



human energy®

# Water Conservation Initiatives – Burnaby Refinery

CAP Meeting

May 11<sup>th</sup>, 2016

Mack Atkinson – Process Engineer  
Kel Coulson – Lead Process Engineer



# Outline

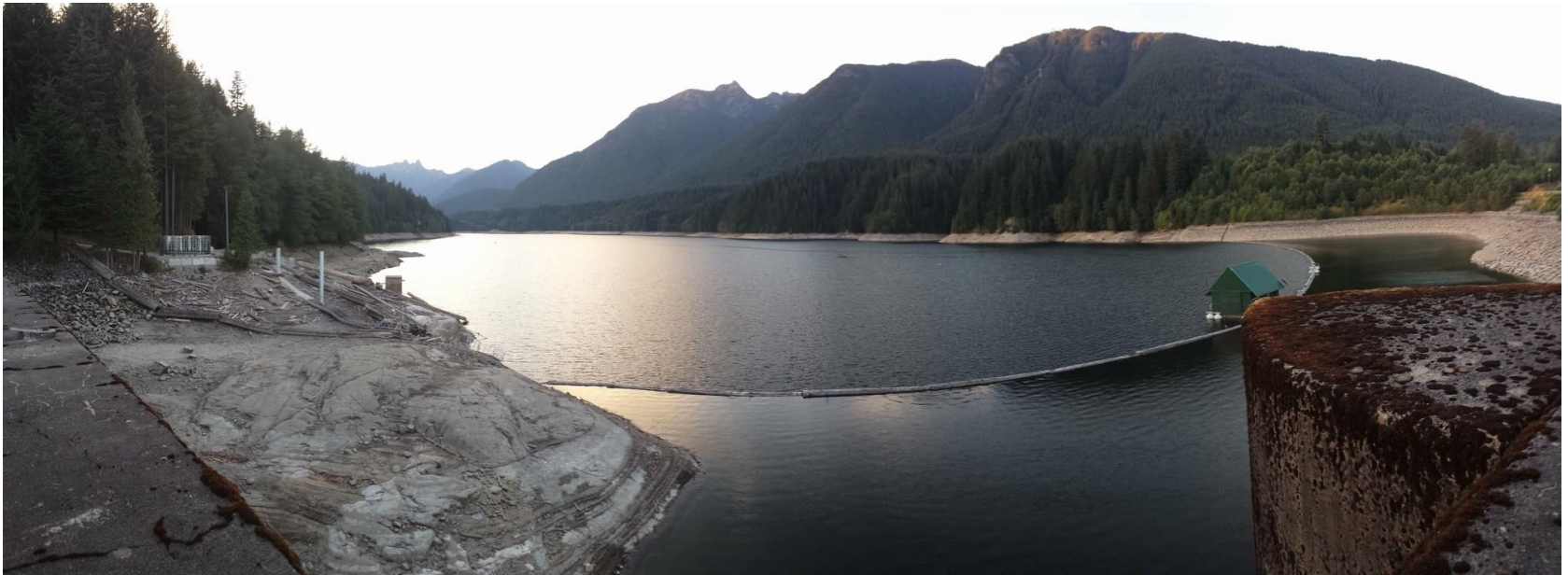
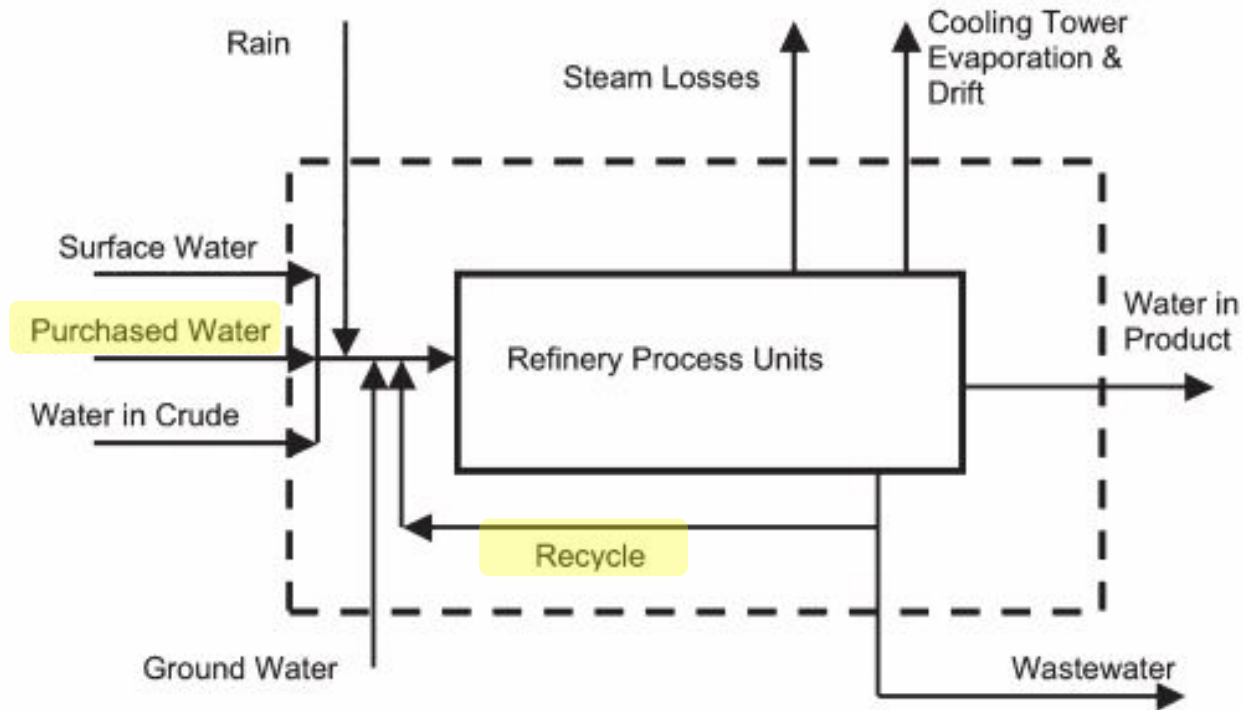


Photo credit: waterbucket.ca

1. General Refinery Water Use Overview
2. Burnaby Refinery Water Use Overview
3. Water Conservation Initiatives
4. Water Conservation Summary



# General Refinery Water Use Overview

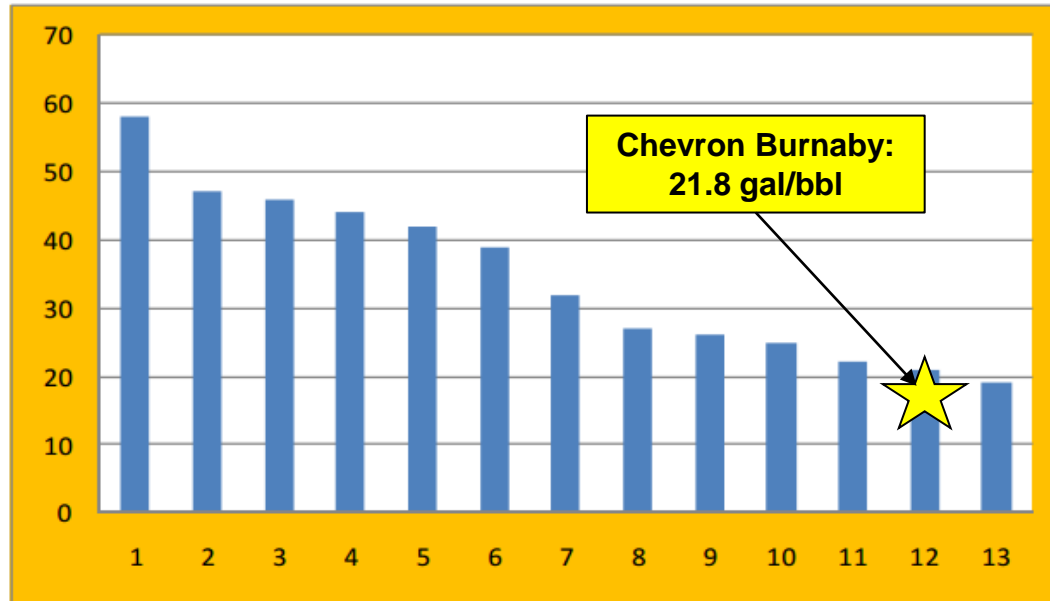


Crude oil refineries utilize water in multiple ways for separation and refining of the petroleum products:

- Adding heat to the process streams (boiler steam system)
- Removing heat from the process (cooling water system)
- Removing salt and impurities from crude (desalting the crude)
- Protecting equipment from corrosion (water washing overhead lines)
- Controlling product quality parameters (steam stripping in distillation columns)
- Equipment cleaning and maintenance



# Burnaby Refinery Water Use Overview



Worst in Class  
(50-60 gal/bbl)



Best in Class  
(10-20 gal/bbl)

- The Chevron Burnaby Refinery uses approximately 21.8 gallons of water to process 1 barrel of crude oil which equates to 362 MM gallons per year
- This can also be represented as 0.52 BBL of water to process 1 BBL of crude oil, compared to the industry average of 2 BBL of water for 1 BBL of crude oil



# Burnaby Refinery Water Use Overview



## We use less water than other refineries because:

- Our purchased water comes from Metro Vancouver's reservoirs which are comprised of rain and snowmelt from the Capilano, Seymour and Coquitlam Watersheds. The region has high quality water which allows us to recycle more water than other locations. The water has a low hardness which allows for high reuse within the refinery without causing scaling or corrosion of equipment.
- Cooling Towers use water to cool hot process streams through heat exchangers. Some refineries operate with a once-through cooling system, while the Burnaby refinery has cooling towers which cool the water that is recycled back. **We are able to reuse 98-99% of our cooling water** (1-2% losses occur due to evaporation and blowdown).
- Boilers use water to generate steam that is used around the refinery to heat process streams. After use it condenses and is returned to the boilers as condensate. The refinery steam system has a high condensate recovery. **We recover 67% of the condensate generated in our steam system, which is double the industry average of 20-45%.**



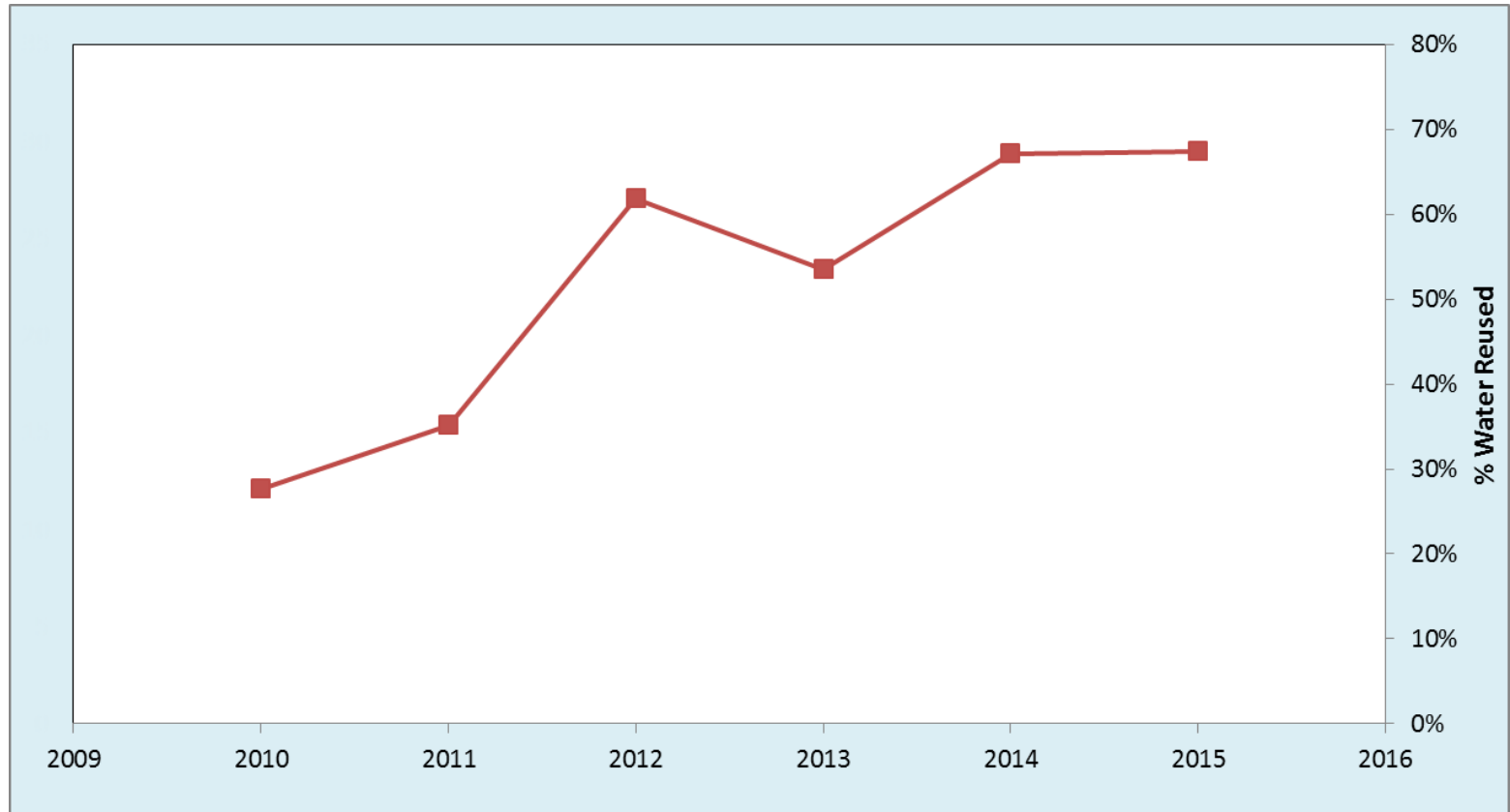
# Water Conservation Initiatives

1. Boiler Water Conductivity Increases
2. Steam Trap Energy Conservation
3. Reuse Treated Process Water for Cleaning
4. Fin-Fan Cleaning & Use of Fin-Fans
5. Superheating Stripping Steam
6. **Stripped Sour Water Reuse**
7. **Surface Condenser Improvements**
8. **Distillation Column Steam Reductions**
9. **Cooling Water Conductivity Increases**
10. **Splitter Water Recycle – Test Run Results**





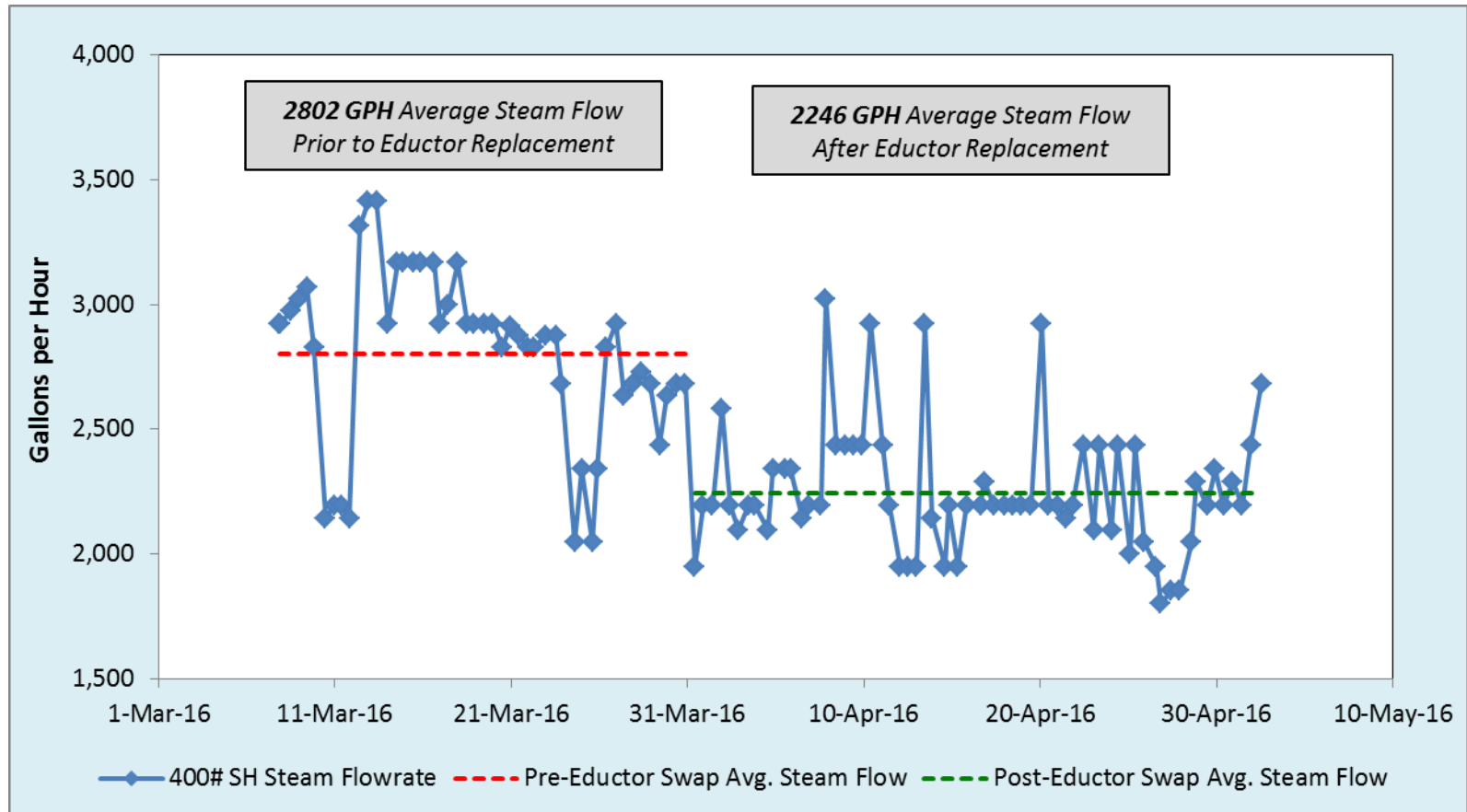
# Stripped Sour Water Reuse



- Currently reusing between 60-70% of the stripped sour water, reducing demand for fresh purchased water by approximately 30 MM gallons per year
- The volume of stripped sour water re-used has more than doubled since 2010 & 2011 due to process optimization initiatives



# Surface Condenser Improvements

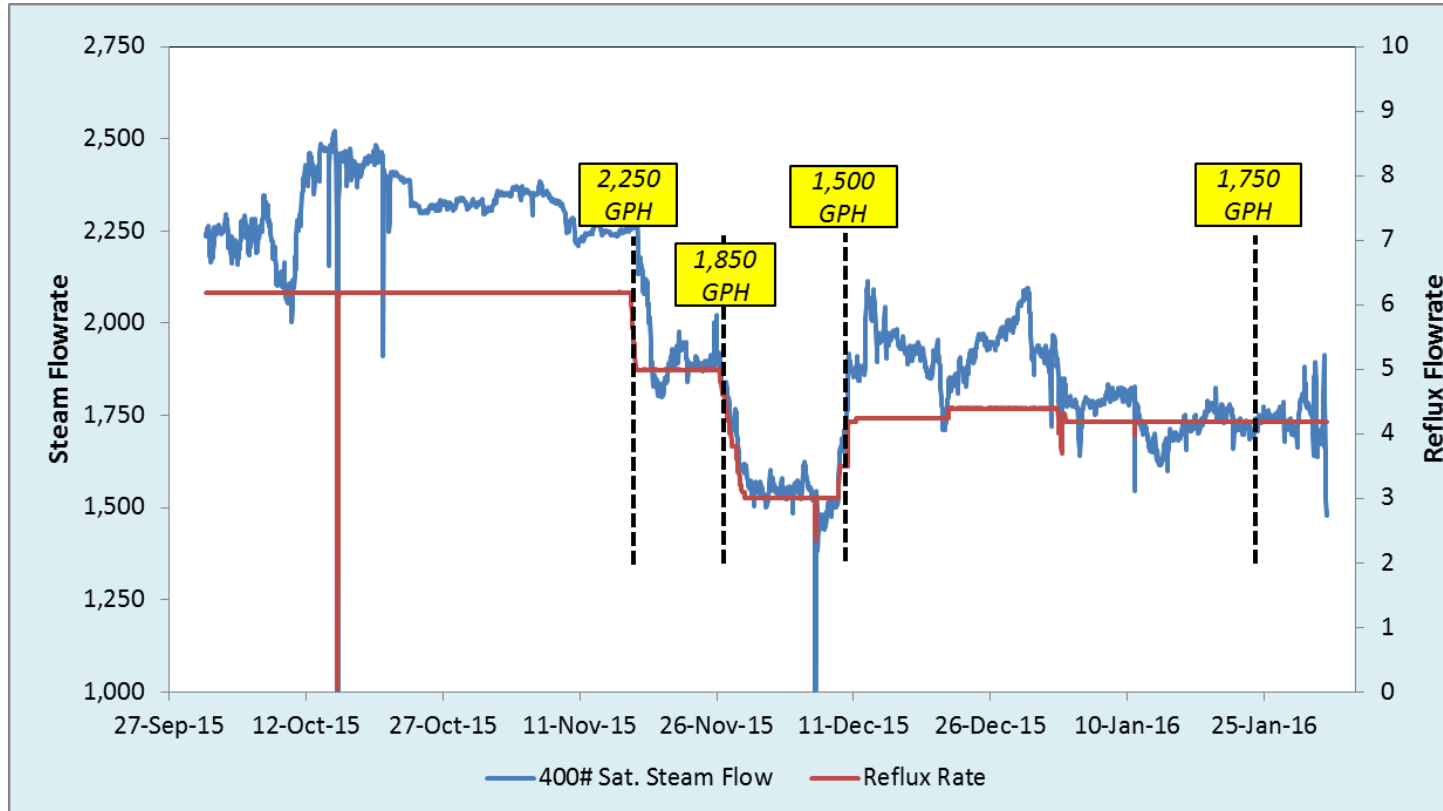


- This surface condenser is one of the largest 400# steam users in the refinery.
- The vacuum was improved by replacing the ejectors on March 31<sup>st</sup> which decreased steam demand by 556 gallons per hour – this equates to water conservation of 4.9 MM gallons per year.





# Distillation Column Steam Reductions



- The reboiler on this column is another large 400# steam users at the refinery.
- A test-run was conducted in November 2015 to optimize the column operation and reduce the steam demand. The successful test run led to a 500 GPH reduction in steam demand, equating to 4.4 MM gallons reduced water demand.
- Additional controls are being added to this column this summer which could result in additional water savings greater than 2.2 MM gallons.



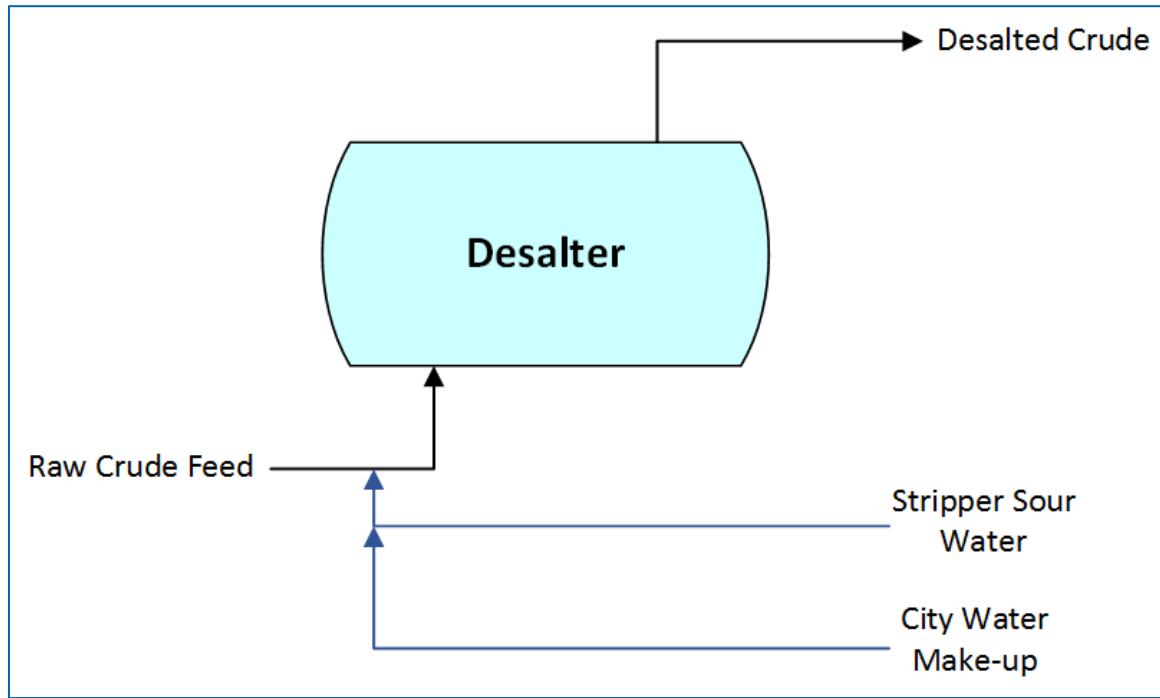
# Make-up Cooling Water Reductions



- Higher summer temperatures increase the rate of water evaporation from the cooling towers which concentrates minerals in the system. To optimize the process for water conservation we increase the conductivity set point (mineral concentration) which decreases the requirement for makeup water.
- In 2015 we operated in this posture for approximately 1.5 months which reduced the volume of purchased makeup water by 1.5 MM gallons. We have already made the change for 2016 with anticipated water reductions likely to be 3x higher.



# Splitter Water Recycle – Test Run Results



- Desalters are used to remove salts from the incoming crude to protect the downstream equipment from corrosion. To accomplish this, high pressure water mixes with the crude oil and is removed as brine, which is treated in our wastewater plant.
- A test run was performed that looked at recycling some of this brine for re-use in the desalter with initial positive results. The results are being reviewed to determine if this is a feasible solution to implement from a reliability perspective.
- This could result in a water conservation of 7.9MM gallons per year.



# Water Conservation Summary

- The new initiatives that are being pursued could lead to an annual reduction of 21.7 – 23.9 MM gallons of purchased water per year.
- The objective for these projects is for the changes to become the new normal operation and sustain the water reduction in future years.
- The team at the Burnaby Refinery is continuing to identify these projects and work them through to completion.

<b>Initiative</b>	<b>Volume (% of Total)</b>
Stripped Sour Water Reuse	8.3%
Surface Condenser Improvements	1.4%
Distillation Column Steam Reductions	1.2% - 1.8%
Cooling Water Conductivity Increases	1.2%
Splitter Desalter Brine Recycling – Test Run Results	2.2%

