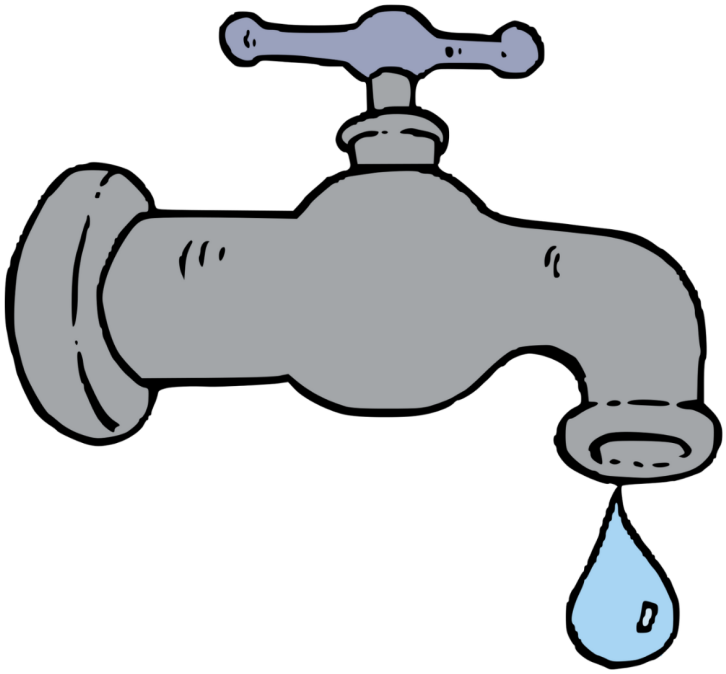
Hampstead Water Well Handbook

A Homeowner's Guide

Prepared by:

Hampstead Water Resource Committee

September 2021



HAMPSTEAD WATER WELL HANDBOOK

Introduction **3**

What is Most Important? 3

How A Typical Well Pump System Works **4**

Where Does Your Water Come From? **7**

Water Levels in Wells **9**

Troubles With Your Water Well **10**

How to Keep your Pump and Pressure Tank in Good Condition 10

Warning signs associated with water well problems 10

Well is Pumping a Mixture of Air and Water 10

Well is Pumping Sand or large amounts of sediment 11

Low Water Pressure 13

Electric Bill has increased dramatically 15

Pressure Switch and Pump Continuously Cycles On and Off 15

Water Quality has Changed 16

Water quality checklist 17

Water Quantity has Changed 18

Water Quantity checklist 18

Routine Well Maintenance **19**

Basic troubleshooting checklist **21**

Useful web references: **22**

Introduction

Are you thinking about having a new water well drilled? Do you have questions about an existing well or are you experiencing adverse changes in water quality or quantity? Perhaps you are building a new home or replacing an existing water supply. Perhaps you have previously lived in a home connected to a public water supply system and you've moved to a home that uses a private well for its water supply. Whatever the case, this handbook contains important information, including an overview of:

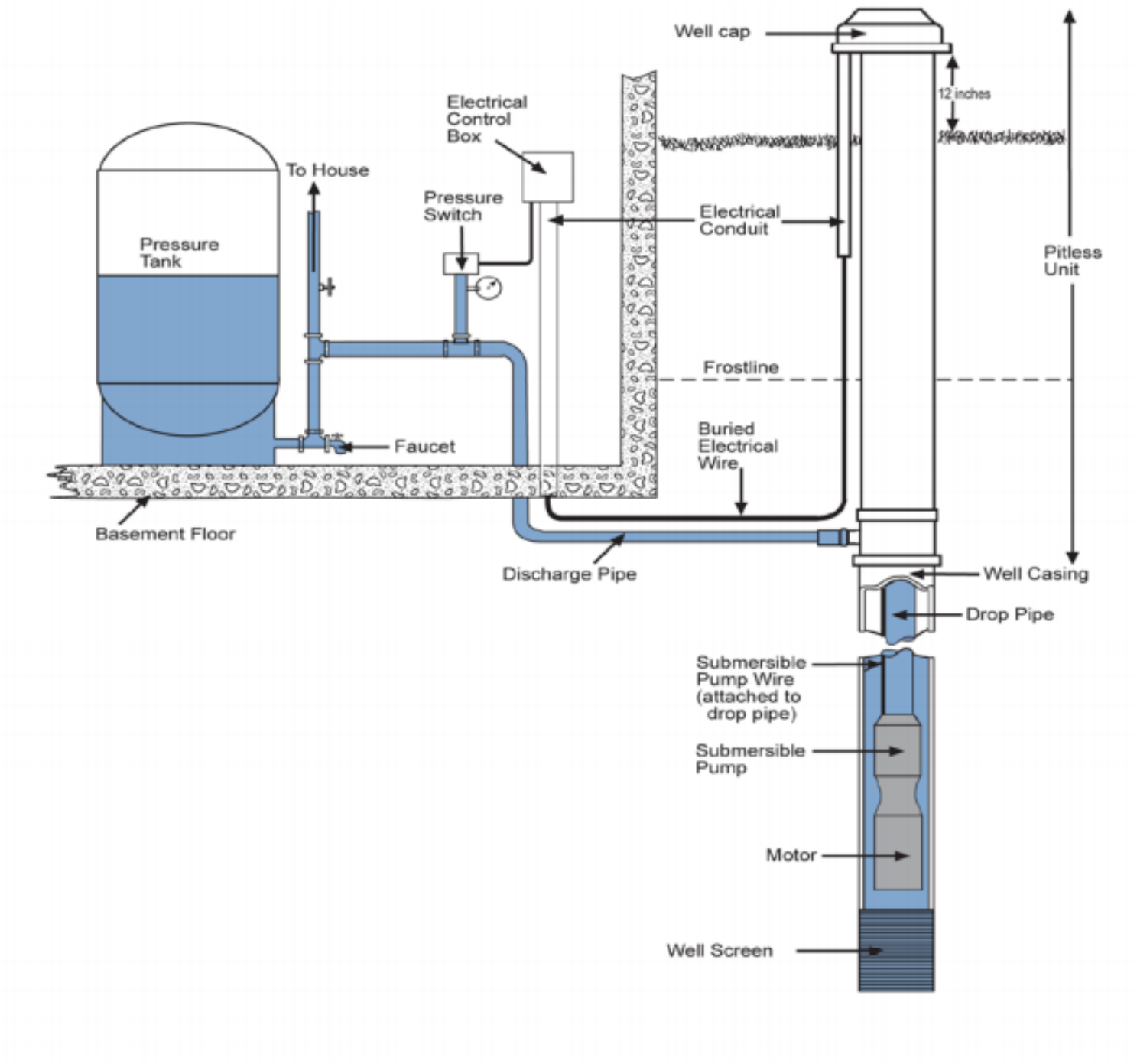
- Hampstead's groundwater resources
- Typical well construction
- Well protection and common problem troubleshooting
- Well operation and maintenance
- Well water safety and testing
- Sealing unused wells

What is Most Important?

- **Learn about your well and the components of your water system.** Wells don't last forever. If your well is old or is experiencing a decline in performance, have it inspected by a licensed well contractor (pages 10-22).
- **Collect a water sample from your well on a regular basis and have it tested** for total coliform bacteria and nitrate. If you are having a new well constructed, a water sample is required to be taken from a new well by the licensed well contractor (pages 16-17).
- **Test your well water for common naturally-occurring chemicals that may be health hazards**, such as arsenic, radon and other radionuclides (pages 16-17).
- **Maintain your well in a sanitary condition**. The well should have a waterproof cap, and the well casing should extend at least 1-foot above the surface of the ground. Keep septic systems, fertilizers, gasoline, fuel oil, and chemicals away from your well (pages 19-20).

How A Typical Well Pump System Works

Typical residential water wells have a submersible pump that pumps water directly to the house. Alternatively, some wells (e.g., shallow dug wells and driven well points) have surface pumps called “jet pumps” that are located on the surface at or near the top of the well.



As shown above, most well pumps are used in conjunction with a ***pressure tank***. The goal of the well water pump system is to maintain a constant supply of pressurized water in the house and piping system. To maintain the water pressure, the well pump is switched on and off with a ***pressure switch***. This usually means the pump is turned on when the pressure switch senses the pressure is at a low point (the ***"cut-in"*** point) and off at a pre-set high-pressure point (the ***"cut-off"*** point).

Image of how a well connects to a pressure tank, showing the pressure gauge, pressure switch and storage tank

Close-up view of the pressure switch that turns the pump on/off; The blue tank is the pressure tank

A main water shutoff valve, in this case the blue lever labeled "WATER" with white tape, is shown to the left of the pressure gauge and pressure tank drain valve in our photograph (white arrow).

Water tank pressure gauge. The water pressure gauge on home water systems is one of the most helpful and simple devices used in diagnosing poor water pressure and pump, well, or pump control problems.

Where Does Your Water Come From?

As the name implies, groundwater is found beneath the land surface — in cracks and crevices in bedrock, or in pore spaces, which are the small spaces between soil or rock particles in sand and gravel deposits.

Surface water becomes groundwater when it seeps downward to the ***saturated zone***. The saturated zone begins at the point where the pore spaces and cracks in the soil, sediment, or rock become completely filled with water. The top of this zone is called the ***water table***.

An ***aquifer*** is a layer of sediment, such as sand or gravel, or permeable space within bedrock fractures, that stores and transmits water. A ***confining layer*** is a layer of low permeability sediment or rock that slows or prevents the downward movement of water — a thick layer of clay is an example of a confining layer.

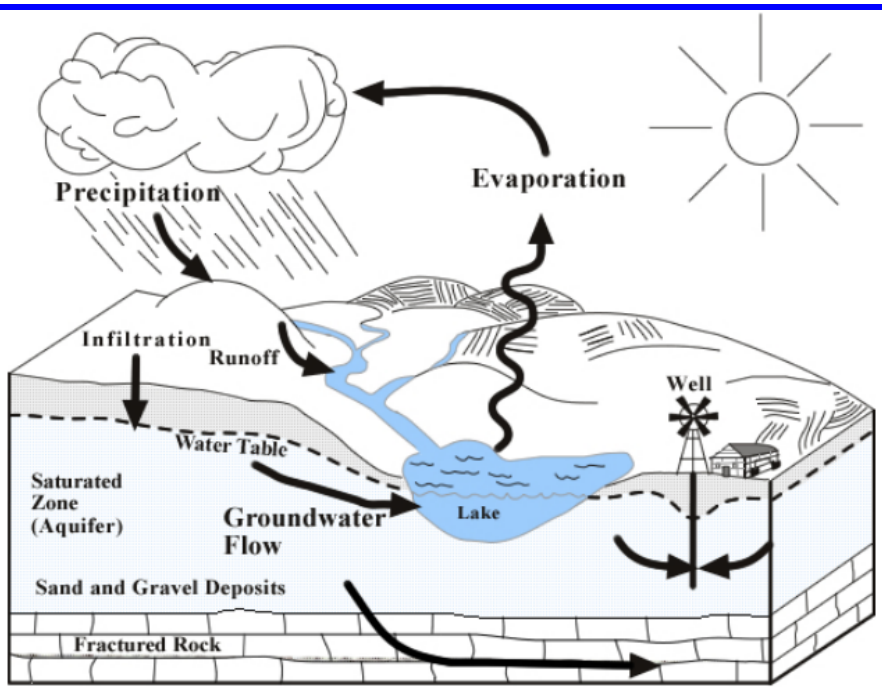


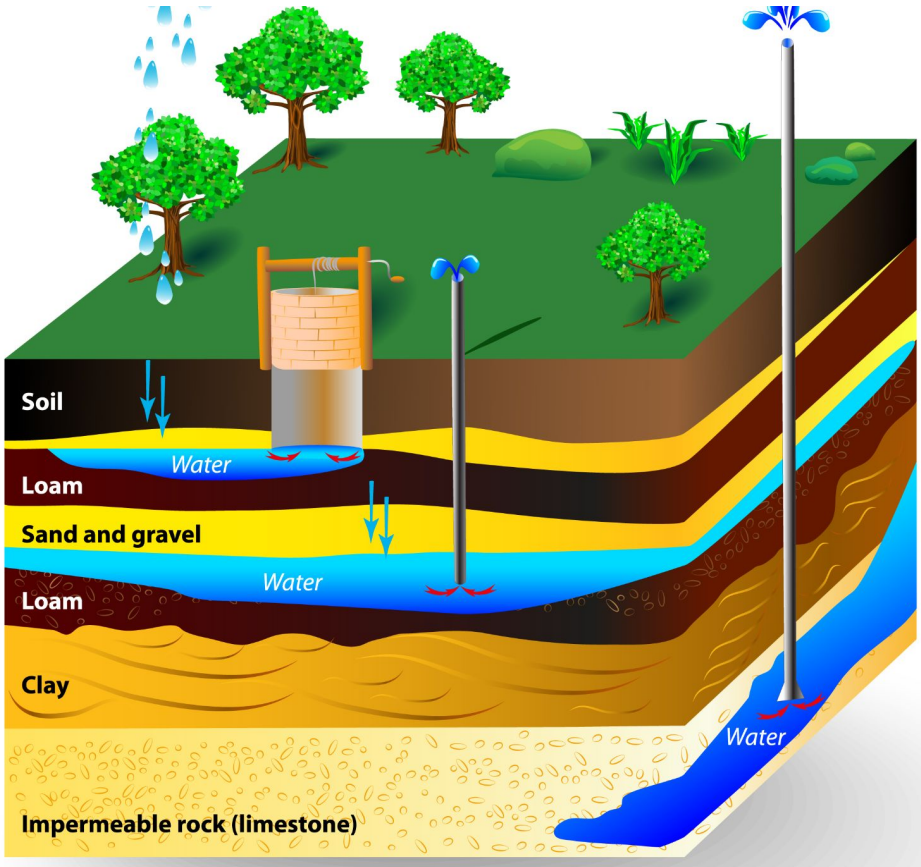
FIGURE 1 The Hydrologic Cycle.
SOURCE: Modified from *Using Ground-Water Data for Water Planning*, Educational Series-8, 1987, Minnesota Geological Survey.

There are several common types of water wells dependant on the source of the water:

- **Dug wells** are holes in the ground dug by shovel or backhoe. They are lined (cased) with stones, brick, tile, or other material to prevent collapse. Dug wells have a large diameter, rely on shallow groundwater and are usually not much deeper than 15 feet below land surface. These wells are generally easy to identify in your yard because they are relatively large stone or concrete objects protruding from the ground and many have well houses built over them for protection or ornamental purposes.

- **Driven wells** are constructed by driving pipe into the ground and are also relatively shallow (approximately 30 to 50 feet deep).

- **Drilled wells** may be completed in unconsolidated deposits (primarily sand and gravel) that overlay bedrock or drilled through the unconsolidated earth deposits into the upper surface of the bedrock and cased with steel pipe. Drilled bedrock wells tap water from fractures in the bedrock and range in depth from less than 100 feet to more than 1,000 feet. Drilled bedrock wells can often be identified as a capped, 6-inch steel pipe sticking out of the ground.

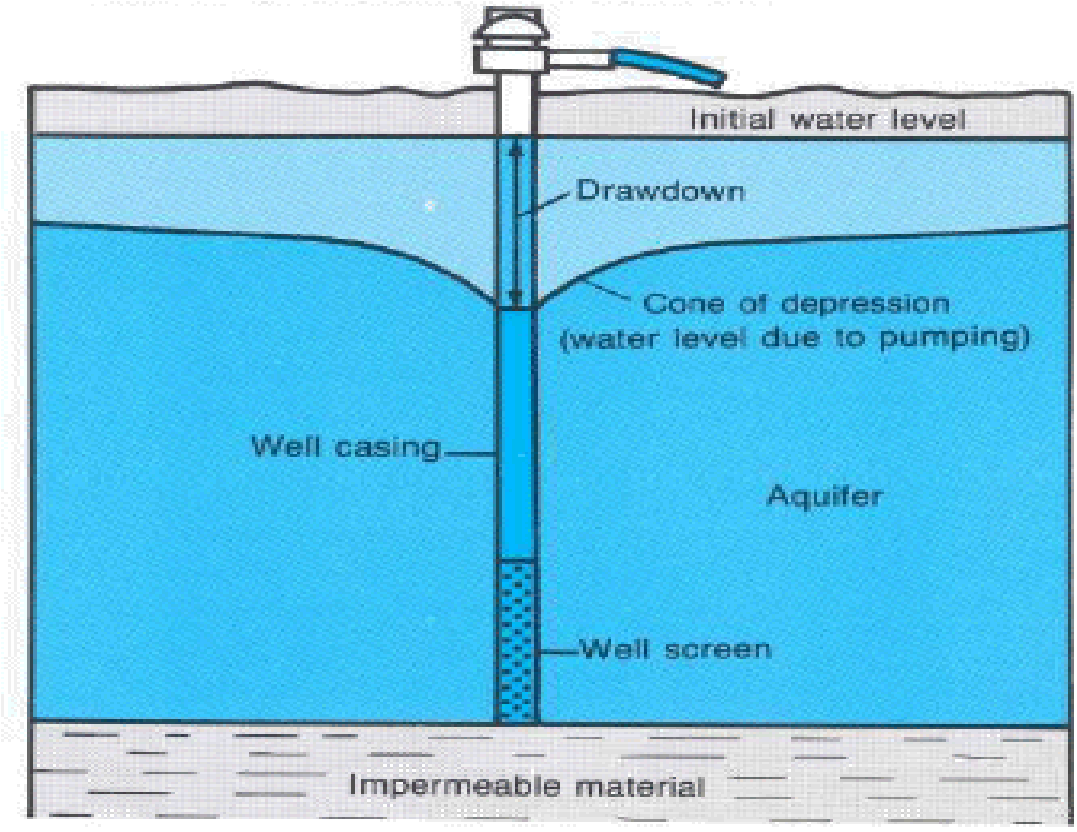


Water Levels in Wells

Groundwater users would find life easier if the water level in the **aquifer** that supplied their well always stayed the same. Seasonal variations in rainfall and occasional drought periods affect the "height" of the subsurface water level. Withdrawing water from a well causes the water levels around the well to lower. The water level in a well can also be lowered if other vicinity wells are drawing water from the same sources (either sand and gravel or bedrock fracture zones). When water levels drop below the levels of the pump intakes, then wells will begin to pump air - they will "go dry."

Pumping a well lowers the water level around the well to form a cone of depression in the water table. If the ***cone of depression*** extends to other nearby wells, the water level in those wells will also be lowered. The cone develops in both shallow water-table and deeper confined-aquifer systems. In the deeper confined-aquifer system, the cone of depression is indicated by a decline in the observed water (*piezometric*) pressure and the cone may spread over a much larger and more linear area than in a water-table system. For a given rate of withdrawal, the cone of depression extends deeper in low-yielding aquifers than in high-yielding ones.

Even though water is present at some depth at almost any location, the success of obtaining an adequate domestic supply of water from a well depends on the permeability of the rock. Where permeable materials (sand and gravel) are present near land surface, a shallow well may be adequate. Elsewhere, such as where less permeable clay-rich material directly overlies bedrock (common in this area), a deeper well extending into bedrock may be needed.



Troubles With Your Water Well

The typical modern residential water well system can generally produce water for many years with minimal servicing. However, as with any home system, your water system does require routine maintenance and service when necessary to continue operating properly. The following is a helpful online webinar:

How to Keep your Pump and Pressure Tank in Good Condition

- https://www.youtube.com/watch?v=6lvv0ZZwosE

A basic well problem troubleshooting checklist is provided at the conclusion of this document, as well as useful links to more information.

The following are some telltale signs to look for that may alert you to well water problems:

Warning signs associated with water well problems

- **Well is Pumping a Mixture of Air and Water**

If you turn on your kitchen faucet and out blasts a mixture of air and water, this can be an indication that something is wrong within the well. The worst case scenario is that your water table has dropped to a point that is at, or below the well pump and the pump is drawing in air some time during the pump cycle.

Another cause would be that the *well pump drop pipe* (the pipe that connects the pump to the top of the well and the water system) is broken or the subsurface pipeline from the well to the house is compromised.

Water system pipes are made of either iron pipe or plastic PVC or polyethylene pipe. They may become broken/corroded and develop cracks or even in some instances break apart, allowing for air to be sucked in.

In some cases, the water level is fine and there aren't any cracked pipes or fittings. Some groundwater tables do contain various types of gas. These gases may be dissolved within the water, yet later come out of solution and trigger water to spurt or sputter out of the tap. These types of gasses may be carbon dioxide, methane, hydrogen sulfide or other gasses, and can be harmful and cause significant safety and health problems. In the event that this is an ongoing problem, the well can usually be treated to eliminate these gases by means of aeration and degassing systems. Such problems should be looked into and repaired by a skilled well or pump company.

- **Well is Pumping Sand or large amounts of sediment**

If your well suddenly starts to pump sand, this is often a sign that the well is *"silting in"*, or filling with sand and silt. Typically, the well pump is installed so it is at least 10 – 20 feet above the bottom of the well.

When the pump turns on, the water level in the well can drop to a lower level. If the pump is down near the bottom of the well, sand and sediment can be sucked in.

In the case of wells with screens, the screen may have become degraded and is allowing sand or sediment in from the gravel pack around the well screen. In open rock wells, sand-sized material may be produced from bedrock fracture zones. Sand can quickly wear out the pump valves and fill up the bottom of the well with sand. In any case, a sudden presence of sand is not a good sign and the cause should be determined.

Sand can be removed from the water before the pressure tank or storage tank by means of a sand and sediment trapper or a 60 mesh filter screen with an automatic purge valve.

Above is an example of a sediment filter and a chlorine filter. If you have these you may need to change the filters periodically, check your owners manual.

Low Water Pressure

There can be many causes of low water pressure. Including a failing well pump, stuck check valve, partially closed or bad gate/ball valve, and leaking/failing pressure tank. The pressure tank is usually located in the basement or a utility room, although some types of tanks may be buried underground.

The pressure tank has three purposes:

1. **To store water and provide water under pressure** when the pump is not running.
2. **To build up a reserve supply of water each time the pump runs**, so the pump has to start and stop less often. This serves to prolong the life of the pump.
3. **To provide a reserve supply of water** for use during times of high demand.

As the name implies, a pressure tank contains water under pressure. As water is pumped into the tank, it compresses the air in the tank until the pressure reaches a preset level — typically from 40 to 60 pounds per square inch (psi) — which automatically shuts off the pump.

When a faucet is opened, the air pressure in the tank forces water through the pipes until the pressure drops to another preset level — usually from 20 to 40 psi — which starts the pump again. A pressure switch starts and stops the pump at the preset pressure levels, and allows the system to work automatically.

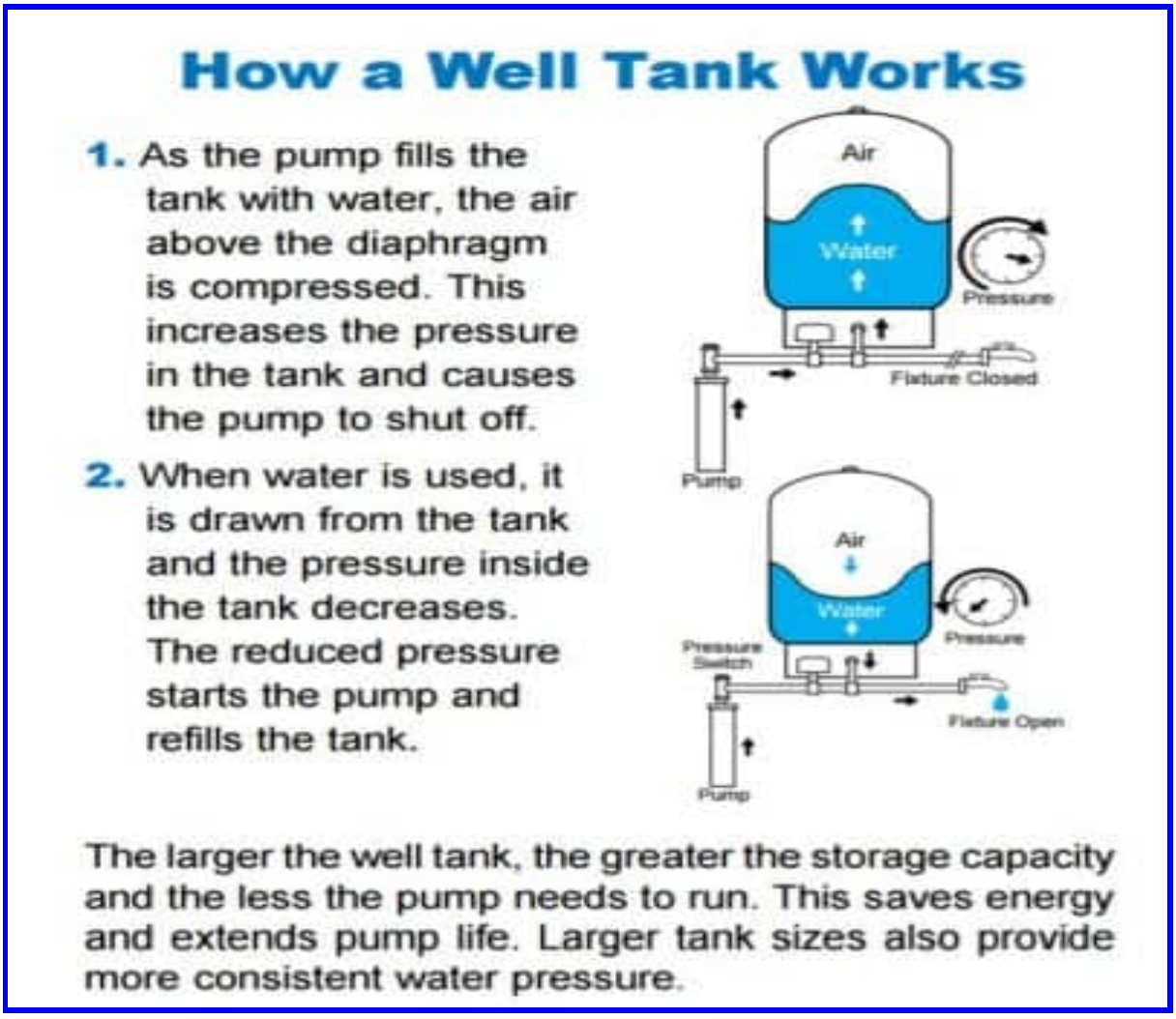
The size of the tank usually depends on the amount of water produced by the pump in 1 to 2 minutes. The amount of water delivered by the pressure tank between the time the pump shuts down and the time it starts up again is called the "***drawdown***." The drawdown is typically much smaller than the overall size of the tank. Common pressure tank sizes range from 10 gallons to over 200 gallons. Tanks holding 20 to 44 gallons, which have a drawdown of 5 to 16 gallons, are the most frequently used. Larger tanks, or more than one tank, may be needed for low-yield wells or systems with high water demands.

The most common type of pressure tank design has a diaphragm or bladder, which provides a permanent separation between the air and the water in the tank. If the air and water are not separated, the water can eventually absorb all the air in the tank, a condition called "***waterlogging***." The pump will then rapidly turn on and off, which is called *“cycling.”* It is a good idea to have a faucet placed near the pressure tank for flushing the tank and collecting water samples for testing.

In some cases, iron bacteria clogs up the pipe nipple leading to the pressure switch causing the pressure switch to incorrectly sense the pressure. If your well water tests high in iron bacteria, your pump and/or well screen may become clogged with iron bacteria. Having the well cleaned with a special solution designed to remove iron bacteria, slime and scale can often restore the well to a better condition.

In some well systems, the pressure can be set too low for today's homes and appliances. It is sometimes possible to raise the pressure to provide adequate water pressure in the home, but care should be taken to not over-pressurize your home plumbing system..

The pressure switch can often be adjusted to accommodate this higher pressure, assuming the well pump and well can operate without difficulty at the higher pressure. Air pressure inside the pressure tank must be adjusted if the pressure switch is adjusted. A background video on How to Check and Adjust Pressure Tanks is provided at: https://www.youtube.com/watch?v=w21qa2bMUh8



- **Electric Bill has increased dramatically**

When a pump wears out, or becomes blocked with sand, silt or iron bacteria, it needs to work much harder than if it was in good shape. This can result in an increasingly higher power cost.

Another common cause of a high power bill is when the check valve in the well goes bad. This enables water from your pressure tank to flow back down into the well, which then reduces pressure and signals to the pressure switch to turn the pump on again and pressurize the pressure tank. This on-and-off cycle may occur every few minutes and essentially allow the well pump to run practically 24 hours a day, causing a high power bill.

- **Pressure Switch and Pump Continuously Cycles On and Off**

This can be caused by one or more leaks in the home causing the well pump to run continuously. This can also be due to corrosion of well casing, liner or screen, causing holes. Holes can allow water of undesirable quality to enter the well. Look for leaking toilet flush valves, reverse osmosis systems, iron filters, and other backwashing filter systems that may be malfunctioning. As discussed above, another common cause is a failed check valve.

Another very common issue is the pressure tank losing its captive air pressure. This is easy to check. Turn off power to the well pump and run water after the pressure tank or in the house until there is no water pressure left. Using a tire pressure gauge check the Schrader valve on top of the pressure tank. It should be 2 PSI less than the cut-in or lower pressure. If your well turns on at 30 PSI, the pressure tank should have 28 PSI in it.

● Water Quality has Changed

Well water can also contain contaminants that can adversely affect health. These can either occur naturally, as in the case of arsenic or radon, or as a result of human activities such as chemical spills, improper waste disposal, or failing septic systems. Water quality can also change as a result of significant changes in the water level in your well. Wells that are old, shallow, in disrepair, or are not properly located and constructed are more likely to have unsafe water.

It is always preferable to have naturally safe well water, rather than relying on treatment. Drilling a well deeper may give additional protection from surface contaminants such as nitrate and spilled chemicals. There are a number of drinking water contaminants that can adversely affect the health of you and your family. Some of the most common include bacteria, nitrate, arsenic, radon, manganese, and synthetic chemicals such as fuels, solvents, and pesticides. If you live in an older home, reduce your potential exposure to lead in drinking water (from lead solder) by letting the faucet run for 30-60 seconds before using the water for drinking or cooking, especially after the water has not been used for more than six hours.

If testing does indicate the presence of a health-related contaminant, options may include the addition of treatment equipment, repair of the existing well, installation of a new well and removal of the source of contamination. For example, the presence of coliform bacteria in the water often does not indicate that the groundwater is contaminated, but that there is a problem with well construction, operation, or maintenance, allowing surface water or contaminants to enter the well. If multiple thorough well disinfection applications do not solve the problem, the well probably needs to be repaired, upgraded, or replaced.

A simple water quality test can tell you what you need to know about the chemical makeup of your water. This test is painless; a technician comes out and collects a couple samples of your water and takes it back to a lab for testing. Alternatively, residents can obtain sample containers from private laboratories or from the State Lab in Concord, collect water samples and drop them back off at the lab.
https://video.nhpbs.org/video/planet-granite-test-it/

NHDES recommends the following schedule of well testing*:

- Test the water in a home with a private well before purchase. Thereafter:
- Bacteria & Nitrate, Yearly
- Standard and Radiological analysis, 3-5 years

The following conditions would call for more frequent testing:

- Heavily developed areas with land uses that handle hazardous chemicals.
- Recent well construction activities or repairs. NHDES recommends testing for bacteria after any well repair or pump or plumbing modification, but only after thorough flushing of the pipes.
- Unacceptable or borderline levels of contaminants found in earlier testing.
- Noticeable changes in the water, such as a change in taste, smell or appearance after a heavy rain, or an unexplained change in a previously trouble-free well.

Note that if you have any water treatment or filtration systems, the samples should be collected before treatment. This can generally be accomplished at the faucet installed at your pressure tank.

Water quality checklist

- Change in water quality, often coupled with the sudden appearance of sediment in the water.
- Failure of the annulus or casing seal
- Iron bacteria or sulfate-reducing bacteria (biofouling)
- Change in water quality such as color, odor (e.g. rotten egg) or taste. Check inside of toilet tank for slime buildup and inspect pump.
- Contamination from man-made sources
- Changes in water quality as indicated by color, odor or taste. Compare results from regular water analyses for changes.
- Limited aquifer extent/Reduced aquifer recharge
- Increase in constituents such as hardness, iron, manganese and sulfate. Compare results from original water analyses for changes. Taste and color changes in the water may also occur.

- ## Water Quantity has Changed

Typically, dug wells, shallow bedrock wells, wells located near topographic high points, wells constructed in areas where bedrock is close to the ground surface and wells in hydraulic communication with high yield water production wells are more susceptible to failing. The typical homeowner does not have a means of determining a well's water level, although symptoms of well failure may be obvious.
https://www.youtube.com/watch?v=6cJgPdM8kuI

Water Quantity checklist

- No water.
- Sudden drops in water pressure or pressure surges.
- Air bubbles coming out of non-aerated faucets.
- Cloudy or heavily silted water.

There are two primary causes of well failure; a shortage of water, or other associated with the well casing, valves, waterlines, pump, pump electrical or pressure tank. A shortage of water can result from an extended drought period, large volume water withdrawals from nearby homes and businesses, or withdrawals from community water supply wells. Well problems can arise for many reasons, some simple (such as a thrown well pump circuit breaker) and others complex (a silted-in well or burned-out pump) It is important to work with a licensed pump installer and/or well driller to diagnose the problem and determine the appropriate corrective action to take. If you are experiencing any of the above issues in your water system, turn the pump off to prevent your pump from continuously pumping air and burning itself out. A water pump can be turned off from a home's electrical panel. Also, address issues immediately as completing the work in the winter may not be possible or could be more costly.

Routine Well Maintenance

Modern wells require remarkably little routine maintenance, but there are several steps that you can take to protect your well:

- When constructing new additions to your home, adding new buildings, or altering waste systems or chemical storage facilities, be sure to maintain adequate isolation distances.
- When landscaping your yard, keep the top of the well at least 1-foot above the soil surface. This will help keep insects, dirt, and other contaminants from entering your well. If you must grade within 1-foot of the top of the well, you should arrange with a licensed well contractor to extend the well casing. Do not pile snow, leaves, or other materials around the well. Slope the soil away from the well casing to promote proper drainage. Be careful when working around your well. Avoid damaging the well casing, which could jeopardize the sanitary condition of your well.

- Have any defective well parts repaired by a licensed well contractor or pump installer. Be sure the well cover or well cap on top of the casing is properly attached and in good repair. Any connections to the cap also should be watertight. Provide flood protection if the well is in an area subject to flooding.
- When working with hazardous chemicals like paint, fertilizer, pesticides, and motor oil, keep them away from your well.
- Take steps to prevent back-siphonage, which occurs when a drop in water pressure causes potentially hazardous substances to be sucked back through your plumbing system — and into your well. When connecting a hose to a faucet, do not submerge the hose end in a laundry tub, chemical tank, container, or sprayer — or leave it lying on the basement floor. When filling pesticide tanks or containers with water, avoid placing the hose inside the tank or container. The nozzle of the fill hose should be secured at a distance above the container or tank opening, which maintains an air gap. The distance should be equivalent to at least twice the diameter of the delivery pipe.
- Be aware of changes in your well, the water from your well, and the area around the well. Changes in how often your pump runs, or in the smell or color of the water, can tip you off to potential problems. If necessary, seek the advice of an expert, such as a licensed well contractor or a well specialist from the NH DES. Have your well inspected at the first indication of trouble. Have the water tested regularly for coliform bacteria and nitrate.
- Have any wells that are no longer in use permanently sealed by a licensed well contractor or a licensed well sealing contractor.

Basic troubleshooting checklist

It is important that a homeowner does NOT open their well “to have a look around”! There is really nothing to see here. Your pump is probably several hundred feet down and you should not be trying to pull it out!! Further, opening a well can lead to the introduction of contamination. If the problem is thought to be the well itself, call a well contractor.

Problem	What to check / what it means	How to correct
No water	Well circuit breaker (usually a two pole breaker since the well pump is usually 240v)	Try turning the circuit breaker on, if it trips again call a licensed well contractor or licensed electrician
No water	Expansion Tank pressure gauge should be showing correct pressure (usually 20 to 40 psi)	Call a licensed well contractor
Sputtering water	Air in the system	Call a licensed well contractor Might be a malfunctioning pump or cracked water line between the pump and the house
Low water pressure	Check any sediment or other water filters for clogging Check screens in the faucet to ensure it isn’t clogged It may be a pump issue, or an issue with the screen in the well	Clean the filter Clean the screen Call a licensed well contractor
Cloudy or muddy water	Sediment (silt/sand) is being pulled up by the pump	Call a licensed well contractor - the pump may not be filtering sediment out or well conditions have changed
Spike in electric bill	Well pump may be running all the time	Call a licensed well contractor - The pump may be malfunctioning - The water in the well is low - The pressure switch (which is mounted on the storage tank) has failed or is stuck
Funny taste / odor from the water	Conditions have changed; Here in NH it’s not uncommon to get a sulfur (rotten egg) smell in the spring and again in the fall	Have your water tested by a state certified lab;

How do we diagnose a pressure tank bladder issue?	Background videos on how to diagnose are provided at: https://www.youtube.com/watch?v=jfh3hB9XZu8 https://www.youtube.com/watch?v=NzZI7WOnMMQ https://www.youtube.com/watch?v=w21qa2bMUh8 https://www.youtube.com/watch?v=6lvv0ZZwosE	

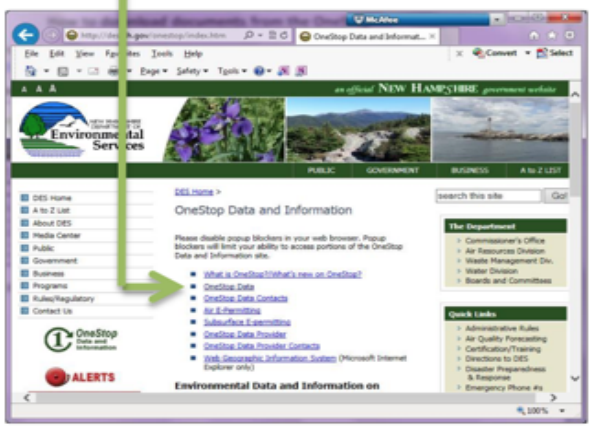
Useful web references:

https://video.nhpbs.org/video/planet-granite-test-it/

HOW TO FIND WELL REPORTS FROM THE NHDES ONESTOP WEBSITE

1. Type in the NHDES webpage address: http://des.nh.gov/

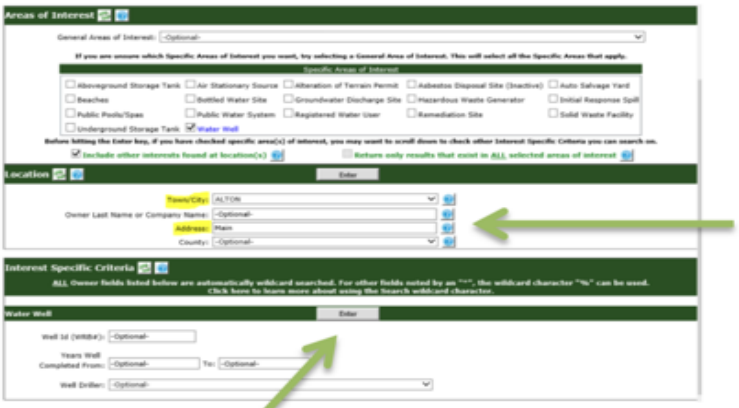
2. Click on the green **OneStop** icon on the left.
3. Click on **OneStop Data**.



4. Click the **'Water Well'** box

5. Search by typing in your town and street name. For the best results keep the search entry as short as possible and omit the house number and extension (ST, RD, etc) from the address. You can also search by property owner, builder, driller, year completed and Well ID.

(ex. For 15 Settlers Green Way, Bedford, search Town 'Bedford' and 'Settler' *OR* 'Green' in address field.)



6. Click the **Enter** button.
7. Look through the search list of wells. Click **'Show'** to view an individual report, or click the **Save Results** icon to export the data for all of the results into excel.

Please note:

- Well construction reports are filed by licensed water well contractors.
- Reporting of well construction records was mandated by state law effective January 1, 1984. **No records exist in the Well Completion Reports table prior to this date.**
- Road name changes for E911 are not reflected in the database.

QUESTIONS? Please call 603-271-1974.

Rev. 05-09-2018 AF