A FIELD GUIDE FOR

CONSULTANTS & PUMPING TEST OPERATORS

(Small Production Wells for Small Community Water Systems)

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Revised May 2009

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A FIELD GUIDE FOR PUMPING TEST OPERATORS

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Prepared by

The New Hampshire Department of Environmental Services
Water Division, Drinking Water & Groundwater Bureau
29 Hazen Drive, P. O. Box 95
Concord, N.H. 03301-0095
603-271-2947
http://des.nh.gov/organization/divisions/water/dwgb/dwspp/well_siting/index.htm

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I. INTRODUCTION

Water falls from the atmosphere in either liquid or solid forms like rain or snow. When water reaches the ground it runs off into surface waters, evaporates back to the atmosphere, sinks into the ground, or is stored in ice or snow packs. All the water that exists on our globe is in one of these four places. Groundwater, the portion that sinks in, is either taken up by plants or stored in underground "reservoirs" called aquifers. Aquifers are not huge underground lakes and rivers as some believe. The water is really stored in the spaces between sand and gravel particles and in the cracks in bedrock.

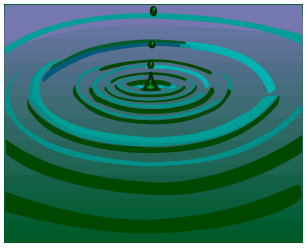
Water naturally moves very slowly underground. When a well is sunk in an aquifer and the pump turned on, water begins rushing towards the well. As pumping continues, water is drawn from farther and farther away. Eventually, the amount of water pumped from the well is greater than the volume of water stored in the aquifer and without recharge, the well runs dry. Recharge is the water that is added to the stored water in an aquifer and comes from many sources, usually rain, snowmelt, surface water, or another aquifer.

The volume pumped from the well is called discharge. When discharge is greater than recharge plus storage, an aquifer acts like a checking account on overdraft. Funds are being withdrawn faster than they are being deposited. The aquifer dewaters and the well runs dry. Too many wells in a single aquifer or too large a withdrawal from a single well or cluster of wells can tip the discharge/recharge balance into the red. A pumping test provides the needed information to keep withdrawals smaller than deposits and allows the aquifer account to stay in the black.

II. PURPOSE

As an extremely important part of the well siting process, pumping tests must be performed correctly, based on the requirements of New Hampshire Administrative Rules Env-Dw 301, *Small Production Wells for Small Community Water Systems.*

The purpose of the rules is to ensure that a small community water system can provide enough good quality water from its wells to meet a water system's needs. The pumping test provides the data needed to determine if a well can maintain a particular yield for long periods without rain, snowmelt or other recharge to the aquifer. The New Hampshire Department of Environmental Services (NHDES) created this guide as a tool for pumping test operators and applicants to better understand how to satisfy the pumping test requirements in the rules.



III. STANDARD PUMPING TEST REQUIREMENTS OF ENV-DW 301

When an applicant chooses to site a new well, a preliminary report including site-specific information and a pumping test proposal with water quality analysis is submitted to NHDES. Upon approval of the preliminary report the pumping test and water quality analysis may be performed. The data gathered during the pumping test is evaluated and presented in the final report. Once all the required information is received and reviewed, NHDES either approves or denies the well siting application. Two different types of pumping test may be required, depending on the type of well siting application. The most common pumping test is called a Standard Pumping Test, but under special situations the operator may be called on to perform a Non-Standard Pumping Test. Both types of pumping test are explained in this guide.

PLEASE NOTE: A temporary groundwater and/or surface water discharge permit is required, even if pumping test water is not discharged to a stream. Contact Mitch Locker at 603-271-2858 for a permit application form. There is no application fee associated with a temporary discharge permit, and the application can usually be completed and received within 10 days or less.

Before Starting the Test

The pumping test operator should **obtain a copy of the pumping test design** if he did not propose the pumping test for the approved preliminary report. The design contains very important information the operator needs to know before beginning the test. It contains the proposed pumping rates for all wells being tested. This helps size the pumps and inline flow meters. It also tells if other wells or surface waters need to be monitored during the test. It documents the type of water level monitoring equipment that should be used and how often water level measurements must be taken. The design also describes water quality sampling, frequency of sampling, parameters to be sampled, which lab is being used, and whether the operator or the consultant is expected to collect the samples. The pumping test proposal will also note whether or not microscopic particulate analysis (MPA) sampling will be done. This type of sampling requires special plumbing on the discharge line for the filtration assembly. This plumbing must be installed prior to starting the pumping test.

If no pumping test design is available, be sure to ask the client if this is a community water supply well and remind the client that community water supply wells must be approved by the state.

Single family home developments (10 houses or more), condos, apartment complexes, mobile home parks, schools with dorms, and large vacant acreage that could be subdivided into several house lots are examples of existing and potential housing that might use a community water supply system and require approval from NHDES.

Sometimes, non-standard pumping tests are required. In some cases the operator will be testing an existing well that is being reactivated, or has been deepened or hydrofractured. These situations have different pumping test requirements and are dealt with in Section IV of this guide. The operator needs to know whether the well is being tested as a new well or as a rehabbed existing well.

Another special application requiring a non-standard pumping test is a replacement well. These wells are drilled into the same aquifer type and in the same general area as an existing well that

failed. A condition of approval of a replacement well is that the existing well be abandoned. Pumping test requirements for replacement wells are dealt with in Section IV of this guide. Just because a well is newly drilled, do not assume it is a "new" well in relation to the pumping test requirements. If there is an existing well nearby, ask if the new one is replacing the old well before you charge the client for a standard pumping test.

MPA sampling will be required if the new or existing bedrock well is located within 200' or if a gravel well is located within 100' of surface water or an inundated wetland. MPA sampling analyzes the well water for biological indicators of surface water. Though the consultant will probably perform the MPA sampling, the operator will usually set up the plumbing for the device. Guidance on MPA sampling and the correct plumbing setup is included in Appendix D of this guide.

A. SETUP

Try to set up all pumps, plumbing, hoses, and other equipment at least a day in advance so any joint compounds, or other materials, are dry and do not affect water quality results. If the well is chlorinated after setting the pump, the operator needs to plan on at least a day for the chlorine to dissipate. It is very common to detect contaminants such a toluene, phthalates, and chloroform in the well water even after two days of pumping. These contaminants are associated with electrical tape, PVC piping used for still water tubes, and chlorination. A well contaminated by these man-made compounds cannot be approved without further sampling and analysis to demonstrate they no longer exist in the well water. Avoid using large quantities of electrical tape since that seems to be the most common source of introduced contamination.

Setting up a day early also allows the operator to check all equipment prior to the test to make sure it works. Delays in starting the test can cause a huge ripple effect that might cost the operator and the client time and money. Lab tests may need to be rescheduled, the consultant may have to spend more days in the field than budgeted for, or the operator’s time may be wasted chasing down replacement equipment. If equipment is not tested in advance and failure occurs once the test has started, the test may be canceled, causing problems for both the operator and the client.

The equipment attached to the discharge line should include an inline meter, a valve to control flow, a sampling tap for water quality samples, and, if necessary, the plumbing for MPA sampling. A separate tube should be inserted down the well for ease and accuracy of water level measurements (still water tube).

Plan to man the pumping test for the duration. Bring everything needed, including food and water, with you. If personnel are taking shifts, each person should bring enough personal gear and food along for the entire shift. Even if dataloggers are utilized for water level measurement, the test site should never be left unattended for any length of time. Vandalism has occurred in the past at unattended sites, some severe enough to abort the test. At the very least vandalism causes delays and extra work for the operator.

1. Pump

The pump and electrical service to the pump must be able to run the entire length of the test without stopping. The pump should be sized correctly to pump at the rate designated in the proposed pumping test design. It should be located above a water-bearing fracture in the well so that water flows upward over the pump, cooling it. Three-phase wiring is recommended and may be necessary for the electrical supply being used.

If using a portable generator, make sure there is enough fuel on hand to run it for the whole test. If the operator leaves the test site for any reason, make sure the generator is gassed up before leaving. If refueling the generator during the test, outfit it with a plastic "diaper" to catch any spillage during the refueling process. To install a "diaper", lay a large heavy mil plastic sheet or tarp flat on the ground and back the generator over it. Pull the sheeting up around the wheels and secure it with duct tape to form a catch basin under the generator. Set a five-gallon pail under the filler pipe as an extra spill catcher.

Back up equipment, such as an extra electronic water level measurement device or generator, should be on site or readily available in case of failure. A long time spent searching for back-up equipment may result in repeating the pumping test.

Please note that if the pump will be permanently installed in the well, rather than temporarily for the pumping test only, that pump must be installed by a New Hampshire licensed pump installer.

2. Discharge Setup and Location

The discharge pipe should be equipped with a gate valve or similar device to regulate and maintain a constant discharge rate. An inline flow meter must be used to determine the rate. A bucket and stopwatch is not acceptable for measuring the discharge rate, though this method may be used as a rough check of the meter accuracy. Choose a meter that reads in gallons, rather than cubic feet, for ease of recording flow rates. A cumulative or 'totalizing' meter is recommended.

A water quality sampling tap is advised. Locate the tap where it is least likely to be affected by turbulence in the pipe. Some of the sample bottles are small and require a slight but steady flow to fill. Make sure that the type of tap installed is capable of delivering this kind of flow. Water quality testing is very expensive and a sampling tap helps keep the water samples clean. Do not take water quality samples from the end of the discharge hose.

If MPA sampling is necessary, the operator must equip the discharge line with a diverter valve for the filter assembly before pumping is started. Very low flows must be maintained through the filter assembly (1-2 gpm). Turbulence must be kept to a minimum in the filter, so pressure regulation is very important. See the diagram in Appendix D for a schematic of the diverter setup.

The discharge line must be long enough to discharge the pumped water where it will not affect the aquifer's response to pumping. A good rule of thumb is at least the length of the sanitary

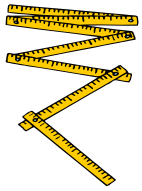
protective area radius, but it may need to be longer depending upon site conditions. For instance, bedrock outcrops or coarse sand and gravel might cause water to flow in a direction that affects aquifer hydraulics and the pumping test. A discharge location was proposed in the Preliminary Report. However the proposed location may not be practical on the day of the test. Onsite conditions may have changed such that a different site is necessary. Any change from the proposed discharge location requires NHDES approval.

Water should easily flow away from the well site. Look for natural drainage areas to locate the discharge outlet. Care should be taken so that the discharged water will not cause erosion or scouring at the discharge point. Make sure to bring extra lengths of discharge line to the site in case the discharge location must be changed. Have at least 1000 feet of hose available. NHDES personnel will attend the test and may require the operator to move or extend the line, or ponding or some other problem may occur during the test. For example, the well is located in a low spot. The 200-foot discharge line dumps the water uphill, but it just runs back down towards the wellhead, puddling there. In this situation, add more lengths onto the discharge line until the water flows down the other side of the hill and away from the well. Monitor the discharge location periodically during the test to make sure no ponding occurs. Check for leaks in the line and fix them.

Wetlands, flat terrain, sandy soil, or an urban setting all offer challenges when choosing a discharge location where the discharged water will not affect pumping test hydraulics. Most wetlands have a natural or man-made outlet. Try to set the discharge as close to this outlet as possible. Add on extra discharge hose if necessary. Nowhere in New Hampshire is totally flat. Search out natural drainage areas and use them. Add on extra hose if necessary. Sandy soils can potentially route discharge water rapidly back to the well. In this situation as much as 1,000 feet or more of discharge line may be necessary. Please note that unless a surface water discharge permit was obtained, pumped water may not be discharged directly into a surface water body. Pumped water should be discharged onto the ground in an area where it will readily sink in. At least 75' from the surface water body is a good rule of thumb.

Urban settings pose different kinds of problems. Do not discharge pumping test water to storm drains or roadside ditches without permission from the regulating agency. The N.H. Department of Transportation frowns on discharging anything other than storm water onto state rights-of-way, especially when freezing can occur. Also be careful not to flood neighboring lots. This situation requires a delicate balancing act of choosing a location far enough away to not affect test hydraulics, but not so far as to impact neighboring lots.

In most cases, discharging water from an unapproved source into the water system storage tank is not allowed. Always obtain permission from NHDES's Drinking Water & Groundwater Bureau prior to discharging pumped water into the water system's storage tank. Contact Jim Gill at 603-271-2949 for further information. Please note, a flow meter, sampling tap, and a method for controlling the flow rate on the discharge line are all still necessary if pumped water is directed into the storage tank.



3. Water Level Measurement Equipment

Always measure water levels from the same point on the top of the casing. Water levels must be measured with a device capable of reading to less than an inch and recorded in either fractions of an inch or 100ths of a foot (0.00). The reason for this is that NHDES defines stabilization as a water level that varies less than an inch in two hours for a 12-hour period. This means that for the entire 12 hours the water level cannot change more than an inch per each two-hour block of time. Electronic measurement equipment should be used. Make sure all personnel know how to read the tape on the electronic probe before starting the test. Some tapes read in inches, others in 10^{ths} of a foot. Others may only read in feet. Some equipment reads in both scales, one on either side of the tape. Know the equipment! Remember, water levels must be read and recorded at less than an inch. One inch equals .083 feet, so if an electronic tape is calibrated in 10^{ths} of a foot the operator needs to be able to determine a variation of .08 feet. This means reading the tape to the nearest 100^{th} of a foot.

If the scale on the tape does not read to100^{ths} of a foot, or if the scale is in inches, a carpenter's rule is necessary to read fractions of an inch between the tick marks on the probe tape. The easiest way to do this is to measure from the nearest foot mark on the probe tape.

Pressure transducers with dataloggers may be used, but should be checked often to avoid having to restart or repeat the test in case of a failure. Beware! These devices may appear to be recording water levels, but when downloaded the data is absent. If unfamiliar with dataloggers, make sure to get some training on setting up and running one. If you have multiple wells being tested a multi-channel datalogger can be the most efficient measurement tool. However, these devices are complicated to set up and run. Make sure your thoroughly understand how the device works before using it. A test run is advised a few days before you start the pumping test.

To avoid getting the probe stuck in the well, a separate still water tube should be used for water level measurements. Faulty readings can also result from water cascading down from fractures above the water level in the well and turbulence from the pump. Be careful when choosing PVC pipe for the measurement tube. Some is coated with a resin that contaminates the water sample. Flexible tubing can kink, especially when used in very deep wells. Kinds or bends in the tube will make it impossible to lower the probe past the obstruction. Take special care when using this type of still tube and ease it down the well to avoid kinking.

Make sure the diameter of the tube is large enough to accommodate the probe. One inch is usually large enough. Each well being tested should, ideally, have its own water level monitoring device. Besides being time consuming, completely removing the tape from the well each time a measurement is taken can cause the tape to kink, giving inaccurate readings. Back up equipment should be on site, or readily available to avoid having to restart or repeat the test in case of a failure.

B. DISCHARGE

Note: If the wellhead is flooded or there is any ponded water within 20' of the wellhead, do not start the pumping test until the area is dry. If open slurry pits are located near the wellhead, they must be filled in before starting the test.

1. Constant Rate

The new well and all other wells needed to meet the system's source capacity requirements must be pumped together at a constant rate. System source capacity should be listed in the pumping test design submitted with the preliminary application. New wells must be pumped at their proposed permitted production volume (PPV). Existing wells, if not needed to demonstrate source capacity, should be shut off during the pumping test. If shutting down existing wells is impractical or the wells are needed to demonstrate source capacity, they must be pumped at either their PPV or the volume needed to supply the system, even if that means discharging excess water onto the ground. If not shut down or run at a constant rate, when the pumps cycle on and off supplying water to the system, existing wells can cause water levels in the new wells being tested to jump around and a stable water level cannot be reached. However, if the existing wells are far enough away to not affect water levels in the wells being tested (at least 1,000 ft.), they do not need to be shut down during the test. The pumping rates for all wells, new and existing, should be outlined in the pumping test design.

New wells may be pumped at volumes greater than the PPV as long as the total rate for all new wells does not equal 40 gallons per minute (gpm), or a volume of 57,600 gallons over any 24-hour period. Wells that pump more than 40 gpm are regulated by rules requiring more technical analysis and involve longer, more sophisticated pumping tests. Divide PPV by 1,440 to get the discharge rate in gpm.

2. Measuring Discharge

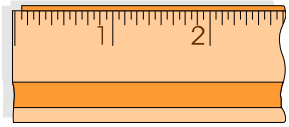
Changing the pumping rate during the test causes water levels in the well to change too. The consultant uses these water levels to tell how the aquifer reacts when pumped. Changing the pumping rate clouds this picture, making it hard to assess aquifer conditions. For that reason, the pumping rate may not change more than +/- 5 percent after the first six hours of pumping. For a 10 gpm well this means +/- ½ gpm, +/- 1 gpm for a 20-gpm well, and +/- 2 gpm for a 40 gpm well. Discharge must be measured with a device that can give this kind of accuracy. The apparatus favored by most operators is an inline cumulative water meter or the equivalent.

Discharge measurements must be taken every 15 minutes for the first 2 hours and at least once every hour after that. Many operators fail to take this measurement often enough. If using a cumulative meter, record the meter reading, not just the gpm, before the start and after the end of the test and once every hour during the test.

Some meters read in gallons only, others in gallons per minute (gpm), and some may even read in cubic feet per second. Know the equipment! If a device reads in gallons only, usually a cumulative meter, the operator will need to determine gpm. The best method for doing this is to take two readings one minute apart and subtract the smaller reading from the larger one. Do this several times and average the results.

NHDES discourages the use of digital flow meters commonly used to measure flow in pumphouses. Unless these meters are routinely calibrated they may give faulty readings. An inline flow meter, though it makes for more work for the operator, if new out of the box and properly calibrated, should provide accurate results.

Please note that a single new well pumping greater than 40 gpm or a group of new wells with a combined rate greater than 40 gpm are considered large wells and fall under the requirements of Env-Dw 302, *Large Production Wells for Community Water Systems* and Env-Ws 387 & 388, *Large Groundwater Withdrawal Permitting.*



C. WATER LEVEL MEASUREMENTS

1. Frequency

Record the casing stick-up height above ground surface, if possible, and the water level measurements from the top of the well casing in feet, inches and fractions of an inch, or in feet, 10^{ths} and 100^{ths} of a foot. At the same time, write down the elapsed time in minutes from the start of the test for each water level measurement. Enter all data on a well log sheet. A sample sheet can be found in Appendix A. Feel free to photocopy it. Each well should have its own log sheet. Putting several columns of water levels on one sheet allows for mistakes to occur. It is very easy to record a water level in the wrong column. If you know when you should be taking water level and discharge measurements, you can fill in the elapsed time column before the pumping test to save time during it.

The pump should have been off for at least 24 hours before starting the test. This allows the well to fully recover if the pump was tested during setup. Record the static water level just before starting the pump. Do not record the static water level earlier. Atmospheric pressure can affect water levels in non-pumping wells, so the static water level today is apt to differ from yesterday's. Measure and record water levels <u>every 5 minutes</u> for the first hour of pumping. This may require some scrambling if several wells are being tested at once, since pumping rate must also be measured and regulated frequently during the first hour. Consider using extra helpers for the first hour, especially if testing more than one well. One person can regulate and record discharge rate while another is measuring and recording water levels.

After the first hour of testing, water levels must be taken at least every hour or at the frequency that was proposed in the approved pumping test design. If the person who designed the pumping test is not present during the test, the operator should have a copy of the pumping test design as approved in the preliminary report before beginning the test. <u>Do not start the pumping test without knowing how it was proposed in the preliminary report.</u> If the consultant does not supply you with a copy of the pumping test proposal, contact NHDES for one.

2. Accuracy & Equipment

Water levels must be recorded in fractions of an inch or 100^{ths} of a foot. Use water level measurement equipment that can measure to less than an inch. NHDES recommends electronic equipment.

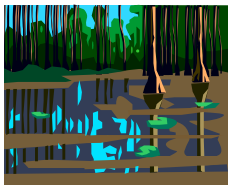
A tape and plopper can be used to measure water levels in private wells. When using a tape and plopper be careful not to tangle it in the pump wires. Always mark the tape with blue carpenter's chalk. Take at least three readings for each measurement and average them. Dry and rechalk the tape between each reading. Read the tape to fractions of an inch.

Newer model non-invasive sonic meters, often called pingers, are allowed for all wells other than the production well being tested. Make sure the meter reads to 100^{ths} of a foot and was recently calibrated. NHDES recommends sonic water level devices for monitoring private wells, if possible, due to the non-invasive nature of the device. However be careful. They do not work on all wells. The device operates by bouncing sound waves off of objects. The time it takes for the sound wave to leave and return to the meter is recorded and the distance to the object is calculated.

For the sonic device to work properly, the sound wave must bounce off the water in the well. If there are any obstructions inside the casing, like wire guides, the meter may only be recording the depth to that object. Always test a sonic device on a well before utilizing one. Take a measurement, then ask the homeowner to flush a toilet or turn on an outside spigot. The measurement should change. If it does not, try different spots inside the casing.

Once it has been determined that the device works for a particular well, mark the measuring point with an indelible marker and always use the same spot. That way the device is always bouncing sound waves off water and not something else like wires.

Reality check the measurements you take in private wells. For instance, if you see steam coming from a dryer vent, it is safe to assume the homeowner has recently done a load of laundry. If your water level has not changed since the last reading something may not be working properly. Double-check your reading with another device or ask the homeowner to run water and check that the measurement changes.



3. Other Water Level Measurements

If there is any surface water body or inundated wetland within 150 feet of the well(s), water levels must be measured there also. An inundated wetland is one that is flooded for at least 30 consecutive days. The pumping test proposal should note if surface water or wetlands must be monitored. Using a staff gauge or similar device, take readings before pumping starts and every 12 hours thereafter. The measurement device should be affixed to a stake driven into the bottom of the surface water body. Be sure the calibrated side of the device is facing the bank. A yard stick works well for this. However, be sure to note the pre-pumping water level regardless of the device used.

It may be necessary to measure water levels in private or other public water supply wells. The applicant will have obtained written permission from the well owner prior to the pumping test. However, if possible, introduce yourself to the homeowner and remind them of why you are there. Let them know when you plan to visit their property to take water level measurements and avoid going after dark. In the past some very surprised pumping test operators have been confronted by police officers questioning their reasons for entering private property.

Use the water level equipment discussed in section (2) when monitoring non-system wells. If using invasive water level equipment, wipe the device down with bleach every time before placing it in the well.

If MPA sampling is required, the pumping test operator may also be responsible for measuring pH, specific conductance, and temperature of the discharged well water and the nearest surface water. If so, make sure the equipment necessary for these measurements is on hand. Choose a measurement point on the surface water body that is both near and accessible. Put a stake with flagging at the measuring point. For safety reasons, NHDES does not expect the operator to take surface water measurements during nighttime hours. Though no requirements regarding the frequency of these measurements have been developed, NHDES recommends taking measurements at least hourly for the first 8 hours. See Appendix D for complete directions for MPA sampling.

4. Weather Conditions

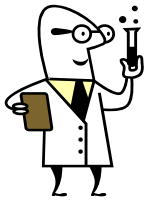
Precipitation data must be collected for one week prior to testing. The consultant may assume responsibility for this task, but find out if you are expected to do so. The operator must record on the log sheet all rain or snow events and other weather conditions at least twice daily throughout the testing and recovery period. Try to measure rainfall amounts using a rain gauge, and set one up even if fair weather is predicted. Also make notes describing the intensity, frequency and duration of all rain events. For instance, 'off and on drizzle for 6 hours', or 'heavy downpour for 15 minutes followed by 2 hours of moderate rain'.

D. Troubleshooting the Pumping Test

Things can go wrong in a pumping test and frequently do. If water levels are dropping too fast and dewatering appears likely, throttle back the pumping rate. Do not wait until water levels drop to the elevation of the pump before taking action! The experienced operator can usually tell within the first hour of a test if the well is being pumped at too high a rate. Water level drops of greater than a couple of feet every 5 minutes at the end of the first hour usually means the aquifer is being over-stressed and the well will probably not reach stabilization or, worse, dewater.

If anything must be changed during the test, remember that at least 12 hours of pumping at a constant rate is needed to determine stabilization and you must demonstrate 24 hours of a constant rate that varies less than +/- 5%. **Note all changes made during the test on the log sheet and the reasons for the change.**

The test may run the entire 48 hours and not reach stabilization. If water levels do not meet the "less than an inch in any two-hour period" definition of stabilization at the end of 48 hours, either reduce the rate and continue pumping until stabilization is reached, or determine if the 180-day estimated water level meets stabilization requirements as defined by Env-Dw 301. Usually, the consultant will make this determination for you. See Appendix B for an explanation of how to determine the 180-day water level estimate, if necessary.



E. WATER QUALITY SAMPLING

1. Timing

Unless proposed differently in the pumping test design, the water samples must be taken right at the end of the test before shutting down the pump. A full Safe Drinking Water Act (SDWA) analysis must be done. A listing of the parameters for that analysis can be found in Appendix C. Double check the DWGB website http://des.nh.gov/organization/divisions/water/dwgb/documents/sdwalist.pdf for the most current version of this list.

If using the NHDES laboratory for the analyses, schedule the tests in advance. Be sure to coordinate the laboratory sample analysis with the timing of the pumping test. Call the NHDES lab at 603-271-3445 or 3446. Commercial labs may also require scheduling of the tests. Make sure to check with any lab before assuming they will accept or be able to process the samples within the holding time. It is usually a bad idea to take water samples on a Friday afternoon, since holding times on some parameters are less than 48 hours.

2. Lab

The laboratory chosen must be accredited by the State of New Hampshire for all drinking water categories being tested, use approved methods, and be able to meet required detection limits. A list of labs and the parameters they are accredited to analyze can be found at http://www4.egov.nh.gov/DES/NHELAP/ .

3. Collection and Delivery

Be very careful when collecting water samples and always use a sampling tap. This will help ensure the sample is not contaminated during the collection process. If possible, wear latex gloves and avoid touching the insides of both the sample bottles and their caps. Directions for taking water samples can be found in Appendix C. Any contamination introduced into a water sample will make it useless, and additional testing will have to be performed. The client will have to pay for another test. The full range of testing for SDWA costs over $1,000 for just one well and this does not include the cost of MPA. Also, store the samples in a cooler with ice, not cold packs, while transporting them to the lab. The NHDES lab will measure the temperature of the samples when they arrive and reject any sample warmer than 50 degrees F. NHELAP sets

standards for temperature of the samples, so commercial labs will also note the temperature of the samples when received.

Samples must reach the NHDES lab within 24 hours of being taken. If using a private lab, check with them to determine the holding time for a sample before it is rejected.

F. DURATION

A small production well pumping test must be run for at least 48 hours. A pumping test can be stopped after 48 hours only if stabilization has occurred. See Section III.A.3 for a definition of stabilization. NHDES urges the pumping test operator to contact the person who designed the pumping test before shutting down a well in which a water level has not stabilized. NHDES may also be contacted at 271-2947 for advice.

G. RECOVERY

The small community well siting rules require the pumping test operator to record water levels during the recovery period. There is no set schedule for measuring water levels during recovery as long as at least 10 measurements are taken and recorded. The recovery period must last until the well has recovered 95% or 24 hours, whichever is shortest.

IV. NON-STANDARD PUMPING TEST REQUIREMENTS

Before Starting the Test

Note: Pumping rates for some of these tests may exceed 40 gpm if such a yield was originally approved for an existing well.

The pumping test operator should obtain a copy of the pumping test design if he did not propose the pumping test. The design contains very important information the operator needs to know before beginning the test. It contains the proposed pumping rates for all wells being tested. This helps size the pumps and inline flow meters. It also tells the length of the test, if other wells or surface waters need to be monitored during the test, the type of water level monitoring equipment that should be used, and how often water level measurements must be taken. The design also describes water quality sampling, frequency of sampling, parameters to be sampled, which lab is being used, and whether the operator or the consultant is expected to collect the samples. Refer to the 'Setup' portion of Section III of this guide for information on setting up the wellhead and discharge for the test.

A. Hydrofracture or Deepening to Regain Lost Well Capacity

The deepened or hydrofractured well must be pumped at a constant rate for at least six (6) hours at the yield established when the well was originally approved, or the yield the rehabbed well is capable of producing, whichever is less. If the owner wishes to use the well at a higher yield than was originally established, then a standard pumping test must be performed and a new well siting application submitted. Water levels should be recorded at regular intervals during the pumping period. A water quality sample must be collected just prior to shut down, and analyzed for all current drinking water parameters. No recovery period is required, but is highly recommended.

B. Replacement Wells

The replacement well must be pumped at a constant rate for at least 12 hours. The pumping rate in the replacement well can be no greater than the yield established when the existing well being replaced was originally approved. Water level measurements must be taken in the same manner as outlined in Section III.C. A water quality sample must be collected just prior to shut down, and analyzed for all current drinking water standards. No recovery period is required, but is highly recommended.

C. Demonstration of Source Capacity on Existing Inactive Wells

Typically pumping tests in this case follow the standard pumping test requirements outlined in Section III of this guide. Exceptions are sometimes made, so check with the client or NHDES prior to starting one of these tests. If a non-standard test is allowed, follow the requirements for Replacement Wells above.

For Further Information:

Website: http://des.nh.gov/organization/divisions/water/dwgb/dwspp/well_siting/index.htm

Call: 603-271-2947

V. Terms and Abbreviations Used in This Document

Aquifer- An underground water-bearing geologic formation.

Community Water System-A public water system that serves 15 service connections or 25 residents, year-round.

Constant Pumping Rate-One that does not vary more than +/- 5%.

Discharge-The process of pumping water from a well and moving to another location.

Datalogger- A computerized electronic device that automatically records water levels.

NHDES-New Hampshire Department of Environmental Services

DWGB-The Drinking Water & Groundwater Bureau.

Env-Dw 301- The Administrative Rules regulating the siting of wells pumping at a rate less than 40 gpm for small community water systems. (Small wells.)

Groundwater-Water stored in water-bearing underground geologic formations.

MPA-Microscopic Particulate Analysis. A test used to determine if organisms common to surface water but rare in groundwater exist in the well water.

Permitted Production Volume (PPV)- The maximum volume of water permitted by NHDES that may be withdrawn from the well in any 24-hour period.

Preliminary Report- Report submitted to NHDES by the applicant or consultant that outlines how the pumping test will be operated.

Private Wells-Those not owned by the system being tested or by another public water system.

Recovery- The period just after a pump is shut down when water level in the well returns to a pre-pumping condition.

SDWA- Safe Drinking Water Act

Still Tube-Any tube placed in a well through which water level measurements are taken.

Surface Water- Any body of stand or flowing water, such as a lake, pond, stream or wetland.

Wetland-Any area, not a surface water, that is inundated for greater than 30 days and supports vegetation typically adapted for life in saturated soil conditions.

Appendix A

Pumping Test Log

Water System Name:_____EPA ID#:_____

Description of Well Location:_____

Well Depth:_____Depth of Pump Intake/Screen: _____

Reference Point Used to Measure Depths:_____ Casing Stick-up:_____

Test Performer Name:_____

Date Test Started:_____ Static (No Pumping) Water Level:_____

Day/Time	Elapsed Time	Depth to Water	Pumping Rate	Comments/Weather/Meter Reading

Appendix B

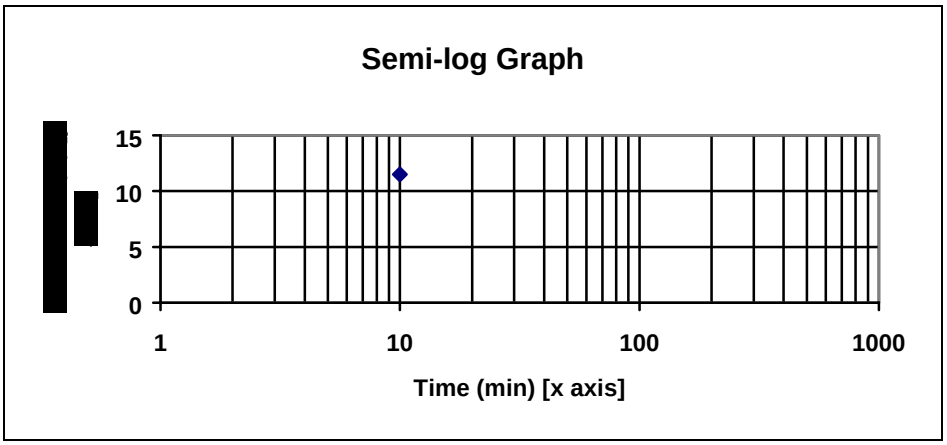
Guide for Creating a 180-Day Time Drawdown Chart

The criterion for ending a pumping test after 48 hours is stabilization. The primary method for determining stabilization is reaching a water level that varies no more than one inch in two hours for a 12-hour period. Often a pumping test will not reach stabilization by this method.

Another method for determining stabilization is the 180-day time drawdown chart. This is a semi-logarithmic graph that estimates what the water level in the well would be at 180 days if the drawdown trend at the end of the pumping test continued the same. It assumes a constant pumping rate for 180 days with no recharge and a water level variation that does not change after 48 hours. If the resulting estimated water level is more than five feet above the level of the pump, there should be enough water available for the system's needs.

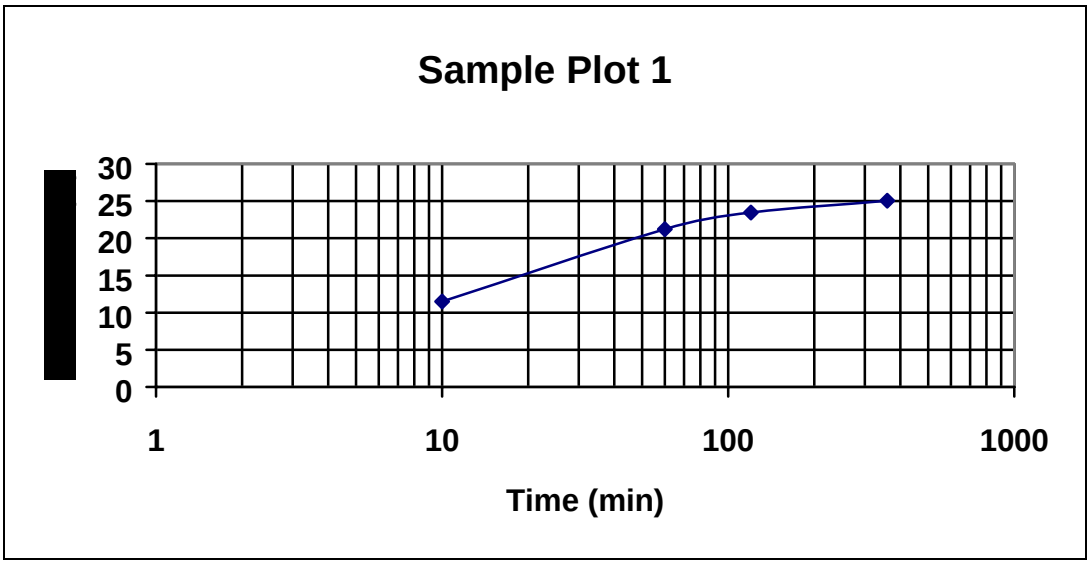
Begin by recording the pumping test water level measurements and the elapsed times at which the measurements were taken. These data points will be graphed on a semi-logarithmic plot. A semi-log plot has one axis in logarithmic scale and the other in normal scale. Each increment on a logarithmic axis is 10 times the previous one. For example, a log axis with a maximum of 1,000 would have the increments 1, 10, 100 and 1000. The lines on the graph between 1-10 represent 2, 3, 4……, and the ones between 10-100 are 20, 30, 40 …, etc. (See the semi-log graph below.) Plot the data on semi-log graph paper or by computer. Directions for creating a semi-log plot in *MS Excel* can be found at the end of this document.

When creating the plot, time in minutes should be graphed on the logarithmic scale axis (usually the x axis) and drawdown in feet on the normal scale axis (usually the y axis). Mark the points on the graph by matching the drawdown measurement on the y axis to the elapsed time on the x axis. For example, the graph below shows one measurement of 11.51 ft. taken at 10 minutes into the test.

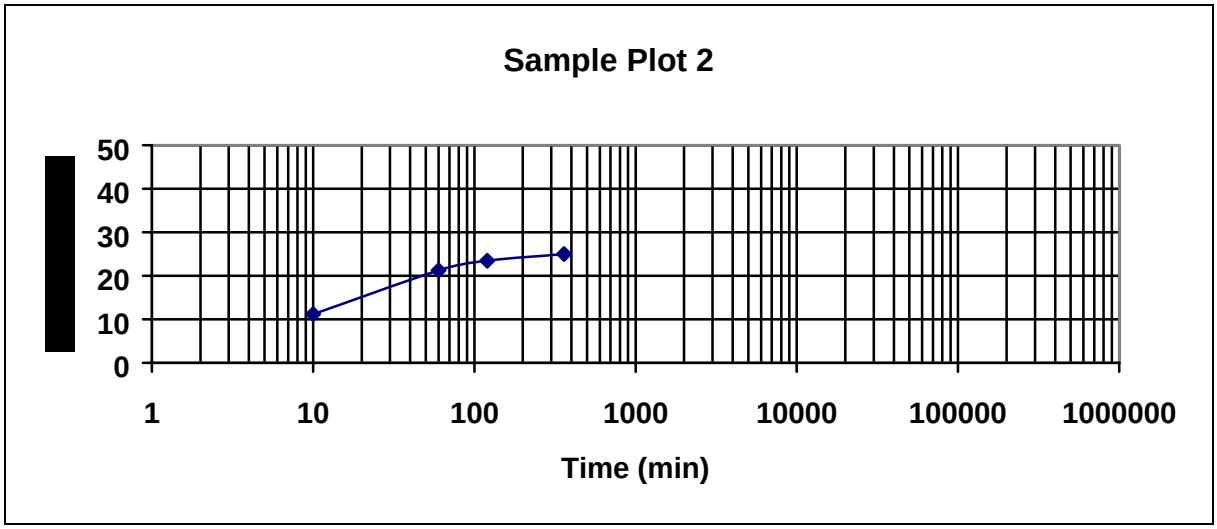


The rest of the measurements are then plotted the same way. Sample Plot 1 employs the data points listed in the table below. For simplicity, only four drawdown measurements are plotted. Use all the measurements taken during the pumping test.

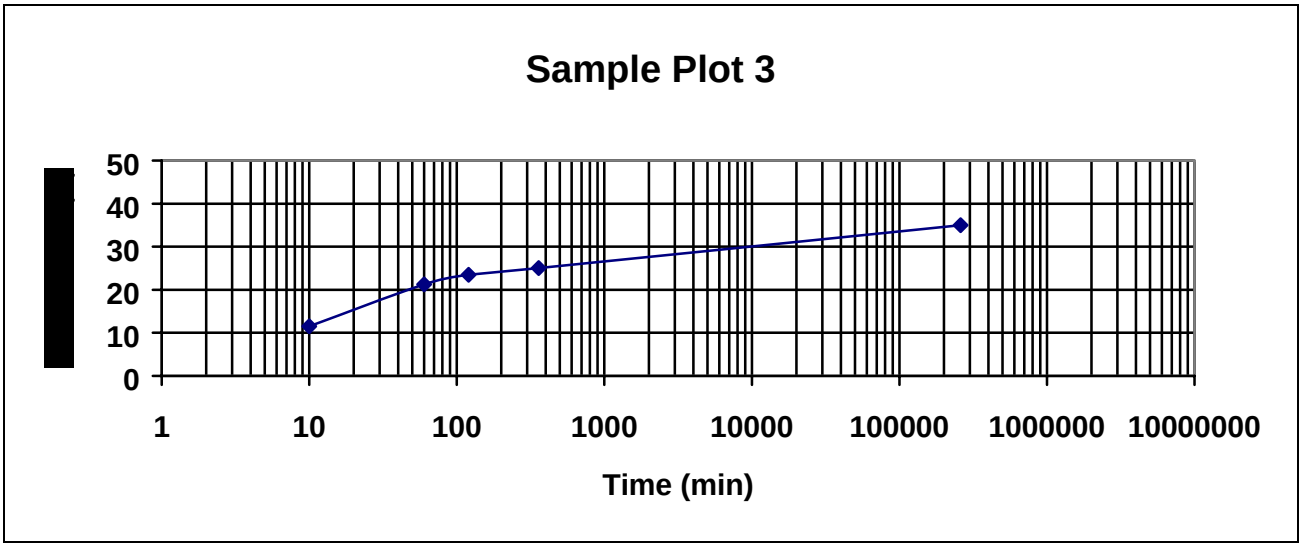
Time(min)	Drawdown(ft)
10	11.51
60	21.24
120	23.46
360	25.03



Now extend the time axis out to 180 days, or 259,200 minutes and the drawdown axis to 20 or 30 feet more than the largest drawdown measurement, as in Sample Plot 2.



Draw a best-fit line by laying a ruler along the data points taken from the last 12-36 hours of the test and marking a straight line through them. Extend the straight line out to the180 day point, or 259,200 minutes, as shown in Sample Plot 3.



Read the drawdown at 180 days from the chart. In this instance that water level is approximately 35 feet. If this water level is below the pump, either lower the final elevation of the pump or continue the pumping test, using a slower pumping rate. After 12 hours of pumping at a constant rate, repeat the process above if stabilization is not reached by the primary method. Please note that the pumping rate may not vary more than +/- 5 % for at least 24 consecutive hours. This may mean extending the test for another day or longer.

Creating A Semi-Log Plot in *MS Excel*

Step 1. Plot the data in two columns in an *MS Excel* spreadsheet. Head the columns with the titles of the x and y axes, usually 'elapsed time' in the x axis column and 'water level' in the y. If you want time on the x axis, be sure to list these data points in the first column Highlight both columns including the headers.

Step 2. Click on “Insert” and then “Chart.”

Step 3. Choose “xy (scatter).”

Step 4. Choose the style you want by clicking on the appropriate box.

Step 5. Click “next” twice.

Step 6. Fill in the appropriate boxes for all the tabs. Check major and minor gridlines on the x axis values section of the gridlines tab. If plotting pumping test results for only one well, uncheck the “show legend” box on the legend tab.

Step 7. Click “next.”

Step 8. Click “finish.”

Step 9. Move the chart to its final location by clicking on it until the corner boxes show, then drag the chart into position.

Step 10. Right click on the x-axis data numbers.

Step 11. Choose “format axis” from the pop-up menu.

Step 12. Click the “scale” tab and click in the box labeled “logarithmic scale” at the bottom of the window. Change the maximum scale to 1,000,000. If necessary, change the ‘major’ and ‘minor unit’ to 10.

Appendix C

Guidance for Conducting and Reporting SDWA Analyses
For New Community Wells and Groundwater Sources of Bottled Water

The following parameters are required for water quality analysis of a new drinking water source for a community water supply system or source of bottled water. This guidance will be updated periodically. The applicant is responsible for obtaining and using up-to-date information. Contact NHDES at (603) 271-2947 with questions and for the most recent guidance.

The laboratory must: apply EPA approved drinking water methods.
have current drinking water certification for all analyses.
identify all subcontracted analyses, laboratories and their certification.

Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
E. coli	Bio	Absent	Presence
Fecal Coliform	Bio	Absent	Presence
Total Coliform	Bio	Absent	Presence
Arsenic	IOC	0.010	0.005
Aluminum[e]	IOC	0.05[e] – 0.2	0.05
Barium	IOC	2	1
Cadmium	IOC	0.005	0.0025
Chloride[d]	IOC	250[d]	250
Chromium	IOC	0.1	0.05
Copper[c]	IOC	90% of trigger[c]	1.3
Copper[d]	IOC	1.0[d]	1.3
Cyanide (as free C)	IOC	0.2	0.1
Fluoride[a]	IOC	4.0 [a]	2.0
Fluoride[d]	IOC	2.0 [d]	2.0
Iron[d]	IOC	0.3[d]	0.3
Lead[c]	IOC	90% of trigger[e]	0.015
Manganese[d]	IOC	0.05[d]	0.05
Mercury	IOC	0.002	0.001
Nickel[n]	IOC	n.e.[n]	
Nitrate (as N)	IOC	10	5
Nitrite (as N)	IOC	1	0.5
Selenium	IOC	0.05	0.025
Silver [e]	IOC	0.1[e]	0.1
Sodium[e]	IOC	100-250[e]	250
Sulfate[d]	IOC	250[d]	250
Sulfide[e]	IOC	0.05[e]	0.05
Antimony	IOC	0.006	0.003
Beryllium	IOC	0.004	0.002
Thallium	IOC	0.002	0.001

Parameter	Group	MCL (mg/l)	Trigger (mg/l)
Zinc[d]	IOC	5[d]	5
pH[d]	IOC	6.5-8.5[d]	8.5
Uranium (Mass)	Rad	30 ug/L	If Detected
Radium 226[e]	Rad	n.e.[e]	
Radium 228[e]	Rad	n.e.[e]	
Radium 226 & 228 (Combined)	Rad	5 piC/l	If Detected
Analytical Gross Alpha[e]	Rad	n.e.[e]	
Radon[k]	Rad	n.e.[k]	
Compliance Gross Alpha	Rad	15 piC/l	If Detected
Beta Particles[i]	Rad	4 mrem/yr[i]	If Detected
Endrin	SOC	0.002	If Detected
Lindane	SOC	0.0002	If Detected
Methoxychlor (DMDT, Martate)	SOC	0.04	If Detected
Toxaphene	SOC	0.003	If Detected
Dalapon[h]	SOC	0.2[h]	If Detected
Diquat[h]	SOC	0.02[h]	0.02
Endothall[h]	SOC	0.1[h]	0.1
Glyphosate	SOC	0.7	If Detected
Di(2-ethylhexyl)adipate	SOC	0.4	If Detected
Oxamyl (Vydate)	SOC	0.2	If Detected
Simazine	SOC	0.004	If Detected
Di(2-ethylhexyl)phthalate	SOC	0.006	If Detected
Picloram	SOC	0.5	If Detected
Dinoseb	SOC	0.007	If Detected
Hexachlorocyclopentadiene	SOC	0.05	If Detected
Aldicarb sulfoxide	SOC	0.004	If Detected
Aldicarb sulfone (aldoxycarb)	SOC	0.002	If Detected
Carbofuran (Furadon, 4F)	SOC	0.04	If Detected
Aldicarb (Temik)	SOC	0.003	If Detected
Atrazine (Atranex, Crisazine)	SOC	0.003	If Detected
Alachlor (Lasso)	SOC	0.002	If Detected
2,3,7,8 TCDD (Dioxin)[h]	SOC	0.00000003[h]	If Detected
Heptachlor	SOC	0.0004	If Detected
Heptachlor epoxide	SOC	0.0002	If Detected
2,4-D	SOC	0.07	If Detected
2,4,5 TP (Silvex)	SOC	0.05	If Detected
Hexachlorobenzene	SOC	0.001	If Detected
Benzo (a) pyrene (PAHs)	SOC	0.0002	If Detected
Pentachlorophenol	SOC	0.001	If Detected
Polychlorinated biphenyls (PCB)[h]	SOC	0.0005[h]	If Detected
Dibromochloropropane (DBCP)[h]	SOC	0.0002[h]	If Detected
Ethylene dibromide (EDB)[h]	SOC	0.00005[h]	If Detected
Chlordane	SOC	0.002	If Detected
Methyl tertiary-butyl ether (MtBE)[g]	VOC	0.013[g]	If Detected

Parameter	Group	MCL (mg/l)	Trigger (mg/l)
Methyl tertiary-butyl ether (MtBE)[d]	VOC	0.020[d]	0.020
Tertiary amyl methyl ether (TAME)[e] (2-methoxy-2-methylbutane)	VOCU	n.e.[e]	
Tertiary butyl alcohol (TBA)[e]	VOCU	n.e.[e]	
Ethyl tertiary butyl ether (ETBE)[e]	VOCU	n.e.[e]	
Di-isopropyl ether (DIPE)[e]	VOCU	n.e.	
1,2,4-Trichlorobenzene	VOC	0.07	If Detected
1,2-Dichloroethylene (cis)	VOC	0.07	If Detected
Chloroform[f,m]	VOCU	n.e.[f,m]	
Bromoform[f,m]	VOCU	n.e.[f,m]	
Bromodichloromethane[f,m]	VOCU	n.e.[f,m]	
Chlorodibromomethane (Dibromochloromethane)[f,m]	VOCU	n.e.[f,m]	
Xylene (total)	VOC	10	If Detected
Dichloromethane (methylene chloride)	VOC	0.005	If Detected
1,2 Dichlorobenzene (o)	VOC	0.6	If Detected
1,4 Dichlorobenzene (para)	VOC	0.075	If Detected
Vinyl chloride	VOC	0.002	If detected
1,1-Dichloroethylene	VOC	0.007	If Detected
1,2-Dichloroethylene (trans)	VOC	0.1	If Detected
1,2 Dichloroethane	VOC	0.005	If Detected
1,1,1-Trichloroethane	VOC	0.2	If Detected
Carbon tetrachloride	VOC	0.005	If Detected
1,2-Dichloropropane	VOC	0.005	If Detected
Trichloroethylene	VOC	0.005	If Detected
1,1,2-Trichloroethane	VOC	0.005	If Detected
Tetrachloroethylene	VOC	0.005	If Detected
Monochlorobenzene (Chlorobenzene)	VOC	0.1	If Detected
Benzene	VOC	0.005	If Detected
Toluene	VOC	1	If Detected
Ethylbenzene	VOC	0.7	If Detected
Styrene	VOC	0.1	If Detected

Abbreviations:

MCL- The **M**aximum **C**ontaminant **L**evel allowed in drinking water
SDWIS – **S**afe **D**rinking **W**ater **I**nformation **S**ystem
Bio - biological
Rad - radiological parameter
IOC - inorganic compound
IOCU - inorganic compound - unregulated
SOC - synthetic organic compound
SOCU - synthetic organic compound - unregulated
VOC - volatile organic compound
VOCU - volatile organic compound - unregulated
n.e. - not established-reporting is required

Footnotes:

[a]Fluoride has a secondary MCL of 2.0 mg/L, and a primary MCL of 4.0 mg/L
[b]pH is expressed in units of hydrogen ion activity
[c]Lead and Copper samples are collected in tap water samples throughout the distribution system
[d]Aesthetic Regulated Secondary MCLs
[e]Recommended additional reporting parameters
[f] Total MCLs combined equals 0.100 mg/L
[g] MtBE has a secondary MCL of 0.020 mg/L and a primary MCL of 0.013 mg/L
[h] State waiver in place-sampling required for initial water quality testing only
[i] Beta particle testing required only for systems deemed vulnerable by the Department and notified that testing is mandatory.
[k] Radon testing only required for initial water quality of new wells

How to Take Water Quality Samples During Pumping Tests

This form describes the different bottles used for an initial water quality sampling of new community water supply wells. Samples should be taken at a sampling tap installed in the discharge pipe. Please read this information carefully since some of the bottles contain preservatives, which should not come in contact with eyes or skin. Keep in mind that the bottle descriptions are for bottles used by the New Hampshire Department of Environmental Services (NHDES) lab; other labs may use different bottles. Please call the NHDES Lab at 603-271-3445 with questions about how to take these samples. Hold times for the samples vary from as soon as possible to six months, depending on the test.

All samples must be kept on ice. Ice packs will not keep them cold enough. The NHDES lab will reject all samples warmer than 50°F.

IOC Sampling

Bottles used: 1 round plastic 125 mL bottle for bacteria.
1 square, 500 mL pre-cleaned bottle for metals.
1 pear shaped, 100 mL bottle for cyanide.
1 oblong shaped, 500 mL bottle for anions, alkalinity, and pH.

Preservatives in bottles: 5 mL of concentrated nitric acid added to metals container;
3 pellets of sodium hydroxide to cyanide container;
no preservative in anion container,
1 sodium thiosulphate pellet added to bacteria container.

Procedure for filling bottles: Turn on sampling tap and run water for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that the stream of water is no greater than 1/8 inch in diameter. Remove container caps. Do not put caps face down or in pocket. Do not allow inside of caps, inside of container or bottle threads to be touched by any object. Use caution when filling these bottles. The square bottle contains acid. As the water comes in contact with the acid a white cloud will drift from the bottle. This is normal. Do not put your face within the cloud or inhale the fumes. Fill bottles to shoulder. Do not overflow. Screw caps on securely.

Nitrate and/or Nitrite Sampling

Bottle used: Pre cleaned plastic or glass bottle (usually 40 mL), yellow cap.

Preservatives in bottle: None

Procedure for filling bottle: Same procedure as IOC sampling.

Radiological Sampling

Bottles Used: 1 pre-cleaned 1-gallon plastic bottle and 1 40 mL glass vial with Teflon septa.

Preservatives in Bottles: There are no preservatives in either bottle.

Procedure for filling bottles: Same procedure as IOC sampling.

SOC Sampling:

(Please note, if using the NHDES Lab, SOC samples must be scheduled prior to collection. Call the lab at 603-271-3445 for an appointment. If using a private lab, call in advance for their policies regarding the scheduling of tests.)

Bottles used: 2 pre-cleaned one-liter amber glass bottles with Teflon-lined caps.
6 pre-cleaned 40 mL glass vials with Teflon-lined caps.

Preservatives in Bottles: Both types of bottles contain chemical preservatives. Use caution when taking samples.

Procedure for filling bottles: Turn on sampling tap and run for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.

For each one-liter bottle: Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object. Do not rinse bottle. Use caution when filling these bottles, open them slowly and carefully to avoid acid burns. Fill to shoulder of the bottle. Screw on cap securely.

For each of the 40 mL vials: Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside or vial or bottle threads to be touched by any object. Use caution when filling these bottles, open them slowly and carefully to avoid chemical burns. Do not rinse vial. Fill vial to the top creating a crown but do not overflow due to the preservative. Screw on cap securely. Check for air bubbles by inverting the vial and gently tapping the cap. If bubbles are present, add additional water.

VOC-MTBE-TTHM and HAAS:

Bottle used: 2 pre-cleaned 40 mL glass septum vials with Teflon septa each sample site.

Preservatives in Bottles: 0.25 mL of 1:1 Hydrochloric acid.

Procedure for Filling Bottles: Turn on sampling tap and run for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter. Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object. Do not rinse bottle. Use caution when filling these bottles, open them slowly and carefully to avoid acid burns. Fill to the top, creating a crown, but do not overflow due to preservatives in the bottle. Screw on cap securely. Check for air bubbles by inverting the vial and gently tapping the cap. If bubbles are present, add additional water.

Appendix D

Microscopic Particulate Analysis (MPA) Sampling Guidance

If the well is being approved as a new well, or an existing well being reactivated and a standard pumping test is required, the MPA sampling can be run either at the end of the test or during it, provided tasks (a)-(k) below are performed. These wells are typically not plumbed to a pumphouse.

If the well is an existing well and MPA sampling is required because the well is suspected of producing groundwater under direct influence of surface water (GWUDI), or if the well is already plumbed to a pumphouse, tasks (l)-(t) below should be performed.

The discharge flow rate for sampling is very low, only 1-2 gpm, so the sampling valve must be equipped with a meter to determine flow rate. Also the MPA sampler(s) must be able to measure the temperature, pH, and specific conductance of the discharged water, either through the diverter for the MPA analysis or from the discharge water that is to be pumped to waste.

New Well or Reactivated Well With Pumping Test:

a. NHDES generally follows USEPA's *Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA).* The method constitutes diverting 500-1,000 gallons of source water through a synthetic filter over an approximate 8 to 24-hour period at a flow rate of between 1-2 gpm.

b. Equip the pump discharge piping with a diverter valve that is to be used with the filter assembly before the start of pumping. See Figure 1 for an example of the type of set-up needed, per the guideline in item (a.) above. Please note that the valve/faucet control can be either on the inlet or outlet line. It is more commonly located on the inlet line.

c. If the filter canister is clear plastic it should be protected from sunlight. Wrap the canister with any material that will exclude light. Sunlight causes some surface water organisms to multiply, resulting in a false high count. If testing is performed in cold weather, the canister must be protected from freezing.

d. Begin pumping the production well at the constant rate required for new well approval and start monitoring pH, conductivity and temperature in both the discharge water and the nearby surface water feature(s). Preferably, monitoring for these parameters should begin as soon as feasible during the pumping test, however; an acceptable minimum monitoring period prior to MPA sample collection is 8 to 10 hours.

e. The stabilization criteria for discharge water screening parameters is considered the following:

i. **pH** : +/- 0.2 standard units
ii. **Specific Conductance** : +/-3%
iii. **Temperature** : +/- 2 degrees Celsius (about 3 to 4 degrees Fahrenheit)
iv. Minimum stabilization time for the parameters above (i. – iii.) that needs to be demonstrated prior to sample collection: **8 to 10 hours**

f. After 8 to 10 hours of demonstrated stability for pH, specific conductance, and temperature, the MPA sampling should commence. If the parameters in (e) above vary widely or do not converge then screening shall continue until screening parameters meet the stabilization criteria and then MPA sampling should commence. If convergence has not occurred prior to the end of the standard pumping test, contact NHDES for further guidance.

g. Divert water through the MPA filter apparatus only after field parameters have stabilized [see (e) above].

h. Prior to starting the MPA sampling, run pump discharge water through the empty canister for several minutes to rinse it. After rinsing, turn off water to the canister, pour out the rinse water and insert the filter. Use latex gloves when handling the filter. Reassemble the canister.

i. Continue to monitor pH, Specific Conductance and Temperature throughout sampling.

j. When sampling is complete, carefully remove the filter from the canister, again using latex gloves, and package according to the directions received with the unit, as provided by your analytical laboratory.

k. Please note that the stabilization criteria listed above are general guidelines and are not "fixed"; NHDES recognizes that site-specific issues and professional judgment play a role in determination of stabilization, and encourage the sampler to contact this office and discuss the issue should it arise.

Existing or New Well Plumbed to a Pumphouse:

l. NHDES generally follows USEPA's *Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA).* The method constitutes diverting 500-1,000 gallons of source water through a synthetic filter over an approximate 8 to 24-hour period at a flow rate of between 1-2 gpm.

m. Equip the pump discharge piping with a diverter valve that is to be used with the filter assembly. With an existing source that is on-line and hooked to the system, this location will most likely be the source tap on the incoming supply line from the well. Please note that attention should be given to the need for backflow prevention between the inlet line of the

sampling apparatus (shown in Figure 1) and both the source and distribution system.

n. If the filter canister is clear plastic it should be protected from sunlight. Wrap the canister with any material that will exclude light. Sunlight causes some surface water organisms to multiply, resulting in a false high count. If testing is performed in cold weather, the canister must be protected from freezing.

o. Set the production well for 'hand' or ‘manual’ operation and begin pumping at a constant rate. The pumped water can be directed into the storage tank or discharged to waste. Start monitoring pH, conductivity and temperature immediately in both the discharge water and a nearby surface water location. These parameters should be monitored for at least 2 hours before starting the MPA.

p. If the pumped water will be directed into the storage tank, excess water should be diverted from the tank to avoid overflow. In some cases temporarily shutting down other system wells so that they do not contribute water to the tank can help reduce overflow. If it is not possible to divert enough water from the storage tank to avoid overflow, care should be taken that overflow of the tank does not cause soil erosion outside the pumphouse, or flooding inside the pumphouse itself.

q. After the 2-hour pumping period divert water through the MPA filter and begin the sampling process. Prior to starting the MPA sampling, run pump discharge water through the empty canister for several minutes to rinse it. After rinsing, turn off water to the canister, dump out the rinse water and insert the filter. Use latex gloves when handling the filter. Reassemble the canister.

r. If the well is equipped with a high capacity pump, it may be difficult to maintain a 1-2 gpm flow through the filter assembly. In these cases a splitter should be attached to the discharge tap used to divert water through the filter. A garden hose can be attached to one arm of the splitter and the filter assembly attached to the other.

s. Continue to monitor pH, Specific Conductance and Temperature throughout sampling for the entire duration it takes to collect a sample (8-24 hours).

t. When sampling is complete, carefully remove the filter from the canister, again using latex gloves, and package according to the directions received with the unit, as provided by your analytical laboratory.

Laboratory Considerations and MPA Sampling Materials:

When your project needs to collect an MPA sample, you should plan to contact your lab well in advance of the pumping test. Since most labs do not perform MPA in-house, they will need extra time to arrange the analysis with a separate lab and order your sample

containers and filter. If your regular lab does not subcontract MPA, contact NHDES for assistance in locating a laboratory that performs MPA.

Figure 1

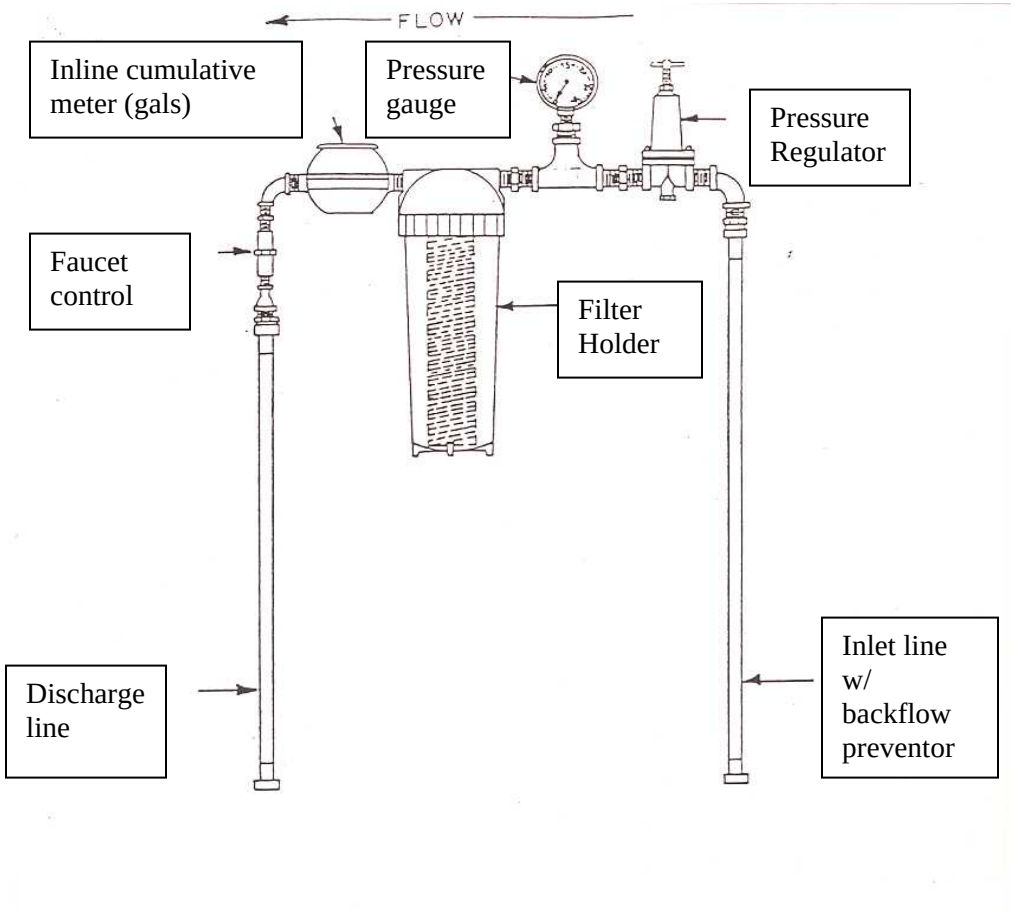


Figure from "Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis". USEPA, October 1992; Find the complete document online at http://www.doh.wa.gov/ehp/dw/GWI.htm.