

Water Infrastructure Investment Plan (WIIP) (2015-2024)

Table of Contents

1. Executive Summary	3
2. Services Delivered via Infrastructure.....	3
3. Investment Drivers	4
4. Building the Water Infrastructure Investment Plan.....	5
5. Priorities by Investment Drivers.....	6
5.1 Maintain Assets: \$70-\$90 million.....	9
5.2 Regulatory & Environmental Protection: \$50-\$70 million.....	11
5.3 Services: \$40-\$70 million	12
5.4 Growth: \$160-\$200 million	15
6. Investment Priorities by Program	18
6.1 Water Treatment Plants: \$15-\$30 million	19
6.2 Water Network: \$50-\$90 million	20
6.3 Wastewater Treatment Plants: \$120-\$150 million	20
6.4 Wastewater Network: \$50-\$90 million	21
6.5 Drainage Facilities and Network: \$30-\$50 million.....	22
6.6 Facilities & Equipment: \$10-\$15 million.....	23
7. Funding Sources.....	23
8. Summary	23
APPENDIX A	24

1. Executive Summary

The Water Infrastructure Investment Plan (WIIP) is a strategic, long range capital plan that underpins the delivery of water, wastewater and drainage services. Capital investments are needed to: maintain assets, meet increasingly stringent regulatory requirements, provide reliable and high quality services, and keep pace with growth. The WIIP identifies the infrastructure investments needed over the next 10 years (2015-2024) to address these four investment drivers and will guide the development of the 2015-2018 capital budget. The proposed WIIP includes a total investment requirement of \$3.5 billion, averaging \$350 million per year. The prioritization and sequencing of investments within the \$3.5 billion capital envelope is underway. Once completed, the finalized WIIP will inform the 2015-2018 Action Plan.

2. Services Delivered via Infrastructure

The Utilities manage and operate infrastructure valued at approximately \$38 billion across three lines of service: water, wastewater and drainage. The infrastructure takes water from river to tap and back again within an integrated system that includes the Water and Wastewater Utilities and the Drainage line of service. This infrastructure is vital to the delivery of services to citizens as follows:

- Reliable delivery of safe and high quality drinking water:
 - Glenmore reservoir;
 - Two water treatment plants (Glenmore and Bearspaw);
 - Network of pipes, reservoirs and pump stations; and
 - Bulk water stations.
- Protection of public safety and property:
 - Fire hydrants;
 - Sanitary collection sewers, trunks and lift stations;
 - Catch basins, storm sewers, dry ponds and outfalls;
 - River berms and flood protection works.
- Environmentally responsible management of our precious water resources:
 - Three wastewater treatment plants (Bonnybrook, Fish Creek and Pine Creek);
 - Stormwater ponds and water quality retrofit ponds;
 - Reclaimed water system;
 - Shepard constructed wetland; and
 - Riparian areas.
- Efficient and effective operation of the business:
 - Facilities and office space;
 - Compliance testing laboratories;
 - Tools and equipment; and
 - Information technology.

The WIIP investment programs are categorized along the utility/line of service divisions, plus a category for common facilities and equipment:

1. Water Treatment Plants
2. Water Network
3. Wastewater Treatment Plants
4. Wastewater Network
5. Drainage Facilities and Network
6. Facilities & Equipment

3. Investment Drivers

Over the next ten years, the water, wastewater and drainage programs will experience increased pressure due to factors such as:

- Aging infrastructure, which impacts the ability to operate efficiently and effectively without service interruptions;
- Changes to regulatory and environmental requirements, which necessitate infrastructure upgrades or the construction of additional infrastructure;
- Introduction of new services or service levels, which requires infrastructure upgrades or new infrastructure;
- Continued population growth, which triggers capacity upgrades and expansions.

These factors are the four primary capital investment drivers, and are common to the Utilities and Waste & Recycling Services. Table 1 summarizes the four investment drivers.

Table 1: Investment Drivers

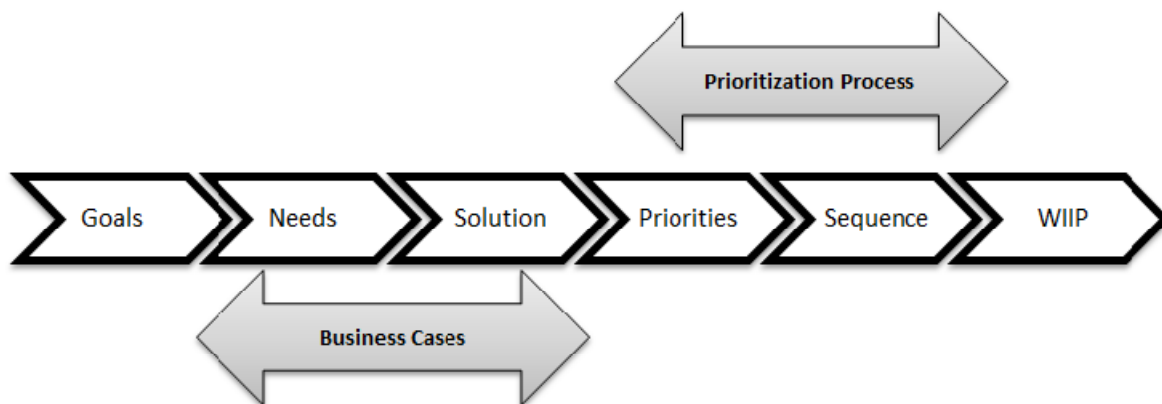
INVESTMENT DRIVER	EXPLANATION
Maintain assets	Maintaining, protecting and extending the life of infrastructure investments.
Regulatory & Environmental Protection	Continuing to meet increasingly stringent regulatory and environmental protection requirements.
Service	Continuing to provide reliable and high quality services to meet the needs of citizens.
Growth	Providing infrastructure to meet the needs of a growing Calgary.

Each investment driver provides a different perspective on when and where infrastructure investments are needed. The process to prioritize investments considers the need and timing of investments in light of the four drivers. The desired outcome is to meet customer and environmental priorities while staying within the financial capacity of the Utilities.

4. Building the Water Infrastructure Investment Plan

The WIIP is built on a foundation of asset management that determines the most appropriate blend of policy, operational activity, asset maintenance and capital investment to meet specified service level objectives within the financial capacity of the Utilities. The WIIP is developed by identifying the desired customer outcomes and level of service (goals) and then identifying what is needed to meet these desired outcomes. These goals were developed by program (Water, Wastewater, Drainage and Facilities and Equipment) for each investment driver (maintain assets, regulatory & environmental protection, service and growth). The appropriate infrastructure solutions are developed to address the identified needs and compiled into an overall list of capital investments. The investment requirements are then evaluated to determine the priorities and sequence of investments, resulting in the WIIP. Figure 1 outlines this process.

Figure 1: WIIP Process



Policy documents, legislation and planning processes that are inputs to the WIIP include:

- Municipal Development Plan
- Calgary Metropolitan Plan
- Alberta Environmental Protection and Enhancement Act
- Drinking Water Safety Plan
- Water Efficiency Plan
- Stormwater Strategy
- Water resource planning
- Asset management planning
- Long range infrastructure planning and treatment plant master planning

Based on the identified needs, business cases are prepared for the required capital investments to be considered in the ten-year investment plan.

The prioritization of capital investments is a cornerstone of good utilities management. The Utilities use a rigorous approach of quantitative and qualitative decision-making processes for prioritizing investments. The methodology involves identifying and prioritizing decision criteria, defining rating scales using a pairwise comparison methodology, and rating investment

proposals against the weighted decision criteria. The outcome is a measure of the relative importance of each proposed investment referred to as a “benefit score”.

This score is used as a starting point in the prioritization process; project timing is adjusted with consideration of the Utilities financial capacity and delivery capability and to reflect project dependencies so that the projects are sequenced in a logical manner. The financial capacity of the Utilities informs the preparation of a sequenced investment plan that remains affordable to its customers. The ability of the Utilities to deliver the investment plan is also evaluated and informs the sequencing of investments. Factors that impact the delivery of capital projects have been identified and addressed in the development of the delivery strategy. Those factors include:

- The size and complexity of projects within the capital portfolio.
- Project specific requirements, including stakeholder engagement, environmental, regulatory and land requirements.
- Financial, budget and procurement management systems.
- Internal capacity, including available resources and project management expertise.
- Market capacity, including design and construction capacity.

In addition to other initiatives to increase the delivery capacity of the Utilities, the delivery strategy recommends additional positions to deliver on the proposed WIIP.

The balancing of investment needs, financial capacity and delivery capability results in a WIIP over the 2015 to 2024 horizon of approximately \$3.5 billion, averaging to \$350 million per year over the next ten years. This level of investments is significantly more than the Utility has delivered over the last three years. The investments in the 2015-18 cycle will be phased in to achieve an average of \$350 million per year in alignment with the delivery strategy.

The prioritization and sequencing of the investments within the \$3.5 billion capital envelope is underway. The finalized WIIP will be used to inform the 2015-2018 Action Plan.

5. Priorities by Investment Drivers

The proposed infrastructure investments will allow the Utilities to address issues of aging infrastructure and changing regulatory and environmental requirements, provide new or enhanced services, and provide services for a growing population. Some programs and projects may span across two or more investment drivers. For example, upgrading a sanitary sewer may reduce the risk of sanitary backups, accommodate future growth, and replace the old sewer pipe with a new pipe. In these instances, the cost of the project has been distributed between the affected drivers.

The following table summarizes the investments for the 2015-2024 timeframe based on the investment drivers for the six investment programs.

Table 2: Priorities by Investment Driver and Program

	Utilities Investment Allocation 2015-2024							
	Water		Wastewater		Drainage	Facilities & Equipment	% of Total	Average Annual investment (per year)
	Treatment Plants	Distribution Network	Treatment Plants	Collection Network				
Maintain Assets	<5%	5-15%	<5%	<5%	<5%	<5%	20-25%	\$70-\$90 M
Regulatory & Environmental	<5%	<5%	5-15%	<5%	<5%	<5%	15-20%	\$50-\$70 M
Service	<5%	<5%	<5%	5-15%	<5%	<5%	10-20%	\$40-\$70 M
Growth	<5%	5-15%	20-30%	5-15%	<5%	<5%	45-60%	\$160-\$200 M
% of Total:	5-10%	15-25%	35-45%	15-25%	10-15%	3-5%	100%	-
Average Annual Investments (per year)	\$15-\$30 M	\$50-\$90 M	\$120-\$150 M	\$50-\$90 M	\$30-\$50 M	\$10-\$15 M	-	\$350 M/year

Table 3 below summarizes the proposed expenditures, risks, outcomes and infrastructure for each of the investment drivers.

Table 3: Outcomes by Investment Driver

Investment Driver	Risks and Pressures	Outcomes	Investments Required
Maintain Assets \$70-90 M/yr (20-25%) <i>Maintaining, protecting and extending the life of infrastructure investments</i>	Aging Assets Growing inventory of infrastructure	Reduce risk of unplanned service interruptions Services are provided to citizens at an optimal cost Reduce net lifecycle costs	Condition Assessment Programs Main Replacements or Rehabilitation Programs Capital Maintenance Programs for critical infrastructure Corrosion Protection Programs
Regulatory and Environmental Protection \$50-70 M/yr (15-20%) <i>Continuing to meet increasingly stringent regulatory and environmental protection requirements</i>	Increasingly stringent Provincial and Federal regulations Increasing stewardship expectations and responsibilities Growing City putting pressure on regulatory targets (e.g. total contaminant loadings to rivers)	Protect public health Protect and manage precious water resources Continued delivery of high quality drinking water and responsible management of wastewater	Bonnybrook Wastewater Treatment Plant Upgrades and Expansion Drinking Water Disinfection Upgrades Lead Service Line Replacements
Services \$40-70 M/yr (10-20%) <i>Continuing to provide reliable and high quality services to meet the needs of our citizens</i>	Older communities are below modern service standards resulting in higher risk of sewer backups and odour issues Increasing focus on the resiliency of utility services during extreme events	Increase levels of service in older communities towards modern service standards Increase infrastructure resiliency to extreme events	Community Drainage Improvement Program Sanitary Upgrade Program Flood Mitigation Programs
Growth \$160-200 M/yr (45-60%) <i>Investing in growth to meet the needs of a growing Calgary</i>	Higher than forecast population growth Upgrades and expansions to infrastructure are required to meet the forecast growth in population and service areas.	Ensure the City delivers infrastructure capacity to meet the demands of growth.	Major Wastewater Treatment Plant Expansions Significant Water Treatment Plant Expansion Investments in linear infrastructure in North East, South West and South East for new developing communities

The tables in Appendix A of this report further summarize the type of infrastructure to be provided in each Utility program from the perspective of the four investment drivers.

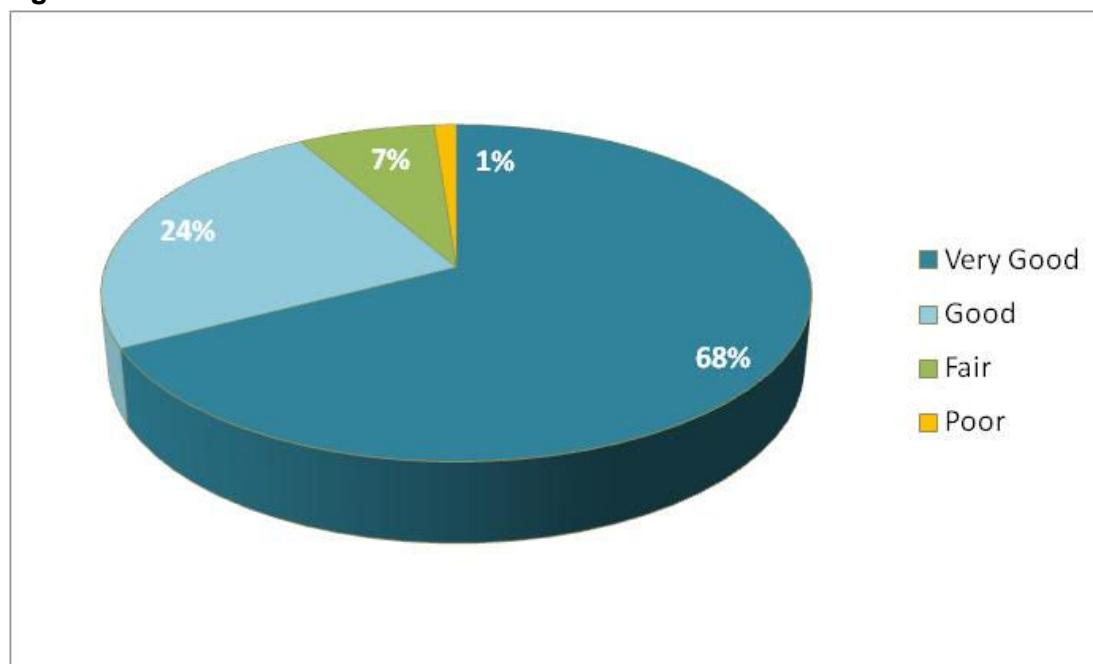
The following sub-sections provide context and an overview of the investments proposed within each of the four investment drivers.

5.1 Maintain Assets: \$70-\$90 million

Investments in capital maintenance are necessary to keep existing infrastructure operating to meet its intended purpose. Customers benefit from these investments through fewer service interruptions, lower utility rates, less property damage, and lower risks to public health.

Water has ongoing condition assessment and maintenance programs, which have helped identify and eliminate potential service failures that could be costly to replace on a reactionary basis. The condition assessment and maintenance programs are vital since approximately 8 percent of the Utilities' total infrastructure is at or below fair physical condition (refer to Figure 2). This infrastructure is critical to maintaining levels of service to all areas of the city. Asset management strategies and maintenance investments ensure that the Utilities continue to provide a high level of service to citizens.

Figure 2: Asset Condition Assessment



In 2004, the McKnight feedermain (a large water transmission pipe) failed catastrophically, inundating a stretch of McKnight Boulevard and adjacent areas (Figure 3a). The cost of the emergency repair was \$7 million. Equally important, the failure posed a risk to public safety, interrupted water services to several northeast communities, caused local flooding and disrupted traffic in the area until the repairs were completed. Since that event, a comprehensive feedermain inspection program has been implemented. This program uses industry leading non-destructive techniques to detect defects in the feedermain. During the 2013 feedermain inspection program, a section of feedermain along 68th Street SE revealed pipe conditions that could lead to a pipe rupture (Figure 3b). The cost of the inspection and the planned repair is \$100,000. If left undetected, the rupture of the pipe would have resulted in a repair cost of \$1.5

million plus an estimated \$2 million in other indirect costs. This illustrates the value of sound asset management, and how smart investment decisions can directly impact Calgarians.

Figure 3:

Figure 3a: McKnight Feedermain



Figure 3b: 68th Street Feedermain Repair



The proposed 2015-2024 WIIP includes budget for the feedermain inspection and replacement program, the water main replacement program for smaller pipes, the cathodic protection program to reduce the corrosion of metallic pipes, and smaller programs aimed at replacing smaller assets like valves and hydrants. A similar set of proactive programs have been developed for the wastewater and drainage collection systems. The program for the wastewater system was initiated at the start of the current business planning and budget cycle. Starting in the 2015-2018 Action Plan, proactive programs for the drainage system have been included in the proposed WIIP. These proactive programs are supplemented by infrastructure upgrades driven by the needs of growth, which also replace old infrastructure with new.

The responsible management of treatment plant assets is vital to the continued operation of our water and wastewater systems. Without capital maintenance investments, the Utilities are at risk of regulatory non-compliance, rising operating costs and an inability to meet service needs. The importance of capital maintenance programs was underscored when The City of Calgary continued to supply high quality drinking water through the 2013 flood and its aftermath. The

proactive capital maintenance programs at the two water treatment plants ensured that the plants continued to operate without equipment failures; more importantly, water customers were not subjected to a boil water order for the duration of the event. The proposed 2015-2024 WIIP includes budget for capital maintenance throughout The City's five water and wastewater treatment plants, including the rehabilitation of a filter bed at the Glenmore Water Treatment Plant (WTP), and concrete repairs and rehabilitation of the Glenmore Dam. The electrical upgrades program at the Bonnybrook Wastewater Treatment Plant (WWTP) will provide an opportunity to replace old and outdated electrical infrastructure throughout the plant.

The 2015-2024 WIIP proposes to invest \$70 to \$90 million per year across the Water and Wastewater Utilities and the Drainage line of service.

5.2 Regulatory & Environmental Protection: \$50-\$70 million

Capital investments are necessary to ensure that all federal and provincial regulatory requirements are met and The City remains in compliance. The risks of non-compliance fall into two broad categories. The first is when regulations are changed, and new treatment processes must be adopted. The second category is linked to population growth; the cumulative impact of growth places greater pressure to remain below regulatory limits and triggers new investments. Both types of risks will be factors as the Utilities work with the regulators to renew the Utilities' Approval-to-Operate by 2018.

The City currently meets all wastewater effluent quality limits. Phosphorus loadings to the Bow River and effluent concentration limits are under review by Alberta Environment and Sustainable Resource Development (AESRD). Total Nitrogen limits are also under review by AESRD. Tightening of these effluent quality limits will have a considerable impact on both the Bonnybrook and the Fish Creek WWTPs. One option is to modify the operations of the plants to achieve the new limits. The plant modifications could result in a downgrading of plant capacity and result in the need to advance new plant expansions. The second option is to invest in new processes that can remove more phosphorus and nitrogen from the effluent. Either option requires new infrastructure investments. Infrastructure investments driven by regulatory requirements have also been identified for the Water Utility, as documented in the recently completed Drinking Water Safety Plan.

The second category of non-compliance risks are triggered by population growth. A number of regulatory limits are defined as total daily loading limits, typically measured in kilograms per day. Total suspended solids (TSS) is one such regulatory limit. The City must restrict the total amount of TSS added to the Bow River from sources within Calgary. These sources include residual TSS in the wastewater effluent and the TSS from stormwater drainage generated by all developed and, to a lesser extent, undeveloped lands within the city limits. Urban development results in more TSS reaching the rivers, unless investments are made in either developing or developed communities. Options for reducing the amount of TSS released from a development include improved source control practices, investments in green infrastructure and low impact development solutions, and the construction of stormwater quality treatment ponds in developed communities. Figure 4 illustrates an example of stormwater protection with the recently built

Shepard Wetland that is part of a 227 hectare storm water management initiative to improve the quality of storm water entering the Bow River.

Figure 4: Shepard Stormwater Diversion Project



Capital investments are also required to ensure continued compliance with occupational health and safety (OH&S) regulations. The Utilities typically leverage capital maintenance programs to improve the working conditions and protect the safety of City staff and the general public. Renovations to existing facilities and all new facilities will be designed to meet OH&S regulations.

The 2015-2024 WIIP proposes to invest \$50 to \$70 million per year under this investment driver. While this level of investment may appear relatively low given the regulatory environment in which the Utilities operate, the investments necessary to remain in regulatory compliance are embedded in larger projects and programs that also meet the other investment drivers.

5.3 Services: \$40-\$70 million

Calgarians have historically reported a high level of satisfaction in the services provided by the Utilities, as demonstrated by the annual City Satisfaction Survey results. In 2013, 75% of citizens reported that they were “very satisfied” with the quality of The City’s drinking water services. The total rises to 94% when “satisfied” and “very satisfied” responses are combined. Despite such positive indicators of service levels, opportunities exist to improve services and better meet community expectations.

When older communities in Calgary were built, the standards of the day gave little consideration to the management of stormwater. Investments to retrofit these communities and bring them up to modern standards reduce the risks of localized flooding and stormwater backups. Since the mid-1990’s, infrastructure upgrades have been installed in the most at-risk communities. The Utilities plan to invest approximately \$105 million in the next ten years. This expenditure plan will deliver the \$170 million in identified upgrades by 2030 (delivering the upgrades within the next 16 years). Figure 5 shows an example of an existing area, Woodlands-Woodbine,

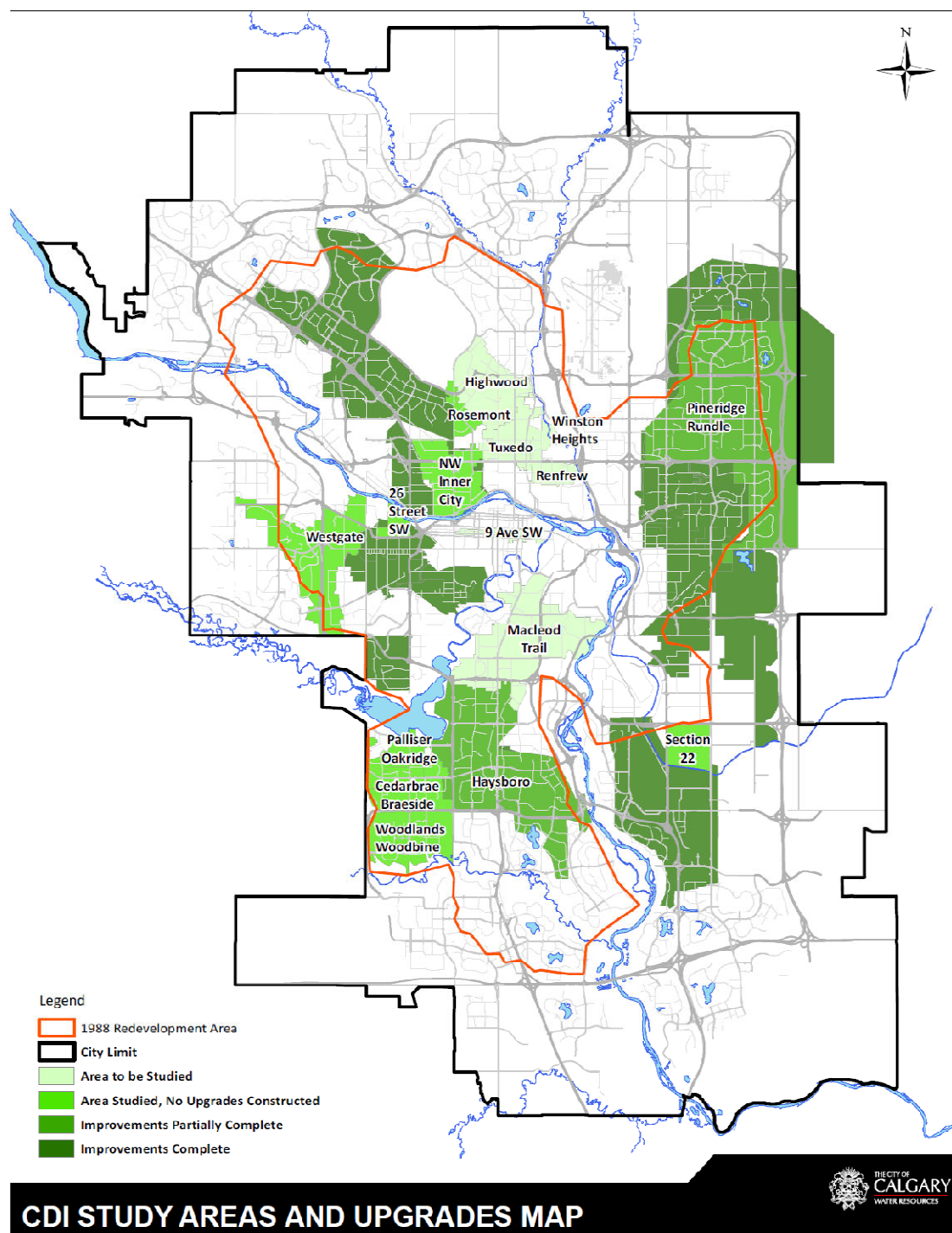
requiring community drainage improvements (CDI) to improve the drainage of the area and avoid flooding events.

Figure 5: Woodlands-Woodbine CDI Improvement Area



The CDI program delivers stormwater infrastructure upgrades in older communities that were built before the use of modern drainage techniques and standards. Figure 6 identifies the 23 areas planned to be upgraded in the next 15-20 years.

Figure 6: Proposed CDI Areas for Upgrades



Investments to reduce the frequency of sanitary sewer backups have been included in the proposed 2015-2024 WIIP. The vast majority of sanitary backups are the result of blockages in private service lines. Fats, oils and grease (FOG) are the biggest culprits. In the worst cases, FOG build-up can accumulate in the public sanitary sewers, creating conditions where multiple properties are at risk of sanitary backups. Other causes of sanitary backups include the

intrusion of tree roots, the accumulation of debris, and the structural failure of sewer pipes. Proactive flushing operations provide a cost-effective strategy to reduce the frequency of these events. Educational programs also play a role in the elimination of sanitary backups. However, infrastructure investments can play a role in the reduction of sanitary backups, especially in locations where the capacity of the sanitary collection system is limited. Excessive inflow and infiltration into an aging collection system during wet weather events is a common reason for capacity limitations. The proposed WIIP includes budget to eliminate capacity limitations; these capacity upgrades are primarily combined with capacity upgrades needed to accommodate future growth.

The June 2013 flood has highlighted the efforts of the Utilities to make the water, wastewater and drainage systems more resilient to large catastrophic events. As previously mentioned, the water treatment and distribution system remained operational for the duration of the event, and continued to deliver high quality drinking water to the citizens of Calgary. The wastewater collection and treatment system does not have the same level of resilience. The proposed 2015-2024 WIIP includes investments in a new effluent outfall to reduce the risk of river water backing up into the Bonnybrook WWTP, flood protection works to keep flood waters out of the Bonnybrook site, and electrical system upgrades to allow the plant to remain operational during power failures. The investments also ensure that the wastewater system can return to full operations quickly after a catastrophic event.

The Utilities must address the level of flood protection provided to Calgary communities located along our rivers. Our riverbanks and critical infrastructure must become more resilient to large river flows. Budget has been allocated to invest in more resilient designs for our stormwater outfalls and riverbank restoration works, and the investigation of new flood protection works. These funds will need to be largely supplemented by funding from other levels of government if substantial flood mitigation works are to be constructed to protect lives and property.

The 2015-2024 WIIP proposes to invest \$40 to \$70 million per year to improve levels of services to Calgarians. This plan does not include the significant funds necessary to construct the large scale flood mitigation works being contemplated by the city's flood mitigation expert panels and the provincial flood recovery task force.

5.4 Growth: \$160-\$200 million

Growth continues to be the predominant driver for capital investments in the Utilities. Growth over the last two to three years has exceeded previous forecasts. The outlook is for more growth over the next five years than previously forecasted, with expectations that Calgary will grow by another 124,000 people by 2018. New urban development and the intensification of developed areas will be necessary to ensure that these new Calgarians have affordable housing options. The Framework for Growth and Change, Part 5 of the 2009 Municipal Development Plan, guides appropriate levels of municipal investment to accommodate the needs of growth. The Framework also ensures that infrastructure investment plans across Business Units are aligned to maintain a supply of land serviced by the leading infrastructure necessary for development. The Utilities have endeavoured to align the proposed 2015-2024 WIIP with the Framework's prioritized and sequenced lists. The targets embedded in the Framework provide a

balance between maintaining a sufficient supply of serviced land and overbuilding infrastructure. The Utilities also maintain sufficient water and wastewater treatment plant capacity to support growth.

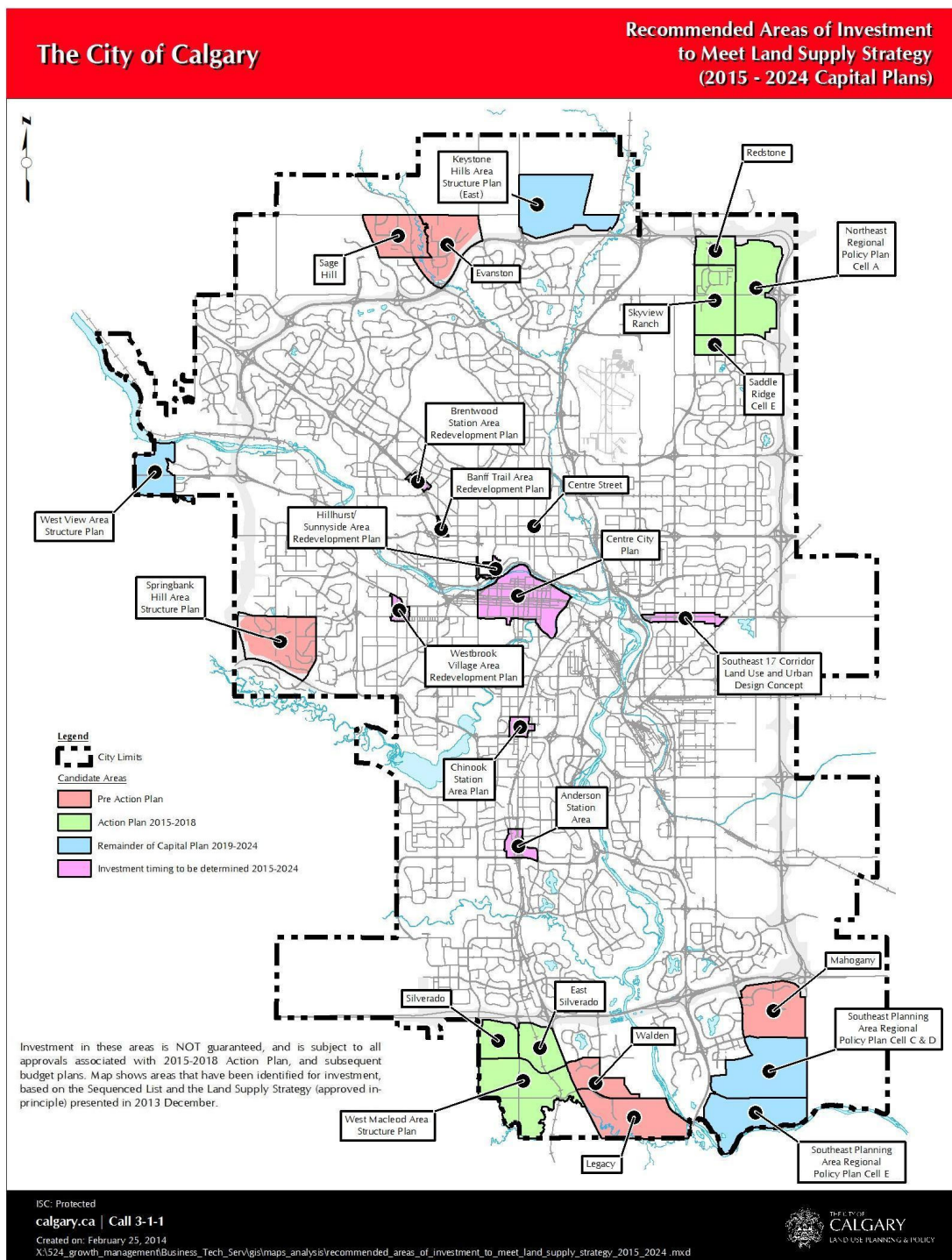
Significant investments are required in the 2015 to 2024 timeframe. Historical growth trends for the past 20 years suggest that the capacity of our water and wastewater treatment plants need to be expanded every 8 to 12 years. Each wastewater treatment plant expansion typically adds the capacity to treat the wastewater of 250,000 people; a capacity increment that achieves economies of scale without installing capacity too much in advance of the need. With the last plant expansion (the Pine Creek WWTP) commissioned in 2008, the Utilities have been planning for new wastewater treatment plant capacity by 2020. This new capacity will be provided by a series of process upgrade projects at the Bonnybrook Wastewater Treatment Plant (WWTP) and the construction of the Bonnybrook WWTP Secondary Plant D.

The proposed 2015-2024 WIIP includes the construction of an expansion at the Glenmore water treatment plant. This expansion will add the capacity to treat an additional 150 million litres per day. This capacity is needed to meet the water needs of a growing population, and build the resilience necessary for the reliable delivery of high quality drinking water. The planned capacity expansion works in concert with the water conservation efforts detailed in the 30-in-30 Water Efficiency Plan. Although water conservation helps to offset the total water consumption, a water plant expansion is still required to address the increasing peak day water demand and other factors such as regulatory compliance.

The water, wastewater and drainage pipe networks will need to be expanded and upgraded to meet the needs of the forecasted growth. In past years, suburban growth only needed pipes to be extended into the new communities. The existing network had sufficient capacity to accommodate the needs of these new communities, as well as the needs of intensification in developed areas. With the unprecedented growth of the last ten-plus years, this surplus capacity has been depleted. The Utilities must now reinvest in the existing networks and add capacity. This need to reinforce the existing networks significantly increases the cost of servicing growth in both developing and developed areas.

The Framework for Growth and Change has produced a sequenced list that orders future developing areas. Figure 7 identifies the areas on the Sequenced Lists for the Framework for Growth and Change that would potentially need investment started within the 2015-2024 Capital Plan to align with the Growth Management Land Supply Strategy. The timing of these areas yields a supply of serviced land (defined as land with all leading infrastructure, including water, sanitary, storm, fire and transportation) within specified city-wide and north and south sector targets. The first target is the city-wide target of 2 to 5 years of serviced land. The other two targets are associated with north and south sectors, and establish 2 years of supply in each sector. The WIIP meets the minimum of 2 years citywide serviced land supply with an endeavour to meet the midpoint of the 2-5 year range that the Framework for Growth and Change strives to reach to account for fluctuations in market demand. There is a possibility that the south sector target will not be achieved for one year in the 2015-2018 budget cycle. This will be reviewed and reported as the 2015-2018 capital budget is finalized.

Figure 7: Framework for Growth and Change Identified Areas



The growth portion of the proposed 2015-2024 WIIP has been designed around the timing of investments necessary to align with the Sequenced Lists of the Framework for Growth and Change. If another area within the sequenced list is advanced, this change in service timing

may require water and sanitary upgrade projects to also be accelerated. This scenario would not be accommodated within the proposed capital investment envelope.

The 2015-2024 WIIP proposes to invest \$160 to \$200 million per year to support the rapid growth being experienced in Calgary.

6. Investment Priorities by Program

Figure 8 identifies the proposed investments in the six Utilities programs. The Utilities will continue to invest heavily in wastewater treatment and collection. This higher level of investment reflects a greater impact of growth on wastewater treatment capacity needs; water treatment continues to benefit from the water conservation measures introduced under the 30-in-30 Water Efficiency Plan. The wastewater collection system also requires a higher level of investment to upgrade the capacity of major sanitary trunks.

Figure 8: Investment Ranges by Program

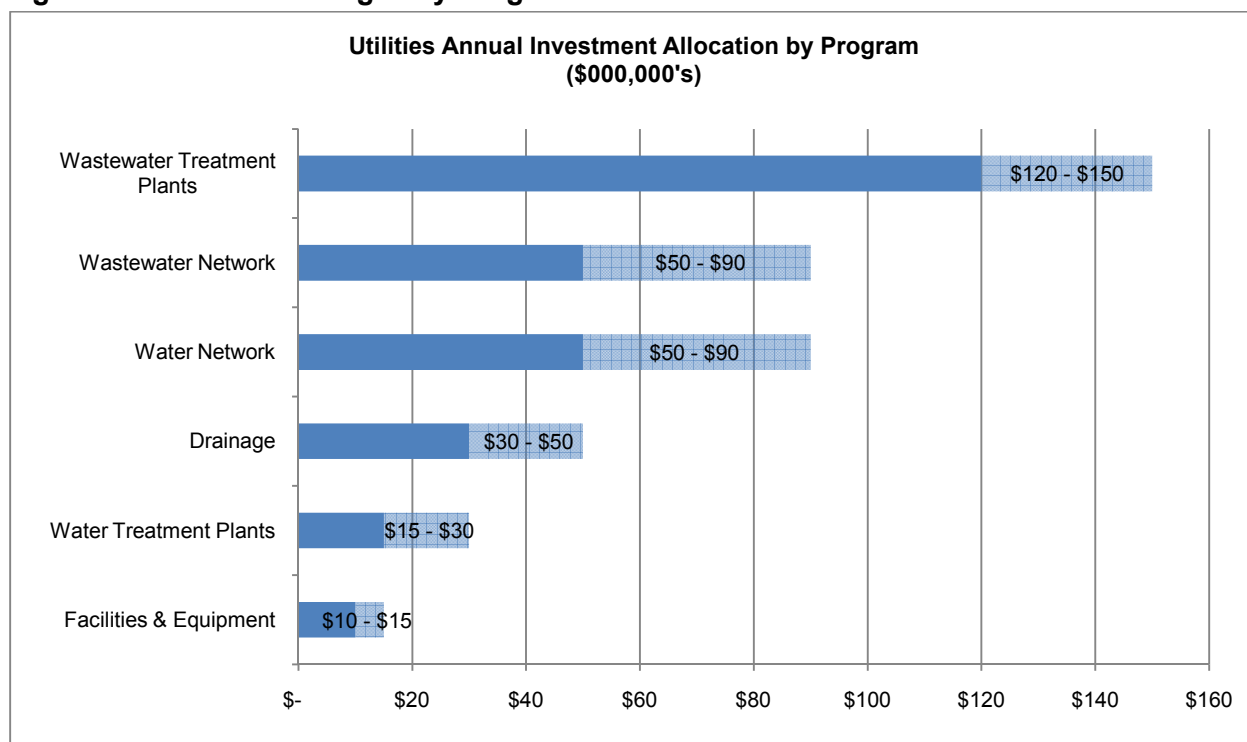
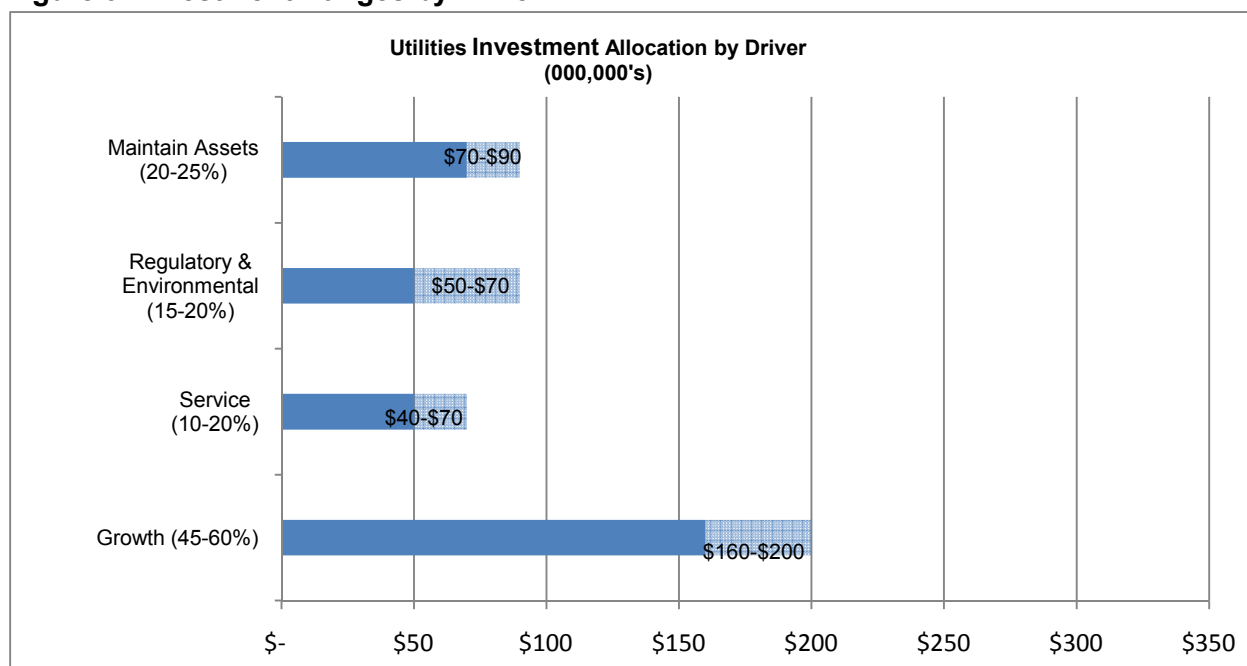


Figure 9 summarizes the preliminary investment ranges for the 2015-2024 timeframe based on the four investment drivers.

Figure 9: Investment Ranges by Driver



The use of investment ranges reflects the need for the Utilities to remain nimble and respond to shifts in priorities and business risks, and also reflects that prioritization is still underway. The capital distribution by program and driver will be updated and refined when further prioritization and sequencing of the WIIP is completed. This could result in variances from the ranges identified above.

6.1 Water Treatment Plants: \$15-\$30 million

The investments at the Glenmore and Bearspaw Water Treatment Plants (WTPs) will ensure that customers continue to receive high quality drinking water. An expansion to the Glenmore WTP will deliver an additional 150 million litres per day to meet the needs of growth. This capacity expansion will be supplemented by smaller upgrades at the Bearspaw WTP. An ultraviolet (UV) disinfection facility will be constructed as part of the Glenmore WTP expansion to keep pace with regulatory requirements. UV disinfection will follow at the Bearspaw WTP in the latter part of the ten year WIIP to match the regulatory triggers for that plant.

Capital maintenance programs at each of the WTPs will ensure that these complex facilities remain operational. Upgrades to the air scour systems are planned at both sites. These investments will improve the reliability of these critical systems, while reducing the operational costs of the Actiflo™ treatment process.

Major Investments:

- Water Treatment Plant Expansion & Upgrade
- Drinking Water Disinfection Investments,
- Capital Maintenance Programs,
- Glenmore Dam Crest Stop Logs.

Renovations to the filter pipe gallery at the Bearspaw WTP will also be done in advance of the installation of the UV disinfection facility.

The Glenmore Dam is included in the asset base of the water treatment plants. Planned concrete repairs and rehabilitation of the dam structure will ensure that the dam continues to meet dam safety requirements. The crest stop logs (an engineered, removable wooden structure used to increase water storage during the summer and autumn months) will also be replaced since they have reached the end of their useful life.

6.2 Water Network: \$50-\$90 million

The water transmission system will be extended and reinforced to meet new water demands in both the north and south of the city. This investment plan accommodates the sequencing of land servicing established by the Framework for Growth and Change. The proposed 2015-2024 WIIP also positions the Utilities to better respond to the infrastructure needs of redevelopment and proactively supports targeted redevelopment opportunities.

As previously mentioned in the Maintain Assets section of this report, the proposed 2015-2024 WIIP includes budget to maintain a comprehensive asset management program. Calgary is recognized as an industry leader in the management of water network assets. Proactive programs for the next ten years include the feedermain inspection and replacement program, the water main replacement program for smaller pipes, the cathodic protection program to reduce the corrosion of metallic pipes, and smaller programs aimed at replacing smaller assets like valves and hydrants.

Major Investments:

- *Linear infrastructure to meet growth demands in both north and south,*
- *Feedermain inspection and replacement program,*
- *Water main replacement program*
- *Corrosion protection.*

6.3 Wastewater Treatment Plants: \$120-\$150 million

The single largest capital project in the next ten years will be the Bonnybrook Plant D expansion. Combined with the Bonnybrook WWTP upgrades, the Utilities will have the installed treatment capacity to meet the forecasted growth in the north sanitary catchment until about 2030. This plant expansion will also relieve the growth pressures in the south sanitary catchment. Wastewater will be transferred from the south catchment to the north, thereby delaying the construction of the next plant expansion at the Pine Creek WWTP site. Budget is included in the second half of the proposed 2015-2024 WIIP to design and start construction of the expansion of the Pine Creek WWTP. Higher than expected population growth, in excess of the current projections, could place even greater pressure on the proposed WIIP; the Bonnybrook WWTP upgrades and the Plant D expansion would need to be accelerated. The Utilities will also have to work closely with the regulators as the capacity headroom (the difference between the installed capacity and the population served) diminishes during the time prior to the capacity increases.

The planned upgrades and plant expansion on the Bonnybrook site have triggered electrical upgrades for the site. A comprehensive electrical program will be delivered to coincide with the new power demands of the Bonnybrook WWTP. This program provides an opportunity to replace electrical infrastructure that has reached the end of its useful life, and improve the reliability of the electrical system to meet the power needs of the treatment operations.

The Bonnybrook biosolids dewatering facility will be constructed in advance of the organics composting facility. The dewatering facility will allow the use of biosolids generated by the wastewater treatment operations as a feedstock for the composting facility.

Capital maintenance programs at each of the three WWTPs will ensure that these complex facilities remain operational. These programs include upgrades to the plant control systems to more effectively operate the plants. The H₂S gas scrubber at the Bonnybrook WWTP will also be replaced, enabling increased utilization of biogas to generate electricity in the existing power generation facility and reducing the amount of electricity purchased from the grid.

Major Investments:

- *Bonnybrook Wastewater Treatment Plant Expansion & Upgrade,*
- *Bonnybrook biosolids dewatering,*
- *Capital maintenance programs.*

6.4 Wastewater Network: \$50-\$90 million

The wastewater collection system will be extended and reinforced to meet new service demands in both the north and south of the city. This investment plan accommodates the sequencing of land servicing established by the Framework for Growth and Change. The proposed 2015-2024 WIIP also positions the Utilities to better respond to the infrastructure needs of redevelopment and proactively support targeted redevelopment opportunities.

The proposed 2015-2024 WIIP includes budget for asset management programs. Since these programs are not as advanced as those for the water network, a larger proportion of the funds in the initial years of the programs will focus on condition assessments of the pipe infrastructure. The lining of sanitary sewers will be continued as a cost effective solution to the structural rehabilitation of aging pipes. Lining of pipes to reduce inflow and infiltration of stormwater during wet weather events will also continue to be explored. Other innovative rehabilitation options will be investigated to deliver cost effective alternatives to pipe replacement.

Capital maintenance programs are scheduled for a number of sanitary lift stations. These programs will

Major Investments:

- *Linear infrastructure to meet growth demands in both north and south,*
- *Condition assessment,*
- *Lining programs,*
- *Capital maintenance programs,*
- *Wastewater sewer upgrade program.*

address the lifecycle replacement of outdated equipment, OH&S considerations, and the improved resiliency of lift stations during extreme events.

6.5 Drainage Facilities and Network: \$30-\$50 million

The capital infrastructure program has been significantly increased to address emerging issues. Drainage facilities are reaching a point in their lifecycle when capital maintenance investments are needed to maintain the effectiveness of these facilities, and offset rising operational costs. Local flooding and stormwater backups continue to impact the quality of life of residents in affected communities. These investments have been compounded by the June 2013 flood, creating a new set of needs to build a Calgary that is more resilient to extreme high river events.

The WIIP proposes that funding to the Community Drainage Improvement program be increased to enable the delivery of the \$170 million of infrastructure upgrades by 2030. This new schedule will deliver the benefits of the upgrades up to ten years sooner.

The stormwater management system will be extended to meet new service demands in both the north and south of the city. This investment plan accommodates the sequencing of land servicing established by the Framework for Growth and Change. The proposed 2015-2024 WIIP also positions the Utilities to better respond to the infrastructure needs of redevelopment and proactively support targeted redevelopment opportunities.

The proposed 2015-2024 WIIP includes budget for asset management programs. Since these programs are not as advanced as those for the water network, a larger proportion of the funds in the initial years of the programs will focus on condition assessments of the stormwater facilities and network of pipes. Opportunities to enhance the performance of storm ponds will also be incorporated in these programs.

The Utilities will continue to invest in stormwater water quality projects in the 2015 to 2024 timeframe. These investments are vital if The City is to continue to comply with the Approval-to-Operate and continue to grow. In the past decade, the Utilities have constructed a number of retrofit ponds within older communities. These projects have yielded cost effective reductions in total suspended solids (TSS). Another four retrofit ponds are planned for the 2015-2024 horizon. Further necessary reductions in TSS loadings will require closer partnerships with the development industry, to embed low impact development practices and green infrastructure within developing and developed communities. Budget has been included in the proposed 2015-2024 WIIP as a catalyst for these initiatives.

Major Investments:

- *Community Drainage Improvement Program (CDI),*
- *Linear infrastructure to meet new service demands,*
- *Innovative stormwater management,*
- *Storm pond retrofits,*
- *Storm water lift station replacements,*
- *Stormwater main replacements.*

The Utilities will continue to recover from the June 2013 flood, effecting repairs to riverbanks and outfall structures. These projects will incorporate modifications to their designs to make them more resilient to future high river events. Stormwater lift stations that were impacted by the June 2013 flood will also be modified to improve their resiliency. While funding for the larger flood protection projects, currently being contemplated by flood mitigation expert panels, is uncertain, it is expected they will be funded primarily from the Provincial and Federal governments, supplemented by some additional funding through the Drainage line of service. A delivery strategy for these projects will also need to be developed.

6.6 Facilities & Equipment: \$10-\$15 million

Investments in common facilities are needed in the next ten years to accommodate the growing operations across the three lines of service, improve working conditions for operations staff, and ensure that the Utilities continue to meet OH&S regulations.

In the ten-year timeframe, investments in Information Technology will aid in optimizing the operations of the Utilities, the management of business and infrastructure data, improve infrastructure planning, and support mobile workforce management.

Major Investments:

- *Workspaces,*
- *Facilities,*
- *Furniture,*
- *Technology equipment,*
- *IT strategic plan.*

7. Funding Sources

It is estimated that approximately 60-80% of the proposed \$3.5 billion WIIP investments will be debt financed. The remaining 20-40% will be cash financed.

8. Summary

The Water Infrastructure Investment Plan (WIIP) provides a prioritized perspective for long-term strategic investments in infrastructure. The plan balances the service needs of citizens with business risks and the financial capacity of the Utilities. The result is a plan that provides a logical sequence of infrastructure investments, increases the effectiveness and efficiency of the Utilities, and maintains affordable utility rates for its customers.

The Utilities have the financial capacity to deliver the projects and programs incorporated with the proposed 2015-2024 WIIP while still moving towards full compliance with financial policies.

Further prioritization and sequencing of the WIIP is required to develop the 2015-2018 Capital Budget.

APPENDIX A

Table A1: Water Priorities

<i>Water</i>	Treatment Plants 	Distribution Network (pipes and supporting infrastructure) 
Priorities	Continue to produce clean, safe drinking water in compliance with all regulatory requirements	Ensure high quality water is distributed to customers with minimal interruption
Maintain Assets	Maintain capacity, performance and reliability at the 2 Water Treatment Plants (value \$4 B). <i>Capital Maintenance Programs</i> <i>Glenmore Dam Crest Stop Logs</i>	Limit future watermain breaks (4900 km of water mains worth over \$8 B). <i>Watermain Replacement Program</i> <i>Corrosion Protection Programs</i>
Regulatory and Environmental Protection	Respond to requirements imposed by the recent introduction of Drinking Water Safety Plans and pending regulatory changes. <i>Drinking Water Disinfection Investments</i>	Ensure drinking water quality is maintained within the distribution system. <i>Line Replacement Programs</i> <i>Dead end Main Program</i>
Services	Ensure resiliency of services under extreme operational conditions. <i>Plant Upgrades</i>	Improve water pressure and flows for fire protection and continued citizen satisfaction (94% of Calgarians reported to be 'satisfied' or 'very satisfied' with the quality of the City's drinking water services). <i>Pump Stations</i>
Growth	Continue to meet the demands of a growing Calgary and Regional customer base. <i>Water Treatment Plant Expansion & Upgrades</i>	Provide sufficient serviced land to allow for continued development of new communities and support for redevelopment areas. <i>Linear infrastructure in North East, South West, South East and North Central for new communities</i> <i>Water transmission system</i> <i>Water Pump Station Upgrades in North Calgary</i>

Table A2: Wastewater Priorities

Wastewater	Treatment Plants 	Collection Network (pipes and supporting infrastructure) 
Priorities	To treat and manage wastewater and biosolids responsibly in order to protect public health and the environment, and remain in compliance with all regulatory requirements.	Ensure reliable wastewater collection services for customers by minimizing risks of sewer backups.
Maintain Assets	Maintain plant capacity, performance and reliability at the 3 Wastewater Treatment Plants (value > \$2 B). <i>Capital Maintenance Programs</i>	Limit wastewater sewer main failures and major customer disruptions (4300km of sewer mains worth over \$6 B). <i>Condition Assessments Lining programs Main Rehabilitation Programs</i>
Regulatory and Environmental Protection	Ensure foreseeable regulatory requirements will be met with increased population growth. <i>Bonnybrook Wastewater Treatment Plant Expansion & Upgrades Bonnybrook Biosolids Dewatering Facility</i>	Limit the environmental impacts of asset failures or capacity constraints. <i>Wastewater Rehabilitation and Replacement Programs</i>
Services	Increase flood resiliency to prevent river backup into the Bonnybrook Wastewater Plant during high water events. <i>Effluent Outfall Upgrades at the Bonnybrook Wastewater Treatment Plant</i>	Increase levels of service in older communities towards modern service standards in those communities at the most at risk for sewer backups. <i>Wastewater sewer upgrade program (Bowness, 15th Street and Nose Creek Trunks)</i>
Growth	Continue to meet the demands of a growing Calgary and Regional Customer base. <i>Bonnybrook Wastewater Treatment Plant Expansion & Upgrades</i>	Provide sufficient serviced land to allow for continued development of new communities and support for redevelopment areas. <i>Linear infrastructure in North East, South West, South East and North Central for developing communities</i>

Table A3: Drainage Priorities

<i>Drainage</i>	Stormwater Treatment and Network (pipes and supporting infrastructure) 
Priorities	Protection of water resources and river habitats by reducing Calgary's stormwater impacts on the River systems.
Maintain Assets	Operate stormwater facilities effectively (4300 km of storm mains worth over \$6 B). <i>Stormwater Main Replacements Condition Assessments and Rehabilitation Stormwater Lift Station Replacements</i>
Regulatory and Environmental Protection	Reduce sediment loadings and maintain The City's Approval to Operate. <i>Storm pond retrofits Innovative stormwater management Water quality monitoring</i>
Services	Increase levels of service in older communities towards modern service standards in those communities most at risk of drainage backups. <i>Community Drainage Improvement Program</i>
Growth	Provide sufficient serviced land to allow for continued development of new communities and support for redevelopment areas. <i>Linear infrastructure in North East, South West, South East and North Central for developing communities</i>

Table A4: Facilities & Equipment Priorities

<i>Facilities & Equipment</i>	Supporting office space and technology 
Priorities	Support efficient and effective operations of the utility business units.
Maintain Assets	Maintenance of facilities and replacement of outdated technology and equipment. <i>Facilities/Furniture Technology Equipment</i>
Regulatory and Environmental Protection	Automated control systems and other critical monitoring equipment required to ensure compliance. <i>Real-time process control equipment Wastewater Lift station control system</i>
Services	Increase organizational and operational efficiency. <i>IT Strategic Plan</i>
Growth	Accommodate a growing workforce. <i>Technology Equipment Workspaces</i>