What is an Assessment Report?

In order to properly protect drinking water, we need to understand what is going on in the surrounding watershed - both above ground as surface water and below ground as groundwater. It is also important to understand how and where surface water and groundwater interact as these are vulnerable areas that need special protection.

The area of land that drains water in a given region is known as a watershed. A watershed can be thought of as bathroom sink. Any rain or snow that falls within the sink-bowl runs down the sides of the sink and into the drain, which can also be thought of as a water supply intake such as a well or surface water intake pipe. Watersheds are based on natural boundaries, created by natural features of the land. They do not follow municipal, provincial or national borders.

An *Assessment Report* looks at an entire watershed, or the bathroom sink, and the factors influencing the quality and amount of water (quantity) found there. *Assessment Reports* are a key requirement of the *Clean Water Act,* involve the technical components outlined below and include information such as the physical characteristics of the land, land uses, where drinking water sources are located, how much water is being used and how much is available for future uses, where vulnerable water source areas are located, what issues already compromise drinking water sources and what threatens drinking water sources from overuse and contamination.

Assessment Reports will provide Source Protection Committees with information that will help determine how best to protect the quality and amount of their local water resources. *Assessment Reports* will be the basis for developing Source Protection Plans and making local policy decisions for protecting drinking water quality and quantity.

1. What is a Watershed Characterization?

The introductory part of the Assessment Report is a characterization of the watershed. It provides a snapshot of the watershed today. It answers questions such as: What is the land's surface like? Where are the rivers and wetlands located? Where are the roads? What types of soils are there? What types of bedrock are there? Where are the factories? Where do people live? A *Watershed Characterization* is a collection of information that reports specifically on:

Local Watershed Description

A description of the local watershed area, including information on natural characteristics, population distribution, and land use.

Water Quality

Information on water quality and trends in the watershed to determine if the water quality is improving, deteriorating, or staying the same.

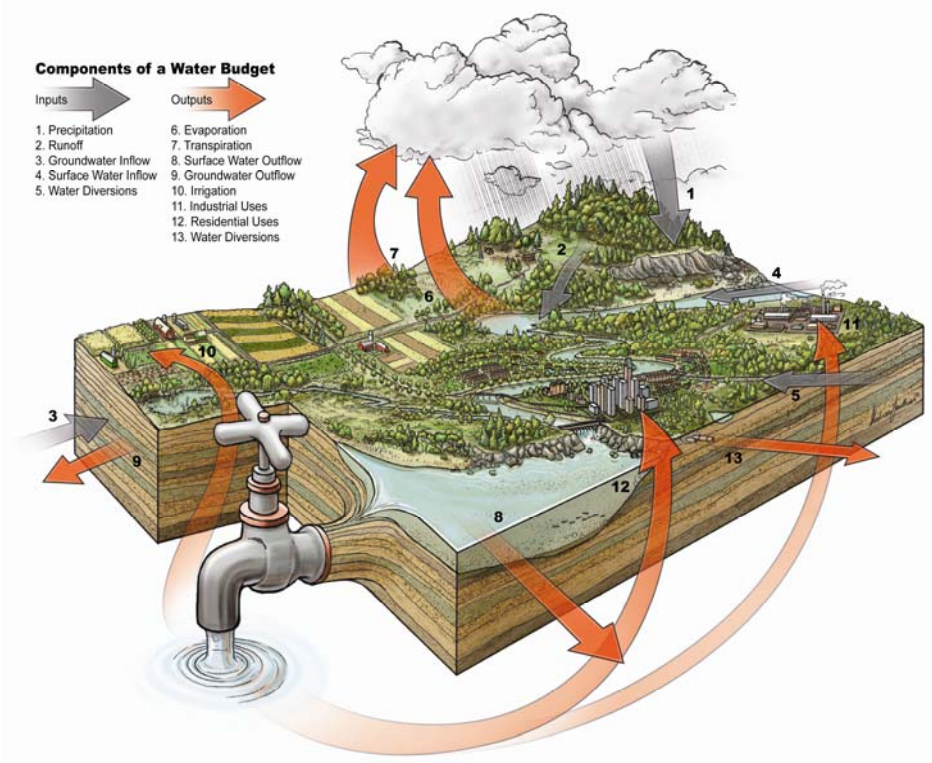
General Water Use

Information on water use by drinking water systems to show the current draw on water sources.

2. What is a Water Budget?

Water Budgets are another critical component of the Assessment Report. They focus on water quantity, or how much water there is available. A *Water Budget* looks at how much water enters a watershed, how much water is stored and how much water leaves. This information helps determine how much water is available for human uses, while ensuring there is still enough left for natural processes (e.g. there has to be enough water in a watershed to maintain streams, rivers and lakes and to support aquatic life). A *Water Budget* is similar to your household budget. How much money do you make? How much have you saved? How much can you afford to spend?

The *Water Budget* process can include up to four levels, which start simple and get more complex if there are concerns about how much water is available at any level. The higher the level or tier, the more complex the science involved and the narrower the geographic focus. The purpose of moving from one tier to another is so those involved in source protection planning can understand where sources of water are located, how much water is being used and to ensure the complex work is focused where it is needed.



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Conceptual Water Budget

A *Conceptual Water Budget* is the first of the four possible water budgets. It looks in general at the amount of water in, and its movement through, the watershed. This includes an overview of the natural inputs and outputs within each watershed, including precipitation (rain or snow), evaporation and transpiration, infiltration and recharge (rainwater that soaks into the ground and becomes groundwater), runoff and groundwater flow.

The *Conceptual Water Budget* also takes into consideration surface water and groundwater features, land cover (e.g. the proportion of urban versus rural uses), human-made structures (e.g. dams, channel diversions, water crossings) and water takings for human uses. An understanding of the effects of local climate change on the *Conceptual Water Budget* over a 25-year period is also included.

The Conceptual Water Budget looks at an entire watershed

Tier 1 Water Budget

A *Tier 1 Water Budget* looks at whether or not a water source can meet water use demands in a subwatershed and not be under stress. It uses simple analytical tools such as spreadsheets and GIS maps to look at the amount of water currently being taken, as well as future takings. It also calculates how quickly a natural water source replenishes itself, known as a recharge rate, which will vary due to several factors including land use, topography and geology. If a subwatershed could be under stress, a Tier 2 Water Budget is required.

The Tier 1 and 2 Water Budgets look at a subwatershed

A subwatershed is a stand-alone area that functions like a watershed, but also joins with other subwatersheds to form one large watershed.

What is a Water Quantity Stress?

The word stress is used to talk about potential concerns with water quantity and means more work needs to be done to better understand the water source, its water uses and the environmental needs of the area.

The level of stress is determined by comparing the amount of water that is available in a subwatershed to the amount of water being used by humans and needed for the environment. The higher the stress level assigned the greater the amount of water being used and the more likely the water source cannot supply enough water for all needs. It is important to understand when, where and how water is leaving a drinking water source and compare it to how quickly that source can be naturally replenished.

Water quantity stressors include water that is taken by municipalities for drinking water; water that is taken by industry for manufacturing and processing; water that is taken by business for activities such as food and beverage processing; water that is taken by agricultural for irrigation; and even private well use. Water quantity stressors include land use activities that reduce or divert water sources. Climate change may also lead to water quantity stress if water supplies become variable or reduced or if a drought occurs.

Tier 2 Water Budget

The *Tier 2 Water Budget* refines and verifies the information gathered under the Tier 1 Water Budget with the goal of better understanding surface water and groundwater sources, the amount of water being used and the potential stress levels. This water budget assesses the stress level of a subwatershed under current, future, planned and drought conditions.

A subwatershed is considered under stress when human demand and environmental needs for water is too high for the natural supply. Based on the amount of available water that is consumed, the stress level for the subwatershed is classified into one of three categories: low, moderate, or significant. Subwatersheds containing communities with a history of water shortages at a well or intake are classified as having a moderate stress level.

If the stress level of the subwatershed is determined to be low in the *Tier 2 Water Budget*, no further water budgets are required. If the stress level of the subwatershed is moderate or significant, a tier 3 water budget is needed.

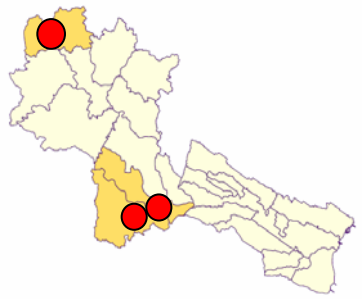
Tier 3 Local Area Water Budget (and Water Quantity Risk Assessment and Threats Identification)

The *Tier 3 Local Area Water Budget* is used to conduct the *Water Quantity Risk Assessment and Threats Identification*. The Tier 3 assessment is only completed if the Tier 2 Water Budget determines that the stress level of a subwatershed is moderate or significant, which means there could be problems meeting existing or future water needs of a community

The *Tier 3 Local Area Water Budget* moves from the subwatershed level to focus on local areas containing municipal water systems, such as areas around a well (known as a water quantity wellhead protection area or WHPA-Q) or areas contributing to a surface water intake (known as a water quantity intake protection zone or IPZ-Q).

The *Water Quantity Risk Assessment and Threats Identification* then looks at how vulnerable each local area (WHPA-Q or IPZ-Q) is to being overused under different land development and water supply scenarios, including current, planned and drought conditions. It determines the level of risk to these local areas as low, moderate or significant.

Local areas containing municipal drinking water systems that are unable to meet current or future water needs will be assigned a significant risk level. If a significant risk is assigned to the local areas during this final water budget, then the threats in these areas will be identified, will be considered significant and will be dealt with in Source Protection Plans.



The Tier 3 Local Area Water Budget looks at municipal drinking water systems, such as *water quantity* wellhead protection areas and intake protection zones

What is a Water Quantity Intake Protection Zone (IPZ-Q)?

The *water quantity intake protection zone* or IPZ-Q includes any area upstream of the water intake that drains into the surface water source, plus any area that would contribute groundwater, in the form of discharge, to the area. Its size is determined using theTier 3 Local Area Water Budget.

The water *quantity* intake protection *zone* (IPZ-Q) encompasses a different area than the water *quality* intake protection zones (IPZ-1,

IPZ-2 and IPZ-3) that are used in looking at how quickly contaminants can reach a municipal surface water intake and affect the quality of water. The *water quantity intake protection zone* (IPZ-Q) includes the areas of the water quality IPZs (IPZ-1, IPZ-2 and IPZ-3) located upstream of a surface water intake.

What is a Water Quantity Wellhead Protection Area (WHPA-Q)?

The *water quantity wellhead protection area* includes the area of land around a municipal well that contributes water to the well (known as a drawdown area), any wells that intersect each other and any local areas that reduce groundwater recharge. Its size is determined using the Tier 3 Local Area Water Budget. The *water quantity wellhead protection area* (WHPA-Q) encompasses a different area from the water *quality* wellhead protection area that is used in looking how quickly contaminants can travel through the ground to a municipal well and affect the quality of water. In most cases, the *water quantity wellhead protection area* (WHPA-Q) includes the area of the water quality WHPA.

What are Water Quantity Drinking Water Threats?

Threats to water quantity include water-taking activities that consume water or otherwise change the amount of water available. That includes any activity that takes water from but does not return it back into the local water source. Threats also include activities that reduce groundwater recharge by not allowing rainwater to enter the ground.

3. What is a Surface Water Vulnerability Analysis?

The Vulnerability Analysis has two parts. It looks at how vulnerable both surface water and groundwater are to contamination.

Because it is above ground, surface water, or water that is found in lakes, rivers and streams, is vulnerable to many types of contaminants. The *Surface Water Vulnerability Analysis* is the part of the Assessment Report that looks at the likelihood that surface water will become contaminated, especially in the areas around drinking water intake pipes. The *Surface Water Vulnerability Analysis* requires that vulnerable areas around intake pipes (also known as water quality intake protection zones or IPZs) be identified, mapped and given vulnerability scores. An uncertainty assessment is also done to identify where the science may need to be improved in future source protection planning cycles.

What is a Water Quality Intake Protection Zone or IPZ?

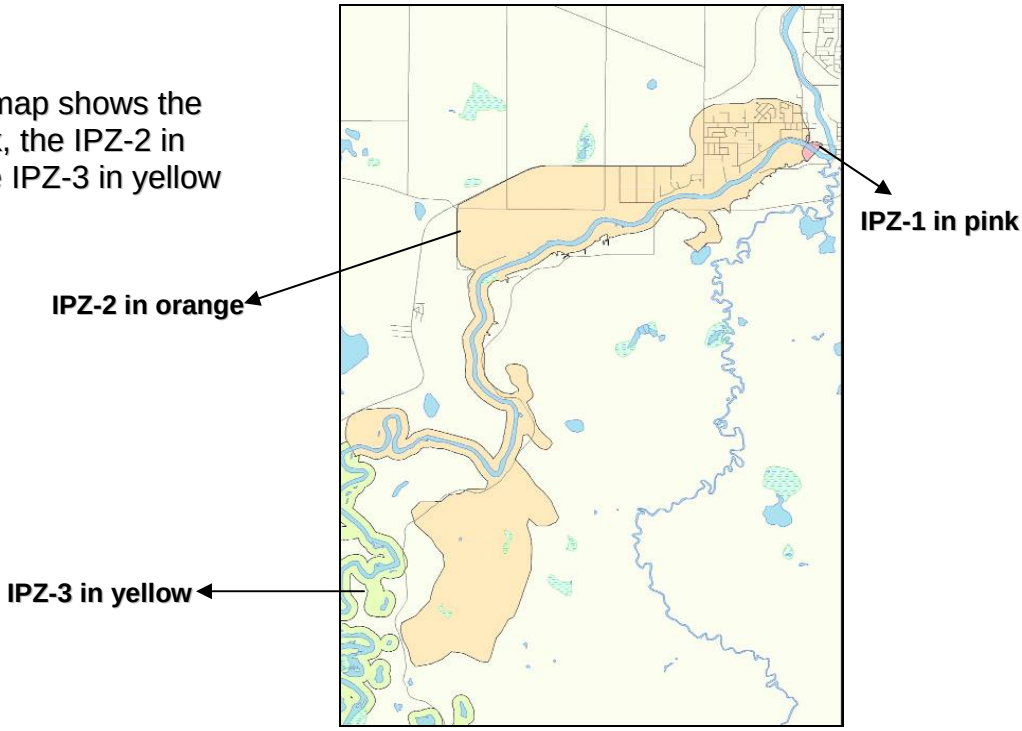
Protecting the area around a surface water intake means protecting the

surrounding water and, in most cases, the land that surrounds the water. This area of water and land is known as an *water quality intake protection zone,* or *IPZ. Water quality intake protection zones* in a large lake where the intake pipe is located far from shore, such as a Great Lake, may end up in the shape of a circle and never touch shore, however, *water quality intake protection zones* in smaller lakes or on rivers may also include the land surrounding it, as well as several smaller feeder rivers or tributaries.

The area of water and land within a *water quality intake protection zone* is determined by a variety of factors such as the amount of time it would take any material spilled in or near a river, for instance, to flow downstream to the water intake. This is called the 'time of travel'. A fast or slow flowing river can change the area of a *water quality intake protection zone* significantly. For example, a fast flowing river may end up with a larger *water quality intake protection zone* than a slow moving river of the same size.

Under the *Clean Water Act,* the Province on Ontario has required that several *water quality intake protection zones* be identified: one for the area immediately adjacent to the intake (IPZ-1); one for the area further upstream where a spill might reach the intake before the plant operator can deal with it (IPZ-2); and a third that includes a larger part of the watershed (IPZ-3).

This sample map shows the IPZ-1 in pink, the IPZ-2 in orange and the IPZ-3 in yellow



For the purposes of establishing the second *water quality intake protection zone*, technical staff examine a minimum time of travel of two hours, although it could be longer if the water treatment plant operator needs more time to shut down the plant in the event of a spill. River flow rates, streams feeding into the river or lake, and the location of municipal storm sewers or rural drains are all considered when determining a *water quality intake protection zone* since they all affect the time it could take a contaminant to reach a water supply intake pipe.

How is the Vulnerability Score of the Water Quality Intake Protection Zone Determined?

Once water quality intake protection zones are identified and mapped, scientific calculations, along with professional experience, are used to determine how vulnerable each IPZ is to contamination. This is called the v*ulnerability score*.

Vulnerability scores are used to look at the potential sources of contamination to determine how much of a threat it is or could be (e.g. the chance of that contamination being released). The activities (e.g. nearby storage of oil or chemicals) that could pose a significant threat to a drinking water source if something did go wrong (e.g. oil or chemical leak) are called significant threats and are the focus of source protection planning under the Clean Water Act. Also, conditions, or contamination which exists due to past practices but which are no longer occurring, are also considered significant threats if they are in a more vulnerable area.

Areas closest to the water quality intake protection zone (IPZ-1) will be assigned higher vulnerability scores than areas further away from the water intake pipe (IPZ-2 and IPZ-3) since the IPZ-1 is closer to the intake and therefore more vulnerable to contamination.

4. What is a Groundwater Vulnerability Analysis?

The *Groundwater Vulnerability Analysis* is the second part of the overall Vulnerability Analysis. It looks at underground sources of drinking water. There are three main areas that are vulnerable to contamination: wellhead protection areas, highly vulnerable aquifers and significant recharge areas. This study identifies and maps these vulnerable areas and assigns vulnerability scores. An uncertainty assessment is also conducted to identify where improvement of the science in the Assessment Report may be necessary in future source protection planning cycles.

What is a Water Quality Wellhead Protection Area (WHPA)?

Wells of all types, municipal and private, urban and rural, pump water from under the ground. This‘groundwater comes from rain or snow that seeps

below ground and pools in cracks or spaces in the soil, sand and rock. These underground sources of water are usually referred to as aquifers. The level of groundwater, or the water table, rises and falls depending on the season, temperature, amount of rain or snow that percolates through the ground and the amount of water withdrawn from the aquifer.

A wellhead is simply the location of the well, usually associated with the physical structure of the well above ground. A *water quality wellhead protection area* (WHPA) is the area around the wellhead where land use activities have the greatest potential to affect the quality of water that flows into the well.

The amount of land involved in a *water quality wellhead protection area* is determined by a variety of factors such as the way the land rises or falls, the amount of water being pumped, the type of aquifer, the type of soil surrounding the well, and the direction and speed that groundwater travels. All of these factors help to determine how long it takes water to move underground to the well itself and how much land around the wellhead should be protected.

Generally, the longer it takes for something (a chemical or pathogen – e.g. bacteria) to get into the well or intake, the less likely it is to be a problem. Think of the well as the CN Tower. If people travel there by car, bus or subway, how long would it take them to get there? What are all the different routes they could take to get there? Some people could be there in 2 minutes if they live nearby. Some could take 25 minutes if they live further away. The same can be said for groundwater traveling to a well. Rain falling near the well could get into it in 2 years, while rain falling further away could take 25 years to get there. Back to the CN Tower example - what if there was a traffic jam? This could slow the people down if they are traveling by car. This is similar to what clay can do to groundwater since groundwater travels more slowly in clay than it does in sand and gravel. So maybe the people decide to take the subway because it is faster. This is similar to water traveling through a sandy aquifer.

What is a Significant Recharge Area?

An aquifer is an area of soil or rock under the ground that has many cracks and spaces and has the ability to store and release (as discharge) a significant amount of water. Water that seeps into an aquifer is called ‘recharge’. The natural recharge of an aquifer comes from rain and melting snow.

The land area where the rain or snow seeps down into the ground and flows to an aquifer is called a *recharge area*. *Recharge areas* often have

loose or permeable soil, such as sand or gravel, which allows the water to seep easily into the ground. Areas of bedrock without much soil over it, and where a lot of fractures/cracks exist, are also often *recharge areas*. In some areas, where the soils are tighter or more compact, it is harder to determine where the recharge areas are. *Recharge areas* are significant when they supply more water to an aquifer used for drinking water than the land around it.

What are Highly Vulnerable Aquifers?

Aquifers are considered highly vulnerable based on a number of factors, including how deep it is underground, what sort of soil or rock is covering it and the characteristics of the soil or rock surrounding it. Soil or rock that has many large cracks and spaces, and is looser rather than more compact, allows water to flow quickly into an aquifer. Generally, the faster water is able to flow through the ground to an aquifer, the more vulnerable the area is to contamination.

How is the Vulnerability of a Water Quality Wellhead Protection Area Determined?

Areas within water quality wellhead protection areas (WHPAs) are given a number value or score to show how vulnerable that area is to contamination. The higher the number (ranging from 2 to 10), the more vulnerable the area, and, more importantly, the more vulnerable the underground aquifer is. The vulnerability scores are determined using science and mathematical equations that look at factors such how deep the aquifer is, what types of soils are present, and how quickly water can travel through the ground.

5. What is the Drinking Water Quality Threats Analysis?

The final component of the Assessment Report is the *Drinking Water Quality Threats Analysis*. It examines existing water quality issues in a drinking water system and identifies and describes threats that contribute to, or have the potential to impact, municipal drinking water sources. It also identifies what activities would pose a threat to drinking water if they were located in a vulnerable area in the future.

Drinking water issues can be chronic, which means they have existed over a long period of time or reoccur seasonally and are likely to continue if nothing is done to address the activities that cause them. Through the source protection planning process, issues that impact water quality will be linked to specific land uses and areas so that actions can be taken to manage them.

For the *Drinking Water Quality Threats Analysis*, drinking water threats are classified as significant, moderate or low. In order for a threat to be included in

the Assessment Report, it must first be recognized by the Provincial government in the official threats table. Threats not listed by the Provincial government can be included with proper approval. To add a threat, it must be proven, using science and professional experience, that the threat has the ability to impact human health.

What is the Difference Between Issues, Activities and Conditions?

The first step in understanding the *Drinking Water Quality Threats Analysis* is understanding three important terms that apply to water quality threats: *issues*, *activities* and *conditions*.

In terms of source protection planning in Ontario, the pre-set threats table includes 21 potentially harmful *activities* that pose a threat to a source of drinking water and will need to be addressed through source protection plans. *Conditions* refer to contamination that already exists and is linked to past activities. *Issues* are known problems with water quality for a source of drinking water.

Examples of human activities that could negatively affect local water quality if not managed properly include:

- Chemical storage
- Spreading sewage treatment sludge
- Storing and spreading road salt
- Animal feedlots
- Use of fertilizers and pesticides
- Accidental spills of hazardous materials
- Septic systems
- Underground storage tanks
- Underground pipelines or sewers
- Landfills
- Wastewater discharge
- Sewage bypasses
- Storm water runoff
- Mining

For instance, arsenic can be found in drinking water sources and can result from either human activities, such a mining, or be naturally occurring. The presence of unacceptable levels of arsenic is considered an *issue*. If it is linked back to an operating, regulated mine, this site, or *activity*, is an activity-related threat. If the source of arsenic is from an historical mining site that is no longer controlled by regulations, then it is considered a *condition*. Regardless of whether or not it is an activity or a condition that contributes to the issue, if arsenic in a drinking water source

is above acceptable levels, steps will need to be taken to address it in a Source Protection Plan.

What is a Source Protection Plan?

In general, a *Source Protection Plan* builds on the information collected in the Assessment Report to establish policies to protect drinking water sources. Although the Ministry of the Environment has not yet completed regulations to outline what they will require in the plans, the Clean Water Act states that the plans must address significant threats to drinking water quality and quantity.

There are various tools and approaches that may be included in a Source Protection Plan. Many of these are already available to people who manage land uses and activities, such as municipalities, for the protection of drinking water. Some of these will be familiar to people, such as land-use planning (by-laws and zoning), regulations (e.g. you need a nutrient management plan to apply animal waste), and stewardship (e.g. education and Best Management Practices). Others may be less familiar, such as monitoring water quality to make sure an activity is not impacting the local area in a way that would negatively impact drinking water sources.

What is a Source Protection Committee?

Conservation Authorities, which have been grouped into 19 Source Protection Areas and Regions for efficiency, and participating Municipalities have been responsible for conducting the various technical components that make up the Assessment Report. Established in late 2007, Source Protection Committees, with support from Conservation Authority and Municipal staff, are responsible for developing source local, watershed-based source protection plans by 2012.

These committees involve almost 290 locally-recruited members across Ontario, including:

- **93 Municipal representatives** (one third of Source Protection Committees are made up of representatives from local municipalities);
- **93 Agriculture, Commercial, Industrial and Small Business representatives** (one third of source protection committees are made up of representatives from the following sectors: agriculture, industry, aggregates, commerce, tourism and recreation, land developers, golf courses, mining, petrochemical, forestry and transportation);
- **93 members who fall under the category of 'other' representatives** (one third of source protection committees are made up of representatives from landowner and lake associations, environmental groups, the public at large and topic experts.
- additional seats are available for First Nations representation in areas where reserves are located

How will Source Protection Planning affect me and my community?

Source protection planning will affect everyone to different degrees. First of all, it will ensure municipal sources of drinking water are protected and communities will have a healthy source of water now and for the future. Depending on where you live, however, what sorts of activities you engage in and how much you want to get involved, you may be affected to a greater degree than other people you know.

If you live near an Intake Protection Zone, a Wellhead Protection Area, or near a Highly Vulnerable Aquifer or Significant Recharge Area and you engage in any type of activity that could pose a significant threat to a drinking water source, there is a good chance you will be required to make some changes. If you run a business or agricultural operation in one of these areas, you may need to make a lot of changes, or, depending on how you currently operate, you may not need to make many or any changes. If you are following recognized best practices and regulations for your industry then it is likely you already doing enough to manage your activity. In very rare instances where a landowner or business is operating in a manner that poses a significant risk to a drinking water source, they may have to make more substantial changes to the operation. The best way to reduce the effect of any changes will be to work together co-operatively with the regulating body.

At this point in the source protection planning process, while the technical work is still being conducted, it is hard to know what the impacts of a source protection plan will be. After 2012, when vulnerable areas have been identified and mapped, threats have been determined and verified, and Source Protection Plans are complete, we will have a better idea of the measures needed to protect our sources of drinking water from contamination and overuse. Whatever changes that may be required of you, it's always good to remember that the cost of cleaning up a contaminated source of water or finding a new source of water is always much higher than protecting it in the first place.

How do I know if I am a threat to drinking water?

Every Source Protection Area or Region will approach Source Protection Planning somewhat differently because every community is different, with different issues and unique needs. In some watersheds, water intake pipes might already be naturally protected because they are far away from any sort of threat or threatening human activity. In another watershed, the wellhead might be next to a major highway or in the centre of a town and be exposed to multiple threats.

Every day, as more information is collected, more research is completed, more maps are created and more technical guidance from the Province is finalized, the

answer is becoming clearer about what is a threat to municipal drinking water sources and who needs to be notified. If you end up being in a vulnerable area, you will be notified by your local Conservation Authority. You can stay involved by watching local papers or making a point of regularly checking the website of your local Source Protection Area (to find a listing, go to www.conservationontario.ca > What We Do > Protect Water > Drinking Water Source Protection and look for a link for finding your local *Source Protection Area or Region*).

Regardless of where you live and whether or not you live or work near a vulnerable area, you can still help protect your local sources of drinking water. For more information on how to conserve water in your home, in your yard and how to ensure you don't pose a threat to local rivers, lakes, streams, aquifers or recharge areas, go to www.conservationontario.ca > What We Do > Protect Water.