Healthy Aquatic Environment – Improving Watershed Health through Water Reuse

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About EPCOR

EPCOR OPERATIONS

- Electricity Distribution & Transmission
- Water Facilities
- Wastewater Facilities
- Water/Wastewater Facilities
- Industrial Wastewater Facilities

Driver for Reuse: Water Scarcity

- Water scarcity is driven by a number of factors
  - Urbanization, growth, a greater understanding of environmental instream flow needs and climate change
- 80% of the world's population is expected to be living in dry or drought-prone regions
  - By 2020 the UN estimates water use to increase 40% to support food requirements
  - In China 400 of the countries 660 cities lack sufficient water
- Historically water scarcity has not been a significant issue in Canada, but is starting to be …
  - 85% of Canadian populations live in the south, 60% of our water flow north
  - Most water basins in Southern Alberta are now closed
  - It is very much a local issue
- Will result in increased costs to obtain water supplies
  - Poorer water sources, greater transport distances, reuse and desal.

Is Water Reuse Part of the Solution?

- Water Reuse is becoming a significant source of water in many locations
  - In Australia a target of 20% reuse of wastewater has been set in some territories
  - The California Water Plan Update 2009 highlights municipal reuse water represents a relatively energy-efficient water management strategy in many areas of the state. Requires water and wastewater agencies to adopt policies by 2015 that promote the use of recycled water for all appropriate, cost effective uses.

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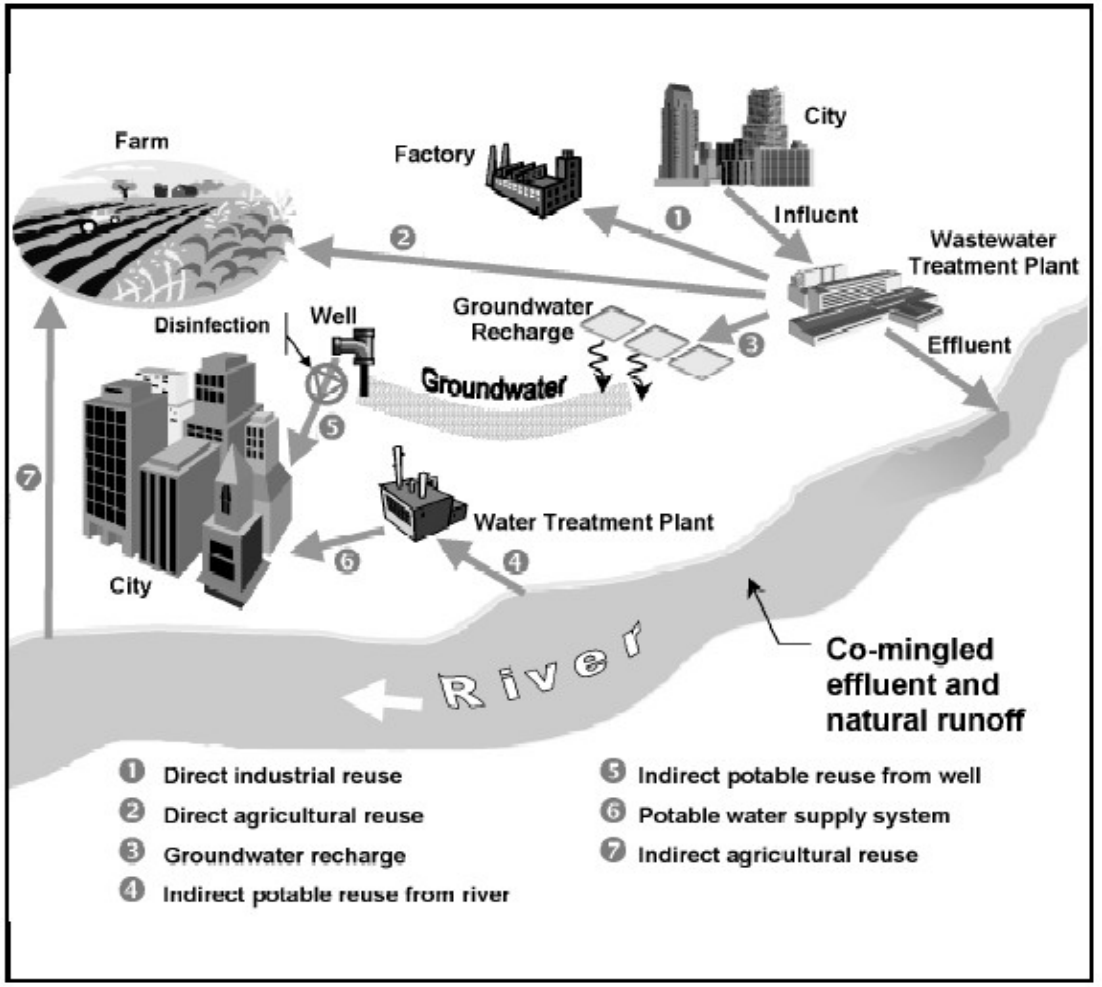
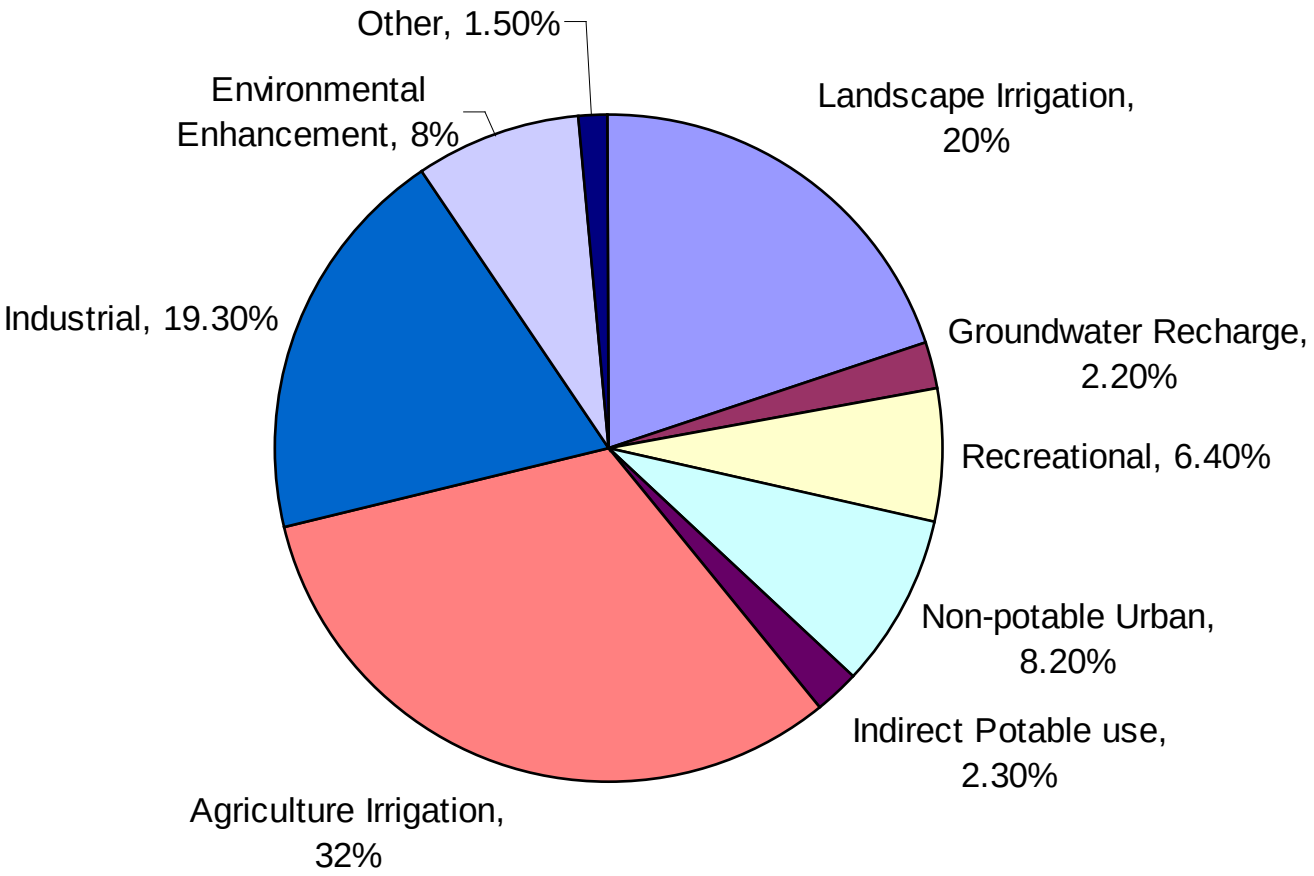
Water Reuse Applications (WateReuse Association 2004)



Types of Water Reuse

- **Augmentation of supply sources**
  - Groundwater recharge
- **Urban Reuse**
  - Irrigation of parks, highway medians, golf courses, etc.
  - Toilet and urinal flushing
- **Environmental and recreational**
  - Create, restore, and/or enhance wetlands
  - Recreational and aesthetic impoundments
- **Agricultural use and reuse**
- **Industrial Reuse/Recycling**
  - Cooling water
  - Boiler feed and make-up water
  - Industrial process water
  - Commercial uses (e.g. vehicle washing, window washing, etc.)
  - Fire protection
  - Dust control

Water Reuse Projects



Source: GWI/PUB Water Reuse Inventory (2009)

Potential Benefits of Water Reuse

- Conservation of fresh water supplies
- Management of nutrients
- Improved protection of sensitive aquatic environments by reducing effluent discharges
- Economic advantages by reducing the need for supplemental water sources, associated infrastructure and energy use
- Proximity: available in urban areas
- Dependability: A reliable source

WWTP Effluent, Effluent Standards and In-Stream Water WQ Objectives

Parameter	Gold Bar WWTP Effluent [1]	ESRD Effluent Standards [2]	Surface WQ Objectives (open water/ice covered) [3]
cBOD (mg/L)	2 - 3	≤ 20 mg/L	- -
TSS (mg/L)	3 - 6	≤ 20 mg/L	17 / 30
NH_3–N (mg/L)	0.3 – 0.7 S 1.5 – 3.4 W	< 5.0 S < 10 W	0.05 / 0.12
Total P (mg/L)	0.2 – 0.9	< 1.0 mg/L	0.029 / 0.014
E. coli (per 100 mL)	3 - 19	≤ 200	29 / 15

1. Monthly averages of GB final effluent based on 2013
2. As per current ESRD approval
3. ESRD Proposed 50th %ile WQ Objectives for Pakan
4. Ammonia-N for summer (S) and winter (W)

Considerations for Reuse

- Economics
- Matching supply and demand
- Return flows must be considered
  - Instream flow needs often require return flows
  - Important for consumptive use
  - Can substitute for fresh water use, basins where allocations are available or discharges to ocean

Challenges for Reuse in Canada

- Globally, reuse has focused on irrigation (over 50% of projects)
- In Canada limitation on irrigation use
  - Limited irrigation season (would require large storage)
  - Urban irrigation makes up a small portion of overall water use
    - 6% of water used for outdoor watering in Edmonton compared to 40 to 50% in SW US
    - Negatively impacts the economics of purple pipe systems
- In Canada need to find reuse opportunities that have year round demands
  - Industrial requirements meet this need

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The EPCOR-Suncor Solution at Gold Bar

- EPCOR's Gold Bar wastewater treatment facility treats the City of Edmonton's municipal wastewater and delivers a portion of it to Suncor's Edmonton Refinery

- Gold Bar Wastewater Treatment Facility
  - One of Canada's largest tertiary treatment plants treating wet weather flows from a combined sewer system
  - One of Canada's largest Class IV wastewater treatment plants
  - Average daily flow 255 ML of wastewater treated per day
  - Membrane-based wastewater recycling facility treats and supplies water to Suncor refinery

Project Overview

- Reclaimed wastewater to Suncor's 135,000 bbl/day Edmonton refinery
- Capacity of 15 ML/D – reduced Suncor's fresh water use 40%
- 5.5 km pipeline from the Gold Bar WWTP to the Suncor Refinery
- Reclaimed water for cooling water and the production of hydrogen at Suncor

Project Drivers – Suncor

- Refinery Conversion Project
  - Diesel Desulphurization
  - Bitumen Processing – Heavy Oil Upgrader
- Increased need for hydrogen and steam resulted in higher demand for water
- Options considered for water supply
  - North Saskatchewan River
  - Reuse Water from Gold Bar
- Cost a significant driver
  - Increased costs for river intakes
  - Costs to treat river water are high

WWTP Effluent, Reclaimed Water (MPW)and North Sask. River Conditions

Parameter	Gold Bar WWTP Effluent[1]	Re-Use (MPW) [1]	Typical River Conditions [2]
cBOD (mg/L)	2 - 3	< 2	- -
DOC (mg/L)	- -	6.9 – 9.5	1.5 - 13
TSS (mg/L)	3 - 6	0.7 - 0.8	< 5 - 300
TDS (mg/L)	- -	520 – 740	180 - 210
Turbidity (NTU)	2 - 4	0.24 – 0.31	1 - 3,500
NH_3–N (mg/L)	0.3 - 3.4	0.2 – 2.6	< 0.04 – 0.2
Total P (mg/L)	0.2 – 0.9	0.1 – 0.6	0.02 – 0.2
E. coli (per 100 mL)	3 - 19	< 1	< 1 to 60

1. Based on monthly averages of GB 2013 data
2. Based on 2013 data from Rossdale WTP intake

Anthem

- Surface water treatment plant utilizing Colorado River water
- Composed of one 7 MGD water treatment facility and one 3 MGD wastewater treatment facility on a common site.
- Water is used three times; potable water, wastewater, and effluent/recycle; 100% of water is reused locally in community.

- Both treatment plants utilize ultrafiltration membrane technology (ZENON/GE) for treatment
- Used water membranes are reused at the wastewater plant before discarding them, almost doubling membrane life
- Treatment plant serves a population of 20,000 in Anthem.
- There are approximately 15 employees working at this campus (five of them are maintenance personnel who also serve 3 other districts)

Delivering Water to Anthem

EPCOR Water provides water and wastewater service to the Anthem community east of I-17

- Approximately 8,800 water and 8,600 wastewater connections
- One Surface Water Treatment Plant
- One Wastewater Treatment Plant
- Two groundwater wells

Delivering Water to Anthem

Three different systems:

- Potable water treatment and distribution system
- Wastewater collection and treatment system
- Reclaimed water distribution system

Reclaim, reuse, and/or recharge 100% of wastewater

- Treated to A+ standards
- Used for community parks, greenbelts, golf courses and recharge

Comparison of Systems

- Gold Bar
  - Industrial reuse
  - Driver largely infrastructure costs
  - No formal regulatory framework for reuse

- Anthem
  - Irrigation and recharge reuse
  - Water scarcity and cost of source water major driver
  - Well developed regulatory framework for reuse

Sustainable Return on Investment (SROI)

- SROI analysis was conducted for a residential reuse project in Edmonton
- SROI an enhanced cost benefit analysis, which in addition to traditional financial analysis values various social and environmental impacts
- Factors considered were reduced water quality, improved water quality, GHGs and community development
- As a result of the relatively low reduction in water use, as a result of reuse, the overall SROI was negative for this project

Conclusions

- Water reuse is an important tool to address water scarcity challenges
- Reuse can improve watershed health
- In Canada, must look for opportunities where demand matches supply
- In Alberta regulatory frameworks need to be developed as has been done in many other jurisdictions

Thank you!

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