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WATER CATEGORY

Category: Water - Asset Management

DEPLOYMENT OF ADVANCED INLINE INSPECTION TOOLS AND CONDITION ASSESSMENT OF RIVER CROSSING PIPELINES IN WINNIPEG, MANITOBA

All Authors:
Marv McDonald, Chris Macey, Adam Braun, Armand Delaurier

Presenter(s):
Marv McDonald

The City of Winnipeg has over 120 water and wastewater pipelines across the Red and Assiniboine Rivers and their local tributaries. The wastewater crossings include both wastewater siphons and force mains while the water main inventory includes both transmission and distribution mains. Inventories include a diverse array of pipeline materials including ferrous materials, concrete pressure pipes, AC pipes and thermoplastics. About 45% of the inventory is over 40 years old, the oldest having been in service approximately 100 years.

AECOM was engaged by the City of Winnipeg to carry out comprehensive condition assessments of the more critical river crossings, which included 19 pipelines at 14 locations; 13 wastewater and 6 water main crossings. The ferrous metal pipelines were inspected using Remote Field Eddy Current Technology (RFEC) between 2012 and 2015 with the intention of assessing corrosion related deterioration. Deployment of inline inspection tools in a municipal environment required careful planning, development of pipeline access for pressure pipelines, deployment of complex flow control systems.

By gathering real condition data on the City of Winnipeg's more critical river crossings AECOM was able to develop a staged capital program including slope stabilization and pipeline rehabilitation, saving the City the costs associated with full replacement of these crossings.

Category: Water - Asset Management

DESIGN FOR COMMISSIONING FULL CIRCLE

All Authors:
Josh Yohnke

Presenter(s):
Josh Yohnke, B. Tech, A.Sc.T., Associated Engineering

A plant process control narrative is similar to the body's nervous system in that it connects nearly everything within a facility. Therefore, an effective process control narrative is an

essential component of system design: its benefits include mitigating design omissions, field changes during construction, commissioning risk, and long-term operational problems following completion of a project.

This presentation draws on experience from the recent City of Saskatoon Avenue H Reservoir and Pump Station project and addresses the importance of:

- A clearly structured and thorough process control narrative that addresses the functional requirements of a system under normal operating conditions as well as response to failure modes, degraded and manual modes of operation for all systems and components.
- Clear presentation of alarming, operator set-points and interlocks.
- Using the process control narrative as the basis for development of testing and commissioning plans, and how these plans are used to close the loop between design intent and actual operation.
- The designers using the preliminary control narrative and commissioning plans to incorporate the necessary equipment, piping and capacity to allow for commissioning to be completed without adversely affecting the operation of other systems
- The importance of engagement with the end-user Engineering and Operations teams during development of the process control narrative.

Category: Water - Asset Management

ASSET MANAGEMENT - FROM THEORY TO PRACTICE

All Authors:
Oscar Aular

Presenter(s):
Oscar Aular, P.Eng., Infrastructure Engineer, The City of Calgary

The water utility provides five main lines of business: water distribution, water treatment, sanitary collection, sanitary treatment and drainage.

The infrastructure assets to provide those services have a total replacement value of $40.2 billion.

Asset management plans (AMP) are aimed to guide responsible management of assets, in compliance with regulatory requirements, and to inform the decision making process when assessing funding requirements. Asset management plans highlight responsive management of assets (and services provided by these assets); compliance with regulatory requirements, and awareness about funding needed to deliver the required levels of service.

However, translating these concepts into documented initiatives and every day activities presents a singular challenge given the unique make-up of each organization.

The key elements of infrastructure asset management are:

- Document the services/service levels to be provided and the costs of providing the service,
- Communicate the consequences for service levels and risk, where desired funding is not available, and
- Provide information to assist decision makers in managing service levels, costs and risks to provide services in a financially sustainable manner

Category: Water - Asset Management

VS OR CS PUMPING: ARE YOU CONSIDERING THE RIGHT VARIABLES?

All Authors:
Bob Hawboldt, Ph.D., P.Eng.

Presenter(s):
Bob Hawboldt, Ph.D., P.Eng., Senior Specialist, Associated Engineering

Variable speed pumping is considered to be superior to constant speed pumping in applications where either pressure or flow regulation are required. But is it? Given the specific process requirements, the decision to use variable or constant speed pumping depends on control effectiveness and life cycle cost.

The presentation will provide a general discussion on the hydraulics of pump control performance and pumping energy input for a variety of typical applications. These include combinations of high and low static lift system curves with different classes of pump curves. However, the discussion will also address the effect of pumping load profile on energy input requirements and long-term pump performance.

Using pumping specific energy estimates, the relative benefit of variable to constant speed pumping can be readily compared. When used with the load profile, or flow frequency distribution, and a pump duty estimate, the annual pumping input energy can be estimated with greater precision. Consequently, various pumping options can be compared quantitatively in terms life cycle cost as well as their ability to meet their process control requirements.

The presentation will also include specific examples of pump selection of both variable and constant speed pumps to demonstrate the sensitively of total energy input to pump curve shape, system curve shape and load profile.

This material is based on input to the upcoming update to the Hydraulic Institute's Application Guideline for Variable Speed Pumping to be published later this year.

Category: Water - Asset Management

DEVELOPING AN ASSET MANAGEMENT FRAMEWORK

All Authors:
Lindsay Hall

Presenter(s):
Lindsay Hall, P.Eng., Specialist, Asset Management Strategy, EPCOR Water

EPCOR Water Services Inc. (EWSI) began development of their Asset Management Roadmap / Framework in 2011. EWSI attempted use a traditional framework development process, but struggled to gain buy-in and to finalize framework elements. During the same time period, ESWI successfully support multiple site initiatives related to specific elements of Asset Management, such as Sustaining Capital Plans and Key Performance Indicators.

The Asset Management Office at EWSI decided to rework their approach to Asset Management implementation and to build on their success with the site specific initiatives. A gap analysis indicated that lack of Asset Management Plans (and all of the information, standards and procedures that would be used to develop Asset Management Plans) was a key concern for many areas of the business.

The Sustainable Infrastructure Management Program Learning Environment (SIMPLE) 10-Steps of Asset Management approach was identified as a structured process that could be implemented to bridge this gap.

In 2014, a pilot project focussing on the 10-Steps of Asset Management (SIMPLE) was completed. The pilot project allowed demonstration of the start-to-finish development of an asset management plan, and the development and field testing of several standards, procedures and tools that will become part of the Asset Management Framework. This approach demonstrated the value of asset management, resulting in greater understanding and acceptance of asset management throughout EWSI.

Category: Water - Asset Management

COMMISSIONING FOR SUCCESSFUL TURNOVER

All Authors:
Rob St. Pierre, P.Eng.

Josh Yohnke, B. Tech, A.Sc.T., Associated Engineering

Presenter(s):
Rob St. Pierre, P.Eng., City of Saskatoon

The City of Saskatoon (COS) Water Treatment Plant recently completed a $45 million upgrade to their Avenue H Reservoir that added reservoir capacity, UV disinfection, transfer pumping, and new high lift pumping. Successful turnover of the project required seamless integration into the existing treatment and distribution systems while maintaining plant operation. Overcoming these challenges not only required well planned construction, but also an innovative, thorough, and diligent commissioning process.

Research has found a statistically high probability of equipment experiencing early life failure when proper start-up procedures are not employed. In an effort to combat this phenomenon, commissioning processes were developed to verify both the operation of individual system components as well as whole systems. This was achieved through execution of prescribed pre-functional and functional performance tests that confirmed equipment and system response to routine and failure mode operations.

Implementation of this comprehensive and systematic commissioning program required a methodical approach with extensive coordination. Given the complexity of the systems and requirement for the facility to maintain continuous operation, all systems and their individual components were tested in a defined sequence to verify compliance to design and the COS's operational requirements. Coordination of test procedures became critical to ensure all required equipment and personnel, including representatives of the Owner, Engineer, Contractor and other stakeholders, were engaged at appropriate times.

This paper describes specific project examples to demonstrate that diligent commissioning effectively mitigates operational risk and increases the level of operational confidence; thereby, increasing the likelihood of successful project turnover.

Category: Water - Distribution

CALGARY WATER MAIN BREAK PREDICTION MODEL

All Authors:
Joanna Line, Roy Brander
City of Calgary

Presenter(s):
Joanna Line, P.Eng., Senior Infrastructure Engineer with Asset Planning, City of Calgary

Over the past six years, City of Calgary engineers have used extensive main break records and inspection results to create a model that predicts the future behavior of metallic mains, based on diameter and material grouping. During model development, we also determined the ideal range of historical main break data to use for predictions, and altered the strategy for main replacement limits.

The first predictive model was completed in 2012. In 2015, the model was reviewed to ensure it was still predicting accurately. This presentation will discuss the formation of the original predictive model, the 2015 review, and how the City of Calgary uses the results to guide their replacement and rehabilitation programs.

Category: Water - Distribution

CORROSION MONITORING AND ACTIONS FROM THE WATER TREATMENT PLANTS TO THE DISTRIBUTION SYSTEM IN CALGARY, ALBERTA

All Authors:
Jian Fu Deng, Kelsey Kundert, Kelly Stonehocker, Dalibor Ambrus, Nancy Stalker, John Jagorinec

Presenter(s):
Jianfu Deng, Team Lead - Lab Instrumentation Water Quality Services - Laboratory Operations, City of Calgary

For the last decade, there have been several major process upgrades implemented in both Glenmore and Bearspaw Water Treatment Plants in Calgary. Those upgrades include coagulant agents change, pre-treatment facility (Actiflo), carbon dioxide for pH suppression, and sodium hypochlorite on-site generation. In order to ensure a safe and reliable drinking water supply after the implementation of the process upgrades, monitoring of water quality and corrosion in distribution system became a critical task. The water quality (trace metals, major ions, pH, etc.) in raw and effluent of water treatment plants, treated water from different parts of the distribution system, and tap water in residences, has been regularly monitored and the results will be discussed. Water quality indices, including Saturation Index (SI), Langelier Stability Index (LSI), Ryznar Stability Index (RSI) and Puckorius Scaling Index (PSI) and Calcium Carbonate Precipitation Potential (CCPP), used as corrosive tendency monitoring tools, will be also presented. Considering that the internal plumbing system of residences is an integrated part of the whole water distribution system, the Tap Water Sampling Program has been conducted from 2008 to 2015. Overall corrosion situation, short and long term corrective actions will be summarized in the report as well.

Category: Water - Distribution

BENEFITS OF A HOLISTIC SYSTEM WIDE HYDRAULIC TRANSIENT ANALYSIS

All Authors:
Eppo Eerkes, P. Eng.

Presenter(s):
Eppo Eerkes, P.Eng., AECOM

Water managers are becoming more aware of the impacts that hydraulic transients have on their systems in terms of structural integrity, water quality and operational efficiency. In the past, protection design relied on rules of thumb and 'worst case' conditions. Systems have evolved since facilities were constructed.

Significant advances in modelling software and extensive system data can be leveraged to conduct comprehensive transient assessments to predict transients and evaluate operations system-wide, as well as predict the influence of proposed capital works and demand growth. This offers operators with a better picture of transients at the pumping facilities and distribution to facilitate more intelligent decision making.

Case studies from several municipalities are presented. These desired an evaluation of protection and operations of the systems in their entirety. Modelling included routine operation and severe global power failures. This evaluated protection effectiveness as to whether they benefit or are detrimental to the system, determined the criticality and benchmarking of protection, evaluated where to enhance transient protection and prioritized increased inspection and rehabilitation. Operational and process procedures were evaluated. Modelling outputs were correlated with pipe condition rating to characterize transient related structural deterioration and water quality vulnerability due to negative pressure intrusion.

A risk based assessment of the reduced vulnerability with enhanced protection led to the development of a holistic transient management strategy. This provided guidance and priorities for protection, rehabilitation and maintenance within vulnerable areas, short and long term best practices, as well as evaluated impacts of new infrastructure or system expansion.

Category: Water - Distribution

ELIMINATING CONFINED SPACE ENTRY IN AIR RELEASE VALVE CHAMBERS

All Authors:
Derek Traquair - Martech Inc.

Presenter(s):
Derek Traquair, Martech Inc.

Eliminating Confined Space Entry in Air Release Valve Chambers

Confined space entry is a considerable concern for municipalities as infrastructure needs by the community, and the necessity of streamlining operator efficiencies continue to grow. Confined space requires significant training, health and safety concerns, and time commitments for tasks that can and should be conducted in a safer, more cost effective manner.

The City of Leduc has taken a large step in eliminating confined space entry with their air release valve replacement program. The City is taking out traditional air release valves that cost more to maintain, require increased man hours, and present greater safety concerns;. These are being replaced with self contained ARI air release valves, capable of being maintained at the surface. This process requires a fraction of the time, cost and eliminates a large portion of the hazards that a traditional maintenance program entails.

This paper and presentation serves as a haw to guide to the installation and maintenance of a self contained ARI air release valves for both water and wastewater systems. It will detail the benefits that the City of Leduc have experienced and outline how other Alberta communities can address and repeat this success.

Category: Water - Emergency Response

UTILIZING THE INCIDENT COMMAND SYSTEM (ICS) FOR RESPONDING TO WATER RELATED INCIDENTS

All Authors:
Martin Pollard, City of Calgary

Presenter(s):
Peter Berridge, Business Continuity & Emergency Management Planner, City of Calgary Water

Every water utility must be prepared to respond to a variety of incidents that may impact or threaten their ability to provide safe drinking water to their customers.

While the type and scale of incidents may vary, there is a common response need for a reliable, proven incident management system. In North America, the Incident Command System (ICS) is the most common and most successful incident management system. ICS is used by first responders, various levels of government, industry and non-governmental organizations. The success of the system is its' ability to address the most commonly identified "incident response challenges": Lack of Accountability, Lack of a Planning Process, Effective Supervision and Division of Labor, and Resource Coordination.

This presentation will focus on why the City of Calgary's Water Department has recently chosen to adopt the use of ICS for responding to water related incidents, with an emphasis on its' use in their Emergency Operations Centre. By referencing actual Calgary Water incidents, ICS implementation challenges, considerations and successes will also be discussed.

Category: Water - Planning for the Future

CITY OF CALGARY WATER TREATMENT MASTER PLAN

All Authors:
Jeff Huber, P. Eng. - Associated Engineering

Michael Jin, P. Eng. - City of Calgary

Presenter(s):
Jeff Huber, P.Eng., Process Engineer, Associated Engineering

This paper will summarize the Water Treatment Master Plan recently completed by the City of Calgary and Associated Engineering. The Master Plan developed a framework for the future of Calgary's Water Treatment system. It encompassed raw water supply, timing / location of future water treatment expansions, and near-term opportunities for optimization of existing facilities. The Master Plan also developed site plans showing the proposed ultimate build-out of the Glenmore and Bearspaw water treatment plants.

Category: Water - Small Systems

OPTIMIZING WTP DISINFECTION VIA BIOLOGICAL PRE-TREATMENT, FROM CONCEPT TO FULL SCALE SYSTEM

All Authors:
Shengtao Weng, M.Sc., P.Eng.

Presenter(s):
Shengtao Weng, M.Sc. P.Eng., Associated Engineering

Achieving a level of primary disinfection equivalent to 4-log virus inactivation with free chlorine is complicated when naturally occurring ammonia is present in a raw water supply. A chlorine dosage slightly higher than the breakpoint dosage is required to maintain a stable and reliable free chlorine residual. This breakpoint dosage is typically in the order of 10 times the ammonia concentration, over and above any additional chlorine demands. For naturally occurring ammonia concentrations exceeding 1 mg/L, the required breakpoint chlorine dosage can exceed NSF 60 dosage limits for commonly used chlorine products such as sodium hypochlorite and calcium hypochlorite. For ammonia concentrations exceeding 3 mg/L, the required dosages can exceed the maximum acceptable gas chlorine dosages.

Many First Nation Communities in Saskatchewan use groundwater sources with ammonia concentrations between 1 mg/L and 4 mg/L. Typical water treatment processes (aeration, chemical oxidation, Manganese Greensand Filtration with chlorination for disinfection) by themselves are not capable of reducing ammonia levels sufficiently for breakpoint chlorination.

However, biological removal of ammonia can be a cost-effective approach for providing efficient disinfection. In addition to reducing the chlorine demand required for primary disinfection, the biologically stable water produced prevents bacterial regrowth in potable water storage reservoirs and distribution systems.

This presentation discusses the key factors influencing system selection, the pilot study, the system design considerations as well as the challenges associated with the treatment system start-up, commissioning and operation.

Category: Water - Small Systems

ARSENIC REMOVAL FROM GROUNDWATER VIA ADSORPTION: COMPARING THEORETICAL PERFORMANCE WITH PERFORMANCE MONITORING AND PILOT TESTING RESULTS

All Authors:
Mark Burger, P.Eng.

Presenter(s):
Mark Burger, Water Treatment Engineer
Kerr Wood Leidal Associates Ltd.

Adsorptive media is commonly used for arsenic removal from groundwater in small drinking water systems. Several arsenic removal media products are available on the market, and all of them will work under the "right conditions". However, site-specific requirements may favour the selection of some media over others. Water quality analysis can help in selecting a short-list of products that are expected to be most effective, and pilot testing can identify which of the short-listed materials achieves the best performance for arsenic removal and media life. Other site-specific conditions such as backwash water availability, backwash flow requirements, and disposal options for exhausted media may also affect media selection and vessel sizing. To provide insight into how different adsorptive media perform in the real world, this presentation will share performance data from an operating water treatment plant and from pilot testing in two First Nation communities in British Columbia. Some discussion on manganese removal will also be included because manganese is often found in arsenic-contaminated groundwater and was at the two sites that will be discussed. Manganese must often be removed upstream of arsenic removal because it can interfere with the performance of some arsenic removal media. Monitoring of manganese concentrations during pilot testing and full-scale WTP operation should, therefore, be conducted alongside monitoring of arsenic upstream and downstream of each treatment step.

Category: Water - Small Systems

CHALLENGES OF A GWUDI SYSTEM DESIGN: HORSE LAKE FIRST NATION WTP

All Authors:
Nathan Miller, P.Eng., Jackie Mykytiuk, P.Eng.

Presenter(s):
Jackie Mykytiuk, P.Eng., Project Manager, M2 Engineering

Nathan Miller, P.Eng., Lead Process Engineer,
M2 Engineering,

This project paper will examine the conceptual, preliminary and detailed design phases of a water treatment plant upgrade for Horse Lake First Nation. The presentation will review the challenges and successes of the project to-date, and provide examples of how the engineering design team selected the treatment technology required for construction of a new water treatment plant that uses a groundwater source under the influence of surface water.

Key topics to be discussed in this paper include:

Hydrogeological Challenges: the existing WTP had three existing wells, two which were functioning. As part of the project the hydrogeological team attempted to refurbish the existing wells and register them with AEP. This came along with several challenges, including: issues with the existing well condition, and coordination to ensure the existing plant maintained continuous operation.

Groundwater Quality: during the hydrogeological work, our team revealed that the groundwater was under the direct influence of surface water due to the failed condition of one of the wells. This impacted the immediate operation of the existing plant as well as impacted the overall design concept for the upgraded WTP.

Treatment Technologies: the groundwater quality was known to exceed aesthetic objectives of manganese, TDS, and sodium at the beginning of the project. These aesthetic objectives drove the treatment technologies evaluated, including electrodialysis reversal and reverse osmosis. Once the groundwater was identified as GWUDI, an ultraviolet disinfection system was no longer a consideration but a requirement to achieve disinfection targets.

Category: Water - Small Systems

FINANCIAL ISSUES FACING SMALL SYSTEMS IN ALBERTA

All Authors:
Aaron Janzen, Gopal Achari, Mohammed H.I. Dore, Cooper H. Langford

Presenter(s):
Aaron Janzen, Graduate Student, Department of Civil Engineering, University of Calgary

Small drinking water treatment systems lack economies of scale because of the smaller volumes they treat. They are often located in remote locations far away from service providers, suppliers and consultants. These capacity and economy of scale challenges have been well documented in general, but specifics concerning costs, both capital and O&M, as well as cost recovery and affordability are not easily available. Reliable data on small systems is difficult to gather in part because of the management capacity challenges.

This paper will present the findings of recent analysis of 25 small municipal drinking water treatment systems. Analysis is based on capital costs, O&M costs, water rate structure, water rate revenues, annual water volumes and median household income will be used to discuss the following questions:

- How do water treatment cost curves in small systems in Alberta compare to more national general surveys?
- What are the different cost recovery options?
- What impact would pursuing the different cost recovery options have on water rate affordability?
- At what population do revenue shortfalls begin if affordability is considered?
- What are possible solutions for systems with populations below the cost-revenue intersection?

Category: Water - Small Systems

IMPLEMENTING POINT-OF-ENTRY (POE) IN SMALL AND RURAL COMMUNITIES USING A COMMUNITY CIRCLE STRATEGY, WITH FULL PARTICIPATION OF HOMEOWNERS

All Authors:
Madjid Mohseni, Megan Wood

Cheryl Gomes, Associated Engineering
Ted Molyneux, Indigenous and Northern Affairs Canada (INAC).

Presenter(s):
Madjid Mohseni, RES'EAU WaterNET

Point-of-Entry (POE) drinking water treatment systems may be a feasible alternative for small remote communities, where central treatment is not affordable. However, POE systems have not gained momentum in Canada due to perceived maintenance challenges, limited technical support, community hesitation, and/or difficulty achieving regulatory compliance.

RES'EAU, in collaboration with VIQUA, Opus DaytonKnight, and Indigenous and Northern Affairs Canada (INAC), is completing a 12-month pilot program to investigate implementation of POE in two First Nations (FN) communities in BC; with full support of FN residents, operators and band administration.

A cost-effective POE system with minimum maintenance requirements is designed and installed in every home of the community. All POE systems are regularly monitored; water is sampled before and after the treatment process for one year. Throughout the project, community consultation is prioritized to document all feedback from residents and operators. Additionally, a parallel analysis is performed to compared the cost of POE versus central treatment for these cases.

This presentation identifies precisely when POE is a cost-effective solution and what site-specific considerations may impact its efficacy (such as water quality variations, water demand, pilot test protocols, technology selections, installations, O&M, public education, liabilities, capital/O&M costs, logistic and administration strategies).

More than one thousand Canadian communities do not receive a safe or reliable drinking water supply. Affected populations typically reside in small remote communities, where access to financial support is limited. Household water treatment systems are often recommended based on the supposition that it will be less costly than one centralized facility. However, to date, there has been no detailed analysis of the parameters affecting the choice between central, point-of-entry (POE) and point-of-use (POU) treatment – what is the best investment for small communities?

This project examines the feasibility of central versus POE/POU treatment for three cases: Lytton IR25 (Lytton First Nation, BC; 6 homes), Middle River (Tl'azt'en Nation, BC; 11 homes) and Shawnigan Lake (Cowichan Valley Region District, BC; 2000 residents). Several hypothetical systems are designed to:

- Resolve the water quality problems associated with each unique water source,
- Minimize O&M requirements, and,
- Deliver drinking water that satisfies Health Canada standards.

A model is developed to estimate the 20-year life cycle cost and a sensitivity analysis is performed to consider long-term growth. The methodology suggests POE is an economically viable option for smaller systems and could potentially resolve hundreds of Boil Water Advisories across Canada.

Despite substantial savings, POE is not prevalent for many non-economic factors; such as maintenance challenges, community hesitation, limited technical support and difficulty achieving regulatory compliance. The presentation provides a big picture assessment of central versus POE/POU treatment by examining the three cases from a community, regulatory, and business perspective.

Category: Water - Small Systems

DESIGNING A SMALL REGIONAL WATERWORKS SYSTEM IN SOUTHEAST ALBERTA: EXPERIENCES WITH THE TOWN OF FOREMOST/COUNTY OF FORTY MILE WATER SUPPLY

All Authors:
Luke Schoening, P.Eng.

Jayson Fraser, E.I.T.

Presenter(s):
Luke Schoening, P.Eng., Environmental Systems Engineer, MPE Engineering Ltd. (Lethbridge)

Jayson Fraser, E.I.T., Environmental Systems Engineer, MPE Engineering Ltd.

The County of Forty Mile is located within a portion of Southern Alberta that lies Southeast of Lethbridge and Southwest of Medicine Hat. The central part of the County contains the The Village of Foremost, Hamlet of Manyberries and Hamlet of Etzikom. All of these small primarily agricultural communities draw groundwater from wells at least five hundred feet deep in the Milk River Aquifer for the purpose of municipal potable water supply. Over the past several years each of these communities have been separately identified by regulatory authorities as not meeting standards due to the exceedance of federal and provincial limits for fluoride in the finished water. Each community has been separately mandated to complete upgrades. Other treatment challenges include natural gas and trace metals.

This paper reviews the project steps taken so far from concept development through to design and construction of a regional groundwater supply and water treatment facility. The regional water treatment plant based in Foremost will eventually provide potable water to the communities of Foremost, Etzikom, Manyberries and Skiff as well as some rural consumers in the County of Forty Mile. Discussion items will include the rationale for regionalization, selection of a raw water source, challenges of securing sufficient raw water volume and initial challenges faced in system design including process selection and pre-treatment.

Category: Water - Small Systems

TREATING HIGH TURBIDITY SOURCE WATER FROM THE SOUTH SASKATCHEWAN RIVER - REDCLIFF WTP PROJECT

All Authors:
Andrew Kleisinger, P.Eng.

Presenter(s):
Andrew Kleisinger, P.Eng., MPE Engineering Ltd.

Dean Harrison, Operator, Redcliff Water Treatment Plant

The Town of Redcliff Water Treatment Plant (WTP) obtains its supply of raw water from the South Saskatchewan River. During spring runoff and early summer rain events, River turbidity can spike in excess of 1,000 NTU. Prior to the WTP upgrade, the Town relied on the addition of high doses of Alum and the use of raw water sedimentation / retention ponds to reduce turbidity levels to the point where the existing gravity sand filtration units could effectively treat the water.

In 2011, MPE was commissioned to complete a water treatment system upgrade project. The project included a detailed pre-design report to select appropriate treatment options and ultimately recommended solids contact clarification and membrane microfiltration. Piloting of the preferred treatment option was completed in 2012. Detailed design and construction of an upgraded Raw Water Pump Station and twin raw water supply pipeline was completed in 2014. Finally, detailed design, construction, and final commissioning of the upgraded WTP was completed in 2016.

This paper provides a background for the entire project and focuses on development of the process design of the WTP. Operational data from the first year of plant operation will be presented to demonstrate the effectiveness of the treatment process in treating highly turbid water from the South Saskatchewan River.

Category: Water - Small Systems

MAXIMIZING UV SYSTEM PERFORMANCE FOR SMALL COMMUNITY DRINKING WATER DISINFECTION

All Authors:
Adam Festger, Scott Bindner

Presenter(s):
Scott Bindner, Market Analyst for Drinking Water
Trojan Technologies

Delivering safe drinking water to small communities is a continuous challenge. Storage and transport of chemical disinfectants, disinfection by-products, taste impacts from chlorine, and lack of skilled operators can all affect decisions regarding drinking water disinfection. This complexity can lead small communities to either default to chemical-based drinking water disinfection or decide to omit disinfection altogether. For the treatment of groundwater in particular, there is significant opportunity to expand the use of disinfection methods and improve the drinking water in small communities. Ultraviolet (UV)-light is an option to accomplish this goal. However, technical concerns including space constraints, energy demands, and maintenance are known to hinder UV's acceptance in small communities. Engineering small UV systems to provide high-efficiency UV treatment is critical to overcoming these issues. With this in mind, TrojanUV developed an advanced flow modification technology and incorporated it into its newest UV products designed for small-community operation. In brief, this Flow Integration (FIN™) Technology tailors flow so that areas of high flow and low flow within a UV chamber are exposed to high and low levels of UV intensity respectively, resulting in significantly improved dose (UV intensity x contact time) distribution within a UV chamber. This ensures optimum use of UV energy allowing for a compact chamber design with fewer lamps and overall reduced maintenance of the UV system. With this presentation, we intend to highlight how properly engineered UV systems with advanced flow conditioning throughout a UV chamber can ensure efficient use of high-intensity UV lamp technology in a small community setting.

Category: Water - Source Water Management

EVALUATING PARASITE OCCURRENCE IN SOURCE WATERS: PREVENTING BIAS AND ERRONEOUS INTERPRETATION

All Authors:
Monica Emelko, Norma J. Ruecker, Paul Mayberry

Presenter(s):
Dr. Monica Emelko, Associate Professor, Department of Civil and Environmental Engineering, University of Waterloo

It has been observed that the Giardia two-year running averages in the Bow River have increased from 4 Giardia cysts/100L in 2009 to 24 cysts/100L by the beginning of 2014. Over the same period, similar increases were also observed in the Elbow River (4 to 17 cysts/100L). Where did these apparent increases in Giardia levels originate? A Quantitative Microbial Risk Assessment (QMRA)-like analysis was conducted and included consideration of random measurement errors associated with variable sample volumes, non-detect results, and non-constant analytical recovery. The implications of data reporting/handling and potential biases were also explored. It was determined that improved laboratory performance (e.g., increases in Giardia matrix spike recoveries from 37.5% to 58.6% between 2009 and 2013) partially, but substantively, explained the long term raw water Giardia trending results. Changes in data reporting can further contribute to such trends. The generic "bin" category driven regulation and theoretical log reduction credits for treatment technologies are reasonable when limited source water quality and treatment data are available; however, in their current form they can penalize systems that use improved methods (as demonstrated herein) or have more detailed information (e.g., pathogen infectivity or plant performance data). Such policies can be improved because decision-making to protect public health is better informed when more or higher quality and unbiased data are available.

Category: Water - Source Water Management

UNDERSTANDING IMPACTS OF PLANKTONIC ALGAE AND CYANOBACTERIA ON THE TASTE & ODOUR OF WATER FROM THE GLENMORE RESERVOIR

All Authors:
Norma J. Ruecker, Jillian Thompson, Kelly Stonehocker, Jian Fu Deng, Theingi Maw, Eric Camm, City of Calgary

Presenter(s):
Eric Camm, Senior Watershed Biologist, City of Calgary

Volatile organic compounds (VOCs) produced during the growth and decline of algae and cyanobacteria are commonly known to be primary sources of taste and odour problems in drinking water. Historically, one of Calgary's source water reservoirs has had sporadic episodes of odour as identified by an increase in complaints. The most common descriptor for the odour of raw water from the reservoir, as described flavour profile analysis, is "earthy/musty" with episodes of "fishy". The most commonly detected VOC from the reservoir is geosmin , however based on microscopic observations from reservoir, there is little detection of planktonic forms of cyanobacteria and no known geosmin producing organisms present in the water column. It is, therefore, assumed that geosmin level in the reservoir is primarily from benthic organisms. Although there is a wide range of VOCs (>150) known to be produced by various algal species, the City of Calgary determines only a few compounds analytically. As a result, the flavour profile can change without an observed change in the VOC detection. In an attempt to better understand the contribution of algae to the odour of raw water from the Glenmore reservoir, algae and cyanobacteria were enumerated over a three year period and compared to the flavour profile results. Analysis showed a tendency towards a "fishy" descriptor by the flavour profile when percentages of the Chlorophyte algae taxa decrease and algae belonging to the Crysophyte and Cryptophyte taxa of algae increased. Spatial variation of algal taxa across the source water reservoir and the potential use of an online-fluorometer as an early warning for water treatment mitigation will also be presented.

Category: Water - Source Water Management

ASSESSING WILDFIRE RISKS TO MUNICIPAL WATERWORKS

All Authors:
Monica B. Emelko, Uldis Silins, Norma Ruecker, Mike Stone

Presenter(s):
Dr. Monica Emelko, Associate Professor, Department of Civil and Environmental Engineering, University of Waterloo

Wildfire poses a significant threat to drinking water source quality and treatability in many parts of western Canada. While some impacts of wildfire on water quality (e.g., N) recover after 3-4 years, other impacts of wildfire on water quality (e.g. suspended solids, P, C) can be severe and extremely long-lasting in western Canada. This is because of our unique, sediment-rich geology and our rivers' capacity to store sediment and associated contaminants over decades. In this work, wildfire risks to municipal drinking water treatment were evaluated. Both infrastructure capacity and operational responsiveness to several potential shorter- and longer-term impacts of wildfire on water were evaluated. A risk analysis framework encompassing a wide range of drinking water treatment approaches was developed for assessing the potential risks of landscape disturbances on downstream treatability. This risk framework will be applied utilizing the City of Calgary as a case study; however, other scenarios relevant to western Canada will be discussed.

Category: Water - Source Water Management

THE CITY OF CALGARY'S SOURCE WATERSHED AND RISK CHARACTERIZATION STUDY

All Authors:
George Roman, M.Sc., PMP

Presenter(s):
George Roman, M.Sc., PMP, Senior Water Resources Planner, Watershed Planning, The City of Calgary Water Resources

Source water protection is the “first line of defence” in a source-to-tap approach to providing high quality potable water supplies over the long term. To improve our understanding of source water risks and prioritize potential risk mitigation actions, The City of Calgary recently led a Source Watershed Assessment and Risk Characterization Study (SWARC). Using a spatially explicit risk mapping framework within a computerized Geographic Information System (GIS), inventories of potential contaminant sources were combined with watershed and landscape indicators representing pathways through which contaminants could reach The City's raw water intakes for the Glenmore and Bearspaw Water Treatment Plants. Building on The City of Calgary's Drinking Water Safety Plan, source water risks were synthesized in a risk evaluation framework that prioritized and ranked risks based on estimates of likelihood and consequence. Aspects related to treatability and potential future capital and operating costs associated with degraded source water quality were also integrated into the risk framework. Results are being applied to develop and implement a formal Source Water Protection Plan for The City of Calgary in partnership with other agencies and stakeholders, while also integrating with other regional and urban land use planning initiatives.

Category: Water - Source Water Management

FULL SCALE AQUIFER TEST APPROACH FOR HIGH-DEMAND DRINKING WATER PROJECT

All Authors:
Andre Laforest, P.Eng. M.Sc.

Presenter(s):
Andre Laforest, P.Eng., M.Sc., Hydrogeologist, HCL

The City of Thetford Mines, in the Province of Quebec, was forced by the Ministry of Environment to totally replace its drinking water source for its 27,000 inhabitants and its industrial water needs.

Surface water and groundwater were considered as replacement sources, but as stand-alone and individual solutions. The multi-year groundwater study ultimate aquifer test is presented to depict the approach, the engineering, the contingency management and the results.

It is daily practice by hydrogeologists to conduct aquifer tests, but it rarely needs to produce an Environmental Impact Assessment (EIA) prior to conducting an aquifer test. The EIA covered the temporary impacts related to conducting the aquifer test, as well as the temporary and permanent impacts related to the eventual permanent construction of a high-capacity pumping station.

A vast public-relations campaign was deployed, as the aquifer test raised regional concerns and was highly depicted in both regional and provincial media. The aquifer test is deemed to be the largest deployment in terms of investment and manpower in the Province of Quebec as far as an aquifer test is concerned.

The results of the seven-month aquifer test at 11,400 cubic metres per day were used to design a water-supply solution composed of a radial Ranney collector well, for which environmental impacts were predicted via a groundwater flow numerical model.

Category: Water - Water Demand

PLANNING OUR CITIES, CONSERVING OUR WATER

All Authors:
Katina Tam, M.Sc., AIT

Presenter(s):
Katina Tam, M.Sc., AIT, Environmental Program Specialist, The City of Red Deer

As cities expand, it is critical that effective planning for the design, development and management of urban areas is in place to accommodate such growth. An equally important consideration during planning processes is the sustainable management of our natural resources.

Water resources management is quickly emerging as a "hot topic" across the country, and for good reason: it is essential to life. An ongoing concern among municipal water operators is how they can minimize the volume of water used to support the needs of residents, businesses and the surrounding ecosystems. The City of Red Deer, Alberta, achieved an exciting milestone, reaching a population of over 100,000 in 2015. With this in mind, along with continual business growth and future climate change threats to the Red Deer River Watershed, The City is placing water conservation and efficiency at the forefront of environmental management. This paper will discuss, why water consumption should be a priority to municipalities, the role of municipal planning in water conservation and efficiency, as well as innovative projects that can achieve potable water saving for all sectors in municipalities.

Category: Water - Water Treatment Optimization & Technology

WEATHER RELATED CLARIFIER UPSETS AT THE 205 ML/D BUFFALO POUND WTP: A CASE STUDY

All Authors:
Simon Breese - AECOM

Rudi Sapach - Buffalo Pound Water Administration Board

David Hambley - AWI, Inc.

Presenter(s):
Simon Breese, AECOM

The Cities of Regina and Moose Jaw, SK experienced significant water shortages throughout the cities, in May, 2015, triggering an EOC Level I and II. These shortages were the result of a serious, week long weather event which caused a process upset at the 205 ML/d Buffalo Pound Water Treatment Plant.

AECOM were engaged on an emergency contract to mobilize to the plant, and working closely with plant operations staff as well as AWI, to troubleshoot the issues causing the upset, and recommend approaches to mitigate the upset.

The issue clearly seemed to centre around a long-standing issue with the development of so-called “rising floc” events in the clarifiers, where turbidity spikes suddenly arose in the clarified water, resulting in solids carryover onto the filters. In turn, these rising floc events typically result in impacts to filter run times. During the week of May 24th, 2015, a week-long rising floc event occurred, which had such a profound impact on filter productivity that the plant was unable to meet demands.

This paper will examine the work conducted to troubleshoot the causes of the rising floc events, and will focus on the recommended measures taken to address the issues both in the short term, and over the longer term, to ensure that such an emergency condition does not arise again.

Category: Water - Water Treatment Optimization & Technology

DEGRADATION OF PESTICIDES USING A PHOTOCATALYTIC LED WATER TREATMENT SYSTEM

All Authors:
Linlong Yu, Gopal Achari, Cooper H. Langford

Presenter(s):
Linlong Yu, Postdoctoral Fellow, University of Calgary

The presence of emerging contaminants such as pesticides in drinking water supplies have led to increased concern both among regulators, operators and the general public. Some of these loose group of contaminants behave like hormones and are known to have adverse effects on aquatic species. Conventional treatment processes do not specifically target these emerging contaminants leading to their release in water bodies through our wastewater treatment plants. Long term exposure to these emerging contaminants, even at very low concentrations, can have significant ecotoxicological effects in the aquatic and terrestrial environment.

Advanced Oxidation Processes based on TiO2 photocatalysis has been developed as an efficient approach to alleviate water pollution with emerging contaminants. Upon UV irradiation, TiO2 is excited and generates holes, excited electrons and hydroxyl radicals equivalents all of which aid in the oxidation of most organic compounds. Usually this leads to harmless compounds and in many cases complete mineralisation. Light emitting diodes (LEDs) being highly energy efficient and having a long lifespan are the next generation of light sources. LEDs are also mercury-free and cost effective.

In this research, a photocatalytic LED water treatment system was developed. The photocatalytic LED reactor is evaluated by degrading chlorophenols, phenoxy pesticides and a commercial herbicide product (Killex®). The results indicate that the photocatalytic LED reactor can become a promising approach to remove these emerging contaminants from drinking water.

Category: Water - Water Treatment Optimization & Technology

SCALE TROUBLESHOOTING IN SODIUM HYPOCHLORITE FACILITY AT CITY OF CALGARY

All Authors:
Patrick Chan, P.Eng. Kelsey Kundert, P.Eng.,
The City of Calgary

Shane Thompson, P.Eng., Sutha Suthaker, P.Eng., Amy McClintock, E.I.T., Associated Engineering

Presenter(s):
Patrick Chan, Bsc Mech Engineering, P.Eng.,
The City of Calgary

The formation of scale plugging has caused several problems in the operation of a NaOCL Generation and water disinfection at both the Glenmore and Bearspaw water treatment plants.

Scale plugs were found at several points downstream of generator cells at both facilities and the accumulation of these scale flakes has coated the internals of many components including critical isolation valves. Over time, the plugs lead to the inability to produce NaOCl, a critical plant process, as well as preventing the safe service/preventative maintenance of major equipment.

Samples of the scale were made of 85% Calcium carbonate (CaCO3), moisture and other trace element deposits including cations, metals chloride and organic carbon.

It is currently unclear the exact source and rate of Calcium buildup in the system, but salt brine samples taken Jan 27th were shown to be non compliant with AWWA specification regarding total impurities. Water softener readings have historically showed

Category: Water - Water Treatment Optimization & Technology

FREE CHLORINE TO CHLORAMINES: CHALLENGES IN SWITCH-OVER

All Authors:
Supramaniam (Sutha) Suthaker, Ph.D., P.Eng., Nicholai Kristel, P.Eng., Garry Drachenberg, P.Eng., Associated Engineering

Presenter(s):
Supramaniam (Sutha) Suthaker, Ph.D., P.Eng.
Associated Engineering

Some water treatment plants (WTP) chose chloramines as residual disinfectant in order to control disinfection by-products. Some WTPs that are hubs of regional water supply systems often chose chloramines as residual disinfectant for its stability over free chlorine. Switching the disinfectant from free chlorine to chloramines often appears as a simple exercise but requires careful consideration in the design, implementation and public perception.

The stoichiometry of chloramination is generally not a real indicator to determine the correct chlorine:ammonia ratios. While the literature cites a range of ratios, actual ratios could be very much site-specific. Selection of appropriate chloramines monitoring equipment is critical for process control as well preventing downstream impact of water quality. The switch-over process requires careful planning to mitigate the residual loss related risks at the interface where chlorinated waters and chloraminated waters come into contact. There is a growing body of evidence in the scientific literature that the use of chloramines for disinfecting drinking water systems could lead to unintended water quality consequences such as nitrification and microbial growth in the treated water reservoirs and distribution system. Apart from the technical details, public perception can be easily turn against the chloramination switchover because of internet availability of “incorrect” or “biased” information as well as “misinterpretation” by the public fuelled by the social media.

This presentation illustrates the key considerations in making decision to switch from free chlorine residual to chloramine residual, design, implementation and examples of public perception.

Category: Water - Water Treatment Optimization & Technology

IMPACT OF HYDRAULIC DISTRIBUTION IN GRANULAR MEDIA FILTERS

All Authors:
David Hambley

Presenter(s):
David Hambley, Technical Services Manager, AWI

The movement of a fluid in most situations is a powerful force. To ensure effective and sustainable performance of granular media filters, the hydraulic flow of the influent and backwash water must be well-designed and balanced. Issues with the hydraulic flow may cause permanent damage to the media bed and/or reduce the ability of the filter media to filter out particulate. A review of the hydraulic flow within each filter should be completed as part of the asset management plan at water filtration facilities.

Recent AWI research confirms that granular filter media beds can have a long service life when properly maintained. The hydraulic effect of the influent water can cause disturbances in the media bed, leading to water channeling, turbidity breakthrough and even breakdown of the filter media. Poorly distributed backwash water can quickly reduce the filter media's ability to filter out particulate, which can lead to shorter filter run times and lower unit filter run volumes.

Computational fluid dynamics (CFD) modelling is a cost-effective tool that can be used to simulate hydraulic distribution. It can highlight potential distribution issues during the design stage of new filters and filter upgrades, as well as help identify the root cause of poor performance in existing filters. CFD modelling can also demonstrate the effects of potential flow correction methods like baffles and orifice placement and sizing. Through proper planning and design, costs associated with resolving hydraulic issues may be reduced or even avoided.

Category: Water - Water Treatment Optimization and Technology

PROCESS RELIABILITY AND EFFICIENT OPERATIONS DEPEND ON EFFECTIVE POLYMER MANAGEMENT

All Authors:
Chris Howorth, P.Eng.

Presenter(s):
Chris Howorth, P.Eng., Veolia Water Techologies Canada

Chemical cost is a significant part of the operating budget for many water and wastewater treatment plants, with polymers often being a large component. Polymers are used for various applications, including flocculation, thickening and sludge dewatering. Numerous considerations affect the efficiency and performance of polymer, hence it is important for both designers and operators to understand these to ensure reliable process performance and to manage costs. These considerations include what type to use (e.g. emulsion based or dry), how to prepare it, and how to dose it.

A particular challenge for operators is knowing whether hydrated polymer has reached sufficient activation (i.e. full maturity), and is therefore ready for use. Current practice is typically simply time based, but this ignores factors that can affect maturation (e.g. water quality, temperature etc.). Importantly, the first time operators become aware of a problem with a polymer batch is typically when the performance of the treatment process using the polymer fails.

This presentation discusses the suitability of polymer types for different applications, the keys to successfully making down dry polymer and presents some polymer management equipment currently available. It also presents methods of evaluating polymer activation, including a new online polymer activation measurement instrument.

WASTEWATER CATEGORY

Category: Wastewater - Biosolids

SELECTION OF A THERMAL HYDROLYSIS PROCESS FOR THE BONNYBROOK WWTP

All Authors:
Jennifer Peters, M.Eng, P.Eng, CH2M

Kari MacDonald, P.Eng., - City of Calgary, AB

Ryan Roberts, P.Eng., PMP - Stantec

Presenter(s):
Jennifer Peters, M.Eng., P.Eng., CH2M Calgary

Kari MacDonald, P.Eng., City of Calgary

As part of the Plant D Expansion at the City of Calgary's Bonnybrook Wastewater Treatment Plant, increased sludge handling capabilities are required due to the greater mass of waste solids generated by the expanded plant. Various alternatives for solids stream treatment were considered during Conceptual Design and evaluated using a triple-bottom-line assessment for their component infrastructure requirements along with technical considerations such as reliability, robustness, resiliency, future proofing, operations and maintenance considerations and impacts on community and resources.

Three solids handling alternatives were short-listed. These solids management processes were:

1. Conventional Mesophilic Anaerobic Digestion
2. Acid Gas Digestion
3. Thermal Hydrolysis of Secondary Sludge

The solids options were highly sensitive to changes in economic and non-economic factors as well as whether planning for a Plant D expanded capacity or a larger expansion. Of the three short-listed options, a thermal hydrolysis process (THP) demonstrated the most significant advantages for the plant. One of the key advantages was eliminating the need for future digesters when considering expansions in the short or longer term. Other advantages include: reduced sludge viscosity; increased volatile solids reduction (VSr); increased biogas production; increased dewaterability of digested sludge; and elimination of digester foaming.

This presentation will discuss how a thermal hydrolysis process (THP) of secondary sludge was selected to achieve the increase in solids treatment capacity required as part of the Plant D Expansion. It will then discuss the key advantages of THP and how they relate to plant operations and future expansions at Bonnybrook.

Category: Wastewater - Biosolids

EMERGING SUBSTANCES OF CONCERN IN CALGARY'S WASTEWATER AND BIOSOLIDS

All Authors:
Victoria Arnold, Natasha Harckham, Susan Dong

Presenter(s):
Victoria Arnold, Organic Chemist, The City of Calgary

Producers of wastewater and biosolids are faced with an increasing number of questions from the public as to the presence and potential impacts of emerging substances of concern (ESOCs), such as pharmaceuticals, personal care products, and hormones. Traditional wastewater and biosolids treatment processes were never designed to remove these compounds and residues remain in the final products, typically in parts per trillion to low parts per billion concentrations. Although there are currently no regulations for ESOCs in Canadian wastewater effluent or biosolids, guidelines are beginning to emerge at the federal and provincial levels for surface water for the protection of aquatic life. In addition, the CCME's Canada-wide approach for the management of wastewater biosolids supports ongoing research in this area. For these reasons, the City of the Calgary has been testing for a variety of ESOCs in its wastewater and biosolids products since 2007 and 2011, respectively.

An overview of the results from the past several years of monitoring will be provided. Although some ESOCs decreased in concentration in the liquid stream during wastewater treatment, for many compounds this apparent removal was due to sorption to the solid phase. This highlights the importance of using an integrated approach to assess ESOCs in wastewater products by examining both the liquid and solid treatment trains. Initial efforts to characterize the full circle of treatment by testing various points in the process will be presented, as well as some of the challenges associated with accurately calculating ESOC removals.

Category: Wastewater - Biosolids

BIOSOLIDS MANAGEMENT PLAN: LESSONS LEARNED IN EDMONTON

All Authors:
Lalith Liyanage, Ph.D., P.Eng., Principal, Stantec Consulting Ltd.

David Curran, P.Eng. - City of Edmonton

Presenter(s):
Lalith Liyanage, Ph.D., P.Eng., Principal, Process Engineering, Stantec Consulting Ltd

In 2012, the City of Edmonton in collaboration with the Alberta Capital Region Wastewater Commission completed it's comprehensive short term and long term biosolids management plans. This presentation describes the background, plan development process and most importantly the lessons learned during the execution of the Short Term Plan and some components of the Long Term Plan.

Some of the items of the Short Term Plan include a number of initiatives such as the expansion of non-agricultural land application, expansion of the biosolids dewatering capacity. and off-site stock-piling of dewatered biosolids with the objective of de-coupling the biosolids transportation and land application. Preparatory capital work required for the execution of the Long Term Plan include, biosolids dewatering capacity expansion, construction of a new on-site dewatered biosolids storage facility, and biosolids loading station improvements at the lagoon site. One of the recommendations of the Long Term Plan is to utilize the landfilling as a back-up option for dewatered biosolids.

Non-agricultural land application pilot tests and landfilling pilot tests were conducted as part of the Long Term Plan recommendations and the findings will also be presented and discussed. Implications of the pilot findings on the Long Term Biosolids Management Plan will be discussed.

Category: Wastewater - Construction

BONNYBROOK WWTP NEW PUMPHOUSE AND EFFLUENT CHANNEL MODIFICATION CONSTRUCTION STAGING & DESIGN

All Authors:
René Gonzalez, P. Eng.

Presenter(s):
Rene Gonzalez, P.Eng., Structural Engineer, Stantec Consulting Ltd.

The paper we are planning to present considers the wastewater treatment plant infrastructure upgrades at Bonnybrook Wastewater Treatment Plant in Calgary, Alberta. As with most prospering cities, the population growth in Calgary has put more demands on treating wastewater and thus requiring additional wastewater infrastructure.

The upgrade project was found to be complex in both design and construction and required innovative efforts from all key members, which consisted of Stantec Consulting Ltd., Graham Construction, and the City of Calgary.

In general, the scope of work required converting a below-grade tunnel section into a new pump house to be located under an effluent channel and to re-route other effluent channels to account for the additional wastewater treatment infrastructure. Furthermore, as the plant was operating near full capacity, the existing effluent channels were to remain operational during construction.

The initiative was to re-use the current infrastructure to its maximum capability, thus being economically beneficial to the City of Calgary. During the design phase, Stantec worked diligently with the City to deliver creative design strategies to keep the plant operational during construction and to avoid any adverse effects to the existing structures. Stantec and Graham worked meticulously together during construction to implement ground-breaking construction plans to provide top-quality structures while maintaining plant operations and preserving the existing structures.

The paper will be presented by Stantec with input by Graham Construction and the City of Calgary as required. As such, we would be honored if our paper was considered for presentation.

Category: Wastewater - Conveyance

SANITARY SEWER RISK MODEL

All Authors:
Roy Brander, Gloria Boorboor

Presenter(s):
Roy Brander, Sr. Infrastructure Engineer (retired), Calgary Water Resources

Gloria Boorboor, Engineer in Training, City of Calgary

The Water Resources Asset Planning Group at the City of Calgary is working to implement a risk based approach to improve decision making with respect to operating and maintenance funding and capital investments. As a result the Sanitary Sewer Risk Model was developed as risk based framework to identify critical sanitary assets whose failures would have a substantial combined social, financial, and environmental cost. By identifying these critical assets the City of Calgary can proactively target critical sanitary mains for inspections, replacement and rehabilitation to reduce the risk of spills to water bodies, transportation disruption, service disruptions and property damage.

The model determines risk (in dollars) for each sanitary main by multiplying the consequence of a failure by the probability that the failure would occur. Proximity to major water bodies, intersection with LRT and CPR Rail, being positioned under major roads, and backups into services are the criteria that the model considers for its evaluation of consequences factor. Properties of a pipe such as the type of material and diameter, CCTV records for the pipe, documented defects and past work records were used for the probability of failure factor. Once the risk is calculated using these factors it is displayed on a GIS map of the City of Calgary to clearly show the areas of critical infrastructure.T55

The City of Calgary was immediately able to start using the data from the Risk Model to prioritize capital and operating programs such as annual inspection programs, sanitary replacements, and trenchless rehabilitation.

Category: Wastewater - Conveyance

EMERGENCY REHABILITATION OF THE ST. JAMES INTERCEPTOR SIPHON BY CIPP METHODS IN WINNIPEG, MANITOBA

All Authors:
Chris Macey, Adam Braun, Marv McDonald, Kas Zurek

Presenter(s):
Adam Braun, P.Eng., AECOM

This paper outlines the inspection, condition assessment, and rehabilitation of the St. James interceptor siphon crossing beneath the Assiniboine River in Winnipeg Manitoba, Canada. The St. James interceptor siphon, constructed in 1963, services approximately 2,200 hectares of northwest Winnipeg, and conveys peak dry flows of up to 713 L/s. The twin 600 and 500 mm steel siphons were inspected using a host of advanced condition assessment tools including: Sonar in 2012 and Remote Field Eddy Current Technology (RFEC) in the fall of 2014. The RFEC data gathered during the inspections indicated that portions of the 500 mm siphon had deteriorated to the point of having no effective remaining wall thickness, while the 600 mm siphon appeared to be in much better condition an emergency repair project was undertaken.

The operational configuration and vertical profile of the siphon permitted individual isolation during dry weather flows and rehabilitation using Cured-In-Place-Pipe (CIPP) technology. The use of water inversion/curing processes and a full length temperature monitoring system permitted curing of the liners in a very complex heat sink environment. The siphons were successfully rehabilitated in the fall of 2015 under very challenging conditions without incident.

Category: Wastewater - Conveyance

ASSESSING THE PERFORMANCE OF 38 YEARS OF CIPP INSTALLATIONS IN WINNIPEG, MANITOBA

All Authors:
Chris Macey, Chris Mitchell,Adam Braun, Kas Zurek, Ron Sorokowski

Presenter(s):
Chris Macey, P.Eng., AECOM

The City of Winnipeg, Manitoba, Canada has a sewer system that services approximately 700,000 people. It commenced sewer rehabilitation with cured-in-place pipe (CIPP) with its first trial installations in 1978, one of the earliest installations of CIPP in North America. Used as a trial rehabilitation method initially, the program increased in frequency from a project every couple of years in the 1980's to more frequent trials in the 1990's. By 1998, the annual Sewer Condition Upgrading Program evolved and CIPP was transformed from a trial rehabilitation technology to a competitively bid technology that has encompassed approximately 75% of the annual rehabilitation program from 1998 to date.

This paper reports on the use of CIPP liners in the City, those installed from 1987 through 2005 (both pre- and post ASTM F1216). The modern Sewer Condition Assessment in Winnipeg has visually captured the condition of many of these liners after many years of service (ranging from 10 to 37 years). The assessment of this broad a cross section of CIPP liners over a such a wide range of product, installation and design variations, provides unique insight into the adequacy of prevailing CIPP installation standards as well as realistic insight into the longevity of the product.

Category: Wastewater - Conveyance

INGLEWOOD SANITARY TRUNK – ROUTE OPTIMIZATION OF A LARGE DIAMETER SANITARY TRUNK IN CALGARY'S OLDEST NEIGHBOURHOOD

All Authors:
Patrick Ilasewich, Melanie Gray

Presenter(s):
Patrick Ilasewich, P.Eng. Senior Municipal Engineer, AECOM

The existing 15th Street sanitary trunks were installed in the early 1960's and convey sewage from entire north portion of Calgary, and communities beyond. Currently servicing an equivalent population of 1.14 million residents, they are a critical component of the City's sanitary conveyance system which connect multiple siphons crossing the Bow River to the Bonnybrook Wastewater Treatment Plant, the City's largest wastewater treatment plant. Both a consultants study and the City's long range planning identified that the existing trunks were not able to provide the required level of service and additional conveyance capacity was immediately required.

The conceptual alignment proposed in the functional report was not constructible, and a detailed route selection analysis and optimization was required. The route selection process would prove to be highly complex in nature. The project is located in Inglewood, Calgary's oldest community which consists of dense residential and heavy industrial land use. As a result there is limited space for a trunk of this size and to add to the complexity the proposed depth of cover on the trunk ranged from insufficient to over 13m. The soils are highly variable with a high potential of encountering areas where soils or groundwater will be contaminated. In selecting the optimal route the analysis performed considered methodologies ranging from conventional cut and cover construction to state of the art pressurized face Microtunneling to develop a route which would balance cost and impacts on the community, minimizing construction risk while still meeting the hydraulic objectives of the project.

Category: Wastewater - Conveyance

THE PROCESS OF HOW THE CITY OF CALGARY IMPROVED TWO LIFT STATIONS TO MEET A LEGAL ORDER

All Authors:
Daniel Schaefer, P.Eng,

Presenter(s):
Daniel Schaefer, P.Eng., Operations Engineer for the City of Calgary, Water Services

The Symons Valley Lift Station failed on Aug 6, 2011, causing a wastewater discharge to West Nose Creek, and leading to legal charges for violating the Fisheries Act. Following legal negotiations, a Creative Sentence was arrived at on January 8, 2014, ordering The City of Calgary to improve the remote monitoring and alarming for two other lift stations along the same waterbody, in terms of both technical and budgetary requirements, before 2015.

Although the legal order provided some direction, translating it into a project required extensive coordination with internal stakeholders to define the project scope and roles, and the approach to design and execution. To honor the spirit of the law, not just the letter, The City sought to address any discovered deficiencies that could impact the function of either lift station (e.g. replacing antiquated equipment). Associated Engineering Ltd. was engaged to create as-built drawings, and to lead and document the commissioning process, both being reviewed with assistance from The City's Electrical, Instrumentation & Controls group. Also, documentation was compiled by the PM to establish a paper-trail.

Using an existing lift station controls cabinet design, and with the hard work and expertise of The City's Control Systems Services group, the modifications to improve monitoring and control of the pumps, and monitoring of supporting equipment (e.g. standby generator), were completed before the deadline. Discovered deficiencies were also resolved during this time, and after.

The presentation will review the above, and should interest anyone dealing with similar projects or legal issues.

Category: Wastewater - Emergency Recovery

BONNYBROOK WWTP UNDERWATER: COPING WITH THE 2013 FLOOD AND DEVELOPING RESILIENCY MEASURES

All Authors:
Catalina Nadeau-Bonilla, M.A.Sc, P.Eng.,
Kari MacDonald, P.Eng.

Presenter(s):
Catalina Nadeau-Bonilla, M.A.Sc., P.Eng., Leader of Operational Performance, City of Calgary,
Kari MacDonald, Senior Project Engineer, City of Calgary

In 2013 during wet weather season the City of Calgary and the neighboring watersheds in the Rocky Mountains received unusually heavy rainfall that combined with spring runoff and caused extremely high flows in the Bow and Elbow Rivers, which ultimately flow through Calgary. This resulted in severe flooding of a number of areas of the City, including downtown. The flood also caused significant damage to the largest WWTP in Calgary, Bonnybrook.

This paper will describe the emergency at the plant, the steps taken to recover the treatment and operational lessons learned; the results of a post-flood investigation, and the development, evaluation and implementation of flood resiliency measures to prevent plant flooding in the future.

Category: Wastewater - Emergency Recovery

BONNYBROOK WWTP PLANT D EXPANSION - OUTFALL RELOCATION

All Authors:
Juan Morales, Cory Albers

Presenter(s):
Juan Morales, P.Eng., Stantec

Cory Albers, Co-Owner, Source2Source Inc.

The Bonnybrook Wastewater Treatment Plant (BBWWTP) is one of the largest sanitary treatment facilities in North America and currently discharges treated effluent to the Bow River via a bank outfall immediately adjacent the BBWWTP site. In response to the major 2013 flood of the Bow River, the outfall is being relocated approximately 650 m downstream from the existing plant effluent outfall to a lower hydraulic discharge elevation so that gravity discharge can be maintained during another major Bow River flood. The outfall is being designed to convey 1962 ML/D (22.71 m^3/s) to a new exfiltration style diffuser under the Bow River bed that will deliver high effluent dilution performance. An innovative emergency outfall system is being also used to deliver high performance with very little head loss.

Complicating the outfall relocation project is the close proximity (within a few tens of metres) to both an existing CN Rail bridge and embankment, and a proposed new Bow River crossing of the Greenline Southeast Transitway. Construction scheduling and navigability considerations during construction add to the already high complexity of this project.

The presentation will focus on describing the motivations to relocate the existing outfall, the different components of the proposed outfall infrastructure, key challenges, detailing the required hydraulic performance of the outfall conveyance system and the emergency outfall system. The diffuser system design and expected effluent dilution performance will also be described. Lastly, steps taken toward preserving navigation safety during construction will be presented.

Category: Wastewater - Modeling

USING A COMPUTER BASED TREATMENT PLANT SIMULATOR TO ASSESS PLANT CAPACITY AND MAINTENANCE/FAILURE LIMITS ON OPERATION

All Authors:
M. Kim Fries - CH2M

Jigs Patel, Jason Sinclair, Catalina Nadeau-Bonilla, City of Calgary

Presenter(s):
Kim Fries, CH2M

The Pine Creek WWTP was commissioned in 2009 to treat wastewater from the south portion of Calgary. The original design of the plant envisioned the treatment of the flows and loads generated by a serviced population of 250,000 equivalent population (EP). Experience since that time has indicated that there is a potential that the plant could treat the wastewater from a greater population, especially given that the population currently attributed to that plant is about 280,000 EP.

A study was commissioned to develop a computer based biological treatment simulator to assess the total capacity of the plant. Further, the simulator could then be used to determine the likely operating constraints associated with removing major process units from service due to equipment failure or to facilitate equipment maintenance.

A dynamic model was developed for the plant using BioWin™ software as the platform, which included all of the major process elements and allowed for the input of one year's worth of wastewater data harvested from plant records. Data from 2013 was used as the basis for the work.

This presentation will focus on the data gathered in preparation for the modeling study, development of the model, calibration of the model to replicate plant performance, and the use of the model to predict the reliable total capacity that could be expected from the facility. Further, the various failure/maintenance scenarios will be described and their results discussed to illustrate the impact upon operations.

The purpose of the presentation will illustrate how commercially available modeling tools can be used knowledgably to re-assess asset capabilities and provide guidance to owners in the capacity and operation of their plants during normal and adverse conditions.

Category: Wastewater - Modeling

USE OF DYNAMIC PROCESS SIMULATION TO PLAN WASTEWATER TREATMENT BIOLOGICAL SYSTEM START-UP

All Authors:
Dean Shiskowski, Ph.D., P.Eng.

Presenter(s):
Dean Shiskowski, Ph.D., P.Eng., Vice President, Water Resource Recovery, Associated Engineering

The start-up of conventional nitrifying biological systems is complicated by the slow growth rates of ammonia and nitrite oxidizing bacteria. A further complication, which can manifest itself during treatment of high-ammonia wastewaters, is the potentially inhibitory effects of the substrates (i.e. ammonia, nitrite) used for their growth and that can accumulate in bioreactors during start-up. While the actual mechanisms and extent of such inhibition are still debated there is ample reason to consider their possible effects on system start-up. In response to these complications, mechanistic models describing biological processes, when implemented in simulation software packages that can provide dynamic, time-varying predictions, provide a useful tool to assist the planning of treatment system start-up. They allow the "virtual" testing of alternative start-up strategies and in doing so provide a level of risk mitigation. This presentation discusses nitrifying system start-up issues, illustrates the apparent effect of substrate inhibition in a landfill leachate system start-up situation, and demonstrates the application of dynamic process simulation to plan an industrial wastewater system start-up.

Category: Wastewater - Modeling

EFFECT OF SLUDGE HOLDING TANK (SHT) ON NUTRIENT REMOVAL PERFORMANCE OF WWTPS

All Authors:
Pouria Jabari, Dr. Quan Yuan, Dr. Jan A. Oleszkiewicz

Presenter(s):
Pouria Jabari, M.Sc., Dr. Quan Yuan, Dr. Jan A. Oleszkiewicz, University of Manitoba

The treatment of produced activated sludge (AS) is a major cost of wastewater treatment plant (WWTP). The anaerobic sludge holding tank (SHT) has recently gained high interest as a cost effective and environmental friendly method to effectively reduce sludge production in WWTP. A portion of recycle activated sludge (AS exchange ratio) is hold in SHT for hydraulic retention time (HRT=SRT) of 1 to 4 d and then returned back to aeration basin. The beneficial effect of SHT on sludge reduction, COD removal and AS settling property is established but its effect on nutrient removal performance of WWTP needs to be investigated.

BioWin 5 was used (steady state modelling) to simulate the effect of SHT on Biological Nutrient removal (BNR) performance of a BNR-WWTP at different SHT operations (HRT of 1-4 d and AS exchange ratio of 5 – 20%). In kinetic tests, different types of AS (BNR sludge, only COD removal AS or mixed of both) were treated at different HRT in anaerobic condition (similar to SHT condition) and P and N release and stored poly-phosphate and aerobic P uptake of sludge before and after treatment was measured. Kinetic tests were also simulated in BioWin (Dynamic modelling).

Simulation results showed that SHT at relatively short retention time (1 d) and maximum allowable AS exchange ratio (SHT volume permitting) could provide the lowest P in WWTP's effluent. Similarly, results of kinetic tests showed that SHT at HRT less than 1 d provide maximum benefit. For SHT with HRT>1, kinetic tests showed the P removal significantly reduces; but, BioWin (inconsistently) predicts P removal efficiency increases with HRT of SHT. This study (consistent with literature) showed that shifting PAO over GAO rather than positive net VFA production is the probable mechanism through which SHT could benefit BNR performance of WWTP.

Category: Wastewater - New Technology

LEACHATE TREATABILITY AND REUSE STUDY AT EAST CALGARY WASTE MANAGEMENT FACILITY, THE CITY OF CALGARY

All Authors:
Lourdes N. Lugue, The City of Calgary

Owrang Kashef, CH2M

Presenter(s):
Lourdes Lugue, P.Eng., Waste & Recycling Services, The City of Calgary

Owrash Kashef, P.Eng., MBA, Environmental Engineer, Senior Project Manager, CH2M

This paper will describe the findings from the performance of Chemical Precipitation process, MBR - Ultrafiltration and Reverse Osmosis in studying the treatability of raw leachate generated at the East Calgary Waste Management Facility. The objectives of this project is to determine the design parameters for the future full scale leachate treatment facilities to be built for each of the 3 active landfills of the City (East Calgary, Spyhill and Shepard)

Category: Wastewater - New Technology

EFFICIENT TERTIARY TREATMENT METHODS TO DEGRADE CARBAMAZEPINE IN WASTEWATER EFFLUENTS

All Authors:
Purnima Somathilake, John Albino Dominic, Gopal Achari, Joo-Hwa Tay

Presenter(s):
Purnima Somathilake, University of Calgary

Carbamazepine (CBZ) an anti-epileptic drug prescribed for control of seizures, is a commonly detected Emerging Substance of Concern (ESOC) in treated wastewater effluents and surface water bodies. CBZ is highly recalcitrant to biodegradation and is not removed by conventional waste water treatment processes. Advanced Oxidation Processes (AOP) such as ozonation, H2O2/UV and TiO2/UV individually or in combinations have indicated promise in treating some of these recalcitrant contaminants. This study presents the results of AOP based treatment techniques for degradation of carbamazepine in treated domestic secondary effluents. We investigate the conventional AOP treatments such as UV, ozone, TiO2, and H2O2 for degradation of CBZ. Further, studies on effectiveness of UV-LED in combination with conventional AOP methods such as ozone, TiO2, and H2O2 for degradation of CBZ were conducted and the reaction kinetics were compared.

Category: Wastewater - New Technology

BEHAVIOUR OF ZINC OXIDE NANOPARTICLES IN BIOSOLIDS

All Authors:
E.A. Vialykh, C.H. Langford, G. Achari, Nahid Hassanvand-Gandaei

Presenter(s):
Elena Vialykh, PhD Student at University of Calgary, Chemistry Department

The dramatic increase in the use of nanoparticles (NPs) in our daily needs has led to their increased content in domestic wastewaters. Most NPs get precipitated out from wastewaters during treatment, leading their accumulation in biosolids. Most municipalities use their biosolids as fertilizer. Consequently NPs that are in biosolids, also get applied to the fields and then become part of the trophic ladder.

This research focusses on the fate of ZnO NPs in biosolids. First, we compared the kinetics of Zn2+ (aq.) ions and ZnO NPs uptake by a resin. Results indicated that Zn2+ ion is captured more rapidly than ZnO NPs. However NPs do not survive in the environment for a long time. No NP was detected in solution after 7 days.

Further, biosolids were spiked with 10-40 nm NPs and kinetics of Zn release to a strong binding chelating resin was monitored. Kinetics of the release was controlled by varying the solution pH. At pH 8 all Zn was retained in the biosolids, whereas at pH 5, 20-25% of Zn was released into solution. Adding resin to the system at pH 5 promote further Zn release from the biosolids. Nonetheless, it required at least 360 hours to release 85 % of Zn from the biosolids in presence of the resin.

Category: Wastewater - Nutrients

THE BOW RIVER PHOSPHORUS MANAGEMENT PLAN: MOVING FROM PLANNING TO IMPLEMENTATION

All Authors:
Rob Wolfe

Presenter(s):
Rob Wolfe, Environmental Planner, Alberta Environment and Parks

Heightened nutrient levels in the Bow River downstream of Calgary have long been a concern. In the 1970s and 1980s, high nutrient levels resulted in excessive aquatic plant growth resulting in low dissolved oxygen and occasional fish mortality. An interim policy on effluent limits was released by Alberta Environment in 2008. This policy required that a regional nutrient load reduction plan be developed for reaches at risk of exceeding water quality guidelines. At the same time the Government of Alberta was transitioning to an environmental management approach that addresses the cumulative effects of resource management decisions and considers the environmental, economic and social implications of development for an entire region.

In 2011, Alberta Environment and Sustainable Resource Development (ESRD) invited contributing parties in the affected reach of the Bow River to initiate a voluntary, collaborative process to address phosphorus loadings, not just from point sources such as the wastewater treatment plants, but from non-point sources as well.

The Bow River Phosphorus Management Plan (PMP) is a strategic plan to address sources of phosphorus in the middle reach of the Bow River between the Bearspaw and Bassano Dams. It is the culmination of work by contributing parties from government and non-government, urban and rural sectors, and a wider constituency of subject matter experts who contributed on task teams to define the issue, establish goals and objectives, and recommend strategies and actions to manage phosphorus in the Bow River.

The PMP seeks to enable management actions to meet social, economic and environmental outcomes now and into the future. This is a proactive, place-based, knowledge-driven and adaptive plan with collective action by, and accountability of, contributing parties.

The PMP was released in April 2014 followed by the establishment of a PMP Implementation Committee in May 2014. The focus of the presentation will be on the implementation of the plan.

Category: Wastewater - Nutrients

A NEW INNOVATIVE TECHNOLOGY FOR LOW ENERGY NITRIFICATION USING MEMBRANES

All Authors:
Rob Hacking, Jeff Peeters

Presenter(s):
Jeff Peeters, P.Eng., Senior Product Manager, GE Water and Process Technologies

The paper would introduce a new technology called Membrane Aerated Biofilm Reactor and the use of new innovative gas transfer membranes which create high oxygen transfer conditions combined with biofilm technology to create a nitrification process which operates at 3-4x the aeration efficiency of traditional fine bubble diffusers and suspended growth activated sludge systems. The paper would include the results of the 4MLD pilot system currently operating on the City of Chicago's O'Brien Wastewater Treatment Plant whose interest is in upgrading their existing infrastructure to develop bio-P and to achieve energy neutrality in 2022, both goals are relevant for communities with mechanical plants across western Canada.

Category: Wastewater - Nutrients

WASSTRIP® INVESTIGATION AT LETHBRIDGE WASTEWATER TREATMENT PLANT

All Authors:
Derek Lycke - Ostara Nutrient Recovery Technologies Inc.

Presenter(s):
Derek Lycke, MASc, P.Eng., Ostara Nutrient Recovery Technologies Inc.

The Waste Activated Sludge Stripping To Remove Internal Phosphorus (WASSTRIP) process is a pre-digestion WAS phosphorus release method applied in sewage treatment works using biological phosphorus removal. In this process, WAS is held anaerobically which causes phosphorus accumulating organisms (PAOs) to release orthophosphate as well as cations (e.g. Ca, Mg and K) to maintain charge neutrality. Thickening liquor from WASSTRIP processed WAS can be sent to a struvite precipitation process allowing released phosphate and magnesium to be used for phosphate recovery and reducing the amount of struvite that forms in digesters and on dewatering equipment.

This study considers the effects of total suspended solids (TSS) concentration and carbon addition on WASSTRIP in an effort to both reduce the size of WASSTRIP system and increase the concentration of orthophosphate in the WASSTRIP thickening liquor. Impacts on overall phosphate recovery efficiency, digester struvite formation, and other nutrient recovery benefits will be considered.

Category: Wastewater - Planning and Delivery

REGINA WASTEWATER PLANT P3: OPERATIONS DURING CONSTRUCTION COMPLETION & COMMISSIONING YEAR 2

All Authors:
Vicki Campbell, P.Eng.

Presenter(s):
Vicki Campbell, P.Eng., Senior Manager, Saskatchewan Operations, EPCOR Water

This paper will continue on from where the paper on Year 1 presented at last year's 2015 conference left off. The focus of this paper will be on Year 2 of the project from an Operations perspective. The challenges of Year 2 were not only how to keep an existing plant running while the construction activity moved from greenfield construction into the existing plant under a very tight timeline, but also from a recruitment, change management, and training perspective. Training was an important focus for the year for all aspects of employee development such as safety, EPCOR business systems, asset management and technical training in efforts to grow the team to become knowledgeable of the new process and work environment. This required an enhanced change management focus to help employees think differently with more of a business mindset and implement safety into everything they do.

The paper will also review the commissioning challenges as the plant evolves from the old lagoon based facility to a new BNR plant. This includes some of the challenges that were encountered in preparing employees for their new company, operations of a plant with a stricter operating permit and how to deliver on contract requirements at the same time as negotiating a brand new Collective Agreement.

Category: Wastewater - Planning and Delivery

WASTEWATER INFRASTRUCTURE PLANNING FOR TWO MAJOR CITIES IN WESTERN CANADA

All Authors:
Joyce Chang, P.Eng., Kim Fries, P.Eng. - CH2M HILL

Jason Sinclair, P.En.g - City of Calgary

John McMahon, P.Eng., Ed von Euw, P.Eng. - Metro Vancouver

Presenter(s):
Joyce Chang, P.Eng., CH2M

Municipalities often face the question of how best to invest their capital funds on infrastructure needs related to population growth, aging infrastructure, and regulatory requirements. The City of Calgary and Metro Vancouver are two examples of municipalities who are addressing such strategic issues for their wastewater infrastructure.

The City of Calgary operates two wastewater treatment facilities in its South Catchment. The Pine Creek Wastewater Treatment (WWTP) is a biological nutrient removal facility built in the late 2000s to serve 250,000 people. The Fish Creek WWTP is a smaller facility that has been in operation since the 1960s and is in need of an upgrade to meet more stringent effluent discharge criteria if it were to continue operation. Metro Vancouver operates two wastewater treatment facilities in the Fraser Sewerage Area. The Northwest Langley WWTP is a small local facility serving 30,000 people whereas the Annacis Island WWTP is a large regional facility that treats wastewater from 1.2 million people in 14 member municipalities. In each case, the municipality faces substantial challenges in determining the best path for upgrading the wastewater infrastructure in a manner that accommodates population growth and provides regulatory compliance, while minimizing capital expenditure and achieving non-monetary goals.

This paper will discuss how a decision and assessment framework was used to facilitate the evaluation of servicing options for both municipalities and how 'multi-objective decision analysis' informed the decision making process. The presentation will illustrate how a similar framework was applied to both cases yet led to a different outcome.

Category: Wastewater - Planning and Delivery

BONNYBROOK WWTP: AN OVERVIEW OF THE 135MLD PLANT D EXPANSION

All Authors:
Darren Finney, City of Calgary

Ryan Roberts, Stantec

Presenter(s):
Darren Finney, Leader Bonnybrook Plant D Expansion, The City of Calgary

Ryan Roberts, Vice President, Water, Stantec Consulting Ltd.

The Bonnybrook WWTP is the largest of the three wastewater treatment plants in Calgary, with an estimated existing installed capacity of 946,000 Equivalent Population (EP) (or 833,000 EP at firm capacity, meaning the largest secondary treatment train being out-of-service). Upgrades currently under construction on Bonnybrook WWTP Plants B and C, planned for completion by 2019, will increase the installed capacity of the plant to 1,041,000 EP (or 912,000 EP at firm capacity). The service area population reported for 2014 (the last available annual reports) was approximately 933,260, including Calgary and regional customers.

The Plant D Expansion project will accommodate an additional 325,000 equivalent population (EP) bringing the total service population of Bonnybrook to around 1.24 million EP.

The presentation will discuss the drivers for the project and provide an overview of the infrastructure involved in the project, both as new and upgrades to existing which include:

- Primary Clarification - Two new primary clarifiers
- Primary Influent & Effluent Conveyance - New conduits to serve the Plant D secondary treatment processes
- Biological Nutrient Removal (BNR) - Three new bioreactor trains
- Secondary Clarification - Six new secondary clarifiers and associated pump houses
- Effluent Filtration Facility – to provide capacity to nominally filter 40 percent of the total average effluent flow from the Bonnybrook WWTP
- Ultraviolet Disinfection - Expansion of the existing system to treat total plant flow through replacement of existing equipment in an existing building
- Plant Effluent Outfall - New in-bed diffuser type outfall for discharge to the Bow River
- Primary Sludge Thickening and Fermentation - Retrofit of existing units
- Waste Activated Sludge Dewatering - New centrifuge dewatering of thickened waste activated sludge before Thermal Hydrolysis Process
- Thermal Hydrolysis of Dewatered Waste Activated Sludge - New sludge pre-treatment process to enhance downstream anaerobic digestion
- Biogas Management - Expansion of gas collection, storage and waste gas handling systems
- Flood Protection Berm - to protect the facility from a 1:100 year river flood event.

Category: Wastewater - Planning and Delivery

HIGH RATE BALLASTED CLARIFICATION OF WET WEATHER FLOWS AT WINNIPEG'S SOUTH END WPCC

All Authors:
Jeremy Kraemer, Barry Williamson, Kim Fries, Laura Seaman- CH2M Hill

Presenter(s):
Jeremy Kraemer, Ph.D., P.Eng., Senior Wastewater Engineer, CH2M Hill

This submission will discuss the use of high rate ballasted clarification (HRC) at the Winnipeg South End WPCC for the treatment of excess peak wet weather flows to meet the plant's revised regulatory licence. The submission will focus on the analysis and rationale for the selection of HRC, as well as briefly discussing the competitive pre-purchase process which selected Veolia Actiflo as the preferred vendor and the facility design features.

Category: Wastewater - Planning and Delivery

THE CRITICAL WASTEWATER PLANT STORY - ASSET CRITICALITY IDENTIFICATION

All Authors:
Rino Fedato, Sharmila Acharya

Presenter(s):
Rino Fedato, P.Eng.,MBA,
Sharmila Acharya, M.Eng., P.Eng., The City of Calgary

The Asset Planning (AP) team and the Water Operational Performance (OP) & Plant Maintenance (PM) teams at the City of Calgary (COC) have joined together to develop and implement a strategic Water Treatment Asset Management Plan. This venture was sparked in mid-2014 in response to the Scottish Water Service Based Review Analysis of Water Services at the COC, where one of the recommended key areas of focus was to increase efficiency by taking a risk based approach to maintenance, operation, and management at the Water and Wastewater Treatment Plants (WTP and WWTP).

A risk based maintenance approach required us to identify “Critical Assets” for all Plant Areas. The first step was to develop specific criteria for ranking the assets. Then we tested the criteria by scoring all the assets within the Plant using the same criteria from Plant Area to Plant Area. This was accomplished through a “storyboard” presentation and team workshops.

The assets that are identified as ‘Critical’ through the Workshops are further investigated to more easily identify future areas of capital spending, reduce reactive maintenance, develop preventive maintenance methods for those assets that currently don’t have any, or look into refinement of existing preventive maintenance on specific assets. Furthermore, it will help with improving spare parts inventory, and planning and scheduling of maintenance. The strategy to identify the WWTP critical assets took over one year to develop fully, and since its implementation, several Bonnybrook WWTP and Pine Creek WWTP areas have been completed and their critical assets identified.

We would be honored to share our Asset Criticality Story with you should you give us the opportunity.

Category: Wastewater - Planning and Delivery

REGINA WWTP UPGRADE PROJECT - A FAST TRACKED DESIGN AND CONSTRUCTION APPROACH

All Authors:
David Lycon, Ph.D., P.Eng.,

Presenter(s):
David Lycon, Ph.D., P.Eng., Senior Wastewater Process Engineer, Stantec

The City of Regina was in need of an upgrade to its aging facility in order to meet new, more stringent effluent quality standards by January 1, 2017. In an effort to meet this requirement and allow for a cost-effective delivery method, a P3 approach was selected. Stantec, as part of a design-build joint venture team has provided the design services for this project.

Working with existing plant infrastructure, the design-build team proposed to design and construct a Modified Johannesburg biological nutrient removal (BNR) treatment process as the backbone of the facility. To aid the secondary treatment process, a primary sludge fermenter and a sidestream bioreactor for centrate treatment were also added to the overall process. Other process modifications and enhancements include improved grit removal, a new ultraviolet disinfection process and plant effluent re-use system, improved digester mixing and capacity enhancements, and a new waste secondary solids thickening process. The capital cost for the delivery of this project is $181 million, which is substantially less than the original estimate of $225 million.

Design began concurrently with construction in the summer of 2014, with commissioning scheduled for the summer of 2016. In spite of challenging climatic conditions and a complex commissioning sequence, the project is progressing on schedule and well within the proposed cost. The full presentation will include descriptions of the key features of the selected design, a construction update and the initial commissioning results.

Category: Wastewater - Preliminary Treatment

STATE-OF-THE-ART SANITARY GRIT TREATMENT FACILITY AT GOLD BAR WWTP

All Authors:
T. Manning, EPCOR Water Canada, L. Opyr, Stantec Consulting Ltd.,

A. Suarez, EPCOR Water Canada, N. Szoke, Stantec Consulting Ltd.

Presenter(s):
Trina Manning, M.Sc., P.Eng., EPCOR Water Canada, Edmonton WWTP

Luke Opyr, P.Eng., Stantec Consulting Ltd.

The practice of disposing highly odorous debris collected from Edmonton's wastewater sewer system at the Clover Bar lagoons was found unsustainable and required an alternative solution. Upon careful review of options, a purpose built facility at the Gold Bar WWTP was determined as the best option. On behalf of the City of Edmonton and in coordination with Drainages Services, EPCOR is in the process of implementing a state-of-the-art HUBER Technology based Sanitary Grit Treatment Facility. It will be the first of its kind in North America and capable of processing 3.0 m^3 of solids per hour. Hydrovac trucks, operated by Drainages Services, will dispose of the material at this facility. The facility has to accommodate up to 10 trucks per day each with a payload up to 6.9 m^3. Special attention was paid to air handling systems to reduce odour from the disposal of the sanitary grit. Noise modeling was undertaken to determine possible measures required to attenuate noise from the operation of the facility. The processing of the sanitary grit requires wash water supplied at a rate of 142 m^3 per hour. An equivalent amount of reject water is returned to Gold Bar for full treatment. The washed grit will have an organic content of less than 3%. The washed and separated grit is suitable for reuse (e.g., trench fill) This project is aligned with Edmonton's strategic plan "The Way Ahead" and demonstrates EPCOR's commitment to provide cost-effective and practicable solutions with attention to integrated resource recovery.

Category: Wastewater - Preliminary Treatment

CHEMICALLY ENHANCED PRIMARY TREATMENT (CEPT): DESIGN, CONSTRUCTION, AND OPERATION AT THE MEDICINE HAT WWTP

All Authors:
Zac Kostek, P.Eng,

Presenter(s):
Zac Kostek, P.Eng., MPE Engineering Ltd.

The CEPT process implemented at the Medicine Hat Wastewater Treatment Plant consists of the chemical addition of a coagulant (aluminum sulphate – alum) at the plant headworks, followed by the addition of a flocculent aid (polymer), directly upstream of primary clarification. Through the process of coagulation and flocculation, the alum and polymer additions cause the agglomeration of suspended particles. The larger particles (floc) enhance primary treatment efficiency by increasing the rate of settling and therefore allow primary sedimentation basins to operate at higher loading rates.

This paper reviews the implementation of CEPT at the Medicine Hat Wastewater Treatment Plant. It discusses the theoretical CEPT process and objectives, chemical feed system selection and detailed design, construction, operation and maintenance, process effectiveness, and challenges thereof.

Category: Wastewater - Preliminary Treatment

BONNYBROOK WWTP HEADWORKS FACILITY UPGRADE

All Authors:
Simon Meikle, Ryan Roberts, Zorica Knezevic - Stantec Consulting Ltd.

Presenter(s):
Simon Meikle, Peng. Engineer, Water
Stantec Consulting Ltd.

The presentation will focus on the design and configuration of the new headworks facility at Bonnybrook Wastewater Treatment Plant.

As one of Canada's largest wastewater treatment plants, additional capacity was required at Bonnybrook to serve the growing population of Calgary. The headworks upgrade was completed to improve process efficiency, increase performance, and expand system capacity to accommodate the City's anticipated growth over the site built-out design horizon. The new headworks facility is sized for a firm capacity of 420 MLD annual average flow and 1,390 MLD peak flow which will service about 1.24 million people.

The existing headworks facility (constructed in the early 1970s and mid-1980s) used antiquated technologies that led to large amounts of solids and grit passing through, causing extensive operational and maintenance issues in the downstream facilities. This presentation will focus on the process elements and configuration of the new headworks facility, which consist of 6mm multi-rake bar screens, multi-tray vortex grit removal, screening and grit washing/dewatering systems, solids conveyance systems and truck/trailer storage and off-site disposal facilities.

Partial operation of the new headworks facility started in summer of 2014, with final commissioning in spring of 2015.

Category: Wastewater - Reuse

MEASURING THE PERFORMANCE OF NON-POTABLE WATER REUSE SYSTEMS (CSA B128.3) AND THE CREATION OF A TESTING AND CERTIFICATION PROGRAM IN EDMONTON, AB

All Authors:
Janice Isberg

Presenter(s):
Janice Isberg, Director of Operations,
Edmonton Waste Manage Centre of Excellence

Health Canada and other jurisdictions within Canada have developed guidelines for domestic reclaimed water for use in toilet and urinal flushing as an option to reduce water consumption, in response to the growing interest in water conservation in Canada. The use of domestic reclaimed water can make significant contributions to reducing water use. However, domestic reclaimed water must be treated and managed effectively, as there is a potential health risk to users, particularly from pathogens that can be responsible for severe gastrointestinal illness. To take this issue a step further, the Canadian Mortgage and Housing Corporation (CMHC) and the Alberta Ministry of Municipal Affairs spearheaded the development of the CSA B128.3 standard “Performance of non-portable wastewater reuse systems”.

The CSA B128.3 standard covers packaged non-potable water reuse systems for wastewater or greywater that are intended for treatment applications and have a capacity of 10,000 L/d (2650 gal/d) or less. This Standard also covers site-assembled components included in packaged non-potable water reuse systems.

EWMCE has become accredited through the Standards Council of Canada (SCC) to perform certification of wastewater reuse systems under the Standard.

Testing and Certification ensures:

- Product is in compliance with the relevant standards for the technology.
- Evaluation is performed by credible, competent, independent laboratories.
- Product tested is the same as the product manufactured.
- Manufacturer is held accountable for compliance in all certified products to the requirements of the standard.

Category: Wastewater - Reuse

A COMPACT, EFFICIENT AND EXPANDABLE TITLE 22 TREATMENT SYSTEM FOR SMALL WATER SYSTEMS

All Authors:
Peachie Maher Hytowitz – Amiad Water Systems

Charles Grace – GES

Jon Turner – Phoenix Civil Engineering, Inc.

Presenter(s):
Eric Peterson, VP of Business Development and Strategic Accounts, Amiad Water Systems

Abstract

The community of San Simeon, CA was faced with a state fine due to violations of their discharge permit from their secondary effluent ocean outfall. The community was given the option to direct a portion of the fine funds towards an environmental improvement project that was related to the violation cause. The decision was made to pursue reducing their effluent discharge volume by installing a water reuse system to provide California Title 22 compliant water for local irrigation needs. Through innovative engineering and product selection the community was able to build a very simple and effective tertiary level treatment system for their wastewater flow which was installed within a small footprint at the WWTP and with modularity to allow for easy future expansion as the community recycled water demands expand.

Solution

The system installed includes an Amiad AMF^2-36K microfiber filter rated for 20 micron particle removal followed by a HiPOx AOP system for disinfection.

The current operating capacity of the treatment system is approximately half of the 90,000 gallon average daily flow. One benefit of the system selected is that it is modular in design to allow expansion to double the treatment capacity so that the community can recycle 100% of their discharge flow for reuse.

Category: Wastewater - Small Systems

CITY OF THOMPSON WWTP - FROM PRIMARY TREATMENT TO BNR UPGRADE

All Authors:
Saibal Basu, Jamie Brewster - Stantec Consulting

Presenter(s):
Saibal Basu, Principal (Water), Stantec Consulting, Winnipeg

The City of Thompson is located approximately 740 km north of Winnipeg. The City currently operates two aging existing wastewater treatment facilities which function independent of each other. A mechanical WWTP provides primary treatment only for approximately two-thirds of the City's total wastewater flows while a single cell continuous discharge aerated lagoon treats the remaining one-third of the flows. Based on review of alternative process and life cycle costs analysis during the preliminary design, a centralized wastewater treatment facility utilizing a SBR technology was selected to service a projected population of 15,000 people. The system is designed for biological nutrient removal (BNR) to meet a TP limit of ≤ 1mg/L and TN of ≤ 15 mg/L.

The design team developed a novel concept to place the administration portion of the facility and a majority of the process/mechanical areas on top of the SBR tanks. This compact plant layout allows all process tanks to be covered while meeting the functional requirements for plant operation utilizing three (3) operating levels. For tank covers, pre-cast concrete slabs were selected for lower costs and quicker installation. This compact design resulted in the optimal use of the existing site and energy use while retained space for future plant expansion and upgrades. The project presents several challenges, including high groundwater, poor sub-surface conditions, a fast-track design and construction process to meet the funding deadlines. The paper will discuss process evaluation, design challenges and project innovations. Construction is anticipated to start May 2016.

Category: Wastewater - Small Systems

LAGOON-BASED PHOSPHORUS REMOVAL CASE STUDIES: LESSONS FROM SUNDRIDGE, ONTARIO

All Authors:
Martin Hildebrand, Philip Wiebe

Presenter(s):
Martin Hildebrand, P.Eng., President, Nexom

Canadians understand the threat of phosphorus-rich wastewater being discharged into the environment. In the same way phosphorus helps important crops grow, it can also help algae run rampant, as it has done in the Great Lakes, Lake Winnipeg, among others.

Governments working to restrict the phosphorus flow continually put more pressure on individual wastewater treatment facilities to meet specific limits. This can create issues for lagoon systems in particular, including that of Sundridge, Ontario.

Located 40 minutes south of North Bay, Ontario, Sundridge had a 2-cell facultative lagoon system that saw concentrations as high as 9 mg/L of Total Phosphorus (TP) in its influent. The ideal solution was lagoon-based and reflected the O&M requirements associated with common aerated lagoons, and is what Sundridge's chosen solution—the opTPhos® Total Phosphorus Removal system—strives to achieve.

A common way of removing TP, and the method employed by Sundridge's system, is by binding the phosphorus to ferric or alum to create phosphates, allowing those phosphates to collect into floc, and either filtering those floc out or allowing them to settle. The paper discusses each one of these steps and examines how individual efficiencies—such as dosing amounts or slow- and rapid-mix times—were optimized.

Sundridge's quality easily surpasses the removal rates needed to meet the facility's 0.27 mg/L TP limit. In achieving these impressive results, Sundridge has greatly reduced its impact on the surrounding environment and offers hope to other lagoon systems that may soon face a similar challenge.

Category: Wastewater - Small Systems

IMPROVING UNDERSTANDING OF THE CHEMICAL AND BIOLOGICAL NUTRIENT REMOVAL MECHANISMS IN EXISTING WASTEWATER LAGOONS

All Authors:
Richard Vendramelli

Presenter(s):
Richard Vendramelli, M.Sc., University of Manitoba

There are many rural communities in Manitoba using lagoons to treat their wastewater, but the nutrient removal process is ambiguous. The purpose of this paper is to improve understanding of chemical and biological nutrient removal mechanisms of wastewater lagoon treatment and compare two similar stabilization ponds – one aerated and one facultative. Surface samples were collected from lagoon cells and analysed. The windward and leeward sides of the ponds were usually sampled and the results were averaged. The facultative lagoon achieved overall ammonia-N removals similar to those of the aerated lagoon, and slightly lower orthophosphate removals. Nitrogen is likely removed primarily by ammonia volatilization; and assimilation into biomass. Phosphorus is likely removed by precipitation with calcium at alkaline pH; and assimilation into biomass. There was no significant advantage for aerated over facultative lagoons; they will meet their ammonia discharge limits, but will require additional phosphorus treatment.

Category: Wastewater - Small Systems

CHARTING A NEW DIRECTION FOR WASTEWATER TREATMENT IN NUNAVUT

All Authors:
Kenneth Johnson

Presenter(s):
Kenneth Johnson, Cold Regions Specialist,
Stantec Consulting Ltd.

The so-called “leaky lagoon” was a generally accepted design concept for many years in the Nunavut Territory, formerly the Northwest Territories. However, because of the application of more stringent effluent quality standards and the requirement of a controlled effluent discharge, this design concept is now unacceptable. The current design concept applied for lagoon systems in the far north is a retention lagoon with a seasonal discharge. In addition, the use of wetlands has emerged as a supplementary process for lagoon systems.

The construction of retention lagoons applies modern geomembranes in many cases because of the absence of fine soil materials for the construction of structures with low permeability. New issues are emerging with the construction of these relatively complex earth structures because of the extreme cold climate, permafrost earth regime, and construction techniques.

The anticipated costs of remedial work to address these issues are in the order of ½ of the original capital costs of the original multi million dollar structures, which are beyond the available capital funding. A much needed new direction is being charted based upon research to develop the northern science for wastewater treatment. This science is being communicated to the audience of regulators, as well as the communities to incorporate the “social science”, and “applied science” or engineering is also being incorporated. With this activity it is anticipated that a new, more appropriate direction for wastewater treatment may emerge for Nunavut.

Category: Wastewater - Tertiary Treatment

DISINFECTION CAPABILITIES OF MEMBRANE BIOREACTORS (MBR)

All Authors:
Rob Hacking, Samantha Kendrick

Presenter(s):
Robert Hacking, Regional Manager,
GE Water & Process Technologies

Overview of common disinfection requirements for effluent and reuse water. Review of MBR technology. Introduction of results from 10 MBR plants of varying ages and review of the 2725 data sample set results and conclusions. Discussion on monitoring and integrity of the membranes. How the results could affect full scale costs and O&M.

Category: Wastewater - Tertiary Treatment

EFFLUENT FILTRATION DESIGN FOR PHOSPHOROUS REMOVAL AT THE BONNYBROOK WWTP

All Authors:
Steven Pickle, Gabrielle Jablonski

Presenter(s):
Steven Pickle, M.Sc., P.Eng., Water/Wastewater Engineer, AECOM

An effluent filtration is currently under design as part of the Plant D Expansion project. Effluent filtration is being implemented primarily to reduce phosphorous loading to the Bow River. It will also provide treated effluent water for plant use and improve secondary effluent quality upstream of the existing UV facility. The presentation will review the design approach, focusing on phosphorous removal requirements and objectives, the facilities side-stream configuration (not all plant flow is treated), and hydraulic challenges associated with incorporation into an existing constrained hydraulic profile. An update on the current design and construction status will also be provided.

STORMWATER CATEGORY

Category: Stormwater - Low Impact Development

BIORETENTION FACILITIES IN RETROFIT CONDITIONS: CITY OF CALGARY PILOT PROJECTS AT CARBURN AND DEERFOOT PARKS

All Authors:
Caroline Gort, P.Eng.

Presenter(s):
Caroline Gort, P.Eng., Kerr Wood Leidal

The City of Calgary retained Kerr Wood Leidal Associates Ltd. (KWL) to design stormwater management solutions for two of its parks: Carburn Park and Deerfoot Athletic Park. One of the City's main goals for the project was to demonstrate successful retrofits to existing infrastructure using Low Impact Development stormwater practices as a means to educate the public.

The main approached used to manage the stormwater on site was to redesign parking lot grading to drain to central bioretention cells. The design requirements were to capture the water quality event, meet specific annual runoff volume targets and to maintain a safe ponding depth during events up to the 1:100 year return period. The cells were designed based on Module 2 in the City of Calgary's Low Impact Development Guidelines. KWL's team considered many factors in the design including: ponding depth, I/P ratio, sediment accumulation, growing media properties, drain rock depth, filtration layers, mulching and vegetation.

KWL supervised the construction of the bioretention cells and advised the contractor and client as to the importance of staging of the work on site. Ensuring that the subsoil as well as the multiple layers of the bioretention cell were not compacted during construction as well as ensuring that the drain rock and geotextiles were clean during construction was essential.

Some of the issues that were overcome during the design and construction of the bioretention cells included:

- meeting stringent water volume reduction criteria;
- providing easily cleanable scour protection;
- tying into existing stormwater infrastructure; and
- low subsoil infiltration rates.

Category: Stormwater - Low Impact Development

STATE-OF-THE-ART OF LID MONITORING: THE CALGARY EXPERIENCE

All Authors:
David Seeliger, Scott Struck, Bert van Duin, Natalya Sapova, Mia Yu

Presenter(s):
David Seeliger, MPE Engineering

The City of Calgary (City) is currently implementing Low Impact Development practices or Source Control Practices SCP projects as part of its commitment to protect the water quality in its watersheds and provide sustainable stormwater solutions in the City. The purpose of SCPs is to capture and treat stormwater runoff at or close to the source with objectives of mimicking pre-development hydrology and improving water quality characteristics of site discharges. Examples of SCP projects currently being developed include pilot projects, capital projects, and subdivision projects.

The City is currently developing a monitoring program that seeks to better understand how SCPs function and perform within Calgary's unique climate. The monitoring program will consider a number of the City's SCP pilot projects, covering bioretention, soil cells, permeable pavement, green roofs, absorbent landscapes and infiltration chamber technologies.

The development of the monitoring program has involved a systematic approach that has included confirming objectives, identifying proven and effective monitoring techniques, identifying which of the pilot projects are suitable for monitoring and prioritizing which sites should be monitored based on available budgets. Overarching SCP monitoring guidance for the full range of practices and approaches together with site specific monitoring plans have been developed. The plan is to stage the implementation of the monitoring plan starting in spring.

The proposed paper will overview the development of the monitoring program and the approaches and learning from implementing the individual site plans.

Category: Stormwater - Low Impact Development

LESSONS LEARNED AND SUCCESSES: BIOSWALE APPLICATIONS IN COLD CLIMATE – EDMONTON

All Authors:
Xiangfei Li, Ross Bulat, Danlin Su, Andrew Liu, Kerri Robinson

Presenter(s):
Kerri Robinson, M.Sc., P.Eng., City Planning, Drainage Planning and Engineering, City of Edmonton

Low Impact Development (LID) is a stormwater management and land development approach that mimics natural hydrological cycle to manage stormwater at its source(s). Bioswale is a LID feature that has been increasingly applied in green field development and redevelopment to treat stormwater and enhance aesthetics of the communities.

Bioswale application is promoted in Edmonton as part of the City's LID implementation plan and environmental initiatives. For bioswale to become a norm, addressing cold climate challenges is critically needed.

This paper presents the site investigation results from 2014 to 2015 and field monitoring results since 2011. A few bioswale facilities were visited during dry and wet weather conditions and spring melt events. Observation of bioswales in a variety of locations shed lights on how to locate bioswales with considerations of winter road maintenance, snow removal, and icing issues. Site investigation finds construction issues potentially affected the infiltration of bioswales. The City has been monitoring infiltration rate, water quality and vegetation health at a few bioswale facilities. It is promising to see that a bioswale in industrial area increased its ability to infiltrate runoff. On the other hand, there are a few bioswales facing ponding water issues due to reduction of infiltration rate. This paper analyzes the reasons behind those bioswale facilities and recommends on future improvement in terms of design and maintenance. The knowledge and data from those bioswale projects would be beneficial to other municipal communities in similar climate conditions to address cold climate challenges.

Category: Stormwater - Low Impact Development

RIPARIAN BIORETENTION BUFFER

All Authors:
Anton Skorobogatov, Bernie Amell, Dawn Smith, Cory Albers, Angus Chu

Presenter(s):
Anton Skorobogatov, Environmental Designer, Source2Source Inc.

This project focused on managing stormwater run-off from a public works yard in the Town of Okotoks, adjacent to Sheep River. The objective was proposed to be met by constructing an extensive riparian bio-retention system that utilizes the biogeochemical functionality of plants and permeable soils to treat and manage stormwater.

The proposed riparian bio-retention system offered multiple environmental benefits, including: buffering effect on the hydrological regime, decrease in the risks of flood and drought, and enhancement of natural aesthetics. To date, the design of similar absorbent landscapes has been primarily focused on maximizing infiltration through the use of coarsely grained (sandy) soil mixes. Multiple incidents of clogging and functionality loss have been documented with bioretention systems constructed using coarsely grained media. The proposed system utilized cohesive soils instead of sand, and facilitated biological processes to sustain infiltrative capacity of the system over long term.

A part of the overall bioretention system is a dedicated research testing area, where small scale bioretention beds will be constructed and tested for their performance. Analyzing the performance of these systems in-situ will shed light on the optimal design configurations for areas that experience freezing temperatures, have characteristic spring run-off, and receive substantial salt and grit loadings. Meteorological, hydrological, and water chemistry data will be collected as part of this research project.

The presentation will mainly focus on the design and construction of the bioretention facility. Highlights of the future research and proposed testing program will also be presented.

Category: Stormwater - Other

37 STREET STORM TRUNK RELOCATION

All Authors:
Charles Pullan, P.Eng, - The City of Calgary

Gabriel Jean, P.Eng. - Associated Engineering

Presenter(s):
Charles Pullan, P.Eng., City of Calgary

Gabriel Jean, P.Eng., Associated Engineering

As part of the SW Ring Road project, Alberta Transportation requested that The City of Calgary construct a new 1600 m long, 2400 mm diameter storm trunk within the 37 Street SW right of way, south of Glenmore Trail to the Elbow River, 1000 m of which was included in Contract 1.

Within Contract 1, the northernmost 400 m of the installation ranges in depth from 9 m to 14 m. Associated Engineering (AE) determined that this segment of the installation should be completed through trenchless installation to maintain vehicle traffic. To facilitate innovation in bridging the open cut and tunneling construction, AE enabled the contractor to have flexibility on the southern limit of tunneling by including a transition zone that left the installation methodology to the contractor. The trenchless methods allowed included microtunneling and tunneling.

As the City does not maintain a list of contractors pre-qualified to complete such work, AE developed and evaluated a tunneling contractor pre-qualification to limit the pool of bidders to those with the relevant experience. The trunk was installed by open cut and microtunneling, and at an ID of 2500 mm, this marked the largest diameter microtunnel in North America. A 12 m diameter launching shaft was installed to a depth of 14 m at the north end of the installation and the MTBM exited through a smaller reception area. The pipe including the microtunneled portion was successfully completed in December of 2015, well ahead of schedule.

Category: Stormwater - Ponds

BOWMONT NATURAL ENVIRONMENT PARK STORMWATER RETROFIT PROJECT - THE PROJECT'S JOURNEY

All Authors:
Penelope Reid - City of Calgary Water Resources,
Chris Manderson - City of Calgary Urban Conservation ,
Tristan Surtees - Lead Artist Watershed+ ,
Charles Blanc - Lead Artist Watershed

Presenter(s):
Tristan Surtees and Charles Blanc, Watershed + lead artists

Penelope Reid, Project Engineer, Water Resources, City of Calgary

In 2010, The City of Calgary expropriated an abandoned gravel pit adjacent to Bowmont natural environment park along the Bow River with the intention to restore riparian and upland habitat. The site also presented an opportunity for major end-of-pipe stormwater quality improvements, something not contemplated in the original acquisition of the lands, and something arguably contradictory to the original restoration intent. A collaborative design approach between City departments was fostered through Watershed+, a City of Calgary public art initiative. Artists were integrated into the design process from the beginning to bridge the two design intents, one formed by ecological restoration of the landscape with that of water resource engineering. Using stormwater as a rationale for introducing wetland habitats into the restoration, artists lead the concept development to make the treatment train visible throughout. Instead of an imperceptible and visually disconnected treatment system, the journey of stormwater through the park and its creation of different habitats is made apparent. The different stages of the treatment train are designed as distinct environments defined by their treatment functions, bringing stormwater management to the public's attention in kinetic and expressive ways. This presentation will articulate how embedded creative process and cross-disciplinary collaboration resulted in a design that provides treatment for 1775 hectares of stormwater drainage, while bringing the journey and treatment of stormwater to the public's attention. It will showcase how stormwater was looked at as opportunity to create different habitats within a park, and its role restoring the ecological integrity of the landscape.

Category: Stormwater - Ponds

BOWMONT NATURAL ENVIRONMENT PARK STORMWATER RETROFIT PROJECT – A FUNCTIONAL LANDSCAPE

All Authors:
Cory Albers, Penelope Reid

Presenter(s):
Cory Albers, Co-Owner, Source2Source Inc.

The Stormwater Retrofit Project is a major end-of-pipe stormwater quality improvement facility within the Bowmont Natural Environment Park adjacent to the Bow River in Calgary. In addition to improving stormwater quality prior to discharge to the river, the project offered a unique opportunity to restore the disturbed landscape into a natural environment while bringing the stormwater treatment train into public focus through embedded creative process.

Lead artists, embedded on the design team, collaborated to establish a design language expressing the journey of stormwater throughout the system. The considerable task of the design team was to ensure the creative vision was achieved by presenting the water as art form while maintaining hydraulic system functionality.

At its core, the project is a functioning stormwater system. The 90m diameter Nautilus Pond™, an innovative WWTP clarifier style system, was used to remove the majority of stormwater sediment diverted from existing major storm trunks. The high functional performance of the Nautilus Pond™ system enabled the majority of the project footprint to consist of green infrastructure such as wet meadows and wetlands to further polish water and remove nutrients.

This presentation will articulate how the creative vision for expressing the journey of water through the park was reconciled with the need to provide a high-functioning system for improving stormwater quality. It will show how the system was designed as an analog to a WWTP design where robust pre-treatment was followed by similarly robust green infrastructure serving to polish water and remove nutrients.

Category: Stormwater - Ponds

CONDITION ASSESSMENT PROGRAM FOR CITY OF CALGARY STORMWATER PONDS

All Authors:
Mark Draper - CH2M

Thant Aung-Kyaw - The City of Calgary

Presenter(s):
Thant Aung-Kyaw, P.Eng., The City of Calgary
Mark Draper, P.Eng., CH2M

Management of stormwater runoff from urban development has been recognized for many years as a major challenge facing both municipalities and developers because of the potential impacts on receiving streams. Within the boundary of City of Calgary, Water Resources and Water Services manage over one hundred and twenty five (125) wet ponds and wetlands that are expected to treat the urban stormwater runoff. Some of these wet pond and wetland assets have been in operation for over 30 years. Since the construction of these assets in early 1970s, many changes have occurred in the stormwater industry specifically in the areas of treatment optimization and sediment management. These developments are important, as they influence current best management practices. Maintaining these assets to meet suitable level of service and providing financial sustainability are proven to be a challenge for municipalities. Knowledge of the conditions of these assets is necessary to assist in decisions related to design, operation, maintenance and renewal. In 2014, City of Calgary began to take an initiative in developing a Condition Assessment Program for wet ponds and wetlands in hope that the findings and recommendations from the condition assessment program will aid in the development of long term funding strategies and a sustainable asset renewal and replacement planning process. This paper outlines a criticality rating process for establishing the program prioritization and describes the assessment methodology for ongoing, systematic and consistent determination of the conditions of pond assets.

Category: Stormwater - Ponds

AN INEXPENSIVE SYSTEM FOR SUSTAINABLY MANAGING STORMWATER SEDIMENT

All Authors:
Cory Albers, Bernie Amell

Presenter(s):
Cory Albers, Co-Owner, Source2Source Inc.

The City of Calgary and other municipalities are facing an enormous and growing unfunded liability associated with managing stormwater pond sediment. Using current stormwater pond design and maintenance practices, it is estimated by the City of Calgary that the average cost for managing 25 years worth of sediment is approximately $5 million per pond. With 10 - 12 new stormponds coming online every year, the annual City of Calgary unfunded liability could eventually exceed $50 million. Source2Source proposes constructing a sediment transformation system that uses a natural systems approach to greatly reduce the life cycle cost of managing sediment. With the proposed system, sediment can be relocated in a simple maintenance operation every 5 years. The eventual product of this system is a transformed and useful soil product rather than a nuisance and expensive waste product. The constructed system will have the look, feel, and associated amenity value of a natural area in a small stream floodplain. S2S estimates that the total sediment management life cycle cost could be reduced by more than half while greatly improving water quality and reducing associated odour problems that generate most complaint calls from residents.

This presentation will focus on how a natural systems based approach for managing stormpond sediment can be inexpensively applied to both greenfield and retrofit projects where even previously deposited sediments can even be used in the retrofit construction process. Life cycle cost issues will be discussed with design and maintenance practice comparisons between the proposed and current systems.

Category: Stormwater - Ponds

ICE PROCESSES ON STORM WATER PONDS

All Authors:
Jeffrey Kemp, Mark Loewen, Evan Davies

Presenter(s):
Jeffrey Kemp, University of Alberta

The winter recreational use of storm water ponds and exposure of the public to unsafe ice conditions is a concern for many municipalities. As components of a drainage network that is designed to remain functional year-round, these facilities can be expected to receive run-off during mid-winter thaw events, resulting in significant flow beneath the ice cover. It was hypothesized that the design and operation of the facilities influence the spatial and temporal variability in the ice cover thickness; however, the extent of the variability and the driving mechanisms were uncertain.

The research being presented evaluates the variability in ice thickness and characterises the ice processes that drive that variability. To achieve this, four study ponds in Edmonton, AB, were selected and then instrumented and monitored for a period of two years. Submerged instrumentation, local climate stations, and time-lapse cameras provided continuous measurements and monitoring of ice conditions. Surveys of the spatial variability in ice thickness were conducted using ground penetrating radar. The field monitoring program found that the physical characteristics of the four study ponds have a significant influence on both the ice cover and ice processes. It was also observed that the ice cover itself significantly reduced storage, altered flow regimes, and influenced the growth and decay of ice.

Category: Stormwater - Stormwater Planning

FLOOD MITIGATION IN THE CITY OF EDMONTON

All Authors:
Scott Macintosh - City of Edmonton

David Yue - Sameng Inc.

Presenter(s):
Scott MacIntosh, P.Eng., Senior Project Engineer
City of Edmonton

David Yue, Principal, Sameng Inc..

Overview of the City of Edmonton's Flood Mitigation Program. Historically this has been a reactive program implemented after severe storm events. Moving forward, the City of Edmonton is becoming a leader in Flood Mitigation by developing a proactive approach, where systems are designed to provide a 1:100 yr service level throughout the City. This program is planned to facilitate the pressure of growth within the City and actively plan for major flood events, instead of relying on emergency response after events have occurred and resulted in hundreds of millions of dollars of damages. This is accomplished through proactive design and implementation of LID, Infrastructure upgrades, dry/wet ponds etc...

Category: Stormwater - Stormwater Planning

LEVEL OF SERVICE DETERMINATION IN FLOODPLAIN COMMUNITIES

All Authors:
Andrew Rushworth, P.Eng. - Associated Engineering

Brad Larson, P.Eng. - City of Calgary

Presenter(s):
Brad Larson, City of Calgary Water Resources

Andrew Rushworth, Associated Engineering

The City of Calgary experienced an unprecedented flood on the Bow and Elbow Rivers in 2013. The community of Sunnyside experienced flooding due to two distinct events. The first event was on June 20, when high levels in the Bow River overtopped the berms along Memorial Drive NW. The second event was on July 5, when stormwater runoff was unable to discharge to the Bow River due to closed stormwater outfall gates.

The City retained Associated Engineering to complete a drainage study for Sunnyside and the surrounding area. The City typically mandates that retrofit areas be designed with a 1:50 year rainfall level of service. However, the City does not have a level of service policy for a rainfall event while stormwater outfall gates are closed. The study focused on the determination and analyses of a level of service under typical conditions as well as while stormwater outfall gates are closed.

As part of the drainage study, Associated Engineering conducted an analysis in an effort to assist the City of Calgary in determining a level of service standard. The analysis leveraged the City's network of rainfall gauging stations in conjunction with hydrometric data to illustrate the severity of historical combined river / rainfall events. The analysis proved to be an instrumental first step to establishing a policy for a level of service while stormwater gates are closed in floodplain communities.

Category: Stormwater - Stormwater Planning

A 2D DIRECT RAINFALL ANALYSIS OF STORMWATER SYSTEMS IN MATURE NEIGHBOURHOODS

All Authors:
Neal Cody, P.Eng., - Stantec Consulting

Roland Daa-Naa, P.Eng. - City of Edmonton, Drainage Services

Presenter(s):
Neal Cody, P.Eng., Water Resources Engineer, Stantec Consulting Ltd., Edmonton, AB

Stantec was retained by the City of Edmonton to conduct a hydrologic and hydraulic analysis of the sewer and overland drainage systems in eleven mature neighbourhoods in Edmonton. Over the past several years, the City has undertaken several large and detailed computer modeling projects and has been considering different models and modeling methodologies. Their goal was to produce more accurate and useful results in a timely manner and within a stable model. Stantec and the City worked together to develop a modeling methodology which used detailed input data and an emerging surface modeling engine to produce detailed 2-dimensional maps of surface flooding.

Stantec used detailed data such as catchbasin-level inlets, remote-sensed impervious area data, and 10cm LiDAR data for 3D surface creation. They also employed a method which has been used in academic and scientific research for many years but which has only recently emerged in commercial software – 2D Direct Rainfall (DR). Also known as rain-on-grid or rain-on-surface, the computation method applies hyetographs directly to a 3D surface and uses hydraulic calculations to determine where and how water flows and collects. This method avoids catchment delineation and creation, as well as the estimation of parameters which affect timing lag and attenuation which are usually based on engineering judgment and can be notoriously variable. Infiltration parameters are still specified however and hydrologic losses occur on the 3D surface.

This paper will present the methods and results of this project, along with potential future applications and improvements.

Category: Stormwater - Stormwater Planning

APPLES AND ORANGES: RISK BASED ANALYSIS AND PRIORITIZATION OF STORMWATER UPGRADES

All Authors:
Michael Binns, P.Eng.

Presenter(s):
Michael Binns, P.Eng., Project Manager,
Associated Engineering

The City of Regina undertook a study of two drainage areas that were prone to flooding during storm events. Within the drainage areas, localized areas of flooding were identified and upgrade options developed. A methodology was then required that could effectively compare the value of each option and provide a prioritization for implementation.

The City had previously adopted a set of evaluative criteria for comparing large drainage areas. However, some criteria were not applicable on a smaller scale, or the required data was unavailable. Previous studies had modified or added criteria to address the gaps, resulting in inconsistency in methodology, and difficulty in comparing proposed upgrades. Associated Engineering provided a Risk Based Approach which replaced this with a methodology based on evaluation of risk exposure and reduction. A set of evaluative risks were identified, along with associated unit costs. The impact of various return periods was modeled before and after upgrades to provide both initial and residual risk exposure for each option. These risk exposures were quantifiable across various return periods and expressed in common dollar units for comparison. Benefit for each option was evaluated as Initial - Residual Risk, or the actual value of the reduction in risk. This was then compared against the cost of the proposed upgrade to develop a Cost/Benefit Ratio, or Payback Period. This allowed evaluation of upgrade options of different scales and technologies in an objective, unbiased manner to determine the options providing the most impact (reduction of risk) per dollar spent.

Category: Stormwater - Stormwater Planning

CITY OF RED DEER - INTEGRATED RAINWATER MANAGEMENT PLAN

All Authors:
Tyler Schafer, Brad Dardis

Presenter(s):
Tyler Schafer, P.Eng., Civil Engineer,
Stantec Consulting Ltd.

City of Red Deer – Integrated Rainwater Management Plan

The City of Red Deer has taken the initiative to start looking at less traditional, and more sustainable ways to handle stormwater runoff. They commissioned stormwater management specialists to do a high level academic study on an integrated rainwater management plan (IRMP). An IRMP is a comprehensive strategy for drainage management that integrates and balances the engineering design and construction components with the ecological and sustainability considerations. The IRMP recognizes that drainage is a very complex subject, and regulators must provide the correct balance of facilitating development while providing flood protection, and maintaining the natural hydrologic cycle.

The objective of this IRMP was to identify opportunities to incorporate LIDs, better land use planning, and stormwater BMP's into future projects within the City. These strategies will help to mitigate the increased stormwater runoff that generally accompanies development, and also to help improve the quality of runoff at the source rather than strictly relying on end of pipe measures. The provided strategies will contribute to the City's goals of increased environmental protection, infrastructure sustainability, integrated solutions, and reduced capital and operation and maintenance costs associated with more traditional stormwater management systems.

This study provided an overview of existing BMP technologies, a summary of the existing storm system composition, a review and recommendations of the City stormwater design guidelines as they pertain to stormwater BMPs, and a pilot project study.

Category: Stormwater - Stream

THE CITY OF CALGARY'S RIPARIAN ACTION PROGRAM: OUR COMMITMENT TO RIVER AND STREAM CORRIDOR PROTECTION AND MANAGEMENT

All Authors:
George Roman, M.Sc., PMP

Presenter(s):
George Roman, M.Sc., PMP, Senior Water Resources Planner, Watershed Planning, The City of Calgary Water Resources

Riparian areas unfold like ribbons of green across our watersheds, bordering rivers and creeks, and extending across floodplains. Riparian green infrastructure provides many benefits to Calgarians, including improved drainage, contributions to flood resiliency and public safety, water quality improvement, biodiversity conservation, recreational opportunities, and overall enhancements to the spatial quality of our city.

The history of riparian stewardship and development in The City of Calgary extends over 100 years. More recently, in July 2013, The City of Calgary's Riparian Strategy articulated principles, goals, and strategies related to modern day riparian management. This has evolved into the implementation phase with the development of a Riparian Action Program (RAP) establishing related projects, processes, timelines, and decision support tools. A system for monitoring and evaluating program results with indicators and targets has also been established by the RAP.

This presentation will present the overall program framework, as well as profiles of key projects and decision support tools recently completed or underway related to bioengineering, riparian health monitoring, riparian mapping, land use planning, and citizen engagement and communications. Ongoing implementation of the RAP will be undertaken through collaboration and engagement with a wide range of internal and external stakeholders.

Category: Stormwater - Stream

EROSION AND SEDIMENT CONTROL AT GRANDIN RAVINE AND OUTFALL 7 IN ST. ALBERT, AB

All Authors:
Chris Jones, Greg Tippett, Jon Cleland

Presenter(s):
Greg Tippett, P.Eng., Stantec Consulting Ltd.

Grandin Ravine is a natural ravine located at the south end of St. Albert, Alberta. The ravine acts as a natural conveyance connection between two segments of large diameter storm sewer, which eventually discharges to the Sturgeon River at Outfall #7. Four earthen check dams in the ravine have been used to reduce flow velocity and erosion. However, heavy rainfall in recent years and failure of several of the earthen check dams has resulted in significant erosion damage in the ravine and subsequently a large sediment deposit in the Sturgeon River at Outfall #7. To remediate this problem, approximately 30 naturalized check dams (sediment traps) constructed of wood logs were constructed in the flow channel in Grandin Ravine to reduce flow velocity. The check dams have been designed so that sediments will settle on the upstream side of the logs and will fill in the downcut channel with the hope that the erosion damage will be repaired over time. They were constructed using low impact techniques to minimize disturbance to the natural ravine area. In addition, an oil and grit separator was installed just upstream of Outfall 7 to trap residual sediment before stormwater is discharged to the Sturgeon River, which is susceptible to sediment deposits due to its exceptional slow flow velocity. Public concern over construction within Grandin Ravine and poor soil conditions at the oil and grit separator location added challenges to this project. This paper is a case study for this unique project.

Category: Stormwater - Stream

BANK STABILIZATION FROM PLACING ROCK TO RESTORING AN ECOSYSTEM, HOW STREAM BANK PROTECTION HAS CHANGED

All Authors:
Dr. Steven Tannas

Presenter(s):
Steven Tannas, PhD, P.Ag., President, Tannas Conservation Services Ltd.

After the flooding in 2013 numerous bank stabilization projects were required to protect critical infrastructure and prevent further failures of critical infrastructure. However the historical methodology to protect banks of streams and rivers has been to harden them. This in effect results in lost habitat for wildlife, plants, and fish. Regulatory pressure has increased significantly in the years after 2013 due to the vast number of bank protection projects. If fish habitat is lost compensation is now required. Regulators are in many cases rejecting projects out right if they do not contain bio-engineering features. For this reason industry and municipalities must think about bank stabilization differently. The use of Bio-engineering, with other soft erosion control techniques can effectively stabilize stream and river banks while maintaining healthy ecosystem function.

Although bio-engineering has become popularized it is typically applied inappropriately or as an afterthought to bank stabilization projects. In many cases Engineers, Biologists and Agrologists have jumped into bio-engineering without taking the time to ensure they understand the complexity of bio-engineering. The failure of many projects can be easily predicted from clear design flaws. When inappropriately applied bio-engineering can cost more money cause significant failures and discourage people from using the technique.

In contrast properly designed projects reduce costs, environmental impact, and improve aesthetics. Within these 9 projects restoration has become the focus and is integrated into the engineering design from day one to ensure the long term success. These projects represent partnerships between Professional Agrologists and Engineers that have resulted in unique designs for each location. Properly designed projects require a multi-disciplinary approach that involves engineering, erosion control, aquatic biologists, terrestrial ecologists and plant propagation experts. The more complex the project the more complex the team that is required to ensure success.

Category: Stormwater - Watershed

WATER QUALITY STRATEGY – RIVER FOR LIFE

All Authors:
Fernando Sacluti, Xiangfei Li, Ross Bulat, Kerri Robinson

Presenter(s):
Kerri Robinson, M.Sc., P.Eng., City of Edmonton, City Planning
Drainage Planning and Engineering

River for Life, a 30 year water quality strategy initiated by the City of Edmonton, was developed with the mission to "[prevent] pollution by continuously reducing discharges of contaminants to the environment towards a goal of net zero impact from human activity." The strategy includes four foundational processes to support implementation of discharge quality enhancement projects and five implementation plans to provide specific direction for reducing discharge pollutant loads to the North Saskatchewan River.

River for Life is currently underway as the initial Planning steps to support implementation are taken. In 2015, the Discharge Improvement Zone (DIZ) study Phase 1 was completed. This study is one of the major components outlined in the River for Life and makes the important shift from focusing on outfall discharges to looking at the city-wide sources of contaminants before reaching any sewer system. The City has been divided up into geographically distinct areas (DIZs) based on land-use zoning and sewer system. Load generation for different pollutants is estimated for each zone. DIZs Study Phase 2, starting 2016, will identify prioritized and targeted DIZs for capital improvements to reduce the amount of pollutants discharged to our watercourses. The communication of River for Life to stakeholders will initially focus on engaging the public on their impact on water quality.

This paper presents the overall framework and implementation plan of River for Life strategy. It also discusses the results from recent studies and the way moving forward to reduce contaminant loading.

Category: Stormwater - Watershed

CO-OPERATIVE STORMWATER MANAGEMENT INITIATIVE

All Authors:
David Seeliger, Erwin Braun, Simone Bourke

Presenter(s):
Erwin Braun, P.L.(Eng), General Manager, Western Irrigation District

David Seeliger, P.Eng., MPE Engineering

Urban stormwater runoff generated in the region east of Calgary flows naturally towards the Western Irrigation District's (WID) irrigation canal distribution system. Control of the nutrient loadings in stormwater runoff from existing urban land development has proven to be a challenge. Significant urban development is projected over the next 25 years. In late 2011, municipal partners and the WID ascertained that there was a need to undertake a collaborative process to develop a sustainable stormwater management solution for the region to accommodate future land development while retaining the integrity of the water quality in the WID canal system. Thus, the Co-operative Stormwater Management Initiative (CSMI) was formed.

The CSMI is comprised of the following partners: City of Chestermere/Chestermere Utilities Incorporated (City of Chestermere/CUI), City of Calgary, Rocky View County (RVC), Town of Strathmore, Wheatland County, and Western Irrigation District (WID) and the Calgary Regional Partnership (CRP).

A Planning Study was completed in 2014 and recommended an out-of-canal stormwater management (SWM) alternative whereby urban stormwater runoff would be intercepted and conveyed via a designated canal system from the WID irrigation main canal system. A water balance analysis was then commissioned to quantify potential downstream impacts of stormwater discharges from future land development areas and refines the level of mitigation measures, such as riparian improvements and bioengineering that are needed to lessen these impacts. The study also demonstrated how the adoption of emerging stormwater management approaches such as low impact development can be used to minimize downstream impacts.

The proposed paper will overview why and how a collaborative approach was used to develop a regional plan including discussing the various process and technical challenges. Discussion on progress and the next steps to implementing the plan will be provided.

Category: Stormwater - Watershed

THE INTEGRATION BETWEEN SOURCE WATER PROTECTION AND STORMWATER MANAGEMENT - CASE STUDY: HASKAYNE MASTER DRAINAGE PLAN AND SOURCE WATER PROTECTION STUDY

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The Bow River is one of two drinking water sources for the City of Calgary. Water is drawn from the river in the Bearspaw Reservoir at the Bearspaw Dam, and about 4 km downstream from the dam. A recent proposal to develop lands along the north side of the Bearspaw Reservoir led the City to commission a study to assess potential impacts to source water quality due to development.

Specifically, the City was concerned that stormwater outfalls into the reservoir would compromise source water quality and that contaminated stormwater could infiltrate through permeable soils and rapidly migrate to the reservoir through the alluvial aquifer, also compromising source water quality. The City engaged a project team led by Kerr Wood Leidal and supported by MPE Engineering and Tetra Tech EBA to complete the study.

The study goal is to develop mitigation measures to conserve existing source water quality or limit adverse impacts to source water quality from the Bow River due to stormwater inflows from new development. Aspects of the project include characterizing the existing water quantity and quality in the Bow River; characterizing the hydrogeology in the proposed development lands; identifying and evaluating risks to water quality in the Bow River; evaluating and designing mitigation options for managing stormwater around the City's source water; and developing source water protection policy recommendations. T60

The results of this study are intended to guide stormwater management planning and design around the City's source water. It will also inform the Master Drainage Plan for the Haskayne Area Structure Plan.

Category: Stormwater - Watershed

STORMWATER RUNOFF MONITORING IN TWO SMALL URBAN COMMUNITIES IN SOUTHERN ALBERTA

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Stormwater management receives much attention in large urban centres, as loadings of various contaminants can have a significant effect on downstream water quality. Regulations often include required pretreatment in stormwater ponds and with controlled release. Small urban centres are not subject to the same level of regulation. To determine whether small urban centres may have a measurable impact on downstream water quality during storm (precipitation) events, we examined water quality in Pincher and Lee creeks, two tributaries of the upper Oldman River in Southern Alberta. Each tributary passes through a small urban centre namely, the towns of Pincher Creek and Cardston.

Water quality during storm events was compared with water quality during baseline events both upstream and downstream of each town. Key variables included: fecal coliform bacteria, total nitrogen, total phosphorus, total suspended solids and pesticides. Water quality data were compared against federal guidelines to determine exceedances of various uses, namely, for protection of aquatic life, for livestock watering, irrigation use and for contact recreation.

During baseflow, water quality was generally good. During rain events, contaminants entering the creeks in storm water runoff resulted in a decline in water quality. Concentrations of all variables were high at the downstream sites, indicating that both towns were measurable contributors of nonpoint source (diffuse runoff) contaminants. To decrease contaminant loadings to creek water from urban stormwater runoff, recent innovations in stormwater management, including “Low Impact Development” programs are presented as potential solutions.