For more information refer to the Water Wells That Last video (Part II — Managing and Maintaining).

In some areas of Alberta, up to one-third of the new wells licensed are considered marginal or poor for either water quantity or quality. Monitoring and maintaining these wells is key to maximizing the water available and preserving the quality.

Monitoring and Maintenance of Your Water Well

Preserving the water source on your farm or acreage is as vital as preserving the quality of your soil.

When we think of factors that limit farm production, what come to mind are land base, finances, time and energy. What doesn't always come to mind is how necessary water supplies are. Imagine having to reduce the size of a cattle herd or not being able to water your horses because of a lack of water. Water is key to our quality of life as well. Waiting an hour to take a bath or not having enough water to serve two bathrooms would be a change for many families.

Proper care and maintenance of your water source are key to protecting your water supply. An effective monitoring program will identify changes in water levels and water quality before they become serious problems. Just like a vehicle needs an oil change, tune up and inflated tires to run properly, your well needs to be monitored, checked and cared for. Regular, systematic inspections and treatment of problems will help increase the life of your well. A licensed water well contractor may be required at times.

In this module you will learn several methods of monitoring your well. A worksheet where you can record your own information is included at the back.

The first step in preventative maintenance of your well is taking some simple measurements. Two measurements that you need to take on a routine basis are:

- Water level measurements
- Water quality measurements.

Water Level Measurements

Taking water level measurements on a regular basis will tell you whether water levels have changed significantly. In turn, this can help you spot the following problems:

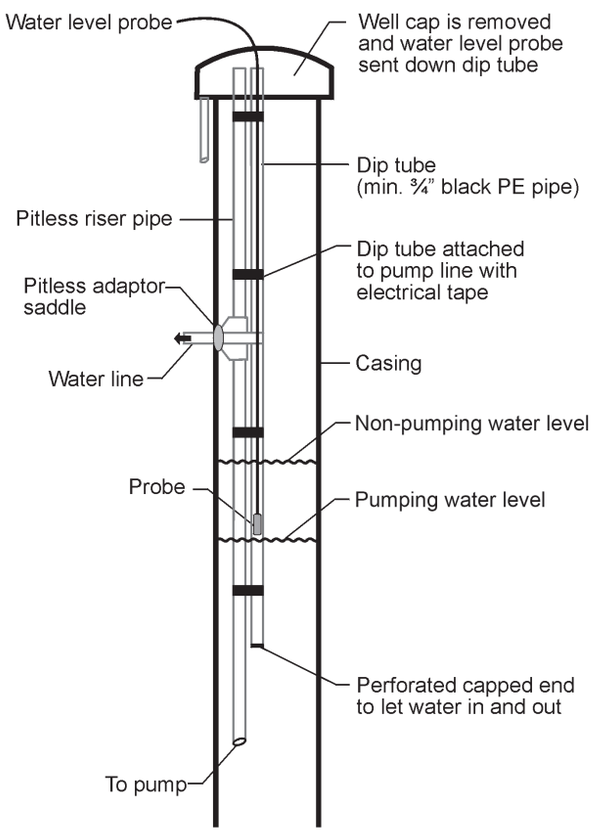
- Pumping the well at a greater rate than it is designed for (stressing the well by over-pumping)
- Pumping the well at a greater rate than the aquifer is capable of producing (depleting the aquifer)
- A plugged screen (or slotted casing) can diminish the well's efficiency and production rate
- Reducing groundwater recharge due to land clearing and surface water drainage.

It is good practice to take a water level reading monthly or quarterly as shown in the example below. Note in the example that readings were taken both with the pump on and the pump off (with time to recover). Readings taken with the pump on will alert you to any problems with the efficiency of the well (for example, a plugged screen). Readings taken with the pump off will alert you to any problems with the aquifer and the quantity of water available for pumping.

Water Level Measurments Example

Month	Water Level	Time	Pumping	Non-pumping	Comments
Jan.	3.28 m	6:00 am		✓	
Feb.	4.30 m	7:45 am	✓		
March	3.31 m	6:10 am		✓	
April	4.27 m	7:55 am	✓		
May	3.26 m	6:00 am		✓	

Figure 1 Dip Tube



How to Measure Water Levels

There are several devices and methods for measuring water levels:

- Dip tube
- Water well sounder
- Sonic Sounder.

Dip Tube

A dip tube can be constructed using a minimum 18 mm (3/4 in.) potable grade plastic pipe or hose that is lowered into the well, to below the pumping water level. It should be taped to the pump line with electrical tape and have a capped bottom with two, 6 mm (1/4 in.) holes perforated on the bottom to let water in and out, allowing it to fluctuate with the water inside of the well. The dip tube should extend down to 1.5 m (5 ft.) above the top of the pump. A measuring device, such as a weighted line or a well sounder tape, can then be lowered inside of the dip tube to measure the water level, with no threat of getting it entangled in the electrical wires or pumping equipment (see Figure 1, Dip Tube). A dip tube can be installed by a licensed water well contractor at the time of construction or, on existing wells during well maintenance.

Water well sounders and sonic sounders may be available for sale or rent from water well drilling companies and water well industry suppliers. Tape sounders should be sanitized before and after each use.

Water Well Sounder

A convenient method for measuring the water level is to use a water well sounder (also called a water tape). You can purchase one from various suppliers in the province. Although it is relatively expensive, it is a good investment. It's an accurate and convenient way to take water level measurements.

Sonic Sounder Method

The sonic well sounder is convenient because it does not need to be lowered down the well. It is simple to use for most well constructions and only requires that the well cap be removed. This instrument sends a pulse of sound down the well and records the time required for the sound to echo back from the water surface, using time to calculate the distance to the water level. It is non–invasive and easy to operate but may be more expensive and less accurate than a well sounder.

Interpreting Water Levels

Once you have an accurate method for measuring water levels, you need to be able to interpret two types of water levels — non-pumping (static) and pumping.

Non-pumping Water Levels

Deep wells of 60-90m (200-300 ft) do not experience seasonal fluctuations like shallow wells.

The non-pumping water level is recorded after the water level in the well has been allowed to fully recover and before the pump is turned on. A good time to take a non-pumping reading is first thing in the morning before there has been any water use.

After you have recorded several measurements over a period of time, you can determine if the non-pumping water level in the well has changed significantly. Some change will occur due to seasonal fluctuations. For example, in shallow wells, water levels are usually highest in June or July and gradually decline in late September or October and throughout the winter.

Let's look at some examples and how the results might be interpreted.

Example 1

The table below shows four non-pumping water level readings.

Month	Time	Water Level*	Pumping	Non-pumping
January 1, 2012	6:00 am	3.28 m		✓
April 3, 2012	5:45 am	3.27 m		✓
August 1, 2012	5:30 am	3.30 m		✓
December 1, 2012	6:10 am	3.29 m		✓

*Distance from the top of the casing to water level.

Interpretation: It would appear that there have been no significant changes in the water level over the year so no action is required. The aquifer seems able to supply water to the well at the rate you have been pumping.

Example 2

You look back over your records for the past year and note the following non-pumping water level readings.

Month	Time	Water Level	Pumping	Non-pumping
February 1, 2011	6:05 am	10.35 m		✓
April 1, 2011	5:45 am	12.48 m		✓
June 1, 2011	6:00 am	11.53 m		✓
August 1, 2011	6:05 am	16.31 m		✓
October 1, 2011	5:50 am	20.22 m		✓
December 2, 2011	6:00 am	26.57 m		✓
February 1, 2012	5:55 am	30.34 m		✓

If the non-pumping water level suddenly drops after remaining steady for many years, it may be a result of increased use from nearby wells that are completed in the same aquifer as your well.

Interpretation: In this case, you should be concerned. The water level has dropped 20 m over the past year. To address the drop in water level, reduce the amount of water you draw from the well. You can do this by reducing the pumping rate and cutting back on the amount of water use.

Take another measurement in a month to see if the water level is recovering. If you find that the water level begins to rise again, you have been over-pumping your aquifer, producing more water from the well than the aquifer can supply. To prevent your well from going dry, you will need to pump your well at a reduced rate.

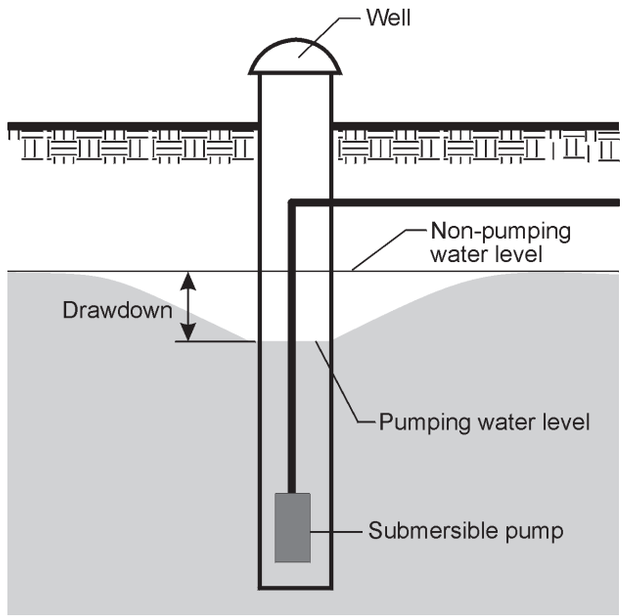
If the water level does not recover, you will need to:

- Further reduce water use
- Look for other possible water sources.

Pumping Water Level

Record the pumping water level while the pump is operating. If you take several readings over time, you will have data that can help you assess the efficiency of the well. When you take pumping water level measurements, you need to be consistent about when the measurements are taken. For example, you might take the measurement after the pump has been on for 2 hours. Being consistent allows you to compare the readings (see Figure 3, Pumping Water Level Drawdown).

Figure 3 Pumping Water Level Drawdown



A good time to take a pumping water level reading is during the day when the pump is pumping, for example, at noon. By then there has been significant water use. Taking the reading at the same time of day will give you comparable water levels, unless water use varies considerably between seasons.

Now let's look at the significance of some pumping water level measurements.

Even when the pumping water level remains relatively steady, you need to do regular annual maintenance, including shock chlorination, to control bacteria buildup. If you allow a well to deteriorate for too long, it may not be possible to restore its original capacity.

Example 3

In the table below, six readings were taken after the pump was on for 2 hours.

Month	Time	Water Level	Pumping	Non-pumping
February 2, 2012	11:30 am	6.67 m		✓
March 1, 2012	11:15 am	5.23 m		✓
May 1, 2012	11:35 am	6.34 m		✓
June 1, 2012	11:20 am	5.35 m		✓
September 2, 2012	11:25 am	6.29 m		✓
December 2, 2012	11:15 am	7.02 m		✓

Interpretation: Since the levels are relatively constant, there does not seem to be a problem with the efficiency of the well and no action is required.

If the well yield declines, yet the non-pumping water level remains constant, the well may need to be serviced by a licensed water well contractor. If your well is capable of producing more water than you require, you may not notice a decrease in well yield unless you are routinely monitoring your water levels.

Example 4

You look back over your records and find that, although the original non-pumping water level has remained constant, the pumping water level has declined.

Month	Time	Water Level	Pumping	Non-pumping
February 1, 2011	11:30 am	20.15 m		✓
April 2, 2011	11:20 am	21.56 m		✓
June 1, 2011	11:35 am	26.26 m		✓
August 3, 2011	11:45 am	28.37 m		✓
October 1, 2011	11:30 am	33.45 m		✓
December 2, 2011	11:40 am	37.20 m		✓
February 1, 2012	11:50 am	40.16 m		✓

Interpretation: The screen (or slotted casing) may be plugged with sand, bacterial growth or mineral incrustation. When this happens, the efficiency of the well is diminished and the production rate (yield) drops.

See Module 7 "Troubleshooting Water Well Problems" for more information on well problems.

To correct the problem, hire a licensed water well contractor to determine exactly what is causing the reduced efficiency of the well. The screen (or slotted casing) may need to be surged to remove sediment or in some cases may need to be replaced. You may need to shock chlorinate the well to reduce bacteria or acidize it to remove incrustation on the casing or screen.

Water Quality Measurements

Noting changes in water quality is an effective way to monitor your water well. Aquifer contamination, problems with a well's structure, or lack of routine maintenance could each lead to a change in water quality.

Use the following checklist as a starting point to determine if a problem exists.

Checklist to Determine a Water Quality Problem

- ❒ Unpleasant odour or taste
- ❒ Red discoloration on plumbing fixtures and fabric
- ❒ Cloudy, dirty water
- ❒ Soap curd on dishes and fabrics
- ❒ Scale in pipes and water heater
- ❒ Salty alkali taste

Some changes in water quality are not detected by changes in taste, smell or appearance. For this reason it is important to sample and analyze your water on a routine basis.

A bacteriological analysis can be done for minimal cost through your local health unit. This should be done annually.

Bacteriological Analysis

Bacteriological analysis determines the total coliform and faecal coliform bacteria in the water. Coliform bacteria are usually present in soil and surface water. Faecal coliform are present in animal and human waste. Both are indicator organisms for the potential presence of pathogenic (disease causing) bacteria.

A bacteriological analysis does not test for iron bacteria or sulphate-reducing bacteria which are commonly found in well water. A bacteriological analysis should be done annually.

A routine chemical analysis should be done every two to five years.

Chemical Analysis

A routine chemical analysis tests for the most common chemical parameters found in water, such as iron, sodium, sulfates, nitrates and nitrites. In some cases, you may need to request testing for additional parameters when a regional health concern is identified (such as arsenic or fluoride).

Tests for chemical contaminants such as pesticides, hydrocarbons, etc., require special arrangements.

Non-routine Testing

Non-routine testing is necessary when unusual situations occur. Unexplained illnesses, obvious contamination situations such as pesticide or hydrocarbon spills, or flooding are examples. Occurrences on neighboring properties may also provide reason for non-routine testing. Since specialized testing is expensive, get advice on which parameters are worth testing.

Sampling

How you collect a water sample is as important as the analysis. Proper sampling bottles and procedures are required and can be obtained through your local health unit or private laboratory. Samples not in the proper sampling bottle will not be accepted for testing.

Check ahead of time with your local health unit or private laboratory for proper sampling procedures and drop off times.

Important considerations are:

- Length of time well is pumped prior to sample taken
- How sample is stored
- Length of time for sample to be delivered to a laboratory.

Collect the sample as close to the well head as possible to avoid any effect the water treatment or distribution system may have on the sample. If you want to assess the effectiveness of your treatment system, you will have to take an additional sample.

Interpreting Results

Whenever an analysis is done, you will receive a written copy of the results. Keep this information in the front pocket of this manual with your other important papers. It helps to create a history of your well to use for comparison should the water quality ever change.

You can also use the analyses to help you decide whether or not any water treatment equipment is needed to improve your water quality.

The "Rural Water Quality Information Tool" provides For information on interpreting water quality analysis results. See Module 12 "Other Resources".

Local health units are responsible for identifying whether water is fit for human consumption. The Canadian Drinking Water Quality Guidelines published by Health Canada are used to establish when the parameters exceed established maximum acceptable concentrations.

Worksheet

Water Well Monitoring Log

Year_____ Well No. _____ Qtr_____ Sec_____ Twp_____ Rge_____ W of_____Meridian Lot_____ Blk_____ Plan____

Month / Day	Time	Water Level		Comments (quality, presence of sediment, yield problems)
		Pumping	Non-pumping	
January _____				
February _____				
March _____				
April _____				
May _____				
June _____				
July _____				
August _____				
September _____				
October _____				
November _____				
December _____				

* At the end of the year, review the chart for any water level trends.
* **Working copies are included in the pocket on the back cover.**