Well Owners Workshop

Presentation developed by:
BC Ministry of Environment,
Agriculture and Agri-food Canada &
the BC Groundwater Association

CVRD **Hosted by the Environmental Policy Division**

Agenda

1. Introduction
2. Understanding groundwater
3. Understanding how your well works
4. Common well problems
5. Water quality enemies
6. Water Quality and Disinfection
7. Take home messages
8. Acknowledgements
9. Panel discussion

Introduction

- The key to ensuring your groundwater supply is safe and secure is understanding your well and how to properly maintain it.
- As a landowner, you are responsible for looking after the water well(s) on your property.

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Understanding Groundwater

WELL OWNERS WORKSHOP

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The Hydrologic Cycle

PLAY
"The Hydrologic Cycle" Video
Full Screen

PLAY
"The Hydrologic Cycle" Video
800 x 600

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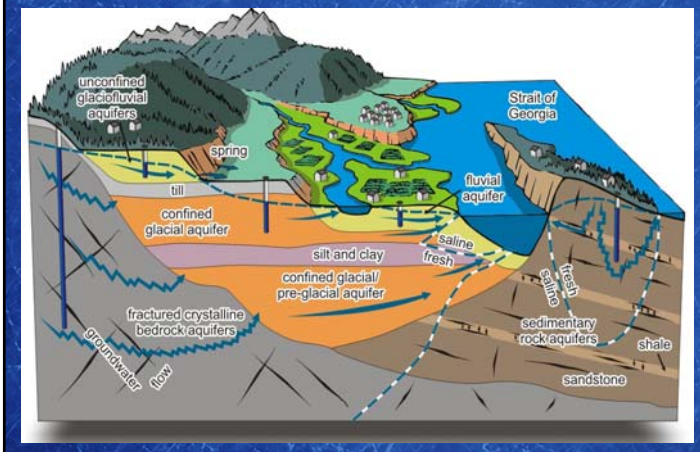
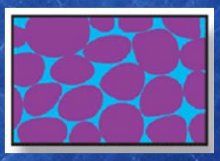
Coastal BC Aquifers



Water in rock fractures



Water between grains of sand

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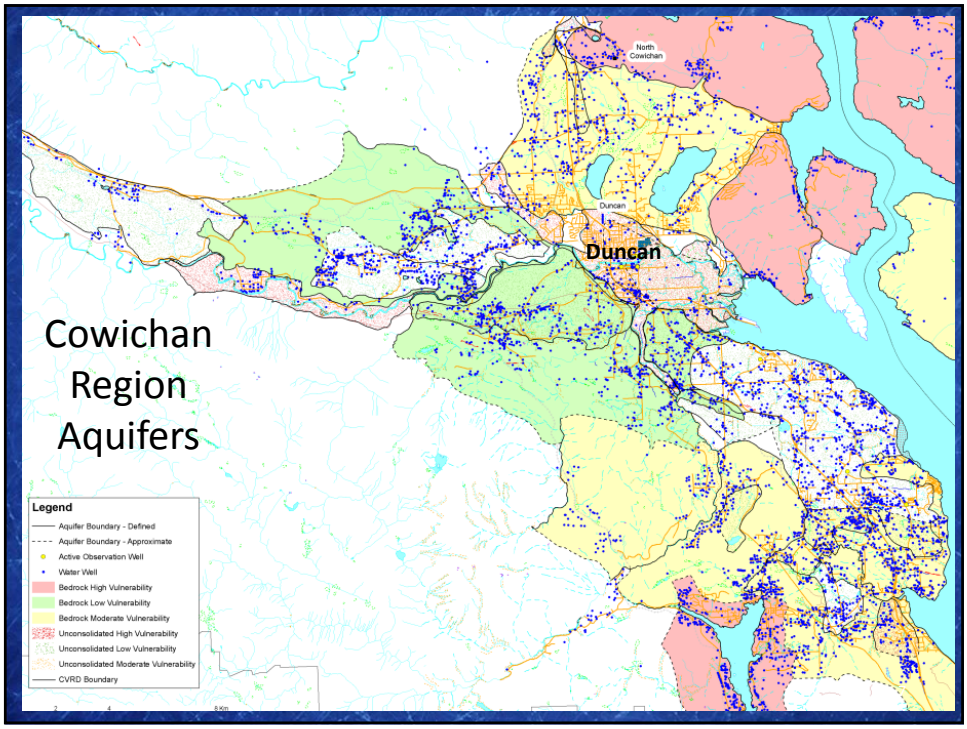
North Cowichan
Duncan
Duncan
Cowichan Region Aquifers
Legend
Aquifer Boundary - Defined
Aquifer Boundary - Approximate
Active Observation Well
Water Well
Bedrock High Vulnerability
Bedrock Low Vulnerability
Bedrock Moderate Vulnerability
Unconsolidated High Vulnerability
Unconsolidated Low Vulnerability
Unconsolidated Moderate Vulnerability
CVRD Boundary


Duncan
Cowichan Bay
South Cowichan Aquifers (e.g. Cobble Hill, Shawnigan Lake, Mill Bay)
Shawnigan Lake
Mill Bay
Saanich Peninsula
Malahat
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Understanding How Your Well Works

WELL OWNERS WORKSHOP

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Types of Wells

Drilled Wells

Dug Wells

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Types of Wells

Drilled Wells in Pits

Sandpoint Wells

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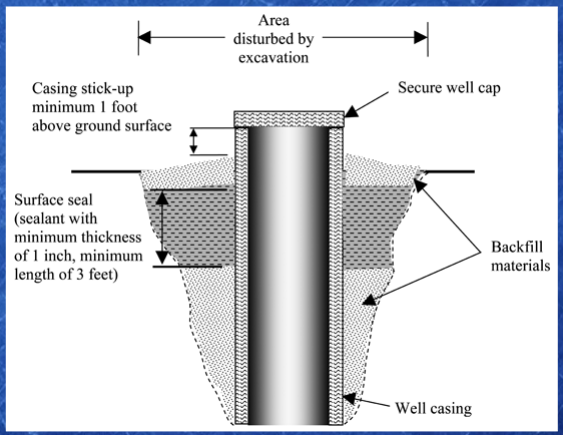
Well Types: Dug

- Large diameter – up to 3 feet in diameter.
- Shallow – less than 50 feet in depth.



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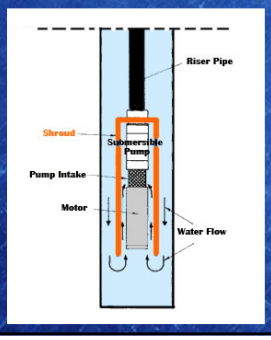
Well Types: Drilled (Bedrock)

- Usually 6 inches in diameter for domestic wells.
- Bedrock – deeper wells.
- Well pumps should have a shroud placed over the pump and motor.



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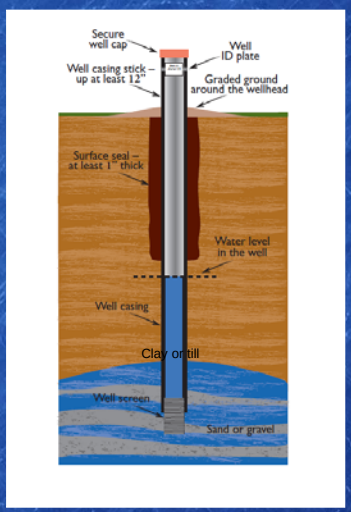
Well Types: Drilled (unconsolidated-sand and gravel)

•Usually 6 inches in diameter for domestic wells.
•Depths can vary depending on the aquifer, e.g., confined or unconfined



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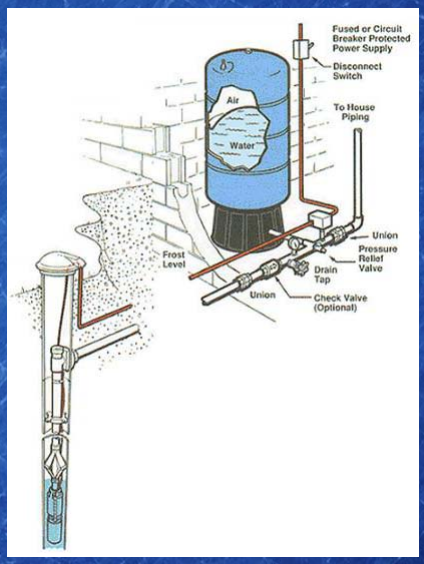
Other Components of a Well System - Pressure Tank

- Stabilizes pressure
- Tells pump when to turn on
- Keeps the pump primed and protects pump.



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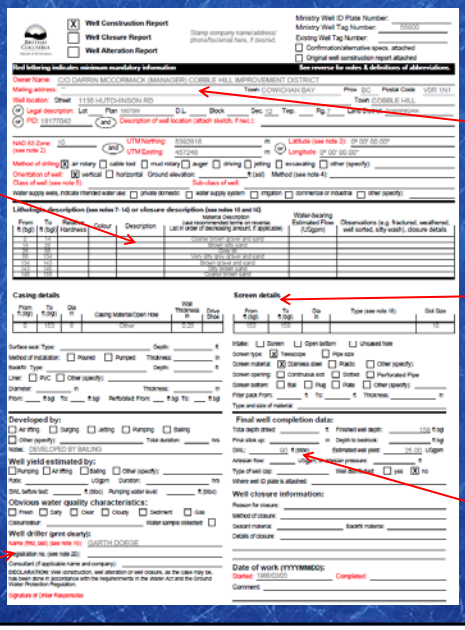
Driller's Well Construction Report

The lithology tells us what formations the well is drilled through, e.g. at least 80 feet of aquitard.



Owner and well location information

Screen information tells us where the well is sourcing its water.

Static water level and estimated well yield

Driller information

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Common Well Problems

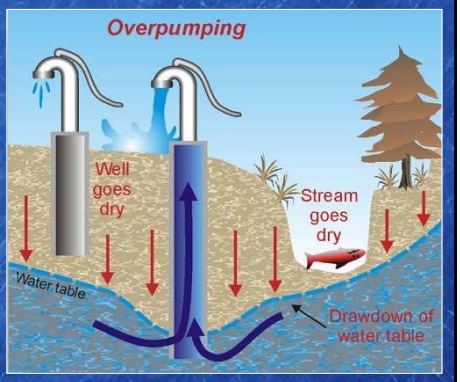
Water Well Problems

- Common well problems affect:
  1. Water quantity .
  2. Water quality.
  3. Both (eg. biofouling, sediment plugging).

Water Quantity

Supply influenced by:

- Pumping rate.
- Depth and water level.
- Geology.
- Aquifer size and type.
- Precipitation (recharge).
- Well interference.



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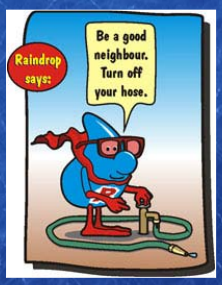
Water Quantity Problems

- Over-pumping.
- Uncontrolled flowing artesian wells.
- Aquifer overuse or depletion.
- Interference between adjacent well users.
- Lower recharge.

Under the *Water Act*, groundwater use currently not licenced in BC.



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Over-pumping

- **Do not over-pump your well!**
- Check your well pump installation report for:
  - Recommended pump intake depth.
  - Recommended pumping rate.
- Could eventually cause well failure.


Well Pump Installation Report

Well Pump Installation Information

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Overpumping – *What You Can Do*

- Operate at the recommended rate.
- Choose right pump size.
- **DO NOT** place pump inside intake portion of well or below the major water bearing fracture.
- For bedrock wells - if no major water-bearing fractures are present, the pump should be set in the lower portion of the micro-fracture formation.
- Conserve water.
- Install flow control device and additional storage, if needed.

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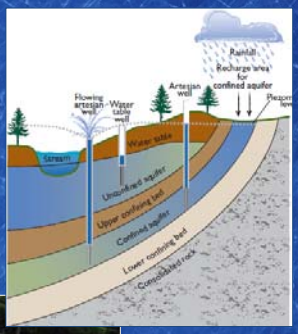
Flowing Artesian Wells

An uncontrolled flowing well:

- Wastes lots of water.
- May lower the confining pressure and affect neighbouring wells and nearby streams and springs.
- May cause flooding damage and/or subsidence.



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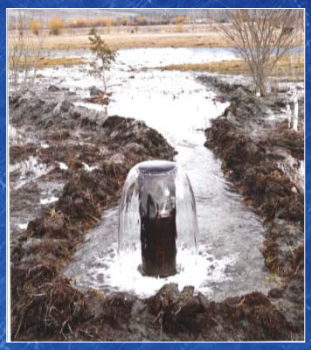
Flowing Artesian Wells – *What You Can Do*

- It is the well owner's (or land owner's) legal responsibility to stop and control the flow.
- New wells – talk to the driller and make sure stopping and controlling the flow is part of the contract before beginning drilling, if in an area of known flowing artesian conditions.
- Existing wells – hire a qualified well driller or qualified professional to stop and control the flow.



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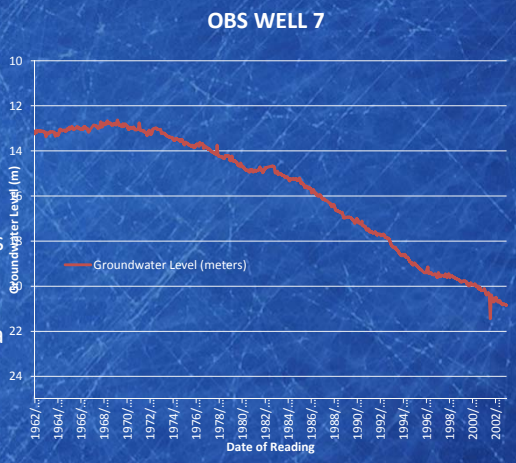
Aquifer Depletion

- Drop in local or region water levels due to overuse or drought or flowing artesian wells.
- Lowering of static water levels over time.
- Drop in well yield is not always due to aquifer depletion.
- Seasonal water shortages can occur in areas where there is a long period with no rain or recharge, such as on the Gulf Islands or in the Okanagan region.



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Aquifer Depletion – *What You Can Do*

- Everyone contributes to aquifer depletion so conserve water!
- Close or control flowing wells.
- May need to drill a replacement well into another deeper aquifer, if another aquifer is present and if preventative measures were not successful.
- Expand provincial observation well network.

Provincial observation well 272 in Abbotsford

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Interference Between Adjacent Well Owners

- Occurs when large volumes are pumped.
- Can result in water loss for neighbouring wells.
- At present, no regulations - litigation is an option.
- Can be accentuated by dry conditions and where micro-fractures go dry or dewater.

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Water Quality

- Changes in water quality can occur through:
  - Biofouling.
  - Mineral incrustation.
  - Sediment plugging.
  - Well casing failure.
- Changes in water quality can also be influenced by land use practices, e.g., manure spreading, improperly maintained septic tanks, pesticide applications, etc.

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Water Quality – Check List

Observation	Possible indicator of
Gastroenteritis – acute diarrhoea and vomiting	Presence of bacteria (e.g., *E. coli*) in the well
Rotten egg smell to the water	Hydrogen sulphide produced by natural bacteria
Gasoline smell, gas bubbles in water	Presence of hydrocarbons (natural or contaminant source)
Scaling on fixtures and around faucets	Hardness (high calcium & magnesium)
Salty taste	High TDS or salt water intrusion
Red/brown staining of fixtures and toilets	Elevated iron and/or manganese

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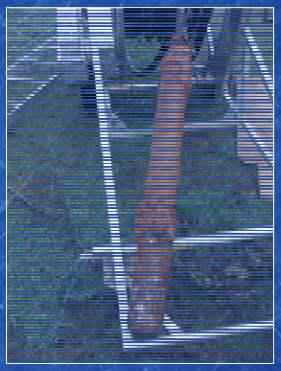
Biofouling – *What Is It ?*

- Nuisance bacteria that accumulate in a well:
  - Iron-related bacteria (IRB).
  - Sulphate-reducing bacteria (SRB).
  - Other slime forming bacteria.
- Pumping a well increases nutrients and oxygen leading to an increase in production of slime in groundwater susceptible to bacteria conditions.



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Biofouling - *Symptoms*

- Slime build-up on plumbing fixtures.
- Changes in water quality such as:
  - Water discolouration.
  - Staining of plumbing fixtures and laundry.
  - Bad taste and odour (rotten egg smell).
- Gradual decrease in yield.
- Increased corrosion of metal parts in your well and distribution system.

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Biofouling – *What You Can Do*

- Regularly test your well for bacteria.
- If bacteria found, disinfect your well.
- Contact a Qualified Well Driller or Qualified Well Pump Installer to clean the well before disinfecting, if needed.

Well screen before

Well screen after

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Mineral Incrustation/Scale – *What Is It ?*

- Dissolved minerals (calcium, magnesium, iron) precipitate and plug the well intake.
- Common occurrence in hard water supplies.

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Mineral Incrustation/Scale – Symptoms.

- Build up of mineral incrustation/scale in your well and on plumbing fixtures.
- Gradual decrease in yield.

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Mineral Incrustation/Scale – *What You Can Do*

- Perform chemical analysis to determine risk.
- Reduce pumping rate.
- May need to have well cleaned by a Qualified Well Driller or Qualified Well Pump Installer.

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Sediment Plugging – *What Is It ?*

- Sediment plugs well screen and surrounding aquifer.
- Accelerated by:
  - Poor well design and construction.
  - Inadequate development.
  - Over-pumping.

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Sediment Plugging - *Symptoms*

- Increased sediment in water.
- Decrease in yield:
  - Well won't provide the amount of water you're used to.
  - Static water level remains unchanged but pumping water level declines.

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Sediment Plugging – *What You Can Do*

Existing wells:

- Reduce pumping rate.
- Provide storage.
- Have a professional look at your well.

New wells:

- Talk to a Qualified Well Driller or Qualified Well Pump Installer about proper design and development of your well.
- Have your well system designed to meet your needs based on the capability of the well.

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Water Quality Enemies

WELL OWNERS WORKSHOP

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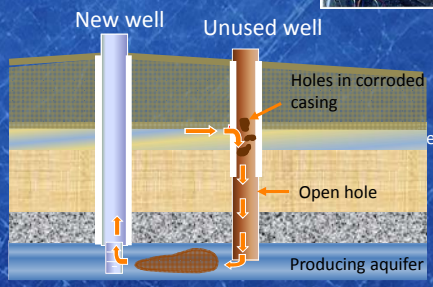
Old, Abandoned Wells



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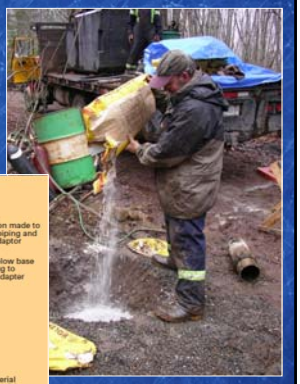
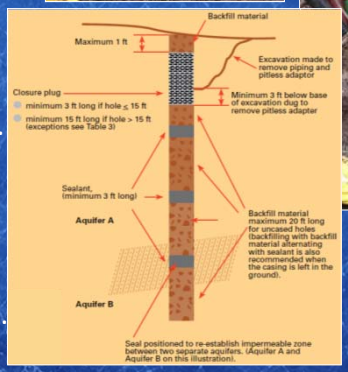
Abandoned Wells – *What You Can Do*

- Hire a Qualified Well Driller or Qualified Well Pump Installer to properly close all unused wells.
- If an unused well is planned for future use, make sure it has a proper cap or cover.
- Well is permanently closed by back-filling well bore with combination of fill and sealant materials.





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Wells in Pits

Problems with wells in pits:

- Confined space can accumulate dangerous gases and present a hazard to workers or home owners.
- Pit wells are often flooded –surface water can transport nasty things into the well.
- Rodents, frogs and bugs can fall into the pit and into the well.

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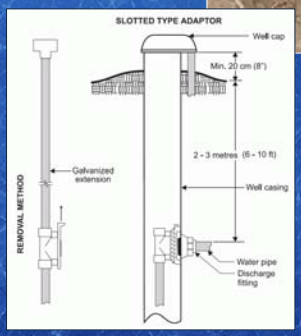
Wells in Pits – *What You Can Do*

Hire a qualified well driller with confined space entry certification to remove well pit cribbing and extend the casing above ground level.



Pitless Adapter Setup

Hire a qualified well pump installer with confined space entry certification to install a pitless adapter below the frost line to protect water lines from freezing.

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Missing or Inadequate Surface Seal

- Seal prevents contaminants from entering the well along the outside of the casing.
- All new domestic wells require a surface seal .
- Owner of a new well with a surface seal must ensure integrity of the seal is maintained.

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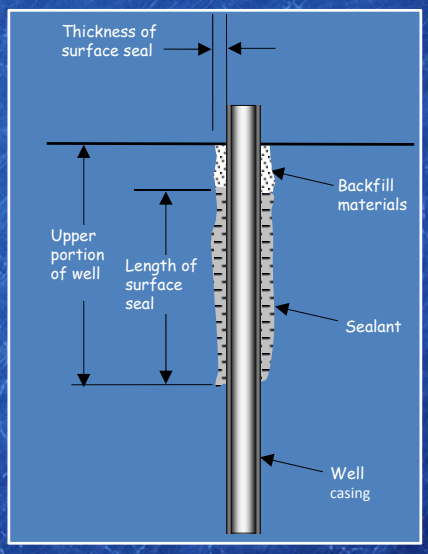
Surface Seals – *What You Can Do*

Contact your qualified well driller or qualified well pump installer about options for establishing or re-establishing the surface seal.



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Inadequate Well Cap

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Inadequate Well Cap – *What You Can Do*

Install a secure well cap

Cap with space for wiring
(pitless adapter style set-up)

Sanitary seal

Locking cap

Concrete lid on dug well

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Poor Siting and Wellhead Protection Problems

- Top of casing at or below ground surface.
- Ponding around wellhead.
- Well located on lower elevation than potential contamination sources.
- Well not accessible for inspection, maintenance, testing or repair.

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Poor Siting and Wellhead Protection - *What You Can Do*

- Ensure wells are not located in low lying areas when siting new wells. If possible relocate existing wells.
- Make sure the land surface surrounding the well is mounded and sloped away from the well casing.
- Keep or extend top of casing at least 1 foot above ground level.
- Maintain proper setbacks from potential sources of contamination.

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Health Hazard Regulation Setbacks* from Potential Sources of Contamination

20 ft (6m) → Nearest building or private dwelling

100 ft (30 m) → Any probable source of contamination

400 ft (120 m) → Cemetery or dumping ground

**Note: these are minimum setbacks, the distance can be greater.*

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Septic Systems - Improper Maintenance or Location

Improper maintenance or location can result in:

- Premature malfunction of the system.
- Create a health hazard.
- Contaminate your groundwater and/or surface water.

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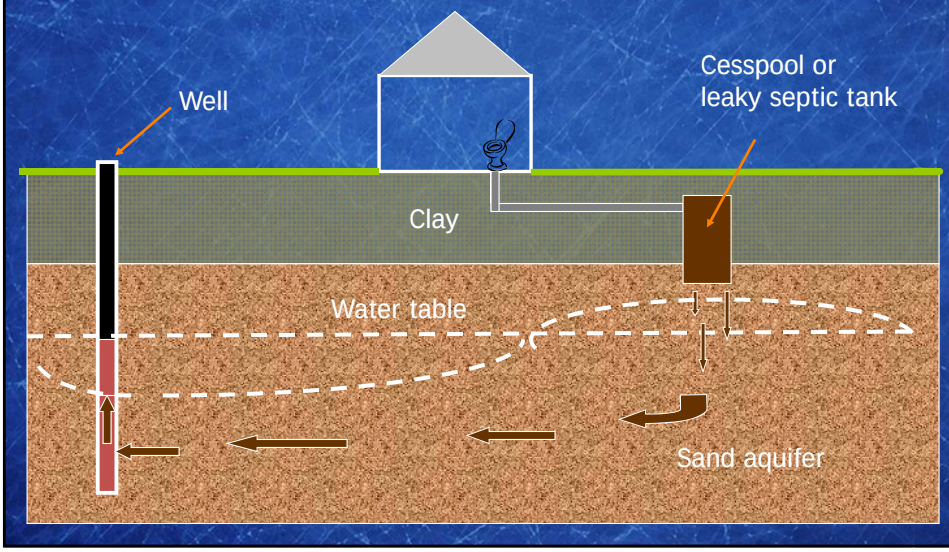
Poor Septic Systems



Poor Septic Systems – *What You Can Do*

- Your well should be located at least :
  - 50 feet (15 m) away from your septic tank.
  - 100 feet (30 m) away from the drain field.
- Properly site and construct your sewage system.
- Note down the location of your well in relation to your septic system.
- Hire an Authorized Person to maintain the sewage system.

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Hazardous Material Storage

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Storage – *What You Can Do*

- DO NOT use the pump house for storage of hazardous materials (fuels, solvents, pesticides).
- Keep well head free of debris and clutter.
- Control/eliminate vermin (rodents, insects) in and around well head and in pump house.

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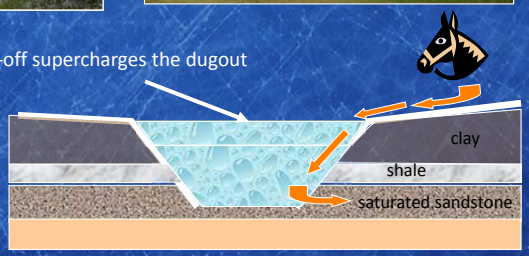
Poor Manure Management and Groundwater Fed Dugouts



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Manure Management - What You Can Do

- Adopt best management practices > review Environmental Farm Plan Reference Guide
- Provide off-site watering.
- Protect groundwater fed dugouts.
- In BC there is a regulation for proper manure management – manure piles should be at least 50 feet (15 m) from a watercourse and 100 feet (30 m) from a drinking water well.

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Sustainable water management – What you can do

Residents

- Conserve water.
- Use storage to offset seasonal shortages:
  - Dugouts.
  - Cisterns.
  - Rainwater collection.

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Sustainable water management – What you can do

Farming/agriculture

- Low water use practices:
  - Mulches, ground covers, low water use irrigation.
  - Choose crop types based on irrigation needs.
- Best practices for fertilizer and manure application to minimize water quality impacts.
- Environmental Farm Plan: Offers guidance on best practices, audits, retrofits, funding opportunities:

(http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Refguide/Refguide_toc.htm).

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Estimated cost of well upgrades

FIX	APPROX. COST
Well cap	$40 to $60 (approx. $100 or more for dug well)
Re-grade area around well head	$0 - $100
Increase height of stickup*	$100 - $300
Retrofit surface seal*	$500 to $1500
Close well*	$800 to $2000
New well*	$7,000 to $20,000

*Registered qualified well driller or qualified well pump installer required to do this work, except for closing a well that is ≤ 15 feet (4.57 m), a dug well ≤50 feet (15 m) or a test pit.

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Water Quality and Disinfection

Water Quality

- Most well owners drink untreated groundwater.
- Wells can contain naturally occurring harmful minerals, or become contaminated with harmful *chemicals or pathogens.*
- Some water quality parameters can't been seen or smelled such as toxic metals (e.g. arsenic, lead, chromium) – need to test for these.

Potential Contaminants

Fecal matter

- **Bacteria**
  - e.g. *E. coli, total coliforms*
- **Viruses**
  - *e.g. Norovirus*
- **Parasites**
  - *e.g. Giardia (beaver fever), Cryptosporidum*

Human activities

- **Chemicals**
  - e.g. Nitrates, pesticides, hydrocarbons

Minerals

- **Naturally Occurring Minerals**
  - e.g. Iron and/or manganese, hardness (calcium & magnesium), boron, fluoride, sodium, sulphate, chloride, arsenic, or other metals

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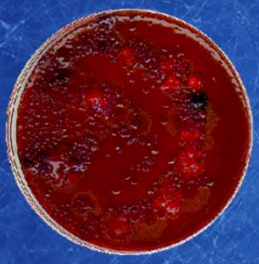
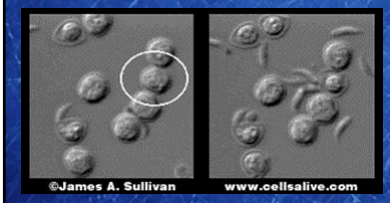
What these organisms look look like

Bacteria (*E.Coli*)

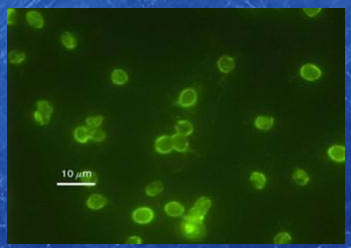


Giardia (Beaver Fever)

Cryptosporidium



Viruses



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Health Concerns

	Bacteria	Nitrates	Arsenic
Detectable?	Only via lab test	Only via chemical test	Only via chemical test
Source	Fecal coliform, E. Coli in human and animal waste and soil.	Leaching – chemical fertilizers, manure, septic/sewer discharges.	Typically in deeper, confined wells.
Risks	May indicate presence of other bacteria, viruses or disease causing organisms.	Can harm infants, especially < 6 months old.	Exposure to high levels can cause short term symptoms and long-term health effects.
Other considerations	Poor well maintenance and construction can increase risk.		If present, may want to consider using bottled water, safe alternate source or treating current source.

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Testing: When to Test?

Bacteria

- 1 to 3 times per year
- After any major plumbing work

~$45

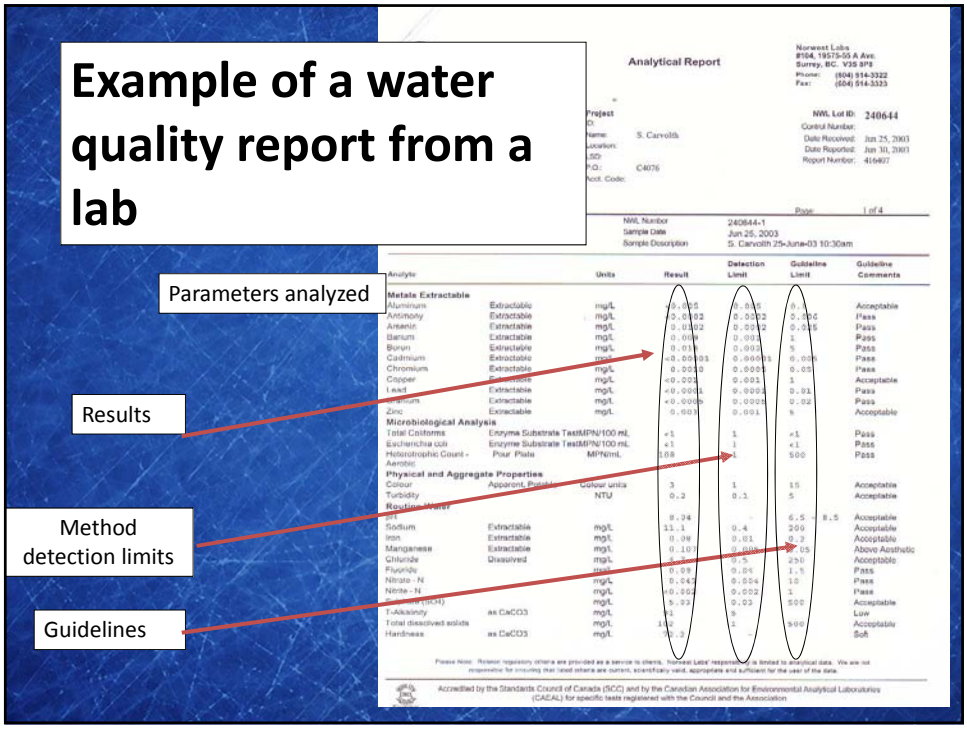
Chemicals and other Parameters*

Generally, twice in first year, and every 3-5 years after

**Note: If there is a treatment system in place the well should be monitored every 2 years for chemicals of concern.*

~$155

Example of a water quality report from a lab



Testing: When to test?

Is there a better time to test?

- •Bacteria - After a large rainfall (fall season, the day after a heavy rain).
- •Chemicals – In dry period.

Other considerations?

- When a new child is brought into the home.
- When elderly individuals stay in the home.
- If you detect changes in water quality (clarity, colour, odour, taste).
- If regular well users get sick.
- When you move into a new home.

When to Disinfect?

- Immediately after installing a new well.
- After repair or replacement.
- Notice change in water clarity, colour, odour, or taste.
- Results show coliform bacteria or *E. Coli* in water.
- Slime in toilet tank.

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Before disinfecting, inspect your well.

- Sources of potential contamination near well?
- Wellhead protected?
- Secure vermin proof cap?
- Well casing at least 1 ft. above ground?
- Gap between well casing and ground around well?
- Cracks in the surface seal?
- Well finished below grade?

➢ **Fix the problem(s) before disinfecting**

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Type of Treatment Systems

Reverse Osmosis

Chlorination

Ultraviolet Disinfection

Take Home Messages

- ✓ Groundwater is shared
- ✓ Regularly inspect your well
- ✓ Regularly test your water
- ✓ Keep good records
- ✓ ALWAYS properly close unused wells

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Workshop Evaluation Form

- Tell us how we've done
- Please fill out the Workshop Evaluation Form

Questions ?

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Acknowledgements

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada
Canada
BRITISH COLUMBIA
The British Columbia Ground Water Association
WORKING WELL Clean water. Well protected.
WEST COAST REGION
C·V·R·D
VANCOUVER ISLAND health authority

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Panel Discussion
WOW
Well Owners Workshop
Well Owners Workshop
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