

Towards a Cleaner River



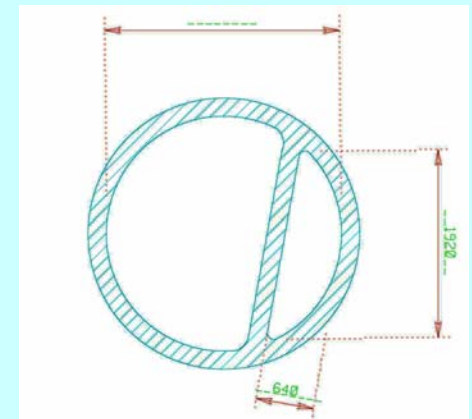
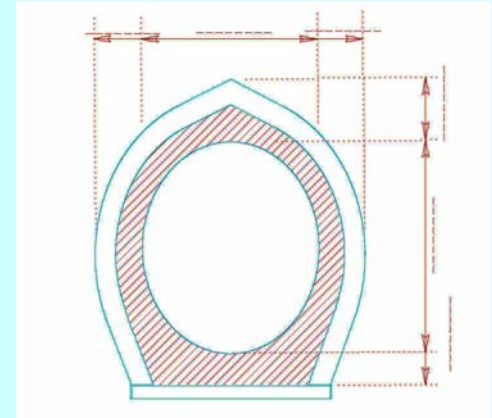
The City of Edmonton's Water Quality Improvement Initiatives



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City of Edmonton, Drainage Services

Outline

1. Regulatory Background
2. Plant Effluent
3. Combined Sewer Overflow Control Strategy
4. Storm Water Collection Systems
5. Water Quality Concerns



Background Information



Total Load



1. Regulatory Framework: The Alberta Environmental Protection and Enhancement Act (EPEA)

- **City builds and operates its sewer systems and treatment plant by permission from the province**
- **Permission issued as a 10 year license.**
- **Specifies discharge water quality guidelines for storm & treatment plant.**
- **License defines required upgrades**
- **Over 50 supporting regulations, federal laws, etc. apply to our work.**

Required Discharge Monitoring

- Extensive field program required.
- Storm sewer monitoring involves twice a month baseflow sampling (grab) and wet weather sampling (flow weighted composite) for 4 sites.
- CSO monitoring – catch 99% of wet weather events (automatic sampler).
- Sampler collects at a fixed time interval (every 30 minutes). Daily, flow- weighted composite sample created for every 24 hours during wet weather event.
- Samples collected are analyzed for: TSS, BOD, TDP, total Cl, metals, hardness, pesticides, etc.

2. Goldbar Wastewater Treatment Plant



Edmonton's Plant

- **Biological Nutrient Removal**
(1997, 310ML/day)
- **Ultraviolet disinfection (1997)**
- **Membrane filtration to supply industry**
(5 ML currently per day, may expand to serve downstream Upgraders, 2005)
- **By far the biggest benefit to the river**
- **State of the art**

Plant Investment

- Gold Bar WWTP opened in 1956, replacing scattered inefficient plants (\$6M)
- 1971 Expansion (Primary & Secondary Capacity, \$26M)
- 1981 Expansion (Primary & Secondary Capacity, \$35M)
- 1997 Expansion (Tertiary & UV Process additions, \$37M)
- 2005 Membrane filtration (\$18M)
- 2010 Enhanced Primary Treatment (High-rate treatment for CSO, \$55M)

BNR – Biological Nutrient Removal

- Tertiary level of treatment
- Completed in 1997
- Final Effluent Improvements:
 - Reduced TKN from 2,400 to 700 tons/year
 - Reduced TP from 350 to 100 tons/year

UV disinfection

- Ultraviolet Light high intensity lamps
- Fecal Coliform removed by 99.9%



EPT

- Enhanced Primary Treatment
- High rate treatment at slightly better than primary levels
- To be used during storms
- Otherwise discharged as CSO

Membrane Filtering

- Additional Level of Treatment
- Generates process water used by Petro-Canada Refinery
- Capacity is 15 ML/d, 5-10% of plant effluent

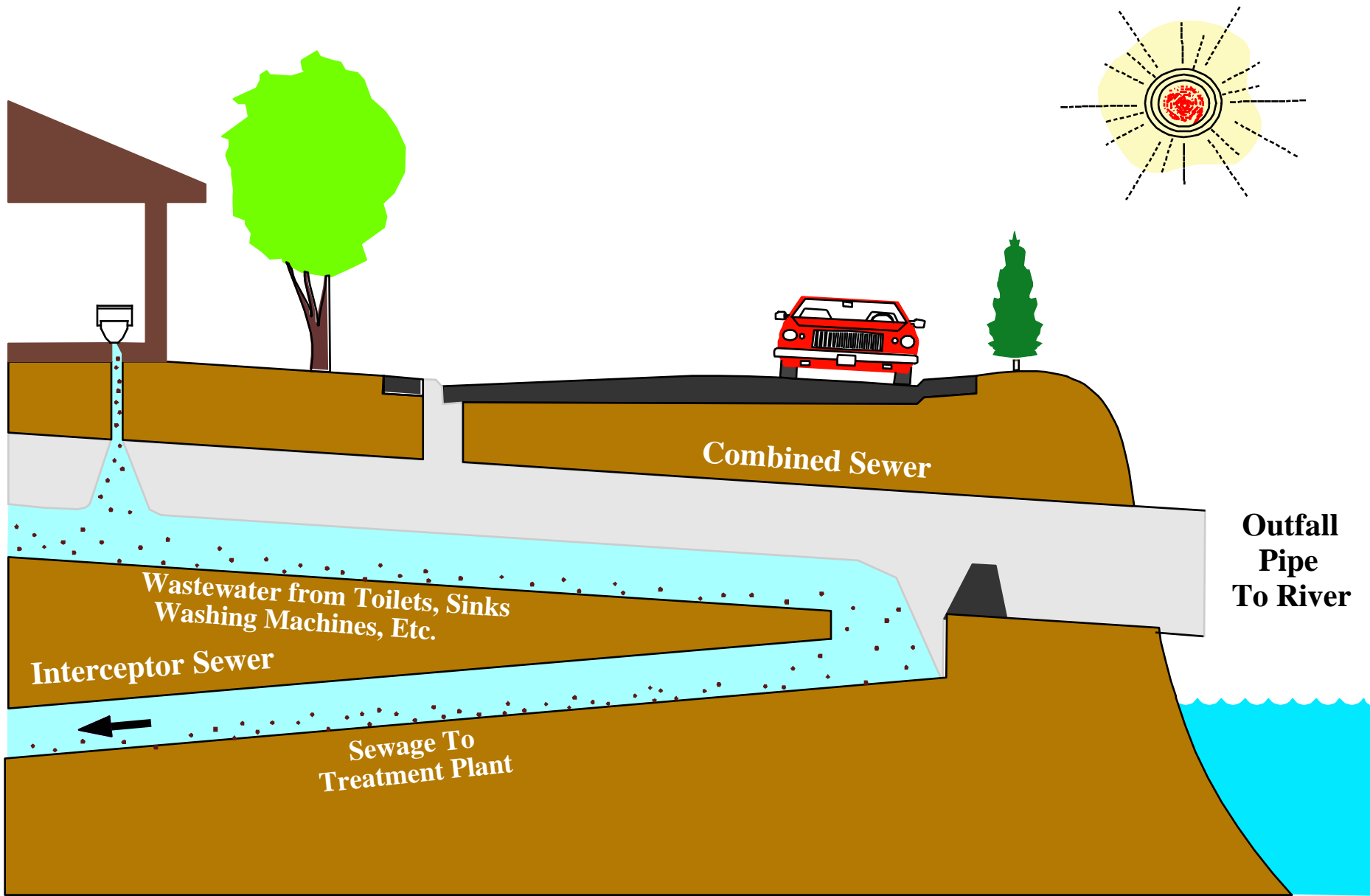
Goldbar Wastewater Treatment Plant

(95 million m³ per year)

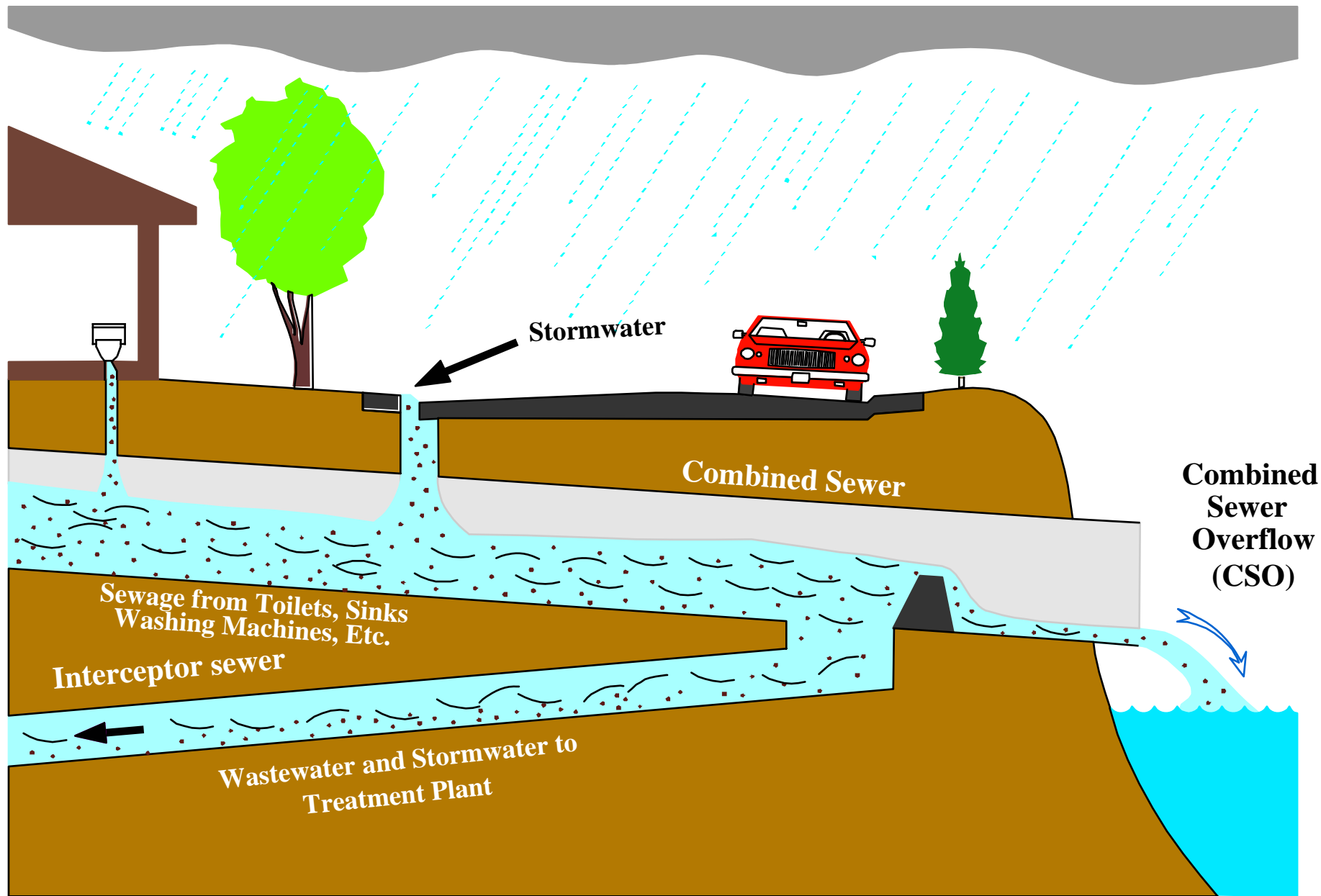


3. Combined Sewer Systems

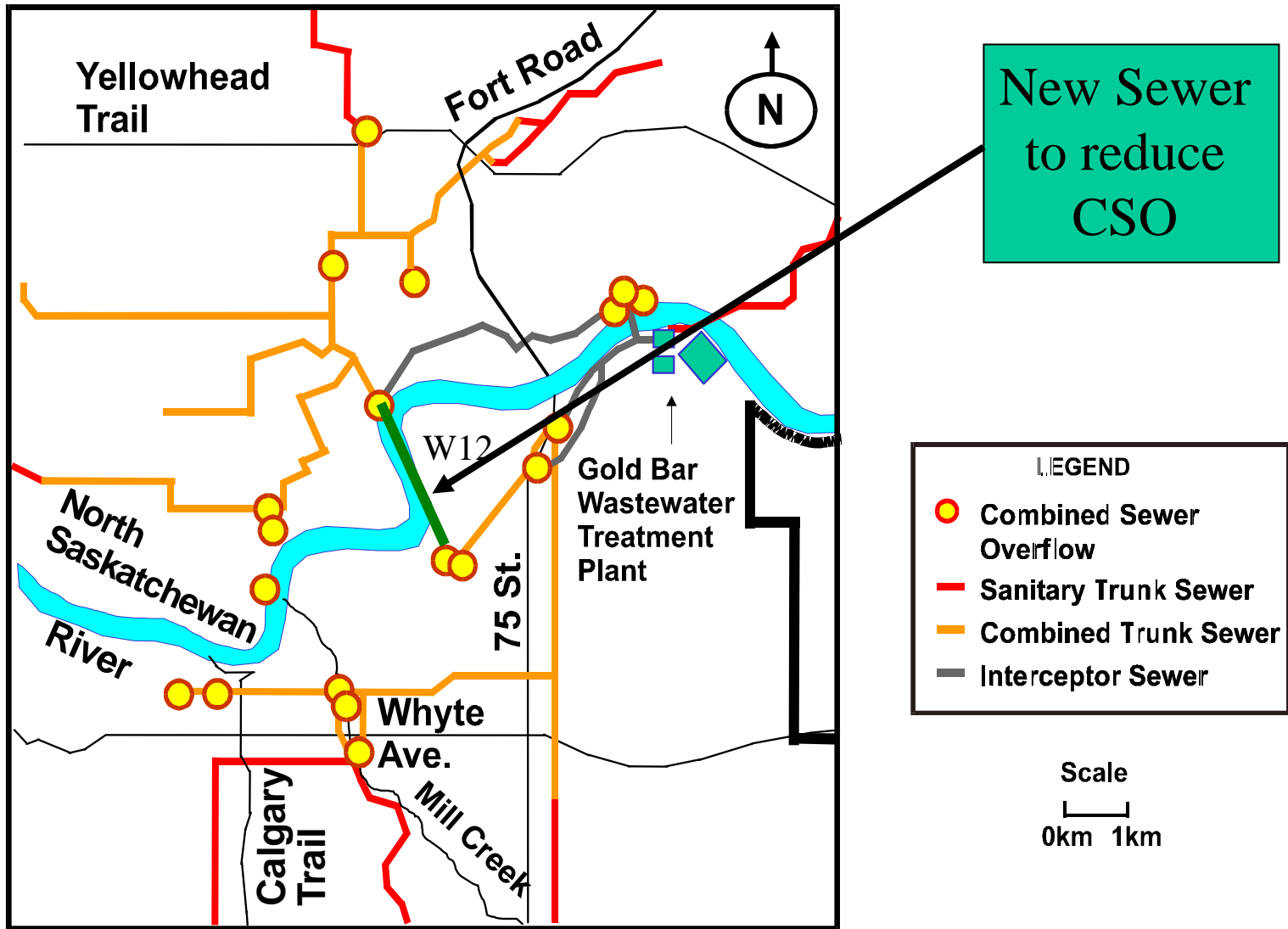
- **Built 1900 – ~1960**
- **Function: Carry both storm and wastewater; overflow when raining**
- **1910 report by New York engineer recommended them**
- **CSO Control Strategy: Developed 1995 - 1999**



During dry weather, all wastewater flows into the sewer that goes to the wastewater treatment plant.



During moderate to heavy rainfalls, the interceptor sewer fills up and some of the combined flow (wastewater and stormwater) overflows to the river.



Edmonton's Combined Sewer System

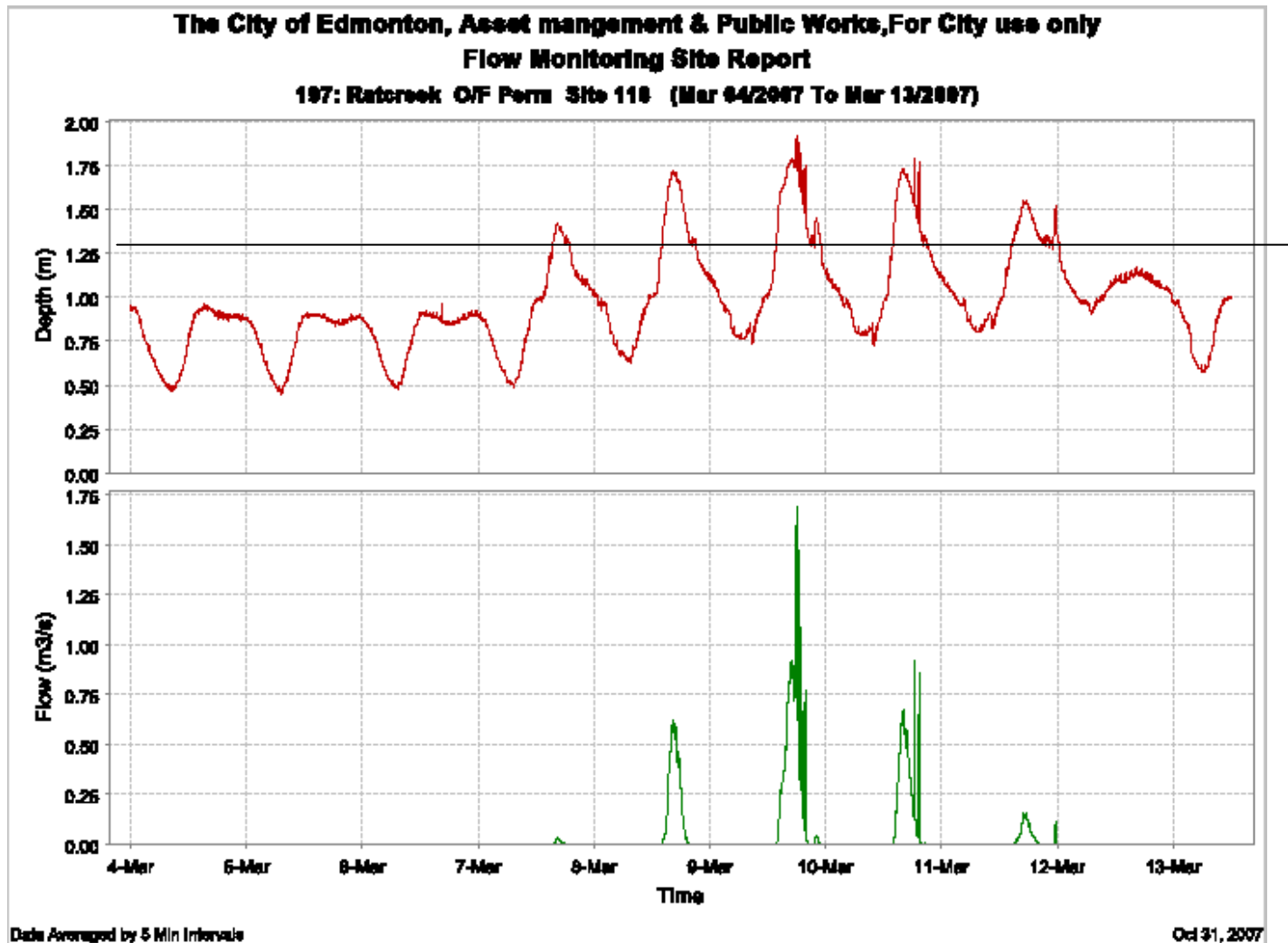
Combined Sewer Overflows

- 50 days per year
- Annual Discharge: 2,207 ML (4.4% of treated sanitary flow)
- Capture 36% of wet weather flow.
- Current Construction will reduce # of days and annual volumes.

Rat Creek CSO (~85%)

- **Flows from all north Edmonton**
- **85% of CSO volume discharges here**
- **Discharging on +/- 50 days each year**
- **Weir overflows to a chute and into the river**

CSO due to Spring Melt



Combined Sewer Overflows

(2.5 million m³/yr)



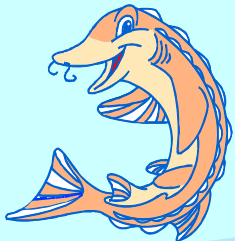
Bacteria, solids, nutrients

CSO Control Strategy

- **Conveyance to Plant**
- **High rate treatment at Plant**
- **Storage in pipes**
- **Opportunistic separation.**
- **Program well advanced – major work done by ~2011**

CSO Control Strategy

- **\$150 Million**
- **15 Year implementation**
- **Focus is treatment:**
 - Increase Wet weather flows to plant
 - Build High Rate Treatment with Disinfection
 - Store flows until plant has capacity



What have we done so far?

- **Enhanced Primary Treatment - \$55M**
- **River Crossing - \$44M**
- **Real Time Control (2 sites) - \$4M**
- **Sewer Separation - \$10M**
- **Ultraviolet Disinfection – \$9.2M**

Review: Water Quality Concerns

- **Goldbar Wastewater Treatment Plant**
 - State of the Art
- **Combined Sewer Overflows (CSOs)**
 - Getting to be under control
- **Stormwater Outfalls – direct / via ponds**
 - Next area of focus

4. Stormwater Systems

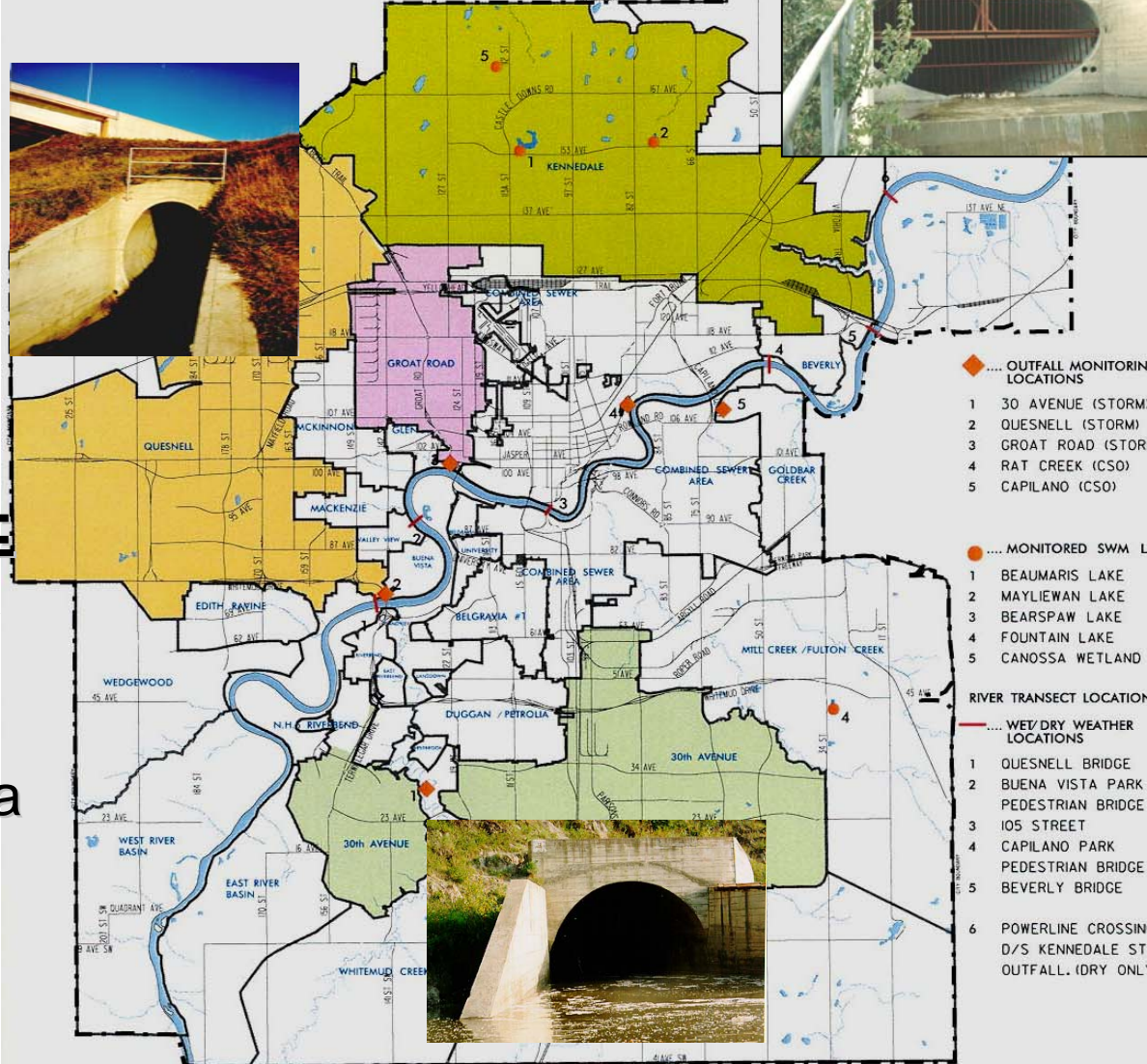
- 97 lakes, 71 dry ponds
- 2228 km of storm piping
- 235 outfalls
- 43 Peak Flow Storage units
- 12 Wetlands

4 Major Storm Basins

(~80% storm flow)

Drainage Basin Areas:

- Kennedale = 8,400 ha
- Quesnell = 5,900 ha
- 30th Ave = 5,100 ha
- Groat Road = 1,600 ha



Stormwater Outfalls

(27 million m³/yr; 20% controlled)



Bacteria, solids, organics, nutrients

TSS Control

- **Low Impact Development**
 - Remove pollutants near the source by limiting runoff
 - Green roofs, permeable pavements, bioswales, rain gardens, ...
- **End of Pipe Treatment Facilities**
 - Kennedale Wetland
 - Groat Road a possibility

Low Impact Development



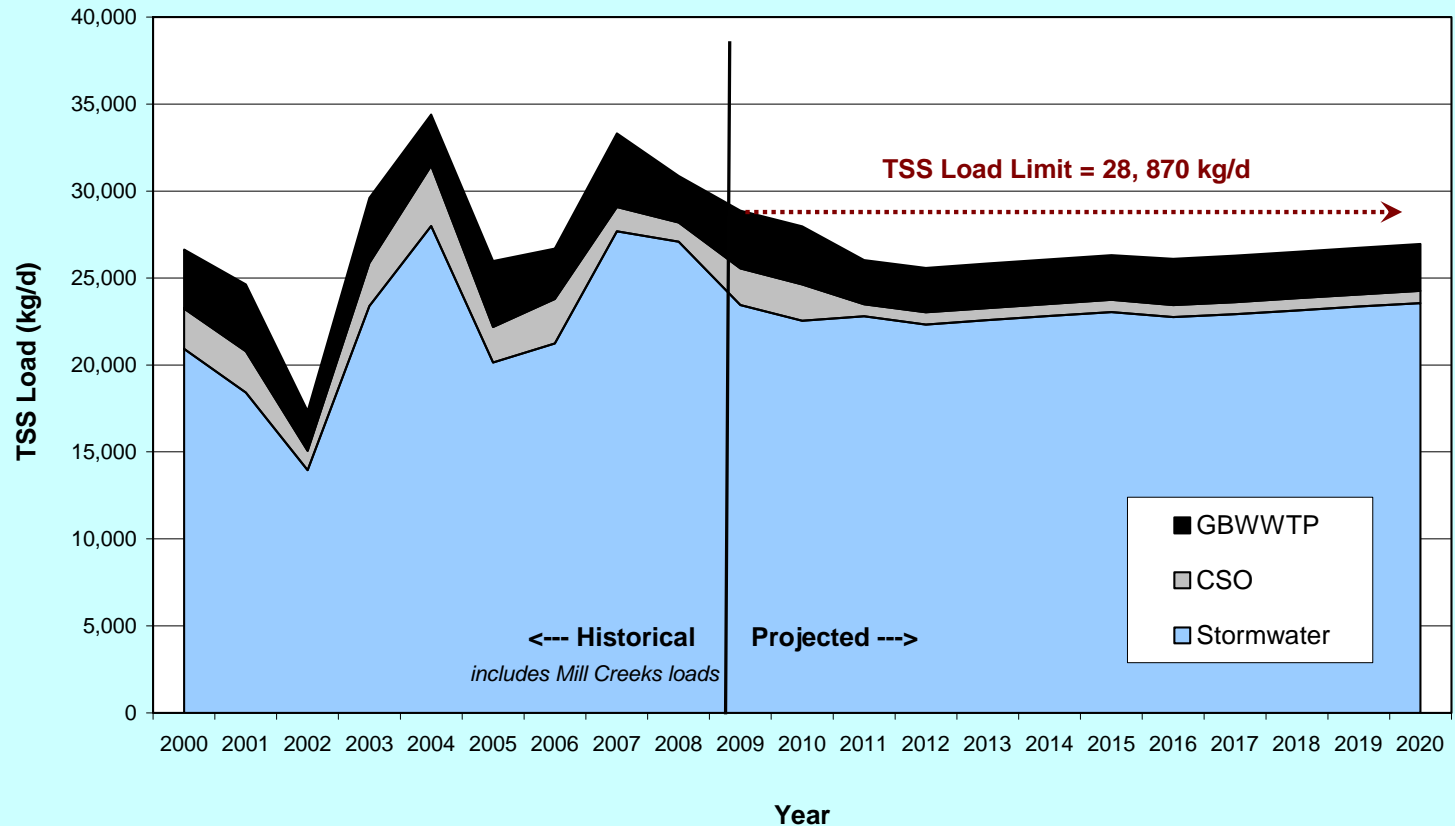
Kennedale Wetland Treatment Facility

- End of pipe treatment for average and low flows.



TSS to the River

TSS Loadings (Full TLP Implementation)



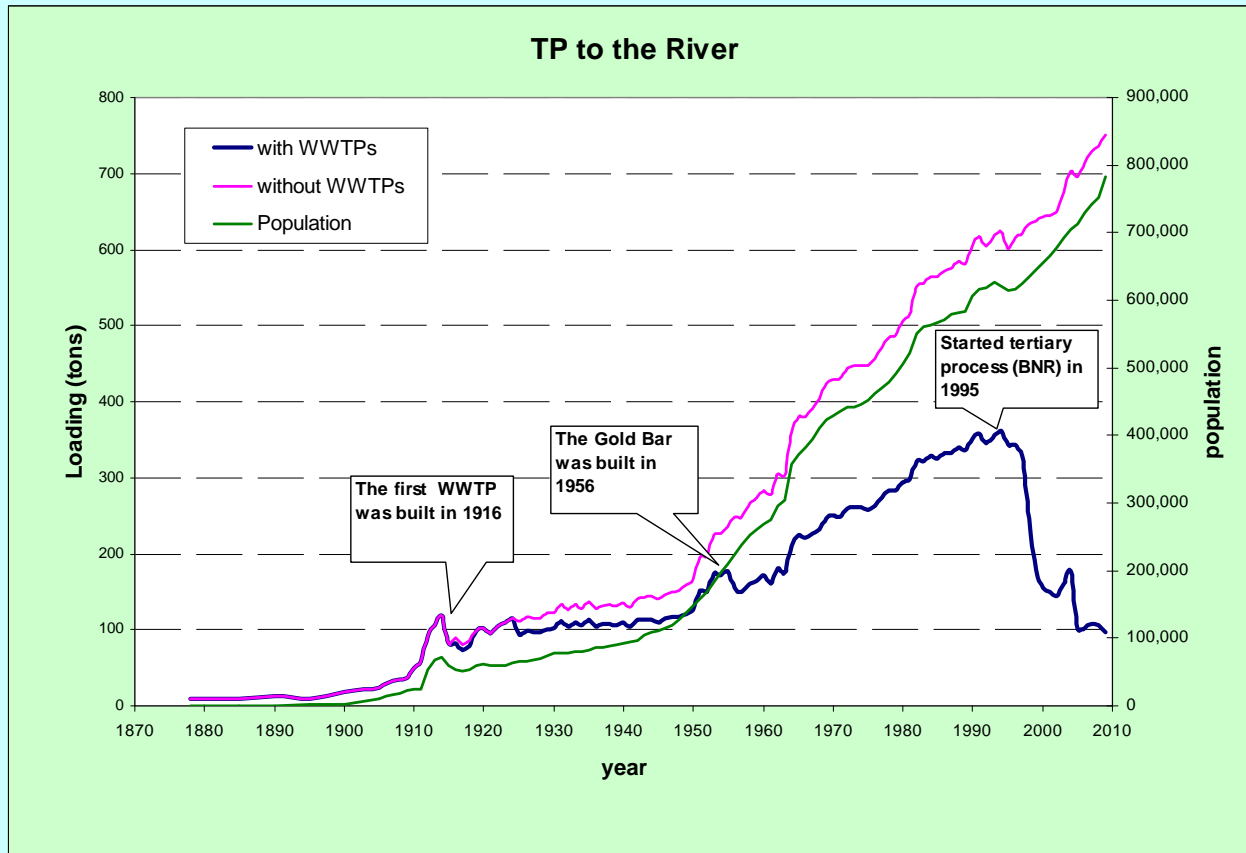
Storm Water Quality

- Focus / biggest source since WW treatment and CSO under control.
- 235 storm outfalls makes fixes hard
- TSS is the focus for action
- Storm water Lakes
- End of pipe treatment (Kennedale wetland, Groat road)

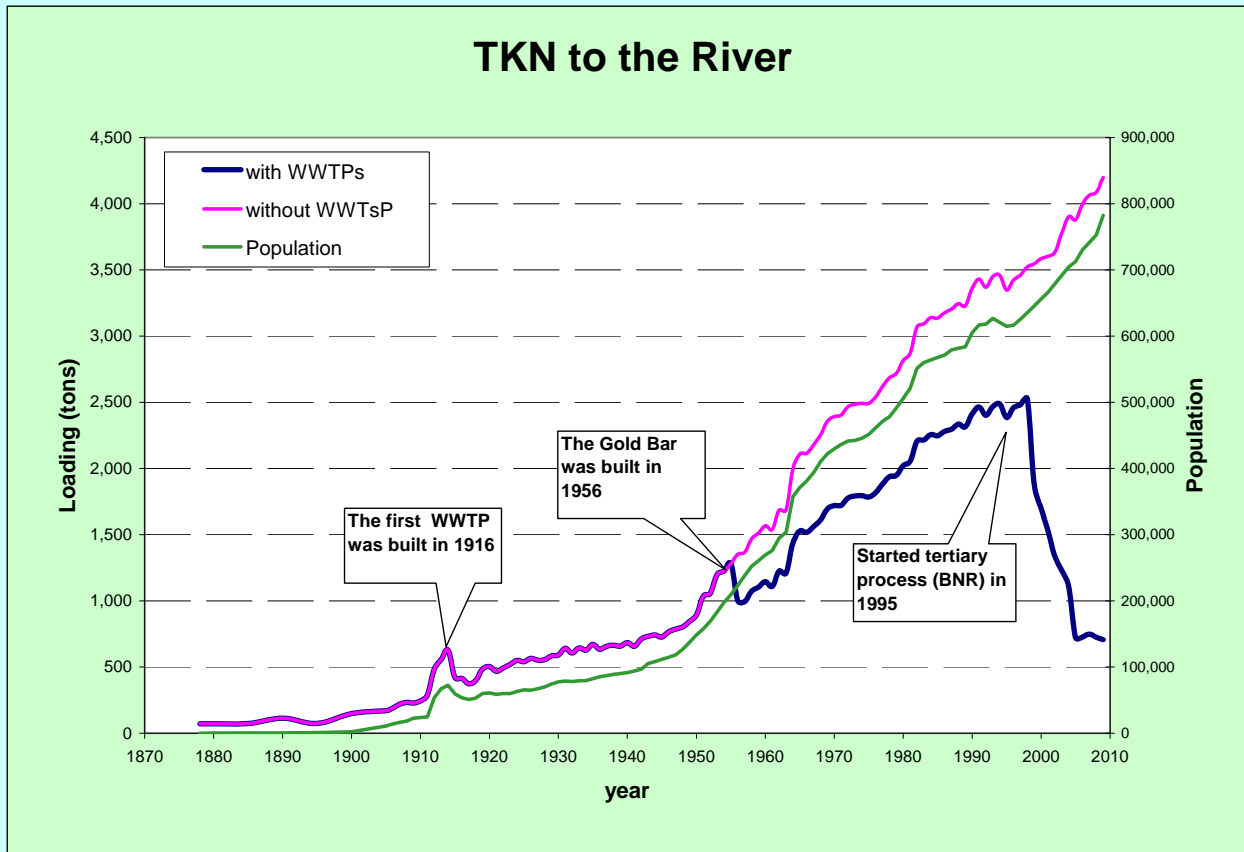
Historical Load Model

- Input parameters:
 - Population
 - Precipitation (Annual total)
 - Treatment efficiency
- Output
 - 6 parameters
(TSS, TP, BOD, TKN, FC, and NH_3N)

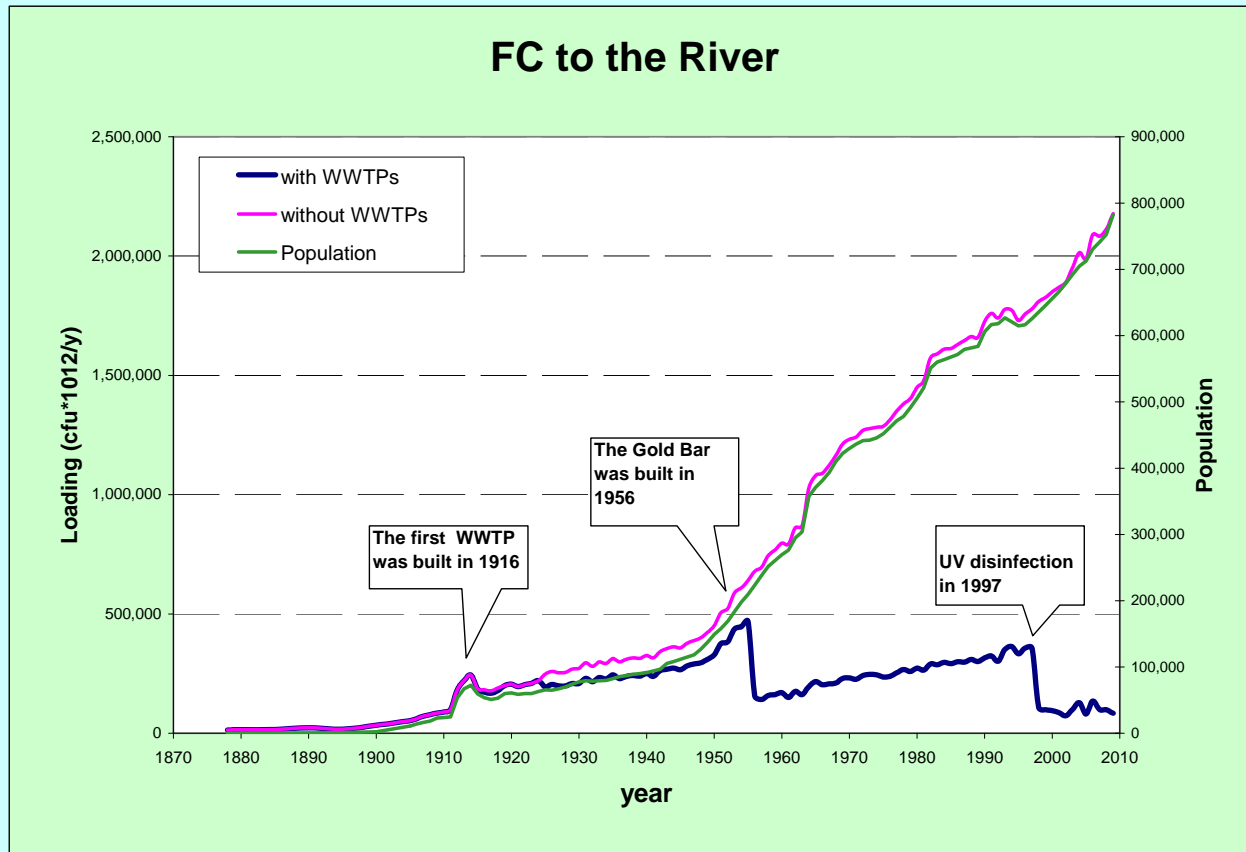
TP to the River



TKN to the River



Bacteria to the River



Conclusions

- Edmonton has done a lot to limit it's impacts on the NSR
- Plant discharges are state of the art
- CSOs are being reigned in with EPT and new pipes
- Stormwater is the new focus area for new initiatives (LID and End of Pipe Facilities)

Questions?

