

**Calgary**



UCS2016-0167  
ATTACHMENT 2

# WATERSHED MANAGEMENT PLANNING



**2015 UPDATE REPORT**



## Table of Contents

<b>1. INTRODUCTION .....</b>	<b>4</b>
<b>Figure 1.0 – Integrated Watershed Management Goals.....</b>	<b>4</b>
<b>2. STRATEGY FRAMEWORK .....</b>	<b>5</b>
<b>Figure 2.0 – Strategy Framework .....</b>	<b>5</b>
<b>3. PROGRAM DEVELOPMENT AND IMPLEMENTATION.....</b>	<b>6</b>
<b>3.1 CREATE CUSTOMER AND CITIZEN PROGRAMS .....</b>	<b>6</b>
<b>3.2 ALIGN POLICY AND REGULATION .....</b>	<b>6</b>
<b>Figure 3.1 – Yardsmart signage .....</b>	<b>6</b>
<b>Figure 3.0 – Engagement for community rain garden Installation .....</b>	<b>6</b>
<b>3.3 OPTIMIZE OPERATIONS AND MAINTENANCE OF EXISTING INFRASTRUCTURE .....</b>	<b>7</b>
<b>3.4 INVEST IN NEW INFRASTRUCTURE .....</b>	<b>7</b>
<b>3.5 IMPLEMENT PRICING/FINANCIAL TOOLS .....</b>	<b>7</b>
<b>Figure 3.2 – Bioengineering Site Upstream of Glenmore Trail on Bow River .....</b>	<b>7</b>
<b>Figure 3.3 – Water Centre Soil Cell Installation.....</b>	<b>7</b>
<b>4. WATERSHED MANAGEMENT PLANNING UPDATE .....</b>	<b>8</b>
<b>4.1 GOAL #1: PROTECT OUR WATER SUPPLY .....</b>	<b>8</b>
<b>Table 4.1 – Goal #1, Protect Our Water Supply Activity Status Summary .....</b>	<b>9</b>
<b>4.2 GOAL #2: USE WATER WISELY .....</b>	<b>10</b>
<b>Figure 4.0 – River Water Withdrawal (ML).....</b>	<b>10</b>
<b>Figure 4.1 – Calgary Water use – Litres Per Capita Per Day .....</b>	<b>11</b>
<b>Figure 4.2 – Peak Day Demand (ML).....</b>	<b>11</b>
<b>Table 4.2 – Goal #2, Use Water Wisely Activity Status Summary .....</b>	<b>12</b>
<b>4.3 GOAL #3: KEEP OUR RIVERS CLEAN .....</b>	<b>12</b>
<b>4.3.1 STORMWATER STRATEGY.....</b>	<b>12</b>
<b>Figure 4.3 – Total Suspended Solids to the River (kg/day) .....</b>	<b>13</b>
<b>Figure 4.4 – Rendering of Bowmont West Stormwater Quality Retrofit Project.....</b>	<b>13</b>
<b>4.3.2 WASTEWATER STRATEGY .....</b>	<b>14</b>
<b>Table 4.3 – Goal #3, Keep our Rivers Clean Activity Status Summary .....</b>	<b>15</b>
<b>Figure 4.5 – Bonnybrook Wastewater Treatment Plant Capacity Upgrades .....</b>	<b>15</b>
<b>4.4 GOAL #4: BUILD RESILIENCY TO FLOODING.....</b>	<b>16</b>
<b>4.4.1 RIVER FLOODING .....</b>	<b>16</b>
<b>4.4.2 STORMWATER FLOODING .....</b>	<b>17</b>
<b>Table 4.4 – Goal #4, Build Resiliency to Flooding Status Summary .....</b>	<b>17</b>
<b>5. ENSURING THE QUALITY OF OUR WATER .....</b>	<b>17</b>
<b>Figure 4.6 – Rosemont Community Drainage Improvement Project.....</b>	<b>17</b>
<b>Table 5.0 – Key Drinking Water Quality Parameters 2015.....</b>	<b>18</b>



**6. RISK ASSESSMENT.....19**

**7. RECOMMENDATIONS/NEXT STEPS.....20**

## 1. INTRODUCTION

From the river to the tap – and back again, The City is dedicated to protecting and managing precious water resources. The City demonstrates leadership of this holistic approach by considering the watershed in its entirety in order to protect our water supply, use water wisely, keep our rivers clean, build resiliency to flooding and be good neighbours through our work with regional partners.

Watershed protection in Calgary aligns to the provincial Water for Life strategy and supports regional Watershed Management Plans (Bow Basin, Elbow River and Nose Creek). Water quality protection is guided by The City’s Approval to Operate, granted by Alberta Environment and Parks. The Approval outlines sediment management and pollutant loading objectives for the Bow River through the Total Loading Management Plan. As well, given challenges such as a finite water supply, a growing population in the city and the region, and impacts of climate change, The City is managing Calgary’s water use to ensure a reliable and sustainable water supply in the future.

High quality water, wastewater and drainage service is important to all of us, and so is the cost. The City of Calgary understands that our customers expect value for their money, and we work hard to deliver high quality water, wastewater and drainage services.



**Figure 1.0 – Integrated Watershed Management Goals**

We take an integrated watershed management approach to protecting public health, conserving our water resources, and supporting the needs of a growing city. This approach considers the whole system to enable opportunities and challenges to be addressed in an innovative, coordinated and efficient way.

Our approach aims to achieve the following goals:

1. *Protect our water supply* by reducing upstream risks to our water source;
2. *Use water wisely* through responsible and efficient use;
3. *Keep our rivers clean* by reducing Calgary’s impacts on the rivers; and
4. *Build resiliency to flooding.*

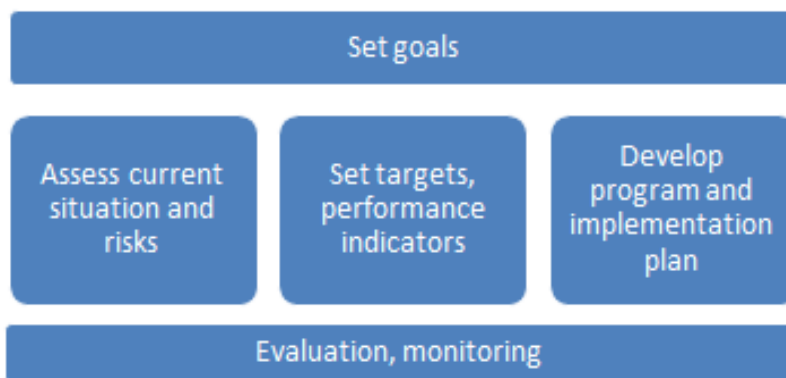
The City aligns with and actively participates with regional partners to collaborate to manage water for all users. And, The City is involved in a number of watershed stewardship groups in the region including the Bow River Basin Council, Elbow River Watershed Partnership and Nose Creek Watershed Partnership.

Calgary is achieving its established Utility targets relating to river water withdrawal, per capita water consumption, and total suspended solid loading to the river.

## 2. STRATEGY FRAMEWORK

A framework is used to effectively allocate resources and implement programs that support watershed goals. The framework:

- Sets overarching goals
- Assesses the current situation and risks
- Sets targets, key performance indicators and defines reporting mechanisms,
- Develops a program and implementation plan, and
- Uses adaptive management to continually evaluate progress, risk, and program effectiveness.



**Figure 2.0 – Strategy Framework**

Moving forward, the Utilities will continue to refine watershed management strategies by reviewing or setting overarching goals, assessing current and future risks, setting targets and developing program and implementation plans in each of the goal areas.

### 3. PROGRAM DEVELOPMENT AND IMPLEMENTATION

The Utilities consider several approaches for developing a comprehensive set of programs to deliver on goals. The programs and examples of how they have been used are elaborated on further below.

#### 3.1 CREATE CUSTOMER AND CITIZEN PROGRAMS

The Utilities engage with customers and stakeholders in timely dialogue to improve decision making, to demonstrate value and to align with citizen and customer expectations. We support customers with engagement and programs to provide technical assistance or reduce barriers to encourage the adoption of behaviours or actions to benefit the watershed. Examples include hotel and motel toilet rebates, the Yardsmart citizen program to encourage citizens to adopt water wise gardening practices and public outreach and engagement activities to support installation of rain gardens in communities.



**Figure 3.0 – Engagement for community rain garden Installation**



**Figure 3.1 – Yardsmart signage**

#### 3.2 ALIGN POLICY AND REGULATION

Policy and regulation can be a powerful way to influence behaviours and technology choices. The City leverages close working relationships with internal and external stakeholders to influence regulatory direction to ensure the local context is considered. When policies fall within The City’s jurisdiction, we can enact bylaws to support watershed management. Examples include the low water use fixture bylaw to promote higher levels of water efficiency and the drainage bylaw to promote good drainage development practices.

### 3.3 OPTIMIZE OPERATIONS AND MAINTENANCE OF EXISTING INFRASTRUCTURE

Investments in capital maintenance are necessary to keep existing infrastructure operating to meet its intended purpose. Customers benefit from these investments through reliable and trusted service, lower utility rates, less property damage, and protection of public health and environment. The Utilities lead by example to look within our own system wide operations and processes to ensure efficiency and effectiveness. Examples include: stormpond maintenance and asset management planning; watermain replacement; leak detection for water operations and riverbank restoration



**Figure 3.2 – Bioengineering Site Upstream of Glenmore Trail on Bow**

### 3.4 INVEST IN NEW INFRASTRUCTURE

Capital investments are necessary to ensure service levels are maintained or improved and that all federal and provincial regulatory requirements are considered to ensure The City remains in compliance. Examples include: investments at Bonnybrook wastewater treatment plants to address regulatory compliance and low impact development stormwater infrastructure at City facilities to demonstrate infrastructure performance.



**Figure 3.3 – Water Centre Soil Cell Installation**

### 3.5 IMPLEMENT PRICING/FINANCIAL TOOLS

Customers pay for services received by the Utilities and these are tied to infrastructure investments, operations and maintenance costs, and levels of service received. Principles for Utility rates include consideration of financial sustainability of the Utilities, fairness and equity to customers and opportunities to encourage customers to adopt behaviours to benefit the watershed. Pricing and financial tools can be a way to incent positive watershed choices, (for example, using less water, developing differently to reduce impacts to the river, or reducing wastewater impacts) and should be part of programs at the appropriate time and phase within a strategy.

## 4. WATERSHED MANAGEMENT PLANNING UPDATE

### 4.1 GOAL #1: PROTECT OUR WATER SUPPLY

Reliable, secure, high quality water supplies are essential for Calgary and the region. History shows that our region is prone to prolonged, severe droughts while rapid growth continues to place upward pressure on water resources in the Bow River watershed. Future municipal and regional development also poses risks of degrading water quality upstream of The City's raw water intakes. Our future water supply is further restricted because of climate change and the provincial closure of the South Saskatchewan River Basin to new water licences.

To meet these challenges, risk assessments are currently underway which will help establish targets. The targets will be used to evaluate current and future programming. Major activities in 2015 and continuing into 2016 are part of the development of a Water Supply Management Plan, which will provide a strategic and coordinated framework to protect Calgary's water supply. Activities within the Water Supply Management plan are explained below.

In 2015, a source watershed assessment and risk characterization was initiated to understand all risks in the Bow and Elbow watersheds upstream of The City of Calgary's water treatment plant intakes. Preliminary results indicate that wildfire and further urban and commercial development upstream of The City are risks that will need to be addressed through appropriate mitigation strategies. A Source Water Protection Plan will be developed based on the risk assessment results to safeguard the quality of source water supplies upstream of our water treatment plants.

The Utilities conduct watershed monitoring and analysis on a daily basis as part of water treatment operations. In addition, the Utilities are also implementing recommendations from the Expert Management Panel on River Flood Mitigation with respect to improved forecasting and modeling for the Calgary region. Collectively, the watershed monitoring and research activities will inform and improve water supply management decisions for daily water treatment operations and long-term water management.

The City of Calgary drafted a Drought Management Plan in 2011 to provide recommendations for administrative action to minimize the impacts of drought. The dry summer of 2015 prompted the application of the Plan and demonstrated a need to review and update the Plan. To improve preparedness and decision-making, an updated water shortage operational response guide will be completed in 2016. The Plan will also be reviewed and updated to strengthen long-term drought resiliency by aligning with other water supply management initiatives, engaging stakeholders and advancing collaboration of City staff.

In 2015, Administration's Director-led Water Oversight Committee, representing various City departments, was created to monitor and coordinate cross-department preparedness and oversee communication initiatives to prepare citizens for the flood and drought season. This Committee will continue to operate in 2016.



The City of Calgary has been monitoring for pharmaceuticals in Calgary’s wastewater, drinking water and surface water since 2006. As technology continues to advance, it is easier to detect these substances in water, but this does not necessarily indicate that they pose a risk to human health or the environment. A program review was conducted in 2015 and a strategy for addressing Emerging Substances of Concern (ESOCs), including pharmaceuticals, has been created for 2016 to 2018. The ESOC Strategy will ensure that resources are directed to key questions of interest to the Utilities, Calgarians, and other stakeholders. The objectives of the ESOC Strategy are to: ensure that public health and the environment are protected; be prepared for potential new guidelines and regulations; be an industry leader to help inform new science and regulations; and, address citizen and customer inquiries. The ESOC program activities in 2016-2018 include the development of a prioritized list of relevant ESOCs to be tested, development of a strategic monitoring program, embedding efficiencies by optimizing testing methods and leveraging research partnerships, and the development of a communications plan.

**Table 4.1 – Goal #1, Protect Our Water Supply Activity Status Summary**

Action	Status	Timeline
Progress on a Water Supply Management Plan by first conducting a source watershed assessment and risk characterization project to assess all risks in the Bow and Elbow watersheds upstream of The City of Calgary’s water treatment plant intakes.	Underway	2015-2018
Develop a source water protection plan.	Not started	2016-2018
Update and refine the drought management operational guidelines.	Underway	2016
Review and update the Drought Management Plan to strengthen drought resiliency.	Initiated	2016-2018
Conduct regular watershed monitoring and analysis as part of water treatment operations and to inform long term watershed planning.	Ongoing	2015+
Monitor and coordinate cross-department preparedness and oversee communication initiatives to prepare citizens for flood and drought season through Administration's Water Oversight Committee.	Ongoing	2015+
Monitor for Emerging Substances of Concern (ESOCs) including pharmaceuticals through the ESOC Strategy, which will ensure that resources are directed to key questions of interest to the Utilities, Calgarians and other stakeholders.	Underway	2016-2018

## 4.2 GOAL #2: USE WATER WISELY

In 2005, City Council approved the Water Efficiency Plan, which aims to accommodate Calgary’s continuing population growth with the same amount of water removed from the river as in 2003 through 2033. In 2015, annual water diverted from the Bow and Elbow Rivers totaled 178,114 million litres (ML), remaining below the 2003 benchmark of 212,500 ML. Withdrawals have met targets every year since they were set in 2003. Major activities in 2015 and continuing into 2016 are described below.

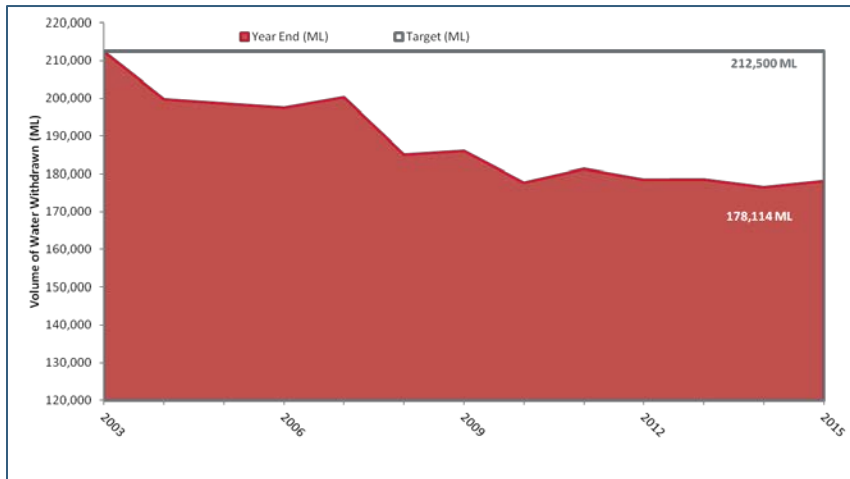
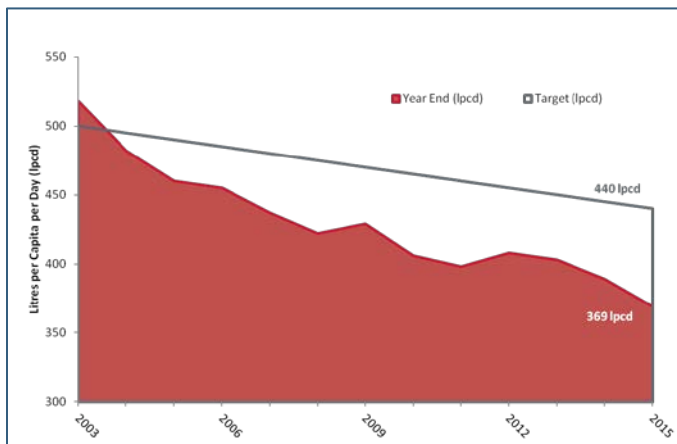


Figure 4.0 – River Water Withdrawal (ML)

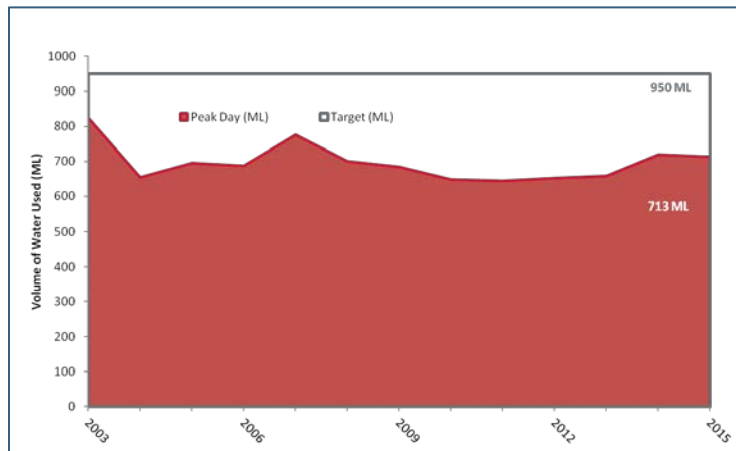
While the Plan goal and targets are well developed and we are on track for success, an assessment is underway to build new customer program opportunities, measure effectiveness of programs and review Plan targets to ensure alignment with long term infrastructure planning.

Indicators for water efficiency are tracked to determine how far along The City is in reaching the water efficiency goal. In 2015, Calgary’s overall water use (including residential, commercial and municipal demand) was 369 litres per capita per day (lpcd), well on track to meet the 2033 target of 350 lpcd. Of the overall water use in 2015, single family residential demand was estimated to be 218 lpcd.



**Figure 4.1 – Calgary Water use – Litres Per Capita Per Day**

Peak day demand, Calgary’s highest total water demand in a single day in 2015 was 713 ML, remaining below the target value of 950 ML. However, population growth forecasts suggest that peak day demand will exceed 950 ML prior to 2033.



**Figure 4.2 – Peak Day Demand (ML)**

The peak day demand is a primary driver for investments in water treatment capacity. The combined output of the Bearspaw and Glenmore water treatment plants must keep up with the water consumed on those peak days. The peak day demand is in turn driven by per capita peak day demand and customer population. With higher than anticipated population growth in the last few years, the next water treatment plant expansion is expected in 2023. The Utilities are assessing the opportunity to reduce per capita peak day demand and offset population growth. This could delay the need for the next plant expansion beyond 2023. This strategy remains appropriate even if population growth rates dip in the next 2-3 years. Forecasts show population growth rebounding and active demand management will continue to play a prominent role in the supply of drinking water.

As part of the Utilities commitment to adaptive management, a water efficiency program review has determined new focus areas to ensure best return on investment for water savings. Future programs will target high-water users in both the residential and industrial, commercial and institutional customer sectors and will focus on reducing peak day demand.

**Table 4.2 – Goal #2, Use Water Wisely Activity Status Summary**

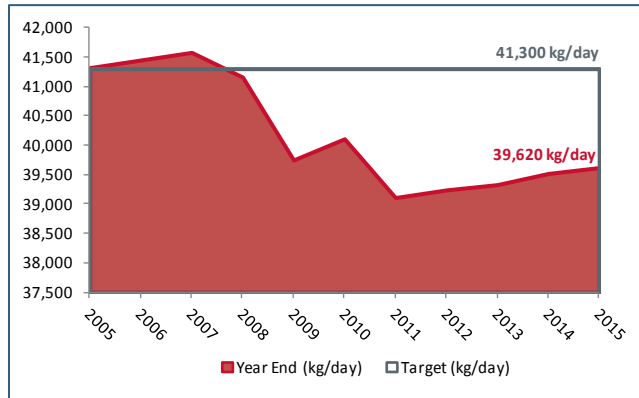
Action	Status	Timeline
Continue to provide technical assistance and education to citizens and customers about water conservation and what they can do to reduce water use.	Ongoing	2003+
Prepare a ten year Water Efficiency Plan program review.	Underway	2015-2016
Build new water efficiency programs that consider best return on investment and market transformation. Increase programming opportunities for industrial, commercial, institutional customers and to reduce peak day demand.	Initiated	2016+
Continue to align water efficiency programming, demand forecasting and infrastructure planning.	Underway	2015+

### 4.3 GOAL #3: KEEP OUR RIVERS CLEAN

New goal and target setting is underway to address both stormwater and wastewater given new assessments and risk evaluations. These goals and targets will be reflected in the 2018 Wastewater Approval to Operate, granted by Alberta Environment and Parks. The Approval will set sediment management and pollutant loading objectives for the Bow River through the Total Loading Management Plan. It is anticipated that more stringent sediment loading targets could be incorporated. Work continues to define key performance indicators, develop reporting mechanisms, and bring many concurrent activities together to develop a comprehensive program and implementation plan. Programs will be defined and coordinated to ensure action in priority areas, which will set clear outcomes for program delivery. Major activities in 2015 and continuing into 2016 are described for stormwater and wastewater.

#### 4.3.1 STORMWATER STRATEGY

In 2005, City Council approved the Stormwater Management Strategy, which outlines goals to reduce pollutants entering Calgary’s rivers, protect watershed function by reducing the rate and volume of stormwater runoff to waterways, protect property from flooding and erosion, and develop sustainable stormwater management practices. The Strategy goal is to maintain total suspended solids levels (TSS) at or below 2005 levels, even with a growing city. In 2015, the estimate of TSS sediment loadings from stormwater to the Bow River is 39,620 kg/day, which is below the 2005 level of 41,300 kg/day.



**Figure 4.3 – Total Suspended Solids to the River (kg/day)**

A review of the Municipal Development Plan impervious area target is underway to confirm if this measurement is appropriate to understand progress toward effectiveness in protecting the aquatic systems within our rivers and streams or if other measures are better suited.

A stormwater asset management plan is underway, including the establishment of a stormpond condition assessment program. The program will yield a priority list for pond maintenance, repairs and sediment removal. A similar program for storm pipes has also been initiated. The two programs will ensure that reinvestments are targeted and stormwater assets continue to function as intended. The programs are also part of a broader integrated infrastructure investment plan to use a combination of traditional and green infrastructure to achieve water quality outcomes.



**Figure 4.4 – Rendering of Bowmont West Stormwater Quality Retrofit Project**

In 2015, a number of low impact development infrastructure practices (rain garden, soil cell and permeable pavement) were installed at City facilities and in communities. These projects provide an opportunity to gain a better understanding of local installations and demonstrate how stormwater management can be functional and beautiful. For example, the community of Oakridge was engaged and educated about stormwater management through the installation of a rain garden in their community. Through a new integrated stormwater management initiative, low impact development practices will continue to be integrated with catchment and community-scale solutions to realize

efficiencies and performance goals. Stormwater reuse is an emerging topic of discussion when it comes to low impact development. In order to implement strategies related to stormwater reuse, The City needs to address the Province's Building Code for Reclaimed Water Systems requirement that a municipality must accept responsibility to ensure that the required monitoring, operation and maintenance plans are in place for a proposed system.

Riparian protection activities aligned with the Riparian Strategy continued in 2015. These included continued riparian health assessments, restoration of the Inglewood Northfield site, increased bioengineering installations, vegetative maintenance, and restoration planting. The City received funding, through the Watershed Resiliency and Restoration Program, to support riparian restoration projects on City lands impacted by the 2013 flood. In 2016, assessments and restoration will continue and social research will be initiated to inform program development for citizens and customers.

Applied research is an integral element of the stormwater asset management plan. The performance of stormwater assets, and how innovative designs can reduce the life cycle costs of these assets, is currently poorly understood. Research partnerships are being established and strengthened to build this knowledge and understanding. A Request for Proposals is also being prepared to enable innovative companies to incorporate their approaches within the Calgary context.

Financial tools, including how customers are charged for Drainage Service, will be further explored once goals and targets are reaffirmed or defined providing direction for the level of investment required. This will allow The City to continue to meet future regulatory requirements while encouraging customers to adopt behaviours that protect the watershed and river water quality.

### **4.3.2 WASTEWATER STRATEGY**

There are both risk assessment work and programs underway to address challenges related to wastewater.

A risk facing the wastewater treatment plants is high strength wastewater, which requires new infrastructure investment to handle high organic loadings. This requires investment in new infrastructure. Work will begin to define target development, key performance indicators, and define reporting mechanisms aligned with the 2018 Wastewater Approval to Operate. Implementation and program planning will identify customer opportunities to build on existing engagement. Work could include research to better understand customer barriers and technical opportunities and the alignment with customer issues faced through the new organics diversion policy. Programs will encourage customers to adopt behaviours or technology to reduce impacts on the river and ensure City infrastructure is used efficiently. Where possible, customer programs will be aligned to other watershed goals.

The most significant capital infrastructure investment program toward keeping our rivers clean and meeting regulatory requirements is the ongoing investments at wastewater treatment plants. Over \$1 billion will be invested in the next 10 years at the Bonnybrook wastewater treatment plant, including the construction of the Plant D expansion. This expansion will ensure that regulatory and capacity requirements are met as the population grows in north Calgary.



**Figure 4.5 – Bonnybrook Wastewater Treatment Plant Capacity Upgrades**

Through the next cost of service study, commencing in 2017, wastewater customer equity will be advanced through the 2019-2022 business cycle to align with equity targets started during the 2015-2018 business cycle. Additional work through the study will include reviewing wastewater contributions and impacts to infrastructure from high strength wastewater.

**Table 4.3 – Goal #3, Keep our Rivers Clean Activity Status Summary**

Action	Status	Timeline
Review goals and targets in the context of the 2018 Wastewater Approval to Operate.	Underway	2015-2017
Conduct river and loading assessment activities to support the 2018 Wastewater Approval to Operate.	Underway	2015-2017
Expand the Bonnybrook wastewater treatment plant, including the construction of the Plant D expansion to meet regulatory requirements.	Underway	2015+
Create a strategy to manage high organic loadings received at the wastewater treatment plants, including target development, key performance indicators and reporting mechanisms aligned with the 2018 Wastewater Approval to Operate.	Not started	2016+
Develop citizen and customer programs to address wastewater challenges.	Initiated	2015+
Continue to advance objectives of the Riparian Strategy including riparian health assessments, restoration of priority sites, increased bioengineering installations and engagement with citizens and customers.	Underway	2007+

Continue to create a stormwater asset management plan, including the establishment of a storm pond condition assessment program, as well as a similar program for storm pipes.	Underway	2015+
Install low impact development infrastructure to test performance and understand local installation of low impact development in the Calgary context.	Underway	2013+
Develop an integrated stormwater management program to integrate Major and Local Stormwater Quality Improvements, Community Drainage Improvements, Asset Management and redevelopment Master Drainage Plans.	Initiated	2016+
Review and update impervious area targets to ensure appropriate measurement of progress toward goals within the Municipal Development Plan.	Underway	2016
Continue to engage and educate citizens and customers about opportunities to adopt and implement stormwater best practices to reduce impacts on watershed health.	Ongoing	2006+
Collaborate with and support watershed partners such as the Calgary River Valleys, Bow River Basin Council, Elbow River Watershed Partnership and the Nose Creek Watershed Partnership to improve watershed health.	Ongoing	2007+

## 4.4 GOAL #4: BUILD RESILIENCY TO FLOODING

### 4.4.1 RIVER FLOODING

For river flooding, evaluation, target setting and implementation plans are being developed concurrently. This is discussed further in a separate report (Flood Resiliency and Mitigation 2015 Annual Update, UCS2016-0168) to the Standing Policy Committee on Utilities and Corporate Services.



## 4.4.2 STORMWATER FLOODING

For stormwater flooding, or Community Drainage Improvements, where some communities experience continued damages as a result of rainfall-triggered local flooding, a strategy is in place and targets are being set to focus the strategy on outcomes.

Reductions in flood damages, measured in terms of economic, social and environmental impacts, are the focus of infrastructure investments. Through delivery efficiency, savings of \$10 million were realized in 2015. These cost savings were redirected to advance work earlier than anticipated in the communities of Woodlands, Woodbine, Cedarbrae and Braeside. Further efficiencies will be realized by integrating stormwater planning with community level flood management to achieve synergies with water quality improvements.



**Figure 4.6 – Rosemont Community Drainage Improvement Project**

**Table 4.4 – Goal #4, Build Resiliency to Flooding Status Summary**

Action	Status	Timeline
Deliver an accelerated program of storm infrastructure upgrades in communities experiencing local flooding	Underway	2015+

## 5. ENSURING THE QUALITY OF OUR WATER

The City’s water quality experts test drinking water, wastewater and stormwater daily to ensure our high standards are met. In 2015, the water quality team took more than 73,000 samples from river to tap and back again. They monitor over 500 different parameters including pH, turbidity, E.coli and total suspended solids and metals. Each water quality laboratory has an ISO 17025 designation from the Canadian Association for Laboratory Accreditation.

**Table 5.0 – Key Drinking Water Quality Parameters 2015**

Water Quality Parameter	Units	Drinking Water Results	Limit <sup>a</sup>	Major Source
		Minimum - Maximum		
<b>Water Treatment Plants - Entering the Distribution System – ON TARGET</b>				
<b>Basic Water Chemistry</b>		Note: '<' indicates not detected above the specified value		
Colour	TCU <sup>b</sup>	<2	≤15 <sup>e</sup>	Erosion of natural deposits in watershed.
Hardness as CaCO <sub>3</sub>	mg/L	132 - 241	No limit	Erosion of natural deposits in watershed.
pH	pH Units	7.3 - 8.1	6.5-8.5	Influenced by the dissolved minerals in the water, temperature and water treatment processes.
Temperature	°C	0.8 - 20.0	≤15 <sup>e</sup>	Surface water temperature.
Total dissolved solids	mg/L	152 - 300	≤500 <sup>e</sup>	Erosion of natural deposits in watershed.
Turbidity	NTU <sup>c</sup>	<0.05 - 0.14	<0.3	Suspended particles in solution.
<b>Inorganic Substances</b>				
Aluminum <sup>g</sup>	mg/L	0.097	0.1 <sup>f</sup>	Plant treatment.
Arsenic	mg/L	<0.0005	0.010	Erosion of natural deposits in watershed.
Barium	mg/L	0.027 - 0.079	1	Erosion of natural deposits in watershed.
Cadmium	mg/L	<0.0005	0.005	Erosion of natural deposits in watershed.
Calcium	mg/L	34 - 63	No limit	Erosion of natural deposits in watershed.
Free chlorine residual	mg/L	0.80 - 1.44	≥0.2	Plant treatment.
Chromium	mg/L	<0.0005 - 0.0023	0.05	Erosion of natural deposits in watershed.
Copper	mg/L	<0.0005 - 0.0007	≤1.0 <sup>e</sup>	Erosion of natural deposits in watershed.
Fluoride	mg/L	0.09 - 0.28	1.5	Naturally occurring. <sup>1</sup>
Iron	mg/L	<0.050	≤0.3 <sup>e</sup>	Erosion of natural deposits in watershed.
Lead	mg/L	<0.0005	0.01	Erosion of natural deposits in watershed.
Magnesium	mg/L	10 - 19	No limit	Erosion of natural deposits in watershed.
Manganese	mg/L	<0.0005 - 0.0007	≤0.05 <sup>e</sup>	Erosion of natural deposits in watershed.
Mercury	mg/L	<0.000002	0.001	Erosion of natural deposits in watershed.
Nickel	mg/L	0.0005 - 0.0020	No limit	Erosion of natural deposits in watershed.
Nitrate as Nitrogen	mg/L	0.023 - 0.231	10	Erosion of natural deposits in watershed.
Nitrite as Nitrogen	mg/L	<0.003	1	Erosion of natural deposits in watershed.
Potassium	mg/L	0.29 - 1.08	No limit	Erosion of natural deposits in watershed.
Sodium	mg/L	2.5 - 10.1	≤200 <sup>e</sup>	Erosion of natural deposits in watershed.
Sulfate	mg/L	37 – 81	≤500 <sup>e</sup>	Erosion of natural deposits in watershed.
Zinc	mg/L	<0.003	≤5.0 <sup>e</sup>	Erosion of natural deposits in watershed.
<b>Microbiological Organisms – ON TARGET</b>				

**Table 5.0 – Key Drinking Water Quality Parameters 2015**

Water Quality Parameter	Units	Drinking Water Results	Limit <sup>a</sup>	Major Source
		Minimum - Maximum		
<i>E. coli</i> .	MPN/100 mL <sup>d</sup>	<1	0	Domestic animals, wildlife and human waste.
Total Coliform	MPN/100 mL <sup>d</sup>	<1	0	Soil, domestic animals and wildlife.

**Treated Water in the Distribution System – ON TARGET**

Water Quality Parameter	Units		Limit <sup>a</sup>	Major Source
<b>Volatile Organic Substances</b>				
Total trihalomethanes <sup>g</sup>	mg/L	0.02	0.1	By-product of chlorination.
<b>Microbiological Organisms <sup>h</sup></b>				
<i>E. coli</i>	Present or Absent/100mL	Absent	0	Domestic animals, wildlife and human waste.
Total Coliforms	Present or Absent/100mL	Absent	0	Soil, domestic animals and wildlife.

**Legend**

a Limit stipulated by Guidelines for Canadian Drinking Water Quality (Health Canada, October 2014) or Alberta Government operating approval for aesthetic, health and operational reasons.

b TCU = True Colour Units.

c NTU = Nephelometric Turbidity Units, a measure of water clarity.

d MPN = Most-Probable Number.

e Aesthetic objective, which is not a health-related limit.

f Federal operational guidance value, which is not a health-related limit.

g Annual average values.

i The City of Calgary ceased fluoridation of its drinking water on May 19, 2011.

NOTE: mg/L = milligrams per litre, or parts per million (ppm).

## 6. RISK ASSESSMENT

As a growing city, Calgary faces significant challenges in managing its water resources. Integrated watershed management planning helps to evaluate and reduce long-term risks to water quality and quantity and meet regulatory commitments.

- The City's Approval to Operate includes the requirement to ensure our pollutant loadings to the Bow River remain below certain levels as part of The City's Total Loading Management Plan. New regulations and policies, such as the South Saskatchewan Regional Plan and the Federal *Wastewater Systems Effluent Regulations*, require The City to adapt its planning, monitoring, operations and infrastructure. The City maintains a close working relationship with regulators to help inform and anticipate upcoming regulatory changes.

- The Approval to Operate is up for renewal in 2018 and it is anticipated that more stringent sediment loading targets could be incorporated, which could result in the adjustment of the type of stormwater quality improvement projects over the next ten years. This risk also applies to wastewater discharge requirements. There may be an impact the amount of infrastructure investment required in order to meet requirements that are more stringent.
- Future climate variability, growth and a basin closed to new water allocations present water supply risks for The City. The City continues to review water efficiency program effectiveness and seek new and innovative opportunities. The ongoing development of a Water Supply Management Plan will help further define current and future risks facing The City's water supplies and recommend a path forward.
- As the Drainage asset management practices evolve, the Utilities will increase their knowledge of the asset conditions. There is a risk that the actual condition of the Drainage assets may require more aggressive replacement or rehabilitation programs than currently planned.

## 7. RECOMMENDATIONS/NEXT STEPS

Moving forward to advance our integrated watershed management approach, actions for 2016 and beyond include:

- Progress on Water Supply Management planning in 2016 through a review of the Drought Management Plan and application of source water risk assessments to build a Source Water Protection Plan.
- Continue work to align water treatment infrastructure planning, water demand forecasting and evaluation of water efficiency program effectiveness.
- Initiate building of new water efficiency programs to ensure best return on investment. Programs will focus on opportunities for industrial, commercial and institutional customers and will further target peak day demand reduction.
- Continue to review goals and targets to keep our rivers clean through risk assessments. These goals and targets will be reflected in the 2018 Wastewater Approval to Operate and Total Loading Management Plan.
- Continue work to bring concurrent activities together for stormwater management to ensure activities are appropriately sequenced and prioritized.
- Build on wastewater strategy and programming, including significant infrastructure investments and customer programming, to ensure The City remains in regulatory compliance.
- Install infrastructure upgrades within targeted communities to improve community drainage.