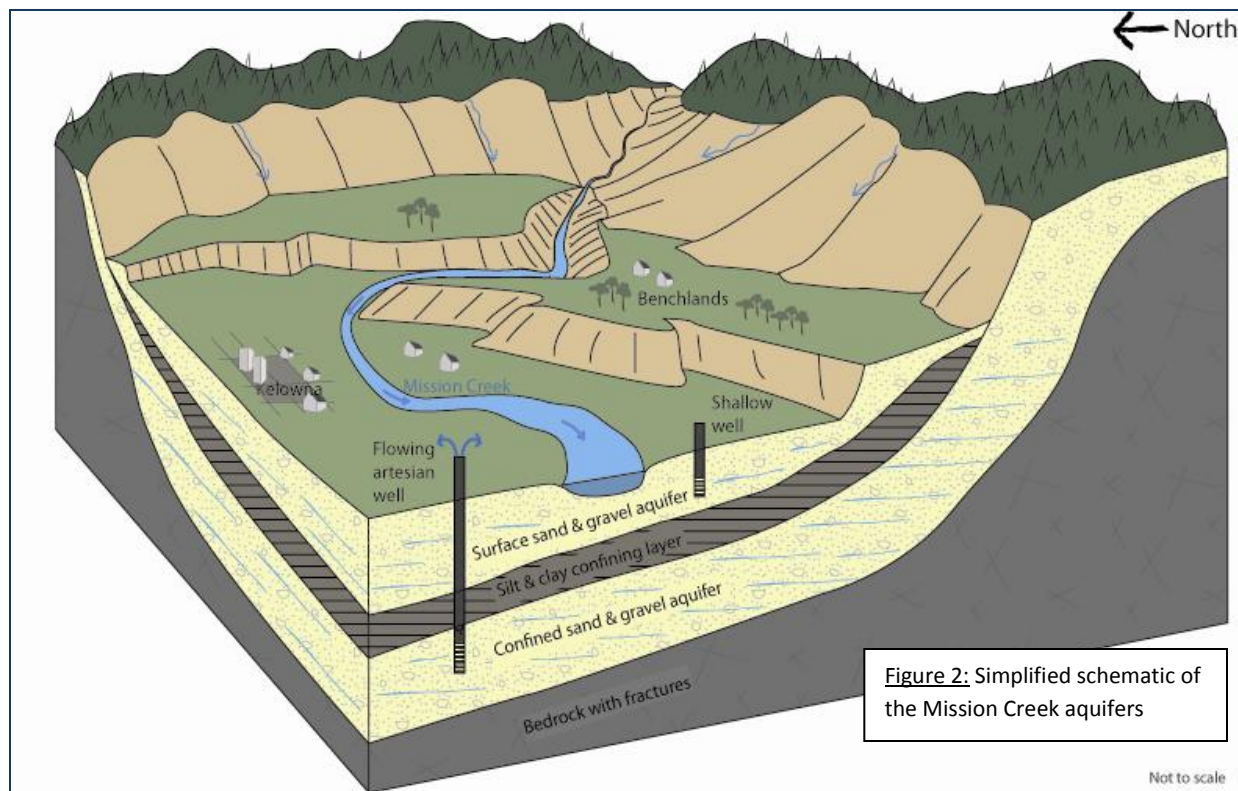
It is important to properly construct the well to control this flow. Controlling artesian flow conserves groundwater resources, preserves the pressure within the aquifer, and prevents damage to the natural environment (i.e., property damage,

¹ Aquifer is an underground layer of water-bearing material (i.e., permeable rock or unconsolidated materials) from which groundwater can be diverted.

flooding, erosion and impacts to surface water). A flowing artesian well can cause substantial damage and incur significant and unexpected costs without careful planning and construction. Water well drillers and home owners must be prepared in case flowing artesian conditions are encountered.

Why are there flowing wells in the Mission Creek aquifer?

The underlying materials in the Mission Creek area are multiple layers of sand and gravel (from fine to coarse grained) separated by silt and clay deposits over top of fractured bedrock (Figure 2). The deeper sand and gravel aquifer is sandwiched between the bedrock below and the silt and clay deposits above causing confined pressure within the aquifer. A well drilled into this confined aquifer has the potential to become a flowing artesian well. Flowing artesian conditions are much less likely to be encountered in shallow wells drilled into the unconfined surface sand and gravel aquifer.



Flowing artesian wells in Mission Creek

A review of the BC WELLS database indicates that 65 known wells in the Mission Creek area reported flowing artesian conditions at the time of drilling based on voluntarily reported information. More flowing wells may be present. The artesian flow rates range up to 300 US gallons per minute (1650m³/day). The depth at which these wells encountered the artesian aquifer range from to 40 to 210 feet (12 to 64 m) below ground level (bgl) (Figure 3).

Depths to artesian aquifer range from 40 ft (12 m) to 210 ft (64 m)

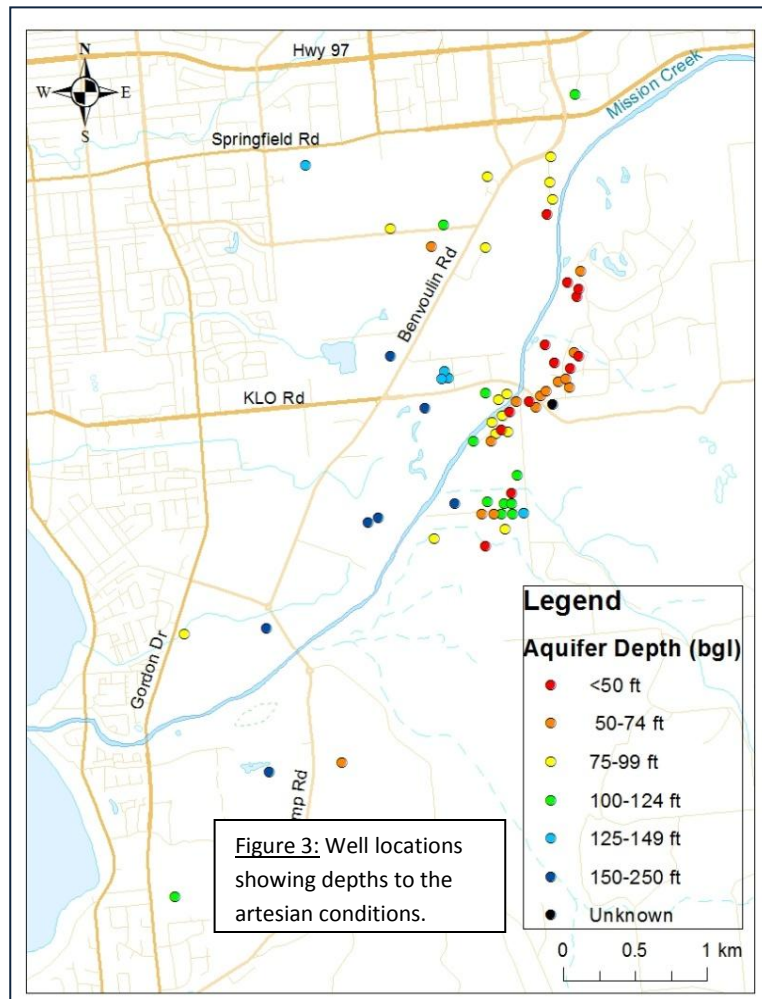


Figure 3: Well locations showing depths to the artesian conditions.

Preparing for drilling in the Mission Creek area

Qualifications and experience

In BC, anyone constructing a well over 15 ft deep must be registered as a qualified well driller or be working under the supervision of a qualified well driller or professional engineer or geoscientist. Anyone can install a well less than 15 ft deep, but if artesian conditions are encountered and the well has the potential to flow, a qualified well driller or professional must be engaged to stop or control the flow. These drillers and professionals must be qualified, but also have the experience and equipment required to deal with flowing artesian conditions.

Water well drillers in BC should be qualified & experienced

Details about the qualifications to become a qualified well driller are set out in Part 1 of the Ground Water Protection Regulation at www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/11_299_2004.

A list of qualified well drillers in your area can be found at the Province of BC's online Register at www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/applications/well_drillers_reg_2013.pdf.

Assuming artesian flow

It is important to understand that geologic conditions are highly variable, and that neither the presence nor absence of flowing artesian conditions can be known with certainty prior to drilling. Therefore, when drilling in the Mission Creek area it should always be assumed that flowing artesian conditions will be present and a precautionary approach should be taken. The well driller and home owner must be prepared for the resulting costs, planning time, materials, expertise and equipment needed to construct the well to control or stop any artesian flow.

Assume flowing artesian conditions will be encountered in the confined Mission Creek aquifer

To help with the uncertainty whether flowing artesian conditions exist, well drillers should always conduct a pre-drilling assessment; this could include:

- Assessing the physical setting of the proposed well (e.g., in a valley or area where nearby water is at a higher elevation),
- Consulting with local groundwater professionals, experienced well drillers, or residents to learn of other flowing wells or springs in the area,
- Examining well records from the Ministry of Environment's WELLS database and the Flowing Artesian Wells layer in iMapBC (http://www.env.gov.bc.ca/wsd/data_searches/wells/index.html)
- Reviewing professional hydrogeologic reports in the Ecological Reports Catalogue (EcoCat) that may identify artesian aquifers (<http://www.env.gov.bc.ca/ecocat/>).

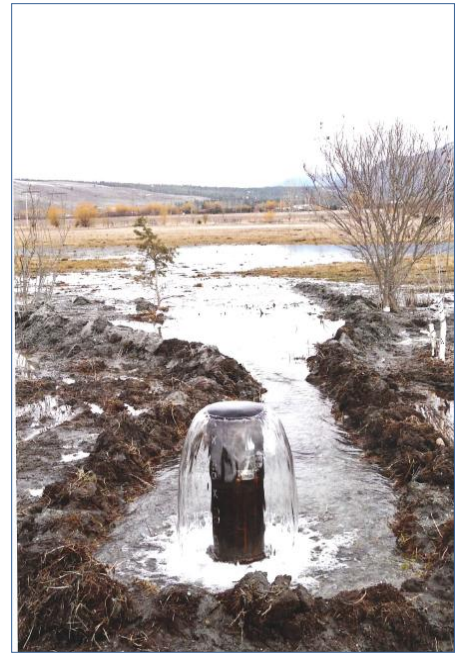


Photo credit: Schibli Drilling

Preparing and budgeting

Although preparing and constructing a well for flowing artesian conditions costs more than routine well construction, it is substantially less than the ensuing costs to repair damages or completely replace the well, should the flowing artesian well not be properly constructed at the onset. In BC, the cost to control a high pressure high flow well that was not constructed to handle artesian flows can reach hundreds of thousands of dollars. However, preparing for flowing artesian conditions and drilling a well accordingly costs only tens of thousands of dollars, only a fraction higher than a routine well construction.

It is also recommended that well drillers have adequate liability insurance to deal with unexpected costs associated with controlling flowing artesian wells.

It is the responsibility of the well driller to advise the home owner of potential hazards associated with uncontrolled artesian flow (e.g., potential for erosion, flooding, subsidence) and the associated costs. The home owner and well driller should always have an agreement in place ahead of time to minimize any misunderstandings in the event that flowing artesian conditions are encountered.

Considerations for Home Owners

- Ensure the driller or professional you hire is registered with the Province, qualified & experienced with flowing artesian conditions.
- Have an agreement in place with the driller to deal with flowing artesian conditions.
- Recognize you may be liable to neighbours & others if uncontrolled flows cause damage.

Considerations for Well Drillers

- Ensure you have experience & equipment to deal with flowing artesian conditions.
- Always assume flowing artesian conditions will be encountered in the confined Mission Creek aquifer.
- Inform home owners of potential risks & associated costs of flowing artesian wells.

If flowing artesian conditions are encountered

If flowing artesian conditions, or conditions that indicate a well is likely to flow periodically, are encountered the person constructing the well or the home owner must engage a qualified driller or qualified professional to ensure that any artesian flow is stopped or controlled.

Controlling artesian flow means that the entire flow:

- must be conveyed through the well's production casing;
- can be stopped indefinitely without leakage outside of the production casing;
- must not pose a threat to property, public safety or the environment.

Flow is not considered controlled if:

- water is surfacing outside the well casing or in another location nearby;
- the flow cannot be stopped (e.g., with a valve shut-off or packer assembly);
- there is subsurface erosion (i.e., evident if flowing water is muddy or murky).

Constructing a well for flowing conditions

Assessing the geological and hydrogeological environment will help determine the best construction process for wells that may encounter flowing artesian conditions:

- For bedrock aquifers, the bottom of the casing should be sealed securely into the bedrock to ensure the flowing water can not rise up through the annular space of the well.
- For sand and gravel aquifers, a permanent outer casing should be grouted into the lowest confining layer before the inner production casing is installed into the aquifer. A seal should be installed between the two casings to ensure flowing water can not rise up between the casings.

Drilling methods such as digging, boring, driving, augering and jetting are not typically recommended where flowing conditions may be encountered; cable tool, air rotary, or mud rotary methods have been used more successfully. Plastic casings are not recommended for use in flowing conditions.

For additional information on assessing, controlling or closing a flowing artesian well refer to the:

- Province of BC's brochure on Flowing Artesian Wells:
www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/flowing_artesian_wells.pdf
- Government of Ontario's, Water Supply Wells – Requirements and Best Management Practices Handbook (Chapter 12): www.ene.gov.on.ca/environment/en/resources/STD01_078655.html
- Michigan Department of Environmental Quality's Flowing Well Handbook:
www.michigan.gov/documents/deq/deq-wb-dwehs-wcu-flowwellhandbook_221323_7.pdf

Legislation and regulatory information

Groundwater Protection Regulation: www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/11_299_2004

Water Act, Part 5: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96483_01

Contact: Province of BC's Regional Hydrogeologist in Penticton: 250-490-8200