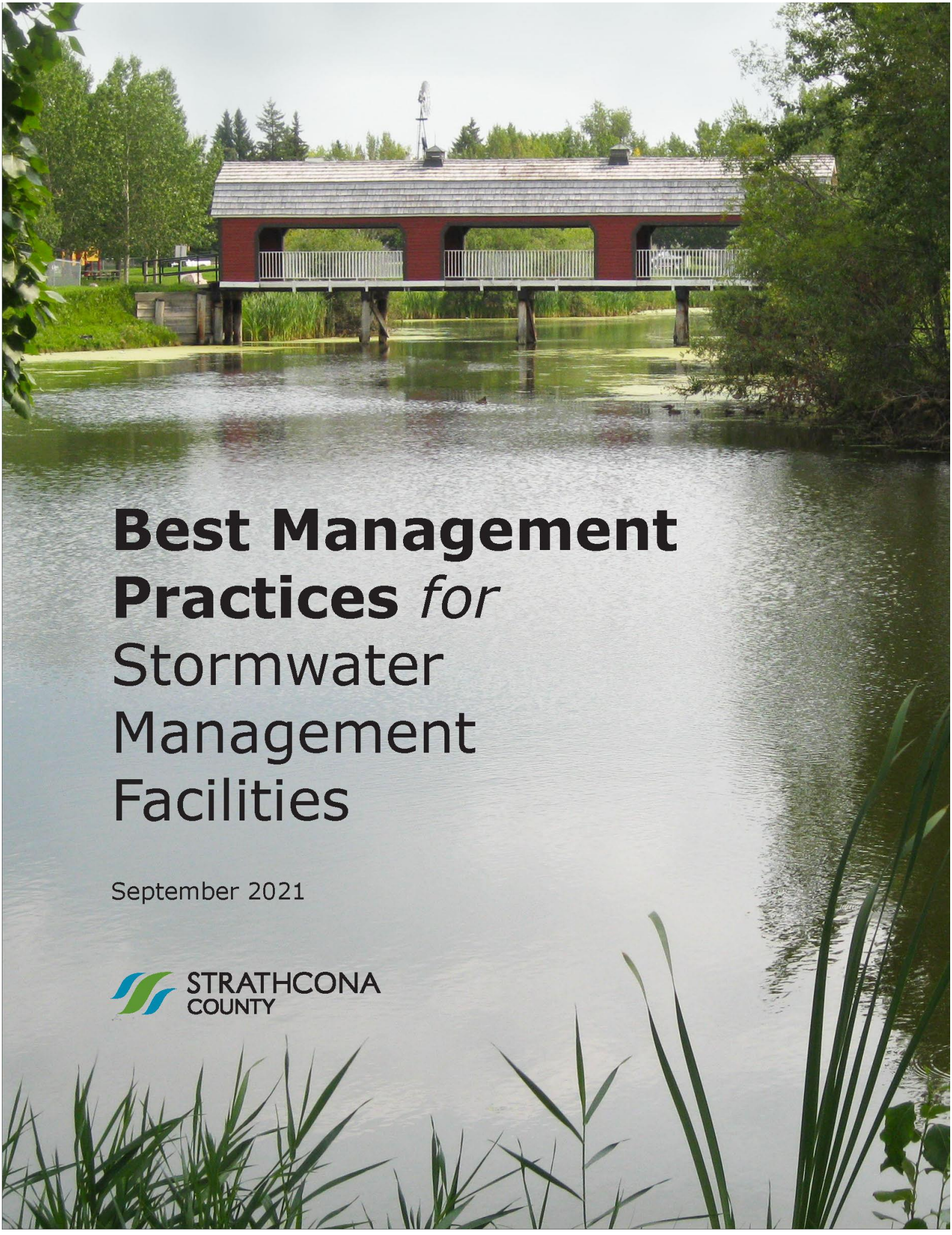

Best Management Practices *for* Stormwater Management Facilities

September 2021

STRATHCONA COUNTY

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Executive summary

Strathcona County is located within the North Saskatchewan Watershed of Alberta, Canada. It is important that Strathcona County be involved with initiatives for watershed ecosystem protection, and water quality and quantity protection on as large a scale as possible.

Strathcona County is committed to being part of Alberta's *Water for Life* Strategy, which has outlined strategies committed to protecting the quality and quantity of Alberta's water resources.

The *Water for Life Strategy* includes three key strategic directions:

- safe, secure drinking water supply
- healthy aquatic ecosystem
- reliable, quality water supplies for a sustainable economy

Stormwater management in Strathcona County specifically addresses the healthy aquatic ecosystem and reliable quality water supply for a sustainable economy. Through the guidelines and best management practices (BMP), Strathcona County will help protect the watershed by managing the quality and quantity of stormwater flowing into receiving waters.

Stormwater in Strathcona County will be managed using a watershed approach. The County's watershed planning approach involves:

- Considering the natural characteristics of the watershed to ensure that stormwater discharges cause the least impact possible on our natural drainage systems.
- Considering past, present and future land use to increase the quality of water flowing to receiving waters.

SWMFs must include the following mechanisms for managing water quality and quantity:

- settling of suspended solids
- reducing or eliminating erosion
- filtration and chemical precipitation through contact of the water with the substrate
- chemical transformation
- adsorption and ion exchange on the surface of plants, substrates and sediment
- breakdown and transformation of pollutants by microorganisms and plants
- uptake and transformation of nutrients by microorganisms and plants
- predation and natural die-off of pathogens

Best management practices now being used within the design of stormwater systems will aid in protection of aquatic ecosystems. With improved water quality flowing to the receiving waters, the ecosystems will sustain a lesser impact. Water quality will be the foundation for each of Strathcona County's BMPs.

Vision

Stormwater management aligns with Strathcona County's Strategic Plan goals to manage, invest and plan for sustainable municipal infrastructure; foster collaboration through regional, community and governmental partnerships; and ensure effective stewardship of water, land, air and energy resources.

Our vision is to:

- Commit to environmental leadership by conservation and protection of the watershed as the highest priority.
- Ensure SWMFs will be designed, engineered, constructed and managed in a most safe, efficient, cost effective and environmentally responsible manner ensuring all government guidelines, standards and regulations are met. Existing stormwater management facilities (SWMFs) will be managed with the same approach.
- Recognize that the importance of ensuring that the principles of sustainable development are embodied in all planning decisions, particularly those related to development and management of overall growth.
- Inform and educate all stakeholders of the need, purpose, function and management of SWMFs.

Mission

This document will include the most current BMPs that will result stormwater management in Strathcona County that is:

- Environmentally responsible, safe, efficient and sustainable
- A priority within the annual budget
- Managed to provincial and federal standards for stormwater quality and quantity
- Educational and informative for residents and employees of Strathcona County
- Educational and informative for external partners and organizations

Strathcona County will incorporate BMPs as the tools to ensure the vision and mission of stormwater management are accomplished.

There are several different SWMF designs that may be used to collect, store, improve water quality and moderate stormwater runoff. Each design will be used based on the site-specific requirements and receiving waters.
The County uses:

- buffer strips
- constructed wetlands
- natural wetlands
- wet ponds
- dry ponds
- oil/grit separators
- vegetative swales

Legislation

The variety of legislation that has developed over time related to water is an indication of the high value placed on this resource and recognizes the potential conflicts that can arise. There are federal, provincial and municipal regulations, specifications and guidelines surrounding the management of water. Strathcona County's municipal policies have been included as appendices to the document.

Best management practices

Strathcona County uses five types of BMPs:

1. source control
2. lot level
3. conveyance
4. pre-treatment
5. treatment

1. Source control BMPs act to remove pollutants at their source. They include:
    - managing pesticides and fertilizers
    - safely discarding household hazardous wastes
    - erosion and sediment control from construction activities
    - street sweeping
    - catchbasin cleaning
    - animal control bylaw (proper pet waste disposal)
    - conserving natural aquatic vegetation

2. Lot level BMPs act to reduce and slow surface water runoff volumes and/or treat runoff before it reaches the SWMF. The BMPs are applied at the individual lot level or on multiple lots that drain a small area (less than 2 ha). Lot level BMPs are site specific, and may include:
    - reduced lot grading
    - infiltration trenches

3. Conveyance system BMPs transport stormwater runoff from developed areas through sewers or grassed swales. They include:
    - vegetative swales/bioswales
    - vegetative channels/ditches

4. Pre-treatment BMPs aid treatment BMPs in initial sediment capture often. They are often located upstream of the treatment facility. They include:
    - buffer strips
    - oil/grit separators

5. Treatment BMPs are typically called stormwater management facilities (SWMF). Treatment SWMFs receive surface and stormwater runoff from a variety of conveyance systems. Treatment SWMFs provide water quality improvement prior to discharge into a receiving water body (with the exception of dry ponds which are used to manage water quantity). They include (in order of preference):
    - natural wetlands
    - constructed wetlands
    - wet ponds
    - dry ponds

Stormwater management

There is some limited experience with stormwater techniques and designs in Alberta particularly when it comes to wetland design and best management practices. While this should not discourage use of new technologies, there must be a higher regard for monitoring performance. Ongoing maintenance is extremely important for continued effectiveness and resources to ensure this is part of the management strategy required.

Nutrients, heavy metals and pathogens should be managed so levels do not reach a point where the SWMF cannot naturally handle them. In most cases, source control BMPs will aid in these processes.

As Strathcona County expands and becomes more urbanized; manmade and natural drainage flows will be more noticeable and will be higher than the pre-developed state.

Traditionally, stormwater was managed for quantity control. One of the primary functions of SWMF is to handle rainfall events to minimize the potential of flooding, the increased risk to life, and the increased risk to property damage.

Changes on the landscape can cause flooding, stream erosion and sedimentation. Flooding and erosion can have direct effects on public safety, while erosion and sedimentation can affect the habitat of aquatic animals.

A proactive management strategy may limit liabilities and additional costs that may be incurred with SWMFs. Maintenance requirements on the SWMF in Strathcona County depend on each facility.

Vegetation along the SWMF will be maintained in a natural state. Use of native plant materials or plants that possess characteristics similar to native plants will be used along the SWMF.

This will reduce long term management requirements, assist in the management of noxious weeds, help stabilize the shoreline and eventually result in shorelines that are similar to those of naturally occurring local bodies of water.

Algae will be managed using various techniques dependent on the SWMF. A vegetable-based food dye will be applied to SWMF to inhibit algae growth. When there is a significant amount of dead vegetation or an abundance of vegetation that negatively affects the functioning of the SWMF, harvesting may be considered. Residents adjacent to the SWMF will be notified of any significant activity occurring in or around the facility.

SWMFs provide for excellent wildlife habitat potential and increase the aesthetics of the facility when managed in an effective manner. Maximizing vegetation density around the SWMF may discourage the entry of domestic animals that would prey on wildlife as well as discourage water fowl from foraging on shorelines.

Storage capacity for minor infrastructure (catchbasins, underground piping, inlets and outlets) is designed to accommodate the runoff from a 1:5 year storm event or greater. Major infrastructure (wetlands, etc.) are designed to accommodate runoff from a 1:100 year event. However, prior to 1997 systems were designed to accommodate a 1:25 year storm.

Responsibilities

Developers are responsible for SWMFs between the Construction Completion Certificate (CCC) and the Final Acceptance Certificate (FAC) processes. Strathcona County maintains and operates the SWMF infrastructure, but the developer is responsible for all major deficiencies or repairs required to the SWMF. The developer must monitor SWMF functions (including design) to ensure the provincial guideline of 85% total load removal is being met.

Once an FAC has been granted, Strathcona County is responsible for operation, maintenance and repair of the SWMF. Residents that are adjacent to a SWMF should understand and adhere to maintenance requirements as outlined in the BMPs.

Vision for the future

The BMPs will incorporate new technologies as they become available and are proven an effective tool for managing stormwater.

Low Impact Development (LID) technology is an alternative ecologically friendly comprehensive approach to stormwater management. It aims to mitigate development impacts to land, water and air. The LID approach emphasizes the integration of site design and planning techniques that conserve natural systems and hydrologic functions of a site. LID aims to reduce the amount of impervious surfaces. Strathcona County currently uses some aspects of LID such as vegetative swales and cluster concept developments.

1.0 INTRODUCTION

"Albertan's care deeply about the Province's water resources, and they recognize the importance of these resources for meeting our social, economic and environmental goals. With a shared commitment to enhance our policy and management approaches, we can ensure that Alberta's water resources are clean, healthy and abundant for current and future generations."

-Alberta Government, *Our Water, Our Future: A Plan for Action,* 2014

1.1 Watershed

A watershed is an entire landscape region (or "basin") which drains into a river or river system. A watershed typically includes several sub-basins with components from the mountains to the sea including glaciers, tributaries, lakes, ponds, aquifers and wetlands. Every watershed is the unique product of its complex make-up. Landscape, geology, soils, wind and precipitation, plants and animals, humans and our activities - all shape and define the watersheds. Each watershed has an overall hydrologic function to capture, store and release water. How well a watershed is able to perform this overall function is dependent upon how well each geomorphic component landform is functioning within the watershed. Component landforms that commonly occur in a watershed include water courses, rivers, stream channels, wetlands, floodplains, stream terraces, slopes and ridge tops. Each has their own function individually, however if one component landform is ecologically altered or degraded, its ability to perform its function within the watershed or ecosystem becomes impaired. Each component landform is interrelated with the others within the watershed. For example, the condition of a stream is closely related to the condition of its floodplain. If the floodplain has been degraded, the water that flows over the floodplain to the stream will degrade as it passes. Each component landform needs to be considered when planning and setting watershed goals.

Strathcona County is located within the North Saskatchewan Watershed, which begins in the Columbia Icefields in Banff National Park and extends through central Alberta and Saskatchewan. It ends where the North Saskatchewan and South Saskatchewan Rivers join east of Prince Albert, Saskatchewan. The watershed covers approximately 80,000 km^2.

Strathcona County is a member of the North Saskatchewan Watershed Alliance (NSWA), a non-profit group whose purpose is to protect and improve water quality and the watershed function of the North Saskatchewan Watershed within Alberta.

It is important that Strathcona County partner with other municipalities, organizations and the Province in order to be involved with initiatives for watershed ecosystem protection, and water quality and quantity protection on as large a scale as possible.

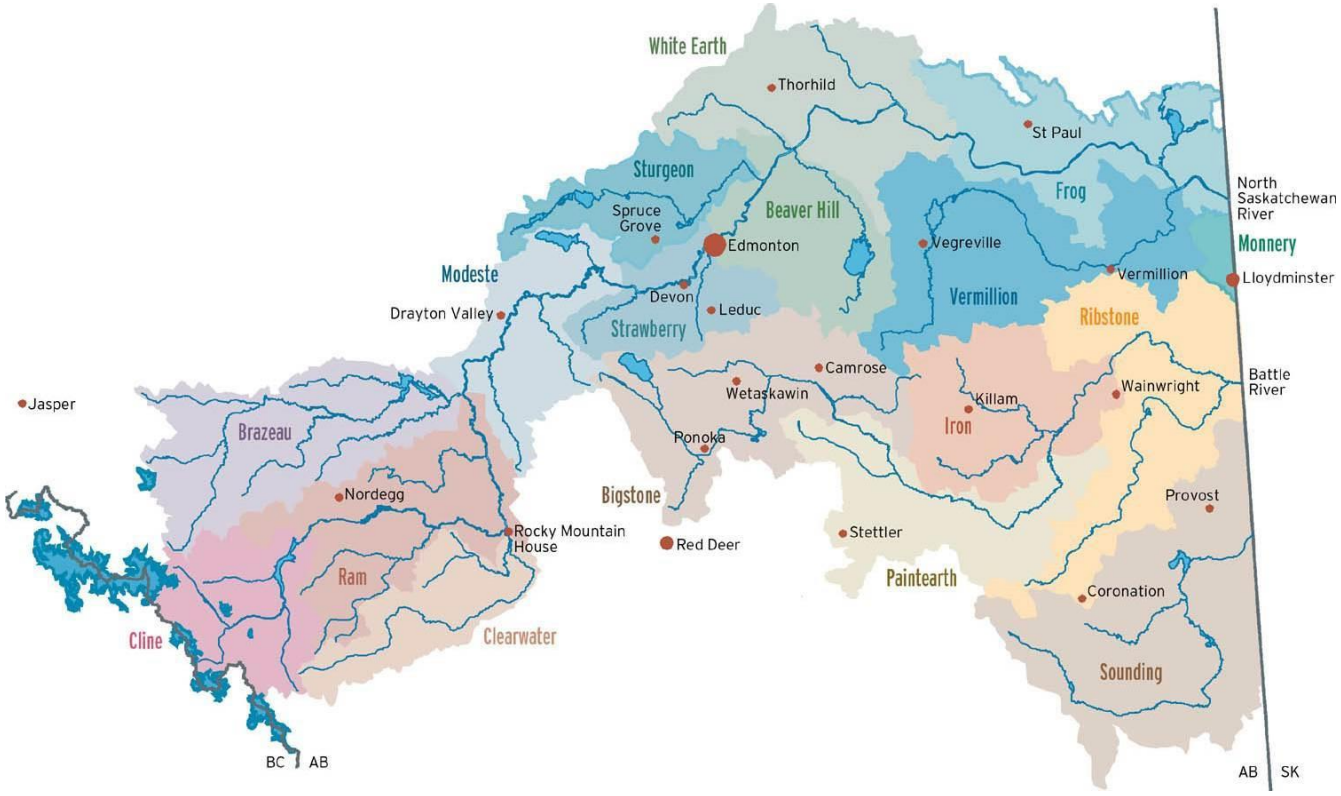


Figure 1-1: North Saskatchewan Watershed
Source: North Saskatchewan Watershed Alliance

The NSWA includes members from industry, government, agriculture, research, education, municipalities, aboriginal communities, health and environmental organizations to provide diverse views on what is important to Albertans regarding watershed protection. The NSWA aims to "find the balance between human desires and watershed integrity."

1.2 Water for Life

Strathcona County is committed to being part of Alberta's *Water for Life* Strategy (Alberta Environment, 2003). The *Water for Life* Strategy, renewed in 2008, has outlined strategies committed to protecting the quality and quantity of Alberta's water resources.

It includes three key strategic directions, which focus on adopting a watershed approach to managing Alberta's water. These strategies will define how water management and decision making is carried out in the future for Alberta while maintaining economic prosperity. They include:

- safe, secure drinking water supply
- healthy aquatic ecosystem
- reliable quality water supplies for a sustainable economy

Water for Life is led by Alberta Environment and Parks and will remain accountable for any decisions made regarding the strategies. A network of three partnerships between the Alberta Water Council, Watershed Planning Advisory Councils, and Watershed Stewardship Groups, will play a vital role in making recommendations to the Government. Each partner will partake in its own initiatives informing, supporting and mentoring the others.

The Alberta Water Council (AWC) will:

- guide implementation of water strategy
- investigate and report on emerging issues
- identify research priorities
- provide policy advice to government

This group includes provincial government departments, municipal government, stakeholders and environmental organizations.

The Watershed Planning Advisory Councils (WPACs) are responsible for:

- river basin planning
- state of watershed reporting
- best management practices
- education and stewardship

These groups include government, industry stakeholders, other water users and environmental organizations.

Community-based Watershed Stewardship Groups (WSGs) are responsible for:

- volunteer stewardship
- local activities and solutions

These groups include volunteer membership from communities and their citizens. Government, industry and businesses offer their support for the volunteer groups.

Stormwater management in Strathcona County specifically supports the healthy aquatic ecosystem and reliable quality water supply for a sustainable economy of Best Management Practices in the design of new stormwater management facilities (SWMFs).

Through the guidelines and best management practices (BMPs), Strathcona County will help protect the watershed by managing the quality and quantity of stormwater flowing into receiving waters. As urban and rural Strathcona County grows, stormwater management design, construction and location of new developments will influence the level of protection applied to the watershed.

Designing systems that minimize stormwater pollution at its source will reduce Strathcona County's costs for maintenance and management of these facilities as well as reduce negative effects on receiving waters and its habitats, as opposed to treating the water once it has reached receiving waters. Stormwater in Strathcona County will be managed using a watershed approach.

The County's watershed planning approach involves:

- looking at the natural characteristics of the watershed
- taking into account past, present and future land use
- conservation of watershed components
- integration of natural systems into SWMF
- considering all of the past, present, and future water use
- working to ensure that stormwater discharges cause the least impact possible on our natural drainage systems
- taking a proactive role in stormwater management to increase the quality of water flowing to the receiving waters

SWMFs should include the following mechanisms for managing water quality and quantity:

- settling of suspended solids
- reducing or eliminating erosion
- filtration and chemical precipitation through contact of the water with the substrate
- chemical transformation
- adsorption and ion exchange on the surface of plants, substrates, and sediment
- breakdown and transformation of pollutants by microorganisms and plants
- uptake and transformation of nutrients by microorganisms and plants
- predation and natural die-off of pathogens

Best management practices being used within the design of facilities will aid in protection of aquatic ecosystems. With improved water quality flowing to the receiving waters, the ecosystems will sustain a lesser impact. Water quality will be the foundation for each of the Strathcona County's BMPs.

1.3 Ecosystem

An ecosystem is all of the organisms in a given place interacting with their nonliving environment. A biophysical assessment determines the importance and conservation values of natural habitats and consists of a biophysical (vegetation, wildlife, soils and water) survey to provide a basis for habitat mapping, priority ranking and impact assessment. Biophysical assessments must be performed by a qualified professional hired by the developer on all SWMF during the design stage to ensure there is minimal negative impact from the facility to the surrounding ecosystem. See Policy **SER-009-032D *Biophysical Assessment Directive***.

1.4 Background

Development of this document originally completed in 2005 involved establishing a committee of internal departments that are responsible for reviewing facilities from design to management. The first task of the committee was to establish a Vision (where we want to be), Mission (how we are going to get there), and Goals. They are listed in the following sections.

Vision

- Commit to environmental leadership by conservation and protection of the watershed environment as the highest priority.
- Proposed or existing stormwater management facilities will be designed, engineered, constructed and managed in a most safe, efficient, cost effective and environmentally responsible manner ensuring all government guidelines, standards and regulations are met.
- Integrate social, economic and environmental objectives into a coordinated decision-making process to maintain high standards of living, social inclusion and environmental quality.
- Recognize that the importance of ensuring that the principles of sustainable development are embodied in all planning decisions, particularly those related to development and management of overall growth.
- Inform and educate all stakeholders of the purpose, function, design, construction, management and importance of stormwater management facilities.

Mission

This policy will include the most current Best Management Practices that will result in:

- environmentally responsible, safe, efficient and sustainable stormwater management
- cost effective stormwater management
- efficient planning decisions
- meeting provincial and federal standards for stormwater quality and quantity
- educated residents and employees of Strathcona County with regards to stormwater management

Goals

While the goal of this document is to provide baseline BMPs, it is not meant to restrict technological innovation and evolution. Design flexibility is important for site specific conditions. Alternative approaches may be considered if it can be demonstrated that there are better ways of achieving the same goals.

2.0 DESCRIPTIONS AND DEFINITIONS

2.1 Stormwater management facility descriptions

Stormwater management has evolved over the past several years and it is now recognized that comprehensive planning is necessary to protect human and animal life, property, and the natural receiving waters. Planning must be coordinated with several agencies, ranging from government regulators to developers to private property owners to users.

Watershed Management Plans are comprehensive strategies that establish broad water management goals and targets for an entire watershed area. Physical, chemical and biological characteristics of the basin are examined and then analyzed to define the existing and potential water uses. Sub-watershed plans address the requirements for stormwater management on a sub-basin level. The information gathered in the Watershed Management Plan is used to develop necessary sub-watershed stormwater controls (infiltration, trenches, swales, SWMFs). Stormwater Management Plans are considered at an early stage of land development as it will significantly affect the layout of subdivision lots, roadways and other services.

The design and construction of all SWMFs should retain as much of the natural runoff characteristics and infiltration components of the undeveloped system as possible and reduce or prevent water quality degradation. Strathcona County must review and approve the engineering drawings and landscape plans for all SWMFs constructed within the Municipality to ensure the facility has reasonable aesthetic qualities, sufficient storage capacity, and appropriate discharge rate, water quality objectives and fulfills public safety criteria. SWMFs shall meet all provincial and federal regulations as well as Strathcona County Design and Construction Standards.

There are several different SWMF designs that may be used to collect, store, improve water quality and moderate stormwater runoff. Each design will be used based on the site-specific requirements and receiving waters. They are listed here in progression from least preferable design to most preferable design.

2.1.1 Dry ponds

Dry ponds are also known as detention ponds and are designed to intercept and temporarily impound a volume of stormwater for gradual release to the storm sewer system. Dry ponds are designed to completely empty out between storm events, and therefore primarily provide stormwater runoff rate control (water quantity), as opposed to water quality control. Dry ponds can provide limited settling of particulate matter, but a large portion of this material can be re-suspended by subsequent storm events. Dry ponds are not designed to provide stormwater retention for more than 24 hours, resulting in lower contamination removal than wet ponds or constructed wetlands.

Strathcona County currently maintains eight dry ponds and will not approve constructing additional dry ponds. It has been determined that dry ponds pose a long-term management expense to Strathcona County with limited productive return in the form of recreational opportunities, wildlife uses, water quality improvements or aesthetic quality.

For further information refer to **Section 4.5.1 *Dry Ponds***

2.1.2 Wet ponds

Wet ponds control peak surface water runoff discharges in urban areas. The primary function of the wet pond is to promote sedimentation, reduce surface water runoff velocities, provide storage and remove pollutants. They store surface water and stormwater runoff to promote pollutant removal and control discharge to predevelopment levels to reduce downstream flooding and erosion in receiving water bodies. The permanent pond in the wet pond system is the major source of water quality improvement.

Runoff entering the wet pond is slowed by the permanent pond and suspended solids and pollutants settle out of the water column.

The major biological process that occurs in the wet pond is nutrient uptake by vegetation around the perimeter and algae and pollutant degradation by microorganisms. Vegetation provides improved pollutant removal, shading, wildlife habitat, safety, and aesthetics.

Wet ponds normally have more open water and less emergent vegetation than constructed wetlands. They are suitable for large drainage areas, for residential, commercial and industrial lands.

The secondary function of a pond is to provide wildlife habitat, and to provide tertiary recreational activities (i.e., non-contact activities such as walking, bird watching, photography, etc.)

For further information refer to **Section 4.5.2 *Wet Ponds***

2.1.3 Constructed wetlands

Constructed wetlands are engineered facilities that retain surface water, improve stormwater runoff and may improve water quality once established. Constructed wetlands consist of shallow extended detention areas with extensive native species plantings and are typically created by excavating a depression. Sedimentation, filtration, biological and chemical processes affect water quality improvement. Wetland plants foster the necessary conditions for microorganisms which help to transform and remove pollutants from the water. It has been shown that constructed wetlands effectively lower biochemical oxygen demand, total suspended solids, and total nitrogen concentrations.

Constructed wetlands are often required mitigation for natural areas lost to a development. They are not intended to replace all of the functions of natural wetlands but to minimize point source and non-point source pollution prior to entry into streams, natural wetlands and other receiving waters. The primary function for a SWMF is to store and treat stormwater runoff, while the secondary functions include providing wildlife habitat.

Constructed wetlands are suitable for large drainage areas for residential, commercial and industrial lands. Unless designed specifically for industrial waste treatment, the runoff must not contain high levels of toxic pollutants that may negatively affect the native vegetation. Constructed wetlands should be designed specifically for water quantity storage and water quality treatment, not simply to mimic a natural feature for aesthetic purposes. Strathcona County prefers these more complex wetland systems over wet ponds for improved water quality, buffers from private landscapes, biodiversity, wildlife habitat and enhanced watershed management.

For further information refer to **Section 4.5.3 *Constructed Wetlands***

2.1.4 Natural wetlands

Natural wetlands exist to conserve the function, soils, microbial activity, wildlife habitat and water treatment processes of wetland facilities already existing on the landscape. Inlets and outlets are often added to adapt the facility for online treatment and sediment forebays are incorporated to filter out concentrated loadings into the facility. Natural wetlands also provide erosion control, air purification, conservation of living systems and offer a teaching tool for youth and community groups.

There are several types of natural wetlands:

Marshes form in low sections on the landscape and collect water into a standing pool. Dominating the marsh landscape are emergent plants such as cattails, rushes and sedges. Forested areas are not found in marshes.

Ponds or shallow open water wetlands have standing water that comes from rain, snow and groundwater sources. The water in a pond is shallow, although in its deepest section a six-foot-tall person could stand, and their head would be under water. While often full of water, these wetlands can dry out during dry periods in the summer months.

Swamps are wet forests. Water may be standing or slow-moving. Trees and shrubs densely cover the area within a swamp.

Bogs are found in cool wet areas. They can be open or forested with spongy carpets of vegetation as the main cover. Bogs are characterized by a high accumulation of peat (> 40 cm). Bogs tend to be low in nutrients.

Fens contain peat like bogs, but also can be found with vegetation such as sedges, grasses and wildflowers. While some fens are open, grassy fields, other fens can be wooded. Fens tend to be nutrient rich.

For further information refer to **Section 4.5.4 *Natural Wetlands***

Glossary of terms

Active storage - is the temporary or dry storage (volume) provided in a SWMF. In a dry pond it is between the bottom of the pond and the High Water Line (HWL). In a wet pond, constructed wetland or natural wetland it is between the Normal Water Line (NWL) and HWL.

Adsorb - to take up and hold (a gas, liquid, or dissolved substance) in a thin layer of molecules on the surface of a solid substance.

Aquatic ecosystem - an aquatic area where living and non-living elements of the environment interact. These include rivers, lakes and wetlands, and the variety of plants and animals associated with them.

Barge - a roomy usually flat-bottomed boat used chiefly for the transport of goods on inland waterways and usually propelled by towing.

Biochemical Oxygen Demand (BOD) - a measure of how much dissolved oxygen is being consumed as microbes break down organic matter. A high demand indicates that levels of dissolved oxygen are decreasing. This results in less oxygen available for aquatic species.

Best Management Practices (BMP) - includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent, eliminate, or reduce the pollution of waters of the receiving waters. BMPs also include treatment requirements, operating procedures, and practices to control site runoff spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Bog - a peat landform which is raised or level with the surrounding terrain and receives water mostly from precipitation. Generally, the water table is at or slightly below the bog surface. Bogs are typically nutrient poor and acidic with *Sphagnum* dominated vegetation.

Buffer strips - are the natural vegetated areas between uplands and aquatic ecosystems. It includes the area along streams, lakes and wetlands where water and land interact. These areas support plants and animals, and protect aquatic ecosystems by filtering out sediments and nutrients originating from upland areas. These areas are also known as *Riparian Areas*.

Catchbasin - an entryway to the storm drain system usually located in a low or depressed area on the street.

Conserve - to protect from wasteful, destructive use or loss of natural resources.

Constructed wetland – engineered wetlands that are built for stormwater detention and treatment. Designed to mimic natural wetland systems by incorporating or preserving appropriate wetland vegetation and soils to assist with reducing shock-loading effects of contaminated stormwater. They may also be designed to provide wildlife habitat.

Construction Completion Certificate (CCC) - the certificate issued and signed for construction completion (entire work except for maintenance/guarantee period).

Design and Construction Standards (DCS) - this manual is used to provide information, set guidelines and establish requirements for Developers, Engineering Consultants, Utility Companies and County Departments, regarding standards governing design, preparation and submission of plans and specifications for construction of municipal improvements within Strathcona County.

Detention storage - temporary storage and gradual release of stormwater.

Dredging – removal of sediment from the bottom of a water body. Typically performed during winter months.

Developer – in this document, a developer is any external entity that develops urban or rural land for real estate purposes. This includes but is not limited to any entity involved in land planning, land alterations, construction and/or design in Strathcona County.

Dry pond - designed to contain runoff temporarily as off-line storage areas and remain dry most of the time. Pond design such that any storm runoff in excess of the permitted predevelopment flow shall be stored in the dry pond. The pond bottom and slopes are top soiled and seeded.

Easement - a non-possessory right created by grant, reservation, agreement, prescription or necessary implication held by one property owner to make use of the land of another for a limited purpose. For example, a drainage easement can allow Strathcona County to limited rights-of-access to an area that is needed for the flow of stormwater

Encroachment - a physical intrusion (generally construction) of a structure, part of a structure, removal of plants and soils or construction onto the property or property interest of another.

Environmentally Sensitive Area (ESA) - refers to the lands in a natural or unaltered state and their ecological significance. Lands may be unusual or unique in the local and/or regional context and perform a natural function that is of importance at a regional level.

Environmental Reserve (ER) - lands that are considered undevelopable and may consist of a swamp, gully, ravine, or natural drainage course, or may be lands that are subject to flooding or are considered unstable. (See the Municipal Government Act for more details).

Erosion - removal of soil particles by wind and water. Often the eroded debris (silt or sediment) becomes a pollutant via stormwater runoff. Erosion occurs naturally but can be intensified by human activities such as farming, development, road-building, and vegetation removal.

Erosion and Sediment Control Plan – a plan comprised of a report and/or drawing which evaluates the erosion and sedimentation potential for a given construction site and outlines the type and location of Erosion and Sedimentation Control measures required to minimize erosion and prevent eroded soil and sediment from leaving the construction site.

Evapotranspiration - the loss of water to the atmosphere through the combined processes of evaporation and transpiration, the process by which plants release water they have absorbed into the atmosphere.

Event - *a* single precipitation and associated runoff occurrence.

Final Acceptance Certificate (FAC) –the certificate issued for final acceptance when the entire work, including maintenance period, has been performed to the requirements of the Development Agreement, landscape plans, DCS.

Fen – peat landform with a water table usually at ground level. Fens receive water from ground water and surface flow that is rich in dissolved minerals. Vegetation on fens is related to depth of the water table and chemistry of the water present. Wet fens are generally dominated by grasses, sedges and brown mosses. Trees and shrubs may be present on drier fens.

First flush - the beginning of a major rain event which flushes out the accumulated pollutants in the storm drain system.

Floodplain - can be either a natural feature or statistically derived area adjacent to a water body where water from the water body overflows its banks at some frequency during extreme storm events.

Groundwater - all water under the surface of the ground whether in liquid or solid state. It originates from rainfall or snowmelt that penetrates the layer of soil just below the surface. For groundwater to be a recoverable resource, it must exist in an aquifer. Groundwater can be found in practically every area of the Province, but aquifer depths, yields and water quality vary.

Habitat - used to describe the natural home of a living organism. The three components of wildlife habitat are food, shelter and water.

Household purposes - water used for human consumption, sanitation, fire prevention, and watering animals, gardens, lawns and trees.

HWL or High Water Level - is the engineered design high water level for a specific facility.

Impermeable or impervious surface - the part of the drainage area surfaced with materials which prevent infiltration of rainwater into the underlying soil and groundwater.

Integrated Pest Management (IPM): an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism.

Marsh - is a wetland that has shallow water, with levels that usually fluctuate daily, seasonally or annually due to tides, flooding, evapotranspiration, groundwater recharge, or seepage losses. The water table usually remains at or below the soil surface. Portions of a marsh may dry up and have exposed sediment under drought conditions. Marsh vegetation predominantly comprised of emergent graminoids (reeds, rushes, sedges, grasses); shrubs; emergent, floating or submergent herbaceous plants; and non-vascular plants such as mosses and algae.

Municipal Development Plan (***MDP)*** - sets out the guidelines for orderly growth and development over the next 20 years and beyond. The MDP provides a comprehensive long-term land use policy framework within which present and projected growth and development may take place.

Municipal Reserve (MR) – municipally-owned parcels of land meant for public use. They may be used for parks, recreation facilities, public buildings, schools, natural areas, and horticultural or agricultural uses.

Non-point source pollution - is a contamination that cannot be identified as originating from one site. This type of pollution comes from a larger area of land and is carried by run-off and/or groundwater.

NWL or Normal Water Level - is the engineered design level in a facility associated with dry weather periods or periods of low stormwater flows.

Planning and Development Services (PDS) –780-464-8080 The Strathcona County department responsible for coordinating Development Agreements, Development Permits and land management (easements, encroachments, open spaces etc.) (See Table 5-3 for specific stormwater management responsibilities).

Point-source pollution - pollution that originates from an identifiable cause or location, such as a sewage treatment plant or industrial outfall.

Potable Water - water that is fit for human consumption.

Public Utility Lot (PUL) - Strathcona County owned land required to accommodate public utilities.

Recreation, Parks and Culture (RPC) – 780-467-2211. The Strathcona County department responsible for landscape maintenance. (See Table 5-3 for specific stormwater management responsibilities).

Retention storage - the collection and storage of runoff for a considerable length of time, whereby release is by evaporation, transpiration or infiltration.

Riprap - a layer of stones laid together without order or similar material on an embankment slope to prevent erosion.

Runoff - the water that moves over the surface of the ground. Runoff collects sediments and contaminants as it moves from higher elevations to lower elevations.

Sediment - soil, sand, and minerals washed from land into water, usually after rain. Sediment can destroy fish-nesting areas, clog animal habitats, and cloud waters so that sunlight does not reach aquatic plants.

Sediment forebay - a permanent pool that is designed to facilitate maintenance and improve pollutant removal by trapping larger particles near the inlet of a constructed wetland.

Stormwater - all surface water runoff from rainfall and snowmelt, predominantly in urban drainage areas. Such areas may include rural residential zones.

Stormwater Management Facilities (SWMF) – may include natural wetlands, constructed wetlands, wet ponds and dry ponds located within an easement and/or County owned property (PUL).

Surface water - all waters on the surface of the Earth found in rivers, streams, ponds, lakes, marshes, wetlands, as ice and snow, and transitional, coastal and marine waters.

Swamp - defined as a treed or tall shrub dominated wetland that is influenced by minerotrophic groundwater, either on mineral or organic soils. Essential features of swamps include tall woody vegetation, generally over 30% cover and peat.

Transportation and Agriculture Services (TAS) – 780-417-7100. The Strathcona County department responsible for wildlife management and street maintenance. (See Table 5-3 for specific stormwater management responsibilities).

Transportation, Planning and Engineering (TPE) – 780-464-8279. The Strathcona County department responsible for design standards. (See Table 5-3 for specific stormwater management responsibilities).

Trust account - a financial contribution from the customer or the developer towards the future operations and maintenance expenditures.

Turbidity - a measure of the clarity of water. Turbidity is caused by the presence of suspended matter such as clay, silt, algae and other microbiological particles.

Undisturbed - not previously disturbed by human activities. A disturbance is an event that causes significant changes from the normal pattern.

Utilities (UT) - 780- 467-7785. The Strathcona County department responsible for the maintenance activities surrounding stormwater quality and quantity management. (See Table 5-3 for specific stormwater management responsibilities).

Utility Right-of-Way (ROW) – an interest in land required for the purpose of constructing, maintaining or operating a road, railway, aerial, electric or other tramway, surface or elevated cable, electric or telephone pole line, chute, flume, pipeline, drain or any right or easement of a similar nature.

Vegetative swale - a low gradient open channel with a dense vegetative cover through which run-off is directed during storm events.

Water for Life - is the Government of Alberta's strategy focusing on three specific areas: (1) Safe, secure drinking water supply, (2) Healthy aquatic ecosystems, and (3) Reliable, quality water supplies for a sustainable economy

Watershed - the area of land that catches precipitation and drains into a larger body of water such as a marsh, stream, river or lake.

Water quality - the chemical, physical and biological condition of water.

Wetland - a transition zone between terrestrial and aquatic systems where the water table is near, at or just above the surface of the land. Wetland boundaries are delineated using three basic parameters:

1. Presence of plant species adapted to life in moist or saturated soils
2. Presence of soils displaying characteristics that develop due to lack of oxygen
3. Evidence of hydrologic input from surface water and/or ground water creating conditions favourable to water loving and water tolerant plants and to the development of wetland soils.

Wet pond – a stormwater management facility that is built to attenuate peak flows downstream while providing improved water quality. A wet pond is comprised of mostly open water areas with perimeter wetland vegetation or armoured shore protection.

Stormwater management acronyms

DCS – Design and Construction Standards

FAC - Final Acceptance Certificate

HWL - High Water Level

IPM - Integrated Pest Management

LID - Low Impact Development

MDP – Municipal Development Plan

MR - Municipal Reserve

NWL - Normal Water Level

PDS – Planning, and Development Services

PUL - Public Utility Lot

RPC - Recreation, Parks and Culture

SWMF - Stormwater Management Facility

TAS – Transportation and Agriculture Services

TPE – Transportation, Planning and Engineering

3.0 REGULATIONS, SPECIFICATIONS AND GUIDELINES

The variety of legislation that has developed over time related to water is an indication of the high value placed on this resource and recognizes the potential conflicts that can arise (Haekel). It is critical that there be a basic understanding of the relevant legislation which governs what can and cannot be done in and around a water body.

The following regulatory summary is intended for general information purposes only. Interpretation and administration of the Act(s), policies and guidelines should be the responsibility of a lawyer or the responsible department representatives.

3.1 Acts (Federal and Provincial)

Provincial - Public Lands Act

The *Public Lands Act* deals with two factors: (1) ownership of the beds and shores of permanent water bodies, and (2) prohibition of certain activities that may cause injury to the beds and shores of permanent water bodies. Since 1930, the *Public Lands Act* has provided for provincial ownership of the beds and shores of "all permanent and naturally occurring" bodies of water and "all naturally occurring rivers, streams, watercourses and lakes". Water and the use of water are also under provincial jurisdiction through the *Water Act*.

The extent of the Province's ownership of the bed and shore of a water body is limited by the bank of the water body. The bank is defined as the line along the upper limit of the bed and shore formed by the normal, continuous action of presence of surface water on the lands. This is a natural boundary between the bed and shore and privately-owned land. The location of the bank is not affected by drought or flooding. The bed of a water body is defined as the land on which the water sits. The shore is defined as that part of the bed that is exposed when water levels are not at the normal level.

When a flooding event occurs, water may overflow the bank and cause erosion on private land. With approval by Strathcona County via Policy **SER-012-009** private landowners may protect their land from erosion and flooding by armoring with rock.

Crown land generally refers to provincial and federal government lands. In the 1970's, the Provincial Government referred to lands administered under the *Public Lands Act* as "public land" not "Crown land". Public land administered under the Act is owned by the Government of Alberta and its uses are allocated in the Act. The beds and shores of a variety of water bodies are public lands, therefore the public can typically walk along the water's edge below the bank without trespassing on private property. It should be recognized that accidental trespassing may occur when the location of the bank is not readily obvious.

Section 54(1) of the Act contains a general prohibition that no person shall do anything on public land that: (1) may injuriously affect watershed capacity, (2) is likely to result in injury to the bed and shore of any river, stream, watercourse, lake or other body of water or land in the vicinity of that public land, or (3) is likely to result in soil erosion. Any unauthorized use of public land may be subject to a variety of penalties, including fines, disposition cancellation, ministerial orders to restore disturbed areas, or legal action-imposed penalties.

Due to the sensitive nature of shore resources, most activities on the bed and shore require authorization from either Public Lands or Water Management. Conditions are placed on all authorizations: (1) to ensure that compatible activities and resources are used properly, (2) to limit the chance of degrading aquatic and shore environments, and where necessary, (3) to mitigate, reclaim or restore an area where disturbance is unavoidable. Approved activities and developments are monitored to ensure environmental standards are maintained (Haekel).

Management for wetlands (and their shores) on public land is concerned with conservation, mitigation of degradation and enhancement/restoration/creation of wetlands in areas where they have been degraded or lost.

Provincial – Water Act

The *Water Act* is the primary legislation dealing with water and its management, from ownership of the resource and the regulation of activities with water bodies, to the allocation and use of water by a licensing and approval system. The *Water Act* is designed to safeguard the aquatic environment, defined as "the components of the earth related to, living in or located in or on water or the beds or shores of a water body, including but not limited to all organic and inorganic matter, and living organisms and their habitat, including fish habitat, and their interacting natural systems".

The Crown owns the resource of water through the *Water Act*. The Act applies over a water bodies floodplain as well and the bed and shore of the water body. An approval is required under Section 36 of the Act for all activities that may impact water and the aquatic environment.

It is an offence under the *Water Act* to commence or continue an activity unless an approval or other authorization under the Act has been issued; to contravene a term or condition of an approval or license; to contravene a water management order; or contravene an enforcement order. Penalties may include fines, water management orders, remedial orders, court orders and civil remedies (Haekel).

Water management is typically to address increasing demands on aquatic resources and to ensure that a clean abundant supply of water is available for a variety of uses, including for the protection of the aquatic environment. Water management may involve a small area (lake management) or a watershed. The key component of the process includes public participation.

Provincial – Municipal Government Act

The *Municipal Government Act* is the primary mechanism that enables municipalities to function, administer, plan and direct development within their jurisdictions. With respect to water management issues, the Act provides municipal authority to:

- determine and control the type and density of land uses
- determine and control extent of land subdivided
- regulate the type and extent of development on private land
- establish bylaws and controls on activities and the use of lands within their jurisdictions
- regulate the type of water disposal systems for cottage and recreational development next to a water body
- regulate the use of zoning bylaws, the placement of seasonal piers within a subdivision
- take the floodable land as Environmental Reserve

Section 60(1) "Subject to any other enactment a municipality has the direction, control and management of the rivers, streams, watercourses, lakes and other natural bodies of water within the municipality, including the air space above and the ground below".

Provincial – Environmental Protection and Enhancement Act

One key component of the *Environmental Protection and Enhancement Act* (EPEA) is to provide a framework for evaluating the impacts of activities on water quantity and quality, protecting the quality of both surface and groundwater, regulating the discharge or deposition of harmful substances into water bodies and aquifers, and managing land uses that can have a significant impact on the quality of water supplies.

The Act prohibits the release of any substance that causes or may case a significant adverse effect unless the release has been authorized. Penalties are issued for knowingly conducting a prohibited activity, releasing prohibited substances, providing false or misleading information, or for violating an approval, Environmental Protection or Enforcement Order.

Provincial – Alberta Land Stewardship Act

The *Alberta Land Stewardship Act* provides for the establishment of regional plans. The purpose is to provide a single planning process where land management decisions could be made on both private and public lands. The Act does not break the Province into regions; these are established under the *Land Use Framework*. Environmental effects on land, air and water are to be balanced with social and economic goals. Issues such as the pace of development, its density, water use, cumulative impacts, disturbance areas and wildlife populations could all be addressed in regional, sub regional or issue-specific plans.

Provincial – Public Health Act

The *Public Health Act* is concerned with the protection of public health. One aspect of the Act is water management. Water management is regulated in the form of outdoor lavatories and limits for amounts of contaminants in water. Guidelines have been established at the federal level for drinking water and recreational water quality.

Federal – Fisheries Act

Changes to the *Fisheries Act,* which took effect in 2013, include focusing the act to protect commercial, recreational and Aboriginal fisheries. Creeks that do not contribute to one of the three previously mentioned fisheries may no longer require approval from DFO, although all waterbodies including creeks, streams and ditches that support sport fish may still require approval from DFO for in-stream works. Clearing vegetation in or beside creeks may still require *Water Act, EPEA or Public Lands Act* approvals. It should be noted that the Crown (Alberta) owns all water resources unless they are specifically titled to the property owner, which is generally not the case.

Provincial - Wastewater and Storm Drainage Regulation

Municipal stormwater drainage and wastewater systems have been regulated by Alberta Environment and Parks primarily through the use of the *Water Act* and related regulations. This legislation sets out requirements for the construction and operation of municipal plants for handling of stormwater drainage and wastewater.

Alberta's environmental laws have been consolidated and updated by *EPEA*. Part 5, Division 1 of the Act deals with the release of substances into the environment, regulating releases and creating general prohibitions with respect to substance release, and provides the necessary powers to regulate the handling of storm drainage and wastewater. The Wastewater and Storm Drainage Regulation and the Wastewater and Storm Drainage (Ministerial) Regulation enable the Department to regulate the operation of storm drainage and wastewater systems and establish standards for such facilities and their operators.

These regulations have updated references to standards and guidelines for specific design and operating criteria, referring to the most recent edition of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* (Government of Alberta).

As well, these regulations have modified requirements for the certification of operators of storm drainage and wastewater systems. Operators of most systems require a certificate as set out in the most current version of the *Water and Wastewater Operator's Certificate Guidelines* (Government of Alberta).

Provincial - Wildlife Act

This Act governs the management of wildlife as a Crown resource and enables the hunting and trapping of wildlife, stating that the remains of dead animals are the property of the Crown unless otherwise specified; also addresses conservation of endangered species.

3.2 Policies (Provincial and Municipal)

To reference Municipal policies, refer to the Municipal Policy Handbook on the Strathcona County public website.

Municipal – SER 001-002 Surface Water Management and Erosion Control

This policy indicates that Strathcona County will promote the sound management of surface water resources utilizing the technical and financial support of various governments, non-profit agencies and cooperating landowners where applicable. The policy states that water management projects and the improvement or enhancement of assets will be ranked in order of priority.

Municipal – SER-012-008 Encroachments onto Lands in which the County Holds an Interest

This policy states that Strathcona County at its sole discretion may authorize encroachments which have occurred onto County property or a County easement/right-of-way through a written agreement with the infringing party. The policy outlines the responsibilities and types of encroachments onto County easements, roads and road allowances, Public Utility Lots, municipal reserves and other County owned properties.

Municipal – SER-012-009 Stormwater Management Facility Easements

The Stormwater Management Facility Easements Policy outlines the non-County use of stormwater management facilities, easements and the management of easement interests. The policy defines an encroachment as any illegal intrusion onto a stormwater management facility. The County may or may not approve proposed encroachments made onto County easements/Right-of-Way both prior to policy and post policy encroachments. Under the policy, development of retaining walls is prohibited. The policy outlines the responsibilities of the County, the Developer and the landowner.

Municipal – SER-009- 036D Wetland Conservation Directive

This directive states how wetlands benefit Strathcona County and identifies a goal of no net loss. Wetland function can be balanced in the urban and rural environment through no net loss where damaged wetlands are rehabilitated, or healthy wetlands are enhanced.

Proponents are required to work through mitigation activities including avoidance, minimization and replacement. As a last resort, compensation for lost wetland functions can be sought by creating wetlands in an area that had none before. Planning and Development Services, Utilities and Transportation and Agriculture Services are all involved in implementing the *Wetland Conservation Directive*.

Municipal – SER -001-034 Weed and Pest Control

The control of weeds, pests and problem species is a shared responsibility between landowners, the Province of Alberta and Strathcona County. The County will educate, inspect and provide notices in accordance with the *Agricultural Pests Act*, *Animal Health Act*, *Fisheries (Alberta) Act*, *Weed Control Act* and *Wildlife Act*. In accordance with the Best Management Practices set forth in this document, controlled weeds should be eradicated using techniques that do not affect the effectiveness of the SWMF (refer to **Section 5.3.2 *Vegetation Management***).

Provincial - Water for Life Strategy: Alberta's Strategy for Sustainability

The *Water for Life Strategy* developed by Alberta Environment and Sustainable Resources Development in 2003 is the Government of Alberta's response to develop a new water management approach and outline specific strategies and actions to address issues Alberta is facing with population growth, droughts, and agriculture and industrial development. The strategy's goals are:

- safe, secure drinking water supply
- healthy aquatic ecosystems
- reliable, quality water supplies for a sustainable economy

The strategy affects how stormwater management is conducted; ensuring watershed protection and improved water quality is the foundation of each best management practice.

In the *Water for Life Action Plan* (2009) aquatic ecosystems are highlighted as the source of Alberta's water. Not only does the economy rely on this water, drinking water supplies are also connected to a stable and safe water source. Regional and watershed plans will establish priorities for sustaining aquatic ecosystems.

Provincial - Stormwater Management Guidelines for the Province of Alberta

The document was intended to be viewed as a tool to assist in making decisions and not as a rulebook for stormwater management solutions. The guidelines outline objectives of stormwater management and the available methodologies and concepts for the planning, design, and operation of a SWMF. The guidelines describe water quantity and quality techniques to be used for effective stormwater management.

Provincial – Alberta Wetland Policy

This policy was approved in 2013. The policy aims to minimize the reduction and degradation of the Province's wetlands while supporting growth and economic development. The goal of Alberta's *Wetland Policy* is to conserve, restore, protect, and manage wetlands to ensure their benefits extend to the environment, society and our economy. It seeks to connect a broad range of knowledge and science around wetland functions and benefits.

The policy focuses on the following outcomes:

- Wetlands of the highest value are protected for the long-term benefit of all Albertans.
- Wetlands and their benefits are conserved in areas where losses have been high.
- Wetlands are managed by avoiding and minimizing negative impacts, and where necessary, replacing lost wetland value.
- Wetland management considers regional context.

Provincial – Land Use Framework

The *Land Use Framework* sets out a comprehensive approach to managing the Province's land and natural resources by establishing seven new land-use regions and calling for a regional plan to be created for each. Each region is broken down by watershed boundary. The Framework sets clear roles and responsibilities for land-use decisions at all levels. The *Land Use Framework* consists of seven strategies that provide a way for the Province to grow while respecting the land, people and economy for current and future generations.

Specifications and guidelines

Design and Construction Standards (DCS)

The DCS manual is used to provide information, set guidelines and establish requirements for developers, engineering consultants, utility companies and Strathcona County departments to ensure all work is done to a specific standard. It focuses on standards, governing design, preparation and submission of plans and specifications for construction of municipal improvements within Strathcona County. The DCS are meant to provide minimum standards; variations for a better technical or economical solution are encouraged to be presented to Strathcona County for approval. It replaces the Engineering Servicing Standards document, Open Spaces Development Standards, urban and rural standards, Strathcona County standard documents and computer aided drafting standards.

Recreational activities

It is important that SWMFs are not treated as natural lakes, as such recreational activities involving contact with the water or ice in SWMFs may be limited. Unacceptable recreational activities are located within the ***Parks Bylaw* 21-2013** (section 13, 14).

3.4 Bylaws (Municipal)

Municipal Development Plan

The Municipal Development Plan (MDP) looks at strategic land use planning for Strathcona County over the next 20 years and beyond. It is a statutory document required by the Province of Alberta under The *Municipal Government Act* (MGA). The MDP highlights the needs and directs the growth of land use, development, economic development, servicing and social infrastructure for the municipality as it moves forward. It provides policy and guidance that considers the vision, goals and objectives for future development in Strathcona County and serves as an important decision-making tool for Council, administration and all stakeholders.

The plan works towards sustainability by creating efficient land use and infrastructure, multi-modal transportation, fostering local business and economic development, and creating communities that are affordable, accessible, and inclusive to people of all ages, incomes and abilities. It sets goals and objectives for the Urban Service Area including direction for stormwater management.

Through the MDP, Strathcona County will ensure safe, reliable and efficient stormwater utilities by requiring wet ponds, constructed wetlands or natural wetlands for new development. It will also promote safe, reliable and efficient stormwater utilities by encouraging the use of low impact development techniques for cold weather climates.

Surface Drainage and Site Grading Bylaw 32-2017

This bylaw controls surface drainage and site grading on private and public sites within the County. Lot drainage requirements and restrictions affecting surface drainage and site grading are detailed for commercial, country residential and residential properties.

Standards and Requirements

Parks Bylaw 21-2013

This bylaw regulates operating hours, public conduct, camping, use of dangerous objects, littering, fires, animals, vehicles, boating, swimming, motorized vehicles and other matters in parks and recreational areas.
Written approval for special park uses may be obtained through Recreation, Parks and Culture at 780-467-2211.

Unauthorized Use of County Property Bylaw 8-2007

This bylaw regulates the unauthorized use of County Property to promote the safe, enjoyable and reasonable use of such land and to protect and conserve natural ecosystems for the benefit of all citizens of the County.

Signs will be located at accesses to SWMFs or areas requested by Strathcona County. Smaller safety signs (no skating, no swimming) will be located between NWL and HWL. The developer is responsible for the cost of designing, purchasing and installation of the signs.

Additional signs will require the following information:

- Site address and name (i.e., Broadmoor Park)
- Plan outlining features of the SWMF including trails, view decks, rest areas, litter receptacles, etc.
- "You are here" locator
- Message that reads: "Did you know? All stormwater management facilities are connected to the natural creek systems within Strathcona County, which drain directly into the North Saskatchewan River"
- Indicate with advisory graphics responsible use information:
    - Keep wildlife wild
    - Stay on designated trails to protect nesting areas
    - Do not approach or feed animals, including birds
    - Do not dispose of fish and/or fish tanks
    - Keep dogs on leash and clean up after your pet
    - Properly dispose of litter

Signage must be completed at the same time subdivision and area structure plan signs are installed in new subdivisions. The installation and timing must be a condition of the Development Agreement. If signs cannot be installed at that time, a construction certificate will not be issued on infrastructure or landscaping of the SWMF until such a time as signs are installed.

Unauthorized Use of Conservation Easements Bylaw 68-2005

This bylaw regulates the use of environmental reserve easements and conservation easements and requires these areas to be left in their natural state. Onsite inspections and enforcement may be required to ensure that these easements are restored or maintained as necessary.

4.0 STORMWATER MANAGEMENT FACILITY BEST MANAGEMENT PRACTICES

4.1 Source control best management practices

Source control BMPs act to remove pollutants at their source. If possible, surface water and stormwater should be prevented from coming into contact with surfaces where pollutants are concentrated. The following table outlines possible pollutants found in SWMFs and their sources.

Table 4-1: Summary of pollutant sources

Contaminant	Contaminant source
Sediment	Street, lawns, driveways, roads, construction activities, atmospheric deposition, drainage channel erosion
Pesticides and herbicides	Residential lawns and gardens, utility right of ways, commercial and industrial landscaped areas, soil wash off
Organic material	Residential lawns and gardens, commercial landscaping, animal wastes
Metals	Automobiles (zinc from tire wear, deteriorating brake pads, or leaks and spills of oil), bridges, atmospheric deposition, industrial areas, soil erosion, corroding metal surfaces, combustion processes
Oil and grease/hydrocarbons	Roads, driveways, parking lots, vehicle maintenance areas, gas stations, illicit dumping to storm drains
Bacteria and viruses	Leaky sanitary sewer lines, sanitary sewer cross-connections, animal waste, septic systems
Nitrogen and phosphorus	Lawn fertilizers, atmospheric deposition, automobile exhaust, soil erosion, animal waste, detergents

In order to implement an effective source control BMP, it is necessary to include those landowners who are the source of the pollution or affected by the pollution, to develop a sense of ownership and stewardship. The landowners can be informed as to problems, consequences and the solution. Effective education programs are aimed at the public and private sectors and include household, recreational and work activities that may result in pollutants. Information regarding pollution reduction will be a focus. Residents can educate themselves on best practices through the good growing neighbours stormwater management information on the Strathcona County website.

Source control BMPs include:

- managing pesticides and fertilizers
- good household practices (sweep instead of hosing down paved areas)
- control of construction activities (install silt fences where necessary)
- street sweeping
- catchbasin cleaning
- animal control bylaw (proper pet waste disposal)
- conserve natural aquatic vegetation

For specific maintenance and management requirements for source control BMPs refer to **Section 5.0 *Stormwater Management*.**

4.1.1 Pesticides and fertilizers

Residents, industry, government and commercial companies use pesticides and fertilizers for various reasons. Even though pesticides are important for activities associated with the various users, the amount and timing of application must be managed. Property owners adjacent to SWMFs must be educated on how their use of pesticides and fertilizers affects the water quality of the facility. Refer to **Section 5.3.10 *Communications*** and **Section 6.3 *Public/Landowner Roles and Responsibilities***. Pesticide use can be minimized through Integrated Pest Management (IPM). The IPM practices develop and deliver sustainable ways to manage pests that are cost-effective and pose minimal risks to human health and the environment.

The IPM practices promote the following alternatives to pesticides and fertilizers by:

- using natural predators and pathogens to control pests
- ensuring the timing of applications are conducted during the most vulnerable phase of the pest's life cycle
- removing insects (including eggs and larvae) and weeds using mechanical devices
- using pesticides that are degradable and non-carcinogenic
- concentrating efforts on the most widely affected areas
- using site specific methods
- controlling weeds by hand where possible
- Fertilizers are a significant source of nutrients in surface water runoff, specifically nitrogen and phosphorous. The use of fertilizers can be minimized by limiting the amount and timing of application. Other alternative practices may include:
    - limiting application
    - incorporating fertilizers directly into the soils rather than surface applications
    - using slow releasing fertilizers
    - substituting natural materials, such as compost and horticulture manure, for fertilizer
    - limiting applications to seasonal periods that minimize losses to surface runoff and groundwater percolation
    - avoiding application during extended dry periods
    - avoiding over watering lawns to limit excess runoff

4.1.2 Household activities

Good housekeeping practices can effectively control source pollution. Residents can practice certain activities (clean up spills, do not hose down pollutants, and cover open piles); however, they can be applied to commercial, industrial, and construction sites as well. For a complete list of activities refer to ***Household Activities*** in **Section 6.3**. Public education is the key component to controlling non-point source pollution. Household, commercial and industrial activities potentially pollute stormwater.

4.1.3 Commercial and industrial activities

Commercial and industrial activities that generate metal and organic pollutants must be managed in a way that promotes recycling and reusing. Generated pollutants that cannot be altered or changed should be covered or contained. If pollutants enter the surface water runoff, on-site treatment is required or routing contaminants to the sanitary sewer, if permitted. Spill prevention and control should be the focus as a proactive and not reactive measure.

Activities related to automobiles typically generate metals and hydrocarbons. Several source control measures include:

- cleaning heavily used parking lots
- using oil and grease recycling centers
- inspecting and repairing vehicle fluid leaks upon detection
- reducing vehicle use

Road de-icing during the winter contributes to heavy metal, cyanide and high salt concentrations in surface water runoff. By reducing the use of de-icing salt or using alternative deicers, the impact of pollutants can be minimized. Strathcona County currently uses salt, and calcium chloride ($CaCl_2$). For more information, see the ***Road Salt Management Plan*** **SER-009-033**.

4.1.4 Construction activities

Construction activities have been recognized as a principal source of causing sedimentation in stormwater. Sediment is soil particles suspended in water. Sediment is caused by soil erosion created by a variety of construction activities. Soil erosion is the removal and loss of soils via water, wind, gravity, or ice movement. In addition to erosion, construction activities also generate pollutants from use of pesticides, petroleum products, nutrients, solid waste, garbage and construction materials. Refer to Strathcona County's Policy **SER-001-002 *Surface Water Management and Erosion Control Program*.**

The owner/contractor is responsible for all erosion and sediment control on construction sites and may be required to prepare an Erosion and Sediment Control Plan as part of development approval process.

This could take the form of socks on catchbasins, sediment filter bags and silt fences where necessary and immediate vegetation planting after soil exposure. Sumps are recommended on private developments and are recommended to be maintained annually at owner's expense. Owners will be responsible for ongoing maintenance/grit removal from the catchbasins as required.

Pollutants can be minimized using non-point source controls. For specific roles and responsibilities refer to **Section 6.3.1** ***Commercial and Industrial Responsibilities***.

4.1.5 Catchbasin cleaning

Catchbasins collect debris and sediment. Cleaning the debris and sediment from catchbasins will reduce the amount of pollutants discharged in the SWMF and is the most cost effective mechanism for removing pollutants. Specific design criteria for catchbasins can be located in the DCS.

Currently, Strathcona County undertakes catchbasin cleaning on a four-year rotational basis.

4.1.6 Street sweeping

Street sweeping removes pollutants deposited on roads and parking lots, thereby reducing pollutant runoff to the SWMF. The effectiveness of street sweeping is dependent upon the time of year, frequency, length of time between rainfall, type of sweeping equipment and the road surface. Early spring is the most effective time to remove accumulated pollutants. Strathcona County currently sweeps the entire urban area (including residential, collector, industrial and arterial) once a year. Collector, arterial and/or industrial may be swept as well on an as needed basis June through October.

4.1.7 Animal waste removal

Fecal bacteria from animal waste are a significant pollutant and risk to human health. Street sweeping is not an effective method for controlling fecal material. Therefore, prohibiting littering and controlling the disposal of animal waste on adjacent land will reduce pollutant loading of the surface water runoff. Public education is paramount to raise public awareness, see **Section 5.3.10** ***Communication*** for further information.

4.1.8 Specifications and design

Specific design criteria for source control BMPs can be located in the **DCS.**

4.2 Lot level

Lot level BMPs act to reduce and slow surface water runoff volumes and/or treat runoff before it reaches the SWMF. The BMPs are applied at the individual lot level or on multiple lots in a small drainage area (less than two ha.). Lot level BMPs are site specific.

4.2.1 Reduced lot grading

Purpose

Reducing lot grades will reduce the volume of runoff by increasing runoff travel time, depression storage and infiltration. The intention of reduced lot grading is to promote recharge and reduce downstream erosion.

Description

In Strathcona County, the local building codes require a minimum lot grade of 10% within 1.5 m of a building. Minimum and maximum slopes on landscaped areas are to be 2% and 10%, respectively. It is within this range of allowable slopes that reduced lot grading can be implemented to achieve the desired benefits. Reduced lot grading BMPs promote depression storage and natural infiltration and reduces risks associated with flooding and erosion. The maintenance of natural infiltration could have positive impacts on baseflow, or low-water flow, depending on evapotranspiration rates.

All lot grading is to be within private property. Where private property grade is higher than surrounding SWMF grades, back sloping is to end at property line. All grades are to form a smooth, even transition into public lands. Fill will not be permitted within the SWMF or in lands adjacent to natural wetlands.

Applicability

Reduced lot grades can be recommended as a lot level stormwater BMP for any new developments and in re-grading or re-landscaping of existing lots in established developments.

Effectiveness

Very little information has been recorded on the effectiveness of lot grades on overall runoff volumes from a developed area. This practice will impact the capacity of usefulness on the landowner's land as the water ponded on lots may take 24 to 48 hours to drain. However, this impact will be greatest during the spring period, with negligible impacts during the summer.

Design

Submit engineering drawings to Strathcona County for approval. Refer to ***Surface Drainage and Site Grading Bylaw 32-2017*.**

4.2.2 Infiltration trenches

Purpose

The purpose of an infiltration trench is to collect and provide temporary storage of surface water runoff and to promote infiltration.

Description

Infiltration trenches may be constructed at ground surface to intercept overland flows directly or constructed in the subsurface as part of a storm sewer system. Generally, infiltration trenches are composed of a clean stone storage material with a sand or peat filter layer.

Applicability

Infiltration trenches are recommended for small drainage areas less than two ha., specifically for small residential areas of a few lots, multi-family housing, commercial areas, parking lots and open space areas. Use of infiltration trenches for industrial land is discouraged due to a greater potential for pollutants. Some form of upstream pre-treatment may be required.

Effectiveness

Infiltration trenches provide limited water quantity control as they are sized for quality control. Infiltration trenches do result in reduced runoff which reduces end-of-pipe storage requirements. Infiltration trenches provide groundwater recharge potential and enhance water quality; however, pre-treatment may be required if sediment content is high.

Design

Submit engineering drawings to Strathcona County for approval.

4.3 Conveyance system

Conveyance system BMPs transport surface water and stormwater runoff from developed areas through sewers or grassed swales.

4.3.1 Vegetative swales/bioswales

Purpose

The purpose of the vegetative swale is to convey stormwater runoff at a low enough velocity that will not cause erosion and will enhance water quality through infiltration, sedimentation, and filtration and should be designed in such a manner that minimal mowing is required. Vegetative swales have been historically constructed for stormwater conveyance; currently they are used to store, infiltrate and convey road and on-lot runoff.

They are open channels that are designed specifically to treat and attenuate stormwater runoff for a specified water volume during minor and major rain events, offering a percolation function. Swales are normally associated with low-density developed drainage basins. They are not conducive to areas where weeping tile flows are entering the bioswale and should be placed in a location without weeping tile flows as ice build-up can occur during winter months.

Description

A vegetative swale is a broad shallow earthen channel vegetated with erosion resistant and flood tolerant grasses and plants, underlain by an engineered soil mixture. Hydrophytic plant species (grasses, cattails, sedges) within the swale reduce flow velocities, prevent erosion and filter pollutants (heavy metals, chemical oxygen demand, nitrate nitrogen, ammonia nitrogen and suspended solids). Plants with deep roots should be avoided as they may puncture the filter fabric. There are several swale designs including grassed, dry, and wet, however all provide the same purpose of improving stormwater runoff quality

Applicability

Where possible, vegetative swales should be designed as a conveyance system into or between SWMFs. Vegetative swales provide effective water quantity and quality control of urban and rural runoff. Many stormwater contaminant particulates are effectively filtered by vegetative swales including heavy metals, chemical oxygen demand (COD), nitrate and ammonia, nitrogen and suspended solids. They are especially effective near highways and residential roadways. Vegetative swales are typically used in more rural areas with rolling or relatively flat land. Swales may be designed to replace curb and gutter controls.

Effectiveness

Water quality improvement is dependent upon the contact area between the water and the swale and the longitudinal slope. Deep narrow swales are less effective than shallow wide swales.

Design

Submit engineering drawings to Strathcona County for approval.

4.3.2 Vegetative channel/ditches

Purpose

Vegetative channels are constructed to store and convey road and on-lot runoff. Channels are normally associated with low-density developed drainage basins.

Description

Vegetative channels differ from vegetative swales in size and volume/speed of flow that passes through. Vegetative channels have less naturalized characteristics and may have a more unstable bank.

Applicability

Vegetative channels are applicable to define flow. Having a flat vegetated bottom discourages erosion.

Effectiveness

Channels are effective in residential areas where roof and impervious surface runoff primarily collects in the channel.

Design

Submit engineering drawings to Strathcona County for approval.

4.4 Pre-treatment

Pre-treatment BMPs are often found surrounding SWMFs or just upstream of the facility. They may offer primary settlement or assist with nutrient uptake.

4.4.1 Buffer strips

Purpose

Buffer strips are vegetated natural or naturalized areas between development and receiving waters. They are designed or conserved to protect wetlands, streams and drainage corridor systems and to protect vegetated riparian areas to minimize the impact of development of the water body itself.

Description

Buffer strips are the first filter for surface water and stormwater runoff by slowing the runoff rate, removing nutrients and filtering sediment. The protection of stream and drainage corridors provides significant benefits to wildlife, aquatic habitat, terrestrial habitat and linkage between natural areas.

Applicability

Buffer strips are best applied as one of a combination of BMPs as the maintenance of sheet flow through the vegetation has been difficult to maintain in practice. With uneven sheet flow consistent water quality benefits are difficult to attain.

Effectiveness

Limited buffer strip performance data is available although it is generally thought that properly designed buffer strips can remove a high percentage of stormwater particles. Vegetative buffers around the perimeter of the SWMFs are recommended for erosion control and additional sediment and nutrient removal. They also provide a barrier between domestic animals and wildlife, and often provide habitat within the urban area. With the introduction of the Best Management Practices, enforcement and education will assist in ensuring the buffer strips remain in place to function as they were designed or conserved.

Design

Specific design considerations are not documented, although vegetation should be suited to the adjacent habitat and land uses. Existing buffer strips do not require submitted drawings. If new buffer strips are being designed, submit engineering drawings to Strathcona County for review.

4.4.2 Oil/grit separators

Purpose

Oil/grit separators are a variation of the traditional settling tank, designed to capture sediments and trap hydrocarbons in surface water runoff. They settle solids and trap litter and oils before stormwater enters a permanent waterbody. Heavier materials will collect at the bottom of the chamber while floatable materials collect at the surface. The rest of the stormwater will pass through the chamber and continue on through the system.

Description

An oil/grit separator is an underground retention structure that takes the place of a manhole in the storm sewer system. There are two designs; the three chamber and the bypass separator. Three chamber separators operate most effectively when constructed off-line, with low flows directed to this separator. Bypass separators should be installed online, as they can handle high flows. Some common types of oil/grit separators include StormSceptors, Samurators, Continuous Deflective Separation Systems, and SNOUT® hooded outlet covers, but a variety of designs exist.

Applicability

Oil/grit separators are suitable for drainage areas smaller than five ha. They are best suited to areas of high impervious cover where there is a potential for hydrocarbon spills and polluted sediment discharges, including parking lots, commercial sites, industrial sites, gas stations, airports and pre-treatment in residential areas. Regular maintenance is important for performance.

Effectiveness

Oil/grit separators provide effective treatment of surface water runoff quality when used at the source or as pre-treatment. Separators that do not incorporate a flow bypass are ineffective in removing and containing sediments and oils due to continuous re-suspension. Oil/grit separators are effective in reducing total suspended sediments, depending on land use, drainage areas and site conditions. Oil/grit separators are not designed to provide water quantity control.

Design

Submit engineering drawings to Strathcona County for approval.

4.5 Treatment

Treatment BMPs are typically called stormwater management facilities (SWMF) and include dry ponds, wet ponds, constructed wetlands and natural wetlands; listed from least preferred to most preferred by the municipality. Treatment SWMFs receive surface and stormwater runoff from a variety of conveyance systems. Treatment SWMFs provide water quality improvement prior to discharge into a receiving water body (with the exception of dry ponds which are used to manage water quantity).

4.5.1 Dry ponds

Purpose

As mentioned in previous sections, dry ponds are designed to temporarily store stormwater; they do not retain a permanent pool of water. They are largely used for water quantity and erosion control and are used in conjunction with other SWMFs.

Description

Existing dry ponds will be maintained to existing standards as a part of our stormwater management system. They are not parks and cannot be maintained to that standard and will be left in a more natural state. Strathcona County does not permit the development of dry ponds in future developments and encourages alternate methods of handling stormwater.

Applicability

Dry ponds are often used when land restraints require a stormwater management facility with a smaller area. Without a permanent pond however, dry ponds are not effective for meeting water quality objectives. They were originally intended to be used as recreation facilities during dry periods, however wet fields, uneven soil and sediment deposits proved to be a hindrance for recreational uses. Strathcona County has found that their most effective use is for temporary storage of stormwater.

Effectiveness

Dry ponds are ineffective for water quality control since they can only infiltrate limited volumes of stormwater. They are used in conjunction with wet ponds and wetlands to remove suspended solids.

Design

Strathcona County does not permit new development of dry ponds, for further information contact the Utilities department (780-467-7785) or the Planning and Development Services department (780-464-8080).

4.5.2 Wet ponds

Purpose

Wet ponds store surface water and stormwater runoff to control discharge to pre-development levels to reduce downstream flooding and erosion in receiving water bodies.

Description

These facilities were designed to include the following features:

- a permanent pool that prevents re-suspension
- a permanent pool that minimizes blockage of outlet
- biological removal of pollutants
- a permanent pool that provides extended settling time for silt
- additional capacity above permanent pool for temporary storage

Runoff entering the wet pond is slowed by the permanent pond where suspended solids and pollutants settle out of the water column. The major biological processes that occur are nutrient uptake by vegetation and algae and pollutant degradation by microorganisms.

Vegetation provides improved pollutant removal, shading, wildlife habitat, safety, erosion resistance and aesthetics. Friction of vegetation on water slows the speed of runoff. Wet ponds have significantly less vegetation coverage, density and variety than **Section 4.5.3 C*onstructed wetlands*** or **Section 4.5.4**. ***Natural wetlands***.

Applicability

Wet ponds are suitable for large drainage areas, for residential, commercial and industrial lands. Wet ponds used to be the most widely used design for SWMF. Preference recently has been for facilities that offer more vegetation and more natural treatment processes.

Effectiveness

Flood control, erosion control for small storm events and pollutant removal are generally provided by most wet pond designs. The permanent pool allows sediments to drop to the pond bottom, minimizing pollutant concentrations in downstream watercourses. Shoreline plants take up nutrients and heavy metals while microorganisms break down other organic impurities.

In older developments, homes backing on to the wet pond had direct access to the facility. Despite education and outreach about municipal encroachment bylaws in place, natural shorelines were often replaced with rip rap and manicured landscaping to ensure clear views and access to the SWMF for the homeowner. In this type of environment, Canadian Geese are often the dominant species. Taller vegetation discourages the geese and allows for a diversity of other wildlife species.

The open water focus of the wet pond design often results in higher resident expectations of aesthetics. Its appearance as a park amenity rather than a treatment facility can lead to confusion about water and ice contact and acceptance of natural state landscaping. Concerns over algae and tall vegetation are common with these designs as perceived home value is often associated with stormwater treatment facility appearance.

Design

Wet pond designs need to ensure 85% Total Suspended Solids removal of 75 microns or larger as per the 2001 *Alberta Stormwater Management Guidelines* (Section 6.0).

Submit engineering drawings to Strathcona County for approval.

4.5.3 Constructed wetlands

Purpose

Constructed wetlands retain surface water and stormwater runoff similar to a wet pond but provide additional water quality enhancement through biological treatment. Wetland plants present in the constructed wetland provide the necessary conditions for slowing water flow and dropping out additional sediments. The microbial action surrounding the plant life and its soils can break down pollutants such as phosphorus, nitrogen and bacteria from stormwater runoff. These reactions create available nutrients for plant growth while making other pollutants inactive.

Because of their benefits, these facilities are the most common treatment facility in new developments. The vegetation surrounding constructed wetlands is an integral part of the treatment process and mow widths should be considered to maximize bank stability and nutrient uptake.

Description

Constructed wetlands consist of shallow extended detention areas with extensive native species plantings. They are constructed by excavating, backfilling and grading, often with flow control structures to mimic spring and summer flow differences. Changes in water level are used to encourage health and biodiversity for resident species.

These facilities are designed with the basic features of a wet pond but have less exposed water, more vegetation and a buffer between houses or other hardscape. Fenced access from surrounding private back yards to the natural park space surrounding the wetland is rare. Recreational trails may be added below the high-water line to encourage community use of the facility during baseflow (non-rain or melt event) periods.

Applicability

Similar to wet ponds, constructed wetlands are suitable for large drainage areas, for residential, commercial and industrial lands. These facilities can be a solution for wetland mitigation requirements under the Strathcona County and Alberta Wetland Policies ***SER-009- 036D Wetland Conservation Directive*** and *Alberta Wetland Policy.*

Effectiveness

Sedimentation, filtration, biological and chemical processes affect water quality improvement. It has been shown that constructed wetlands effectively lower biochemical oxygen demand, total suspended solids and total nitrogen concentrations.

The permanent pond in the constructed wetland system is the major source of water quality improvement. Constructed wetlands are very effective in controlling peak runoff discharges and the enhancement of water quality. Constructed wetlands are designed to meet specific water quality and quantity objectives and mimic natural wetlands.

Wetland plants, trees, shrubs and tall, native grasses can also discourage resident goose populations.

Design

Submit engineering drawings to Strathcona County for approval.

4.5.4 Natural wetlands

Purpose

Wetlands are some of the most diverse and biologically rich ecosystems in the world. Natural wetlands for stormwater treatment are the ultimate solution for mimicking natural hydrologic flows and water treatment capabilities. Rather than built structures, they are natural waterbodies already established in a new development. Additional treatment for water quality is provided by the established ecosystem which incorporates existing soils and vegetation to enhance water quality treatment capabilities for the purpose of watershed protection.

Permanent pools store surface water and stormwater runoff to promote pollutant removal and control discharge to pre-development levels. Similar to wet ponds and constructed wetlands, they help to reduce downstream flooding and erosion in receiving water bodies.

Description

Minimal engineering changes are made to natural wetlands to conserve the capability for treatment and wildlife habitat. While no two natural wetland features will ever be similar, they may share similar characteristics. Such as:

- existing soil and soil microbes
- presence of baseflow or surface water
- providing moisture to vegetation

Applicability

Similar to wet ponds and constructed wetlands, natural wetlands are suitable for large drainage areas, for residential, commercial and industrial lands. Natural wetlands can only be incorporated into a stormwater management facility if it resides within the area to be developed, making them rare in most urban communities.

Effectiveness

Preserving a natural wetland without stormwater inputs is thought to be the ideal use of these facilities; however, they have proven to be an effective tool for stormwater management. If managed responsibly, natural wetlands should not significantly reduce the quality of water from its previous use. ATV use and active recreation in the riparian zone should be discouraged to protect against erosion and harm to wildlife.

Design

Submit engineering drawings to Strathcona County for approval.

5.0 STORMWATER MANAGEMENT

There is some limited experience with stormwater techniques and designs in Alberta particularly when it comes to constructed wetland design and best management practices. While this should not discourage use of new technologies, there must be a higher regard for monitoring performance. Ongoing maintenance is extremely important to ensure continued effectiveness and resources to ensure this is part of the management strategy required.

5.1 Water quality

As Alberta continues to grow and the demand for water increases, water quality is becoming an important issue that must be addressed. Water quality will play a prominent role in defining water management. The useable volume of water from underground sources is limited by its quality. In general, only groundwater within 400 m of the surface is suitable for domestic consumption or industrial use (Alberta Environment and Parks). In association with the altered drainage characteristics caused by urbanization, there are changes in water quality. The runoff from the urban area contributes to the pollution loading of nutrients, bacteria, sediment, heavy metals, oils, grease and in the spring, road salt in receiving water courses.

Traditionally, stormwater has been managed from a *quantity* rather than a *quality* perspective. In prior years, it was perceived that stormwater posed a relatively low source of pollution, however recent studies have shown that there can be a significant pollutant load risk in stormwater runoff. It is now being recognized that the discharge from Stormwater Management Facilities (SWMF) can have an adverse effect on the receiving waters. Stormwater runoff may be contaminated with various pollutants from industrial lots, automobile emissions and other household pollutants (pesticides, fertilizers) often at concentrations exceeding water quality objectives. If not managed properly, these contaminants may become a significant source of pollution and may ultimately affect the potable water supply.

In January 1999, the provincial *Water Act* came into effect, requiring approvals and licenses for any activities that may alter natural drainage, constructing improved drainage channels and outfall structures affecting natural water bodies. Refer to ***Provincial Water Act*** in **Section 3.1**.

The Alberta provincial Government guideline for Total Suspended Solids (TSS) from a stormwater facility is 85% minimum removal of the total load. (Government of Alberta).

In order to ensure the Provincial guidelines are being met, it is Strathcona County's goal to require developers to monitor SWMF functions (including design) between the CCC and FAC in order to meet the provincial guideline of 85% total load removal. Initial designs are discussed during area structure plan creation and subdivision planning.

Table 5-2: Common stormwater pollutants

Constituents	Effects
Sediments – Silt, dissolved solids, turbidity	Stream turbidity Habitat changes Recreation/aesthetic loss Contaminant transport Filling of SWMF
Nutrients – Nitrate, nitrite, ammonia, organic nitrogen, phosphate, total phosphorus	Algae blooms Eutrophication Ammonia and nitrate toxicity Recreation/aesthetic loss
Microbes – Total and fecal coliforms, fecal streptococci viruses, *E. coli*, enterocci	Ear/intestinal infections Recreation/aesthetic loss
Organic matter – Vegetation, other oxygen-demanding materials	Dissolved oxygen depletion Odours Direct and indirect fish mortality
Toxic pollutants – Heavy metals (cadmium, copper, lead, zinc), organics, hydrocarbons, pesticides/herbicides	Human and aquatic toxicity
Thermal pollution	Dissolved oxygen depletion Habitat changes Direct and indirect fish mortality
Litter and debris	Recreation/aesthetic loss

Source: Municipal Stormwater Management, 2nd Edition

Interest has steadily increased over the last three decades in the use of natural physical, biological and chemical aquatic processes for the treatment of polluted waters. This interest has been driven by growing recognition of the natural treatment functions performed by wetlands and aquatic plants, by the escalating costs of conventional treatment methods and by a growing appreciation for the potential ancillary benefits provided by such systems.

Total suspended solids (TSS)

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. TSS can include a wide variety of material such as silt, industrial wastes, decaying plant and animal matter. High TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis cause less dissolved oxygen to be released into the water by plants.

If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water.

Less oxygen leads to less plants and animals which can create anoxic conditions and result in increased odour and decreased water quality.

Settling of TSS from stormwater is a key process in the removal of contaminants. Reduction in flow velocity as runoff enters deeper water is a primary means of increasing settling of solids. TSS also settle as flows are slowed by submerged and emergent vegetation and suspended solids may be trapped on the leaves and stems of underwater vegetation.

Biological oxygen demand (BOD)

Biological Oxygen Demand (BOD) may be in particulate (slowly degrading detritus) or dissolved form. Removal of the particulate fraction can be achieved by settling. The treatment of dissolved BOD requires oxidation, usually by bacteria and other decomposers. For a wetland to be effective there must be adequate retention time to allow microbes to treat the dissolved fraction. Wetlands may also produce BOD as vegetation dies and decays (City of Edmonton).

Nutrients

Nutrients occur in dissolved form. A portion is taken up (absorbed) by plants, used in plant production and bound into biomass. Treatment of nutrients in stormwater involves passing the nutrient water through a plant/algal community that is actively taking up the nutrients. Urban runoff contains increased levels of phosphorus and nitrogen. These increased levels are caused from decaying organic matter from vegetation, animals and fertilizer applications.

Nutrients are released when the plants die and decay in the fall and winter. Vegetation may also act as a pump by drawing nutrients from the soil, transporting them to the shoots and releasing them to the surroundings. When the system reaches equilibrium, phosphorus removal is likely to be reduced to the range of 30% to 50% (City of Edmonton).

Heavy metals

Heavy metals are common contaminants in stormwater. Major sources of metals are from exhaust emissions, oil and grease, corrosion, pigments in paint and stains and breakdown of the road surface. The removal of metals in wetland systems is attributed to precipitation and adsorption. Chemical precipitation is enhanced by wetland metabolism, especially by algal cells that reduce dissolved CO_2 concentrations, raise the pH and facilitate chemical changes that result in metal precipitates. Metals also adsorb onto organic material and clay particles and settle along with these particles, therefore, settling is a partial treatment for heavy metals. Metals such as arsenic, cadmium, chromium, nickel and zinc are quickly concentrated in soils and plants compared with water concentrations, primarily through direct adsorption and absorption by plants (City of Edmonton).

Pathogens

The pathogens of concern in stormwater may include parasites, bacteria and viruses. Major sources of pathogens are from animal and bird waste and cross connection of sewer systems with storm systems. They are removed from the stormwater by predation, sedimentation, adsorption and die-off due to unfavourable environmental conditions.

5.2 Water quantity

As Strathcona County expands and becomes more urbanized, manmade and natural drainage flows respond more quickly and are much higher than the pre-development flows. Drainage flow recession following a rainfall event is also more rapid. This increase in discharge may cause erosion of the drainage channels, due to higher flow velocities but not if properly designed and/or retention of riparian vegetation is incorporated. Evapotranspiration and water infiltration into the soil decrease as there is more impermeable surfaces. The reduction in infiltration results in almost immediate runoff and lowers groundwater discharge and baseflow.

Traditionally, stormwater management focused on quantity control. One of the primary functions of SWMFs is to handle rainfall events to minimize the potential of flooding, the increased risk to life and the increased risk to property damage. Changes in the hydrological cycle can cause flooding, stream erosion and sedimentation. Flooding and erosion can have direct effects on public safety, while erosion and sedimentation can affect the habitat of aquatic animals.

The amount of runoff is related to the season. Generally, most winter and spring storms are of low intensity over a long duration. Therefore, the capability to manage the runoff produced during these storms is readily managed. During the summer and fall, significant change is expected, as storms during these periods are short and intense. Flooding is more common in urban areas because of the increased runoff of precipitation on impermeable surfaces and the presence of systems that carry this runoff to receiving streams quickly. Managing these storms successfully is necessary for the SWMF to be effective in managing stormwater quantity and runoff rates must be considered in the design of an SWMF.

For calculations on determining rainfall/runoff infiltration rates refer to Alberta Environment and Sustainable Resources' *Stormwater Management Guidelines for the Province of Alberta* Section 4.0.

5.3 Management strategy

A proactive management strategy may limit liabilities and additional costs that can be incurred with SWMFs. Often, when SWMFs are not managed effectively and efficiently, the failure rate increases, which may result in preventable expenditures. It is the responsibility of Strathcona County and the developer to maintain SWMFs. Maintenance can be divided into preventative and corrective measures.

Preventative maintenance (proactive management) includes the regular maintenance of a SWMF, inspections, record keeping and analysis of data. Corrective maintenance (reactive management) is unscheduled, generally a response to an emergency including pipe breaks, collapses, or washouts. Both types of actions can be taken to reduce liability, prevent injury, reduce flood potential and/or to protect the environment.

5.3.1 Floodplain maintenance

A floodplain is land surrounding a SWMF that is susceptible to being inundated by floodwater following a rain event or during spring thaw.

Floodplain depths can vary from facility to facility depending on design. On many existing SWMFs the property owner is responsible for maintaining the floodplain within the private property easement up to the High Water Line (HWL) in accordance with Strathcona County Policy. Strathcona County's policy **SER–012-009** ***Stormwater Management Facility Easements*** has been developed as to what types of landscaping will be permitted in this area. In general, Strathcona County will maintain all County-owned land adjacent to the SWMF.

In some cases, new SWMFs are being built with the property line falling at the same location as the HWL, therefore the County would be responsible for maintenance on the entire easement area. Municipal Reserve (MR) around any SWMFs will not be given for the Public Utility Lot (PUL) where lands are below the HWL.

Property owners may be dissatisfied with the level and schedule of maintenance set by the County; however, it is imperative that they understand what is required for the SWMF to operate efficiently and effectively.

The County must work with developers to ensure that purchasers and the public in general know what the expected level and schedule of maintenance will be. Land owners adjacent to a SWMF are responsible for fence and landscape maintenance on private property.

5.3.2 Vegetation management

Vegetation establishment and management is an essential component in the design and functionality of a SWMF.

The objectives of vegetation management are to:

- Meet a set standard for SWMF vegetation by the development and ongoing monitoring of naturalization maintenance standards.
- Require the use of native plant materials or plants that possess characteristics similar to native plants. This will reduce long term management requirements, assist in the management of noxious weeds, help stabilize the shoreline and eventually result in shorelines that are similar to those of naturally occurring local bodies of water.

- Remove nutrients and treat pollutants from the water column for improved water quality.
- Provide habitat for wildlife.
- Offer aesthetic landscapes for park users and nearby residents.
- Educate the public regarding the kinds of vegetation and levels of management to be expected.

An ongoing communication with the public who own or who are considering purchasing property adjacent to SWMFs is required regarding the expected management of the vegetation and its importance to the improvement of water quality. Topics such as Alberta's invasive species, noxious weeds and the importance of healthy shoreline vegetation may be a focus for communication.

Prohibited noxious and noxious weeds, identified by visiting www.abinvasives.ca, www.strathcona.ca/agriculture-environment/plants/weeds or by completing a County Connect request through RPC, should be managed using Integrated Pest Management (IPM) activities to prevent destruction of adjacent vegetation and limit the potential for introducing herbicides to the water. This would also include invasive species. Aquatic weed growth may be controlled by several methods as growth along the inside perimeter of the SWMF may create problems such as decreasing water quality and storage capacity and emitting foul odours. The County applies herbicides in compliance with the Code of Practice for Pesticides to manage vegetation. Other methods to control prohibited noxious and noxious weeds include:

- remove weeds annually
- drain the SWMF to remove growth
- Normal Water Line (NWL) could be lowered during the winter months and then re-established during the spring to drown noxious weed seeds
- mowing or other mechanical removal before seed development

To manage submergent vegetation, Strathcona County will determine methods on a site to site basis. Spraying is rarely performed for aquatic management in Strathcona County.

Perimeter weed growth and vegetation within the stormwater facility should be accepted as a natural state of maintenance; only prohibited noxious and noxious weeds will be controlled. This method is the most economical as it protects the SWMF's water quality, requires the least amount of maintenance of the other methods and increases the aesthetic value of the SWMF. Not all weeds will be controlled even though they may be considered undesirable. Having information on the benefits of allowing growth of some vegetation and the cost savings of not removing them may help with public education and acceptance.

Algae

Algal blooms in SWMFs may occur if the facility is artificially high in nutrients (specifically nitrogen and phosphorous from surface water runoff) and are most likely near inlets. Blooms may be significant with prolonged warm weather and should be treated with chemicals only on an "as required" basis. Chemicals such as

alum or lime are acceptable chemicals for control (pesticides must be approved by Alberta Environment and Parks and should only be used as a last resort).

In 2004 the County began a new method for algae management. The treatment involves the application of a vegetable-based dye to selected SWMFs as a control mechanism for algae and submerged weeds. The dye is designed to shade sunlight wavelengths that promote algal growth. The dye does not harm the other existing vegetation, which is needed for proper functioning of the SWMF. Following an application of dye, the water will appear as an aqua-blue colour. The tint of the water varies somewhat depending upon depth, sediment in the water, and the bottom colour. The results of the effectiveness of colourant on algae growth are to be monitored over subsequent years.

When there is significant amount of dead vegetation or an abundance of vegetation that negatively affects the functioning of a SWMF, harvesting may be considered. It should be noted that a significant build-up of dead vegetation is a sign that the SWMF may not be functioning properly, for example the native microorganism population that function to degrade organic matter may not be sufficient, which in turn may mean that the overall SWMF habitat is not appropriate to support the microorganism population.

Standards and requirements

Landscape construction must pass an inspection process for a Construction Completion Certificate and Final Acceptance Certificate.

A planting strategy is required to provide:

- Shading – shading from trees, shrubs and emergent vegetation will affect temperature of the SWMF making the water body more hospitable for fish and aquatic invertebrates and creating improved biodiversity
- Aesthetics – vegetation will increase the overall visual appeal of the SWMF
- Safety – vegetation along the perimeter of the SWMF will help create an obstruction to keep the public from accessing the SWMF
- Pollutant removal
- Waterfowl management-specifically Canada Geese
- Wildlife habitat
- Sediment filter
- Weed management and maintenance

The purpose of vegetation is to provide a sustainable naturalized wetland community. Plants native to central Alberta should be considered. The developer generally over-plants new projects to accommodate for plant mortality and to choke out weeds to the greatest extent possible. Woody vegetation around the perimeter of the SWMF should be considered as an alternative to deter waterfowl. For additional information, refer to ***Appendix C***.

Native plant selection should consider the slope of the SWMF, as certain species are adapted to certain slope aspects and when established properly would control erosion and provide long-term stability of the slope. Wetland vegetation should be selected for its tolerance of inundation and oxygen-poor, reduced environments.

Desirable characteristics for optimum treatment include tolerance of prolonged inundation and therefore low oxygen concentrations in the water and soils, and rapid dense growth to shade surface waters and reduce algal production. All vegetation surrounding a SWMF requires long-term management although with the selection and establishment of appropriate species, management should be less intensive compared to formally landscaped areas.

5.3.3 Pesticides

All pesticides must be applied in compliance with the *Environmental Protection and Enhancement Act* (EPEA). For specific pesticide use refer to Alberta's *Code of Practice for Pesticides* Section 16(1) *Pesticide Application within 30 Horizontal Metres of an Open Body of Water* and Section 16(12) *Herbicide Application for Aquatic Vegetation Control.*

5.3.4 Signage regulation

Signs are necessary and required for SWMFs in order to communicate to the public the type and function of a particular SWMF. Signs are required at visually effective locations for important public information.

The purpose of this signage is to:

- Identify SWMFs as engineered facilities and not natural lakes or wetlands
- Identify activities not permitted, seasonally and permanently
- Display the importance and intent of the landscape design of the engineered facility or the intent of the conservation of a natural feature
- Reduce misconceptions of the form and function of a SWMF to current and future property owners
- Educate the public regarding the potential and importance of establishing or maintaining wildlife habitat within an urban setting
- Promote water quality conservation
- Assist bylaw enforcement by displaying a telephone number and contact the public can use at any time to report inappropriate behavior

The signs have several advantages. They may reduce County liability by adding a permanent avenue of education, assist current and future property owners in making informed decisions about property backing onto a SWMF and eliminate the perception of SWMFs being recreation facilities (lakes).

In addition, an educated public may reduce water contamination, removal of vegetation and encroachment; increase the protection of wildlife and may take ownership of the subdivision and promote neighbourhood conservation or enhancement through Volunteer in Parks or other community initiatives. For an example of SWMF signage, see ***Appendix B***.

5.3.5 Wildlife management

SWMFs provide for wildlife habitat when managed in an effective manner and increase the aesthetics of the facility. The vegetation chosen should maximize species heterogeneity and value to all types of wildlife. Maximizing vegetation density around the SWMF may discourage the entry of domestic animals that would prey on wildlife. Vegetation will attract various species of songbirds and waterfowl making the SWMF a desirable location for bird watching.

Bank erosion, bank undermining, breaching berms and flooding from blockages to inlets and outlets may occur if naturalization of wetlands is not established, as this would encourage an unnaturally high population of waterfowl. Wildlife may be a source of parasites and diseases through public contact with the water contained within these facilities. Wildlife may also damage adjacent private property if shorelines are not managed effectively and may cause injury to people if approached too closely (protecting their young).

Waterfowl, particularly during spring and fall migration, can congregate in large numbers and use SWMFs as loafing areas between morning and evening foraging. Daytime foraging on adjacent private property may result in damage to ornamental landscapes, accumulation of feces, damage to fencing and over browsing of shoreline vegetation. According to the North American Lake Management Society, ammonia levels in ponds with waterfowl habitation may be two to ten times higher than those ponds without waterfowl. Large algal blooms are more prevalent in ponds with waterfowl (or high nutrient loading from surface water runoff) which affects water quality. In addition, waterfowl may generate bacterial pollution and muddy ponds. Keeping the perimeter of a constructed wetland dense with vegetation (uncut grass, shrubs and trees) will discourage unnaturally high numbers of waterfowl.

Beavers remove trees that are part of the overall SWMF design. Currently, in most SWMFs, beaver and muskrats may be managed in SWMF in accordance with the *Vertebrate Nuisance Control* Policy. In many cases, most wildlife can be left to stay wild in a SWMF, but muskrats can cause damage to the clay lining of the SWMFs and trees removed by beavers can block outlets and cause water levels to rise.

Strathcona County will implement design criteria including naturalized shoreline vegetation, buffering, fencing and maintenance to create a desirable environment for wildlife, therefore minimizing damage to private property and human health.

Strathcona County will not support any new landscaping or other habitat enhancements specifically intended to improve reproduction success of nuisance wildlife (i.e. Canada geese nesting rafts) for any SWMFs. There is a potential increase in budget and labour to control wildlife, however if not undertaken, conditions that favour nuisance wildlife populations will continue to grow. Nuisance and invasive wildlife species displace the more desirable wildlife species through competition and/or aggression.

All control methods must abide by the provincial *Wildlife Act*. Strathcona County must receive written permission from the property owner before undertaking control methods on private property.

The *Migratory Bird Act* is another piece of legislation for activities around SWMFs. It restricts work around shorelines where nesting waterfowl may be located during their reproductive season.

5.3.6 Sediment removal and disposal

One function of SWMFs is to remove suspended solids from the water column, which results in improved water quality. As the sediments accumulate, the SWMF may not operate effectively as the storage volume is reduced and the water quality may decrease to a point where it becomes unacceptable.

Sediment removal or dredging of a SWMF is performed to manage the accumulations of solids, silts and debris to maintain the original capacity and function of the designed facility. In existing facilities, the ability to make improvements through recontouring is desired. Monitoring sediment levels is the best process to ensure water quality remains at an acceptable level. Sediment removed from SWMF must be tested and analyzed to determine where proper disposal can occur.

Further requirements and guidelines may be developed by Utilities as required. An Erosion Control Management Plan is required for each facility by the Utilities department.

The most cost effective and efficient method of dredging will need to be determined on a site-to-site basis. Options include the barge method on an active body of water, as well as the dewatering method and removing the solids and recontouring at that time. The barge method is where a barge is placed on the SWMF with a dredge or pump and the sediment is removed.

In addition, a method needs to be developed for the maintenance of the silt traps and channels in constructed and natural wetlands and creeks. Depth of sediment build up may be monitored using markers placed in strategic locations where build up is likely to occur.

Frequency of dredging will depend on the various factors including:

- size of the facility, smaller SWMFs may require more frequent dredging as sediments will build up quicker. Larger SWMFs may require less frequent dredging. A regular monitoring program using sonar surveys would determine when dredging would be required
- type of SWMF
- age of facility

- upstream land use and level of imperviousness
- effectiveness of BMPs in place prior to discharge into SWMF (i.e. source controls, lot level, etc.)
- municipal practices (i.e. sanding)

When dredging, it is imperative that solids are not re-suspended. To help reduce the risk of re-suspension, dredging during the drier months of the year or during the winter may be an optimal opportunity.

Disposal of the sediment collected during dredging would depend on the analysis of the material. There are two generalized disposal methods; off-site and hazardous waste. The sediment would be taken to an off-site location (sanitary landfill or disposal). Hazardous waste must be deposited at a hazardous waste facility with licensed haulers used to transport the sediment. Permission must be granted from Alberta Environment and Parks as to where the sediment may be disposed.

Timing of dredging will need to consider the *Wildlife* Act and the *Migratory Birds* Act to ensure habitats are not disturbed during times when species are more sensitive to activities.

5.3.7 Infrastructure maintenance and utilization

SWMFs are broken down into minor and major system infrastructure. The minor system is designed to accommodate the runoff from a 1:5 year storm event or smaller. This means that the most severe storm would be expected to occur once in a five-year period. The stormwater generated from these 1:5 year storms go into the underground infrastructure or surface public utility lot (PUL) area.

The minor system includes:

- all underground piping
- catch basins
- inlet and outlet structures
- stormwater manholes
- may include surface PULs

It is important to note that sanitary sewer manholes must be located outside of the SWMF areas and should not be located within overland drainage routes.

The major systems are intended for larger than minor events and allows for flood control. Major systems are designed to accommodate a 1:100 year storm. However, prior to 2003, systems were designed to accommodate a 1:25 year storm. Major systems are always in place. A major system usually involves grading plans to ensure that an overland flow path can accommodate a reasonable capacity.

The major systems include:

- roads and gutters
- receiving waters
- above and below ground conveyance systems
- SWMFs
- lot drainage
- may include PULs

Infrastructure is managed by Strathcona County using asset management principles. Information gathered will be used in conjunction with Closed Circuit Television (CCTV) inspections and operation and maintenance targets to plan for future maintenance and rehabilitation projects.

Asset management requires the following information:

- Type of infrastructure
  - material of construction
  - type of cover
- Location
  - sub-basin
  - street or road priority
  - public or private
- Condition
  - structural condition
  - service condition
- Date of last service

5.3.8 Fountains

Fountains are external structures installed in wet ponds. They may aesthetically improve appearance of the lake for the surrounding community. Fountains provide minimal aeration and circulation in wet ponds and as such do not provide a significant improvement in water quality. Fountains may have adverse effects on water quality, as they may encourage algae growth and the re-suspension of nutrients that have settled on the bottom of the facility. Generally, Strathcona County will not fund any fountains or creek pumps as they offer no water quality enhancement. Contact Strathcona County's Utilities department for more information.

5.3.9 Water diversion

Municipalities must apply in order to draw water from a SWMF under the *Water Act*. The major objective of water diversion is to attain water out of the SWMF and use it for other purposes. Strathcona County's objective is to establish parameters where controlled diversion may be permitted if required. Strathcona County reviews any water diversion license applications with the Province.

Strathcona County supports requests by RPC and TAS for Utilities to apply for a temporary or permanent water diversion licence from Alberta Environment and Parks water diversion department. The goal of this collaboration is to use stormwater for irrigation rather than potable water for water conservation purposes.

5.3.10 Communication

Stormwater communications can improve understanding and lead to sharing knowledge on stormwater issues. They provide information on stormwater policies and issues to stakeholders to promote awareness. They communicate with many "publics" involved in stormwater management (publics refers to both the external and internal groups involved in the program). External publics include the target audience, secondary audiences (or people that influence the targets decisions), policymakers, and regulators. Internal publics are those who are involved in some way with either approval or implementation of the program.

Initiatives that have been undertaken by Strathcona County are outlined in the chart on the following page:

Table 5-3: Stormwater management communication initiatives currently undertaken

Communication	Objectives	Audience
Yellow Fish Road™	To inform residents of Strathcona County that catchbasins and drains lead to a SWMF.	Boy Scouts, Girl Guides, other youth or adult community groups
Pond parties	To encourage residents living near SWMFs to connect personal actions and their community's wellbeing with the health of our storm ponds.	Young families and residents near stormwater management facilities
Blue Broom Crew	To empower residents to sweep instead of hosing down driveways and sidewalks.	Community champions
Adopt a Storm Drain	To empower residents to monitor and maintain nearby catchbasins to protect our waterbodies.	Community champions
Mail out	To inform property owners about programs affecting stormwater management facility maintenance.	Property owners near stormwater management facilities
Brochure	Use interesting facts and helpful suggestions to ensure long term health and acceptance of stormwater system.	Residents of Strathcona County
Website	To inform residents of Strathcona County what a SWMF is, how it functions, and policies pertaining to SWMFs.	Inquiring minds
Interpretive signs	To inform passive users of trails near SWMFs about the function, purpose and design of storm facilities.	Park users
School presentations	To inform students what a SWMF is and its ability to protect water quality in the watershed.	Elementary, Junior High and High School

Future initiatives are endless; stormwater management will become a more prominent issue as Strathcona County continues to become urbanized. Innovative communication initiatives will be explored to effectively reach the target audience in the most cost-effective manner.

5.3.11 Emergency response

Access to SWMFs is important from an emergency response perspective. Sufficient access is required in order to manage emergencies such as flooding, hazardous spills and/or fire. Flooding emergencies must be reported to Utilities at 780-467-7785. Fires and hazardous spills must be called-in to 9-1-1. Utilities has completed protocols for various environmental spills within their department and will notify the Province of spills. For more information on spill response protocols call Utilities at 780-467-7785.

5.4 Facility maintenance requirements

5.4.1 Inspection

Inspections are done to examine inlets and outlets, vegetation condition (is the vegetation flourishing), shoreline buffer (does it need replanting or limited mowing), visual water quality (oily sheen, frothy), debris and general upkeep of the facility. High water level (HWL) is to be monitored in the spring and fall. Refer to **Table 5-3** on the following page for specific frequency and timing of inspections.

5.4.2 Grass cutting

Grass cutting is undertaken to enhance perceived aesthetics of the SWMF. Grass cutting will not enhance water quality. Frequency is dependent on surrounding land uses. Grass cutting around a constructed or natural wetland should ensure that the grass is not to be cut at the edge of the permanent pool. Grass cutting should be initiated as far from the shoreline as possible to maintain healthy buffers around the SMWF. Mowing widths are to-be-determined on a site-by-site basis. Grass clippings will be ejected upland (to reduce potential for organic loadings to the SWMF) on SWMFs that currently do not contain the naturalized strip along the shoreline (i.e. Broadmoor Lake, Woodbridge Farms). Grass clippings will be directed away from trails and private property. This reduces the potential for organic loading to the SWMF and eliminates clippings from entering private property up-slope.

5.4.3 Weed management

As previously mentioned in **Section 5.3.2**, weed management should be controlled by hand or mechanical activities to prevent destruction of adjacent vegetation and to limit the potential for introducing herbicides to the water. Frequency should be determined each year on a site-specific basis. Prohibited noxious and non-prohibited noxious weeds must be controlled. They can be managed using Integrated Pest Management (IPM) activities. For a list of noxious weeds in Strathcona County see **Appendix D *Noxious Weeds in Alberta***.

Table 5-4: SWMF treatment facility maintenance

Operation or maintenance activity	Department responsible	Constructed wetlands and wet ponds	Dry ponds
Grass cutting	RPC/TAS	Site specific	Site specific
Weed management	RPC/TAS	Spraying, mowing, string trimming,	Spraying, mowing, string trimming mechanical pulling
Upland vegetation replanting	RPC/PDS	As needed (seldom)	As needed (seldom)
Floodplain vegetation replanting	RPC	As needed (seldom)	As needed (seldom)
Aquatic vegetation management	UT	As needed (seldom)	N/A
Removal of accumulated sediments	UT	As needed (seldom)	As needed (seldom)
Outlet valve adjustment	UT	As needed	N/A
Oil/grit separator	UT	As needed	N/A
Catchbasin cleaning	UT	On a four-year rotation	On a four-year rotation
Silt trap cleaning	UT	As needed	As needed
Water quality monitoring	PDS / UT	As needed	N/A
Inlet/outlet inspection	UT	Monthly & after major storm events	Monthly & after major storm events
Sediment depth	UT	As needed	As needed
Wildlife management	TAS (Ag*)	As needed	As needed
Goose management	TAS (Ag*)	As needed	N/A
Accept design of SWMFs and adjacent public lands	PDS	As needed	As needed
Invasive species monitoring	TAS (Ag*)/ UT	As needed	As needed
Design construction standards	TPE	As needed	As needed
Permit approvals/policy implementation	PDS	As needed	As needed
Land management	PDS	As needed	As needed
Street sweeping	TAS (TO**)	Annually	Annually
Litter removal (adjacent to the SWMF)	RPC	Site specific	Site specific
Litter removal (From the water)	UT	As needed	As needed

RPC – Recreation, Parks and Culture, **PDS** – Planning and Development Services, **TAS** – Transportation and Agriculture Services, **TPE** – Transportation, Planning and Engineering, **UT** – Utilities, ***Agriculture, ****Transportation Operations**

5.4.4 Vegetation planting and replanting

Once established, upland and floodplain plantings are generally stable. If re-vegetation is required due to disturbance or to enhance biodiversity, some vegetation re- establishment or enhancement may be required. As aquatic vegetation is harder to establish, there should be a contingency for the re-establishment during the first two years after construction to ensure conditions for colonization are created. Planting methods can be separated into three main categories based on the major treatment zones in the SWMF; 1) upland, 2) riparian and 3) shallow water.

Upland replanting includes ground cover (grasses) and woody shrubs and trees. Replanting should take place in the spring, but after water levels have stabilized. If bare ground is exposed, cover it by installing either hydroseed or using a custom seed mix in a nutrient rich medium saturated in an erosion control biodegradable blanket (geojute). Wet riparian replanting should be carried out in mid-May to early June. Some form of protection of the seed mixture should be provided in this dynamic zone of water level fluctuation. The biodegradable blanket is highly recommended to establish ground cover. Shrubs and trees can be planted through openings in the blanket.

Establishing shallow water plantings may require short- and long-term monitoring. Emergent vegetation may be replanted by hand if the substrate is suitable. Young shoots (as opposed to rhizomes or corms) are preferable for replanting as they provide for early stability (established root structure). Plants should be at least 10 cm tall for replanting and should be done late May to early June. Sprigs or plugs of emergent plant material would be preferable for replanting as the root material is already contained in suitable growth medium. Submerged rooted plants should be replanted as mature vegetative growth if planted in late spring to early summer. Mature growth will take advantage of warmer water and sunlight penetration. Plantings in early spring or fall should use vegetative propagules, such as turions or rhizome plugs, which can germinate in spring or over-winter and begin growing in the following growing season. Live topsoil from adjacent wetland areas will also assist with quick establishment of emergent vegetation and initiate microorganism development.

There is opportunity to increase vegetation plantings as well. Volunteer groups and grant funding can be found to add plantings to existing vegetated areas. Sometimes this work may be done internally, depending on resources.

5.4.5 Outlet valve adjustment

Valves should be tested to ensure they are in working order during the spring and fall. These outlets include Emerald Hills/Aspen Trails SWMFs, Buckingham SWMF, Lakeland Ridge SWMF, Clarkdale SWMF, Eastgate SWMF, Heritage Hills Wetland, TransAmerica SWMF, Centennial Wetlands and the Estates of Sherwood Park dry ponds.

5.4.6 Oil/grit separators

Oil/grit separators should be cleaned out using a vacuum truck. Refer to **Table 5-3** for specific frequencies and timing for routine maintenance. Cleaning is required after any known spills have occurred.

5.4.7 Litter removal

Generally, there will be a need to undertake an annual spring cleanup to remove litter from all SWMFs. Litter removal from the water will be performed by Utilities on an as needed basis based on observations during regular inspections after major rain events.

5.4.8 Sediment removal

Frequency of sediment removal is site-specific and dependent on various factors mentioned in **Section 5.3.6** ***Sediment Removal and Disposal***. Specific criteria for dredging have not been established thus far. Monitoring SWMF sediment quantity levels will be carried out to establish what level it will affect the functionality of the SWMF. Surveys will be undertaken of individual SWMFs to determine if that site requires dredging.

5.4.9 Catchbasin cleaning

Catchbasin cleaning in Strathcona County is performed annually, however only selected catchbasins are cleaned each season. The complete inventory of catchbasins are cleaned on a four-year cycle with twenty-five percent of catchbasins cleaned annually. Catchbasin cleaning is done via the use of a vacuum truck which extends a hose into the sump of the catchbasin and sucks out the material which has been deposited in the sump. The Adopt a storm drain and Blue Broom Crew programs help prevent debris build up in catchbasins by encouraging driveway, sidewalk and edge of the road cleaning. For current procedures contact Utilities at 780-467-7785.

6.0 DEVELOPER AND STRATHCONA COUNTY ROLES AND RESPONSIBILITIES

For stormwater management to be effective, roles and responsibilities must be coordinated between all parties involved from designing to maintenance. Strathcona County will take the lead role in determining roles and responsibilities of parties involved or affected by SWMFs. For further information on what management techniques and Best Management Practices (BMPs) are required, refer to specific section in **Section 4.0 *Stormwater Management Facilities Best Management Practices***, **Section 5.0 *Stormwater Management*** and/or **Table 5-3** for department responsibilities.

6.1 Developer roles and responsibilities

General

- Between the Construction Completion Certificate (CCC) and the Final Acceptance Certificate (FAC), Strathcona County maintains and operates the Stormwater Management Facility (SWMF) infrastructure, however the developer is responsible for all major deficiencies or repairs required for the SWMF.
- Some monitoring may be required beyond FAC if the facility is a compensation wetland as per approval from provincial government.
- Strathcona County will respond to emergencies during this maintenance period and the developer will be notified when any corrective maintenance activities have occurred and may be invoiced for the associated costs.
- It is the responsibility of the developer to understand and abide by all requirements and standards set forth by Strathcona County as outlined in the Development Agreement.

Stormwater management facilities

The Developer is:

- In accordance with the Design and Construction Standards (DCS) responsible for the maintenance of all soft landscaping for a minimum of two years after issuance of the CCC and until the FAC is issued.

Water quality

The Developer is:

- To monitor levels of sediment loading into the SWMF between CCC and FAC to ensure designed SWMF depth is maintained prior to the County taking ownership of the facility.
- To monitor water quality of compensation wetlands as per approval from Alberta Environment and Parks.

- To report hazardous spills to Utilities (780-467-7785) immediately and to Alberta Environment and Parks (1-800-222-6514).
- Responsible for all activities and expenses required to remediate any contamination that is caused by the Developer's activities to the satisfaction of Utilities and Alberta Environment and Parks.

Floodplain maintenance

The Developer is:

- Responsible for maintenance within the easements or Strathcona County held land interest.
- Responsible for maintenance within Public Utility Lot (PUL) for a minimum of two years from date of issuance of a CCC until FAC.
- Responsible for the restoration of encroachments in a timely manner and prior to the issuance of an FAC.

Encroachments

The Developer is:

- Responsible for submitting an application for proposed encroachments onto SWMF easement/utility to Strathcona County, including legal description of land upon which the encroachment would exist, details regarding the encroachment and any other information Strathcona County requires.
- Responsible for contacting and obtaining written consent from any utility or service company authorized by agreement with the County (i.e., Telus, Shaw, Atco, etc.) operating in the general area of the proposed encroachment.
- Responsible for knowing and monitoring what encroachments are and are not permitted on SWMFs.

For more information refer to Strathcona County's **SER-012-009** ***Stormwater Management Facility Easements*** Policy.

Vegetation management

The Developer is:

- Responsible for the removal of all prohibited noxious and noxious weeds, in accordance with Strathcona County and provincial legislation (i.e. Weed Control Act). For a list of prohibited noxious and noxious weeds in Alberta refer to **Appendix D**.
- Responsible to ensure all dead plant material as per the approved landscape plan is replaced in a timely manner. All replacements are to be made during the maintenance period to ensure plant material will be in a healthy, vigorous growing condition prior to issuance of FAC.
- Responsible during the maintenance period for submitting any herbicide or fertilizer treatment programs to Transportation and Agriculture Services prior to application.

Signage

The Developer is:

- Responsible for the supply and installation of new SWMF signage, as approved by Strathcona County, in accordance with the DCS and this document.

Sediment removal

The Developer is:

- Responsible for the preparation, implementation, monitoring and maintenance of an Erosion and Sedimentation Control program for each stage of development to ensure erosion and sedimentation is controlled and monitored throughout the lifespan of construction.
- Responsible for the removal of all sediment accumulations within the SWMF before FAC is issued for the facility.
- Responsible to ensure access for maintenance is considered in designs of all SWMFs.

Underground infrastructure maintenance

The Developer is:

- Responsible for cleaning and inspection prior to the FAC being issued.

Communications

The Developer is:

- Responsible for informing new or potential homeowners of responsibilities involved with living adjacent to a SWMF. Interpretive signage about the drainage area is required at the stormwater management facility. A brochure approved by Strathcona County's PDS department is required for property owners that includes the following information:
    - Specific function of the SWMF
    - Water quality inherent with the function of the SWMF and the impact of water quality resulting from fertilizers
    - Encroachments onto floodplain are not permitted
    - Caution required for instability of ice in winter months

Bylaw and legal enforcement

The Developer is:

- Aware and adheres to all provincial and federal regulations, municipal bylaws, policies and conditions outlined in the Development Agreement brought forth by Strathcona County.

Other considerations

- Any new technique or BMP that the developer believes would increase effectiveness or is cost beneficial is encouraged to be brought to Strathcona County's attention for review and/or consideration.

6.2 Strathcona County roles and responsibilities

General

Road de-icing during the winter contributes to heavy metal, cyanide and high salt concentrations in surface water runoff. By reducing the use of de-icing salt or using alternative deicers, the impact of pollutants can be minimized. For more information, see the ***Road Salt Management Plan*** **SER-009-033***.*

Stormwater management facilities

Strathcona County is:

- Responsible for management of a SWMF and the land contained within the PUL following issuance of the FAC to the developer.
- Responsible for establishment of design standards outlined in Design and Construction Standards (DCS).

Water quality

Strathcona County is:

- Responsible for reporting hazardous spills to Utilities (780-467-7785) or Alberta Environment and Parks (1-800-222-6514). Strathcona County has a small inventory of equipment for a first response to a spill.
- Responsible for reporting water quality concerns to Utilities (780-467- 7785).
- Responsible to ensure that water quality complies with Alberta Environment and Parks Code of Practice for SWMFs.

Floodplain maintenance

Strathcona County is:

- Responsible for maintaining the publicly owned land surrounding the SWMF between the NWL and property line (including debris removal) as per specific management requirements for facility.
- Responsible for managing the vegetation along the shore and adjacent riparian slopes for a naturalized condition.
- Responsible for maintenance strips that may vary from zero to three metres depending on facility design and access requirements. Grass clippings will be directed away from trails and private property.

- Responsible for maintaining a mow strip buffer depending on slope, design criteria, environmental conditions and specific site history.
- Responsible for vegetation removal, which will not occur based on aesthetic expectations as vegetation assists with habitat protection, managing runoff and capturing silts.
- May undertake extensive mowing or other vegetation removal between the NWL and private property but only to the extent necessary for noxious and restricted weed control and to remove the excess accumulation of dead vegetation residues.

Encroachments

Strathcona County is:

- Responsible for receiving, evaluating, and responding to all requests for encroachments onto SWMFs.
- Will prepare and execute all necessary documentation for encroachment agreements and/or reviews.
- Responsible for monitoring SWMFs for unauthorized encroachments.
- Must inform encroachment applicants of approval procedures and provide any information required to contact utility and/or service companies operating in the general area of the proposed encroachment.
- Responsible for approving amendments and consider appeals to the Stormwater Management Facility Easements Policy.
- Exempt from the SWMF Easement Policy as it will assist in maintenance or operations of the SWMF.

For more information refer to Strathcona County's **SER-012-009** ***Stormwater Management Facility Easements*** Policy.

Vegetation control

Strathcona County is:

- Responsible for maintaining, planting vegetation, spraying and weed control after FAC.
- Responsible for publishing plans for weed control around SWMFs in the local paper.
- Responsible to educate property owners adjacent to SWMFs about the effects of fertilizers and herbicides on the vegetation on the PUL to encroach upon open water in the SWMF.
- Responsible to obtain approval from Alberta Environment and Parks before the application of herbicides and/or pesticides within the SWMF.

Signage

Strathcona County is:

- Responsible for the creation, display and maintenance of safety and/or educational signs.
- Responsible to retrofit and maintain information signs on existing SWMFs.
- Responsible for reviewing and approving new signage from the developer.

Wildlife

Strathcona County is:

- Responsible for managing wildlife. Nuisance wildlife affecting the function of a SWMF may be removed as per provincial/federal permits.
- Responsible to prohibit fish stocking in any SWMFs. In efforts to maintain the health of existing, native fish species in SWMFs and downstream water bodies, Strathcona County does not support fish stocking in SWMFs with an inlet and outlet present. Facilities with overland flow such as a dugout or ornamental pond and ponds on private property do not fall under this guideline.

Sediment removal

Strathcona County is:

- Responsible to determine the frequency of dredging required for SWMFs.
- Responsible to coordinate timing of dredging with *Migratory Birds Act.*
- Responsible to take a proactive role in preventing excessive sedimentation. Streets will be cleaned as frequently as determined by the County to be most efficient and effective.

Underground infrastructure maintenance

Strathcona County is:

- Responsible for catchbasin debris and sediment cleaning upon issuance of FAC.
- Responsible for inspection and evaluation of infrastructure.

Communications

Strathcona County is:

- Responsible for distributing an information package and a copy of Policy SER 012-008, *Encroachments onto County Lands in which the County Holds an Interest* and SER 012-009, *Stormwater Management Facility Easements* to the property owner adjacent to a SWMF as part of the lot grading program to enforce the message of:
  - Specific function of SWMFs
  - Water quality inherent with the function of the SWMF and the impact of water quality resulting from fertilizers
  - Maintenance which may occur near private property
  - No disturbance to wildlife / limit animal contact
  - No alteration in fencing, structures, or vegetation
  - No alteration to lot grading plan
  - No disturbance to shoreline and upland

- Responsible to establish a communication link between the Planning and Development Services department and Utilities department as per timing of communications sent out.

- Responsible to ensure communications from developer and Strathcona County display continuity in the messages being relayed to the property owner.
- Responsible for communications to property owner after the FAC is issued.
- Required by the *Environmental Protection and Enhancement Act* to notify property owners adjacent to SWMFs when major maintenance to a SWMF is proposed or undertaken (i.e. dredging, spraying for weeds/algae, etc.).

Bylaw and legal enforcement

Strathcona County is:

- Responsible for establishment of bylaws (if/as required) pertaining to stormwater management and their enforcement.
- Not responsible for assuming liabilities with respect to the land, buildings or personal property located on PUL and/or easements unless it is proven negligent in its responsibilities.

County construction activities

Strathcona County is:

- Responsible for frequent collection and disposal of petroleum wastes, cleaning materials, garbage and site debris at County-owned facilities.
- Responsible for erosion and sediment controls as required for controlling soil erosion and retaining soil on-site at County-owned facilities.
- Responsible for erosion and sedimentation controls to be developed as a part of the planning process at County-owned facilities.
- Responsible in order to monitor the effectiveness of the point source controls, water quality in receiving waters should be monitored before, during and after completion of construction activities on County-owned facilities.

Municipal activities

Strathcona County is:

- Responsible for street sweeping which removes pollutants deposited on roads and parking lots thereby reducing pollutant runoff to the SWMF.
- Responsible for prohibiting littering and controlling the disposal of animal waste which will reduce pollutant loading and fecal bacteria of the surface water runoff.
- Responsible for catchbasins collection of debris and sediment. Cleaning the debris and sediment from catchbasins will reduce the amount of pollutants discharged in the SWMF and is the most cost-effective mechanism for removing pollutants.

Other considerations

- Strathcona County will continue to research more effective and cost beneficial BMPs on an ongoing basis to ensure that stormwater management is current and effective.

Two other Strathcona County initiatives may influence roles and responsibilities: The Environmental Framework and the Wetland Replacement Program. The Environmental Framework identifies priorities to focus on to sustain an environmentally healthy and vibrant community. It looks at six key areas: Air, land, water, biodiversity, energy and waste. Stormwater management connects to most of these areas through day-to-day operations and trends over time. The Wetland Replacement Program involves several departments and a representative from the Province to identify sites ideal for retrofit using funds from the provincial program.

6.3 Public/landowner roles and responsibilities

General

Public health and safety

Any activity that may involve contact with the stormwater is not recommended. Stormwater may contain bacteria, fecal matter and/or skin irritants that may adversely affect the health of park users and domestic animals who come in contact with this water source.

Public/Landowners are:

- Responsible for smart use of the land in and around the SWMF to prevent damage or injury.
- Responsible to understand the risks associated with user access to SWMFs.

Household activities

Good housekeeping practices can effectively control point source pollution or pollution which originates from an identifiable source. Residents can practice the following activities; however, they can be applied to commercial, industrial and construction sites as well:

- Promptly contain and clean up solid and liquid pollutant leaks and spills. Absorbent materials should be used where practical
- Do not hose down or discharge pollutants (paint, soap, pool water, etc.) to storm drains, conveyance ditches or receiving water
- Do not overwater outdoor landscape
- Promptly repair or replace all leaking connections, pipes, hoses, valves that can contaminate stormwater
- Sweep handling and storage area regularly and dispose of dust and debris

- Recycle materials such as oils, solvents, coolants, waste, etc.
- Cover and contain materials, equipment, waste and compost piles
- Use drip pans to collect leaks and spills equipment
- Do not dispose of animal waste in a SWMF
- Avoid pesticide use
- Do not remove vegetation or encroach onto County land
- Use environmentally-safe raw material, products, additives, etc.

Public education is the key component to controlling point source pollution. Household, commercial and industrial activities potentially pollute stormwater.

Water quality

Public/Landowners are:

- Responsible for reporting hazardous spills to Strathcona County Utilities at 780-467-7785.
- Responsible for reporting concerns with water quality to Utilities at 780-467- 7785.

Floodplain maintenance

Public/Landowners are:

- Responsible to understand what defines an unauthorized use.
- Responsible for submitting application for unauthorized use onto SWMFs to Strathcona County, including legal description of land upon which the proposed unauthorized use would exist, details regarding the encroachment and any other information Strathcona County requires.
- Responsible for any damage sustained from unauthorized uses onto SWMFs (i.e., retaining walls and fences). Any maintenance required on SWMFs will not be the responsibility of Strathcona County as outlined in Policy **SER-012-009** ***Stormwater Management Facility Easements***.
- Responsible for complying with the conditions of any registered encumbrances, liens and interests on their properties. Under the Utility Right of Way/Easement Agreement, the Landowner shall not without the prior written consent of the County excavate, drill, install, erect or permit to be excavated, drilled installed or erected over, under or through the said right- of-way, any pit, foundation, pavement, building, fence, sidewalk, or other structure or installation. The Landowner shall not alter the surface grade level in any manner which would affect the rights of the County. The Landowner is responsible for the maintenance of their property.

For more information refer to Strathcona County's **SER-012-009** ***Stormwater Management Facility Easements*** Policy.

Vegetation control

Public/Landowners are:

- Responsible to understand the purpose and importance of vegetation maintenance on PUL.
- Responsible to know the difference between prohibitive noxious and noxious weeds, undesirable plants and desirable plants.
- Responsible to control prohibited noxious weeds on their property.
- Responsible to not remove vegetation on public property.
- Responsible to understand the impact of maintenance on SWMFs (i.e. use of herbicides and fertilizers).
- Responsible to not use pesticides on public property.
- Responsible to not release plants or plant material into SWMFs.

Signage

Public/Landowners are:

- Responsible for following directions or recommendations put forth by signage surrounding SWMFs.

Wildlife

Public/Landowners are:

- Responsible to not disturb wildlife (includes dogs on leash and avoiding potential nesting areas).
- Responsible to know what nuisance wildlife is (i.e. beavers, muskrats) and to know when and how to report them to Strathcona County Transportation and Agriculture Services (780- 417-7100).
- Responsible to not release fish, aquarium plants or other living things into SWMFs.

Underground infrastructure maintenance

Public/Landowners are:

- Responsible for not depositing anything down a storm drain.
- Responsible for not tampering with stormwater infrastructure.
- Responsible for not entering and/or exploring stormwater infrastructure.

Communications

Public/Landowners are:

- Responsible to review their land titles and review and understand what actions and behaviours are and are not permitted on their property and public property in regard to a SWMF. Any questions or concerns can be clarified by Strathcona County.
- Responsible to understand all bylaws and policies related to SWMFs. These documents clarify what can and cannot be done near SWMFs.

Bylaw and legal enforcement

Public/Landowners are:

- To abide by any legal enforcement or bylaws regarding SWMFs.
- To ensure any unauthorized uses or landscape improvements abide by Strathcona County's Policies.
- To ensure any unauthorized uses or landscape improvements are approved by Strathcona County.

Other considerations

Public/Landowners are:

- Responsible to contact Strathcona County Main Line (780-464-8111), Transportation and Agriculture Services 780- 417-7100, Utilities (780-467-7785), Planning and Development Services (780-464- 8080) or Recreation, Parks and Culture (780-467-2211) regarding user access.

6.3.1 Commercial and industrial responsibilities

Commercial and industrial responsibilities are the same as public/landowners' roles and responsibilities, however, include the following additional areas of responsibilities.

Commercial and industrial activities that generate pollutants must be managed in a way that promotes recycling and reusing. Generated pollutants that cannot be altered or changed should be covered or contained. If pollutants enter the surface water runoff, on-site treatment is required or routing contaminants to the sanitary sewer, if permitted. Spill prevention and control should be the focus as proactive, not reactive measures. Activities related to automobiles typically generate metals and hydrocarbons.

Several point source control measures include:

- cleaning heavily used parking and commercial lots
- using oil and grease recycling centers
- inspecting and repairing vehicle fluid leaks upon detection
- reducing vehicle use

Construction activities

Construction activities have been recognized as a principal source of causing sedimentation in stormwater. Pollutants can be minimized using point source controls. Some of these controls include frequent collection and disposal of petroleum wastes, cleaning materials, garbage and site debris. Erosion and sediment controls are required to control soil erosion and retain soil on-site. Erosion and sedimentation controls should be developed as a part of the planning process.

7.0 OTHER CONSIDERATIONS

7.1 Vision for the future

Low Impact Development (LID) technology is an alternative ecologically friendly comprehensive approach to stormwater management. It aims to mitigate development impacts to land, water and air. The LID approach emphasizes the integration of site design and planning techniques that conserve natural systems and hydrologic functions of a site. LID aims to reduce the amount of impervious surfaces. LID decentralizes and micromanages stormwater at its source, rather than using traditional treatment BMPs. Strathcona County currently uses some aspects of LID such as vegetative swales and more recently cluster concept developments. Cluster concept development is when housing is clustered into smaller lot areas and can allow for more conserved open space to be used for recreation, visual aesthetics and wildlife habitat.

LID practices are small in scale so they can be used in many places where land is limited or constrained by utilities. Even though they are smaller in scale, they still provide for adequate conveyance of stormwater and provide additional protection for the watershed.

Table 7-5: Summary of LID benefits to various stakeholders

Stakeholder	Benefit
Municipalities	• Protect community's flora and fauna • Balance growth needs with environmental protection • May reduce maintenance costs of SWMFs • Increases property and community appearance and aesthetics which may increase property resale values (curb appeal of landscape) • Reduce municipal infrastructure maintenance costs (streets, curbs, gutters, sidewalks, storm sewers) • Increase collaborative public/private partnerships and public education
Developer	• Reduce land clearing and grading costs • Potentially reduce infrastructure costs (streets, curbs, gutters, sidewalks) • Reduce stormwater management costs (SWMF) • Potentially reduce impact fees and increase lot yields • Increase lot and community marketability

Stakeholder	Benefit
Environment	• Conserve integrity of ecological and biological systems • Protect site and regional water quality by reducing sediment, nutrient and toxic loads to receiving water bodies • Reduce impacts to local terrestrial and aquatic plants and animals • Conserve trees and natural vegetation

Source: Puget Sound

Works consulted

Alberta Agriculture and Forestry. Online. World Wide Web, cited November 30, 2020, available from www.alberta.ca/agriculture-and-forestry.aspx
Alberta Native Plant Council "Plant Collection Guidelines for Horticultural Use of Native Plants" Online. World Wide Web, cited November 20, 2020 available from http://www.anpc.ab.ca/
Amell, Bernard. Stormwater, the Journal for Surface Water Quality Professionals "Deerfoot Trail Extension: Calgary Stormwater Management Innovations" 2002.
Bow River Basin Council Online. World Wide Web, available from http://www.brbc.ab.ca
California Stormwater Quality Association "Stormwater Best Management Practice Handbook Municipal" 2003
City of Calgary "Drainage Bylaw Number 37M2005" 2005
City of Calgary "Stormwater Management" Online. Cited November 30, 2020 World Wide Web, available from Stormwater management (calgary.ca)
City of Calgary "Stormwater Management and Design Manual" 2011
City of Edmonton "Stormwater Quality Control Strategy and Action Plan" 2008
Debo, Thomas N. Reese, Andrew J. "Municipal Stormwater Management, Second Edition" 2003
Environment and Climate Change Canada "Water and the Environment" Online. World Wide Web, cited November 30, 2020, available from Water and the environment - Canada.ca
EPCOR "Drainage" Online. World Wide Web, cited November 30, 2020, available from Drainage (epcor.com)
Government of Alberta "Alberta Land Stewardship Act" 2009
Government of Alberta "Environmental Code of Practice for Pesticides" 2010
Government of Alberta "Environmental Protection and Enhancement Act"
Government of Alberta "Environmental Quality Guidelines for Alberta Surface Waters" 2018
Government of Alberta "Guidelines for the Approval and Design of Natural and Constructed Treatment Wetlands for Water Quality Improvement" 2000
Government of Alberta "Land Use Framework" 2008
Government of Alberta "Municipal Government Act"
Government of Alberta "Municipal Policies and Procedures Manual" 2001
Government of Alberta "Public Lands Act"
Government of Alberta "Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage System"

Part 1 Standards for Municipal Waterworks (2012)
Part 2 Guidelines for Municipal Waterworks (2012)
Part 3 Wastewater Systems Standards for Performance and Design (2013) Part 4 Wastewater Systems Guidelines for Design, Operating and Monitoring (2013)
Part 5 Stormwater Management Guidelines (2013)

Works consulted

Government of Alberta "Stormwater Management Guidelines for the Province of Alberta" 1999
Government of Alberta "Water Act"
Government of Alberta "Water Act Fact Sheet. Canada/Alberta Farm Water Program: Water Licensing Process Under the Water Act" 2002
Government of Alberta "Water Act: Temporary Water Diversions" 2015
Government of Alberta "Water and Wastewater Operator's Certificate Guidelines" 2020
Government of Alberta "Water for Life: Action Plan" 2009
Government of Alberta "Water for Life: Alberta's Strategy for Sustainability" 2003
Government of Alberta "Water for Life: A Renewal" 2008
Government of British Columbia "Stormwater Planning: A Guidebook for British Columbia" 2002. Online.
World Wide Web, available from Stormwater Planning: A Guide Book for British Columbia (gov.bc.ca)
Government of Canada "Achieving a Sustainable Future: A Federal Sustainable Development Strategy for Canada 2019-2022" 2019
Government of Canada, "Fisheries Act"
Government of Canada, "Navigable Waters Protection Act"
Government of Ontario "Stormwater Management Planning and Design Manual" 2003
Haekel, Gerry. 2002. Revised. The law and the lake: navigating Alberta's regulatory framework. Alberta Lake Management Society 1996 Annual Workshop Proceedings. Alberta Sustainable Resource Development. Edmonton. 26 pp.
International Stormwater "Best Management Practices (BMP) Database" Online. World Wide Web. Available from https://www.bmpdatabase.org/index.htm
North Saskatchewan Watershed Alliance Online. World Wide Web, cited December 31, 2013, available from www.nswa.ab.ca
Puget Sound "Low Impact Development, how can we protect Puget Sound as we grow" Brochure 2006
Puget Sound Online "Natural Approaches to Stormwater Management: Low Impact Development in Puget Sound" 2003
Strathcona County "Design and Construction Standards" 2019
Strathcona County "Forwarding our Future. Together: Municipal Development Plan Bylaw" 2017
Strathcona County Municipal Policy Handbook "SER 001-002 Surface Water Management and Erosion Control Program" 2018
Strathcona County Municipal Policy Handbook "SER-012-009 Storm Water Management Facility Easements" 2011

8.0 APPENDICES

Appendix A Stormwater legislation contact information

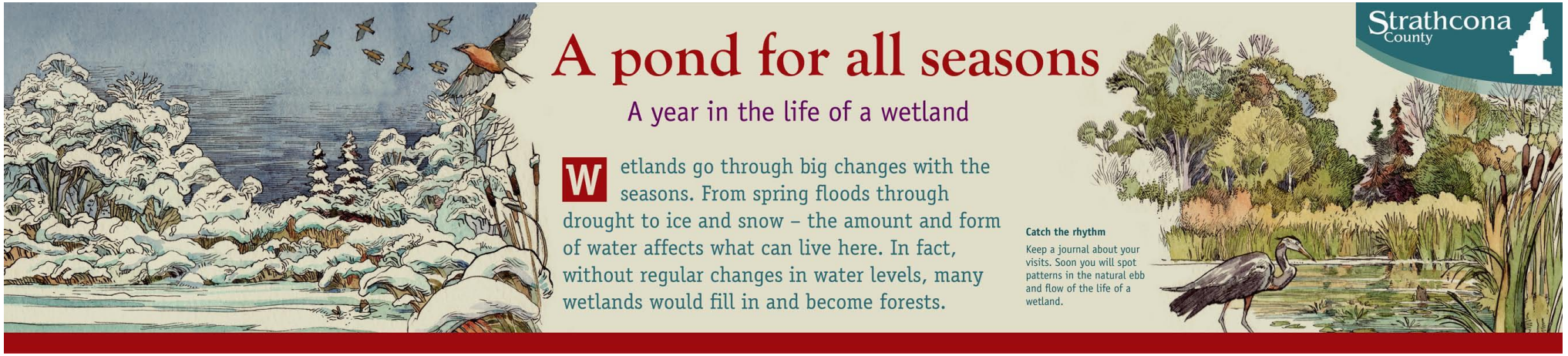
Federal, provincial and municipal legislation contact information

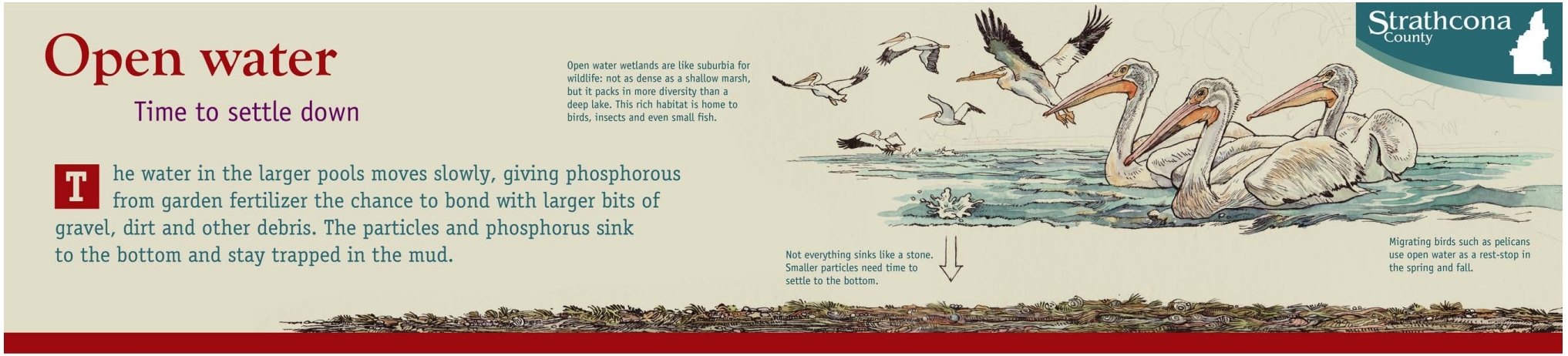
Legislation	Responsible	Contact information
Fisheries Act	Fisheries and Oceans Canada	Edmonton Office 1028 Parsons Road SW Edmonton, AB T6E 0J4 Tel: 1-855-852-8320 Email: info@dfo-mpo.gc.ca
Environmental Protection and Enhancement Act	Alberta Environment and Parks	Edmonton Office Twin Atria Building #111, 4999 98 Ave Edmonton AB T6B 2X3 Tel: 780-427-7617
Water Act	Alberta Environment and Parks	Edmonton Office Twin Atria Building #111, 4999 98 Ave Edmonton AB T6B 2X3 Tel: 780-427-7617
Wildlife Act	Alberta Fish and Wildlife	1st Floor, 4999 98 Ave Edmonton, AB T6B 2X3 Tel: 780-427-3574 Email: aep.info-centre@gov.ab.ca
Weed Control Act	Alberta Agriculture and Forestry	Ag-Info Centre Tel: 310-FARM Email: aginfocentre@gov.ab.ca
Wastewater and Storm Drainage Regulation	Alberta Environment and Parks	AEP Outreach Services Tel: 1-877-944-0313 Email: aep.info-centre@gov.ab.ca
Public Lands Act	Alberta Environment and Parks	Public Lands Division Strathcona County and Edmonton Tel: 780-643-0636 Email: aep.info-centre@gov.ab.ca
Municipal Government Act	Municipal Affairs	Municipal Services Tel: 780-427-2225 Email: ma.lgsmail@gov.ab.ca
Stormwater Management Guidelines for the Province of Alberta	Alberta Environment and Parks	AEP Outreach Services Tel: 1-877-944-0313 Email: aep.info-centre@gov.ab.ca

Legislation	Responsible authority	Contact information
Stormwater Management Guidelines for the Province of Alberta	Alberta Environment and Parks	AEP Outreach Services Tel: 1-877-944-0313 Email: aep.info-centre@gov.ab.ca
Water for Life: Alberta's Strategy for Sustainability	Alberta Environment and Parks	AEP Outreach Services Tel: 1-877-944-0313 Email: aep.info-centre@gov.ab.ca
Stormwater Management Facility Easements	Strathcona County Planning and Development Services	Planning and Development Services 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 464-8080 Fax: 780- 464-8142
Vertebrate Pest Control	Strathcona County Transportation and Agriculture Services	Transportation and Agriculture Services 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 417-7100 Fax: 780- 417-7109
Surface Water Management, Water Management and Erosion Control Program	Strathcona County Utilities	Utilities 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 467-7785 Fax: 780- 464-0557
Weed Control Enforcement Program	Strathcona County Transportation and Agriculture Services	Transportation and Agriculture Services 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 417-7100 Fax: 780- 417-7109
Encroachments on to Utility Right-of-Ways	Strathcona County Planning and Development Services	Planning and Development Services 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 464-8080 Fax: 780- 464-8142

Legislation	Responsible authority	Contact information
Design and Construction Standards	Strathcona County Transportation, Planning and Engineering	Transportation, Planning and Engineering 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 464-8279 Email: transportationplanningandengineering@strathcona.ca
Natural Spaces Management Plan	Strathcona County Planning and Development Services	Planning and Development Services 2001 Sherwood Drive Sherwood Park, AB T8A 3W7 Tel: 780- 464-8080 Fax: 780- 464-8142 Email: planninganddevelopment@strathcona.ca

Appendix B Example of a stormwater management facility sign





Appendix C Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Grasses							
Agropyron trachycaulum	Awned/Slender Wheatgrass			*	*	Wet to dry soil, open woods	Excellent for erosion control
Agropyron smithii	Western Wheatgrass			*		Likes moist soils	Good salt and alkalinity tolerance
Beckmannia syzigachne	Slough Grass		*	*		Wet to moist soils, wet meadows, swamps, marshes and shallow water	
Bromus anomalus	Nodding Brome		*	*		Coarse soils, moist prairie grasslands	
Bromuns ciliatus	Fringed Brome			*		It can tolerate a wide array of sun but prefers moist soil	Native; grows in a clump; it provides habitat for birds and small mammals.
Calamagrostis Canadensis	Bluejoint Grass		*	*		Prefers wet sites, marshes and moist woodlands	Potentially invasive Good for erosion control
Distichlis stricta	Alkali Grass, Salt Grass		*	*		Depressed areas that receive seasonal runoff or have water tables near the soil surface.	Excellent for erosion control
Elymus canadensis	Canada Wild Rye			*	*	Dry sandy gravelly or rocky soil, river banks	Tolerant to wide range of soils
Festuca halli	Plains Rough Fescue				*	Moist black soil	
Festuca ovina	Sheep's Fescue			*			Tolerant to wide range of soils
Festuca ruba	Creeping Red Fescue			*			Tolerant to wide range of soils
Koeleria cristata (macrantha)	June Grass			*	*	Clay soils with moderate to good drainage	
Muhlenbergia asperifolia	Scratch Grass				*	Moist sites	
Phalaris arundinacea	Reed Canary Grass		*	*		Marshes, alluvial meadows, shores and ditches	Potentially invasive; excellent for erosion control

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Poa palustris	Fowl Bluegrass			*		Wet meadows and damp soils	Quick establishing in wetlands and retention basins
Poa sandbergii	Sandberg Bluegrass				*	Moderately coarse sands to fine clays, dry plains	It has a remarkable ability to produce roots which effectively suppress weed growth
Puccinellia nuttalliana	Nuttall's Alkali Grass			*		Moist alkaline soils	Tolerant of alkaline soils
Scolochloa festucacea	Spangle Top		*			Wet depressed meadows, prairie potholes, lake and river margins, shallow water, marshes	
Stipa comata	Needle and Thread Grass, Spear Grass				*	Sandy to loamy well drained soils; this plant does not grow well on heavy clay soils	Will survive with no supplemental water once established
Stipa curtiseta	Western Porcupine Grass				*	Dry ridges and xeric slopes, especially where the soil is thin	
Sedges and Broad-Leafed Aquatics							
Carex bebbi	Bebb's Sedge					Moist soils along margins of wetlands	Establishes quickly and is an ideal species for wetlands

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Lemna minor	Duckweed	*				Floating aquatic plants, still water	Great potential to remove mineral contaminants from waste waters
Mentha arvensis	Canada Mint			*		Moist soils and along streams	
Typha latifolia	Cattail		*			Wet and damp soils	Forms large colonies; important habitat for birds and mammals. Helps filter/clean water
Trees and Shrubs							
Alnus crispa	Green Alder			*		Streams, lakeshores, bogs. Soil textures range from sandy to gravelly or rocky	Good for erosion control
Amelanchier alnifolia	Saskatoonberry				*	Limestone plateaus, riparian areas, thickets, woodland edges and banks of streams, moist well-drained soils	Good for erosion control
Arctostaphylos uva-ursi	Kinnikinnick, Common Bearberry				*	Well-drained, gravely, sandy, slightly acidic soil, dry open woods, roadsides	Good soil stabilizer; often indicator of poor soil

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Betula alleghaniensis	Golden birch, swamp birch, yellow birch			*	*	Moist, acidic, sandy or rocky, well-drained loams	Sensitive to heat, drought and soil compaction
Betula glandulosa	Bog Birch		*			Fens, streambanks, marsh margins, lakes, bogs, seepage areas	Tolerates high alkalinity
Betula occidentalis	Water Birch, Black Birch		*	*		Steam banks, tolerates low soil oxygen, flooding, and clay soil but needs moist conditions	Well adapted for revegetating disturbed riparian sites
Betula papyrifera	Paper Birch			*	*	tolerates a wide range of soils from well-drained to poorly drained but does best on well drained soils	
Cornus stolonifera	Red Osier Dogwood			*		Moist sandy soils, riverbanks, coulees	Excellent soil stabilizer
Elaeagnus commutata	Silver-Berry; Wolf Willow				*	Loamy soils, but is commonly found in dry, sandy or gravelly soils on exposed hillsides	Useful for erosion control; spreads quickly
Fraxinus pennysylvanica 'Rugby'	Prairie spire green ash				*	Adaptable to dry and moist conditions; not particular to soil type or pH	Fast growing, drought tolerant; highly tolerant of urban pollution
Larix laricina	Tamarack, American Larch			*		Associated with poorly drained soils, shade tolerant	

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Larix sibirica	Siberian Larch			*	*	Average to wet conditions, will even tolerate some standing water; not particular to soil type or pH	
Lonicera dioica	Twining Honeysuckle			*		Open or shaded moist woods and clearings	Climbs trees and shrubs
Lonicera involucrata	Bracted Honeysuckle			*		Open or shaded, moist woods and clearings	
Picea glauca	White Spruce			*	*	Shores and streambank, rocky hills and slopes, succeeding in a variety of soil conditions	
Picea mariana	Black Spruce			*		Peat bogs and swamps, also on transitional sites between peatlands and uplands. Tolerant of nutrient-poor soils	
Pinus contorta var. latifolia	Lodgepole pine		*	*	*	Water-logged bogs to dry sandy soils	Susceptible to mountain pine beetles, mistletoe, rusts, and root rot
Pinus sylvestris	Scots pine				*	Acidic, loamy, moist, sandy, well-drained and dry soils	Some drought tolerance; re-seeds

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Populus balsamifera	Balsam Poplar			*		Gravels, deep moist sandy soils of river bottomlands, stream banks, borders of lakes and swamps	Good for erosion control
Populus treuloides	Trembling Aspen			*		Moist areas	Excellent for erosion control
Potentilla fruticosa	Shrubby Cinquefoil				*	Damp rocky ground, shorelines, lime rich soil, open woods	Tolerant of acidic conditions
Prunus pensylvanica	Pin cherry			*		Likes sun, moist but not wet soils.	
Prunus virginiana	Choke cherry			*		Prefers moist soils but will tolerate dryer soils	
Pseudotsuga menziesii	Douglas Fir				*	Well-aerated, well-drained deep loamy soils with plenty of moisture	Intolerant of poor drainage
Quercus palustris	Pin oak				*	Acidic, loamy, moist, rich, sandy, well-drained, wet and clay soils. Tolerates wet soils including flooding. Cannot tolerate alkaline soils	Fast growing, good food source for wildlife especially ducks
Ribes aureum	Golden Currant			*	*	Along streams, prefers sunny, moist sites, river banks, rocky slopes	Tolerant of drier conditions

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Ribes oxyacanthoides	Wild Gooseberry, Northern Gooseberry			*		Rocky and sandy shores, stony banks, moist woods, and thickets	
Ribes triste	Wild red currant (swamp red currant)			*		Moist woods and low marshy grounds	
Rosa acicularis	Prickly Rose			*	*	Rocky ridges and shores, moist thickets, swamps, woods, roadsides	Revegetation on moist to wet sites; a good choice for erosion control
Rosa arkansana	Prairie Rose			*	*	Sandy tame pastures, roadsides, and at the edges of woods	
Rubus idaeus	Wild Red Raspberry			*	*	Clearings or borders in boreal forests, in ravines, on bluffs and streambanks of prairie regions. Well-drained sandy loam to silty clay loam	Good for erosion control
Rubus pubescens	Dewberry			*	*	Damp woods, bogs, low thickets	
Salix amygdaloides	Peach-Leaved Willow			*		Muddy streambanks and in low wet woods bordering rivers	Excellent streambank stabilizer
Salix bebbiana	Beaked willow Bebb willow			*		Upland forests, wet lowlands, thickets, swamps, lakes and muskegs. Moist sandy or gravelly soils	Good soil stabilizer, can tolerate some flooding

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Salix discolor	Pussywillow; Diamond Willow			*		Moist swampy locations, stream banks, aspen and mixed woods, thickets around sloughs	
Salix exigua	Sandbar Willow, Coyote Willow, Silver Willow			*		Immediately adjacent to water's edge, slough margins	Invasive, excellent streambank stabilizer
Salix glauca	Smooth Willow		*	*		Streambanks, sandy and gravelly floodplains. Rocky, well-drained soils	
Salix lucida	Shining Willow		*	*		Wet ground, swamps, along streams, sand dune slacks	
Salix pentandra	Laurel leaf willow			*	*	Tolerates dry conditions to some standing water; drought tolerant; prefers acidic soils	Invasive, fast growing, highly tolerant of urban pollution
Sambucus racemosa	Elderberry			*		Moist swampy locations, open woods	Useful for controlling erosion on moist sites
Shepherdia argentea	Silver/Thorny Buffaloberry			*	*	Semi-wet loamy soils with good drainage, will grow in drier conditions	Good for reclamation and erosion control
Shepherdia canadensis	Canada Buffaloberry, Russet Buffaloberry				*	Sand, gravely or rocky soils, open woods	Useful for revegetating disturbed sites with poor soils Good for erosion control

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Sorbus decora	Showy mountain ash				*	Well drained soils, adaptable to dry and moist locations; not particular to soil type or pH	Highly tolerant of urban pollution. Resistant to fire-blight
Spiraea alba	Narrow-Leaved Meadow Sweet			*		Wet prairies, open habitats with wet soil. Best in moist soil, but adaptable to dry soil	Fast growing
Spiraea betulifolia	White Meadowsweet			*		Thin forested areas of low to moderate precipitation	Medium soil erosion reduction potential when planted with other vegetation
Symphoricarpos albus	Snowberry			*	*	Open woods and clearings, rocky or sandy soils	Adapts well to disturbed sites, useful for rehabilitating riparian areas
Symphoricarpos occidentalis	Buckbrush, Wolfberry, Western Snowberry			*	*	Swale depressions, upland ravines, alluvial floodplain terraces, roadsides	Adapts well to disturbed sites, useful for rehabilitating riparian areas Good for erosion control
Viburnum edule	Low Brush Cranberry			*		Moist, well-drained alluvial soils	
Viburnum opulus	High Bush Cranberry			*	*	Moist woods or forests, along stream or lake margins on gravel or rocky banks, and on swamp or bog margins	
Forbs							
Achillea millefolium	Common Yarrow			*	*	Can tolerate either dry or moist conditions, meadows, pastures, lawns	Excellent for erosion control, among the hardiest of perennials

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Agastache foeniculum	Giant Hyssop Anise Hyssop			*	*	Moist loamy or sandy soils in open meadows	Important pollinator plant
Allium cernuum	Nodding Onion				*	Open woods, meadows and grasslands	
Aster conspicuous (Eurybia conspicua)	Showy Aster				*	Dry, sandy soil, woodlands, clearings	Important pollinator plant
Aster ericoides (Symphyotrichum ericoides var. pansum)	Tuffed White Prairie Aster			*		Dry black soil, gravel prairies, openings in dry rocky forests, areas along roadsides and disturbed areas	Important nectar and host plant for butterflies
Aster laevis (Symphyotrichum laeve)	Smooth Aster			*	*	Woodland edges, moist meadows	Important pollinator plant
Astragalus americanus	American Milk Vetch			*		Moist woods, riverbanks, openings	
Astragalus bisulcatus	Two-Grooved Milk Vetch				*	Dry sites, eroded banks and clay soils	
Astragalus canadensis	Canada Milk Vetch				*	Loam, sand, mesic soils, shores, thickets and open forests	Poisonous to livestock; attractive to pollinators and birds
Bidens cernua	Nodding Beggarticks		*			Along water's edge of sloughs and wet ground	Annual; important to native bees
Caltha palustris	Marsh-marigold		*			Moist – wet soils. Needs part shade / shade	Sap can irritate sensitive skin
Campanula alaskana (C. rotundifolia)	Harebell				*	Moist to dry sites	Important pollinator plant; long blooming
Castilleja lutescens	Yellow Indian Paintbrush				*	Dry slopes and open coniferous forests	Endangered species

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Delphinium glaucum	Tall Larkspur			*	*	Dry, deep loamy soils, meadows, thickets, stream banks, around springs and in moist meadows and open woods	Most abundant where the snow pack persist
Dodecatheon conjugens	Shooting Star			*		Well-drained soils, moist to moderately dry, rich soil	
Dodecatheon pulchellum	Saline Shooting Star			*	*	Meadows and open woodlands, dry conditions	
Dryas drummondii	Yellow Dryad, Yellow Mountain Avens				*	Dry gravely slopes, river bars, roadsides	May form carpet-like coverings along gravel washes and river banks Excellent for erosion control
Epilobium angustifolium (Chamerion)	Fireweed; Great Willow Herb			*		Disturbed ground, cut-over or burned forests and swamps, clays, loams, sandy loams	Tolerant of a wide variety of soils. Spreads by rhizomes & seed
Erigeron caespitosus	Tufted Fleabane				*	Poor well-drained soils, dry eroded areas	Very drought tolerant once established
Erigeron compositus	Compound Fleabane				*	Eroded hillsides, sandy open places	
Erigeron glabellus	Smooth Fleabane			*		Open moist woods, meadows	
Erigeron philadelphicus	Philadelphia Fleabane			*		Sand, clay, growing in large stands in fields, roadsides and waste places	
Erigeron speciosus	Showy Fleabane			*		Well-drained light, loamy, sandy soil, moist open woods	
Eutrochium maculatum (Eupatorium)	Spotted Joe Pyeweed			*		Moist to wet soils, in open meadows	Important pollinator plant

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Fragaria virginiana	Wild Strawberry			*		Fields, open spaces, woodland edges	
Galium boreale	Northern Bedstraw			*		Shores, gravely or rocky banks, streamsides, roadsides, open woods	
Gaillardia aristata	Blanketflower Brown-eyed Susan				*	Gravely, dry banks	Important pollinator plant
Geranium richardsonii	Wild White Geranium			*		Woodlands, forest openings, grasslands, meadows, and riparian areas such as stream terraces and stream margins; loam, sandy loam, and clayey loam soils derived from shale and limestone	Moderately drought tolerant
Geranium viscosissimum	Sticky Purple Geranium			*		Meadows, open sites in sagebrush shrubland, roadsides, creek banks, meadows, coniferous forest, medium-dry to moist or even wet soils	
Geum aleppicum	Yellow Avens			*		Swamps, low ground, moist woods and thickets	
Geum rivale	Purple Avens, Water Avens			*		Damp, shady places, marshes, beside streams edges of hedge-lined fields bordered by ditches	
Geum triflorum	Old Man's Whiskers/Prairie Smoke				*	Dry, open woodlands, loamy sand	
Glycyrrhiza lepidota	Wild Licorice			*		Moist habitats lakeshores, roadsides, riverbanks, depressions, discharge areas and waste areas. Well-drained sandy loam soil	

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Heuchera cylindrica	Sticky Alumroot				*	Dry, rocky ledges/soils, streambanks	
Helianthus nuttallii	Nuttall's sunflower		*			Prefers moist soil in open meadows, ditches and woods	Spreads rapidly by rhizomes; pollinator plant, seeds for birds
Liatris ligulistylus	Meadow Blazingstar				*	Open meadows and woods	Pollinator plant; seeds for birds
Liatris punctata	Dotted Blazing Star				*	Dry, open, upland sites, especially in sandy soil	
Lilium philadelphicum	Western Wood Lily			*	*	Acidic sandy or shallow rocky soil of meadows, open woods	
Linum lewisii	Wild Blue Flax, Lewisii Wild Flax				*	Dry open ridges and slopes usually on dry, well-drained soil	
Linum rigidum	Yellow Flax				*	Sandy and light soils in grassland habitat	
Lomatium dissectum	Mountain Wild Parsley			*	*	Open, often rocky slopes and dry meadows	
Maianthemum canadense	Wild Lily-of-the-Valley			*		Moist or dry woods, in humus-rich slightly acid soils	
Malvastrum coccineum	Scarlet Mallow			*		Roadsides, railway grades and other disturbed places	
Mentha arvensis	Wild Mint			*		Arable land, heaths, damp edges of woods, marshy grounds	Flood tolerant
Monarda fistulosa	Wild Bergamot, Horse Mint			*		Dry hills, shady banks, woodlands edges, dry thickets, clearings, roadsides	Important pollinator plant
Oenothera biennis	Yellow Evening Primrose			*	*	Dunes, roadsides, railway banks, often in sandy soils	Self-seeding biennial

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Oxytropis deflexa	Reflexed Locoweed				*	Substrate ridges, dry, gravel, sand with low organic content	
Oxytropis monticola	Late Yellow Locoweed				*	Rocky, gravelly, open or partially shaded areas in valleys, sandy loam to clay loam soils	Excellent for erosion control
Oxytropis sericea	Early Yellow Locoweed				*	Open, well-drained north-facing slopes, sandy loam soils	Does not tolerate waterlogged soils
Oxytropis splendens	Showy Locoweed				*	River gravels, grasslands and open forests	
Penstemon confertus	Yellow Beardtongue			*		Fairly moist open or wooded places, meadows or by streams, dry sandy pinewoods	
Penstemon nitidus	Smooth Blue Beardtongue				*	Very dry rocky, eroded or gravelly soils. Grows in poor soil	
Penstemon procerus	Slender Blue Beardtongue			*		Dry plains, prairies, open or wooded slopes, meadows, slough margins	
Petalostemon purpureus (Dalea purpurea)	Purple Prairie Clover				*	Dry plains, prairies, hillsides, open woodlands, shaded ravines, and roadsides. Fine to course soils	Valuable for erosion control due to its deep, fibrous, branching root system
Potentilla arguta	White Cinquefoil			*		Clay, rocky material, sand to loam soils, woods, prairies, moist places	
Potentilla gracilis	Graceful Cinquefoil			*	*	Sandy loam, open rocky areas, grasslands, meadows, moist open woodlands	
Psoralea esculenta	Indian Breadroot			*	*	Rocky woods and prairies, dry banks. On calcareous soils	

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Ranunculus rhomboideus	Prairie Buttercup		*			Moist open meadows, grasslands and woods	Important early pollinator plant
Ratibida columnifera	Prairie Cone-Flower				*	Well-drained, neutral to slightly alkaline soil sandy loam, loam, and clayey loam soils Thin, rocky, gravelly and sandy soils, roadsides	
Senecio congestus	Marsh Ragwort		*			Slough margins, ditches and moist to wet soils	
Sisyrinchium montanum	Blue-eyed Grass		*	*		Sough margins, damp meadows. Poor or clay soils	
Smilacina stellata (Maianthemum stellatum)	Star-Flowered Solomon's Seal			*		Moist open or sandy locations, thickets and open forests on gently sloping benches adjacent to streams	
Solidago canadensis	Canada Goldenrod				*	Roadsides and fence lines, in dry open fields, and in open woods or damp meadows that dry out every year, avoiding acid soils	Important late season pollinator plan
Solidago missouriensis	Missouri Goldenrod, Low Goldenrod			*	*	Clearings, thickets dry, open places on the slopes of valleys, on plains, gravels and rocky slopes	Useful for revegetation of disturbed areas
Solidago mollis	Velvety Goldenrod				*	Dry or drying prairies, open woods, frequently found along fence rows	
Solidago rigida	Stiff Goldenrod				*	Dry or gravelly open woods, thickets and prairies. Medium to coarse soils	
Sphaeralcea coccinea	Scarlet Mallow, Scarlet Globemallow				*	Dry grassland prairies, roadsides	Invades disturbed areas

Strathcona County recommended plant list

Botanical Name	Common Name	Moisture Regime				Recommended Location	Notes
		Aquatic	Emergent	Hydric to mesic upland	Mesic to xeric upland		
Symphyotrichum ciliolatum	Lindley's Aster				*	Open meadows and woodlands.	Important pollinator plant
Symphyotrichum puniceum	Purple-stemmed Aster		*	*		Slough edges, moist open woodlands and meadows	
Thalictrum dasycarpum	Tall Meadow Rue		*	*		Low moist ground, ravines, streambanks, thickets, roadsides, meadows, streambank	
Thermopsis rhombifolia	Golden Bean				*	Dry soil, dry sandy grasslands, roadsides	Important pollinator plant
Viola adunca	Early Blue Violet			*	*	Damp banks and edges of meadows in most forest communities	
Viola canadensis	Western Canada Violet			*		Low, moist shady woods and meadows	
Zigadenus elegans	White Camas, Death Camas, Mountain Deathcamas			*	*	Crevices and ledges of north-facing dolomite banks, meadows, stream banks and woods in moist soil	Extremely toxic plant to humans and animals if ingested. Toxicity can vary in a plant according to season, parts, stage of growth. Can absorb toxic substances, (herbicides, pesticides, pollutants) from the water, air, and soil
Zizia aptera	Heart-Leaved Alexanders, Meadow Parsnip			*		Moist to dry prairies, limestone, mesic river shores, and fields showing low to intermediate levels of disturbance.	Important pollinator plant

Appendix D Noxious weeds in Alberta

The following plants are designated as prohibited noxious weeds in Alberta	
Common name	Scientific name
autumn olive	*Elaeagnus umbellata Thunb.*
balsam, Himalayan	*Impatiens glandulifera Royle*
barberry, common	*Berberis vulgaris L.*
bartsia, red	*Odontites vernus (Bellardi) Dumort*
buckthorn, common	*Rhamnus cathartica L.*
cinquefoil, sulphur	*Potentilla recta L.*
crupina, common	*Crupina vulgaris Pers. ex Cass.*
dyer's woad	*Isatis tinctoria L.*
Eurasian water milfoil	*Myriophyllum spicatum L.*
flowering rush	*Butomus umbellatus L.*
garlic mustard	*Alliaria petiolata (M. Bieb.) Cavara & Grande*
goatgrass, jointed	*Aegilops cylindrica Host*
hawkweed, meadow	*Hieracium caespitosum Dumort.*
hawkweed, mouse-ear	*Hieracium pilosella L.*
hawkweed, orange	*Hieracium aurantiacum L.*
hoary alyssum	*Berteroa incana (L.) DC.*
hogweed, giant	*Heracleum mantegazzianum Sommier & Levier*
iris, pale yellow (flag)	*Iris pseudacorus L.*
knapweed, bighead	*Centaurea macrocephala Puschk. ex Willd.*
knapweed, black	*Centaurea nigra L.*
knapweed, brown	*Centaurea jacea L.*
knapweed, diffuse	*Centaurea diffusa Lam.*
knapweed, hybrid	*Centaurea × psammogena Gáyer*
knapweed, meadow	*Centaurea × moncktonii C. E. Britton*
knapweed, Russian	*Rhaponticum repens (L.) Hidalgo*
knapweed, spotted	*Centaurea stoebe L. ssp. Micranthos (Gugler) Hayek*
knapweed, squarrose	*Centaurea virgata Lam. ssp. Squarrosa (Willd.) Gugler*
knapweed, Tyrol	*Centaurea nigrescens Willd.*
knotweed, giant	*Fallopia sachalinensis (F. Schmidt Petrop.) Ronse Decr.*
knotweed, hybrid Japanese	*Fallopia × bohemica (Chrtek & Chrtková) J. P. Bailey*
knotweed, Japanese	*Fallopia japonica (Houtt.) Ronse Decr.*
loosestrife, purple	*Lythrum salicaria L.*

The following plants are designated as prohibited noxious weeds in Alberta

Common name	Scientific name
medusahead	*Taeniatherum caput-medusae (L.) Nevski*
nutsedge, yellow	*Cyperus esculentus L.*
puncturevine	*Tribulus terrestris L.*
ragwort, tansy	*Jacobaea vulgaris Gaertn.*
rush skeletonweed	*Chondrilla juncea L.*
saltcedar	*Tamarix ramosissima Ledeb.*
saltlover	*Halogeton glomeratus (M. Bieb.) C.A. Mey.*
St John's-wort, common	*Hypericum perforatum L.*
starthistle, yellow	*Centaurea solstitialis L.*
tamarisk, Chinese	*Tamarix chinensis Lour.*
tamarisk, smallflower	*Tamarix parviflora DC.*
thistle, marsh	*Cirsium palustre (L.) Scop.*
thistle, nodding	*Carduus nutans L.*
thistle, plumeless	*Carduus acanthoides L.*

The following plants are designated as noxious weeds in Alberta

Common name	Scientific name
baby's-breath, common	*Gypsophila paniculata L.*
bellflower, creeping	*Campanula rapunculoides L.*
bindweed, field	*Convolvulus arvensis L.*
blueweed	*Echium vulgare L.*
brome, downy	*Bromus tectorum L.*
brome, Japanese	*Bromus japonicus Thunb.*
burdock, great	*Arctium lappa L.*
burdock, lesser	*Arctium minus (Hill) Bernh.*
burdock, woolly	*Arctium tomentosum Mill.*
buttercup, tall	*Ranunculus acris L.*
chamomile, scentless	*Tripleurospermum inodorum (L.) Sch. Bip.*
clematis, yellow	*Clematis tangutica (Maxim.) Korsh.*
cockle, white	*Silene latifolia Poir. ssp. alba (Miller) Greuter & Burdet*
daisy, oxeye	*Leucanthemum vulgare Lam.*
dame's rocket	*Hesperis matronalis L.*
henbane, black	*Hyoscyamus niger L.*
hoary cress, globe-podded	*Lepidium appelianum Al-Shehbaz*
hoary cress, heart-podded	*Lepidium draba L.*
hoary cress, lens-podded	*Lepidium chalepense L.*

The following plants are designated as noxious weeds in Alberta	
Common name	Scientific name
hound's-tongue	*Cynoglossum officinale L.*
mullein, common	*Verbascum thapsus L.*
pepper-grass, broad-leaved	*Lepidium latifolium L.*
scabious, field	*Knautia arvensis (L.) Coult.*
sow thistle, perennial	*Sonchus arvensis L.*
spurge, leafy	*Euphorbia esula L.*
tansy, common	*Tanacetum vulgare L.*
thistle, Canada	*Cirsium arvense (L.) Scop.*
toadflax, Dalmatian	*Linaria dalmatica (L.) Mill.*
toadflax, yellow	*Linaria vulgaris Mill.*