



wellSMART



DRINKING WATER & WATERSHED PROTECTION PROGRAM



What is Well Smart?

Well Smart is an education program to help private well owners protect the quality and supply of their drinking water



RDN Drinking Water and Watershed Protection Program

Why be Well Smart?

You are your own water manager




RDN Drinking Water and Watershed Protection Program

Why be Well Smart?

Proper well operation and maintenance can:

- Protect water quality
 - For you & your family
 - For the community
 - For the ecosystem
- Ensure your well yield is sustained
- Save money on costly repairs



Photo credit: BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO)

RDN Drinking Water and Watershed Protection Program

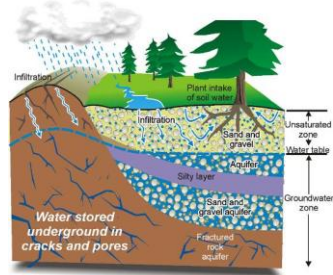

Today we'll be covering

- Understanding groundwater
- Understanding your well
- Well protection
- Drought management
- Water testing
- Water treatment

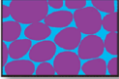


RDN Drinking Water and Watershed Protection Program

Understanding Groundwater

Water in rock fractures

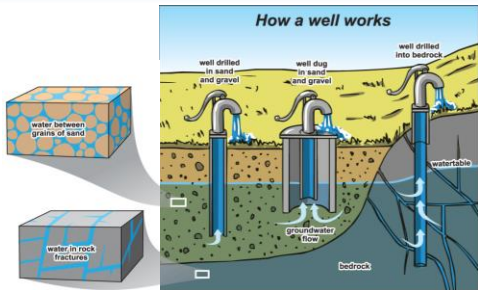


Water between grains of sand

Photo credit: Natural Resources Canada

RDN Drinking Water and Watershed Protection Program

How a Well Works



RDN Drinking Water and Watershed Protection Program

7

What kind of well do I have?

There are 3 common well installations in the RDN



Dug Wells



Drilled Wells



Drilled Wells in Pits

Photo credit: BC FLNRO, Island Health

RDN Drinking Water and Watershed Protection Program

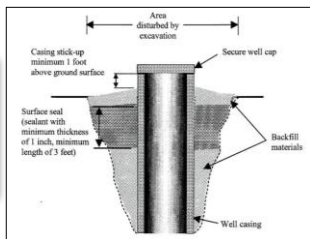
8

Well Types: Dug

Large diameter/
shallow



Photo credit: BC FLNRO, Ontario Ministry of Agriculture, Food and Rural Affairs/ Agriculture (OMAFRA)



RDN Drinking Water and Watershed Protection Program

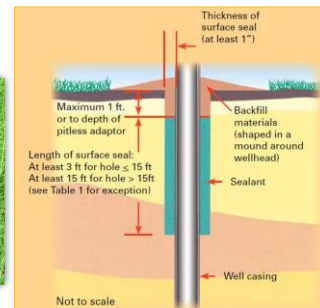
9

Well Types: Drilled

Small diameter/
deep



Photo credit: Island Health, OMAFRA



RDN Drinking Water and Watershed Protection Program

10

Well Types: Drilled Wells in Pits

Well pit (large cribbing) around top 1.8 – 2.4 m (6 – 8') of well

Historically done to protect water line connections from freezing



Photo credit: Ministry of Environment (MoE)

RDN Drinking Water and Watershed Protection Program

11

Well Types: Drilled Wells in Pits

Surface water commonly floods well pits, potentially carrying debris, bacteria, pesticides, fertilizers, etc.

Anyone entering pit without proper safety gear risks asphyxiation (low oxygen, high levels of carbon dioxide)



See MoE brochure "Upgrading Wells in Pits"

RDN Drinking Water and Watershed Protection Program

12

Well Types

Shallow dug wells may be higher risk than drilled wells



The safest water source:
Generally, a **drilled well** into a confined aquifer at a minimum depth of **15 metres (49 feet)**

Photo credit: BC Ground Water Association
RDN Drinking Water and Watershed Protection Program

13

Components of a Water Well

1. Borehole
 - Conduit to aquifer
2. Casing/Cribbing
 - Keep borehole open
 - Houses pumping equipment
3. Surface Seal
 - Prevents contamination from surface
 - Prevents mixing of aquifers
4. Well Intake
 - Allows groundwater into the well
 - Slotted liner/casing or screen

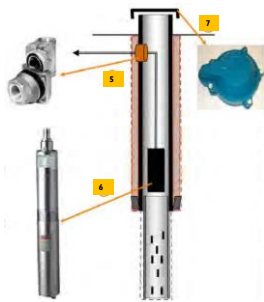


RDN Drinking Water and Watershed Protection Program

Photo credit: Alberta Working Well Program 14

Components of a Water Well

5. Pitless Adaptor or Sanitary Seal
 - Water-tight connection to distribution system
6. Pump
 - Properly matched to recommended pumping rate
7. Well Cap
 - Protects well from direct contamination



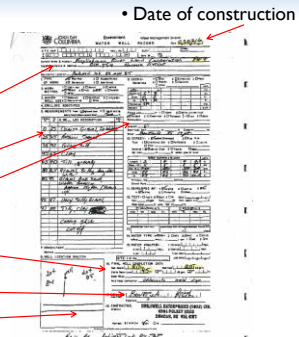
RDN Drinking Water and Watershed Protection Program

Photo credit: Alberta Working Well Program 15

Well Records

Understanding your well record:

- Address and Owners
- Geology
- Construction
- Depth, Water Level, Yield
- Driller
- Location



RDN Drinking Water and Watershed Protection Program

16

Groundwater Laws in BC

Water Act (Water Sustainability Act), Groundwater Protection Regulation

- Protects groundwater supplies by requiring all wells to be properly constructed, maintained, and closed at end of service (BC FLNRO)

Environmental Management Act

- Prohibits disposal of waste without a permit (MoE)

Drinking Water Protection Act

- Protects water supplies by prohibiting contamination of a water source (Island Health / Ministry of Health)

RDN Drinking Water and Watershed Protection Program

17

Well Protection

Factors influencing water quality & quantity:

1. Aquifer properties
2. Location
3. Construction & set-up
4. Maintenance
5. Operation
6. Proper closure



RDN Drinking Water and Watershed Protection Program

18

1. Aquifer Properties

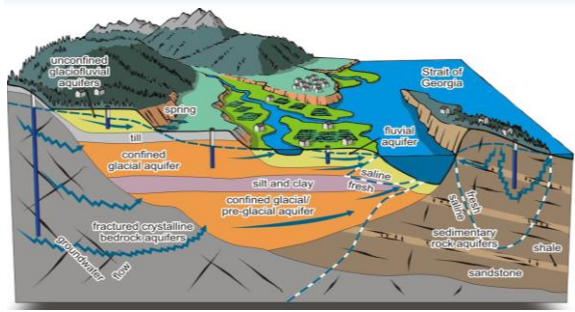
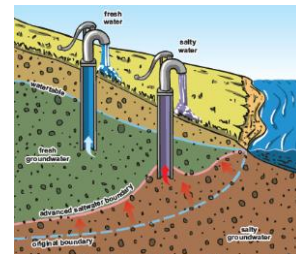


Photo credit: Natural Resources Canada

RDN Drinking Water and Watershed Protection Program

1. Seawater Intrusion

- Seawater intrusion is the process of saltwater from the ocean contaminating fresh groundwater
- Caused by:
 1. Drilling into saline groundwater
 2. Pumping
- Impact on freshwater may be long-term or permanent



RDN Drinking Water and Watershed Protection Program

2. Well Location

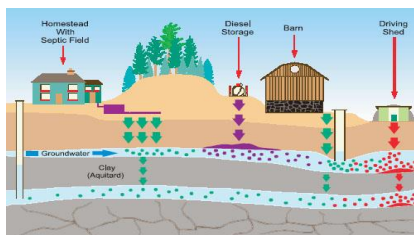


Photo credit: Ontario Ministry of Health

- High elevation
- Secure, dry area
- Avoid wells in pits
- 30m / 100' away from potential contaminant sources
- Not in basement

RDN Drinking Water and Watershed Protection Program

2. Well Location

30 metres or 100 feet from potential contaminant sources including:

Pesticides	Septic Fields
Vehicles	Storage Tanks
Fertilizer	Contaminated Runoff
Fuel	Waste
Animals	Etc.

RDN Drinking Water and Watershed Protection Program

3. Construction & Set-up

Standards for well construction protect the health of your family and the aquifer.

- All drilled wells, and dug wells more than 15m deep, must be constructed by a provincially registered well driller
- All pumps must be installed by a provincially registered pump installer

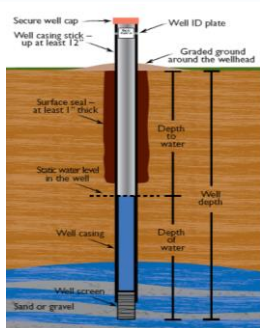


Photo credit: BC FLNRO

RDN Drinking Water and Watershed Protection Program

3. Construction & Set-up: ID Plates

All new wells must have identification plates



Available from the well driller

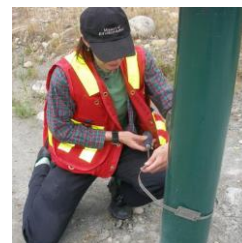


Photo credit: BC FLNRO

RDN Drinking Water and Watershed Protection Program

3. Construction & Set-up: Well Caps

Wells must have a water-tight, vermin-proof cap



Photo credit: BC FLNRO

* Not insect proof

3. Construction & Set-up: Well Caps

Different types of well caps...



* Well seal cap, 4 metal pieces held together by bolts -> do not take off yourself, can fall down well

↑ Dug well
← Drilled wells

3. Construction & Set-up: Surface Seal

A surface seal prevents contaminants from entering a well along the outside of the casing

An improper surface seal allows contaminants into the well

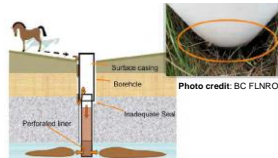


Photo credit: BC FLNRO

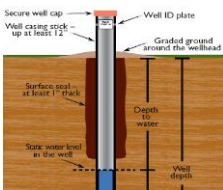


Photo credit: Alberta Working Well Program

3. Construction & Set-up: Surface Seal



Photo credit: MoE

Photo credit: P. Epp

Photo credit: Alberta Working Well Program

4. Well Protection: Good Maintenance

- Inspect the wellhead
- Properly maintain septic system
- Have water quality tested on a regular basis
- Keep wellhead and pump house in good repair and free of contaminants

Disinfect the well and water system if:

- Work is done on the well
- Water testing indicates bacterial contamination
- After a flood if surface water entered well



5. Well Operation

1. Controlling pumping in well
 - Adjust pump depth setting
 - Pumping on timer (well "sipping")
 - Pump to storage tank not directly to pressure tank
 - Install a shut-off valve
2. Increasing water storage
 - ie. pump in wet season, install rainwater collection system, buy water

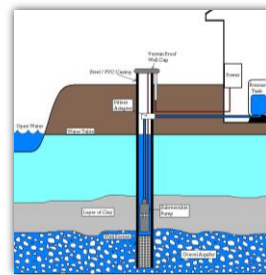


Photo credit: buildingadvisor.com

5. Well Operation

3. Monitoring
 - o Groundwater levels
 - o Meter water use
 - o Electrical conductivity
 - o Water quality testing (include chloride)
4. Early detection & elimination of leaks
 - o no "pump on demand" systems

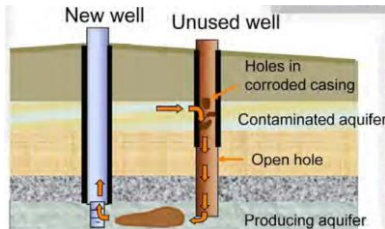


RDN Drinking Water and Watershed Protection Program

31

6. Well Protection: Properly Close

Improperly closed wells create a direct pathway for groundwater contamination



RDN Drinking Water and Watershed Protection Program

32

6. Well Protection: Properly Close



Drilled wells: Must use a provincially registered and qualified well driller to complete the work

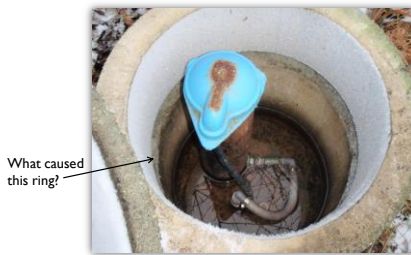
All Wells: Must follow Groundwater Protection Regulation standards and the Water Act / Water Sustainability Act

RDN Drinking Water and Watershed Protection Program

33

Wellhead Protection... Starts with Inspection

What's wrong with this photo?



RDN Drinking Water and Watershed Protection Program

34

Wellhead Protection



What's wrong with these photos?

RDN Drinking Water and Watershed Protection Program

35

Wellhead Protection



What's wrong with these photos?

RDN Drinking Water and Watershed Protection Program

36

Wellhead Protection



Photo Credit: BC FLNRO

What's wrong with these photos?

Estimated Cost of Well Upgrades

FIX	APPROX. COST
Well Cap	\$55 - \$175 (usually more for a dug well)
Well Casing Stick-Up Extension*	\$300 - \$600
Surface Seal *	\$1000 - \$2000
Well Closure *	\$800 - \$2000
New Well *	\$7,000 - \$20,000

* Work MUST be completed by a registered qualified well driller

Water Quantity

The amount of water a well can produce is influenced by:

- Geology
- Aquifer type
- Precipitation / recharge
- Depth
- Pumping rate

Groundwater & surface water are connected: Over pumping of the groundwater can impact stream base flow

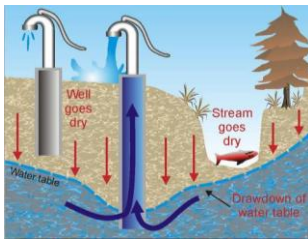


Photo credit: Natural Resources Canada

Water Quantity: Common Problems

- Low well yields
 - ie. Yellowpoint: low producing bedrock aquifers
- Interference between adjacent well users
- Seasonal water shortages
 - ie. Gabriola: water demands exceed water supply in dry months
- Aquifer overuse or depletion



Photo credit: Natural Resources Canada

Water Quantity

- If you are at risk of running out of water → put contingency plans in place before water shortages occur!
 - identify alternate water sources
- Never use your well to store hauled water → buy or rent cisterns / tanks
 - stored water may need treatment

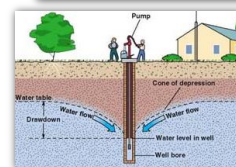
Follow water conservation practices consistent with local restrictions



Climate Change & Drought Management

What can we expect?

- Less precipitation
- Longer 'dry' seasons with drought conditions
- More intense storms
- Multi-year droughts?
- More groundwater use



Below photo credit: wellmanager.com

Climate Change & Drought Management

What can a private well owner do to better prepare and manage their water systems?

- Reduce water use
ie. conversion to low-flow fixtures
- Increase storage capacity on property
- Diversify water source
ie. add rainwater collection
- Change landscaping
ie. xeriscaping, rain gardens, etc.



RDN Drinking Water and Watershed Protection Program

Provincial Observation Well Network

- Groundwater levels are monitored through the **BC Groundwater Observation Well Network**
- Results in 2015 show many observation wells have lower than normal groundwater levels earlier in the season than in previous years
- RDN has partnered with the province to expand the groundwater monitoring network in our region



RDN Drinking Water and Watershed Protection Program

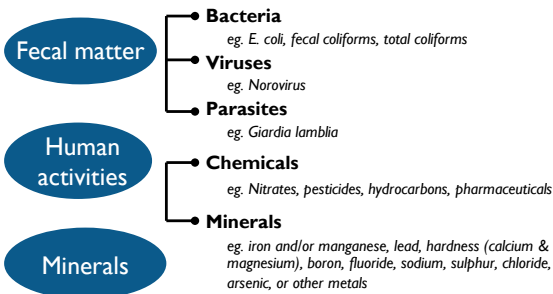
Water Quality: Common Concerns

- Bacteria
- Naturally present minerals
- Aesthetic concerns
- Human activities and contaminants



RDN Drinking Water and Watershed Protection Program

Potential Contaminants



RDN Drinking Water and Watershed Protection Program

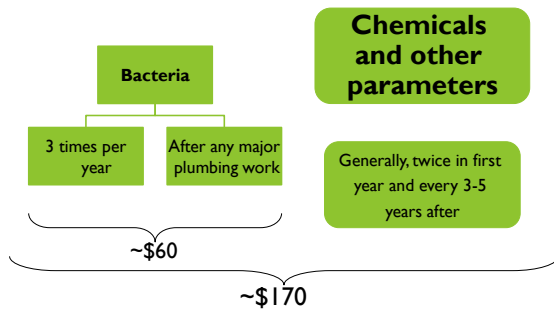
Water Quality Testing

Most well owners drink untreated groundwater
However, wells can contain naturally occurring contaminants, or become contaminated with harmful **chemicals** or **pathogens**

Water may taste and look fine, but contain harmful substances

RDN Drinking Water and Watershed Protection Program

When to Test?



RDN Drinking Water and Watershed Protection Program

How to Take a Water Sample



RDN Drinking Water and Watershed Protection Program

Test Results

HOME SAFETY SCAN (DRINKING WATER)						
Maximum ID						
Sampling Date				2015/09/02		
COC Number				08:00		
	UNITS	MAC	AO	OG	CISTERN	RDL
ANIONS						
Nitrite (N)	mg/L	1	-	-	<0.050	0.0050 8027240
Calculated Parameters						
Total Hardness (CaCO3)	mg/L	-	-	-	26.5	0.50 8024738
Nitrate (N)	mg/L	10	-	-	0.085	0.020 8024739
Misc. Inorganics						
Fluoride (F)	mg/L	1.5	-	-	0.031	0.010 8028453
Acidic						
Dissolved Sulphate (SO4)	mg/L	-	500	-	2.07	0.50 8028633
Dissolved Chloride (Cl)	mg/L	-	250	-	53	0.50 8028631
Nutrients						
Nitrate plus Nitrite (N)	mg/L	-	-	-	0.085	0.020 8027237
Physical Properties						
pH		-	6.5 (6.5)	-	7.48	N/A 8027075
Physical Properties						
Total Dissolved Solids	mg/L	-	500	-	132	10 8027626
Elements						
Total Sulphur (S)	mg/L	-	-	-	3.4	3.0 8025108
Microbiological Param.						
E. coli	MPN/100ml	<1	-	-	<1	1 8026959
Total Coliform	MPN/100ml	<1	-	-	28.8	1 8026959
RDL = Reportable Detection Limit N/A = Not Applicable						

Maximum Acceptable Concentration

Aesthetic Objective

RDN Drinking Water and Watershed Protection Program

Water Quality Tests

Test results will give you CLUES as to the sources of contamination

FOR EXAMPLE ... Total Coliform present

Can mean surface water is getting into the well → problem with the well construction

If test results do not meet Drinking Water Guidelines...



RDN Drinking Water and Watershed Protection Program

Shock Chlorination

- Simple disinfection method
- Used when bacterial contamination of the well has occurred (or is likely to have occurred, such as after pump replacement)
- How to?
 - See MoE brochure "Water Well Disinfection"



RDN Drinking Water and Watershed Protection Program

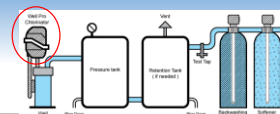
Disinfection

Disinfection for **pathogens**

- ✓ Chlorinators
 - ✓ UV
 - ✓ Distillers
 - ✓ Ozonators
- ✗ Brita filters
 - ✗ Charcoal
 - ✗ Ion exchange

RDN Drinking Water and Watershed Protection Program

Chlorinator



support.cleanwaterstore.com

RDN Drinking Water and Watershed Protection Program

Ultraviolet System

vanislewater.com uvpure.com

Note: iron, manganese, hardness, sediments, turbidity and tannins can interfere with proper UV function. Different types of UV have different tolerances for these parameters. Pretreatment may be required for proper disinfection to occur.

RDN Drinking Water and Watershed Protection Program

Distiller Unit

distilleddeionizedwater.com cleardomesolar.com

RDN Drinking Water and Watershed Protection Program

Ozonator

braintuner.com ozomax.com

RDN Drinking Water and Watershed Protection Program

Treatment

Treatments for **chemical contamination** and **physical parameters**

<ul style="list-style-type: none"> ✓ Reverse osmosis ✓ Activated carbon filters ✓ Ion exchange 		<ul style="list-style-type: none"> ✗ Chlorine shock ✗ UV ✗ Distillers
---	--	--

RDN Drinking Water and Watershed Protection Program

Reverse Osmosis Unit

rainfresh.ca

RDN Drinking Water and Watershed Protection Program

Activated Carbon filtration

rainfresh.ca

RDN Drinking Water and Watershed Protection Program



Ion Exchange

watersystems.com

RDN Drinking Water and Watershed Protection Program

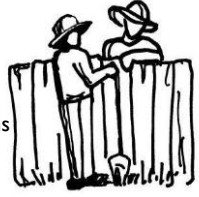
61

Suspected Problems

On your property: Contact Island Health or FLNRO

On a neighbour's property:

- Talk to your neighbour
- Provide information
- Discover barriers to solutions
- If the issue can't be resolved, contact FLNRO or Island Health



RDN Drinking Water and Watershed Protection Program

62

Resources

Island Health
(Vancouver Island Health Authority)
Information on test results and your well
Nanaimo: 250-755-6215
Parksville: 250-947-8222
www.viha.ca

Ministry of Forests, Lands and Natural Resource Operations (FLNRO)
Information on legislation, regulations, local groundwater resources and your well
Nanaimo Regional Office: 250-751-3265
www.gov.bc.ca/for

Ministry of Environment (MOE)
Information on legislation, regulations and your well
Nanaimo: 250-751-3100
www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater

RDN Drinking Water and Watershed Protection Program

63

Rural Water Quality Stewardship – Rebate Program



- ~50% of RDN residents depend on groundwater
- Improperly constructed and poorly maintained wells can act as a direct pathway for surface contaminants
- To assist residents in maintaining and improving groundwater quality, the RDN is offering rebates for well water quality tests and well protection upgrades

RDN Nanaimo: 250-390-6560
TF: 1-877-607-4111
watersmart@rdn.bc.ca
www.rdnrebates.ca



RDN Drinking Water and Watershed Protection Program www.rdnrebates.ca

64

Water Quality Testing

- RDN rebate voucher for 50% off full spectrum tests
- One water test rebate per well
- Water sampling bottle kits available here tonight
- No obligation to test right away – HOWEVER – there will be a water sample lab drop off tomorrow morning HERE between 8:30 -9:30 a.m. for your convenience
- Payment must be received at time of drop-off (cheque only) and requisition form must be filled out




RDN Drinking Water and Watershed Protection Program

65

Well Protection Upgrades

- Well upgrade cost share program offers rebates between \$50 - \$500 depending on the upgrade.
- Goal is to reduce risk to groundwater contamination by helping residents with costs of upgrading their wells.



Upgrade	Max. rebate
Secure Well Cap	\$50 (drilled), \$150 (dug)
Well Casing Stick Up*	\$200
Surface Seal*	\$300
Well Closure*	\$500

* Work MUST be completed by a registered qualified well driller

RDN Drinking Water and Watershed Protection Program www.rdnrebates.ca


66

Key Messages





Groundwater is shared by your family, your neighbours, and the environment



Keep good records of water levels, water testing, chlorination, and repairs



Regularly:


- Test your water
- Inspect your wellhead




ALWAYS properly close unused wells and upgrade components that have failed



RDN Drinking Water and Watershed Protection Program 67





Questions?

Stewarding our shared groundwater resource helps communities maintain healthy water supplies for families, fish and our future.

RDN Drinking Water and Watershed Protection Program www.RDNwellsmart.ca 68