THE CITY OF EDMONTON

DRAINAGE SERVICES MASTER PLAN

2004 - 2014

IMPLEMENTATION AND STRATEGIES

January 2004

APPROVED BY CITY COUNCIL
JANUARY 20, 2004

Prepared By:
City of Edmonton
Asset Management and Public Works
Drainage Services

EXECUTIVE SUMMARY

This 2003 Drainage Master Plan outlines the strategic direction for Drainage Services for the next 10 years. The plan is a continuation of the direction established with the 1991 City Council approved Drainage Master Plan. In the 1991 plan, key areas identified were: protection of existing homes from basement flooding, maximizing environmental protection, and accommodation of new development. Since that time, Drainage Services has developed a number of strategies to address these issues, including the Sanitary Servicing Strategy approved by City Council in July 1998, and the Combined Sewer Overflow Strategy approved by City Council in March 2000.

The 2003 Drainage Master Plan identifies current issues and describes strategies to address these issues. Key issues identified include: Total Loadings to the North Saskatchewan River, New Water Quality Parameters, Regional Servicing, Membrane Filtration, Industrial Land Development, Communication/Education, and Infrastructure Rehabilitation/Maintenance. These issues were identified through a series of workshops and meetings with the following groups and stakeholders: Drainage Master Plan Working Committee, Drainage Services management, an outside expert advisory group, and the representatives from the Infrastructure Technical Advisory Committee.

In the near term, it is not anticipated that the issues identified will have a significant impact on Drainage Services 20-year financial Capital Priorities Plan. However, a few of the issues have the potential to create funding gaps should conditions change from what is known today. These issues include: Total Loadings, Membrane Filtration, and stormwater management facilities for industrial land development.

In July 2002, City Council approved the Land Drainage Utility, a significant step for Drainage Services. The new utility, implemented January 1, 2003, will allow Drainage Services to develop long-term implementation plans for stormwater management projects. However, funding gaps remain as demands exceed available funding. An opportunity exists to further improve water quality in the North Saskatchewan River, with the potential development of a water recycling distribution network driven by industrial and irrigation usage.

Guided by this Drainage Master Plan, Drainage Services looks forward to taking on the challenges of the next decade and beyond.

Kurt Sawatzky, P. Eng.
Manager, Drainage Services

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APPENDICES

1.0 PRINCIPLES AND POLICIES

1.1 Vision

The vision of Drainage Services is:
"To be recognized as a leader in environmental management and in the utilization of best practices for drainage service delivery."

1.2 Mission

Drainage Services' mission is:

"To plan, design, construct, operate, and maintain drainage facilities to collect, treat, and dispose of wastewater and stormwater from residential, industrial, commercial and institutional customers in the Edmonton area in order to ensure a safe environment and public health."

1.3 Operating Principles

The principles under which Drainage Services operates are:

- to protect municipal infrastructure investment by maintaining the existing drainage collection and treatment facilities
- to provide an acceptable level of service to customers
- to maximize environmental protection
- to support orderly development in the City of Edmonton
- to operate Drainage Services in an efficient and effective manner

Drainage Services is committed to protect the environment and to provide an acceptable level of service that is timely and cost-effective.

2.0 DEVELOPMENT OF 2003 MASTER PLAN

2.1 1991 Policy Document

On February 12, 1991 City Council approved the Drainage Master Plan, Part 1: Policy Document. The purpose of the 1991 Policy Document was "*to specifically deal with both the long-term and the very pressing, short-term, drainage maintenance, upgrading and development servicing requirements.*"

The purpose of the 1991 Policy Document was to address drainage maintenance, upgrading, and development servicing requirements.

Objectives of the 1991 Policy Document were as follows:

- Systems Maintenance and Upgrading
- Environmental Protection
- Systems Development

Major strategies developed after the release of the 1991 Drainage Master Plan were:

- Sanitary Servicing Strategy
- CSO Control Strategy
- Inter-connection Control Strategy

From that document the overall Drainage Services objectives were defined as follows: *To provide an acceptable level of service that is cost-effective, timely, and environmentally conscious by:*

- *maintaining sewer systems,*
- *upgrading sewer systems, and*
- *developing sewer systems for future development.*

This was to be achieved through the following principles:

Principle: To Protect Investment and to Provide Acceptable Service Level to Existing Customers.

Strategies:
- reduction of inflow/infiltration to sanitary sewers and combined areas
- upgrade drainage systems and correct deficiencies
- provide adequate drainage systems maintenance

Principle: Maximize Environmental Protection

Strategies:
- minimize effects of non-plant discharges
- provision of additional wastewater treatment capability for enhanced standards
- improve the quality of surface water discharges
- control of other point source discharges

Principle: To support Orderly Development in the City of Edmonton

Strategies:
- Drainage system planning
- expansion of storm and sanitary systems
- provision of additional wastewater treatment capacity

The 1991 Policy Document provided Drainage Services a framework to develop and implement strategies addressing issues brought forth by key stakeholders. Major strategies and programs developed by Drainage Services as a result of the 1991 Drainage Master Plan Policy Document are:

Significant programs identified were:

- Tertiary Treatment
- Lot Grading Inspection Program
- Floodproofing Program
- QualServe

Identification of issues began in April 2001 with the Drainage Master Plan Working Committee.

Issues were further evaluated and new issues identified at a November 2001 workshop that included Drainage Services management.

- Sanitary Servicing Strategy
- Combined Sewer Overflow Control Strategy
- Interconnection Control Strategy
- Tertiary Treatment at Gold Bar Wastewater Treatment Plant
- Lot Grading Inspection Program
- Floodproofing Program
- QualServe Self-Assessment and Peer Review Program

2.2 Identification of Issues

2.2.1 Working Committee

In April 2001, a Drainage Master Plan Working Committee was struck with representation from Planning, Wastewater Treatment, Operations, Design and Construction, and from Corporate Finance and Corporate Communications.

From April 2001 to November 2001 this Committee completed the following items:

- identification of four distinct issues categories – Regulatory, Growth, Technology and Customer Services
- initial identification of issues within each category
- initial identification of strategies to address issues

2.2.2 November 2001 Workshop

The issues identified by the Working Committee were presented to Drainage Services management at a one-day Drainage Master Plan workshop in November 2001.

The management group completed the following at the workshop:

- evaluated and discussed issues presented by the Working Committee
- identified new issues and enhancements to previous issues
- prioritized all issues based on a Value Engineering process.

The complete list of categories and issues is shown in Table 2 appendices.

2.2.3 July 2002 Workshop

In July 2002, the Drainage Master Plan issues were presented to a team of expert advisors in order to obtain an outside opinion on the work completed to date, and to identify areas of risk and uncertainty. Tasks completed by this group were:

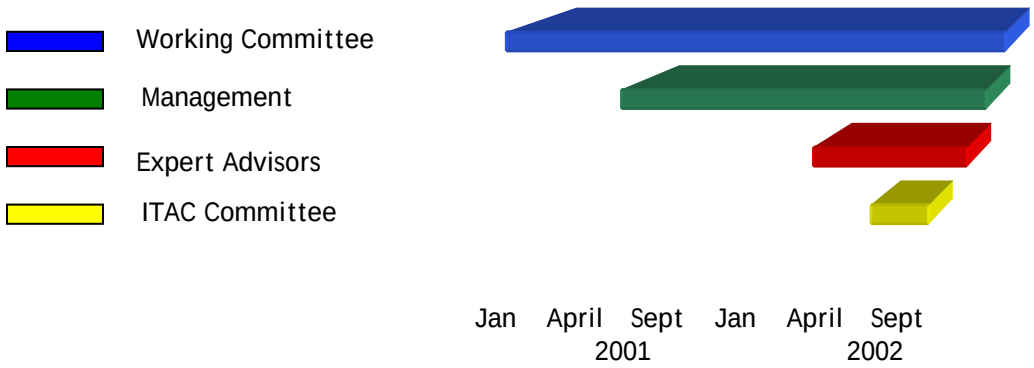
- reviewed objectives and principles of the Drainage Master Plan
- reviewed and further prioritized the 28 previously identified issues
- brainstormed to identify strategies that might be appropriate for the high priority issues
- evaluated and prioritized strategies

2.2.4 November 2002 Workshop

On November 14, 2002, a presentation of the Drainage Master Plan issues and strategies was made to representatives from the Infrastructure Technical Advisory Committee (ITAC). This group represented many of Drainage Services stakeholder groups, such as the Urban Development Institute and Alberta Environment. The group provided feedback and direction to the contents of the Drainage Master Plan.

Representatives from the Infrastructure Technical Advisory Committee (ITAC) provided feedback and direction for the Drainage Master Plan.

Drainage Master Plan Development Process



Drainage Services collects, transmits, and treats Edmonton's wastewater and, collects and transmits stormwater runoff under the Approval-to-Operate from Alberta Environment.

Drainage Services has regulatory authority by means of three bylaws:

1. Sewers Bylaw
2. Sewers Use Bylaw
3. Surface Drainage Bylaw

3.0 DRAINAGE SERVICES

3.1 Mandate

Drainage Services is responsible for:

- the collection, transmission and treatment of Edmonton's wastewater from residential and non-residential sources, including commercial and industrial sources
- the management and proper disposal of bio-solids from the wastewater treatment process
- the collection and transmission of stormwater runoff to the North Saskatchewan River

All services provided by Drainage Services are regulated by Alberta Environment under an Approval-to-Operate. Drainage Services operates both the sanitary sewer systems and land drainage (stormwater) systems as utilities.

Drainage Services derives its authority from City Council by means of three bylaws:

Sewers Bylaw (Bylaw No. 9425) – regulates connections between private drainage systems and the City of Edmonton sewerage system and allows the collection of the Sanitary Sewer Trunk Charge and other assessments.

Sewers Use Bylaw (Bylaw No. 9675) – regulates the release of matter to the City of Edmonton's sewerage system and watercourses and sets the rate charged to customers for sewer service.

Surface Drainage Bylaw (Bylaw No. 11501) – regulates lot grading and surface drainage requirements within private and public lands.

Several initiatives within Plan Edmonton (approved by City Council in 1998) are fundamental to Drainage Services business activities (e.g. protecting the environment, supporting growth, economic development, and regional co-operation). Other issues have been identified in the Infrastructure

Strategy (e.g. infrastructure in decay, increasing service and environmental expectations).

• Project Working Committee Tour of Gold Bar Wastewater Treatment Plant

Drainage Services stakeholders include citizens, land developers, new business enterprises, other City departments, municipal and public sector enterprises

3.2 Customers/Stakeholders

All citizens of the City of Edmonton are Drainage Services customers. Citizens and businesses receive sewerage and drainage services that provide convenience, safety, and public health protection. Key stakeholders include:

- the development industry
- Alberta Environment
- Environment Canada
- Department of Fisheries and Oceans Canada
- environmental and conservation advocacy groups

3.3 Existing Facilities

3.3.1 Combined Sewer System

Built during early 1900s to the 1950s, combined sewers service approximately 5,000 hectares in the City, representing about 15 per cent of Edmonton's currently developed area. Domestic sewage and stormwater are collected in one pipe and transported to the Gold Bar Wastewater Treatment Plant. There are approximately 930 kilometres of combined sewers, forming the core of the City system.

Combined sewers service 15 per cent of the total developed area in the City and form the core of the City drainage system.

Problems associated with combined sewers include the following:

- overloading the wastewater treatment plant during wet weather
- discharges of untreated sanitary sewage into watercourses during high intensity rainfalls
- back-ups of sanitary sewage in basements

Most of the sewage in the sanitary sewer system discharges through the combined sewer system to the Gold Bar Wastewater Treatment Plant.

The stormwater system is comprised of storm sewers, overland flow routes, and stormwater management facilities. The system is designed to limit property damage in a 1:100 year rainfall event.

3.3.2 Sanitary Sewer System

The installation of a separated sanitary system began in the mid 1950s. Currently, approximately 1,700 kilometres of sanitary sewers service about 27,000 hectares of land, or 85 per cent of the total developed land in the City of Edmonton.

Most of the sanitary sewer system flows through the combined sewer system to the Gold Bar Wastewater Treatment Plant. Approximately 3.5 per cent of the developed area of the City drains to the Alberta Capital Region Wastewater Treatment Plant. In exchange, sewage from Leduc County, the City of Leduc and the Town of Beaumont drains into the City system to the Gold Bar Wastewater Treatment Plant.

The sanitary system is interconnected to the storm system in a number of locations in the City. Interconnections were built to provide some relief for the sanitary system during wet weather events. Nearly 400 interconnections were built between 1950 and 1970. However, since the start of the Interconnection Control Strategy in 1994, the number of sites has been reduced to under 200. Work continues to monitor, eliminate, or reduce the impact of all interconnection sites.

3.3.3 Stormwater System

Installation of the separated storm sewer system began at the same time as the sanitary system in the mid 1950s. Currently, there are about 1,900 kilometres of storm sewers servicing about 27,000 hectares of land, or 85 per cent of the total developed area of the City.

The stormwater system also has overland flow routes including ditches, creeks, ponds, and wetlands. Overland flow routes traverse political boundaries resulting in the need for inter-jurisdictional control of stormwater.

The Gold Bar Wastewater Treatment Plant was the first secondary treatment facility in Canada.

3.3.4 Wastewater Treatment and Biosolids Management

The Gold Bar Wastewater Treatment Plant provides tertiary treatment and disinfection for wastewater from the combined and sanitary sewer systems. The Gold Bar Wastewater Treatment Plant has an average capacity of 310 ML/d and a peak capacity of 420 ML/d. Primary treatment processes have a rated capacity of 910 ML/d.

The Alberta Capital Region Wastewater Commission operates a secondary treatment plant to the northeast of Edmonton with a capacity of 90 ML/d. Edmonton and the Alberta Capital Region Wastewater Commission have an agreement that covers the present flow exchange of 10 ML/d.

Biosolids from both wastewater treatment plants are sent to land disposal through the Nutri-Gold program, or to the Waste Management Branch operated co-composter located in the Cloverbar Industrial Neighbourhood in northeast Edmonton.

Design and Construction

3.4 Business Operations

Drainage Services consists of four inter-related work areas: Planning, Design and Construction, Operations, and Wastewater Treatment. In addition, Drainage Services also administers the Office of the Infrastructure.

3.4.1 Planning

Drainage Planning provides management, planning, technical drafting, data retention, customer support and services necessary to commission, repair, upgrade, and mitigate the environmental impacts of the City's sewerage and drainage systems.

3.4.2 Design and Construction

Drainage Design and Construction designs and constructs wastewater and drainage system facilities including open cut and tunnelling. Construction services are also provided to organizations outside of City departments.

Operations

Stormwater Management Services

3.4.3 Operations

Drainage Operations is responsible for operating and maintaining a reliable wastewater collection system (conveying flows to the wastewater treatment plant) and a reliable stormwater management system (conveying flows to the North Saskatchewan River and its tributaries).

3.4.4 Wastewater Treatment

Wastewater Treatment provides biological treatment of wastewater and biosolids management for the City. This section also provides biosolids management services to the Alberta Capital Region Wastewater Commission and leachate treatment services for the Waste Management Branch.

3.4.5 Office of the Infrastructure

The overall goal of the Office of the Infrastructure is to ensure that the City's infrastructure is in a good state of repair, and rehabilitation and development programs are adequately funded on an ongoing basis. This is achieved through the ongoing development and implementation of strategies to address the infrastructure gap - the difference between the projected cost of infrastructure projects and the capital financing available to pay for them.

Additional duties of the Office of Infrastructure includes exploring and investigating innovative tools and processes to improve infrastructure management, optimizing existing and potential sources of funding, co-ordinating annual updates of the City's inventory and investment needs, and promoting awareness of infrastructure issues.

The Office of the Infrastructure also co-ordinates the Infrastructure Canada-Alberta Program, a cost-sharing partnership for infrastructure.

3.5 Business Activities

The primary business activities of Drainage Services are to provide collection, treatment, and disposal services for wastewater and runoff waters. These

Biosolids Management for the Alberta Capital Region Wastewater Commission

Laboratory Services

activities comprise the following service areas:

- **Stormwater Management Services**: includes planning, approval, construction, operation, and maintenance of catch basins, storm sewers, manholes, dry ponds, wet ponds, flow routes, and storm outlets. These services are now paid for from the Land Drainage Utility established January 2003.
- **Sanitary Customers – City of Edmonton:** Drainage Services has over 185,000 residential and 16,000 industrial/commercial customers. These customers receive wastewater conveyance and disposal services including plans, approval, construction, operations, and maintenance of sanitary and combined sewers, wastewater treatment facilities, and bio-solids management and disposal. These services are paid for from the Sanitary Utility.
- **Overstrength Customers:** Customers are usually industrial operations that process large volumes of raw material and have wastewater that is very high in organic or chemical content. Overstrength customers are charged at cost for the extra treatment requirements.
- **Biosolids Management for the Alberta Capital Region Wastewater Commission:** Drainage Services provides storage, decanting, and disposal services for biosolids from the Alberta Capital Region Wastewater Commission's treatment plant.
- **Leachate Treatment Services:** Drainage Services operates the leachate treatment facility for the Waste Management Branch.
- **Laboratory Services:** The laboratory at the Gold Bar Wastewater Treatment Plant performs water quality tests for process control and reporting to Alberta Environment. It also provides testing services for other municipal jurisdictions and other operating units within the City. The laboratory received accreditation in 2003.
- **Lot Grading Program Services:** The lot grading program, under Bylaw 11501, ensures developed properties have surface grades that provide good drainage when the final landscaping is complete.

Construction Services tunnelling crew

- **Private Development Services:** Drawings review and subdivision infrastructure quality assurance services ensure that drainage facilities are designed and built to City standards before the City assumes responsibility.
- **Service Connections:** Properties requiring new connections from main lines pay for this construction work. Drainage Services provides the co-ordination, design, and construction of sanitary, storm, and water (for Epcor Water Services Inc.) service connections. Drainage Services jurisdiction extends from the sewer main located in the City right-of-way to the start of private property.
- **Construction Services:** Drainage Services has plant, equipment, and manpower resources to construct a significant portion of its own infrastructure needs. This includes all tunnelling work constructed for storm and wastewater transmission in the City.
- **Industrial Wastewater Control:** The primary function of the Industrial Wastewater Control Unit is the administration and enforcement of the Sewers Use Bylaw No. 9675. The basic objectives of the Unit are to control wastewater releases which may cause a hazard to human health or the environment, cause damage or upset in the drainage or the wastewater treatment facility, or result in the City violating Provincial standards.

4.0 IDENTIFICATION OF ISSUES

A number of issues have been identified to have a potential impact on Drainage Services. These have been broken into four distinct areas: Regulatory, Growth, Technology, and Customer as shown in Table 1 (appendices). These issues are discussed in detail in the following sections.

Total loadings measures both the concentration and volume of the pollutants entering the North Saskatchewan River.

Selection of the loading parameters and the assimilative capacity of the river is in progress.

Ammonia in the aquatic environment has been listed under the *Canadian Environment Protection Act* as toxic. Other regulations could be introduced that impact final effluent discharge requirements.

4.1 Regulatory

4.1.1 Total Loadings

The sewerage and drainage systems are regulated by an Approval-to-Operate issued by Alberta Environment. In 2005, the City of Edmonton's Approval-to-Operate is expected to be driven by the principle of total loadings. This differs fundamentally from the current regulatory approach.

Total loading is a cumulative method for examining pollutant impacts on a river. Total loading analysis attempts to combine both concentration and volume data from multiple discharge sources. While effluent concentration is a well established and straight forward means for regulating water quality, implementation of a total loadings approach requires further assessment of river conditions.

At present, the City provides to Alberta Environment, a daily summary of storm and combined sewer overflow total loadings to the North Saskatchewan River for several constituents. These records are compiled by the City and submitted to the Province as part of the Annual Report. Both the selection of loading parameters and the assessment of the assimilative capacity of the river will be carried out during the Approval-to-Operate renewal process.

4.1.2 Stormwater Quality Enhancement

Alberta Environment and Environment Canada have both indicated the regulation of stormwater quality will be a requirement in the future. In 2001, an Alberta Environment policy document established suspended solids removal requirements. This has encouraged municipalities to provide some level of stormwater treatment for new developments.

Stormwater control limits could lead to requirements to improve the existing infrastructure. It will likely lead to the introduction of best management practices into the City's Servicing Standards for new infrastructure.

The issue of disinfection regards selecting the appropriate treatment technology and capacity for combined sewer overflow control.

4.1.3 New Water Quality Parameters

Under the *Canadian Environment Protection Act*, *1999,* ammonia in the aquatic environment has been listed as a toxic substance. This decision recognizes that ammonia poses a risk to aquatic health. Under the *Canadian Environment Protection Act*, proposed limits have been developed for ammonia discharges based on pH and temperature conditions. The low level of allowable ammonia for discharge to watercourses directly impacts discharges of final effluent from the Gold Bar Wastewater Treatment Plant. The impacts of additional regulation for ammonia will be clearer when Environment Canada finalizes its prevention strategy.

Environment Canada and Alberta Environment may require further control of other water quality parameters. Possible parameters of concern include: Cryptosporidium, Giardia, pesticides, endocrine disrupters, nitrates/nitrites, chloride, and road salt.

4.1.4 Wet Weather Disinfection

In the future, more combined sewer overflow will be directed to the Gold Bar Wastewater Treatment Plant. Due to the nature of these flows (high volumes and flow rates during wet weather conditions), the Combined Sewer Overflow Control Strategy found that primary treatment followed by disinfection will be effective in protecting the river. Disinfection of some of these flows is being proposed by ultraviolet radiation.

Disinfection for the Enhanced Primary Treatment Project was originally planned to be by chlorination/dechlorination. The concerns regarding chlorinated organics in wastewater raised in the Canadian Environment Protection Act Toxics Assessment in June 2001, has resulted in Drainage Services changing to ultraviolet disinfection. This more intensive capital investment is forcing the review of wet weather treatment capacities for various process components.

A formal environmental management system can be used to improve environmental performance.

Some jurisdictions in the Region do not have agreements with the City on regional regulations, especially enforcement.

Both the Alberta Capital Region Wastewater Commission and the City have concerns with existing servicing agreements.

4.1.5 Sewer Separation

There are two technical reasons for separating the sewer system; first to reduce combined sewer overflows, and secondly to relieve basement flooding. Opportunistic separation is being pursued where these benefits can be realized during rehabilitation programs. While total system separation is cost prohibitive, Alberta Environment has directed the City to move towards environmental performance equivalent to complete sewer separation over the long term (i.e. 100 years.)

4.1.6 Environmental Management

The management and operation of the stormwater and sanitary sewer systems by Drainage Operations involves a continuous interaction with the natural environment. This interaction may be planned, as in treated wastewater effluent discharge, or unplanned, as in a chemical spill or sewage overflow. One of the best methods of managing environmental issues is through the use of a formal environmental management system such as ISO 14001. Advantages of a formal environmental management system can include improved environmental performance, reduced liability, improved compliance, employee involvement, and enhanced customer trust.

4.1.7 Regional Regulations

Sewage discharged into the regional wastewater collection system south of the City is treated at the Gold Bar Wastewater Treatment Plant. This results in the responsibility for any restricted wastes released to the sewers in these communities being transferred to the City. Some jurisdictions in the Region do not have agreements with the City on:

- bylaw limits
- industrial monitoring
- overstrength surcharges
- enforcement

Financing of major stormwater servicing requirements is a concern for industrial land development.

The development industry could face increased costs due to Alberta Environment requirements for sediment removal.

4.2 Growth

4.2.1 Regional Servicing

The Alberta Capital Region Wastewater Commission and Drainage Services share transmission and treatment facilities, which are regulated by a number of agreements. This partnership is a key element in the overall service delivery Drainage Services provides for its customers. Both the City and the Alberta Capital Region Wastewater Commission have a number of concerns related to the existing agreements and future impacts on their respective organizations. These concerns are related to conveyance and treatment capacity, financial viability, growth pressures, and wastewater quality.

4.2.2 Industrial Land Development

In the City of Edmonton, the cost of new infrastructure is front-ended by private developers, with costs recovered through the Permanent Area Contribution system. This mechanism works well in residential areas because development usually proceeds in an orderly, linear, and predictable fashion. In addition, the development of all residential neighbourhoods are preceded by an Area Master Plan and a Neighbourhood Design Report, which clearly identifies all capital works required and the associated costs.

By contrast, industrial land development in the City occurs on a piecemeal basis so that identifying and planning for the financing of major capital expenditures is more problematic. While the Sanitary Servicing Strategy provides a clear mechanism for financing sanitary trunks, there is not the same consistency with regards to financing stormwater servicing. Currently, Permanent Area Contributions for stormwater servicing in industrial lands are collected ahead of the construction of required works.

Industrial land developers are concerned about the perceived high costs of storm sewer servicing and the current design standards for industrial land requiring curb, gutter, catchbasins, and underground storm pipes.

Drainage Services values the retention of existing wetlands and the incorporation of wetlands into the City drainage infrastructure.

Intensification of development in existing neighbourhoods may increase combined sewer overflows, reduce the level of service provided by existing sewers, and increase the risk of basement flooding.

4.2.3 Land Development Requirements

Alberta Environment requires 85 per cent removal of sediments of particle size greater than 75 microns for all new developments. The City of Edmonton will enforce this requirement for all new developments in the City. Further regulation of both design elements and construction activities may be required in the future. The development industry could raise concerns about costs.

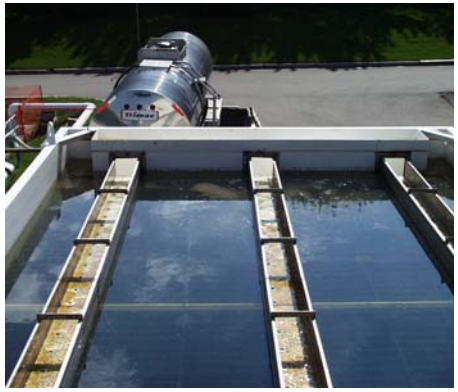
4.2.4 Retention of Wetlands

Existing wetlands form part of the natural hydrological cycle and are important components of a watershed. City Policy C-467 seeks to conserve natural sites including natural wetlands in Edmonton. Senior Management Team created the position of Conservation Coordinator to spearhead this policy. Drainage Services supports the Conservation Co-ordinator in implementing this voluntary compliance policy.

Drainage Services values natural wetlands for their stormwater management and water quality enhancement benefits. Drainage Services would like to incorporate, wherever possible, natural, altered, or constructed wetlands into the City's drainage infrastructure. Water quality control through sediment forebays and pre-treatment cells with submerged flow may be the minimum inlet requirements when using natural wetlands.

Natural wetlands are protected under the *Water Act* (Alberta Environment). They cannot be altered without approval from Alberta Environment, which requires mitigation where wetlands are lost. The preservation, utilization, and management of natural wetlands will form a part of Drainage Service's Stormwater and Water Quality Strategies.

Subject to the requirements of the *Water Act*, the City could exercise direct control over natural wetlands under the *Municipal Government Act* with development of specific bylaws. The development industry is presenting a mixed reaction to wetlands. Some view wetlands as lost revenue, as it is



Construction of enhanced primary treatment will have operational and financial implications.

Introduction of membrane filtration may result in increased capacity for the Gold Bar Wastewater Treatment Plant, allow effluent reuse, and achieve greater disinfection.

land unavailable for development if maintained in its natural state. Some developers are attempting to incorporate wetlands into their plans as a marketing feature.

4.2.5 Land Use Intensification

Intensifying the use of built-up lands will place added burdens on existing sewerage and drainage systems. Increased discharge to the combined sewer system may result in increased frequency and volume of overflows. Overburdened sewers may be prone to increased backup into basements. Examples are apartments replacing houses, and downtown warehouses and office buildings being converted to condominiums. In the last five years, Edmonton has seen a resurgence in the number of developments that have resulted in intensification of existing neighbourhoods. In addition, trends in Edmonton suggest that more people are choosing to live in multi-family units close to the city core. As well, there have been a number of proposals for intensifying other areas of the city including the University of Alberta Campus, the University of Alberta Farms, West Edmonton Mall, and Griesbach.

4.3 Technology

4.3.1 Enhanced Primary Treatment

The Combined Sewer Overflow Long Term Control Plan has committed the City to construction of up to 1,600 ML/d treatment capacity at the Gold Bar Wastewater Treatment Plant. To achieve this capacity, high rate enhanced primary treatment is proposed. There are a number of viable treatment and ultraviolet light disinfection technologies available. The issues surrounding the enhanced primary treatment are:

- choosing the appropriate treatment technologies
- achieving disinfection requirements
- operating impacts of enhanced primary treatment
- financial requirements to operate

4.3.2 Membrane Filtration Technologies

Membrane filtration is a new technology that can achieve greater removal of suspended solids. This technology has the potential to greatly increase the Gold Bar Wastewater Treatment Plant's capacity by allowing more treatment to occur within a smaller area. Other potential opportunities include: effluent reuse and reduced discharges to the river and achieving greater levels of disinfection. As with any new technology, there is limited experience to measure the benefits.

Management of new database technologies needs to be addressed.

4.3.3 Information Management

SCADA, GIS and database (DRAINS) technologies all result in increased abilities to collect, manage, monitor, and interpret operational performance and inventory information. The appropriate management of the systems, processes, and requirements for data need to be addressed, including staff ability, technology capability and redundancy, and funding. Business flows need to be established in Drainage Services to ensure the proper management of information.

4.4 Customer

A funding gap exists for the Land Drainage Utility with regards to future regulatory requirements, growth demands and rehabilitation.

4.4.1 Land Drainage Funding

Establishing the Land Drainage Utility in 2003 provided the framework to address a number of funding issues for stormwater systems. However, the ability of the utility to raise rates in order to undertake all necessary works remains an outstanding issue. Although the utility is in a stronger position to deliver its mandate, current demands exceed available financing. Funding for growth and rehabilitation continue to lag behind needs.

4.4.2 Cost Minimization

During the early to mid 1990s, Drainage Services' revenues from customers was not covering the costs of operating and maintaining the sewerage and drainage systems. During that period, there had been increases in the sanitary rate above inflation in order to bring the sanitary utility to a self-

•Picnicing

New environmental protection measures increase the costs for Drainage Services.

With an aging system comes the risk of line failures and increasing costs in the future.

Increased construction of other utilities within Drainage Services' Right-of-Way may increase future repair costs.

supporting level. Sanitary utility rate increases have been less than inflation since 2000. Customers continue to expect municipal service delivery with minimal cost increases.

4.4.3 Environmental Protection

Customers are well informed regarding environmental issues and are now demanding more environmental protection, resulting in raised expectations and costs. As the environmental awareness of the public grows, expectations may exceed the ability of Drainage Services to satisfy all public expectations. Drainage Services continues to exceed expectations set out in the Approval-to-Operate. Drainage Services continues to address stakeholder issues raised by the River Water Quality Task Force and the North Saskatchewan River Watershed Alliance.

4.4.4 Infrastructure Maintenance and Rehabilitation

As the sewerage and drainage infrastructure ages, there are greater risks of storm and sanitary sewers failing. The Office of Infrastructure recently completed a risk assessment, and it was noted that there is no capital funding for sewer service connections in the 20-year Capital Priorities Plan. All costs for sewer connection upgrading are financed through the operating budget. There may be a concern that the proposed capital budget is not sufficient to meet the regulatory needs of the drainage system.

4.4.5 Right-of-Way Management

Currently, there are numerous locations of intersecting or parallel construction of multiple utilities. The failure of one component can result in damage to the other utilities and possible increased liability to Drainage Services. This may result in higher future costs for repair and rehabilitation. This concern is heightened for new utility operators constructing in the right-of-way.

More public awareness and education regarding the role of Drainage Services is required.

There are limited major drainage routes in existing areas resulting in a higher risk of flooding.

Deep sewer tunnels and pump stations have the potential to create periodic odour problems.

4.4.6 Communications

There is a lack of general public awareness of collection, transmission, and treatment of sewerage and drainage. The mindset of the public is that of "out-of-sight, out-of-mind". There is a lack of understanding of how to minimize environmental impacts of personal activities, or appreciation of the need to pay for drainage costs.

4.4.7 Level of Service

The level of storm servicing in existing areas is generally between 1:2 year and 1:5 year design with limited major system flow routes. In contrast, in newly developed area there is a major system flow route for a 1:100 year event. There is a resulting higher risk of flooding in older areas of the City.

4.4.8 Odour Control

There is a growing public concern with regards to the periodic odour problems from areas such as deep sewer tunnels and pump stations. Public perception is that sewer odour is a potential health concern as well as an aesthetic issue. Generally, there is a lack of public understanding of the overall functioning of the sewerage system, the technical difficulties of mitigating odour problems, and the health impacts of odour.

In addition to public concerns, there are currently no regulations regarding air quality from wastewater. Environment Canada may introduce limits on the amount of hydrogen sulfide that can be released into the atmosphere. Currently, the Gold Bar Wastewater Treatment Plant treats air from the areas of high impact on air quality. Environment Canada could introduce legislation that would require 100% air quality control. Continued efforts to control air quality will be sought through new technologies such as biofilters.

The Sanitary Servicing Strategy was developed to finance the high cost of major sanitary trunks.

The Sanitary Servicing Strategy Fund pools the resources of the City's sanitary utility, developers, and builders to finance the construction of major sanitary trunks.

The Sanitary Servicing Strategy Fund is administered by the Management and Operational Committees, comprised of representatives from Drainage Services, Planning and Development, and the Urban Development Institute.

5.0 STRATEGIES

Table 2, (appendices) Issues and Strategies Matrix, shows how each issue will be addressed by one or more strategies as detailed below. Table 3, (appendices) Strategy Progress, provides a snapshot of the development of each strategy.

5.1 Sanitary Servicing Strategy

5.1.1 Description

Approved by Council in July 1998 and with revenue collection starting January 1, 1999, the Sanitary Servicing Strategy provides a framework for planning, financing, and constructing over $430 million in major sanitary sewers in the City over the next 75 years.

As shown in Figure 1 (appendices) there are three major trunk systems:

- North Edmonton Sanitary Trunk
- South Edmonton Sanitary Sewer
- West Edmonton Sanitary Sewer

Revenue for the Sanitary Servicing Strategy Fund is from three sources:

- an annual fixed amount ($2.6 million) from Drainage Services' Sanitary Utility until 2014
- Expansion Assessment from "greenfield" development, paid by the developer at Servicing Agreement stage
- Sanitary Sewer Trunk Charge, paid by the builder at Building Permit application stage

The principle feature of the Sanitary Servicing Strategy is the opportunity for the implementation to be development driven. Large sections of conveyance tunnelling can be constructed and operated on an interim basis as storage facilities until such time as the downstream conveyance piping to the treatment plant is complete. These "interim" storage facilities can

Issues addressed by the Sanitary Servicing Strategy:

- Regional Servicing
- Industrial Land Development
- Cost Minimization

store all flows during wet weather and are pumped into Edmonton's existing sewerage system during dry weather, temporarily utilizing existing infrastructure without overloading it.

The Sanitary Servicing Strategy will provide key financial elements in development of a Regional Master Plan. Both the North Edmonton Sanitary Trunk and South Edmonton Sanitary Sewer are shown to tie into the Alberta Capital Region Wastewater Treatment Plant. In addition, the South Edmonton Sanitary Sewer is planned to accept flows from regional customers to the south of the City. It is expected that with the Regional Master Agreement, the Alberta Capital Region Wastewater Commission will eventually become a partner in the Sanitary Servicing Strategy.

5.1.2 Issues Addressed

The Sanitary Servicing Strategy was developed primarily to address the issue of financing large off-site sanitary sewers required for growth. In addition, the strategy combines with other strategies to address the issues identified below:

- Regional Servicing (issue 2.1)
- Industrial Land Development (issue 2.2)
- Cost Minimization (issue 4.2)
- Environmental Protection (issue 4.3)

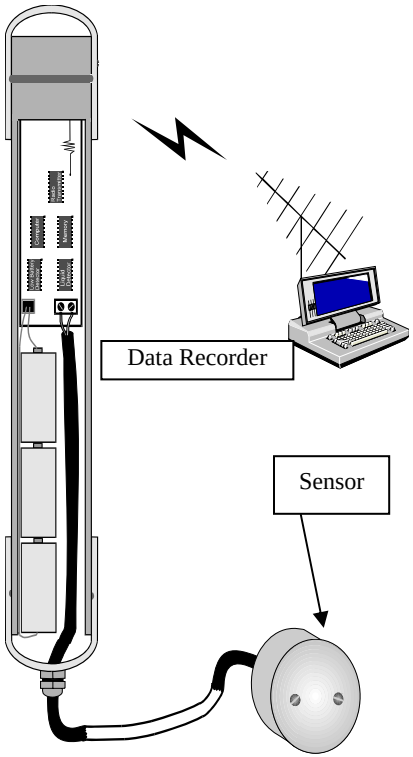
5.2 Combined Sewer Overflow Control Strategy

5.2.1 Description

Approved by Council in March 2000, the purpose of the $150 million Combined Sewer Overflow Control Strategy is to reduce the environmental impacts of the City's combined sewer system. Specifically, the Strategy involves the construction of capital works to reduce the spillage of untreated runoff and sewage to the North Saskatchewan River.

The Combined Sewer Overflow Control Strategy will mitigate the environmental impacts of Edmonton's combined sewer system.

• Project Working Committee Tour of Gold Bar Wastewater Treatment Plant



Issues addressed by the Combined Sewer Overflow Control Strategy:

The components of the Combined Sewer Overflow Control Strategy include:

- **Early Action Control Plan** – This component optimizes the use of the existing sewer system. A main component of the Early Action Control Plan involves the mobilization of in-line system storage through the "Real Time Control" of moveable gates. Other components include: solids and floatables controls, roof leader disconnection work, a wet weather flow management strategy for the treatment plant, monitoring network upgrades, and improved maintenance procedures.
- **Gold Bar Wastewater Treatment Plant Upgrades** – This component involves increasing the plant's capacity to provide high rate treatment for excess flow during wet weather. Specifically, the work will involve the provision of enhanced primary treatment, including disinfection for common wet weather flows and floatables screening for extreme wet weather flows.
- **Tunnel Conveyance Upgrades** – Additional sewer conveyance capacity will allow more flow to reach the plant during wet weather. The work will involve two new sewer tunnels: one connecting the Rat Creek combined sewer overflow site to the South Highlands Sewer, and the other involving a third pipe crossing the river at the Highlands combined sewer overflow site.
- **Modifications to Existing Weirs** – Weirs at four combined sewer overflow sites will be modified to retain more flow in the sewers, reducing the frequency and volume of discharges at those sites.
- **Underground Storage** – A 3000 m^3 off-line storage facility will be constructed at the Strathearn Combined Sewer Overflow site, which will capture combined sewer overflow for later release back into the sewer system and treatment at the plant.
- **Opportunistic Sewer Separation** – This work involves the development of separate sanitary sewers and storm sewers in combined sewer areas on an opportunistic basis. Opportunities arise in neighbourhood renewal programs or other sewer construction projects where

- Total Loadings
- Wet Weather Disinfection
- Sewer Separation
- Enhanced Primary Treatment
- Environmental Protection

stormwater runoff can be redirected away from the combined sewer system into a nearby storm sewer system at an incremental additional cost to the project.

5.2.2 Issues Addressed

The Combined Sewer Overflow Control Strategy was developed to address the concern of bacteria loadings from the sewer system impacting the river during rainfall events. In addition, the strategy combines with other strategies to address the following issues:

- Total Loadings (issue 1.1)
- Wet Weather Disinfection (issue 1.4)
- Sewer Separation (issue 1.5)
- Enhanced Primary Treatment (issue 3.1)
- Environmental Protection (issue 4.3)

5.3 Interconnection Control Strategy

5.3.1. Description

In May 1995, the City of Edmonton's Approval-to-Operate included the following clause:
"The approval holder shall develop: … (b) an Interconnection Identification and Control Strategy to minimize the contamination of stormwater by sanitary sewage and an implementation schedule for elimination of interconnections by June 1, 2000"

In fulfilment of this clause, the Interconnection Control Strategy was submitted to Alberta Environment in March 1998. A key commitment of the Interconnection Control Strategy is perpetual monitoring and assessment for all unmitigated interconnections. This consists of identification, maintenance of data, evaluation, monitoring, correction, elimination, and mitigation.

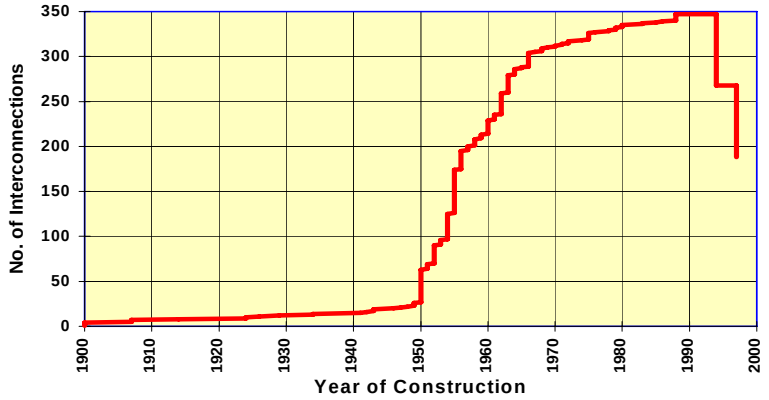
Schematic of monitor device

A key commitment of the Interconnection Control Strategy is

perpetual monitoring and assessment for all unmitigated interconnections.

Issues addressed by the Interconnection Control Strategy:

- Stormwater Quality Enhancement
- Sewer Separation
- Environmental Management
- Environmental Protection



To date, 384 interconnections have been identified and over 200 have now been closed. The remaining open interconnections are being monitored and every year more are closed based on analysis of the monitoring data and system hydraulics. The ultimate goal for the Interconnection Control Strategy is to eliminate, or mitigate, all interconnections in the City of Edmonton.

5.3.2. Issues Addressed

This strategy in conjunction with other strategies helps to address the following issues:

- Stormwater Quality Enhancement (issue 1.2)
- Sewer Separation (issue 1.5)
- Environmental Management (issue 1.6)
- Environmental Protection (issue 4.3)

5.4 Land Drainage Servicing Strategy

5.4.1 Description

The Land Drainage Servicing Strategy will provide a framework to identify works required to solve existing problems in developed areas, works required

The Land Drainage Servicing Strategy will identify works required for both existing and future developed areas, focusing on the industrial lands in the southeast.

A key feature of the Land Drainage Servicing Strategy will be the timing of contributions from both City and private developers.

to provide for the development of new areas; and a financial plan to ensure the required infrastructure can be built in an orderly manner.

Many of the older residential areas of the City were serviced with drainage only for conveyance. Without design consideration for large runoff events, these areas occasionally experience flooding. For some areas, remedial measures have been identified and others require further study. Some undeveloped or partially developed areas have inadequate servicing due to a lack of funding and/or long-term planning. Intensification will raise drainage issues in old combined sewer areas. The industrial lands in the southeast have severe drainage limitations that require work so that development can proceed.

This strategy will identify concept plans for stormwater servicing in existing and new developments. Remedial concepts to bring key existing areas up to acceptable standards will be developed and the costs estimated. Conceptual plans for developing areas will be reviewed, or developed, to ensure development can occur in an orderly fashion.

Special attention will be paid to the industrial areas in the southeast to develop effective plans. This area has restrictions to development that must be addressed if flooding and erosion problems are to be solved. Focus will also be directed to deal with developers concerns of the perceived high costs of storm sewer servicing.

A major component of the strategy will be to develop an effective financial plan that will address the timing of contributions for both the City and private developers. New development in the City is expected to pay its own way. This is largely accomplished through restricting flow rates in these areas and having large properties construct stormwater management facilities.

There are existing stormwater concerns in many developed residential areas of the City as well as in partially developed industrial areas. A plan to finance improvements is required.

Issues addressed are:

- Stormwater Quality Enhancement
- Industrial Land Development
- Land Development Requirements
- Retention of Wetlands
- Land Drainage Financing
- Cost Minimization
- Infrastructure Maintenance and Rehabilitation
- Level of Service

The Stormwater Quality Strategy will include Best Management Practices and wetlands or wet ponds at end-of-pipe.

Issues addressed by the Stormwater Quality Strategy:

- Total Loadings
- Stormwater Quality Enhancement
- New Water Quality Parameters
- Land Development Requirements
- Retention of Wetlands
- Environmental Protection

5.4.2 Issues Addressed

This strategy in conjunction with other strategies helps to address the following issues:

- Stormwater Quality Enhancement (issue 1.2)
- Industrial Land Development (issue 2.2)
- Land Development Requirements (issue 2.3)
- Wetlands Retention (issue 2.4)
- Land Drainage Financing (issue 4.1)
- Cost Minimization (issue 4.2)
- Infrastructure Maintenance and Rehabilitation (issue 4.3)
- Level of Service (issue 4.7)

5.5 Stormwater Quality Strategy

5.5.1 Description

The development of a Stormwater Quality Strategy will mitigate the water quality impacts of the third major source of contaminates (after treated effluent and combined sewer overflow) to the North Saskatchewan River. The strategy will include measures on how to improve the quality of stormwater runoff from new developments and also from older, existing developments.

The City has four major storm basins that contribute about 80 per cent of the total annual runoff: Kennedale, 30th Avenue, Quesnell, and Groat Road. Addressing the water quality from these systems will provide a significant step towards controlling stormwater discharges from the City of Edmonton. Methods that have been tried to date include baseflow diversion and oil/water separator.

For newer developments, Best Management Practices can be used for source controls and also wetlands or wet ponds at end-of-pipe. For the older, existing areas, imaginative solutions are needed. At least 70 per cent of City lands are not serviced through lakes, but instead discharge directly to the North Saskatchewan River.

5.5.2 Issues Addressed

This strategy, in conjunction with others will help to address the following issues:

- Total Loadings (issue 1.1)
- Stormwater Quality Enhancement (issue 1.2)
- New Water Quality Parameters (issue 1.3)
- Land Development Requirements (issue 2.3)
- Retention of Wetlands (issue 2.4)
- Environmental Protection (issue 4.3)

5.6 Transmission System Upgrading Strategy

5.6.1 Description

The Upgrading Strategy is aimed at improving the sewer capacities of trunk and transmission lines in order to:

- reduce basement flooding
- reduce street flooding
- remove system constrictions

Drainage Services, in cooperation with stakeholders, will develop a long-range upgrading plan that links to the Rehabilitation Strategy (5.7)

The purpose of this Strategy is to upgrade the capacities of the existing sanitary, combined and storm transmission/trunk sewer systems to provide an acceptable level of service for drainage system customers. Additional trunk sewer capacity is needed in some locations to: reduce basement flooding, reduce street flooding, convey flows from new developments or higher density redevelopments, convey wet weather flows to storage facilities, and remove system constrictions.

Strategy development is scheduled for the years 2003 through 2004. All trunk sewers will be assessed to determine their upgrading needs, including: all sanitary sewers 375 mm in diameter and greater, all combined sewers 1200 mm and greater, and all storm sewers 1200 mm and greater. Interceptor sewer capacities will also be assessed. One major technical factor in developing this strategy will be in the hydrologic/hydraulic analysis. New ways will be explored to develop design storm characteristics suitable for trunk system analysis.

System performance for both current and future conditions will be assessed. Trunk sewer upgrading criteria will be developed and used to assess upgrading alternatives. A long-range upgrading plan will be developed,

including an implementation schedule and financing plan, in consultation with interested stakeholders. Linkage will be required between plans developed for upgrading needs and rehabilitation requirements defined in the Infrastructure Rehabilitation Strategy (5.6).

5.6.2 Issues Addressed

This strategy in conjunction with others, will help to address the following issues:

- Land Use Intensification (issue 2.5)
- Level of Service (issue 4.7)

5.7 Infrastructure Rehabilitation Strategy

5.7.1 Description

The Rehabilitation Strategy is required to develop structure and focus to a priority plan for the rehabilitation and replacement of aging sewers.

According to the Office of the Infrastructure, in 2002 the City's infrastructure as a whole, was reported to be close to half of its expected life. The total value of the City's infrastructures estimated at $18 billion, of which Drainage Services comprises 45%, or $8.1 billion.

In 2002 the average age of the sanitary system was 28 years, the storm system 29 years, and the combined system 54 years. The life expectancy used for sewer pipe replacement is 75 years. As the sewer systems age, rehabilitation and replacement of these sewers is becoming an increasing concern. The percentage of sewer pipe rated in poor or critical condition is 6% for the sanitary system, 2% for the storm system, and 15% for the combined system.

The City requires tools and direction for inspection of sewers, developing priorities for replacement and rehabilitation, and forecasting future expenditures for this purpose. The goals of this Strategy are to produce an organized and knowledge-based approach to the rehabilitation and replacement of sewers.

Strategy components will include:

- Closed circuit television inspections
- Evaluation of PRISM model
- Review of data collection and storage information
- Evaluation of financial models
- Development of neighbourhood priority plan.

In the past, a number of initiatives have taken place to predict sewer rehabilitation and replacement needs for City sewers. This strategy is an extension of these efforts and will build on these past initiatives. The strategy will also combine and integrate these initiatives in order to provide structure and focus in meeting sewer rehabilitation and replacement needs.

This strategy has a number of existing components, with more to be developed as a result of recommendations from the Sewer Rehabilitation Priorities Plan. The components are as follows:

- conduct closed circuit television inspection for pipe classes that have limited data for the PRISM model (a model to predict the condition of sewer pipers based its history and environmental conditions) and incorporate into an updated PRISM model
- evaluate the PRISM model and provide cost-benefit analysis to determine the merits of including additional parameters
- review data collection/storage of inspection/rehabilitation information and provide recommendations for improvements
- evaluate and recommend financial forecast models
- develop a priority neighbourhood renewal program based on neighbourhood boundaries
- incorporate rehabilitation funding requirements into establishing the Capital Priorities Plan

Linkage will be required between plans developed for rehabilitation needs and upgrading requirements defined in the Transmission System Upgrading Strategy (5.5).

5.7.2 Issues Addressed

This strategy will address the following issues:

- Information Management (issue 3.3)
- Infrastructure Maintenance (issue 4.4)

The Wastewater Treatment Master Plan provides the existing process capacities, projected flows, and an overview of the upgrades, modifications, and expansion that may be required during the next 20 years.

Gold Bar Wastewater Treatment Plant

5.8 Wastewater Treatment Master Plan

5.8.1 Description

The Wastewater Treatment Master Plan serves as a planning document for the Gold Bar Wastewater Treatment Plant for the next 20 years. It provides the existing process capacities, projected flows, and also provides an overview of the upgrades, modifications, and expansion that may be required during this period. The Plan identifies the needs and justification for these projects as related to several factors that include increased flows, age and integrity of equipment and structure, out-dated technologies and development of new state-of the-art technologies, optimization of process units, and changes in regulatory standards.

During the next 10-year period, from 2001 to 2011, the average dry weather flow is estimated to increase from 290 ML/d to 327 ML/d, and could exceed the present plant capacity of 310 ML/d in 2006. Additional tertiary treatment capacity would be required by that time. With the City's plan to treat combined sewer overflows at the Gold Bar Wastewater Treatment Plant, new facilities for treating this additional flow will also be constructed during the next 10-year period. Present plans are to treat Combined Sewer Overflows that exceed the present capacity of the Gold Bar Wastewater Treatment Plant using enhanced primary treatment and ultraviolet light technologies.

The development of a Recycled Water Distribution Network is a further initiative to improve water quality in the North Saskatchewan River. Drainage Services anticipates that industrial and irrigation usage will drive the expansion of this distribution network. The petrochemical industry has already expressed interest in using the effluent as a major water supply for their processes. Community Services Department and the Waste Management Branch have expressed an interest in using recycled water as well.

5.8.2 Issues Addressed

The Wastewater Treatment Master Plan will put into effect strategies and works that will address the following issues:

- Total Loadings (issue 1.1)
- New Water Quality Parameters (issue 1.3)
- Wet Weather Disinfection (issue 1.4)
- Odour Control (issue 1.8)
- Enhanced Primary Treatment (issue 3.1)
- Membrane Filtration Technologies (issue 3.2)
- Information Management (issue 3.3)
- Environmental Protection (issue 4.3)

5.9 Environmental Management System

5.9.1 Description

The purpose of an Environmental Management System is to provide a formal set of procedures and policies that defines how an organization will manage its environmental affairs. An Environmental Management System represents a commitment and a verifiable process to improve an organization's management of environmental issues and ensures continuous improvement in its management of impacts on the environment.

The model chosen by Drainage Services is the International Organization for Standardization, series 14001. This is an internationally recognized Environmental Management System model and is quickly becoming the industry standard. The ISO 14001 Environmental Management System model requires an organization to develop an environmental policy, set a procedure for identifying environmental aspects and relevant performance criteria, set objectives and targets consistent with its environmental policy, formulate management programs, as well as mechanisms for implementation and operation, and perform regular system reviews.

Benefits of an Environmental Management System can include:

- improved environmental performance
- improved compliance leading to reduced liability
- efficient allocation of resources
- reduced costs and increased competitive advantage
- improved public image and trust.

Benefits of an Environmental Management System can include:

- improved environmental performance
- improved compliance leading to reduced liability
- efficient allocation of resources
- reduced costs and increased competitive advantage
- improved public image and trust

5.9.2 Issues Addressed

Implementing an Environmental Management System will put into effect the process to address the following issues:

- Environmental Management (issue 1.6)
- Regional Regulations (issue 1.7)
- Environmental Protection (issues 4.3)

5.10 Regional Wastewater Servicing Strategy

5.10.1 Description

Alberta Capital Region Wastewater Treatment Plant

A Regional Master Agreement will create an efficient, cost-effective, and equitable wastewater treatment, transmission, and sludge disposal system for the Edmonton Region.

The Regional Servicing Strategy will address important short-term (5 years) and long-term (50 years) technical and financial issues regarding regional transmission and treatment. This strategy will consist of negotiation of a Regional Master Agreement between the City and the Alberta Capital Region Wastewater Commission.

From January 2000 to October 2002 the City and the Alberta Capital Region Wastewater Commission held a series of workshops to discuss Regional servicing issues and determine strategies to resolve them. In that time, a Regional Servicing Co-ordinating Committee was formed consisting of elected representatives and administration from both parties. The Co-ordinating Committee concluded that in order to apply a technical and financial basis to the Master Agreement negotiations, a Regional Wastewater Servicing Planning Study is required.

Through a series of workshops and technical analysis, the Regional Wastewater Servicing Planning Study will develop technical and financial solutions that integrate short and long term planning of the two systems and provide a financial model that is equitable to all stakeholders. When complete, the study will form the basis for negotiation of a Regional Master Agreement. This Master Agreement will supersede all of the existing agreements and provide for the long-term financial and technical integration of the treatment and transmission of wastewater flows in the Edmonton Region.

Major agreements between the Region and the City include the Swap Agreement and the South East Regional Trunk Sewer Agreement.

The existing agreements consist of two major agreements, the "Swap" Agreement and the South East Regional Sewer Trunk Agreement, and five minor agreements. The Swap Agreement runs to 2015 and governs the exchange of treatment of wastewater flows between the Alberta Capital Region Wastewater Commission and the City. The South East Regional Sewer Trunk Agreement, on one-year extensions, allows the City to direct a set maximum wastewater flow to the Alberta Capital Region Wastewater Commission owned South East Regional Sewer Trunk.

5.10.2 Issues Addressed

The Regional Servicing Strategy will help to address the following issues:

- Environmental Management (issue 1.6)
- Regional Regulations (issue 1.7)
- Regional Servicing (issue 2.1)

5.11 Depreciation Strategy

5.11.1 Description

The Depreciation Strategy has been developed to define an appropriate rate base for the Sanitary Utility and Land Drainage Utility and to address asset value and costing information for Drainage Services, as a whole. This information will be used in Cost of Service Studies and to address rehabilitation priorities, demonstrating asset stewardship.

The Depreciation Strategy will:

- define a rate base for the Sanitary Utility
- address asset value
- supplement cost of service study
- address rehabilitation priorities

A key component and first priority of the strategy is to develop an asset accounting system.

Drainage Services currently has all asset historical costs in broad asset accounts. However, asset retirements are not recorded. This makes it difficult to determine the historical cost, depreciation, and retirement information of the assets.

The Depreciation Strategy consists of the following components:

- Capital asset accounting system
- Embedded plant conversion
- Depreciation study
- Decommissioning study
- Valuation study

The development of the Capital Asset Accounting System is the first priority and is necessary to move forward on asset tracking. Embedded plant conversion will require the development of unit rates to value and develop historical costs of embedded assets. The benefits of the Depreciation Strategy are:

- determination of a rate base
- asset information for cost of service studies
- Adherence to Public Service Accounting Board requirements (current and future)
- asset information for the Office of Infrastructure
- asset information for rehabilitation initiatives
- comparability to private utilities.

The Depreciation Strategy was initiated in 2000 and is scheduled for completion in 2005. The main focus of the Strategy is the Asset Accounting System, which is required before the other components can be implemented.

5.11.2 Issues Addressed

The Depreciation Strategy is required to address the setting of rates, and establish the long-term financial requirements of the Drainage Utilities in order to remain viable. This is addressed in Section 6.1 – Financing Plan. In

addition, the Depreciation Strategy will help to address the following issues:

- Information Management (issue 3.3)
- Land Drainage Financing (issue 4.1)
- Cost Minimization (issue 4.2)
- Infrastructure Maintenance and Rehabilitation (issue 4.4)

5.12 Drainage Information Management Systems Strategy

A Drainage Information Management Systems Strategy needs to be developed for all drainage database systems.

5.12.1 Description

The Drainage Inventory System (DRAINS) is a repository of all information describing the drainage collection systems. Linkages between this system and the City's graphics system (microstation) have been established. With future linkages planned to Geographic Information Systems (SLIM), Main-Link (operational maintenance management system) and SCADA (Supervisory Control and Data Acquisition) systems, a repository is being created for all spatial and temporal information describing Drainage Services.

Future steps are required to establish a data warehouse of all operational information describing the performance of drainage facilities. This should include consolidation of all SCADA information into a central repository, and the eventual linkage with water quality information in the Laboratory Information Management System (LIMS) database.

In order to proceed with this, a drainage information management systems strategy needs to be developed for all drainage database systems.

5.12.2 Issues addressed:

An information management system plan will address the following issues:

- Environmental Management (issue 1.6)
- Information Data Management (issue 3.3)
- Infrastructure Maintenance and Rehabilitation (issue 4.4)

Odour control facility

The Odour Control Strategy will consist of six (6) interrelated components:

- monitor
- analyze
- prioritize
- mitigate
- expert review
- communication

5.13 Odour Control Strategy

5.13.1 Description

An odour control strategy is required to mitigate the release of malodourous gases from the City of Edmonton sewerage system and to obtain public acceptance to odour control measures.

The strategy will consist of six (6) interrelated components:

Monitor – The monitoring component will be a long-term, city-wide program that collects all data required to understand the dynamics of air movement from the sewer system, as well as the release of gases.

Analyze – The collected data will be analyzed to identify causes and impacts of sewer odour releases, including the determination of commonality, the identification of hot spots for odour releases and site specific causes, the assessment of toxicological concerns, and a literature review on known/suspected health effects of sewer gas.

Prioritize – The city-wide hot spots for odour control and the locations of highest concentration of issues will be prioritized in terms of mitigation strategies. Conceptual level mitigation strategies will include budget implications for the Capital Priorities Plan and 20-year financial plan.

Mitigate – At each hot spot mitigate the sewer odour issue, including the identification of local odour, a search of mitigation approaches, determination of mitigation measures with the local community, screening based on economics, technical viability and community acceptance, and finally the design and construction of mitigation measures.

Expert Review – An external expert review panel will be established to provide guidance and credibility to the Odour Control Strategy.

Communication – Throughout the Odour Control Strategy, public communication will be essential to obtain buy-in to the ultimate solution, including communication packages to educate the public on the sewerage

system, odour, health effects and mitigation measures, and the formation of local community liaison groups to deal with site specific mitigation issues.

5.13.2 Issues Addressed

The Odour Control Strategy, in conjunction with the Wastewater Treatment Master Plan, will address Odour Control (issue 4.4.8)

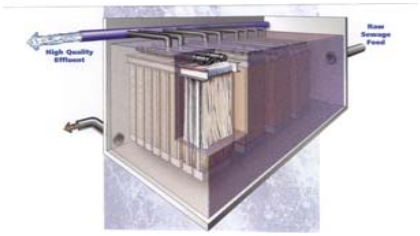
6.0 STRATEGY INTEGRATION AND IMPLEMENTATION

6.1 Financial Plan

Issues identified in the Master Drainage Plan could have an impact on utility rates.

Table 4 (appendices) outlines Drainage Services 10-year capital and operating budget. The assumption for revenue increases is at the inflation rate only for both the Land Drainage and Sanitary utility. The present estimate for inflation varies between 2.0 per cent and 2.5 per cent per year.

The issues identified in this Drainage Master Plan could have an impact on the 10-year budget. Drainage Services presently plans to keep Sanitary utility rate increases at or below inflation. The Land Drainage utility, however, may require rate increases above inflation to account for an estimated $80 million funding gap over the next 10 years. In addition, some of the issues identified could create funding gaps if, for example, new regulations are introduced by Alberta Environment or Environment Canada that substantially change the current operating practices of Drainage Services.



Membrane Filtration

The Sanitary Utility is currently reviewing its financial position, its capital and operating requirements, and the impact of these requirements on both the utility and the rate impact on customers. Once this review is complete, the goal is to develop a dividend and borrowing policy for City Council's review and approval.

The implementation of the Land Drainage Utility on January 1, 2003 will allow Drainage Services to make a significant contribution towards addressing the gap that currently exists for the stormwater system.

Issues that could create funding shortfalls include:

- Total Loadings
- Membrane Filtration
- Industrial Land Development

Communications strategies and action plans will be developed as required to support the execution of the operational strategies identified in this plan.

Communications planning links to business planning to ensure business strategies, goals and objectives drive all communications strategies and tactics.

Issues that could potentially create funding shortfalls for Drainage Services include:

Total Loadings – The cost of addressing the issue of total loadings is unknown at this point as Alberta Environment has not established the criteria for measurement.

Membrane Filtration – This is a new technology that has not yet been tested by Drainage Services.

Industrial Land Development – A strategy for funding major stormwater management works in industrial areas is not complete and total costs are still unknown.

6.2 Communications Planning

Communications planning is essential for maximizing the success of the Drainage Master Plan. As such, communications strategies and action plans will be developed as required to support the execution of the operational strategies identified in this plan.

Communications planning will also seek, where appropriate, opportunities to consolidate communications activities that support the identified strategies to ensure consistent messaging and greater impact.

The following criteria is used to prioritize identified strategies requiring communications support:

- Does the strategy have an environmental, regulatory, health, and/or safety implication?
- Does the strategy affect citizen support and buy-in?
- Does the strategy require stakeholder acceptance and validation?
- Does the strategy present an opportunity for public education?
- Does the strategy garner media interest and scrutiny?
- Does the strategy require political support and approval?

Strategic communications planning links to business planning to ensure business strategies, goals, and objectives drive all communications strategies and tactics.

Well–defined communications also outlines programs to inform, create awareness, seek understanding, solicit input, and educate customers, stakeholders and various other public about Drainage Services' short and long term maintenance, upgrading, and development servicing requirements.

Such an approach ultimately builds support and buy-in for Drainage Services' overall mandate – which is "to be recognized as a leader in environmental management and in the utilization of best practices for drainage service delivery."

6.3 Business Plans

Drainage Services prepares an annual business plan as a precursor to the Capital Priorities Plan development. This update is based on the Asset Management and Public Works Department's annual business plan, and allows for integration into the City's corporate direction and plan. To support this process, Drainage Services has a more comprehensive 3-year business plan. The latest Drainage Services comprehensive business plan is the 2000 to 2002 document, completed in 1999.

This Drainage Master Plan will be implemented through the development of Drainage Services' 3-year business plans. The next scheduled update will be completed in 2003 and will set the direction for 2004 to 2006.

6.4 Drainage Master Plan Update

The original Drainage Master Plan was developed in the years 1988 to 1990 and approved by Council in January 1991. The updated 2004 Drainage Master Plan was developed from 2001 to early 2003, and sets the direction of Drainage Services for the next 10 years. Due to the time and effort spent on development of this plan, the end product is a good comprehensive look into

the future direction of Drainage Services. This document should not require a major substantial review prior to the 10-year span unless a large number of new issues are brought forth that were not identified in the 2004 document.

APPENDICES

TABLE 1

DRAINAGE MASTER PLAN ISSUES

Regulatory	Growth	Technology	Customer
Total Loadings	Regional Servicing	Enhanced Primary Treatment	Land Drainage Funding
Stormwater Quality Enhancement	Industrial Land Development	Membrane Filtration Technologies	Cost Minimization
New Water Quality Parameters	Land Development Requirements	Information Management	Environmental Protection
Wet Weather Disinfection	Retention of Wetlands		Infrastructure Maintenance & Rehabilitation
Sewer Separation	Land Use Intensification		Right-of-Way Management
Environmental Management			Communications
Regional Regulations			Level of Service
			Odour Control

TABLE 2

DRAINAGE MASTER PLAN ISSUES AND STRATEGIES MATRIX

Issues \ Strategies		Sanitary Servicing Strategy	C.S.O. Control Strategy	Inter-connection Control Strategy	Land Drainage Servicing Strategy	Stormwater Quality Strategy	Transmission Upgrading Strategy	Infrastructure Rehabilitation Strategy	Wastewater Treatment Master Plan	Environmental Management System	Regional Wastewater Servicing Strategy	Depreciation Strategy	Information Systems Management Plan	Odour Control Strategy
1.1	Total Loadings		✔			✔			✔					
1.2	Stormwater Quality Enhancement			✔	✔	✔								
1.3	New Water Quality Parameters					✔			✔					
1.4	Wet Weather Disinfection		✔						✔					
1.5	Sewer Separation		✔	✔										
1.6	Environmental Management			✔						✔	✔		✔	
1.7	Regional Regulations									✔	✔			
2.1	Regional Servicing	✔									✔			
2.2	Industrial Land Development	✔			✔									
2.3	Land Development Requirements				✔	✔								
2.4	Wetland Retention				✔	✔								
2.5	Land Use Intensification						✔							
3.1	Enhanced Primary Treatment		✔						✔					
3.2	Membranes								✔					
3.3	Information Data Management							✔	✔			✔	✔	
4.1	Land Drainage Financing				✔							✔		
4.2	Cost Minimization	✔			✔							✔		
4.3	Environmental Protection	✔	✔	✔		✔			✔	✔				
4.4	Infrastructure Maintenance & Rehabilitation				✔			✔				✔	✔	
4.5	Right-of-way Management													
4.6	Communication													
4.7	Level of Service				✔		✔							
4.8	Odour Control								✔					✔

TABLE 3

STRATEGY PROGRESS

Strategies	**Data Collection**	**Systems Analysis**	**Strategy Development**	**Implementation Underway**	**Strategy Complete**	*Comments*
Sanitary Servicing Strategy	———	———	———	- - - -	2050	Strategy implemented January 1999. $450 million over 50 years
Combined Sewer Overflow Control Strategy	———	———	———	- - - -	2016	Strategy implemented March 2000. $150 million over 16 years
Interconnection Control Strategy	———	———	———	- - - -	2016	Alberta Environment approval June 2000
Land Drainage Servicing Strategy	———	———	———	- - - -		Project Charter 2003
Stormwater Quality Strategy	———					Commenced 1999 with monitoring. $700,000 per year investment
Transmission Upgrading Strategy	———				2012	Strategy document by end of 2003
Infrastructure Rehabilitation Strategy	———					DRAINS database and PRISM model
Wastewater Treatment Master Plan	———	———	———	- - - -	2022	Document completed in 2002. Implementation has commenced.
Environmental Management System	———	———	———			ISO 14001 commenced 2002 with 2004 startup
Regional Wastewater Servicing Strategy	———	———	———			Swap Agreement only to 2015, negotiating Master Agreement
Depreciation Strategy	———			- - - -	Continuous	
Information Systems Management Plan	———					
Odour Control Strategy	- - -	- - -	———	- - - -		

Note: ——— Completed - - - - Underway

TABLE 4

DRAINAGE SERVICES BUDGET PLAN
($000)

COMBINED UTILITIES							
	2003	**2004**	**2005**	**2006**	**2007**	**2008-2012**	**Total**
Operating Expenses	72,884	73,803	76,439	81,265	86,231	509,503	900,124
Capital Program:							
Funded	46,108	71,392	71,401	50,348	62,325	267,030	568,604
Unfunded	659	3,335	4,138	8,839	11,952	55,958	84,881
TOTAL CAPITAL	46,767	74,727	75,539	59,187	74,277	322,988	653,485
SANITARY UTILITY							
	2003	**2004**	**2005**	**2006**	**2007**	**2008-2012**	**Total**
Operating Expenses	63,669	65,270	67,173	71,295	75,653	444,149	787,209
Capital Program:							
Funded	32,631	59,831	59,522	40,886	51,305	220,612	464,787
Unfunded	123	101	904	904	889	8,105	11,026
TOTAL CAPITAL	**32,754**	**59,932**	**60,426**	**41,790**	**52,194**	**228,717**	**475,813**
LAND DRAINAGE UTILITY							
	2003	**2004**	**2005**	**2006**	**2007**	**2008-2012**	**Total**
Operating Expenses	9,215	8,533	9,266	9,970	10,578	65,354	112,916
Capital Program:							
Funded	13,477	11,561	11,879	9,462	11,020	46,418	103,817
Unfunded	536	3,234	3,234	7,935	11,063	47,853	73,855
TOTAL CAPITAL	**14,013**	**14,795**	**15,113**	**17,397**	**22,083**	**94,271**	**177,672**

TABLE 5

SUMMARY OF SEWER STATISTICS

	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
SEWER MAIN LENGTHS (KM)										
Storm	1,965	1,942	1,915	1,891	1,867	1,850	1,837	1,827	1,824	1,807
Sanitary	1,793	1,774	1,741	1,716	1,691	1,674	1,657	1,642	1,638	1,619
Combined	936	936	935	935	934	934	933	933	933	934
Foundation Drain	8	7	4	2						
TOTAL	**4,702**	**4,659**	**4,595**	**4,544**	**4,492**	**4,459**	**4,427**	**4,402**	**4,395**	**4,360**
Catchbasin Lead Lengths	783	778	772	768	762	757	750	747	742	736
STRUCTURES (N0.)										
Manholes	58,814	58,330	57,632	56,947	56,097	55,662	55,210	54,916	54,773	54,214
Catchbasin Manholes	8,394	8,223	8,157	8,067	8,8045	8,042	7,996	7,961	7,631	7,546
Catchbasins	47,433	46,954	46,522	45,920	45,527	45,185	44,803	44,508	44,278	43,910
Pumpwells	66	65	65	63	61	61	65	67	64	64
Wet Stormwater Management Facilities	48	44	42	23	29	29	29	24	24	24
Dry Stormwater Management Facilities	53	51	47	54	40	34	28	30	29	29
Peak Storage Tanks	32	32	32	32	32	32	32	31	22	21

SANITARY SERVICING STRATEGY

LEGEND

- S.E.S.S. CONTRIBUTING AREA
- N.E.S.T. CONTRIBUTING AREA
- W.E.S.S. CONTRIBUTING AREA
- T.U.F.S. CONTRIBUTING AREA
- R.D.A. RESTRICTED DEVELOPMENT AREA

FUTURE TRUNK SEWERS 1050mm AND LARGER

- EXISTING TRUNK
- PROPOSED TRUNK OR FORCEMAIN
- S — STORAGE TANK

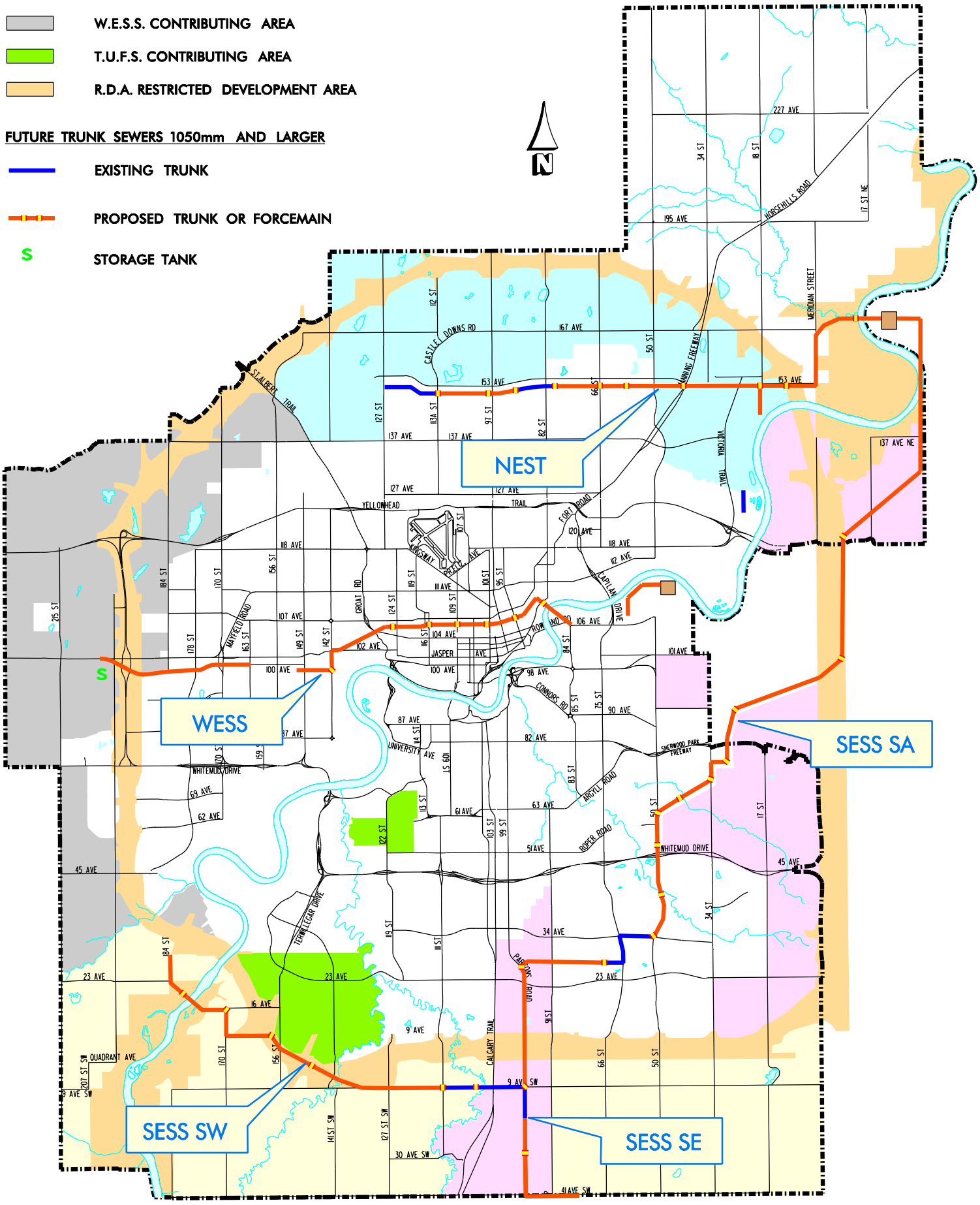


FIGURE 1