



# WELL DRILLING ADVISORY

## Flowing artesian conditions

### Chetwynd, BC

Flowing artesian conditions exist in low elevation valleys in Chetwynd, BC. Well drillers and home owners should be aware of potential complications and costs of flowing artesian wells.



#### Where do flowing artesian conditions occur?

The District of Chetwynd is an area of known flowing artesian conditions. The potential areas under artesian pressure are located in Centurion Creek valley stretching from northeast to southwest across Highway 97 and the Pine River valley from Chetwynd towards the southeast (Figure 1).

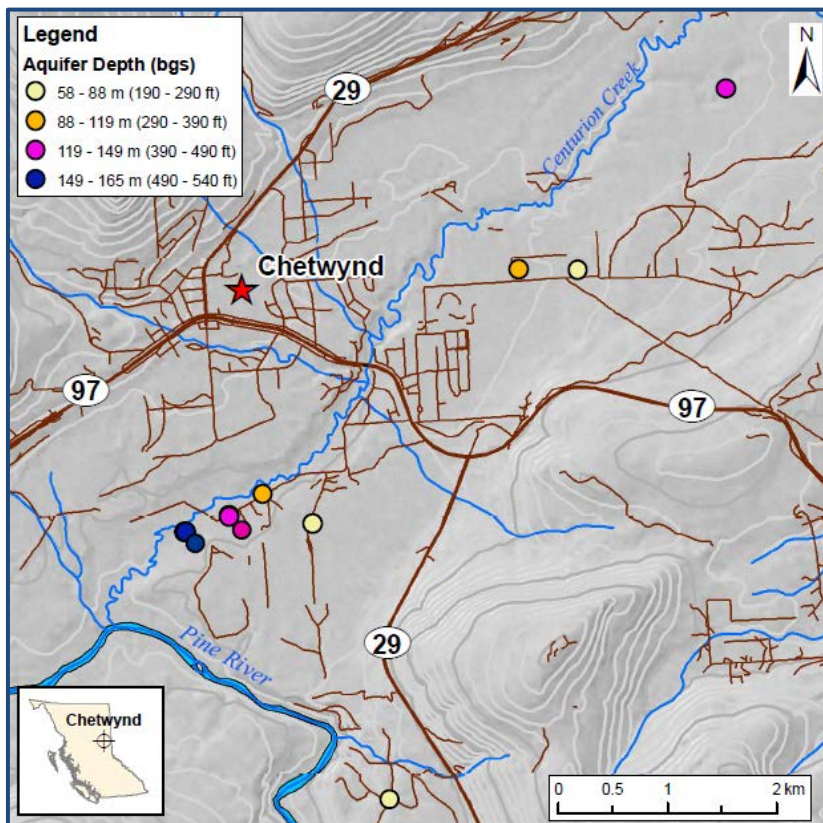


Figure 1: Chetwynd flowing artesian wells (bgs: below ground surface). Aquifer depth is inferred from well depth.

#### What is a flowing artesian well?

Flowing artesian wells occur when a well is drilled into an aquifer under pressure that is high enough to force 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, flooding, erosion and impacts to surface water). A flowing artesian well can cause substantial damage and incur significant and unexpected costs if not carefully planned and constructed. Well drillers and well owners should be prepared in advance in case flowing artesian conditions are encountered.

### Why are there flowing wells in the Chetwynd aquifer?

The main aquifer underlies most of the Chetwynd area and is comprised of coarse sand and gravel deposited in a bedrock valley during the last glacial period. The sand and gravel aquifer is confined because it is sandwiched between geologic materials that do not transmit significant quantities of water. The aquifer is bounded above by a low permeability glacial till and clay, and it is underlain by bedrock (Figure 2). The confined aquifer receives groundwater recharge from the surrounding mountains and because water cannot easily flow out of the aquifer there is a buildup of water pressure within the aquifer. A well drilled into this pressurized confined aquifer has the likelihood to become a flowing artesian well.

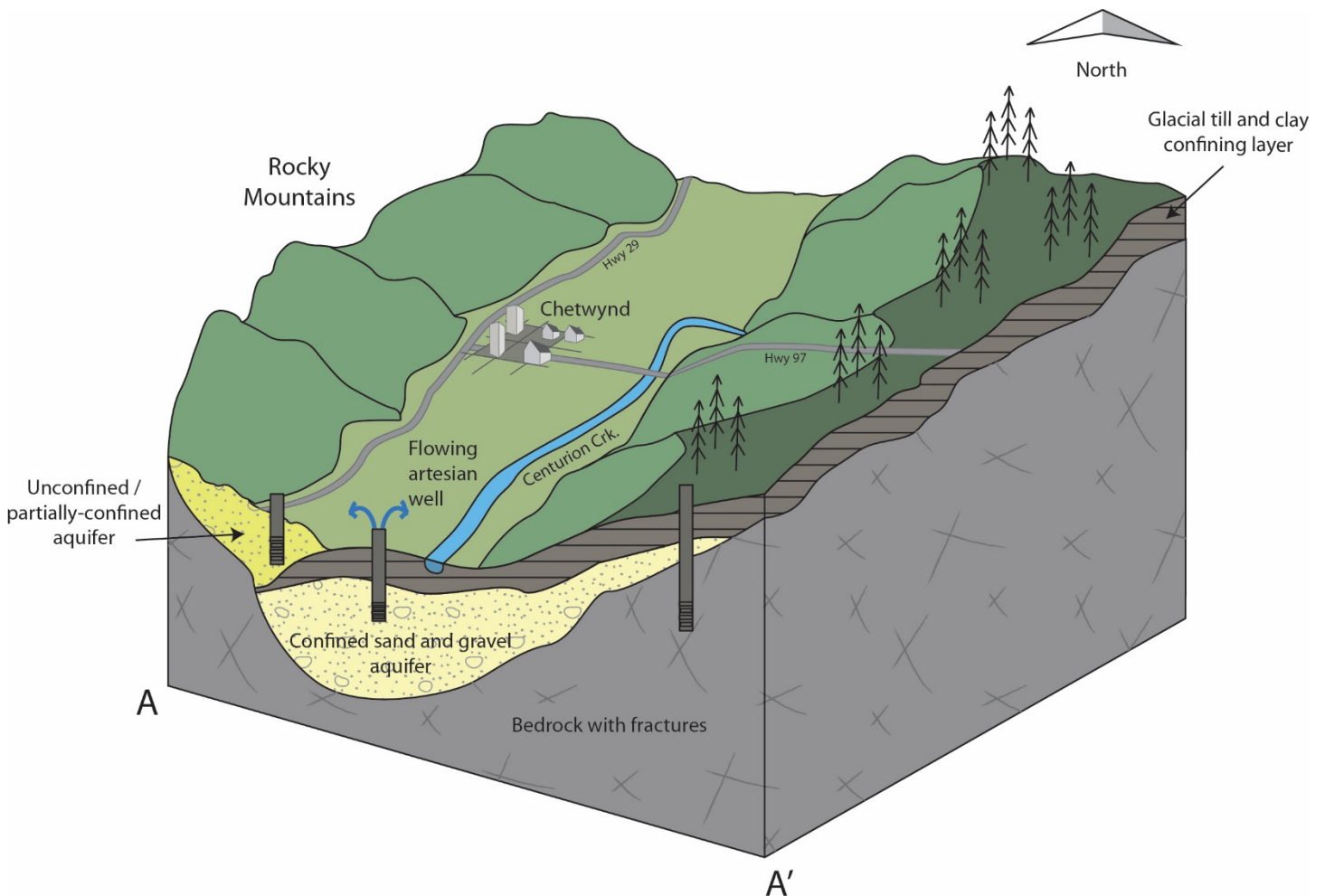


Figure 2: Simplified schematic of the Chetwynd aquifers

### Do all wells in the area encounter flowing artesian conditions?

No. A less extensive shallow aquifer exists at the foothill area along Highways 97 and 29 (Figure 2). This unconfined or partially-confined aquifer is believed to be postglacial alluvial materials originating from streams in nearby mountains. Flowing artesian conditions are less likely to be encountered in shallow wells drilled into this aquifer.

## Flowing artesian wells in Chetwynd

A review of the BC WELLS database indicates that 10 known wells in the Chetwynd area reported flowing artesian conditions at the time of drilling. Based on communication with well owners, additional flowing wells are present in the area, but these wells have not been registered in the BC WELLS database (In BC, submission of well records for most types of wells became mandatory in 2016. Until this point, well records were submitted on a voluntary basis.) Of the known artesian wells, flow rates range up to 1470 m<sup>3</sup>/day (270 US gallons per minute). The depths at which these wells have encountered the flowing artesian aquifer range from 58 to 162 m (190 to 533 feet) below ground surface.

**Depths to artesian aquifer range from 58 m (190 ft) to 162 m (533 ft).**

## Preparing for drilling in the Chetwynd area

### *Qualifications and experience*

If flowing artesian conditions are encountered during well drilling or the well has the likelihood to flow periodically, the well driller constructing the well or the professional supervising the well must ensure that the artesian flow must be stopped or brought under control.

If the person constructing the well is not a registered well driller or a professional (e.g. a person excavating a well less than 15 m deep), the person must notify the home owner of the flowing artesian conditions. The home owner and the person constructing the well must engage a registered well driller or professional to ensure that any artesian flow is stopped or controlled.

**Water well drillers in BC must be registered and must be qualified to work on the particular class of well that they are working on.**

This registered well driller or professional stopping or controlling the flow must have the training, experience, knowledge, skills and equipment required for dealing with flowing artesian conditions.

### **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).

### ***Assuming artesian flow***

It is important to understand that geologic conditions are highly variable and information may not be available near the proposed drilling locations; therefore, neither the presence nor absence of flowing artesian conditions can be known with certainty prior to drilling. Therefore, when drilling into the confined aquifer in the Chetwynd area, it should always be assumed that flowing artesian conditions will be present and assume a precautionary approach (e.g. installing and sealing a permanent surface casing of sufficient length). 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.

To manage the uncertainty, 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 BC WELLS database and the Water Wells - Artesian layer in iMapBC (<https://apps.nrs.gov.bc.ca/gwells/>)
- Reviewing professional hydrogeologic reports in the Ecological Reports Catalogue (EcoCat) that may identify flowing artesian aquifers (<http://www.env.gov.bc.ca/ecocat/>).

### ***Preparing and budgeting***

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 and experienced with flowing artesian conditions.
- Have an agreement in place with the driller to deal with flowing artesian conditions.
- Recognize the real risks and your liability to neighbours and others if uncontrolled flows cause damage.

### **Considerations for Well Drillers**

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

## Constructing a well for flowing conditions

Although preparing and constructing a well for flowing artesian conditions costs more than one in non-flowing conditions, it is substantially less than the ensuing costs to repair damages or to decommission an uncontrolled flowing well. In B.C., the cost to decommission a high pressure, high flow well that was not constructed to handle flowing artesian conditions can easily reach hundreds of thousands of dollars and possibly millions of dollars; in contrast, installing a permanent surface casing of sufficient length to control the flow before drilling into the flowing artesian aquifer costs only tens of thousands of dollars.

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 drilled into the aquifer. An annular 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 may not be conducive to controlling flowing artesian conditions when encountered; cable tool, air rotary, or mud rotary methods have been used more successfully. Plastic casings are not recommended for use in flowing artesian conditions.

For additional information on assessing, controlling or decommissioning 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](http://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): <https://www.ontario.ca/page/water-supply-wells-requirements-and-best-practices>
- Michigan Department of Environmental Quality's Flowing Well Handbook: [www.michigan.gov/documents/deq/deq-wb-dwehs-wcu-flowwellhandbook\\_221323\\_7.pdf](http://www.michigan.gov/documents/deq/deq-wb-dwehs-wcu-flowwellhandbook_221323_7.pdf)

## Legislation and regulatory information

To learn more about the applicable regulations, please see:

*Water Sustainability Act*, Sections 52 and 53: <http://www.bclaws.ca/civix/document/id/complete/statreg/14015>

Groundwater Protection Regulation: [http://www.bclaws.ca/civix/document/id/complete/statreg/39\\_2016](http://www.bclaws.ca/civix/document/id/complete/statreg/39_2016)

## Contact

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Ministry of Forests, Lands & Natural Resource Operations  
Ministry of Environment  
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