2019 marks the tenth year that we have been a carbon neutral company. At Associated Engineering, we believe that we have a corporate responsibility to consider our environment, not only on the projects we deliver, but also in the manner in which we operate our business. In 2007, we made a commitment to become a carbon neutral company. We developed a Carbon Neutral Policy and established a Carbon Neutral Committee to determine our carbon footprint, evaluate how we can reduce our greenhouse gas emissions, and investigate options for carbon offsets. We achieved our goal to become carbon neutral in 2009.

As part of our carbon neutral implementation strategy, we actively reduce our carbon footprint. For example, three of our offices are in LEED certified buildings, and we have reduced our need for business travel by making use of collaboration tools. Since 2008, our overall greenhouse gas generated per employee has dropped by 22%.

Notwithstanding, our business operations do generate greenhouse gas emissions from business travel, facility energy, and personal commuting. To offset these greenhouse gas emissions, we purchase carbon offsets to become a carbon neutral company. Currently, we purchase carbon offsets from ClimateCare, which is supported by the Pembina Institute and David Suzuki Foundation, for the Gyapa cook stove and Kenyan Household Biogas projects.

Located in Ghana, the Gyapa cook stove project replaces traditional coal pots with more efficient cook stoves. This initiative reduces deforestation and frees time for children to attend school rather than collect fuel.

The Kenyan biogas project has provided over 17,000 homes with anaerobic digesters, which are fueled by animal manure to produce methane-containing biogas. Project benefits include reduced reliance on local forests for wood fuel.

A recent study by Imperial College in London, England determined that for every tonne of carbon offset we have purchased from ClimateCare, an average of $664 worth of social, economic and environmental benefits are delivered to the project communities. This means that the offsets we have purchased from ClimateCare have delivered more than 14.4 million worth of community benefits, confirming the added value of selecting carbon offsets that provide social benefits.

Members of our Carbon Neutral Committee include David Kuryk (Chair), Sean Bolongaro, Helen Chan, Lance Kubrak, Kerry Rudd, Dean Shiskowski, and Juliana Tang.
ParioPlan team joins Associated Engineering

Associated Engineering is pleased to announce that ParioPlan’s team of community planners and urban designers have joined our Edmonton office. Our merger provides our clients with the expanded services and greater synergies of our specialists in community planning, urban design, landscape architecture, community engagement, and infrastructure, transportation, and environmental planning and design.

Martin Jobke, President of Associated Engineering, says, "Our firms have a long history, having worked together for over 20 years on projects in communities throughout Alberta. We look forward to continuing to work with our clients to develop creative solutions for healthy and resilient communities."

Armin Preiksaitis, President and Founder of ParioPlan, tells us, "Throughout our long history of collaboration, I have found our firms share the same commitment to sustainable development, excellence, client service, and corporate and social responsibility. I look forward to serving our clients as One Company, Associated Engineering."

Over the years, Associated Engineering and ParioPlan have collaborated on key projects such as the Growth and Economic Development Strategy in Grande Prairie and the West Lethbridge Phase II Area Structure Plan. Our team has been recognized by the Alberta Association of the Canadian Institute of Planners with a number of awards including an Award of Merit for the McKernan-Belgravia Station Area Plan in Edmonton and Fort McMurray Fringe Area Study.

For information on our planning and urban design services, contact Senior Urban Planner & Designer, Marcelo Figueira at figueiram@ae.ca.

Introducing a fresh new look for AE Today

This edition of AE Today introduces an updated design. We hope you noticed and find it to be more engaging and easy to read.

Our Senior Communications Specialist, Michael Tolboom, BFA, CGD, drove the creative direction of the new look.

Michael tells us, "This design of AE Today provides a stronger emphasis on photography and illustration, and a more playful approach to the interplay of headline, story, and art. We’ve made minor adjustments to the design in the past, but this refresh really takes us in a new direction and offers a platform that can work seamlessly with our online content."

Michael adds, "Keep an eye out for the icon at the end of an article - it indicates additional content is available online at www.ae.ca!"
Associated opens Grande Prairie office

Associated Engineering is pleased to announce the opening of our new office in Grande Prairie, Alberta. Local resident, Sean Nicoll, Regional Client Service Manager, leads our Grande Prairie office, providing multi-discipline engineering, environmental, and project management services. Sean says, “We look forward to building our relationships with existing and new clients in the Grande Prairie region on projects that improve our communities and promote economic development while protecting the environment.”

Sean can be reached at nicolls@ae.ca. Our office address is:
Unit 204, 10301-112 Street, Grande Prairie, AB, T8V 8H6.
Tel: (587) 771-1215

Associated receives multiple honours at 2019 CEA Awards

The Consulting Engineers of Alberta recognized Associated Engineering and project partners, ISL Engineering with an Award of Excellence (Water Resources) and an Award of Merit (Project Management) for the Calgary Zoo Flood Mitigation project. Read more about this award-winning project in this issue on page 5.

In addition, we received an Award of Merit (Studies, Software and Special Services) for the NU Girder Bridge Design and Detailing Manual. This resource encourages consistency in designs and detailing, increasing competitiveness and reliability in NU Girder bridge designs. The manual also acts as a training tool for consultants and is a comprehensive design resource.

Regina Bypass Project wins Saskatchewan Premier’s Award for Excellence in the Public Service

Congratulations to the Saskatchewan Ministry of Highways and Infrastructure Phase I Completion Team, which received the prestigious Saskatchewan Premier’s Award for Excellence in the Public Service for the Regina Bypass Project. The Premier’s Award recognizes the team for their work on the $1.88 billion Regina Bypass Project, the largest infrastructure project in Saskatchewan’s history.

Associated Engineering, with prime subconsultant, CIMA+, are Owner’s Engineer on this P3 Project, delivered by Regina Bypass Partners and Regina Bypass Design Builders.

Established in 2003, the Saskatchewan Premier’s Award for Excellence in the Public Service is presented to members of Saskatchewan’s public service who have made outstanding on-the-job contributions to the government and citizens of the province.
Shaping our Shared Future

In 2018, Associated Engineering launched our new Strategic Plan, titled Shaping our Shared Future. The vision of our new plan is Creative solutions for a healthy, resilient world. With this aspiration in mind, in this new series in AE Today, you will meet members of our staff and learn about what they are doing in their professional and personal lives to help shape a more resilient, sustainable world. In the first of this series, we meet Vice President, Transportation Structures, Don Kennedy and Electrical Specialist, Scott Friel.

A bridge and seismic specialist, Vice President, Transportation Structures, Don Kennedy is passionate about improving the seismic resilience of our transportation infrastructure. Over his 30+ year career, he has worked on seismic rehabilitation projects across British Columbia and in New Zealand. Don says, “The many earthquakes around the world have shown that rapid access to a functioning transportation network is among the most critical needs of a region, their businesses, and residents to respond and recover from a damaging earthquake.”

Don has been a leader in the development and adoption of performance-based seismic design methods and codes in Canada. This framework encourages owners and engineers to communicate much more clearly on societal, owner, and the engineers’ expectations for seismic performance and post-seismic recovery. Don chairs the seismic sub-committee on the National Bridge Code, which in 2019 has included performance-based and seismic resilience into the practice of bridge retrofit. He was a co-author of Engineers & Geoscientists of BC’s guidelines, “Performance-based Seismic Design of Bridges in BC”. Don also leads a project for the Canadian Standards Association and the National Research Council to provide specific guidance to code writers to include climate-change resilience measures in the 2024 bridge code.

Through his work and volunteer efforts, Don is leading the way to improve the seismic resilience of our transportation infrastructure.

In 2015, with the price of solar panels and inverters dropping, Electrical Specialist, Scott Friel evaluated installing a solar system on his house, “I designed the system in 2016, and by 2017 the price had dropped from $3 per watt for materials to $3 per watt installed, so I couldn’t say no.” Scott designed 6 kilowatts of panels and 11 micro-invertors, with the potential to generate 7,500 kilowatt hours per year, his average household electrical usage.

At the same time, Scott investigated and then purchased an electric car. He says, “I figured that an electric car would need about 3,000 kilowatt hours per year. My new car’s average consumption is about 145 kilowatts hours per 1,000 kilometres in the summer and 285 kilowatt-hours per 1,000 kilometres in the winter. The usage has been close to my estimates and works out to about $350 per year for power.” Scott adds, “My car has an extended range of 500 kilometres, which gets me from Edmonton to Calgary!”

For Scott, replacing fossil fuels at home and on his commute is his contribution to a healthy, resilient world.

Water Resources practice hosts Capacity Building Seminar

Approximately 40 Water Resource planners, engineers, and specialists from across our offices gathered in Richmond, BC last fall to learn more about the breadth of our water management capabilities, including hydrological and hydraulic modelling and analysis, and the spatial and temporal distribution of water.

John van der Eerden, Vice President, Water Resources, tells us, “The escalation of natural disasters occurring from either too much or too little water, and at the wrong time or place drives the need for us to develop resilient solutions. This led to the seminar theme of Achieving Resilience through Water Resources Modelling.”
Calgary Zoo’s flood mitigation system reduces risks to animals and infrastructure during extreme weather

Located on an island in the Bow River, the Calgary Zoo, a major tourist attraction, is susceptible to flooding during extreme weather and high water levels in the river. During the 2013 Calgary flood, Calgary Zoo was inundated, resulting in emergency evacuation of hundreds of animals and causing an estimated $50 million in damage to the zoo.

The City of Calgary Transportation Infrastructure department retained ISL Engineering, with Associated Engineering as its main subconsultant, to design a flood mitigation system for the zoo. The goal of the system is to prevent damage to the zoo for floods up to a 1:100 year event.

Associated Engineering provided hydrogeological, stormwater, electrical, process mechanical (pump) design and inspection services, and led construction administration and coordination with the contractor and the zoo. Key personnel involved on this project were Robin Clee, Jacques Groenewald, Joe White, Scott Witzke, Corinne Arkell, Neal Barretto, and Emma Sauriol.

Project Manager, Robin Clee, tells us, “The design includes a two kilometre long berm around the island perimeter to protect the zoo from overland flooding and a continuous sheet pile wall down to bedrock also acts as a cofferdam to eliminate groundwater inundation of the zoo.” The sheet pile wall was constructed during the winter to minimize impact to visitors and zoo operations.

Our team also designed an underground, dewatering system to manage the groundwater level within the cofferdam. The automated pump system maintains groundwater within a prescribed range. Groundwater from within the island is pumped from ten dewatering wells and discharged to the Bow River via five new outfalls. Sensors in separate wells monitor groundwater levels, and transmit data to the Cloud so the information can be accessed remotely.

The dewatering system was design to be expandable, since its effectiveness could not be confirmed until the cofferdam was completed. This provision proved to be prudent as two additional wells and pumps were required to achieve the required discharge rates. Senior Hydrogeologist, Jacques Groenewald, says, “Drawdown testing of the groundwater after construction allowed us to calibrate and re-run the hydrogeological model to check the achieved dewatering capacity against that required, and confirm that the dewatering system could handle the 1:100 flood event.”

The Calgary Zoo Flood Mitigation project received an Award of Excellence in the Water Resources category at the 2019 Consulting Engineers of Alberta Showcase Awards Gala.
Located in a remote area in northeastern Saskatchewan, the Hatchet Lake Dene Nation is a community of about 1500 people that continues to grow rapidly. Having provided advisory and engineering services to the community for more than 30 years, Associated Engineering recommended an analysis of the community’s existing water and wastewater system to ensure the systems could accommodate growth and ascertain any issues.

Project Manager, Bob Hergott, tells us, “The analysis identified a number of system components that required upgrades, the most substantial of which was the water treatment plant. The main issues were raw water and treated water capacity problems. The existing water treatment equipment was consistently operating nearly 23 hours per day, thus putting a significant strain on the system. There was also concern regarding firefighting capacity.”

The water treatment plant project involved raw water pump upgrades, a new reservoir, a second clarifier, larger distribution pumps, fire pump conversion at the satellite water distribution centre, and installation of emergency generators to support water treatment plant operations.

The location of the Hatchet Lake Dene Nation presented the greatest construction challenge. The remote community does not have all-weather road access. Ice road access is available for two months each winter, subject to adequate freezing temperatures to build ice. Substantial ice is required because heavy loads for construction materials, gasoline, and propane are transported into the community. Careful planning ensured an effective project delivery plan.

The changing climate was considered in the design of water treatment plant upgrades. Hatchet Lake Dene Nation has experienced more warm weather periods over the last several years, and more autumn rains and winter snow. Heavy snow melts have resulted in large quantities of sediment reaching the lake which has affected the raw water quality entering the treatment plant, and therefore water supply. The sediment deposition has led to precautionary drinking water/boil water advisories issued for periods of time.

The $7.2 million project was completed on time and on budget in the summer of 2018. Associated Engineering provided multi-discipline engineering services for the water and wastewater system analysis and the water treatment plant planning, design, and construction. Key personnel on this project included Bob Hergott, Shengtao Weng, and staff from offices in Saskatoon and Prince Albert.

Upgrades to the Hatchet Lake Water Treatment Plant provide long-term drinking water capacity

Through collaboration, careful planning, and understanding of the local conditions, the team developed a cost-effective project delivery plan.
Mosquito Creek Spirit Trail is Canada’s first pathway that travels below sea level

The Spirit Trail is a 35 kilometre greenway that extends from Deep Cove to Horseshoe Bay in the BC Lower Mainland. The trail provides a safe route for pedestrian and cyclist to access parks, commercial and residential areas, and transportation hubs.

Situated along a picturesque waterfront overlooking Burrard Inlet, the Mosquito Creek Marina section of the Spirit Trail is one of the last and most challenging sections of the trail. A joint initiative of the City of North Vancouver and Squamish Nation, this 250 metre long section of the trail traverses the Mosquito Creek Marina on Squamish First Nations Land. Project Manager, Craig Schaper, tells us, “Prior to the construction of this section of the trail, pedestrians either stopped at the marina or took a long and relatively unsafe bypass route along steep inclines, negotiating heavy traffic, and crossing a railway corridor.”

A construction management project delivery approach allowed early contractor involvement to enhance constructibility and cost-effectiveness. Collaboration between the City of North Vancouver, Squamish Nation, Core Project Management, the contractor, and stakeholders helped to develop an innovative design that minimized impact on the marina and the public.

The new trail includes a pedestrian bridge over Mosquito Creek, a concrete walkway, lighting, a marina boatlift, and earth retaining systems. A portion of the trail is constructed under the boatlift, with the pathway descending 3.4 metres below sea level during extreme high tide. A drainage pump station was designed to manage rainfall runoff into the tunnel, as well as potential inundation during extreme storm events. Associated Engineering led the multi-disciplinary team, including structural, marine, civil, mechanical, electrical, lighting, and geotechnical engineers; environmental specialists; and landscape architects. Key staff included Craig Schaper, Helen Du, Natalya Kucherenko, Christian Brumpton, Chris Hegele, and Shirlyn Liao.

Senior Structural Engineer, Helen Du, says, “The typical daily tidal fluctuations of around 3 metres resulted in constantly changing loading to the tunnel structure, with king-tide fluctuations being even larger. Our design accounted for significant buoyancy forces during extreme high tides.”

To facilitate construction of the piled foundations in short tidal work windows, we designed precast pile caps and custom pile collars to enable the contractor to efficiently land each pile cap on the piles and install cast-in-place monolithic connections. Similar accelerated construction details were developed for the precast pile caps of the boatlift and pedestrian bridge.

Completed in July 2018, the Mosquito Creek Spirit Trail provides safe access to parks and amenities for residents and visitors.

Trail users appreciate the improved safety and ease of access to parks and amenities.
Climate Change Conversations

Considering climate change at the local scale

by Jeremy Fyke, Ph.D., Climate Science & Modelling Specialist

In the previous issue of AE Today, we described how we know with confidence that human activity is driving ongoing climate change, and how this change will accelerate in the future. In this edition, we will explore what this change means for climate at the local scale, how it relates to natural weather patterns, and how it can be integrated into engineering design.

What climate change metrics matter at the local scale?

Often climate change is described in climate science reports and the media as changes in broad statistics like 'annual average precipitation', 'global average temperature', or 'global sea level rise'. But for engineers, what may matter even more are changes to infrequent or 'extreme events' at the local scale. This is because these types of statistics often relate to project-specific engineering design values or targets. Examples of such statistics that we often encounter include changes to the return periods of more frequent and higher intensity rainfall events, increases in the magnitude of hot summer days, or maximum run-up heights of ocean storm surge events.

What factors need to be considered in assessing local climate change?

Changes to extreme events combine the signal of natural weather fluctuations with the underlying 'push' of climate change. For example, understanding climate-driven ocean storm surge run-up changes requires consideration of the natural processes that cause storm surges, such as local winds and barometric pressure, and the underlying signal of increasing water levels from human-caused glacier melting and ocean thermal expansion. Additionally, unique regional natural and built conditions are also factors to consider; for example, vertical land motion due to regional geologic processes will play an important additional role in determining future Canadian coastal storm surge severities. Identifying these unique conditions brings local expertise into play and is critical for translating climate data into engineering design and analysis.

How can climate-driven changes to extreme events be reflected in engineering design?

It is difficult, although increasingly possible, to claim that aspects of individual extreme events, such as a particular storm surge, directly result from climate change and not simply natural weather fluctuations. Instead, it is more appropriate to identify changes to the average magnitude or frequency of occurrence of such events. Fortunately, many engineering design thresholds related to environmental conditions are also described in terms of average magnitudes or frequencies of occurrence. This simplifies the workflow for integrating climate change information into engineering design! For example, 1:100 year magnitudes of projected future storm surge run-up heights could be used in coastal infrastructure design in lieu of past observed historical 1:100 year storm surge observations. In this sense, providing an appropriate Standard of Care for clients will, in part, involve integrating the statistics of tomorrow’s extreme events into today’s engineering design.

For more information, contact Dr. Jeremy Fyke at fykej@ae.ca.
A community of 17,000 located west of Edmonton, Alberta, the Town of Stony Plain has established a visionary Community Sustainability Plan. This plan sets a holistic direction for social equity, economic viability, cultural vitality, and environmental responsibility. Aligning with its sustainable planning vision and Community Master Plan, the town initiated a program to redevelop its downtown core, which included an extensive consultation process. The public and stakeholders identified the need for improvements such as bicycle route linkages, landscape improvements, public seating, traffic calming, spaces for cultural events, and unique shopping, dining and gathering experiences.

Project Manager, Diego Mejia, tells us, "The stakeholder and public meetings provided a significant amount of information. We collated and used this data to inform our conceptual designs of the downtown redevelopment. To help convey the design to stakeholders, we prepared an interactive 3D visual model, including both the existing buildings and the proposed concept. We received very positive feedback from stakeholders and unanimous approval to move forward with the design."

The town implemented a phased approach for its Downtown Redevelopment. Phase 1 included reconstructing the downtown back lanes. In the short-term, the back lanes were enhanced to serve as temporary pedestrian and vehicular detours for subsequent phases of the redevelopment. In the long-term, the back lanes will become multi-use pathways.

In 2018, we began Phase 2 of the Downtown Redevelopment. The reconstruction of the downtown Phase 2 includes two city blocks and two lateral streets. We developed the streetscape concept, and completed detailed design of the streetscape, civil infrastructure, electrical, and structural works.

Project Lead, Chris Parfitt, says, "To improve environmental sustainability, we used soil cells which are soil structures that have sufficient soil to support root growth, allowing trees to reach full growing potential. The load-bearing soil cell support hard surfaces that accommodate vehicles and pedestrians. This technology is used around the world and is gaining traction in Canada."

The team also designed a self-watering system that channelizes surface runoff through the soil cell via catch basins and perforated pipes. Overflow is redirected into the main sewer system.

Key personnel involved on this project include Diego Mejia, Chris Parfitt, Steven Tran, Laurel Richards, Lisa Butler, Kevin Carnagie, Tyson Buckley, Dan Chartrand, and Melvin Lacebal.
Building Communities

Take Your Work to Kid(s) Day
Shirlyn Liao, a Senior Structural Technologist in our Vancouver office, gave a presentation to Grade 9 IT students, including her son, in Coquitlam, BC. She showed output from some of the visualization tools used in bridge engineering, and demonstrated some new commands in SketchUp, a 3D design tool, which the students are learning. Thanks to teachers for the invitation, and congratulations to Shirlyn for a well-received presentation.

Volunteering at the Regina Food Banks
Collin Halliwell, Thomas Goddard, Madison Kot, Chelsea Cooke, Stephanie Reid, Chad Bosgoed, Jared Faber, Justin Nenson, and Nicole DeBond in our Regina office helped the Regina Food Bank with preparing many Holiday Hamper boxes for families in need during the Christmas season. Thank you all for generously volunteering your time!

Lhoosk’uz Dene Nation Water Awareness Day
Manager, Freda Leong and Water Process Specialist, Keith Kohut attended a water awareness event at the Lhoosk’uz Dené Nation. Along with Res’eau WaterNet, the First Nations Health Authority (FNHA), and several dozen members of the community, we discussed options for helping Band Members secure a safe drinking water supply. The FNHA ran a taste test to see if we could tell the difference between treated, untreated, chlorinated, and bottled water. Mási chok (thank you) to Brenda Thomas and her team for organizing the event.

“Smart City, Smart Water” Panel Discussion
The Association of Chinese Canadian Environmental & Municipal Engineering Professionals (CCEMP) held a “Smart City, Smart Water” Panel Discussion in Toronto. Industry leaders and practitioners were invited to share their knowledge and best practices on this topic, including Elia Edwards, Division Manager of Water in our Ontario operation. The event was organized by Kevin Yu, a Process Engineer in our Toronto office, who currently serves as the Chair of the CCEMP.
Employee News

Denis Michaud, AScT, IRCA QMS Auditor has joined our Vancouver office as a Quality Manager. He has almost 30 years of experience in quality management on transportation, industrial, commercial, and residential projects. Denis’ experience includes quality management on the Site C Clean Energy Project, Evergreen Transit Line, and Inuvik-Tuktoyaktuk Highway.

Grant Hall, P.Eng. has joined our Edmonton office as a Project Manager. He has over 18 years of experience in the design and project management of municipal, civil, and water projects from the design stage through to construction management and post-construction activities.

Mohammed Nazief, P.Eng., Ph.D. has joined our Edmonton office as a Structural Engineer. He has 12 years of experience on commercial, institutional, municipal infrastructure, and industrial projects. His expertise includes analysis and design of buildings, water retaining structures, and foundations.

Ben Strokappe has joined the company as a Field Technician. He has four years of experience in winter road construction, ice safety, and environmental monitoring programs. Ben is also an Army Reservist with 41 Combat Engineer Regiment.

Dawn Dierker, B.Sc., CHSC has returned to our Saskatoon office as a Analytic & Training Specialist. She has 15 years experience in water and wastewater operations and training. Her previous water and wastewater experience included positions at Class 4 water and wastewater plants and laboratories.

Ryan Ancelin, M.E.S., P.Biol. has joined our Calgary office as a Senior Environmental Planner. He has 15 years experience completing and managing environmental assessments at the municipal, provincial, and federal levels throughout Western Canada.

Chad Franklin, C.E.T. was named a Top-Rated Speaker at Autodesk University 2018, held in Las Vegas, NV. This is the second consecutive year Chad has received this honour for knowledge-sharing. Based in our Saskatoon office, Chad is a Corporate CAD Coordinator with 20 years of experience.

Steven Vidito, P.Geo. has joined our Calgary office as a Senior Environmental Scientist. He has over 30 years of experience specializing in contaminated sites and remediation in the consulting and mining/exploration industries. Steven will lead contaminated sites and remediation projects in Alberta and Saskatchewan.
Climate change considered in restoring vital infrastructure following flood damage in Chippewas of Nawash First Nation

The Chippewas of Nawash First Nation is located on the Bruce Peninsula, approximately 60 kilometres north of Owen Sound, Ontario. In October 2016, the area experienced heavy rainfall which caused serious flooding, resulting in washouts and erosion that impacted the roads and drainage systems. Resulting temporary and permanent road closures restricted access and impacted the community for several days.

The community sought a holistic drainage review of the area to identify necessary culvert repairs, ditching improvements, and channel alignment modifications to better match the natural flow paths of existing streams, minimize erosion, and improve surface drainage. The First Nation engaged Associated Engineering to provide the drainage review and engineering services for design and construction.

Project Manager, Anna Comerton, tells us, “The first step of the analysis included delineating and characterizing the culvert watersheds using a combination of digital elevation models and GIS tools. Using this information, a hydrological assessment was performed using three runoff estimation methods. A hydraulic analysis was subsequently undertaken to evaluate the capacity and performance of the existing culverts, as well as to identify alternative design solutions.”

Angela Peck, Hydrological/Hydraulics Analysis Lead, says, “This evaluation included a climate change sensitivity analysis which revealed that rainfall intensities may increase 8% over the 50-year design service period, impacting the sizing of the two major culverts.” The climate change sensitivity analysis was completed using the Ontario Ministry of Transportation intensity-duration-frequency Curve Tool.

One of the major culverts discharges directly to the lake, so there are both significant fish habitat considerations, as well as impacts on the hydraulics of the proposed replacement culvert structure. Construction of improvements will adhere to the Department of Fisheries and Oceans restricted activity timing windows to protect fish and habitat.

Key personnel involved on this project include Anna Comerton, Elia Edwards, Simone Bourke, Stan Matthew, Sarvejit Nagi, Christian Concolino, and Angela Peck.

We have built a strong relationship with the First Nation through this project and are now assisting with two other community projects - a condition assessment and repairs to the elementary school and a conceptual design of their ice rink.