# WELL BASICS

## TYPES OF WELLS

There are three main types of water wells:

- drilled
- bored/dug
- sand point.

The following components are common to all wells:

- the **inlet,** which allows groundwater to enter the well – this may be a commercially manufactured well screen in overburden aquifers or an open hole in bedrock
- the **hole stabilizer,** which prevents the formation from collapsing into the well, may be a steel casing, a concrete tile, or an open hole in solid bedrock
- **sanitary protection,** including grout in the annular space around the casing, seals between concrete tiles or at the point of entry of water and electrical lines, sanitary well caps and well seals
- the **pumping system,** including the pump itself, along with electrical lines.

**Best management practices for well construction and maintenance are described in the section that begins on page 33.**

# WELL BASICS

## COMPARISON OF WELL TYPES

| | WELL TYPE | | | |
|---|---|---|---|---|
| | **DRILLED WELLS** | **LARGE-DIAMETER WELLS** | | **WELL POINTS (SAND POINTS)** |
| | | **Dug** | **Bored** | |
| DESCRIPTION | • drilled with rotary or cable-tool water well drill<br>• shallow or deep | • dug by backhoe or by hand<br>• shallow (usually) | • constructed with boring machine<br>• shallow or deep | • driven in or jetted with water<br>• shallow |
| | • small-diameter casing, 10 to 20 cm (4 to 8 in.) | • large-diameter casing, 60 to 120 cm (24 to 48 in.) | | • small-diameter casing, 2½ to 5 cm (1 to 2 in.) |
| ADVANTAGES | • can reach deeper aquifers<br>• can drill into bedrock | • easy to construct<br>• inexpensive initial cost | • more controlled hole than dug well | • generally simple and inexpensive to install |
| | • less subject to contamination, especially if deep<br>• easier to seal<br>• more constant temperature | • large casing provides storage<br>• may be used in poor-yielding aquifer | | |
| DISADVANTAGES | • vulnerable to deep aquifer contaminants<br>• poorer natural water quality from some deep aquifers may occur, e.g., from salt | • if shallow, water shortages are possible in dry periods<br>• easy to seal properly, but requires large volumes of material<br>• vulnerable to near-surface contamination<br>• water temperature may change seasonally | | • limited to permeable materials<br>• shallow water table<br>• limited yield and possible shortages in dry periods<br>• vulnerable to near-surface contamination |

**This drilled well casing has had a frost-free hydrant added with a backflow preventer.**

**Large-diameter wells typically use concrete casing. Older installations may have been cased with brick, stone, timber or corrugated steel.**

# WELL BASICS

## THINGS TO KNOW ABOUT REGULATIONS

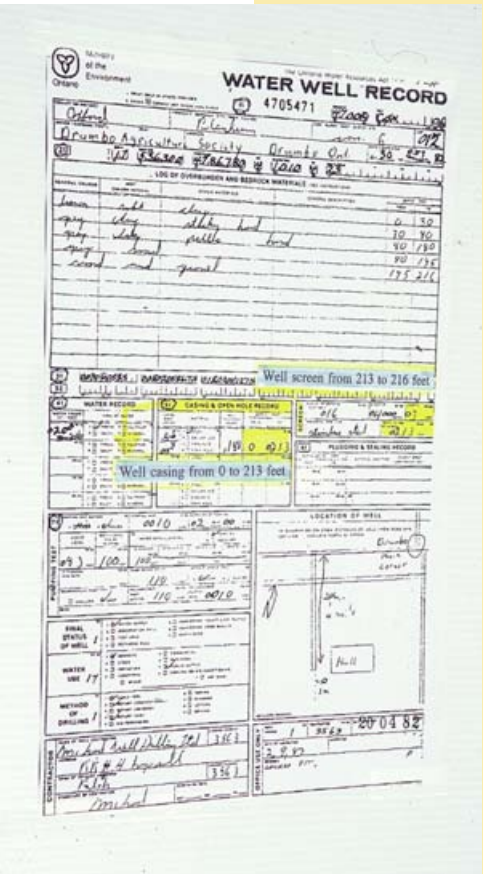
Most jurisdictions have regulations governing the construction of water wells. Such regulations set out minimum construction standards for all types. The main purpose of the standards is to keep surface water and foreign matter out of wells and aquifers. Regulations cover:

- who is qualified to construct wells and install pumps – the Ontario Ministry of the Environment issues licenses to qualified water well contractors
- where a well can be located
- how the well is to be constructed, and what materials can be used
- well owner's responsibilities
- when a well must be properly plugged and sealed.

**For information on regulations in Ontario, see the Appendices, which start on page 82.**

## WATER WELL RECORDS

On completing a new well, the water well contractor provides information in the Water Well Record. See page 13 for a description of what's included in a typical water well record.




**Upon completion of a well, Ontario regulations require all well contractors to submit a copy of the Water Well Record to the owner of the new well and to Ontario Ministry of the Environment. The record gives information on the location, owner's name, date of construction, contractor's name, geologic log, water quality record, well construction details, yield, and more.**

# WELL BASICS

## WELL OWNER RIGHTS AND RESPONSIBILITIES

All rights come with responsibilities. As the owner of a property with wells, you are required to maintain each well to keep out surface water and other foreign materials. If you are not going to maintain your well properly, it should be plugged and sealed.

Proper well construction costs money, and proper maintenance may cost money. Don't cut corners. After a few years, shortcuts can end up costing a lot in repairs, or even cause well collapse and aquifer contamination.

It is very important to look after your well. A properly maintained well ensures a reliable supply of good quality water, and protects the aquifer and other water resources from contamination.

**This is an unused well in very poor condition. Until it is properly plugged, it poses a threat to groundwater quality, and the safety of humans, livestock and wildlife.**

## PLUGGING AND SEALING UNUSED WELLS

Even a well you're not using now, but might use in the future, must be maintained like a working well. Some tips on maintaining your well are found in the section beginning on page 65.

A well that won't be used again must be plugged to:

- protect the aquifer from surface contamination
- prevent vertical movement of water between aquifers, or between an aquifer and the ground surface
- eliminate a safety hazard to humans, livestock and wildlife.

Deep or flowing wells, or wells in fractured bedrock, must be properly plugged by a licensed water well contractor.

Never add water to or dispose of wastes in unused wells.

A new well must be properly plugged and sealed if it is dry or if the water is not suitable for drinking.

The right way to plug a well depends on the well's construction. Methods of plugging unused wells are described in the Best Management Practices chapter. Consulting a licensed well contractor is usually recommended.

**Abandoned wells should never be used as disposal sites for roof water, septic wastes or any other organic debris.**

# WELL BASICS

## TYPES OF PUMPS

The common types of pumps fall into one of two categories: shallow well or deep well.

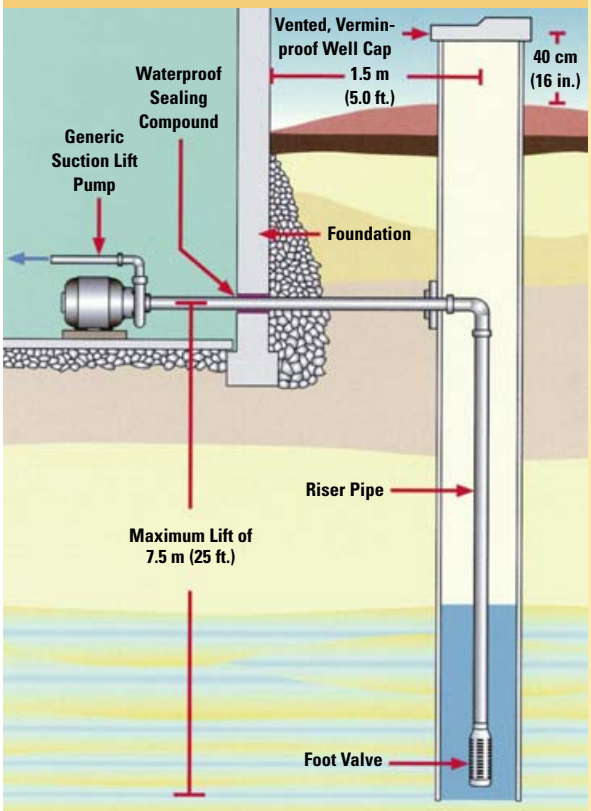
## SHALLOW-WELL PUMPS

Shallow-well pumps work by suction lift, but the lift is limited to about 7 metres (25 ft.). These pumps sit at the ground surface adjacent to the well. They work by creating a vacuum in the pipe, and atmospheric pressure forces water up the pipe. A foot valve on the bottom of the drop pipe keeps the pipe and the pump full of water or primed.

Common shallow-well pumps include:

- reciprocating (piston) pump
- centrifugal pump
- centrifugal-jet pump.

**TYPICAL SHALLOW-WELL PUMP INSTALLATION**




**Centrifugal pumps require little maintenance and can handle some soil particles in the water.**

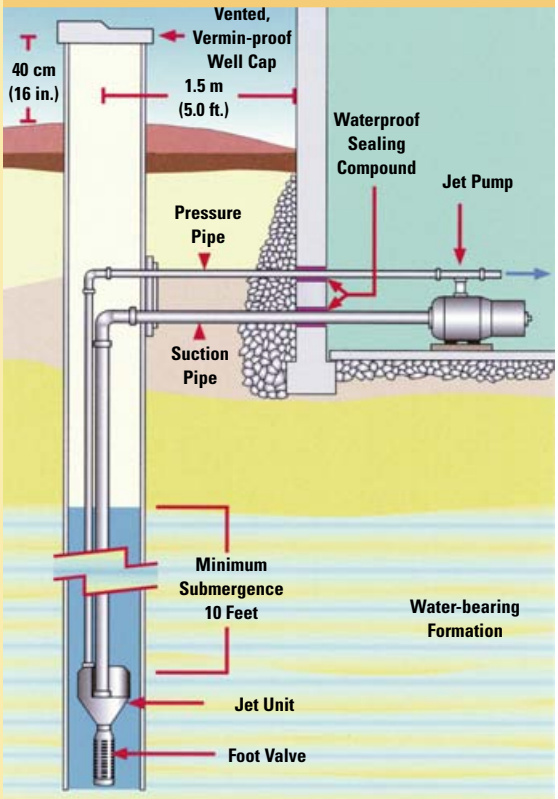
# WELL BASICS

## DEEP-WELL PUMPS

Deep-well pumps work in several ways.

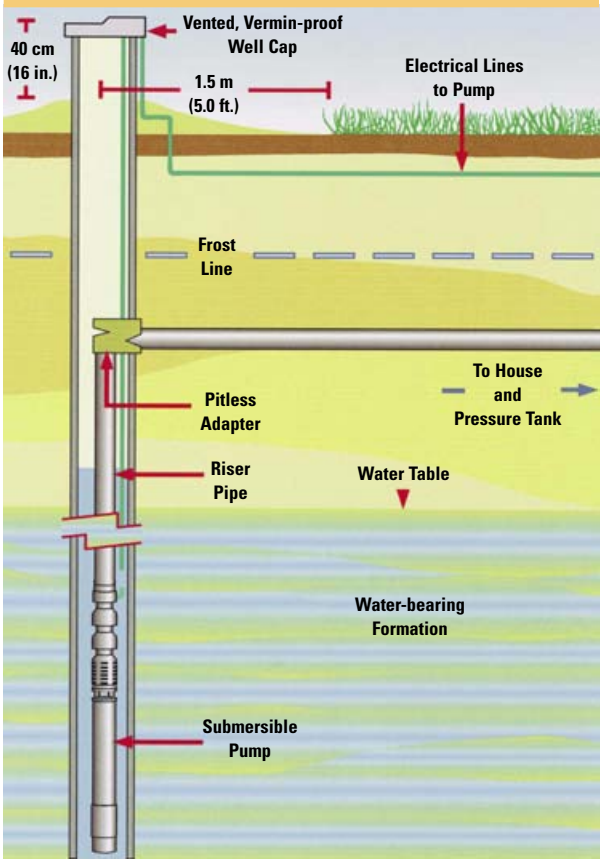
Reciprocating (piston) pumps work the same way as a hand pump. A motor sitting above the well moves a piston up and down inside a pipe in the well casing. On the upstroke, water is pulled into the pipe. A foot valve at the foot of the pipe prevents water from flowing out of the pipe on the downstroke.

### CENTRIFUGAL PUMP




**Centrifugal deep-well jet pumps work with two lines into the well. As water is moved at the surface by an impeller, some of the water is returned to the ejector assembly above the intake. This return water creates a "venturi" effect in the ejector, sucking well water through the check valve.**

### SUBMERSIBLE PUMP




**Submersible pumps are long, narrow pumps that fit into the well and sit below the water level. They are connected to the surface by a plastic or steel pipe and a waterproof electrical cable. The water flow in the well provides cooling for the motor. This type of pump lasts longer in water that is sand- and gas-free.**

# WELL BASICS

## SIZING THE PUMP

The size of the pump required depends on:

- the capacity of the well
- the demand rate for water, and
- the height of lift.

Your Water Well Record contains information pertinent to pump selection.

A well owner can check the yield of an existing well for which no well record exists. See the section on well yield on page 71.

The procedure for estimating daily and peak water demand, which will help you estimate water needs, is described on page 15.

If the pressure tank is too small, the pump has to come on frequently to maintain pressure in the water distribution system. Therefore, the size of the pressure tank is selected to provide enough storage to prevent excessive on/off cycling of the pump.

If the well yield is less than the estimated demand, additional storage capacity may have to be provided. This storage could be in reservoirs, water towers, cisterns or tanks. The pump capacity is not the same thing as the well yield.

## GENERAL CONSIDERATIONS FOR PUMP INSTALLATION

Pump installations must be done in accordance with Ontario regulations. If you are in doubt, consult a licensed pump installer or the nearest office of your local agency responsible for regulating groundwater. In general:

- all connections between the pump and the well must be watertight to avoid well contamination and preserve water pressure – standard connections are shown in the construction diagrams later in this book
- the pump intake will pull sand and silt into the pump if it is too close to the bottom of the well, thus damaging the pump
- keep the intake securely positioned off the bottom of the well – this is especially important with dug wells
- low-producing wells (those that produce barely enough to meet demand) should have a control system to shut off the pump if the water level drops too far – this protects the pump from burnout if the water level drops below the intake

# WELL BASICS

A pumphouse should be clean, insulated and weatherproof – and never used for any other purpose.

**When working on a well, ensure that the components aren't contaminated with soil or other debris. Well components should be decontaminated after any work – inspection, maintenance or repair – is done on a well.**

- all pumps, except submersible ones, need dry frost-proof housing
- if the pump motor is in a well pit or near the well, make sure that oil from the pump can't get into the well
- NEVER ENTER A WELL PIT without taking all the appropriate safety precautions
  - a well pit is a confined space – the absence of oxygen can cause accidents and death from suffocation
  - the presence of naturally occurring gases such as methane may cause an explosion, resulting in injury or death
- pumps must meet standards of the National Sanitation Foundation (NSF)/Canadian Standards Association (CSA)
- pump installations must meet plumbing and electrical codes
- pump capacity should never exceed well yield and available storage in the well
- if your submersible pump was purchased before 1981, check with the Ontario Groundwater Association – some pumps from this era contain PCBs, which should be properly removed and disposed.