

# Nitrate in the Environment

## Nitrogen in the Environment

Nitrogen is the most abundant element in the atmosphere and nitrate is one of the more common forms of nitrogen in the environment. It is an essential nutrient for plant growth but too much nitrate can contaminate groundwater which we use as a source of drinking water, or can affect the quality of aquatic habitat such as our rivers, streams and estuaries. There are many

sources of nitrate in the environment, including deposition from the atmosphere, decomposition of plant and animal material, sewage, manures and chemical fertilizers. The relationship between these sources, and the mechanisms by which nitrate travels through the environment is complex (see Figure 1).

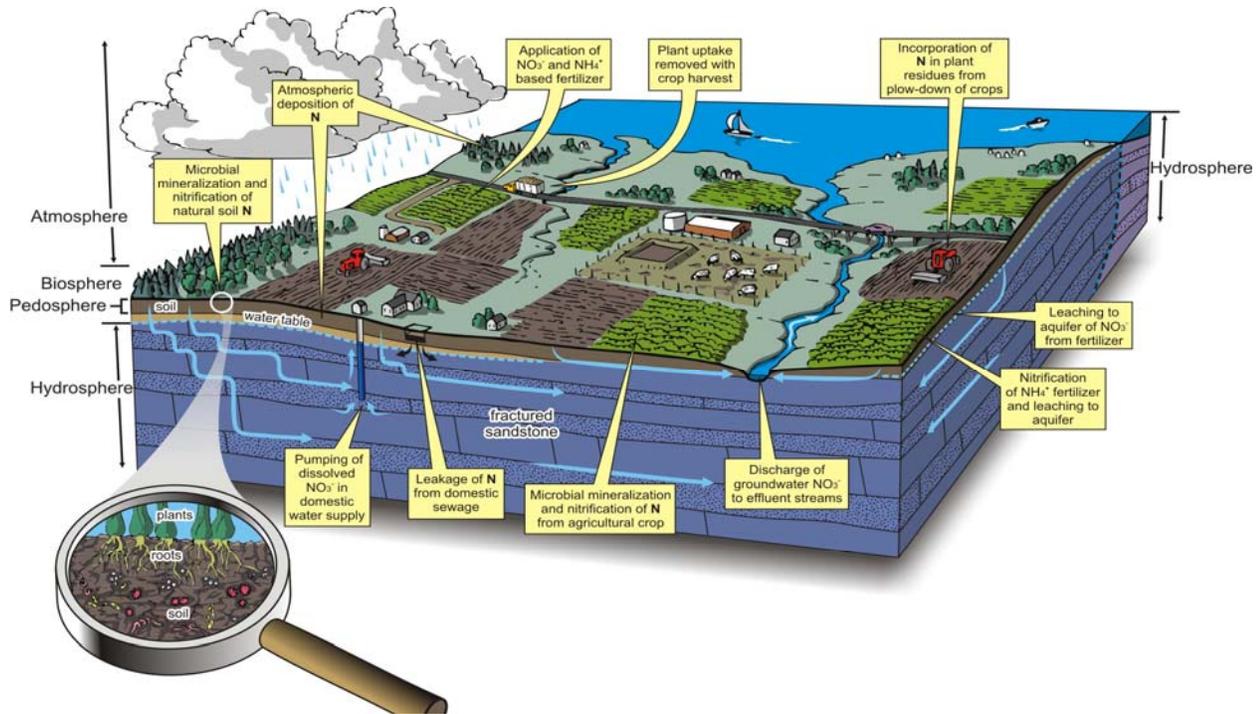


Figure 1. Nitrogen in the Environment (source: Consequences of climatic changes on contamination of drinking water by nitrate on PEI, NRCAN, 2007; [http://adaptation.nrcan.gc.projdb/pdf/109\\_e.pdf](http://adaptation.nrcan.gc.projdb/pdf/109_e.pdf))

## Nitrate in PEI Groundwater

Groundwater is the sole source of drinking water in PEI, and it is recommended that nitrate levels in drinking water do not exceed 10 mg/L. Average nitrate levels in PEI groundwater range from the low background levels expected in a relatively pristine environment, to levels 3 to 5 times higher in areas of more intensive agricultural activity (Figure 2). While on an Island-wide basis, nitrate levels in about 4% of wells exceed the acceptable level, in some areas as many as 1 in 5 wells may exceed this guideline.

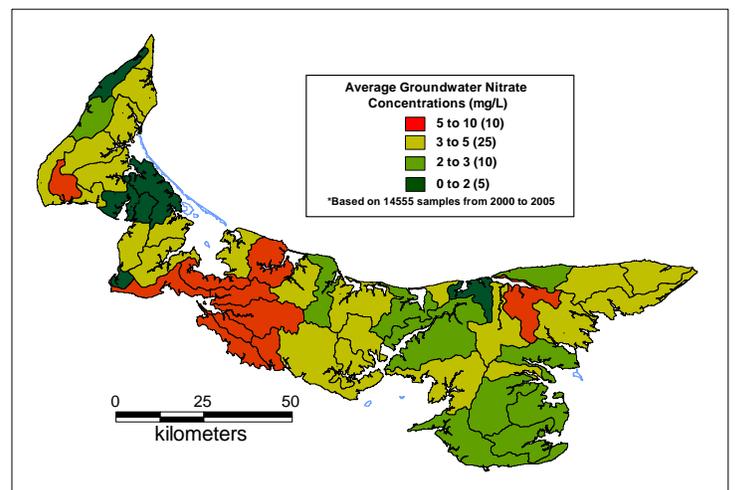


Figure 2. Average nitrate concentrations in groundwater in PEI

## ***Nitrate in PEI Surface Waters***

Nitrate plays an important role in the health of our fresh surface bodies and also our estuaries. Nitrogen is one of the key nutrients for the growth of aquatic plants, and thus an important link in the food chain. Like anything else, however, there can be too much of a good thing.

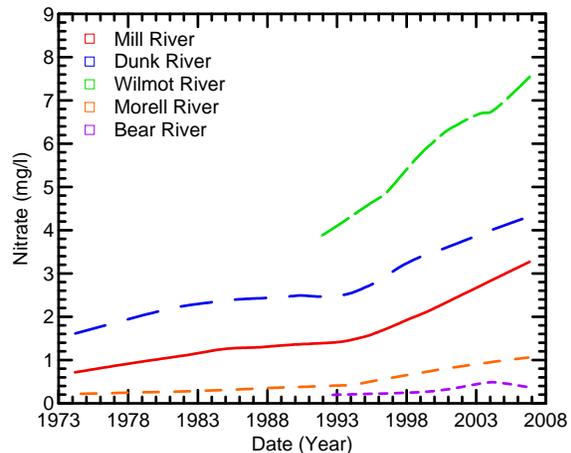
Excessive nutrient levels, in combination with a number of other factors, can lead to an overabundance of some aquatic plant species in our estuaries. This rapid growth of some plant species upsets the natural balance of the ecosystem.

In addition, as this abundant plant material dies and decomposes, it consumes oxygen, sometimes stripping all of the oxygen from the water, causing the death of shellfish and plants and producing very obnoxious odors.

Unlike drinking water, where levels of up to 10 mg/L are considered safe, levels as low as 1.5 to 2 mg/L can be of concern to some forms of aquatic life.

### ***The “link” between nitrate in groundwater and nitrate in surface waters:***

In PEI, there is a close link between groundwater and surface water. When precipitation falls to the ground, some of it evaporates, some runs off quite quickly into streams, ponds and the ocean and a large portion (about 30-35%) soaks into the ground and becomes groundwater. This groundwater in turn “discharges” slowly back to the surface through springs and directly into surface water bodies, and makes up almost two-thirds of the water we see in our fresh water streams on an annual basis. During dry times of the year, this groundwater discharge (often called “base-flow”) makes up almost all the water we see in our streams. When this discharging groundwater is rich in nitrate, it represents the dominant pathway by which nitrate from the land surface is transported to our water ways. Figure 3 below shows the trend of nitrate transported from groundwater to surface water in five river systems in PEI.



**Figure 3. Historical trends for the concentration of nitrate in base-flow to 5 Island Rivers**

### ***The Future – Nitrate management on a watershed basis***

Nitrate levels in both groundwater and surface water have been increasing over a long period of time, and it is unlikely that these trends can be reversed quickly. At the same time, a great deal of study had been devoted to understanding the sources, behavior and distribution of nitrate in the environment. This information will assist in the development of effective strategies to reduce the impact of nitrate on our environment.

One thing that is clear is that the problem is complex, and will require the commitment and involvement of all sectors and stakeholders who share this resource. Only by working cooperatively on the wide range of factors that contribute to the overall distribution of nitrate in our waters, will we make meaningful progress in improving the quality of our groundwater and surface waters.

Watershed planning and management is a process to work cooperatively that is respectful of social and economic needs while providing for the restoration and protection of the environment. Everyone lives in a watershed and needs to be involved in the watershed planning process that sets the goals and objectives for their local area. To become involved, contact your local community watershed group. Contact the Department of Environment, Energy and Forestry (toll free 1-866-368-5044) if you need to determine which watershed group is in your area.