This information is taken from the Four Seasons Environmental Centre materials prepared in 2007. Many thanks to Ken Duncan and Kela Graphics for spearheading the project and Glen Hvenegaard, Chad Winger, Susanna Bruneau, and Kim Macklin for the research and writing on the FSEC project.

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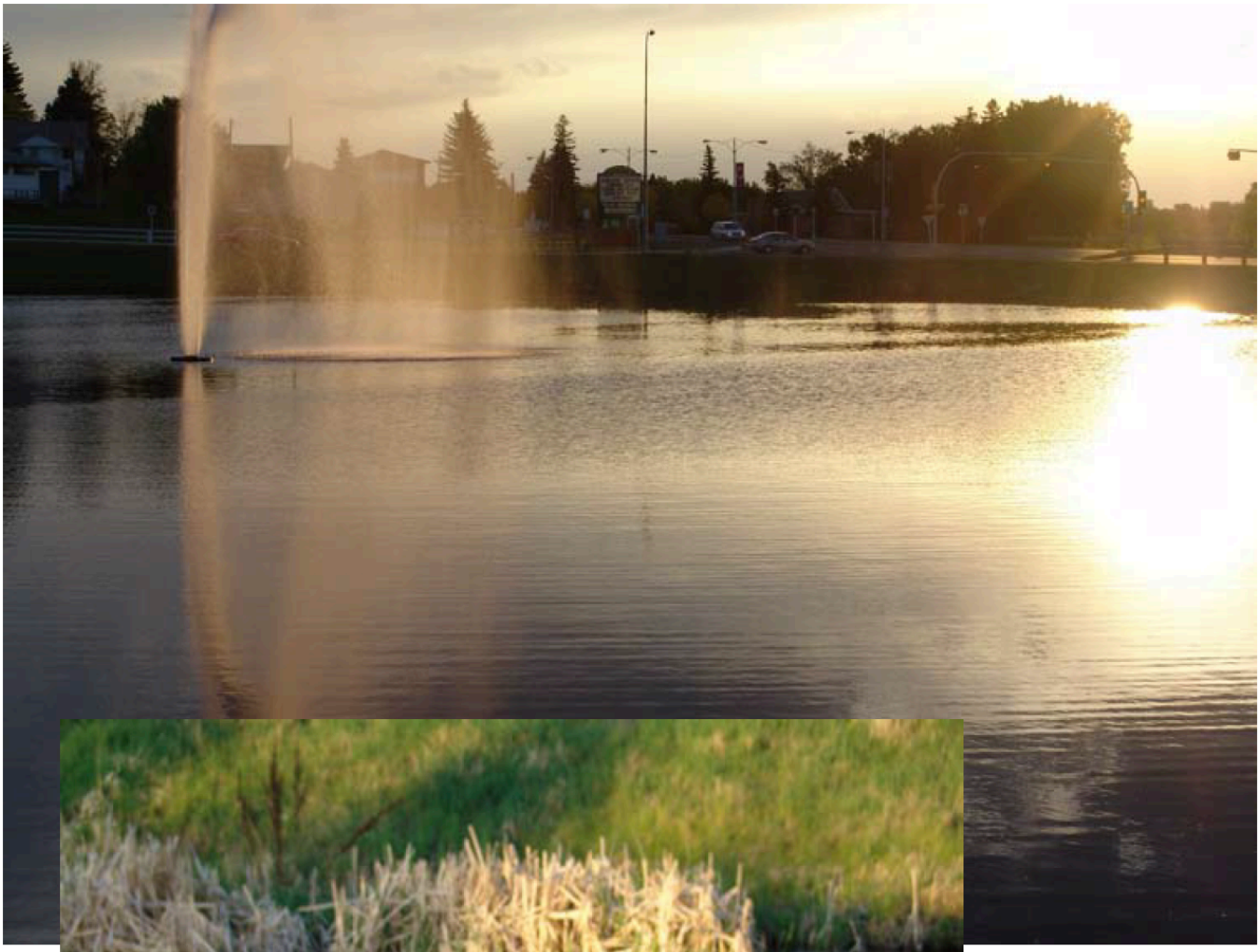
Four Seasons
Environmental Centre

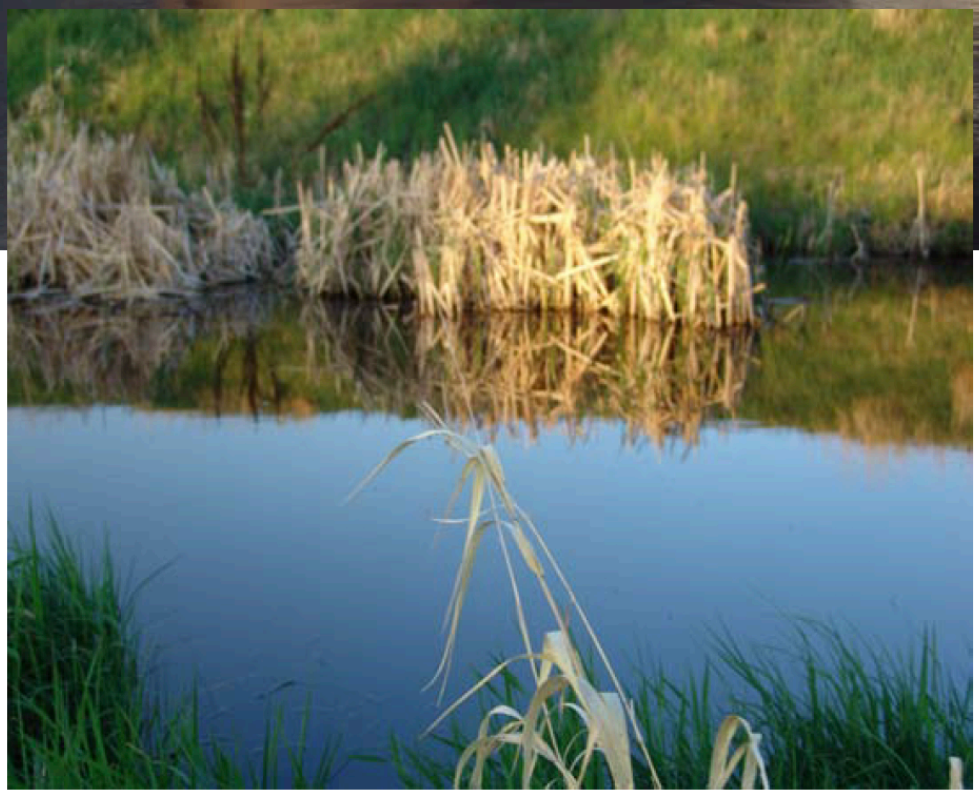
Hydrology

Introduction

Hydrology is the study of the movement and dispersal of water in our environment. Water is essential to all life and is one of our most important yet limited resources. Water in Camrose is supplied from Driedmeat Lake, where it is then filtered and purified numerous times by the Camrose Water Treatment Plant before it gets to our taps. Water plays an even larger role in our surrounding environment. Its supplies native plants and animals with the nourishment they need, provides homes for fish, invertebrates, birds and other mammals. Healthy riparian areas surrounding our waters also help to decrease the amounts and concentrations of contaminants that may leak into our creek, as well as provide unique habitats that create a great source for biodiversity.

Four Seasons Environmental Park is a project of the Camrose Rotary Club





The world's surface is 70% covered by water, only 3% of which is freshwater, and only 0.3% of that is landlocked surface water, not frozen in glaciers or ice caps. Canada is fortunate enough to have 9% of the worlds freshwater supply[1]. Much of this freshwater is associated with wetlands, which purify and enrich water and offer habitats to an array of organisms. Canada has about 14% of the world's wetlands, with Alberta having 11% of Canada's wetlands [1].

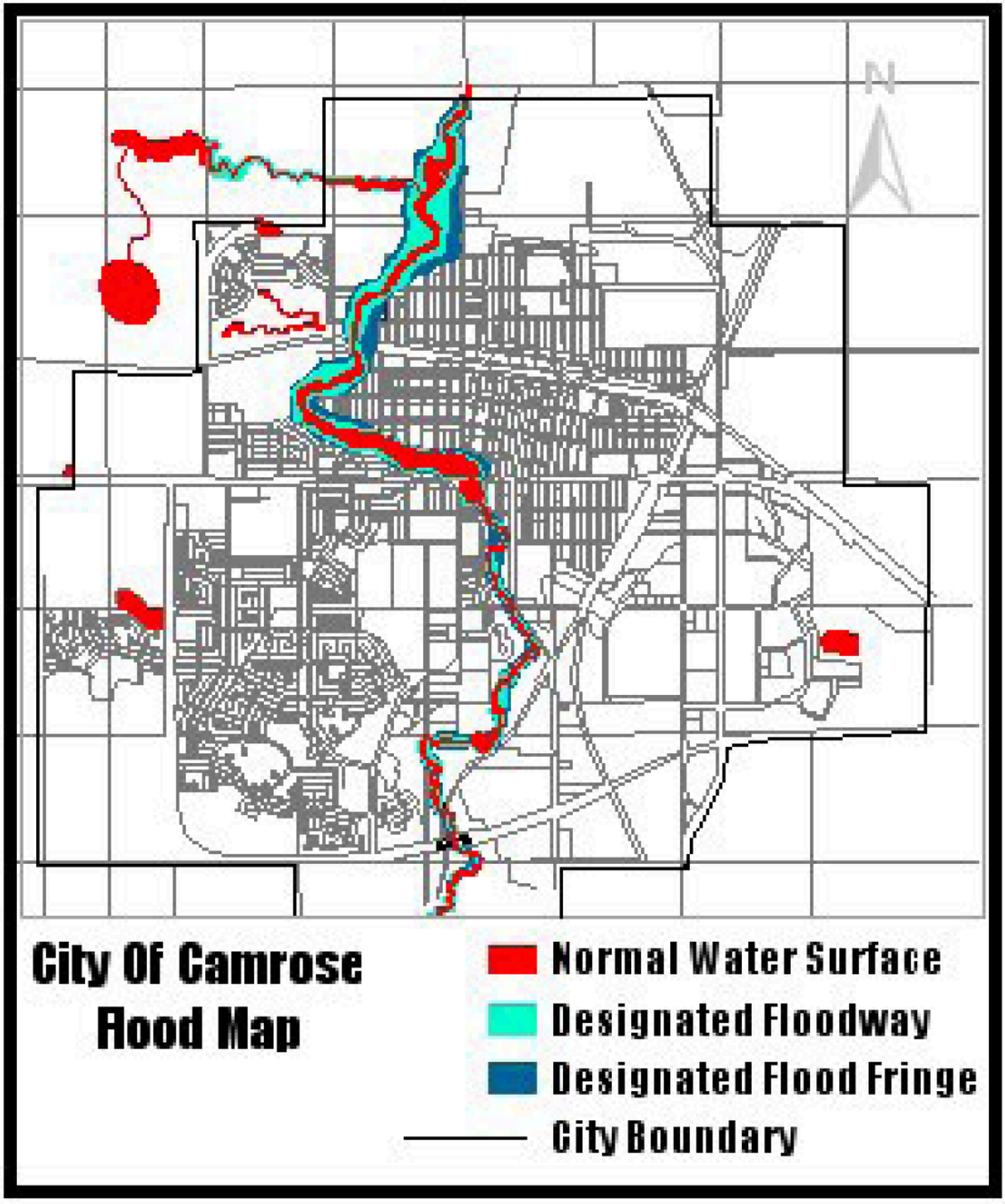
Associated with wetlands are riparian areas, or intermediate areas between streams and the surrounding land [2]. All of these water sources play a key role in the hydrological cycle or the movement of water from the ground, into the atmosphere and back to the surface where it flows as rivers and streams.

Stoney Creek Watershed

Stoney Creek (about 32 km long) flows south from Miquelon Lakes where it is routed through the Lyseng Reservoir. It meanders its way through the Camrose city limits for roughly 8.5 km, and then flows into the Battle River. The final destination is the Hudson's Bay, by way of the North Saskatchewan River and Lake Winnipeg [3]. The total drainage area for Stoney Creek is approximately 355 km2 [4], while that of the Battle River is close to 30,000 km2

Stoney Creek carries sediments from the surrounding area during times of high water flow such as spring snowmelt and summer storms, and deposits them on the creeks banks [4]. This process builds up the banks of the creeks with the deposited soil consisting mostly of silty sandy clays, sands and gravels. These banks are mostly covered by vegetation along the entire length of the creek varying from cattails and grasses to brush and trees. There is roughly a 15m drop in elevation over the 8.5km of the creek in the city, with a 5 m drop at the Mirror Lake spillway. This creates a hydraulic discontinuity, making the southern half of the creek flow faster than the upper half. There are a number of structures that alter the flow of the creek through Camrose. These include the CRP and Grand Drive culverts, the 48th Avenue Bridge, and the Mirror Lake Dam and Spillway [4]. The Stoney Creek is usually flows slowly, but during April and May, the spring melt water may drastically raise the discharge of the creek, so much so that flooding sometimes occurs. The floodplain for the creek is fairly contained, so any municipal damage is usually limited.

In 1995, the city participated in a study to define a 100-year floodplain of the Stoney Creek. This study measured the annual and monthly flow rates of the Creek and mapped out the creek's maximum possible discharge, designated as a 100-year flood event. During a 100-year flood, the discharge was calculated to reach 34.3-36.3 cubic meters/second (34-36000 liters/second), which is much higher than the average of 0.5-1.0 cubic meters/second. As a result of this study, two areas were defined: 1) a flood risk area where development would be restricted and 2) a flood fringe, where development was conditional [4]. This information helped the city of Camrose develop a storm sewer system that would help manage floodwaters by directing overflow to retention ponds, or diverting it to flow outside of residential areas to minimize property damage [5].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City Of Camrose
Rood Map
Normal Water Surface
Designated Floodway
Designated Flood Fringe
City Boundary

Water Source and Treatment

Today Camrose is supplied with water from Driedmeat Lake, which lies roughly 8 km south of Camrose, but this wasn't always our water source. Before 1929, Camrose relied on wells, which supplied the small prairie town. In 1929, Calgary Power Ltd. took control of the water and power utilities for the town and dammed the Stoney Creek within the town limits making a reservoir capable now known as Mirror Lake. Later, a treatment plant was built [6]. In 1940, a military camp placed in Camrose spurred a dramatic increase in the need for water over the next several years. In 1952, a larger reservoir (Lyseng Reservoir) was made in the Stoney Creek drainage basin 8 miles north of
However, due to low creek levels, no transfer of water from the Lyseng Reservoir to Mirror Lake could be made during the winter [6].

With annual demand increasing, a new solution was needed. Mirror Lake's capacity could not be increased due to land values, and wells would not supply adequate amounts of water. If there were successive dry years, there was potential for the Lyseng Reservoir to lose its storage capacity, thus limiting water use. It was decided that Camrose needed a larger water source, and Driedmeat Lake was the answer [6] and has been the source of Camroses water since 1957. In 1980, the city of Camrose purchased the water system from Calgary Power Ltd. and put in a new water treatment facility in 1988.

City of Camrose Water Systems

Source: Water is a valuable natural resource. All water used in Camrose is supplied from Dried Meat Lake, located on the Battle River.

Alberta Environment regulates the amount of water the City of Camrose may draw from the lake to ensure that the lake's ecosystem is protected.

Water Treatment Plant: Safe drinking water is a carefully manufactured product. It is collected, treated, tested, and delivered to your home and business 24 hours a day. The City of Camrose uses a variety of treatment processes to remove contaminants from drinking water. Each drop of water that enters the treatment system takes approximately five days to treat and distribute. These processes include:

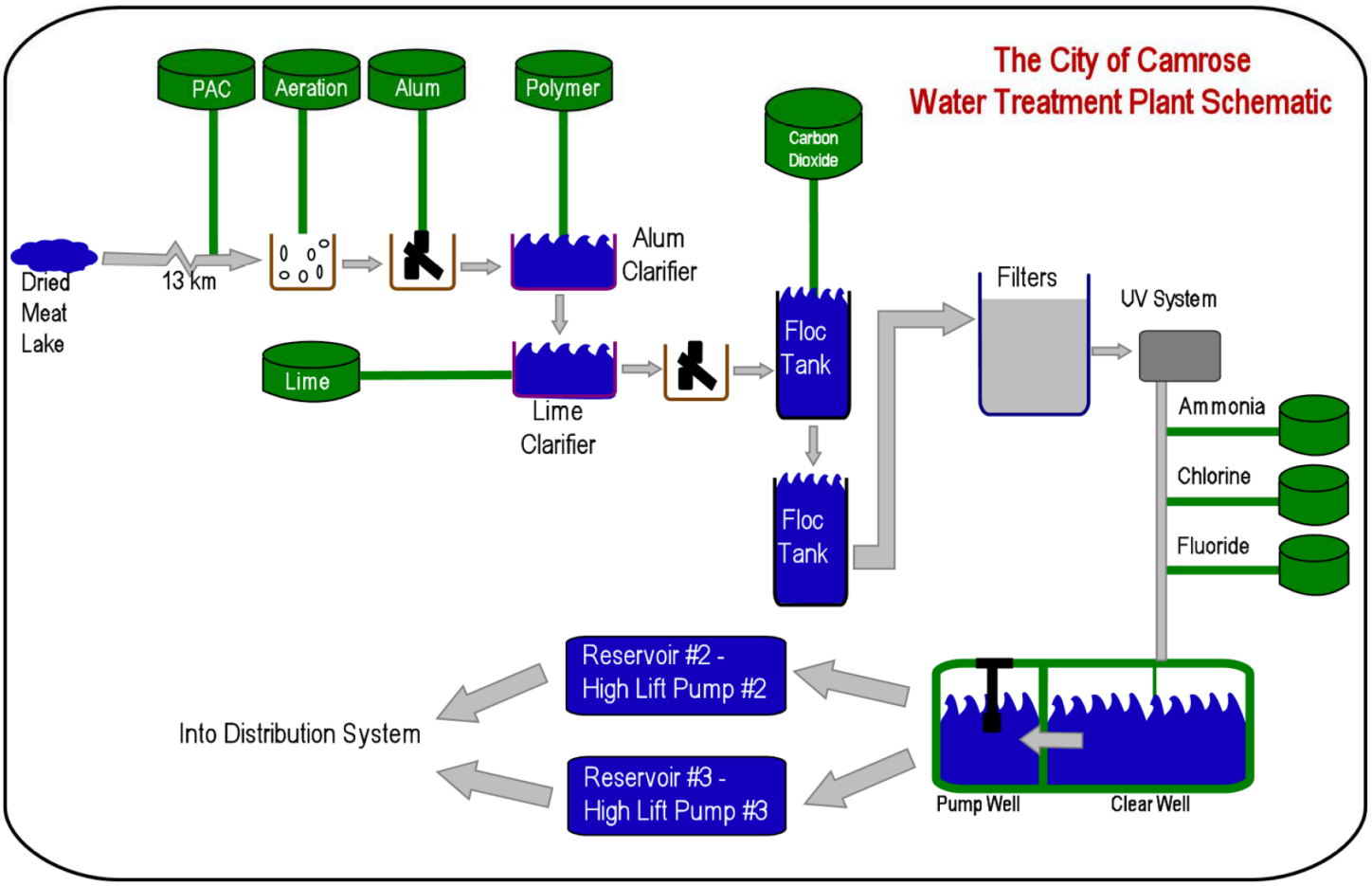
-*Powdered activated carbon (PAC)* removes organic materials, which cause taste and odor.

-*Aeration* Fine bubbles of air are blown through the water to remove taste and odor causing substances in the water such as methane, hydrogen sulfide, and other volatiles.

-*Flocculation* Alum and polymers are added to the water to form tiny particles called 'floc' which attract dirt and other particles suspended in water.

-Sedimentation The flocculated particles then settle out of the water.

-*Water Softening* Lime bonds with calcium and magnesium and then settles out of the water.


The City of Camrose
Water Treatment Plant Schematic
PAC
Aeration
Alum
Polymer
Carbon Dioxide
Dried Meat Lake
13 km
Alum Clarifier
Lime
Lime Clarifier
Floc Tank
Floc Tank
Filters
UV System
Ammonia
Chlorine
Fluoride
Reservoir #2 - High Lift Pump #2
Reservoir #3 - High Lift Pump #3
Into Distribution System
Pump Well
Clear Well

There are a number of steps to treat the water before it reaches our taps. First, large screens on the water intake valves filter out large debris. Once the water reaches the treatment plants first clarifier, it is mixed with black powdered activated carbon to remove organic materials, then air is bubbled through it to remove any gasses. These materials affect taste and odor. Once this is complete it moves to the second clarifier where alum is added which makes any small particles in the water clump together so they can be filtered out in a solution called floc. Once this is done, the water needs to be softened, so they add lime to the mixture to remove calcium and magnesium and then they adjust the pH of the water to 8.3 so that it is neither corrosive nor aggressive. Then the water is filtered once again through a natural sand filter to remove any more particles. After this the water goes through a UV light treatment which inactivates any pathogenic organisms. Then chloramine is added to the water to protect against contamination, and fluoride is added to the water to prevent tooth decay [5]. Each day the water goes through 30 different chemical tests to ensure its quality. The city is continually upgrading their technology to bring the residents of Camrose better quality water.

Riparian Functions

The riparian and wetland areas surrounding the Stoney Creek are some of the most ecologically important environments in the Camrose area. They provide homes and refuge for a range of different organisms, from mammals such as deer and muskrats, to aquatic invertebrates, fish and an array of birds. They also improve water quality, filter out harmful chemicals, trap and store sediment and water, create primary productivity and maintain biodiversity [2].

Although riparian areas occupy only about 2% of the western landscape, they are home to the highest densities of breeding birds in Canada. Various studies have also shown that 90% of all mammals, birds and other vertebrates associated with grasslands depend on riparian areas at some point in their life cycles [7]. Apart from wildlife, domestic livestock are also dependent on riparian areas for water and shelter, but when poorly managed, they can lead to unhealthy riparian conditions.

There are approximately 90 species of trees, shrubs, grasses and forbs found in the riparian area of Stoney Creek. The presence, absence or abundance of certain species helps to determine the health of the riparian area[7]. A healthy riparian area is well vegetated with deep-rooted tree, shrub and grass species that provide bank stability [2]. In an alluvial creek such as the Stoney Creek, it is extremely important to have secure banks so that sediment may be trapped thereby limiting erosion and excess sediment in the water which may be harmful to fish and other inhabitants of the creek.

Trapping sediments also improves water quality by filtering out contaminants and nutrients that may come from runoff or other pollution sources. This enriches the soil in the riparian area to promote enhanced vegetation growth. The floodplain of a riparian area is also

crucial in minimizing the effects of floodwaters. In the event of a flood, a well developed floodplain can trap and store water and energy while reducing the energy of flowing water to limit the damage caused by erosion [2]

Perhaps the largest indicator of a healthy riparian area is biodiversity. The abundance of riparian vegetation not only aids in preserving the creek structure, but provides countless homes for a variety of wildlife species, such as muskrat, beavers, waterfowl, deer, moose, fish and aquatic invertebrates. By having such a diverse landscape, there is room enough to accommodate large numbers of species, each adapted to its own part of the environment. A complete riparian system keeps the food chain in check by minimizing the amount of nutrients and dissolved gasses in the water to prevent events such as algae blooms that rob the water of oxygen. Events such as these can cause desiccation of aquatic invertebrates and fish, which would mean that birds and other animals that relied on them for food would likely disappear.

Riparian areas provide many benefits. They provide areas for scenic appreciation, tourism, recreation, and enjoyment by those who live in the area surrounding the riparian zone. They also provide economic benefits, such as higher property values of the residences adjacent to riparian areas[2].

Threats to Riparian Areas

Due to the many benefits that a riparian area has to offer, they are often exploited to the point where they lose productivity. By modifying the landscape in and around a riparian zone, you risk losing the natural vegetation that maintains the community structure. Activities such as development, grazing or agricultural practices may change the dominant vegetation to non-native species that out-compete the native vegetation creating a biologically assimilated landscape. At this point the stream may lose its sediment holding capabilities, leading to bank loss and sedimentation of the water.

Another effect comes with traffic in the area of the riparian zone, in the form of livestock or machines[2]. They create holes and indentations that collectively flatten the ground, eliminating its ability to absorb water back into the ground. This creates a larger amount of runoff from the area, and any contaminants that may have been present, can go directly into the stream rather than being absorbed by the surrounding vegetation. Damming a riparian area can also have detrimental effects such as the loss of resident vegetation, fish and wildlife and decreased bank stability. The riparian area is adapted to high and low water flows, and so are lots of the

organisms associated with them. However, when water is removed entirely, the dynamics of the riparian area do not function properly and its inhabitants may disappear. The presence of invasive plant species can also be a sign of an unhealthy riparian area. Although usually associated with disturbances such as development, invasive species can wipe out native vegetation quickly, changing the landscape. They often have short life cycles, which allows them to

spread quickly, and shallow roots that don't aid in bank structure. Species such as the Canada thistle, Leafy spurge, and noxious chamomile, are all considered invasive species and can be signs that an area is degrading [2]

How You Can Help

There are lots of ways that people can get involved in the protection of our water resources. To limit the amount of wastewater generated, you can simply conserve water. Small adjustments can add up, saving water and money. The city of Camrose has a public education program that informs the public about the source and treatment of water in Camrose. The city provides water saving kits available at City Hall, Engineering Department, or City of Camrose Public Works Office [5]. The official Website for Camrose also has tips for conserving water in the bathroom, kitchen and laundry room and can be accessed at: http://www.camrose.com/engineer/water/waterwise.htm. The city has also taken part in the Yellow Fish