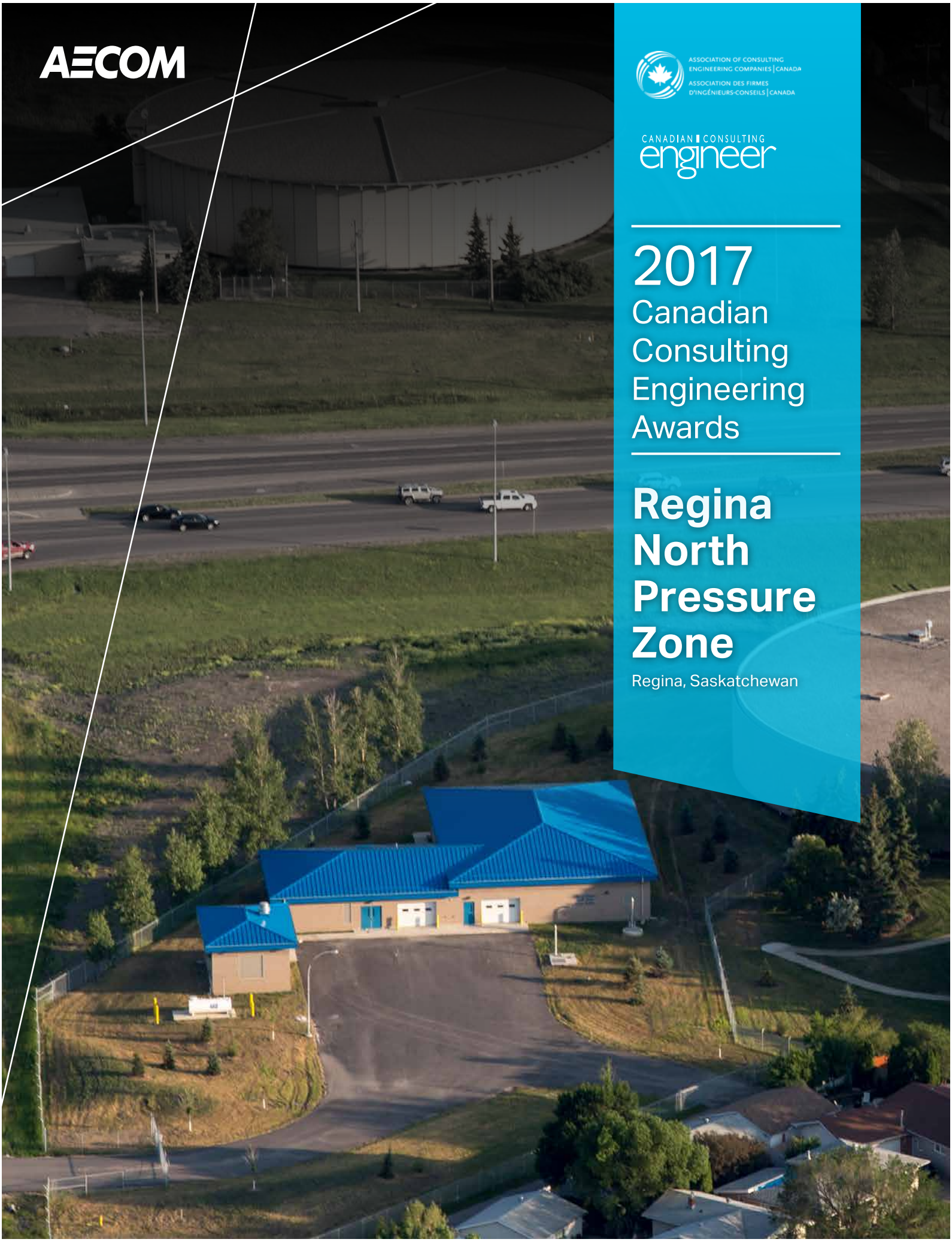

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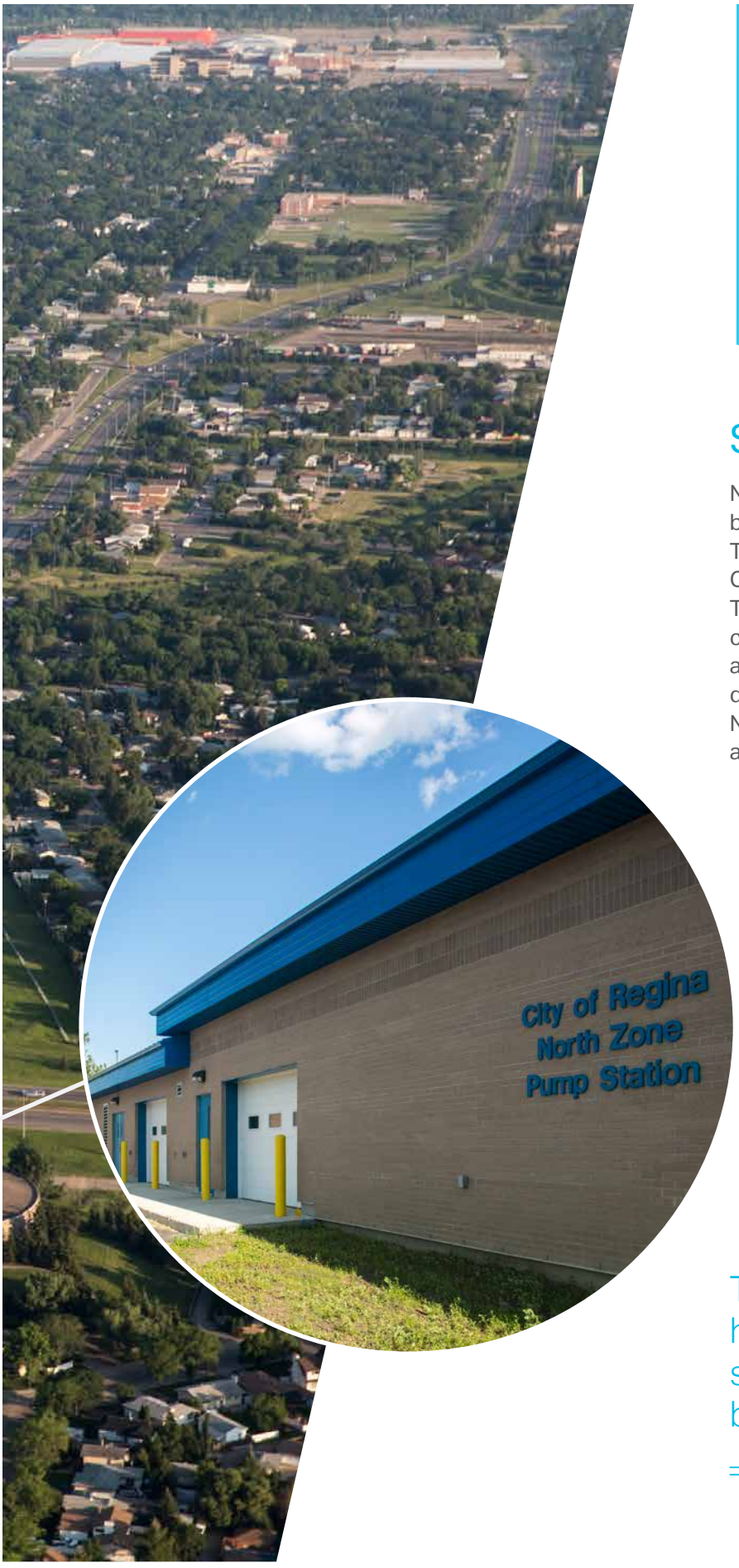
Regina North Pressure Zone

Regina, Saskatchewan

The North Pressure Zone improves water service for 25,000 residents and businesses in the northwest and is scalable to meet demand for up to 60,000 more people.

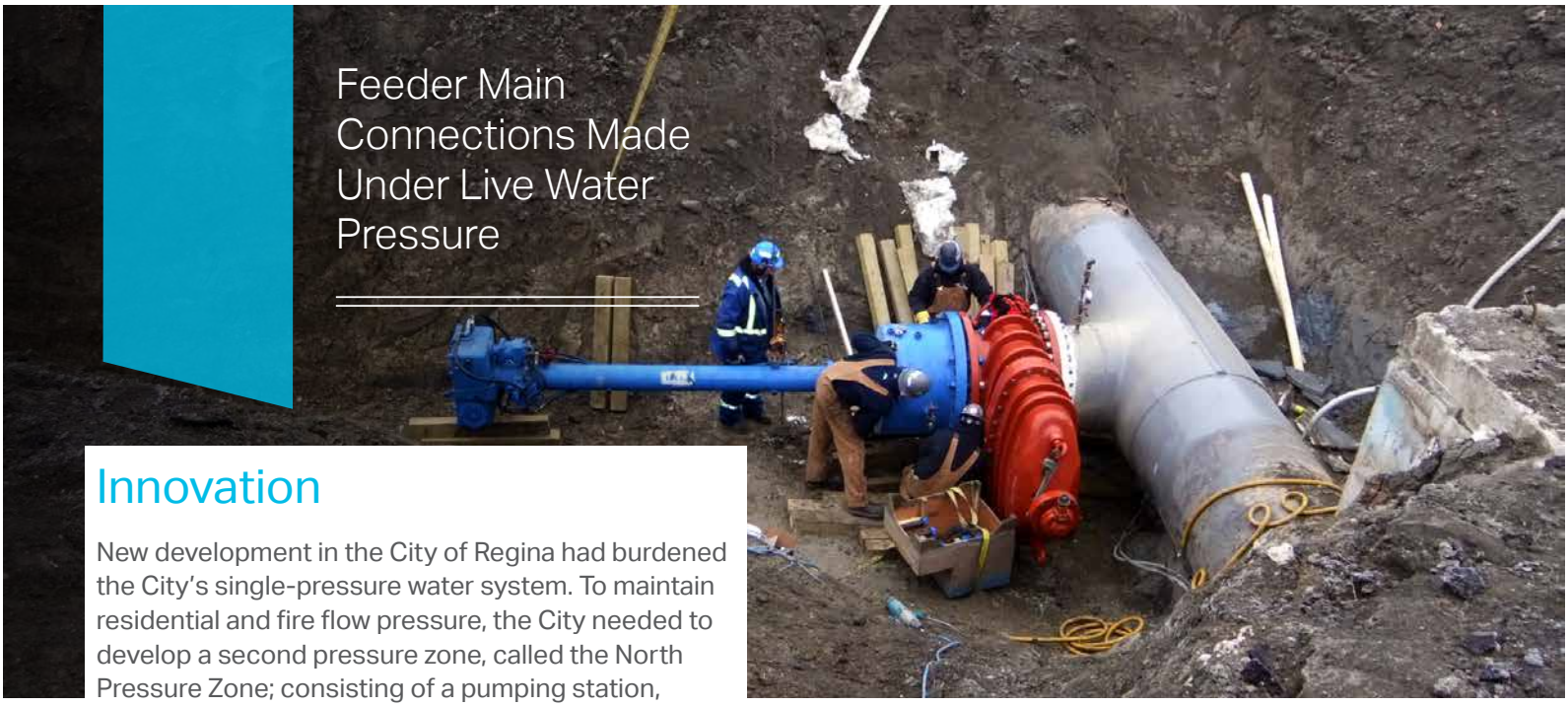
Innovative design and construction methods meant there was no interruption to water service during the complex commissioning of the new system.



Summary

New development in the City of Regina had burdened the City's single-pressure water system. To maintain residential and fire flow pressure, the City needed to develop a second pressure zone. They selected AECOM to design and oversee creation of the North Pressure Zone; consisting of a pumping station, large diameter feedermain and divide the existing zone. Completed in 2015, the North Pressure Zone has improved water service and removed a barrier to future growth.

The North Pressure Zone has improved water service and removed a barrier to future growth.



Feeder Main Connections Made Under Live Water Pressure

Innovation

New development in the City of Regina had burdened the City's single-pressure water system. To maintain residential and fire flow pressure, the City needed to develop a second pressure zone, called the North Pressure Zone; consisting of a pumping station, large diameter feeder main and separate pressure boundaries. Fully completed in 2015, the North Pressure Zone allows the City to continue to provide safe and reliable water service to a growing population and removes a barrier to future development and economic growth. This was a challenging seven-year project successfully completed within budget and on schedule thanks to the following innovations.

Feeder Main Connections Made Under Live Water Pressure

To keep water flowing in the City while commissioning the new system, a large diameter hot tap technique was used. It connected the new feeder main piping from an existing potable water reservoir to the new pumping station. The hot tap was successfully completed while the existing water main was still under pressure.

Utility and Roadway Crossing Uses Unique Solution

Several underground utility crossings were required for the selected pipeline route. The most challenging crossing contained multiple large diameter oil lines paralleling a high pressure gas line. The overall depth of the utility crossing was over 8 meters in soft soils along one of the busiest roadways in Regina.

An extendable slide rail shoring system reached the required depth while protecting the structure of the high traffic roadway above and minimizing the excavation foot print.

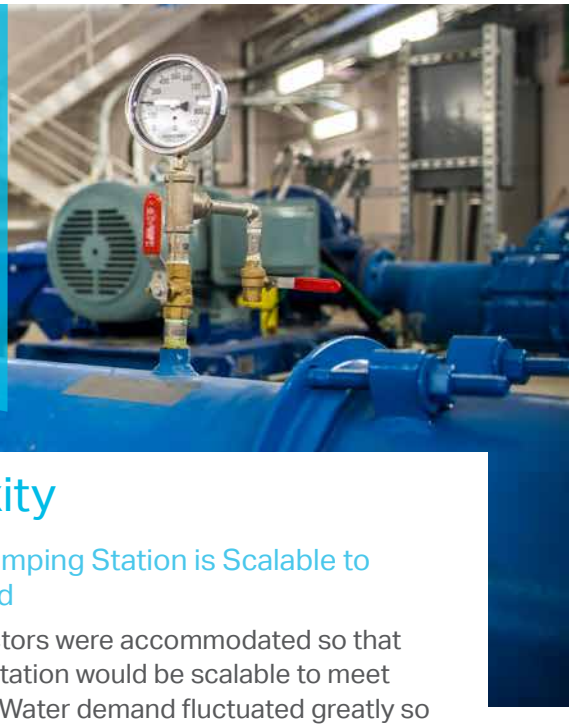
A guided auger bore machine was then assembled at the bottom of the excavation to provide the level of accuracy required for the trenchless crossing.

Isolation Vaults Separate the New Pressure Zone. Check Valves Maintain an Emergency Connection with the Old System

The isolation vaults were designed to separate the North Pressure Zone into its own boundary in order to increase residential water pressure and fire flow for the area. The challenge was designing a method to isolate the new boundary from the existing pressure zone at eight separate locations while maintaining water quality in the network and system redundancy in the event of emergency.

AECOM created a custom concrete vault with valves and bypass piping. The vault contained a check valve set to open in the event flow is required from the primary system, a small flow bypass to maintain water quality and pressure gauges for monitoring.

Slide Rail Shoring



Complexity

North Zone Pumping Station is Scalable to Future Demand

A number of factors were accommodated so that the new pump station would be scalable to meet future demand. Water demand fluctuated greatly so variable speed pumps provide flexibility, accommodate the wide range of flows and can increase the pump station output to accommodate future developments. The pump station layout provides adequate space for proper maintenance and room for expansion. The customized pump control system was sized to accommodate future expansion and integrated into the City's centralized SCADA system to allow for remote monitoring and control.

The pump station is operator friendly and scalable to meet future needs.

Feeder Main Network Installation Faces Complex Challenges

The feeder main network is located adjacent to a high traffic arterial roadway, through a commercial area and green space before crossing a double lane provincial highway, to reach the furthest limits of service. The feedermain alignment included several construction challenges such as narrow working space for pipe installation, roadway crossings, utility easements containing multiple large diameter oil pipelines and a water connection within a major intersection.

Construction Staging Allowed for Complex Project Delivery with No Interruption to Service

The construction and implementation of the North Pressure Zone occurred between 2011 and 2015. To achieve timing and budget objectives while maintaining service, the project was separated into four separate construction contracts and one material procurement contract.

The material procurement contract was issued first and allowed the construction to be systematically staged so the critical materials with long delivery times were available by the time construction contracts were awarded.

Social and/or Economic Benefits

The North Pressure Zone project was a key milestone in the City of Regina's long term goal of 500,000 residents. When taps are turned on, Regina's citizens expect a safe, good quality and abundant supply of clean water. The North Pressure Zone allows the City to meet these needs and grow to support additional residential and commercial development. The North Pressure Zone removes water pressure as a barrier to future development allowing for residential and commercial growth up to 60,000 residents.

The reliability and safety of the water system has been improved for approximately 25,000 residents and commercial business in the northwest. The new system frees up capacity within the main pressure zone to prolong the reliability of the water distribution system in the rest of the City.

In addition to these long term benefits, a number of short term benefits were realized from the team's efforts.

Public disruption was minimized during construction by using trenchless and trench box methods which narrowed the construction footprint. Traffic accommodation plans were created that allowed for safe traffic flow during construction at one of the busiest intersections and roadways in the city. Work was scheduled to minimize noise outside of acceptable hours while keeping the project schedule on track.

Traffic accomodation on Pasqua Street

Environmental Benefits

Environmental concerns were paramount in terms of the safety of the water supply, construction methods that minimized environmental and civic disruption, and building and landscape designs that minimized loss of trees.

Environmental regulations for water quality, treatment and operation of a potable water system were critical in the design and implementation of the North Pressure Zone. The team designed a method to isolate the new boundary from the existing pressure zone at eight separate locations while maintaining water quality in the network.

The pump station includes a chlorine booster system to maintain disinfectant residuals. During the early stages of the project the team met with City staff to discuss the technologies available to boost and maintain disinfectant residuals in the water mains. Technologies include chlorine gas, sodium hypochlorite and onsite sodium hypochlorite generation. All three technologies were evaluated in terms of cost/benefit and potential environmental impact and hazards in the surrounding area. Environmental hazards included type and frequency of operation and maintenance vehicles on site, accidental spills and exhaust of fumes inherent to the technology. Liquid sodium hypochlorite was selected due to its lesser impact to the surrounding environment.

The pump station building is located beside a residential area and was designed to fit into the existing environment aesthetically while preserving mature trees. Trenchless and trench-box construction techniques offered significant environmental value over conventional technologies, such as minimal disturbance to the immediate environment.

The pump station footprint was designed to preserve trees

Meeting Client's Needs

Supporting the City's Long Term Goals

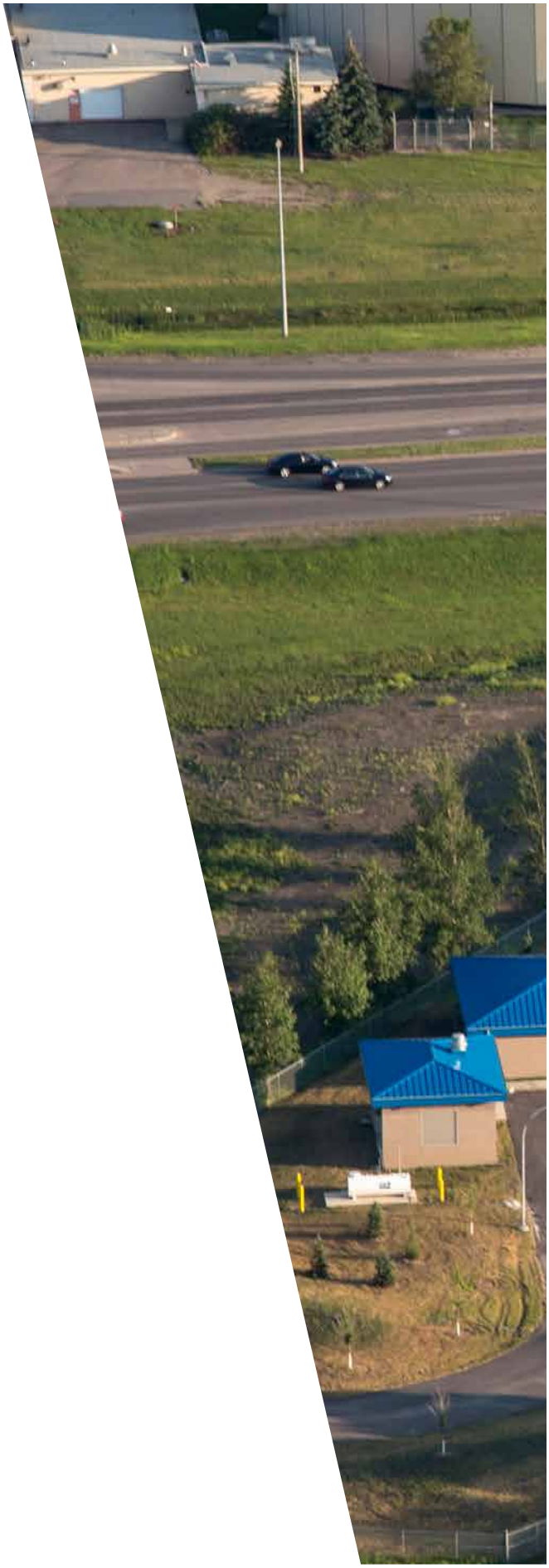
Regina was growing rapidly in the early 2000s and the City needed to improve residential and fire flow water pressure, particularly in the northwest. The system was reaching its maximum capacity and without increased flow, future growth would be hampered and the City's growth plan to 500,000 could not be realized. The North Pressure Zone allows for residential and commercial growth up to 60,000 residents. The reliability and safety of the water system has been improved for approximately 25,000 residents and commercial business in the northwest. The new system frees up capacity within the main pressure zone to prolong the reliability of the water distribution system in the rest of the city.

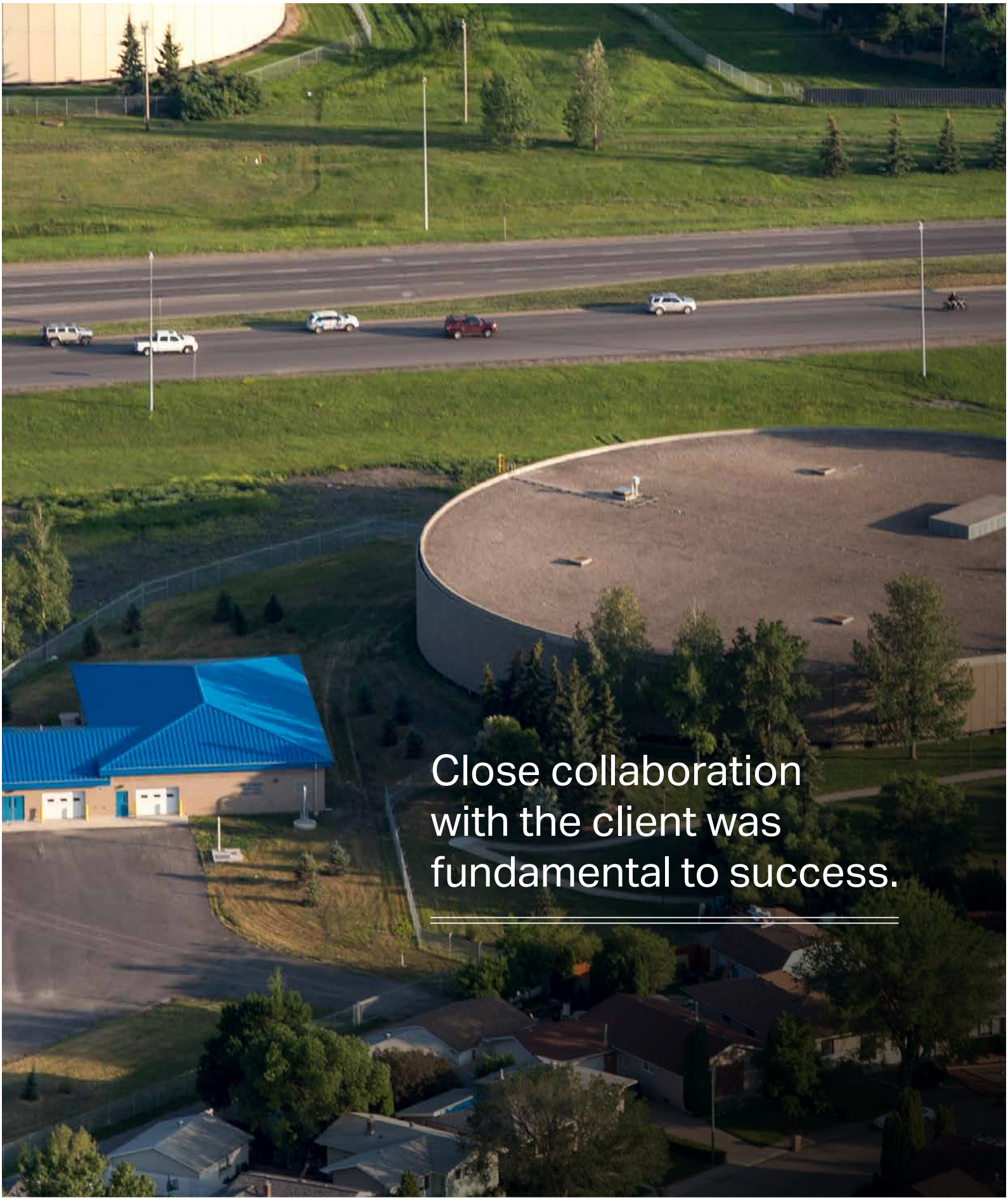
Supporting Immediate Needs While Preparing for the Future

The new pump station design met numerous short term goals for the City while being flexible and scalable for growth. The pump station layout was designed to be operator friendly with adequate space for proper maintenance and room for expansion. A gantry crane system facilitates the maintenance and removal of pumps. Variable pump speeds accommodate fluctuating demand and adequate spacing means there is room to add pumps if needed.

Teamwork the Foundation for Success

Close collaboration between the City and AECOM was foundational for success. Input from City staff was critical to the design of the building and the pump station controls. The project team from AECOM worked closely with the owner, and the sub-consultant Ritenburg and Associates, and contractors throughout the entire project.




Close collaboration
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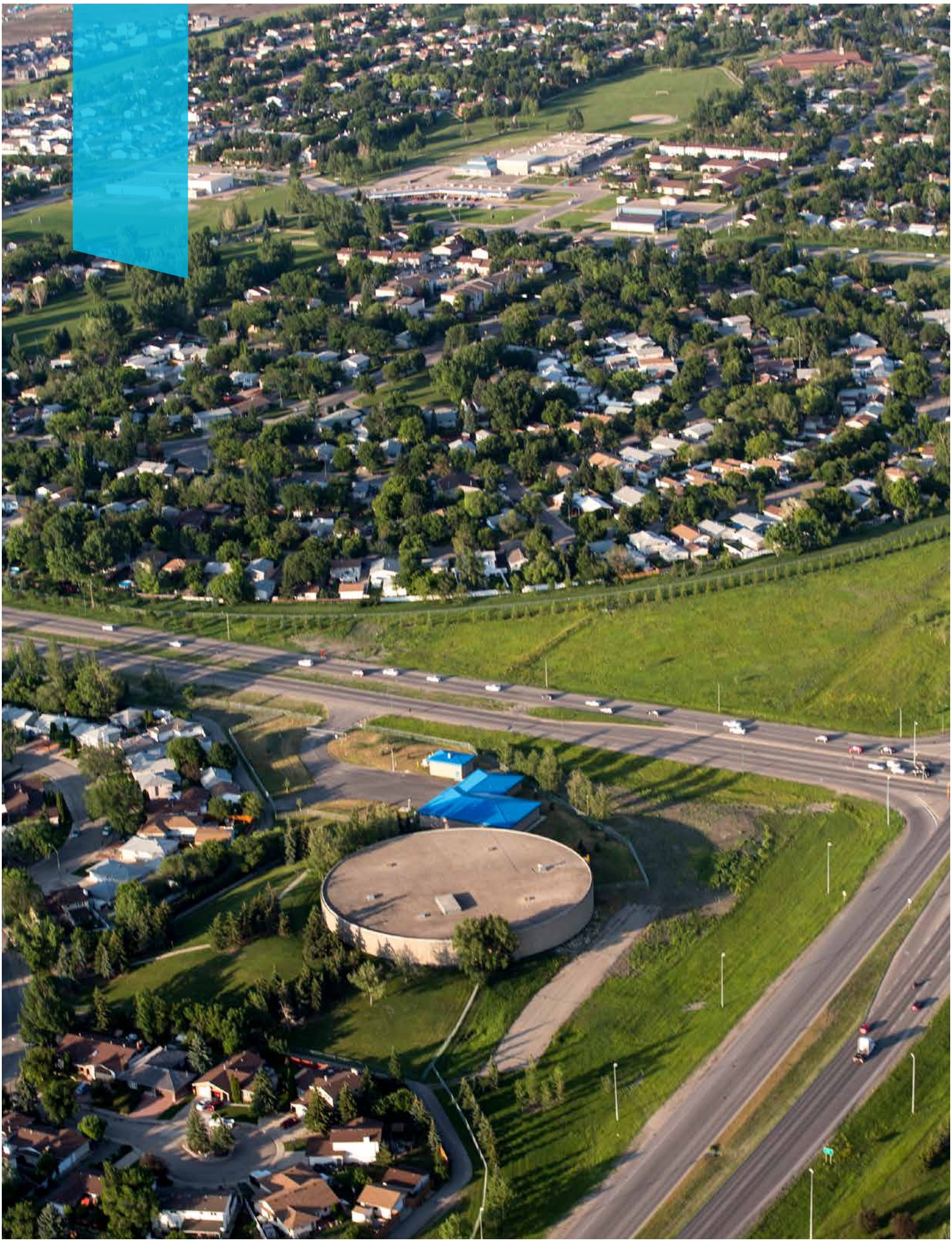

The North Pressure Zone is a key milestone in the City's long term development goal of 500,000 people.

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About AECOM

AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately $17.4 billion during fiscal year 2016. See how we deliver what others can only imagine at aecom.com and @AECOM.