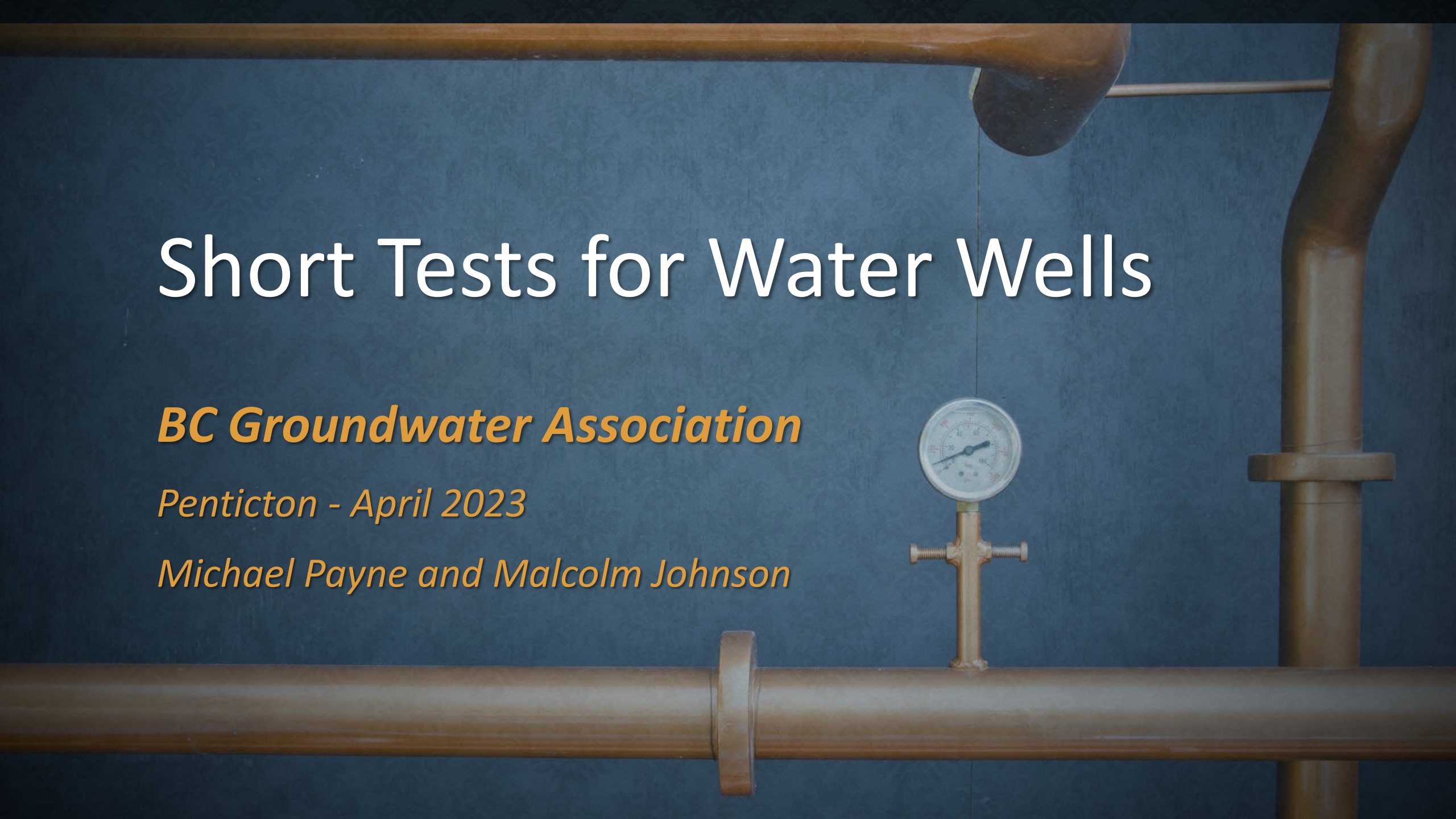


Short Tests for Water Wells

BC Groundwater Association

Penticton - April 2023

Michael Payne and Malcolm Johnson

OUTLINE

1. Testing methods & record keeping – ***Michael Payne***
2. Practical details – ***Malcolm Johnson***

Intended Audience

- Intended for pump installers and drillers.
- Geologists and engineers can stick around though ☺

Part 1 – Test Methods and Record Keeping

Michael Payne

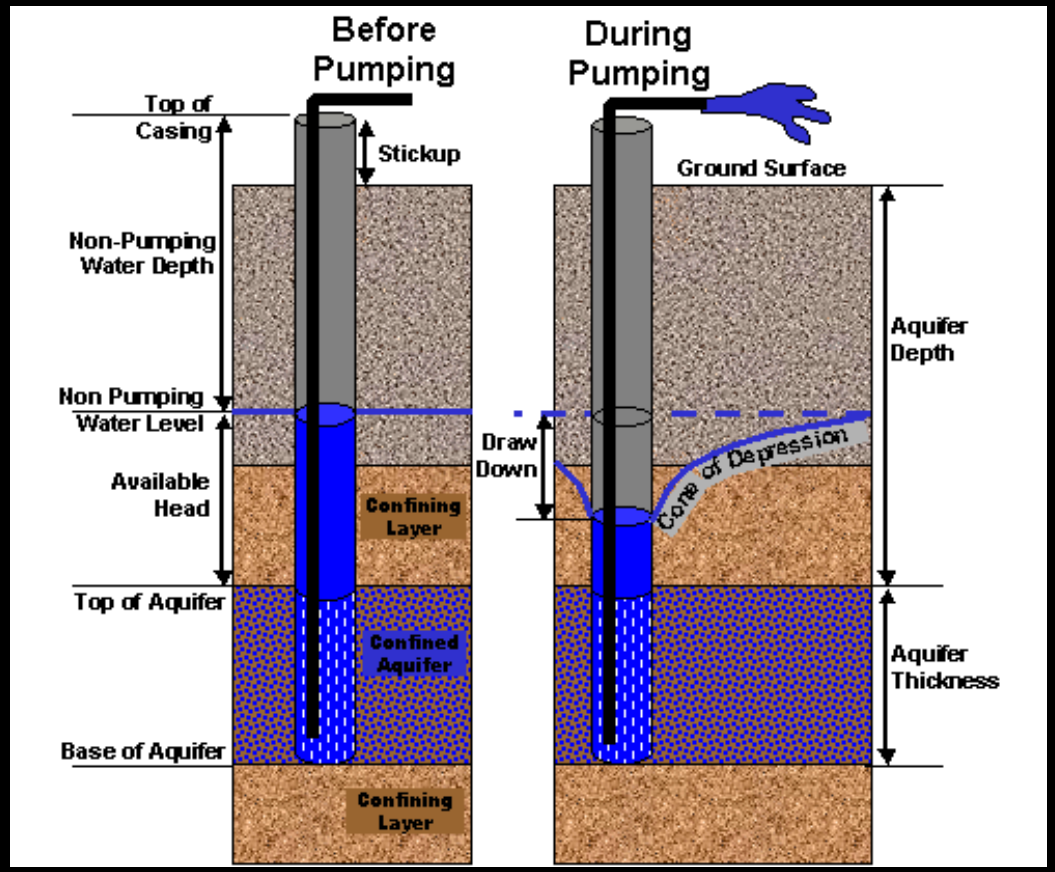
Hydrogeologist and Groundwater Engineer

Payne Engineering Geology Ltd.

What is a Well Flow Test?

SIMPLE VERSION:

- Pump at a **Constant Rate**
- **OR** a **Fixed Volume**
- Measure the drawdown
- Turn the pump off
- Measure the recovery
- Keep good notes



Why Test a Well?

THREE MAIN REASONS:

1. Required by a regulation or bylaw
2. For subdivision approval
3. For the well owner’s information

Well Tests to Meet a Law or Regulation

For a water well supplying a BUSINESS or 2 OR MORE HOUSES:

1. Water licence under the Water Sustainability Act.
2. Certificate approving a Private Water System (2 or more houses) under the Water Utility Act.
3. Operating Permit issued for a Drinking Water System under the Drinking Water Protection Act.

These regulations ALL require a LONG-TERM test (24 to 72 hours) analyzed by a professional with a full report.

Subdivision Approvals

COMMUNAL Versus INDIVIDUAL Wells:

1. For COMMUNAL wells, need LONG-TERM tests (previous slide).
2. For INDIVIDUAL wells, it depends on the location and local bylaws.

A **Short-Term Test** might be allowed.

Testing Domestic Wells for Subdivision Approval

- In RURAL areas, subdivisions are approved by the Provincial Approving Officer (PAO) from Ministry of Transportation (a.k.a. Highways).
- Most municipalities have their own Subdivision Approving Officer.
- Some municipalities and regional districts have bylaws requiring testing of wells.

Rural Areas - Provincial Approving Officers (PAO)

- Ministry of Transportation and Infrastructure

REGULATION – BC “Subdivision Regulations”:

- Says nothing about individual domestic wells

GUIDELINE – “Guide to Rural Subdivision Approvals” (136 pages):

- “If there is no subdivision bylaw … the Approving Officer may require proof of 2,500 litres per day per dwelling …”
- If there is a subdivision bylaw …, the subdivision must comply with it.”

Rural Areas - Provincial Approving Officers (PAO)

- PROCEDURE – There is no standard procedure. Each PAO is different.
- Requirements vary widely.

Municipalities / Districts - Subdivision Bylaws

- This is different for each municipality and regional district.
- MANY bylaws do NOT specify how a DOMESTIC well must be tested.
- Let’s look at examples.

[9:10]

Domestic Well Testing Bylaw - Example 1

Capital Regional District: Bylaw 3602 – Rural Resource Lands:

- An Engineer or Hydrogeologist must direct and approve the testing.
- The well flow test must be at least 12 hours duration.

Domestic Well Testing Bylaw - Example 2

Islands Trust: Bylaw 127 – Galiano Island:

- Requires a report by a professional engineer or geologist.
- The flow test must be “of sufficient duration”.
- THEREFORE – **Could maybe be just a short test**.

Domestic Well Testing Bylaw - Example 3

Cowichan Valley Regional District (if well deeper than 66 feet):

- If drill log says at least 1.0 US gpm, then NO TEST REQUIRED.
- If drill log says less than 1.0 US gpm, then need a professional report.
- At **short test** is allowed, if approved by a professional.

SUMMARY OF SUBDIVISION BYLAWS

- They are all different.
- Some do not require any flow testing.
- Some will allow a short test (less than 12 hours).

Well Testing for the HOMEOWNER

- For the homeowner's information.
- For a purchaser.
- For a mortgage?
- Maybe for subdivision (depending on bylaws).
- If regulation or bylaw applies, then can use a **Short Test**.

Low-Capacity Short-Term Flow Tests

- A simple low-cost well testing method.
- Suitable for domestic water supply wells.
- See the BC “Information on Short-term Well Tests”

- **7-PAGE HANDOUT.**

Estimating Daily Household Water Use

BC GUIDELINES FOR DOMESTIC WELLS ONLY:

- Wet or cold climate: 250 US gallons per day (gpd) – indoor use only.
- Average BC climate: 600 US gpd.
- Dry climate: 1,300 US gpd.
- Super dry: 1,800 US gpd.

Running a Short Well Test - OVERVIEW

1. If well has been in use, turn the pump off for 12 hours.
2. Then, measure the Static Water Level.
3. Calculate Daily Water Use (previous slide). Usually 600 US gallons.
4. Pump that volume of water from the well.
5. Measure the DRAWDOWN water levels and record on the form.
6. Stop the pump after pumping the volume of water.
7. Measure RECOVERY water levels and record on the form.
8. Plot the water levels on a graph sheet.

When is the Recovery Test Finished?

1. Continue measuring recovery until 90% recovery OR
2. For 120 minutes (2.0 hours).
3. Whichever comes first.
4. If water level has NOT recovered 90% in 2 hours, then take another measurement at 24 hours from the **start of the test**.

[9:20]

Running a Short Well Test – IMPORTANT DETAILS

- Use a Sounding Tube for the water level meter.
- Best to pump the water into an empty storage tank or tanks.
- Second option is to discharge through a hose, downslope, and at least 50 feet away.
- Maximum pumping time is 8.0 hours.
- You need to measure the total volume pumped from the well.
- You do **not** need to pump at a **constant rate**.

Is the Well Yield Enough?

The well must meet **both requirements**:

1. The well was able to supply the Household Use in less than 8 hours (usually 600 US gallons).
2. The water level recovered by more than 90% within 24 hours from the **start of the test**.

Keeping Good Field Notes

- Use the Standard Forms provided.
- Fill in all the information.
- Add comments if anything went wrong.
- Get help if you need it.

Cautions About this Short Test Method

THINGS TO KEEP IN MIND:

- This test is for domestic wells for a single family.
- If this is for subdivision approval, check for a subdivision bylaw.
- You can not **guarantee** a well capacity.

Standard Forms for Tests in BC

- BC has standard forms for Pumping Test Report (field data).
- Easy way to find the forms is a Google search for:
- “BC pumping test report pdf”

Modified Standard Forms for Short Tests

- I have modified these standard BC forms to use with Short Tests.
- **5-PAGE HANDOUT**
- BC Groundwater Association can also make an electronic form that you can download.

How to Record Your Information

- Use the handout forms (5 pages)

Example Test Results – PAGE 2 OF 5

DRAWDOWN TEST – Page 2 of 5

Pumping test drawdown data sheet for: *Ron Smith* (include well name)

Well ID plate number: *98765*

Type of pumping test: SHORT TERM WELL TEST (BC Environment protocol)

Date and time at start of pumping (YYYY/MM/DD; hh:mm): *2023/04/05 at 08:00* Static water level prior to pumping: *6.02* ft

Time since pumping started (min)	Measured water level (m or ft)	Drawdown (m or ft) **	Measured pumping rate	Volume of water pumped	Remarks (e.g., pumping rate adjusted, water sample collected)
			Gpm or Lpm	*gals or litres*	** Drawdown is the Measured Water Level minus Static Water Level
0	*6.02*	0.00		0	Start of pumping – Static Water Level - *at 8:00 AM*
1	*12.83*				
2	*19.08*				
3	*25.84*				
4	*29.83*				
5	*37.00*				
6	*45.82*				
7	*50.16*				
8	*56.24*				
9	*62.85*				*A FEW POINTS TO REMEMBER:*
10	*67.05*	*61.03*	*10 gpm*	*100 gals*	*Need to check the Total Volume pumped*
12	*77.93*				*Good to check the pumping rate but not necessary*
14	*87.06*				*Can check once every 10 minutes*
16	*88.25*				
18	*98.95*				
20	*119.01*			*200 gals*	
25	*145.83*				
30	*171.52*			*300 gals*	
35	*198.51*				
40	*225.72*			*400 gals*	
45	*254.40*				
50	*285.62*			*500 gals*	
60	*347.29*	*341.27*	*10 gpm*	*600 gals*	*END OF PUMPING – 600 US gallons – 09:00 AM*
70					
80					
90					

6	*45.82*				
7	*50.16*				
8	*56.24*				
9	*62.85*				*A FEW POINTS TO REMEMBER:*
10	*67.05*	*61.03*	*10 gpm*	*100 gals*	*Need to check the Total Volume pumped*
12	*77.93*				*Good to check the pumping rate but not necessary*
14	*87.06*				*Can check once every 10 minutes*
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35	*198.51*				
40	*225.72*			*400 gals*	
45	*254.40*				
50	*285.62*			*500 gals*	
60	*347.29*	*341.27*	*10 gpm*	*600 gals*	*END OF PUMPING – 600 US gallons – 09:00 AM*
70					
80					
90					

Example Test Results – PAGE 3 OF 5

DRAWDOWN TEST CONTINUED - Page 3 of 5

Pumping test drawdown data sheet for: ***Ron Smith*** (include well name)

Well ID plate number: ***98765***

Time since pumping started (min)	Measured water level (m or ft)	Drawdown (m or ft) **	Measured pumping rate	Volume of water pumped	Remarks (e.g., pumping rate adjusted, water sample collected)
140					
160					
180					
200					
250					
300					
350					
400					
450					
480					Maximum duration of pumping is 480 minutes (8 hours)

INFORMATION AT THE END OF PUMPING:

Date and time at end of pumping (

YYYY/MM/DD; hh:mm): ***09:00*** [A] Static water level prior to pumping: ***6.02 feet***

[B] Water level at end of pumping: ***347.29 feet*** [C] Total Drawdown at end of pumping = [B] minus [A] = ***341.27 feet***

NOTES:

Example Test Results – PAGE 4 OF 5

RECOVERY TEST – Page 4 of 5

Pumping test recovery data sheet for Well ID plate number: *98765*

Time since pumping started (min)	Time since pumping stopped (min)	Measured water level (m or ft)	Calculate Residual Drawdown	Calculate Recovery	Calculate % Recovery	NOTES: Residual Drawdown = Measured Water Level minus Static [A] Recovery = Total Drawdown [C] minus measured water level
60 mins	0	*347.29*	*341.27*	0.00	0%	% Recovery = Recovery divided by Total Drawdown times 100
	2	*340.92*	*334.90*	*6.37*	*2%*	
	4	*336.86*				
	6	*332.07*				
	8	*327.26*				
	10	*322.10*				
	12	*319.82*				
	14	*316.81*				
	16	*314.30*				
	18	*311.40*				
	20	*309.86*	*303.84*	*37.43*	*11%*	*Can usually calculate every 20 minutes*
	25	*304.65*				
	30	*300.80*				
	35	*292.42*				
	40	*284.77*	*278.75*	*62.52*	*18%*	
	45	*282.51*				
	50	*280.81*				
	60	*277.11*	*271.09*	*70.18*	*21%*	
	70	*275.89*				
	80	*273.17*	*267.15*	*74.12*	*22%*	
	90	*271.03*				
	100	*269.83*	*263.81*	*77.46*	*23%*	
180 mins	120	*267.97*	*261.95*	*79.32*	*23%*	
24 hours	*23 hrs*	*40.18*	*34.16*	*307.11*	*90%*	Added measurement 24 hours after the START of pumping.

RECOVERY TEST – Page 4 of 5

Pumping test recovery data sheet for Well ID plate number: ***98765***

Time since pumping started (min)	Time since pumping stopped (min)	Measured water level (m or ft)	Calculate Residual Drawdown	Calculate Recovery	Calculate % Recovery	NOTES: Residual Drawdown = Measured Water Level minus Static [A] Recovery = Total Drawdown [C] minus measured water level
60 mins	0	***347.29***	***341.27***	0.00	0%	% Recovery = Recovery divided by Total Drawdown times 100
	2	***340.92***	***334.90***	***6.37***	***2%***	
	4	***336.86***				
	6	***332.07***				
	8	***327.26***				
	10	***322.10***				
	12	***319.82***				
	14	***316.81***				
	16	***314.30***				
	18	***311.40***				
	20	***309.86***	***303.84***	***37.43***	***11%***	***Can usually calculate every 20 minutes***
	25	***304.65***				
	30	***300.80***				

	35	***292.42***				
	40	***284.77***	***278.75***	***62.52***	***18%***	
	45	***282.51***				
	50	***280.81***				
	60	***277.11***	***271.09***	***70.18***	***21%***	
	70	***275.89***				
	80	***273.17***	***267.15***	***74.12***	***22%***	
	90	***271.03***				
	100	***269.83***	***263.81***	***77.46***	***23%***	
180 mins	120	***267.97***	***261.95***	***79.32***	***23%***	
24 hours	***23 hrs***	***40.18***	***34.16***	***307.11***	***90%***	Added measurement 24 hours after the START of pumping.

CALCULATIONS - Page 5 of 5

Calculations for Well ID number: ***98765*** (identification plate)

Following the BC Ministry of Environment protocol.

Estimated daily water use for this property: ***600*** US gallons (from numbers below)

1. Wet or cold climate: Use 250 US gallons per day (gpd)
2. Average BC climate: Use 600 US gpd.
3. Dry climate: Use 1,300 US gpd.
4. Super dry climate: Use 1,800 gpd.

Volume of water pumped during the test: ***600*** US gallons

Time taken to pump out that volume: ***60*** minutes

Average pumping rate = **Volume** divided by **Time** = ***10*** US gallons per minute

Recovery time for 90% recovery: ***23 hours*** (from page 4)

Percentage recovery after 120 minutes (if measured): ***23%*** (from page 4)

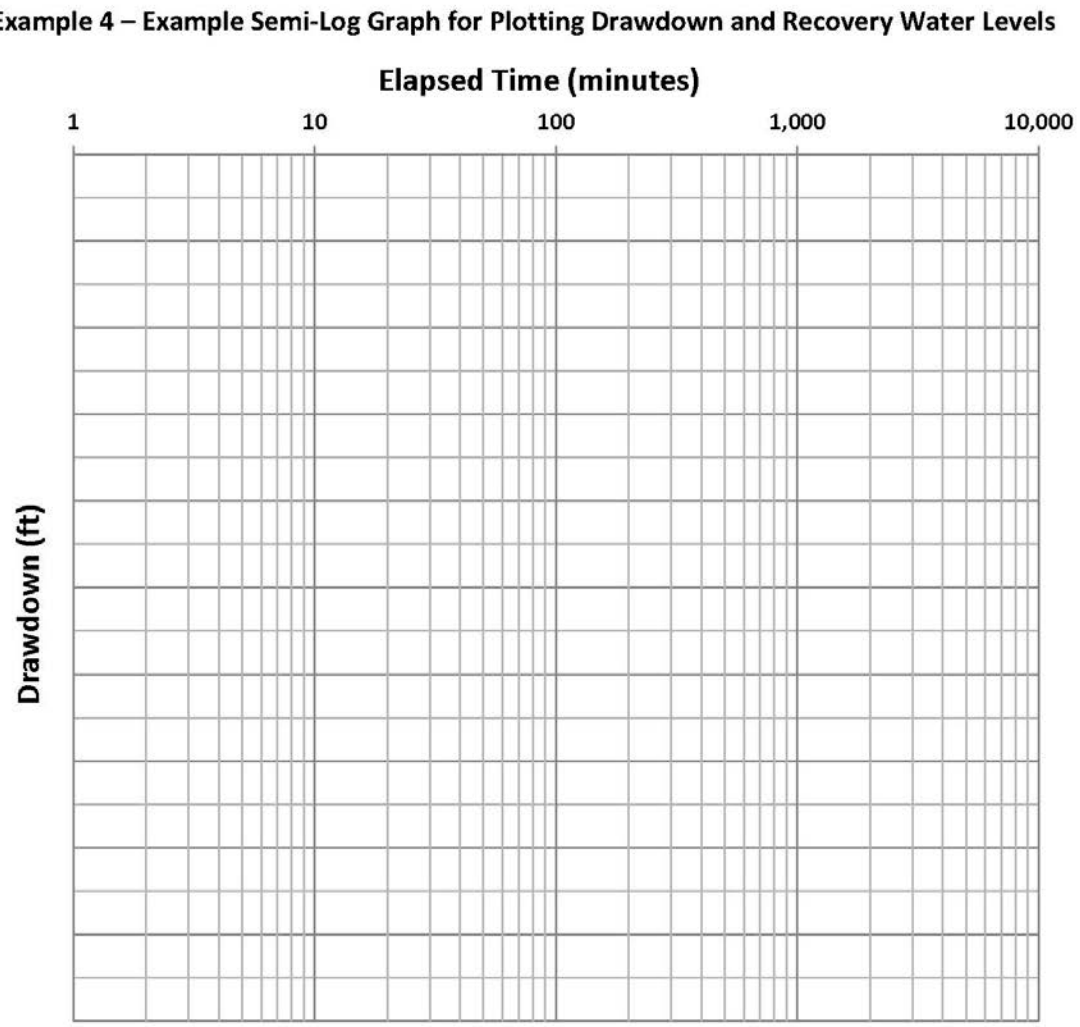
Percentage recovery after 24 hours (if measured): ***90%*** (from page 4)

EVALUATION OF THE WELL:

1. Can the Estimated Daily Water Use be pumped from the well in less than 8 hours (480 minutes)? ***YES***
2. Did the drawdown recover at least 90% within 24 hours from the start of the test? ***YES***

If both answers are YES, then the well passes the test. The well is likely capable of providing the tested volume on a daily basis.

Graph Sheet to Use



Example Test Results – GRAPH

- See the handout for an example of a completed graph

[9:30]

End of Part 1

Questions?

Part 2 – Practical Details

Malcolm Johnson

Qualified Well Pump Installer

Moore's Well and Pump Service Ltd.

Equipment Required for a Test

Planning Ahead

How to Measure the Flow Rate

How to Measure Total Volume Pumped

How to Measure the Well Water Level

[9:40]

Safe Discharge of Pumped Water

Things That Can Go Wrong (and how to fix them)

End of Part 2

Questions?