

# WETLANDS AND WATER QUALITY



## WETLANDS: NATURE'S NATURAL FILTER

Fresh water is a vital resource for human society. We depend upon water for drinking, hydropower, irrigation, cooling, and cleaning; for products such as food, plants, and minerals; and for services such as waste purification, transportation, and recreation. Currently, freshwater resources are being depleted and degraded on a global scale. To ensure long-term sustainability of water resources, we must protect and enhance natural landscape features that ensure water quantity and quality in the future.

### Wetlands

Wetlands serve important hydrologic, geochemical and biological functions in a watershed. Wetland benefits include flood mitigation, groundwater recharge, water quality improvements, carbon sequestration and wildlife habitat. Canada has already lost more than 70% of its original wetlands in the prairie region. This substantial loss is a concern for water quality in Alberta.

### Water Quality

Wetlands influence many aspects of water quality, including nutrients, suspended solids, pathogenic microbes, and anthropogenic pollutants such as pesticides. Because of their high biological productivity, wetlands can transform many pollutants into harmless by-products via natural processes.

### Wetlands Social Return on investment

According to "A business case for wetlands Conservation and Restoration in the Settled Areas of Alberta Vermilion River Subwatershed Case Study", for every \$1 spent on wetland retention society receives \$6.91 in benefits. This benefit encompasses not only water Quality improvement, but all of the ecological goods and services that result from the natural function of wetlands.

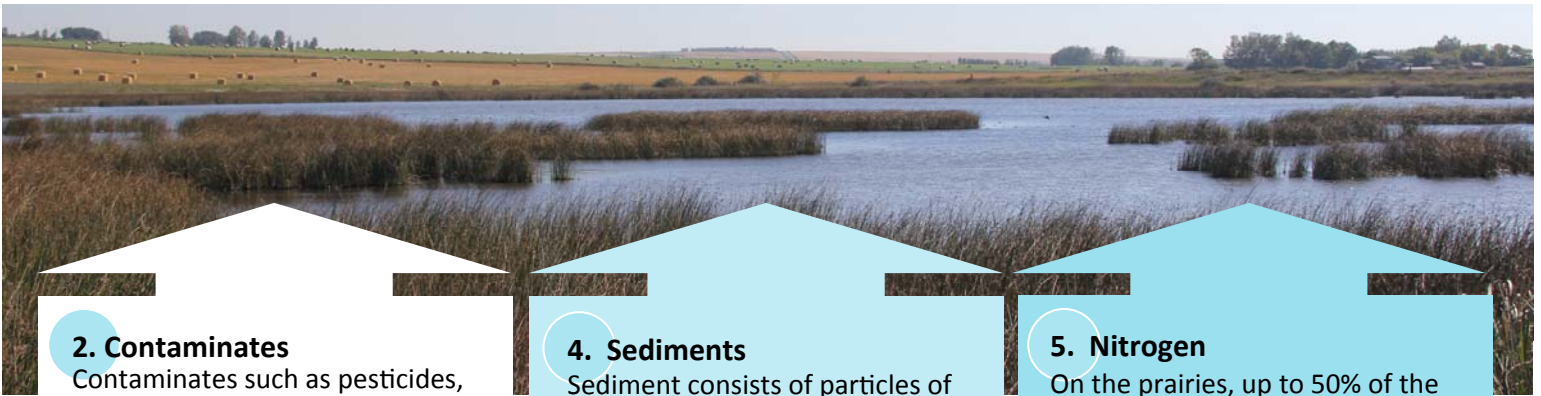
## 1. Phosphorus

Phosphorus enrichment of surface waters, whether by agricultural runoff or by wastewater effluent, and the resultant increase in primary production may lead to many undesirable effects on aquatic systems. These include blooms of nuisance algae that clog water intakes, increased turbidity of water bodies, decline of aquatic macrophytes due to shading, and many other water quality concerns.

### *How can wetlands help?*

Phosphorus retention is considered one of the most important attributes of natural wetlands and is key to determining downstream water quality. Phosphorus retention in wetlands is accomplished by three mechanisms: (1) adsorption onto peat and clay particles; (2) precipitation of insoluble phosphates with metals (iron, calcium and aluminum) under aerobic conditions; and, (3) incorporation into living biomass of bacteria, algae, and macrophytes.

Wetlands are estimated to remove up to 92% of the phosphorus received directly from overland runoff, in some studies reducing up to 46% of phosphorus in rivers.



## 2. Contaminates

Contaminates such as pesticides, metals, landfill leachate, and urban runoff degrade water quality. A study of pesticides in Saskatchewan farm ponds revealed that 100% of wetlands contained some level of popular agricultural pesticide, 2,4-d.

### How can wetlands help?

Photolysis and adsorption in wetlands help to increase pesticide dissipation. High level of productive plant growth in wetlands, increases the availability of surface area for adsorption, plant sequestration, microbial degradation and exposure to light for photolysis.

## 3. Pathogens

Waterborne pathogens can spread infectious diseases that are of serious risk to humans and animals.

### How can wetlands help?

The ability of wetlands to retain water, and the biological functions that they support, lead to the natural die-off or predation of pathogens, or entrapment by sedimentation or adsorption. Wetlands can remove 80%-90% of pathogens in water.

Contaminant	Retention (%)
Nitrogen (Nitrate)	Up to 87%
Nitrogen (Ammonium)	Up to 76%
Phosphorus	Up to 94%
Sediment	Up to 98%
Coliforms (Constructed wetlands)	Up to 99%
Pesticides	< 1 day to several months <sup>1</sup>

<sup>1</sup> Time for residues to decrease by 50%

**Table 1:** Range of percent retention for nitrogen, phosphorus, sediment coliforms and pesticides in natural wetlands

## 4. Sediments

Sediment consists of particles of all sizes, from fine clay particles to silt, sand, and gravel. Sedimentation and siltation of these particles and organic matter can damage aquatic ecosystems by clogging fish gills, suffocating bottom-dwelling (benthic) organisms, reducing fish reproductive habitat (benthic substrata), reducing water clarity, reducing primary productivity due to physical burial and reduced light availability, transporting chemicals attached to sediment particles, and gradually infilling water bodies.

### How can wetlands help?

Wetlands can reduce sedimentation from 49%-98%, depending on local hydrology. Some depressional wetlands, such as prairie pot holes, may retain all incoming sediments. Studies have shown that watersheds made up of 40% wetlands have up to 90% lower sediment loads than watersheds with no wetlands.

### Citations:

Gabor, T.S., A.K. North, L.C.M. Ross, H.R. Murkin, J.S. Anderson, M. Raven. 2004. *The Importance of Wetlands & Upland Conservation Practices in Water Management: Functions & Values for Water Quality & Quantity*. Ducks Unlimited Canada. 4-28 pp.

Pattison, J.K., S. Gabor, T. Scott. 2013. A Business Case for Wetland Conservation and Restoration in Settled Areas of Alberta Vermilion River Subwatershed Case Study. 19 pp.

## 5. Nitrogen

On the prairies, up to 50% of the nitrogen in fertilizers applied to crops may be lost in runoff, primarily in the form of nitrate. Excess nitrate in runoff can then enter surface waters, contributing to eutrophication, or leach into groundwater where it may contaminate drinking water sources. In a survey of drinking water wells in Alberta, 13% of 376 shallow wells sampled had nitrate-plus-nitrite levels above the guideline for human drinking. Thus, prairie groundwater resources are not only at risk, but are already showing signs of nitrate contamination.

### How can wetlands help?

Nitrogen is retained by wetland plants, biota, and sediments, and may be permanently removed by denitrification and harvest of wetland plants. Prairie pothole wetlands can filter over 80% nitrate concentrations through denitrification.

### Additional information

**Bow River Phosphorus Management Plan**  
<http://aep.alberta.ca/>

### Contact

Rob Wolfe, Environmental Planner, Alberta Environment and Parks  
 Phone: 403-297-5383  
 email: [rob.wolfe@gov.ab.ca](mailto:rob.wolfe@gov.ab.ca)