THE DOWNSTREAM PETROLEUM SECTOR WATER CONSERVATION, EFFICIENCY AND PRODUCTIVITY (CEP) PLAN-PROGRESS REPORT OCTOBER 2015

PREPARED BY EMS CONSULTING
FOR
THE CANADIAN FUELS ASSOCIATION
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Executive Summary

The Canadian Fuels Association represents the industry that produces, distributes and markets petroleum products in Canada – including 95 percent of the transportation fuels Canadians rely on to remain mobile and globally competitive. The fuels sector contributes $5.6 billion to Canada's GDP each year and employs nearly 100,000 Canadians at 15 refineries, 70 fuel distribution terminals and approximately 12,000 retail and commercial sites throughout Canada. The petroleum industry continues to be an economic contributor for Alberta and is a net exporter of refined petroleum products to the United States and other provinces.

The original Conservation, Efficiency and Productivity (CEP) plan was prepared and submitted to the Alberta Water Council (AWC) in March 2011 which provided information and opportunities to the various constituents within the petroleum sector. The CEP Plan identified specific and quantifiable goals or targets for improving water use and achieving measurable outcomes in this industry. In addition, this plan provided the sector with an array of tools and mechanisms that could enable implementation and monitoring of CEP-related activities. This report is an update prepared for the period 2011-2014 considering the same criteria used in the original report. This update is in line with the AWC March 2013 publication and section 4.3-4.4 Evaluating Overall CEP Progress and Ensuring Continual Improvement.

The original CEP Plan covered three (3) refineries, one asphalt plant and a large number of marketing and distribution facilities in Alberta that are operated or managed by Canadian Fuels member companies.

The three refineries in the Edmonton area continue to source their water from the North Saskatchewan River in accordance with their water licenses. The Husky asphalt plant in Lloydminster also continues to use groundwater and municipal water for their operation. The vast majority of marketing operations typically draw water from a municipal system, and some located in rural areas use groundwater sources. However, the amount of water used in marketing operations is negligible compared with the amount used in refining operations.

The 2011 report stated that based on refinery utilization rates, the refining segment of the petroleum industry used up to 66% of its allowable water usage under combined licenses allocated to them by Alberta Environment and Parks (AE&P). During the period covered in this report, the same amount of water usage under combined licenses was used.

Water is used in a refinery for a variety of purposes and approximately 40% of water diverted for refinery use is returned back to the river after being treated to a high quality. In marketing and distribution operations, water, for the most part, is used for sanitation purposes.

According to various studies[1, 2] conducted in Alberta for the Watershed Alliance, petroleum refineries are not among the top ten users of water. In fact, refineries are considered to be one of the lowest users of water among all industries in the province.

In accordance with the Alberta Water Council (AWC) guidelines, in 2011, the downstream petroleum industry selected the average of year's 2000 to 2002 water diversion as its **base year.** This equates to a total water diversion of 11.4 million m^3/year. During the past 15 years, an average of 10.8 million m^3/year of water was diverted and an average of 6.5 million m^3/year

has been used. For the purpose of consistency, in this update we are continuing to use the same base year values for reporting.

Over the past 15 years, many environmental regulations related to petroleum product quality have resulted in a re-configuration of refining operations and the addition of energy intensive units. These have added an increase need for water to be diverted from various sources. Changes in feed stock quality (i.e. crude slate) have also demanded use of technologies that are more water intensive.

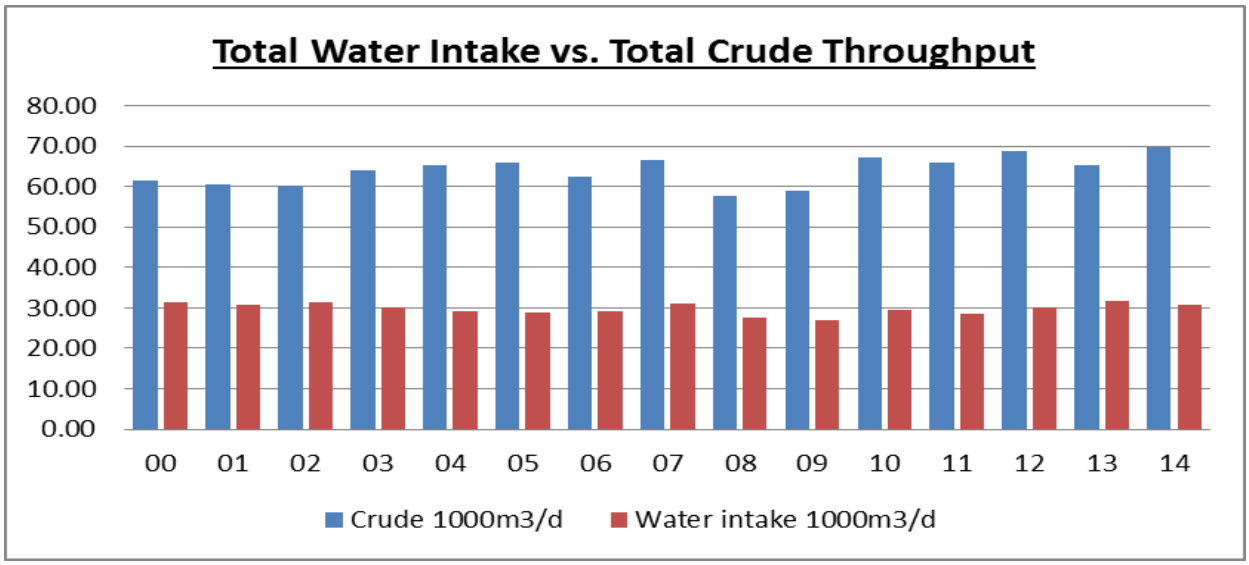
Despite these additional requirements, the downstream petroleum industry continued to make significant gains in water use efficiency. Through continuous improvement and new technologies in operations, the downstream petroleum industry is using approximately 65% of its allowable water intake and on a normalized basis, has reduced intake water by 13.6% and usage by 15.2% from the base year. Please refer to the variation in refinery utilization and water use over the years in the following chapters of this report.

It should be noted that both absolute and normalized water usage are higher in average during the past 5 years than the ones reported in the 2011 report. This increase is largely due to market demand, changes in feedstock quality (i.e. crude slate) and higher utilization of refineries during the economic boom of 2012-2014.

Economic climate and marketing demand for refining products have fluctuated significantly throughout the last 15 years resulting in changes in refinery utilization and therefore, water usage. The chart below provides overall water intake and use for the past 15 years.

In addition to refineries, this sector has spent a significant amount of capital to upgrade its marketing and distribution facilities which has resulted in increased pollution prevention and less impact on surface and groundwater. Marketing network rationalization during the past two decades has reduced demands on municipal water systems and groundwater sources.

The sector will continue utilizing practical opportunities identified in the 2011 report. The petroleum sector will continue optimizing water diversion and/or water use from the North Saskatchewan River.



Note1: Discharge volumes used to calculate use rates includes storm water runoff collected on site.
Note 2: Intake and discharge water used for calculating base year are rounded numbers from actual 11,371,383 m^3 and 7,431,913 m^3 per year

Alberta Sector CEP Plan Metrics						
Component	Units	2000/2002 (Base Year)	2009	2014	%Units 2014 F(U) vs. Base Year	%2014 F(U) vs. Base Year
Refinery Throughput	1000m3 /day	60.7	58.9	69.6	8.90	14.66
Refinery Utilization		95%	85%	101%	6%	6.32
Water Intake (actual)	Mm3	11.4	9.9	11.2	0.20	1.8
Water Discharge (actual)	Mm3	3.9	4.9	4.0	(0.10)	(2.6)
Water Use (actual)	Mm3	7.5	4.9	7.2	0.30	4.0
Water Use (normalized)	m3/m3 crude	0.33	0.23	0.280	0.05	15.2
Water Intake (normalized)	m3/m3 crude	0.51	0.46	0.44	0.07	13.6
Water Intake License	Mm3	17.3	17.3	17.3	0.00	0.00
% License Utilized		66%	57%	65%	0.01	1.75
Refinery Effluent Quality (% of allowable limits)		<15%	<10%	<10%	<5%	
F= Favorable						
(U)= Unfavorable						

The Downstream Petroleum Sector

The Canadian Fuels Association represents the industry that produces, distributes and markets petroleum products in Canada – including 95 percent of the transportation fuels Canadians rely on to remain mobile and globally competitive. The fuels sector contributes $5.6 billion to Canada's GDP each year and employs nearly 100,000 Canadians at 15 refineries, 70 fuel distribution terminals and approximately 12,000 retail and commercial sites throughout Canada.

From 2005 to 2014, Canadian Fuels members' total environmental expenditures were $6.37 billion as a result of proactive initiatives, regulatory response and product quality upgrades. Canadian Fuels members include:

- Chevron Canada Limited
- Federated Co-operatives Limited
- Husky Energy Inc.
- Imperial Oil Limited
- Irving Oil
- North Atlantic Refining Limited
- North West Redwater Partnership
- Parkland Fuel Corporation
- Shell Canada Products
- Suncor Energy Products Partnership

Who We Are

The Canadian Fuels Association represents the industry that supplies 95 percent of Canada's transportation fuels. We are uniquely positioned as experts on the complex issues surrounding the future of Canada's transportation fuels. For years, our members have been active in a number of policy areas and public outreach activities, providing expertise, information and analysis, and practical insight that supports informed decision-making. We are committed to engaging openly and honestly with decision makers, stakeholders and the public.

Our goal is a policy environment that enables decisions based on solid evidence—and that provides decision makers with a full understanding of policy options and their implications, including unintended consequences.

As Canada's fuels leaders, we engage all levels of government—federal, provincial, and municipal—with a focus on environment, health and safety policy, and regulation. We are proactive in seeking a 'convergence of interests' where the policy objectives of government can be achieved without affecting Canadians' access to a secure, reliable and competitively priced supply of fit-for-purpose fuels.

1.0 Overview of the Downstream [3/4] Petroleum Sector CEP Plan and Update

The development of the original CEP plan, dated March 2011, was led by the Canadian Fuels Association, formerly the Canadian Petroleum Products Institute. This sector is a smaller industrial water user in Alberta and has an allocation of less than 1% of Alberta's total water allocation. The sector plan covered three refineries, one asphalt plant and a large number of marketing and distribution facilities in Alberta that are operated or managed by Canadian Fuels member companies. The industry has substantially improved water use efficiency over the past decades through continuous improvement despite regulatory changes requiring more use of energy and water. The sector plan identified15 opportunities for a potential of 22 CEP outcomes:

- ✓ Nine conservation opportunities that may decrease overall water use (e.g., alternative water sources);
- ✓ Eight efficiency opportunities that may decrease overall consumptive water use by reducing water losses to the atmosphere and/or increase the volume of water discharged back to the source; and
- ✓ Five productivity opportunities that may increase production while maintaining the same amount of water used.

The sector also identified how its members' progress is contributing to the three Alberta Water for Life (*WFL)* goals. The petroleum sector acknowledges the broader context in which they operate by understanding the impacts of their CEP activities including the impacts on aquatic ecosystems.

This update will identify the petroleum sector's progress in implementing plans and the sector's success in meeting the targets or benchmarks set out in its original CEP plan. This report will evaluate and quantify productivity and efficiency improvements, as well as, any reductions in water use or diversions that are achieved, consistent with the proposed measures and targets.

The AWC Sector Planning for Water CEP dated 2013[5], outlines the evaluation of Progress and Performance as follows:

"Monitoring and reporting on progress is essential for successful implementation. This ensures that performance is tracked and results are quantified where appropriate according to the Measures and targets in each plan. Sectors need a reasonable amount of time to complete specific projects and see the results, but the Water for Life strategy targets a 30% improvement in overall efficiency and productivity of water use by 2015. Initial thinking was that, between 2012 and 2015, sectors should prepare progress reports every two years, starting two years after their plan is completed, which would be consistent with the Framework. Such reports would be provided to the Alberta Water Council, sector stakeholders and the public. However, several sectors held the view that it is likely to take more than two years to see any real progress as a result of the CEP plans."

The sector will continue to focus on specific measures to achieve further CEP gains and to define targets and mechanisms that will assist them in achieving the CEP gains targeted through AWC's response to Alberta's *Water for Life s*trategy (2003).

EMS Consulting was contracted by the Canadian Fuels Association Western Division to prepare this update on behalf of the member companies operating in Alberta.

1.1 Recommendation # 1 in Sector Progress Report[5]

All seven priority sectors are preparing sector progress reports based on performance data as of December 31, 2014, and are to submit these reports to the Alberta Water Council's final meeting in 2015.

Although the targets set out in the original petroleum sector plan would not change between the time the plan was prepared in 2011 and 2015, ongoing implementation and evaluation is very likely to reveal opportunities for refinements and improvements. Changes in regulations, policy, or technology could also result in necessary adjustments to the sector plan, which should be highlighted in the progress reports.

1.2 Recommendation # 2, Focus of Sector Progress[5]

The Alberta Water Council recommends that sector progress reports should:

- ✓ Describe and evaluate the sector's success in meeting CEP plan objectives, benchmarks and targets, including productivity and efficiency improvements, any reductions in water use, impacts on return flows, and performance relative to the baseline year. This should:
  - — Note the adoption of new industry best practices and technologies, subject to confidentiality and competitiveness considerations;
  - — Note adjustments needed to improve the sector plan or adapt to new technologies or legislative requirements (e.g., regional land use plans); and
  - — Make reference to development of CEP plans by individual sector members, if appropriate.
- ✓ Encourage member(s) to be aware of opportunities that could improve the health of aquatic ecosystems and to work with appropriate organizations engaged in watershed management within the watersheds in which the member(s) operate(s).
- ✓ By using metrics developed for each sector plan, summarize water use, assess and document impacts of CEP efforts, and indicate how implementation of the CEP plan is contributing to the three *Water for Life* goals, namely safe secure drinking water supply, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy. Other environmental impacts of CEP efforts should also be noted; e.g., impacts on riparian health, instream flow improvement, water quality.
  - —discuss opportunities and challenges.
  - —Describe interactions with stakeholders on plan implementation and progress.
  - —Indicate how other environmental endeavours are affecting water use (e.g., increase in water use as a result of efforts to reduce CO2 emissions).

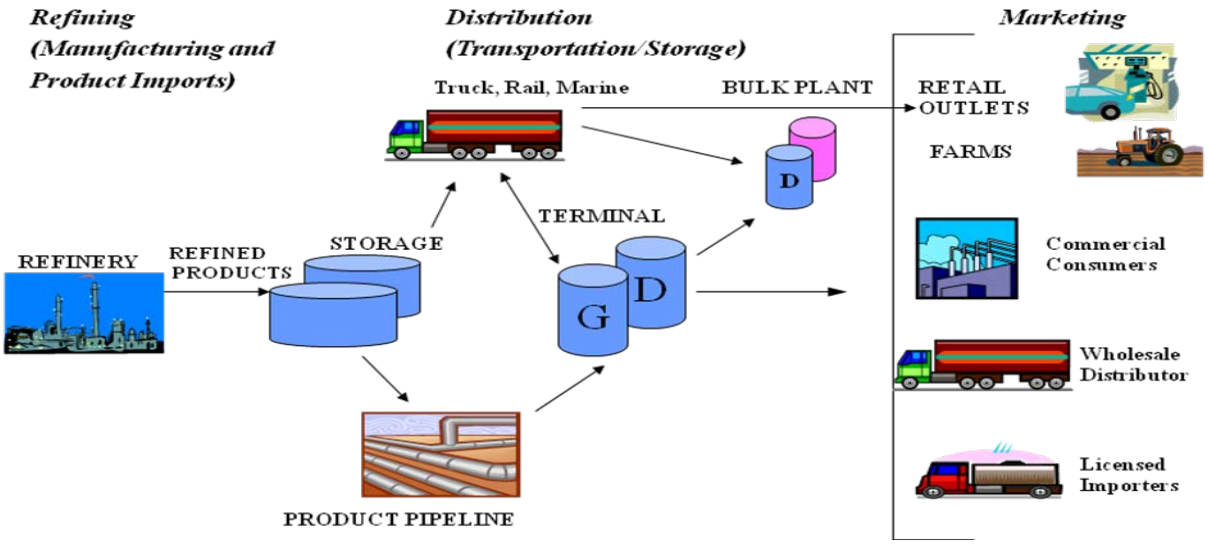
***"As of December 2014, the overall water use by the downstream petroleum sector in Alberta has improved by 13.6%* in normalized intake and 15.2% in normalized usage from the base year."**

The sector CEP's will consider the following or combination of reduction opportunities identified below:

- ✓ Continue to implement projects to reduce the volume of water diverted from Alberta's rivers, lakes and streams per unit of production.
- ✓ Continue to increase recycling of water in the refineries.
- ✓ Increase staff training to improve their understanding of the significance of this resource to Alberta.
- ✓ Provide full management support for water conservation projects and continual improvement activities.
- ✓ Continue to ensure that water diverted for use in the operation is returned in an acceptable quality.
- ✓ Improve operational performance to reduce impact on water courses.
- ✓ Marketing rationalization to meet market demands.

1.3 Scope of the Original Plan[3]

CEP and the progress report continue to cover the refining, marketing and distribution segment of the industry as illustrated below:



Familiar downstream sector products include:

- Gasoline
- Sulphur
- Butane
- Diesel
- Asphalt
- Jet Fuel
- Lubricants
- Home heating oil
- Propane
- Lubricating oils

The Downstream Sector (Canadian Fuels Members) in Alberta

Refining

As of December 31st, 2014, Canadian Fuels members in Alberta operate three refineries, located north of Edmonton (Shell, Suncor and Imperial) and the Husky asphalt plant located in Lloydminster, Alberta. The three Edmonton area refineries divert water from the North Saskatchewan River and the Lloydminster asphalt plant relies on groundwater and municipal water for its operation. It is expected that a fourth refinery will be operational by 2017 operated by North West Redwater Partnership. The date of operation is not known and information in this report does not include the above mentioned refinery.

This report is developed based on the water diverted from the North Saskatchewan River by the three refineries in the Edmonton area. The Husky operation and water withdrawal is not included in this CEP Plan. However, CEP opportunities described in this plan will be reviewed by Husky for consideration and implementation. CEP activities implemented by Husky are also discussed in this report.

Oil refineries are complex manufacturing facilities that take crude oil and produce a variety of products. Most refineries look similar but typically produce different products. The actual products available from a particular refinery differ according to:

- Type of refinery processing units
- Refining processes
- Type of crude oil feedstock

Refineries are built to match the crude oil feedstock. Some refiners use conventional oils, others upgrade to heavy crude oil, and some refine synthetic crude oils. All crude oil contains sulphur and some contain wax, depending on the type and origin. Sour crude has more sulphur than sweet crude. Sulphur is not desirable and, along with wax, is removed during the refining process.

Distribution and Marketing[3]

In addition to refineries, the Canadian Fuels Association member companies operate many distribution and marketing facilities in Alberta:

On December 31st, 2014, this sector operated the following distribution and marketing facilities in Alberta:

- ✓ 6 terminals (company owned and operated) for storage and distribution of various products to the market, normally supplied by pipeline.(Source: NPRI website)
- ✓ 184 bulk plants (agency-operated distribution centres)

- ✓ 334 card locks
- ✓ 1535 service stations

NOTE 1: T*he number of operating terminals, bulk plants and service stations is sourced from a 2007 MJ Ervin report.*

NOTE 2: Many of the marketers and dealers operate facilities with car washes.

The petroleum industry's marketing facilities generally are not significant users of water and the amount of water consumed is negligible. Water in marketing is used as potable, for sanitary purposes and in car washes.

The petroleum industry continued to upgrade its marketing facilities during the reporting period utilizing significant capital expenditures to ensure integrity of its equipment and prevention of leaks or release of products to the environment. These upgrades will be discussed in detail in the following sections. In addition, marketing and distribution facility rationalization due to market demand changes, operating efficiency, and industry restructuring, have resulted in the reduction of the number of sites and a reduction of water demands.

1.4 The Case for Water CEP

The industry has made significant improvements in water use efficiency throughout the past decades by implementing various technologies in its operations. These improvements have been achieved in spite of many regulatory changes requiring reconfiguration of the refineries, the addition of units to upgrade refined products, and changes in feedstock quality that have resulted in increased use of water per barrel of crude refined.

1.5 CEP Plan Champion and Leaders

The most significant gains have been realized through CEP initiatives which occurred within the three Edmonton area refinery operations. Each refinery is unique in its uses and capabilities to conserve and reduce water diversion and use, increase water use efficiency, and each will contribute differently to the projected outcomes.

Canadian Fuels will continue to be the promoter of CEP implementation and utilization of opportunities by all its members since it has the mandate to represent the interests of its members in Alberta.

2.0 Profile of Existing Water Systems

2.1 Water Use Profile

The three refineries in this CEP Plan update are located in the Edmonton area and take water from the North Saskatchewan River.

The following table provides a summary of water use and discharge for the three refineries in the Edmonton area, from 2000 to 2014.

Total water intake and discharge for three refineries in the Edmonton area

(Source: Statistics Canada Industrial Water Use Survey)

Year	Crude Throughput $1000m^3/d$ (1000 bbls/d)	Intake water m^3	Discharge water m^3	Water Used m^3
2000	61.61 (387)	11,444,630	3,939,309	7,505,321
2001	60.37 (380)	11,223,325	4,110,269	7,113,056
2002	60.30 (402)	11,446,194	3,744,831	7,701,363
2003	63.93 (390)	10,952,369	4,094,577	6,857,792
2004	65.12 (410)	10,604,983	3,910,403	6,694,580
2005	65.97 (415)	10,638,280	4,469,739	6,168,541
2006	62.56 (393)	10,690,065	4,128,482	6,561,583
2007	66.40 (417)	11,297,896	4,449,979	6,847,917
2008	57.64 (363)	10,105,847	4,075,332	6,030,515
2009	58.85 (370)	9,857,270	4,923,807	4,933,463
2010	67.07(421)	10,750,237	5,118,884	5,631,422
2011	66.00 (415)	10,420,237	4,758,735	5,702,538
2012	68.69 (432)	11,017,507	4,758,004	6,259,503
2013	65.24 (410)	11,538,256	4,907,863	6,630,393
2014	69.62 (437)	11,221,250	3,978,832	7,242,418

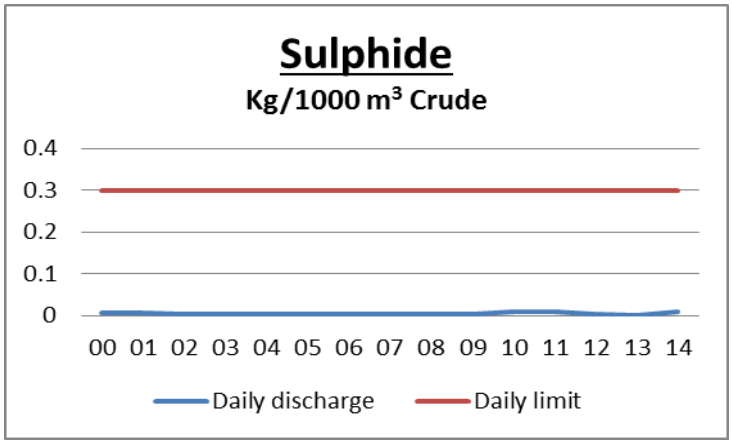
Total water discharge quality for the three refineries in the Edmonton area

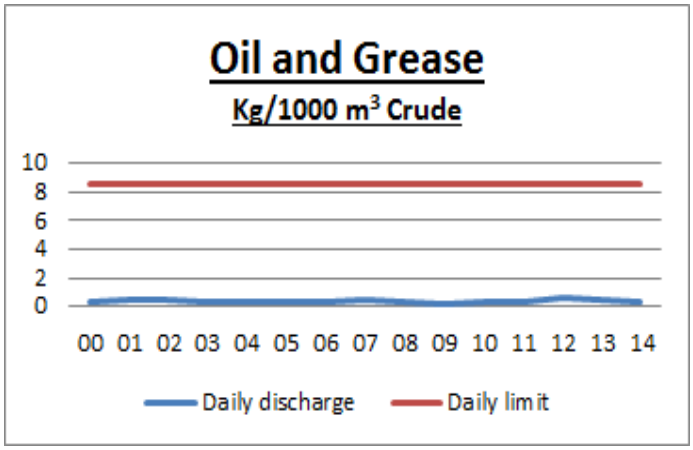
Source: Environmental & Safety Performance Report (ESPR) (Federal Refinery Effluent Regulation)

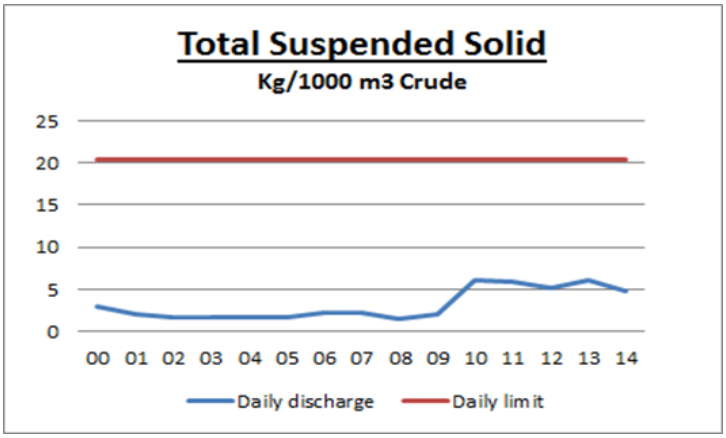
	Oil& Grease	Sulphide	Ammonia Nitrogen	Phenol	TSS
Unit	Kilograms/1000 m^3 Crude Throughput				
Regulation	8.6	0.3	10.3	0.9	20.5
2000	0.34	0.0058	0.080	0.002	3.0
2001	0.43	0.0061	0.066	0.003	1.9
2002	0.41	0.0026	0.080	0.004	1.6
2003	0.34	0.0023	0.091	0.003	1.7
2004	0.30	0.0027	0.066	0.002	1.7
2005	0.20	0.0025	0.047	0.001	1.7
2006	0.35	0.0034	0.085	0.003	2.2
2007	0.48	0.0038	0.060	0.002	2.1
2008	0.31	0.0024	0.061	0.001	1.4
2009	0.24	0.0024	0.088	0.0008	1.9
2010	0.30	0.008	0.384	0.002	6.1
2011	0.38	0.008	0.046	0.003	5.9
2012	0.67	0.002	0.122	0.000	5.1
2013	0.47	0.00	0.156	0.001	6.0
2014	0.39	0.008	0.109	0.002	4.8

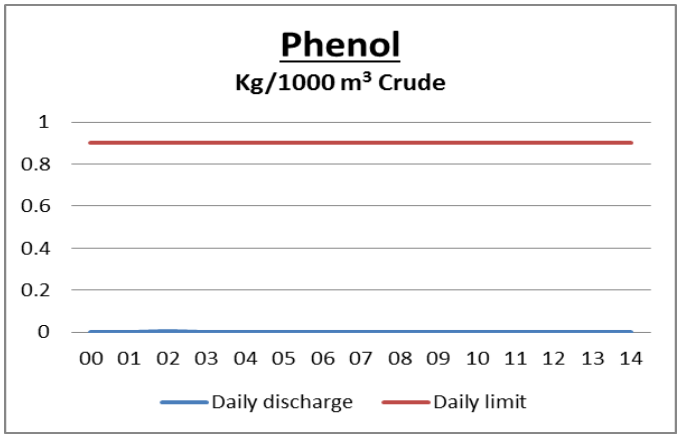
Compliance with Federal Refinery Water Effluent Regulations

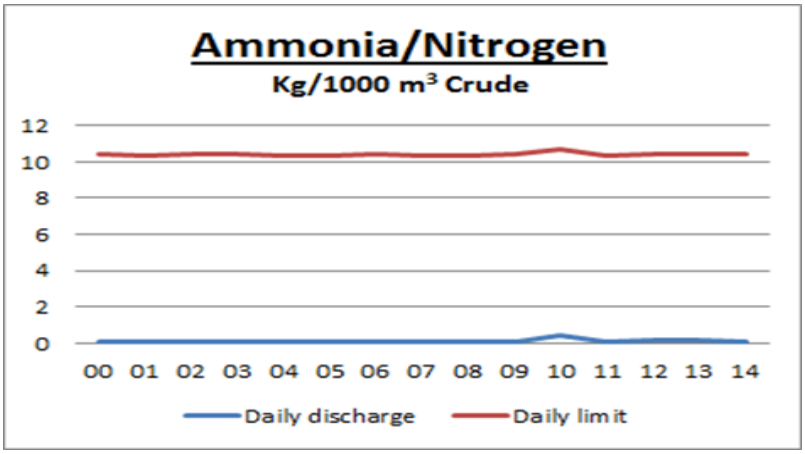
2000-2014











The above charts reflect the refinery effluent quality in accordance with the refinery effluent guidelines under the Federal Fisheries Act. Effluent quality has met and been less than 2% of allowable federal limits in the past 15 years. In addition, the Alberta government has prescribed site specific limits for each refinery in their respective water licenses.

2.1.1 Baseline Water Use

Water License Conditions

The Water Act, R.S.A. 2000, supports and promotes the conservation and management of water, including the wise allocation and use of water, while recognizing the need for economic growth and prosperity.

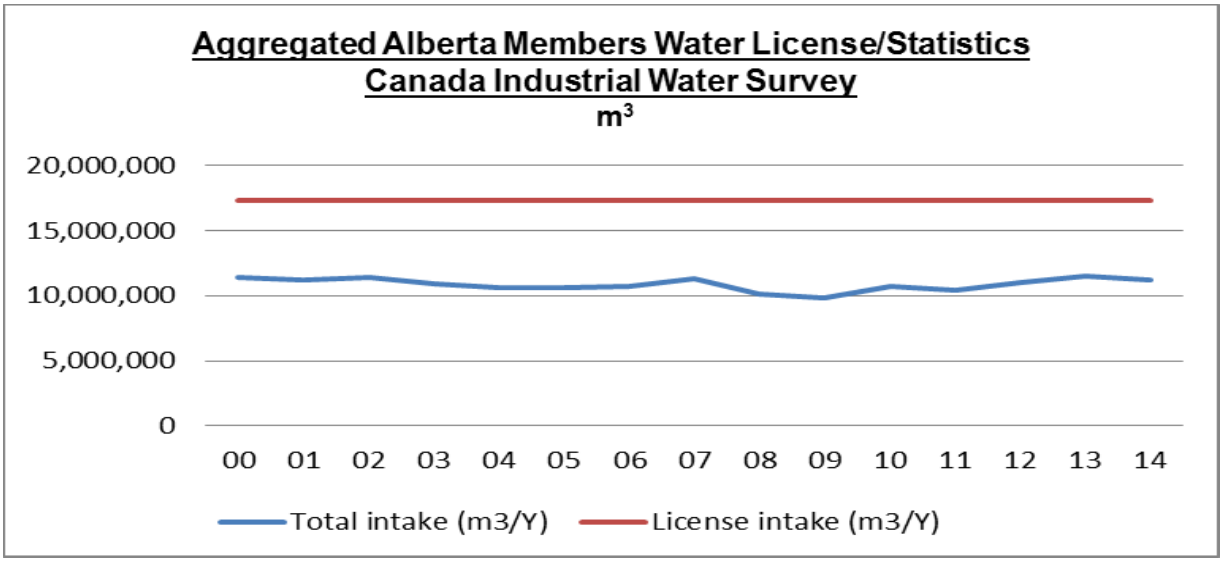
The *Water Act* requires that an approval under the Environmental Protection and Enhancement Act must be obtained for any activity, diversion of water or operation of a works.

The *Water for Life s*trategy was introduced to support the stewardship of water in the province.

All refineries operating in the province have licenses to either divert water from the North Saskatchewan River or use groundwater. Water licenses granted to the refineries after 1999 have expiry dates. Water licenses typically limit the maximum annual volume with some site specific conditions, such as rate of diversion. Some licenses also specify a return flow. *A*ll licensees require that records of water use be maintained. Most users are required to report their actual water use to Alberta Environment and Parks. Alberta Environment and Parks publish the water use and discharge for various industries in their annual report.

Actual Water Intake

Total allowable water diversion and actual diversion of water for the three Edmonton area refineries for the period 2000-2014 is depicted in the following chart:



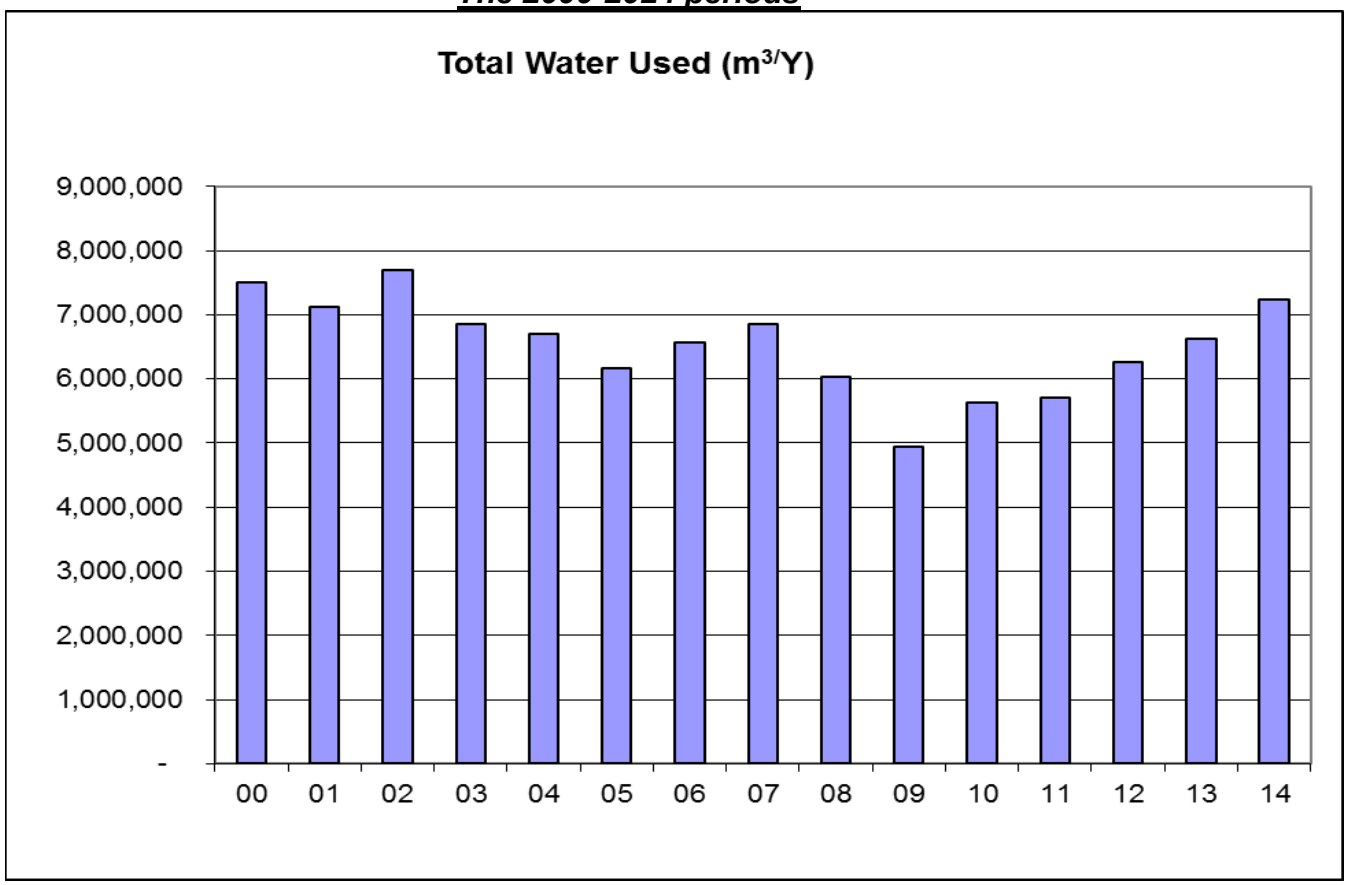
In a typical refinery, approximately 60% of intake water is used for the cooling system and it is generally returned back to the river after being treated to release quality. Some of this water is evaporated in cooling towers.

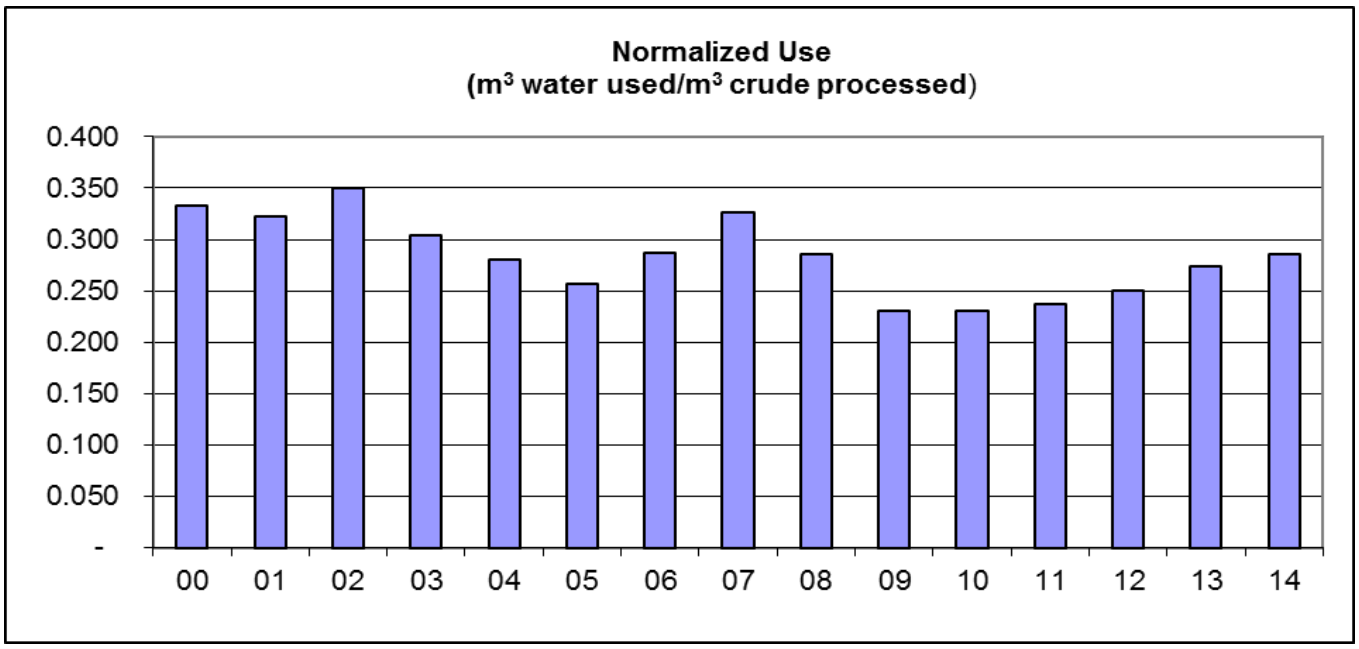
Approximately 35-40% is used in the refining process, either by direct contact with crude, such as de-salting of crude, steam production or production of hydrogen in the hydrogen plant.

Water from refinery operation is treated in waste water treatment plants (WWTP) before it is returned back to the environment. Each refinery's WWTP has varying degrees of complexity. Details of a WWTP in a typical refinery are provided in the original CEP report dated March 2011. Some water that does not meet release quality is disposed of in deep wells, in accordance with specific refinery permits.

Approximately 1% of intake and some city water is used for sanitation. Sewage is normally transported off site by a licensed contractor.

The following charts show total and normalized water use during The 2000-2014 periods





A 15.2% reduction in normalized use from the base year has been achieved. Please note variation in refinery utilization and water use over years.

2.1.2 Description of Key Water Uses/Users

Fresh water is a fundamental part of a refinery operation and is used in many different ways. In many cases, the water withdrawn from the ecosystem is used, treated and returned to source at an equivalent or better quality level than source water intake. Only a portion of the water withdrawn is used as a chemical feedstock or lost to evaporation in cooling towers. During high precipitation periods, the amount of water collected and treated at the site actually exceeds the refinery water use. In these situations, a refinery returns more water to the ecosystem than it removes.

2.2 Related Legislated Conditions or Clauses

There are two distinct regulations/guidelines which directly apply to refinery effluent in Alberta.

1) Waste Water Effluent Guidelines for Alberta Petroleum Refineries-1985

These are intended to define the minimum acceptable levels for waste water treatment at refineries, consistent with good operating practices and environmental protection. Permits or licenses for petroleum refining plants under The Water Act will only be issued if there is provision for an effective control program for plant liquid effluents originating from the refinery process units, surface runoff from the developed area within property boundaries, and sanitary sewage.

2) *Federal Fisheries Act, R.S, 1985*

This Act applies to waste water discharge from petroleum refineries to water bodies and requires rigorous sampling and reporting on a monthly basis for specific parameters.

2.3 Sector History of CEP

Refining

Access to fresh clean water is a prerequisite for petroleum refining operations. Pursuing opportunities in water conservation, efficiency and productivity in water usage has significant environmental benefit and results in operating cost savings since there is a direct relationship with energy use. Unlike many other industries, a typical refinery uses water mostly (60%) for cooling which is returned to the source with high quality treatment. A smaller amount (30%) is used as contact water and needs to be treated before it is discharged. The remaining water (10%) is used for activities such as the generation of hydrogen and fire water.

The downstream petroleum sector has been very successful in developing waste water treatment technologies which remove contaminants from the contact water to the lowest possible level. Many of the technologies adopted have now become standard operating procedure.

Canadian Fuels Association member companies in Alberta operate refineries with varying water treatment complexities and needs. The availability of deep well disposal, has added to this complexity. Disposal via deep well is a regulated practice in Alberta, and has been deemed a safe and viable disposal option where wells are properly constructed, operated and monitored. Volumes of wastewater disposed via deep well injection are reported to regulatory bodies.
As a result of these efforts, the sector has already realized significant and measurable water efficiency and productivity improvements. Although the most obvious CEP opportunities with the largest gains have already been implemented, the sector continues to conduct research and development to pursue further reductions in water use and improve the quality of their discharges.

Distribution and Marketing

As already mentioned, the distribution and marketing segments of the downstream petroleum sector are not significant users of water when compared to refinery operations. Most of the CEP improvements in this part of the industry have been in the form of measures to prevent any adverse impact on water courses and to reduce contamination.

To achieve this objective, the petroleum industry over the past 20 years, has invested many millions of dollars to upgrade their marketing and distribution facilities. The following are examples of the upgrades undertaken:

- ✓ underground tank and piping replacement program
- ✓ aboveground tank upgrading and maintenance
- ✓ installation of leak detection system in all tanks
- ✓ overflow protection for storage tanks
- ✓ overflow protection for loading tank truck and rail car
- ✓ automated shut off system during loading/unloading
- ✓ collection and testing of storm water before discharge
- ✓ proper disposal of tank draw off
- ✓ establishment of an emergency response plan to prevent soil and water contamination
- ✓ staff training and communication
- ✓ preparation and use of best management practice documents

As a result of these upgrades, the marketing facilities have reduced potential impact on the quality of groundwater or surface water.

Examples of CEP Developments in Recent Years

Suncor – Edmonton Refinery

A recycled water line from the City of Edmonton's Gold Bar Wastewater Treatment plant continues to reduce the amount of water drawn directly from the North Saskatchewan River and provides water for Suncor's Strathcona County refinery. The membrane-treated water is cleaner than the wastewater formerly returned to the river at Gold Bar. The recycled water will help Suncor meet federal standards introduced in 2000's in the manufacture of fuels to reduce vehicle emissions and higher utilization.

Shell- Scotford

Beginning operation in 1983, Shell Scotford Refinery is one of North America's most modern refineries utilizing energy efficient processing technologies and an environmental design basis including water conservation features. Included in the design basis is air cooling of process streams eliminating the need for cooling water systems thus avoiding water use and the need for water treatment. Process water from hydrocracking/hydrotreating processes is segregated and until recently was injected in deep well, leaving storm water and utility blowdowns as streams being returned to the North Saskatchewan River. Effective 2003 as part of the integration of processes with the Shell Scotford upgrader, refinery process water is treated at the upgrader, a portion of which is recycled back to the refinery as process make up water, and the balance is treated and returned to the river. Effectively more than 50% of the previously injected water in deep well is now recovered.

Corporate Sustainability Reports

Many companies formally report on their environmental performance, including metrics for water use, in annual corporate sustainability or community reports.

The most commonly reported metric is total annual water use, but others include efficiency (water used per volume of oil or barrel of oil-equivalent produced), re-use rates, volume of water withdrawn and returned, and annual water use broken down by sector or source.

Quote from Imperial Oil 2014 Corporate Citizenship Report

"We are committed to developing our nation's resources responsibly, and minimizing our impact on the air, land and water. We do this by adhering to detailed management systems and investing in research and technology.

Water is an essential component in resource exploration, production and processing. Imperial seeks ways to reduce water use and protect water quality through the design and operation of our facilities, by recycling water for reuse and preventing water pollution.

By working with government, local stakeholders and other industry partners we can develop techniques and technologies that reduce the impact on local water sources, using water more efficiently by recycling and reusing it wherever practical."

Quote from Shell 2014 Annual Report

"Shell Canada is celebrating 20 years of environmental investment by awarding one-time major grants from the Shell Environmental Fund to four Canadian organizations."

"Since 1990, Shell has invested more than $15 million in 4,600 environmental projects across Canada through the Shell Environmental Fund," said Lorraine Mitchelmore, President and Canada Country Chair, Shell Canada Limited. "We are proud to continue this 20-year tradition with this year's recipients who are working with Shell to find innovative ways to better our environment."

"As demand for energy continues to rise in coming decades, the world will need Canadian oil production – including oil sands, therefore using more water; Shell will

- Optimize/integrate water use and wastewater treatment at the Scotford Upgrader
- Develop technology to enable reduced river water requirements"

Quote from Husky 2014 Community Report

"Husky is committed to continuous improvement in environmental performance by reducing the impact to land and habitat, air and water.

The Company meets and strives to exceed regulatory requirements, reflecting its commitment to continuous improvement across all of its operations.

Husky completes risk assessments to develop water management plans for operations. The Company enhances its responsible water use by employing technology and collaborative management strategies.

Husky continues to improve its ability to track water metrics across all business units using the Environmental Performance Reporting System. It participates in a number of national and international programs that help drive better measurement and transparency of water use and issues across the industry.

The Company withdraws water for industrial use, drawing on saline and **non-saline** sources.

In considering a water source for its operations, Husky evaluates risks, including reliability, sustainability, quality, technical feasibility, net environmental effect, economics and regulatory and stakeholder concerns. Where risks are identified, mitigation plans are developed.

Ways to conserve and recycle water are assessed, including consideration of reusing produced water in hydraulic fracturing operations.

In 2014, 97 percent of non-saline water withdrawals occurred in areas considered not water short or low intensity, as defined by provincial regulatory bodies. Two percent of the withdrawals

occurred in areas considered potentially water short or moderate intensity and one percent of the withdrawals in areas considered water short or high intensity."

Quote from Suncor 2014 Annual Report

"We believe water is a shared and precious resource that must be managed wisely. Responsible energy development means balancing industry's water requirements with the need to maintain a clean, safe and plentiful supply of this important natural resource for current and future generations. We strive to always raise the bar on company-wide water performance and water management practices.

Water is an essential part of Suncor's operations. It's important to find ways to more effectively and efficiently use and recycle water across our business units.

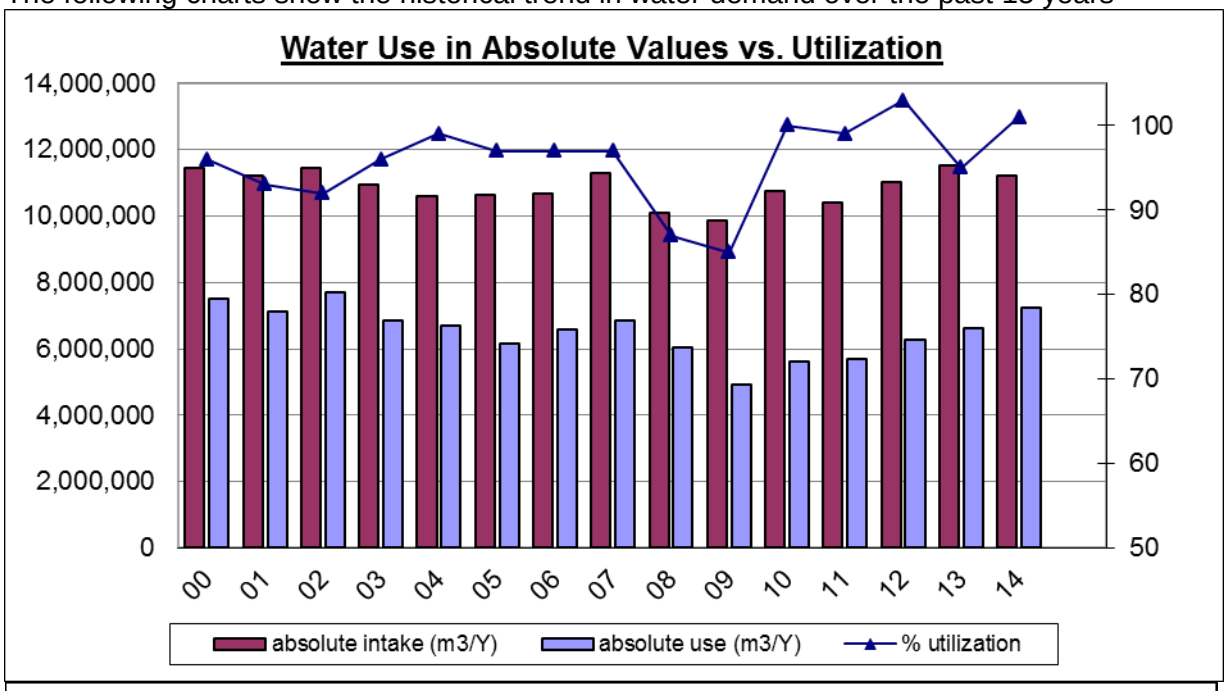
Suncor strives to continuously improve its water management practices. We have committed to reducing our company-wide freshwater intake by 12% by 2015 (as compared to 2007)."

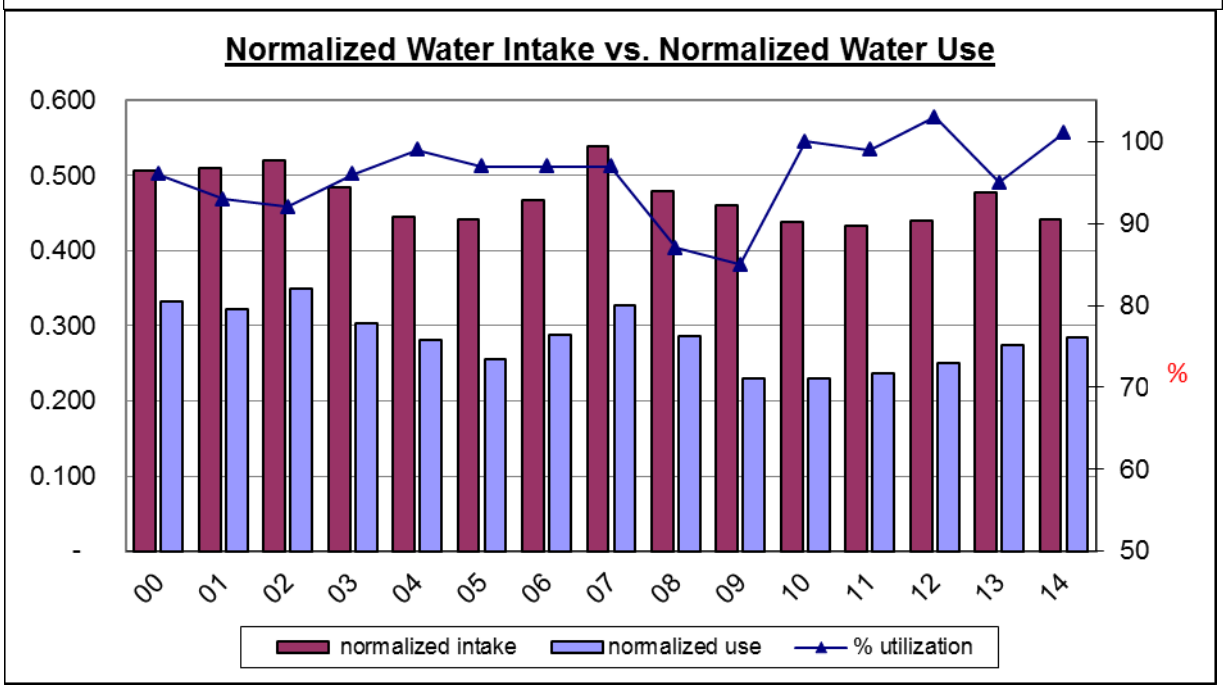
3.0 Water Supply and Demand Considerations

Water demand in refining during the past 15 years has fluctuated for a number of reasons, including:

- Response to regulations affecting quality of refined products
- Economic trends, refinery utilization and market demand
- Crude slate changes requiring refinery reconfigurations

The following charts show the historical trend in water demand over the past 15 years





Response to Regulations Affecting Quality of Refined Products

Over the past 20 years, there have been a number of federal government environmental initiatives in regards to changing the specifications of petroleum products:

- Benzene in Gasoline Regulations (1997)
- Sulphur in Gasoline Regulations (1999)
- Sulphur in Diesel Regulation (2002)
- Renewable Fuel Regulations (2010)

In most cases, the need for the removal of substances such as benzene or sulphur in products requires a high degree of hydrogenation or molecular cracking, which subsequently requires a much higher amount of steam in the form of energy for the production of hydrogen in a hydrogen plant. Throughout the past 20 years, refineries have added a large number of units to reformulate gasoline and diesel as required in the various regulations. In addition, provincial environmental regulations have impacted energy use and resulted in higher use of water in refineries.

Refinery Utilization and Market Demand

Water use in refineries is affected by refinery utilization. In the past decade, there has been a significant economic change in Canada and the rest of the world. This in turn has impacted consumer behaviour and resulted in a fluctuation in the demand for petroleum products. During lower demand periods (2007-2009), refinery utilization is reduced resulting in less water and energy use by the refinery. In recent years, 2011-2014, economic growth and infrastructure improvement by various levels of governments, have increased demand on fuels and therefore, improvement in refinery utilization. Water usage has increased during this period however, the normalized water usage remained at 15.2% lower than baseline.

Crude Slate Changes and Refinery Reconfigurations

The trend to upgrade refineries to utilize synthetic crude from oil sands continued during the 2011-2014 period. The conversion usually involves the addition of units which require a higher degree of energy resulting in more water use for steam, hydrogen production and/or cooling systems.

3.1 Water Demand Forecasting

The water demand forecast discussed in this section covers the period up to 2020. The volume of water demand in the forecast period is based on the base year production and water use rate (i.e. water diversion per unit of crude processed).

The following assumptions were made in developing the forecast:

- No change in regulations requiring additional processing units
- No change in the quality of crude as it is currently utilized
- No significant change in the market demand

Refineries covered in this plan have indicated that they **do not expect a significant change in water demand during the next 5 years provided no external changes are imposed on**

them. In addition, no major capital expenditures are expected which may result in a change in water use. However, the sector will continue utilizing practical opportunities, including the ones identified in this report, to optimize water diversion and/or water use from the North Saskatchewan River.

4.0 Review and Effectiveness of CEP Opportunities Identified in the Original Plan

4.1 Identification of All CEP Opportunities

Many opportunities for water CEP have been examined and implemented in the downstream petroleum industry. In marketing and distribution operations, water use is limited and is normally drawn from local water supplies or municipalities. In some cases, groundwater is used to a limited extent where municipal water supply is not available. The refinery operations are continually to optimize their water use efficiency. As such, many of the opportunities identified in the original plan from 2011, have been considered or implemented by Canadian Fuels members. In most cases, opportunities were in place at some of the refineries. This report provides an update regarding implementation and effectiveness of those opportunities.

It is important to note that due to the complexity and unique set up of each refinery and the different ages of each refinery, some operational constraints exist which limit the implementation of identified CEP actions in all refineries. Water use and reduction projects are very site specific. A project which is practical in one refinery may not be suitable for another.

The opportunities were divided into the three categories consistent with the guidance provided in the CEP framework:

- Conservation:
  1. Any beneficial reduction in water use, loss, or waste.
  2. Water management practices that improve the use of water resources to benefit people or the environment.

  For example, the CEP opportunities identified may decrease overall use of water and therefore, the water diverted by refineries, such as using alternative water sources.

- Efficiency:
  1. Accomplishment of a function, task, process, or result with the minimal amount of water feasible.
  2. An indicator of the relationship between the amounts of water needed for a particular purpose and the quantity of water used or diverted.

  For example, the CEP opportunities identified would decrease the overall water use, these opportunities may reduce water losses to the atmosphere and/or increase the volume of water discharged back to the source.

- Productivity:
  1. The amount of water that is required to produce a unit of any good, service, or societal value.

  For example, The CEP opportunities identified would increase production while maintaining the same amount of water used (i.e. improve water use per unit of crude utilized).

CEP Opportunities for Consideration by Canadian Fuels Member Companies Proposed in 2011 and Updated in 2014

Type of Opportunity			Description of Opportunity	Probability of Implementation/ Comments	Updates from Refineries for 2011-2014
Conservation	**Efficiency**	**Productivity**			
X	X		Reuse of water from other sources such as Municipal Treatment Plants	**Probability :** Medium **Comment**: One refinery is currently using this option. Availability of water should be considered dependent on site specific applicability.	This opportunity was reported previously at one of the refineries and it continues to account for 40% of total intake water for that refinery. Due to differences in refinery configuration, this technology has not been adopted by other refineries.
	X		Optimization of wastewater disposal via deep well. Possible redirection of select streams of contaminated water to WWTP	**Probability**: Medium **Comment:** Increased focus regarding wastewater streams currently disposed of via deep well will optimize the use.	Deep well disposal has been optimized by directing sour wastewater to the Upgrader Sulphur Recovery Complex and wastewater treatment facilities at one refinery and also to the Capital Regions WWTP at another refinery. In one case, treated sour water is returned to the refinery for re-use.
	X		Reduce evaporative losses from cooling towers where applicable by maintenance and upgrades	**Probability:** High **Comment:** Maintenance program requires low capital to maintain operating efficiency. Upgrade is a high capital required project.	Improving cooling towers' operating performance and efficiency continues to be high priority for refineries using water for cooling. Maintenance programs are in place to reduce evaporative loss.
X	X		Use of air fans in place of water cooling	**Probability:** Medium **Comments:** Is already being utilized in various refineries where practical and applicable. Higher use of energy should be considered.	Air fans are used in three refineries to a maximum based on original design and engineering, no further changes since 2011 report.
X			Continue upgrading marketing facilities to prevent impact on surface and groundwater	**Probability:** High **Comments:** Large capital has already been spent to reduce impact. Each member reviews opportunities as required by regulations and internal company policies.	All marketing facilities are upgraded to meet the current regulatory requirements.

CEP Opportunities for Consideration by Canadian Fuels Member Companies Proposed in 2011 and Updated in 2014

Type of Opportunity			Description of Opportunity	Probability of Implementation/Comments	Updates from Refineries for 2011-2014
Conservation	**Efficiency**	**Productivity**			
X	X		Reduce leaks in steam lines/traps and improve condensate collection systems for recycling	**Probability:** High **Comments:** Methods used for VOC reductions through Leak Detection and Repair can be applied to water and steam sources as well	Steam trap leak detection and repair program to ensure leaks from steam traps are repaired in a timely manner is implemented at all refineries.
X			Improve de-salter unit which results in less contaminated water	**Probability:** Low **Comments:** Could require a high capital cost	This opportunity is utilized at one refinery by replacing use of fresh water with stripped sour water which results in less water intake and less contaminated water disposed in deep well.
X		X	Segregation of storm water from contaminated water and recycling of clean storm water	**Probability:** Medium **Comments:** Would not be practical in some refineries due to plant layout and sewer lines	All refineries continue to divert storm water to raw water for use in the refinery. Approximately 210,000 m^3 /year of water is recycled.
X		X	Improve the operation of WWTP to allow recycling of water in process areas	**Probability:** Medium **Comments:** Could result in a high capital cost. May require real estate which is normally limited in an existing refinery.	Two of the refineries do not operate WWTP. One refinery has diverted sour water and wastewater to their upgrader for treatment and reuse, resulting in conservation of 630,000m^3/Y of water. Another refinery is re-using water from the API separator in the steam plant.
		X	Reduce possibility of leaks and spills by improving maintenance and providing rapid response to spills	**Probability:** High **Comments:** Currently in place in all refineries. Tank and pipeline integrity programs vary in each plant.	Leak detection and maintenance programs are used in all refineries as preventative measures. In addition, spill response capability has been improved at all refineries to respond effectively to spills which results in less contaminated water in sewers and on the surface.

The Following Options are Considered *as* Optimization of Equipment, Operating Practices, and Steam Use					Updates from Refineries for 2011-2014
Conservation	**Efficiency**	**Productivity**			
	X		Superheating stripping steam	**Probability** : High **Comments**: will result in better stripping and reduction in use of steam	In one refinery, superheated steam has been in place since the start up. For others, retro-fitting is not planned as it requires large capital.
X	X		Heat exchanger monitoring and maintenance	**Probability**: High **Comments**: could already be in place at some of the refineries	This is adopted in all the refineries' maintenance programs and inspections are in place.
	X		Boiler feed water blowdown monitoring	**Probability**: High **Comments**: Can be monitored daily to reduce to 0.8-1.3% of steam load	Boiler feed water blowdown is monitored daily to minimize the blowdown volume. In one refinery, plans are in place to recover condensate blowdown and other blowdown sources of water that are currently disposed of in a deep well.
		X	Use higher pressure steam	**Probability**: Low **Comments**: could be a very expensive and capital intensive project	All refineries produce high pressure steam as designed during original construction. Refineries continue to optimize stripping steam use in processes to maximize condensate return. Increase in steam pressure is not economically beneficial.
X		X	Internal re-use and recycling of process water	**Probability:** High **Comments:** already used for sour water in de-salter	All refineries recycle and re-use water in different operating units. Recycling opportunities are continuously considered in all refineries.

4.2 CEP Opportunities Identified in Original Report

Use of Water from Other Sources Such as Municipal Treatment Plants

Application of this option greatly depends on the availability of water, quality of water treated, proximity to the alternate source of water, and the distribution capability of the alternate source of water. In addition, the water from "other sources" is typically returned to the North Saskatchewan River and its use by the three refineries would not change the net use of the North Saskatchewan River.

This option is currently in place at one of the refineries and has been successful in reducing the refinery dependence on river water. The capital for construction of such a diversion system is relatively high and significant additional treatment is required by both the municipal water treatment plant and the refinery to obtain the necessary quality of the re-used water, to ensure it is suitable for use in the refinery and various operations. Proper pre-treatment of water is essential to ensure improved reliability so that expensive equipment in a refinery is not damaged, and refinery operations are not interrupted.

Continue to Focus on the Efficient Use of Deep Well Disposal

Deep wells are used at all refineries in Alberta for disposal of water that cannot be treated in the WWTP. This is based on the treatment capacities of the WWTP and the stringent government regulations that the refineries must meet prior to water being discharged to the environment. Optimizing the use of the deep well disposal will continue to be a focus for refineries to ensure that only streams which cannot be treated in the WWTP are disposed of via deep well disposal.

Reduce Evaporative Losses from Cooling Towers

In Alberta refineries, cooling towers are used in place of once through cooling systems to reduce water intake. Cooling towers can be a source of evaporative losses of up to 10% of the re-circulating rate, depending on the age and design of the towers. Proper maintenance, use of chemicals and increasing efficiency could result in reduced water loss therefore, less reliance on makeup water. It should be noted that upgrading and / or replacing a cooling tower is a capital intensive project.

Use of Air Fans in Place of Water Cooling

In newer refineries, the technology of air fans rather than water cooling is the practice of industry. In some of the older refineries, fan cooling has been utilized, where possible. This technology has limited application in units due to the space requirements and difficulty associated with retrofitting equipment, and where more efficient water cooling is essential. Air fan cooling also requires increased use of electricity to power the fans which can have an adverse effect on GHG emissions. Competing environmental priorities must be evaluated when considering replacing water cooling with air fan cooling use.

Application of Leak Detection and Repair Methodology

Leak Detection and Repair has been in place in refining, marketing and distribution segments for many years. It has mostly been used for fugitive emissions reduction to address air quality concerns. The program consists of a systematic maintenance inspection program followed by repairs to any identified leaks. One of the major sources of steam loss are malfunctioning steam

traps which could be managed by a rigorous preventative maintenance program. This CEP opportunity suggests the application of this concept for the elimination of leaks where water or steam is being discharged.

Improving De-salter Units

Desalting of crude is one of the primary and essential processes in a refinery and is done to eliminate salt in the crude which could cause significant corrosion. Desalting is one of the processes that create a contaminated water stream because the water is in direct contact with the crude. This wastewater is disposed of in deep wells. One way to reduce the volume of wastewater to deep wells is to improve the efficiency of de-salters. This could be a very highly capital intensive project for some of the refiners.

Segregation of Sewer and Storm Water Systems

In some older refineries, the sewer system is constructed in such a way that requires storm water to be combined with the process water and directed to the treatment plant. This can result in the unnecessary treatment of clean water that has not come into contact with any petroleum product and could potentially be used for other purposes.

The segregation of sewer and storm systems could be a challenging project for some refineries due to the age and the manner by which the wastewater is collected. In some refineries, the non-contact water (clean storm water) is already segregated and discharged as clean water.

Improving the Operation of the WWTP to Allow Recycling of Water in the Process Area

WWTPs in Alberta refineries are designed to treat contaminated water to meet the discharge limits required by federal and provincial regulations. They typically consist of primary separation with an air floatation system.

Additional wastewater treatment technologies exist and further remove contaminants by allowing treatment of more contaminated water or diverting the water from deep wells or by allowing for recycling of the discharged water for further refinery use. These options would require a major reconfiguration to the WWTP, and would not be practical in some cases due to a lack of availability of space in a refinery and/or the very high capital cost.

Enhancement of Maintenance and Emergency Response Initiatives and Continued Upgrading of Marketing Distribution Facilities

Refineries traditionally use a comprehensive maintenance program to inspect and repair underground tanks, piping and above ground storage tanks. As a result, leakage of product to groundwater and surface water has been reduced significantly over the past decade. Continued diligence will further increase environmental protection performance.

Marketing and distribution facilities are small users of water when compared to refinery operations, but if a leak or spill occurs, it could impact a large volume of ground or surface water. The petroleum sector is committed to continued risk evaluation and tank upgrading at these sites to prevent impact on surface and ground water.

Significant capital has been invested to upgrade marketing facilities and distribution terminals reducing the potential incidence of a release that would contaminate surface or groundwater. In addition, the establishment of comprehensive emergency response and contingency plans (ERP's) has improved response capability to mitigate damage to the environment from accidental releases. ERP's are continuously improved with regularly scheduled simulations and response exercises.

Optimization of Equipment, Operating Practices, and Steam Use

These options may be prohibitively expensive as it may involve a redesign of the steam system and boilers in the refinery. Steam production operating practices may also be an opportunity to reduce water use. Through careful monitoring of wastewater produced from steam production equipment (boilers), steam production could be optimized based on the steam requirements.

Heat exchangers' maintenance will result in improvements in efficiency of the equipment and may reduce the volume of water while still providing the same level of cooling.

4.3 Selected/Recommended CEP Opportunities and Targets

Opportunities to implement conservation, efficiency, and productivity (as defined) exist for the downstream petroleum sector. As noted throughout this report, due to a varying complexity of operations, varying ages of facilities, internal company business plans, and external public policies, it is very difficult to identify specific CEP actions that can uniformly apply to all operations or facilities. Each Canadian Fuels member has considered the opportunities and selected those based on business plan assessments and operating feasibility for their facilities.

In addition to the various feasibility constraints, each refinery will experience different levels of cost constraints due to the varying complexity and unique set up within each refinery. In most cases, the Canadian Fuels member company refineries have been operating their units utilizing the concept of proven and applicable Best Available Technology Economically Available (BATEA) and have used available capital to improve the sector's overall environmental performance and water use in particular.

The CEP opportunities detailed in Sections 4.1 and 4.2 were aggregated for the sector in 2011 and have been reviewed by Canadian Fuels members to provide an update to this report considering site specific issues and individual company's approaches to water conservation and pollution prevention.

5.0 CEP Plan Implementation and Monitoring

5.1 Implementation Schedule

The original CEP report was developed in full cooperation with Canadian Fuels member companies. It was agreed that the opportunities presented in the 2011 report would be considered and implemented as they are applicable to each site. In the period 2011-2014, Canadian Fuels members continued the implementation of water use reduction opportunities despite increase in refinery utilization and production. Increased production was due to higher demand for petroleum products and utilization of refineries which resulted in higher water use.

Canadian Fuels has developed and implemented many Best Management Practices. There are also many industry standards which refiners continue to apply in order to reduce refinery impact on all aspects of the environment.

This report will be distributed to the Canadian Fuels Water Network members and the Canadian Fuels National Environment Committee to monitor progress.

Companies will continue to maintain reliable records on all water use and identify areas for improvement. Canadian Fuels will be used as a vehicle for consultation and communication among the members. Annually, Canadian Fuels member companies will be requested to provide water use information to the Association. This information will be analyzed and consolidated by Canadian Fuels and included in the most recent edition of its document entitled "Water – A Precious Resource" and publicly available on the Canadian Fuels website[7].

5.2 Integration with Other Plans

Best management practices may be updated to include the agreed-to opportunities, findings and metrics in the plan. It must be noted however, that due to the variation in member company refinery operations not all opportunities are applicable at each refinery.

This plan may be used in conjunction with the existing water metric collection as a tool for internal reporting and also as a basis for member company evaluation of water use. It is expected that the information on water use in the plan will be updated when each company provides their water intake and discharge data to Statistics Canada every two years.

5.3 Monitoring and Reporting

Performance Measurement

For refinery operations, monitoring and reporting of water intake, discharge, and use are the best method for each company to measure the impact of its operations on the aquatic ecosystem. For marketing and distribution facilities a reduction in spills and leaks is the best measure of performance.

These metrics are currently measured by each Canadian Fuels member company. Marketing and distribution spills are also reported in the Canadian Fuels internal Environmental and Safety Performance Report (ESPR) on an annual basis. Water use data is used to update the document entitled "Water – A Precious Resource" and available to the public online through the Canadian Fuels website.

Monitoring and Auditing

Monitoring information related to licensed water use is collected and managed by Alberta Environment and Parks (AE&P) and by industry organizations such as Canadian Fuels. Currently, all licensees are required to retain records of water use. Most large municipal, irrigation, commercial and industrial users are required to report their water use to AE&P. For all licensees, AE&P has an online reporting system to obtain additional water use information. Companies are expected to submit all of their water use data electronically to Alberta's Water Use Reporting System. All Canadian Fuels member companies also report water use to Statistics Canada on a bi-annual frequency.

Reporting

The Statistics Canada Industrial Water Use Survey is updated bi-annually (2012 and 2014 during this sector plan period) and will be the frequency (year end 2013 and 2015) for reporting on this plan.

Evaluation and Continuous Improvement

The downstream petroleum sector will continue to comply with all regulations related to water and will continue to evaluate improvements in water CEP.

6.0 Summary

This CEP plan progress update describes the current water use in the downstream petroleum sector, and some of the additional actions taken to date to reduce water diversion from various natural sources, as well as, to increase the efficiency of the water used in refinery operations.

The petroleum sector, representing the downstream industry, is submitting this CEP plan progress update for the period 2011-2014 as part of the Chemical and Petrochemical Sector identified under the AWC guidelines.

Overall, the downstream petroleum industry is expecting limited growth in market demand resulting in similar levels of refining utilization and production of refined petroleum products.

In this sector, refineries are the largest users of water and have taken steps to increase the efficiency of water use. Marketing and distribution facilities use very little water when compared to refinery operations and were not the focus of the CEP opportunities. CEP actions for marketing and distribution facilities have been focused on measures to prevent spills and leaks.

Three refineries in the Edmonton area source water from the North Saskatchewan River in accordance with their licenses. Based on the current refinery utilization, the refining segment of the petroleum industry uses approximately 66% of its allocated water usage under combined licenses issued by Alberta Environment and Parks. Water is used in a refinery for a variety of purposes and approximately 40% of water diverted for refinery use is returned back to the river after being treated to release quality. Ground water is used in an asphalt plant and some of the rural marketing facilities.

The downstream petroleum sector is a relatively small water user when compared to other industry sectors in the province. The sector has already reached 15.2% normalized reduction in water use from the base year. However, the sector will continue utilizing practical opportunities to further optimize water diversion and/or water use from the North Saskatchewan River.

Most of the CEP opportunities identified in the original plan of 2011 are highly capital intensive and may not be applicable to all member company refineries due to the differences in refinery operations and complexity. Allocation of capital will be reviewed in consideration of other environmental expenditures.

Canadian Fuels will be responsible for the overall monitoring and reporting of member company progress in implementing the various plans.

Alberta Sector CEP Plan Metrics						
Component	Units	2000/2002 (Base Year)	2009	2014	%Units 2014 F(U) vs. Base Year	%2014 F(U) vs. Base Year
Refinery Throughput	1000m3 /day	60.7	58.9	69.6	8.90	14.66
Refinery Utilization		95%	85%	101%	6%	6.32
Water Intake (actual)	Mm3	11.4	9.9	11.2	0.20	1.8
Water Discharge (actual)	Mm3	3.9	4.9	4.0	(0.10)	(2.6)
Water Use (actual)	Mm3	7.5	4.9	7.2	0.30	4.0
Water Use (normalized)	m3/m3 crude	0.33	0.23	0.280	0.05	15.2
Water Intake (normalized)	m3/m3 crude	0.51	0.46	0.44	0.07	13.6
Water Intake License	Mm3	17.3	17.3	17.3	0.00	0.00
% License Utilized		66%	57%	65%	0.01	1.75
Refinery Effluent Quality (% of allowable limits)		<15%	<10%	<10%	<5%	
F= Favorable (U)= Unfavorable						

7.0 Glossary

AE&P – Alberta Environment and Parks

Air Fan— cooling system in a refinery using large fans

AWC – Alberta Water Council

Base Year— Average water intake in 2000, 2001 and 2002 (intake, used, discharged)

Best Management Practices (BMPs) - Management practices or techniques recognized to be the most effective and practical means for meeting goals, while minimizing adverse environmental and other effects.

Bitumen – Petroleum in semi-solid or solid forms.

Bulk Plant— A receiving and distributing facility for petroleum products; includes storage tanks, warehouses, railroad sidings, truck loading racks, and related elements.

Card Lock— A commercial version of a retail fuelling station with no attendants, allowing customers to automatically access facilities and purchase diesel and gasoline.

CEP – Conservation, efficiency and productivity.

Cooling Tower— Equipment used in a facility to cool down hot water for re-use as cooling fluid

Conservation – Any beneficial reduction in water use, loss or waste. In addition, water management practices that improve the use of water resources to benefit people or the environment.

Deep Well— Injection of waste streams into cavities of varying depths previously used for recovery of conventional oil and gas.

Downstream—the refining, marketing and distribution sector of the petroleum industry.

Ecosystem – A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Efficiency – The accomplishment of a function, task, process or result with the minimal amount of water feasible. Efficiency is an indicator of the relationship between the amounts of water required for a particular purpose and the quantity of water used or diverted.

ERP— set of procedures used for preparedness and response to an emergency

Heavy Crude Oil – Oil with a gravity below 28 degrees API.

Light Crude Oil – Liquid petroleum that has a low density and flows freely at room temperature.

Makeup Water – Additional water required for a process to make up for losses such as blow down or evaporation.

Normalized Water Use – Total water used per total crude processed

Oil Sands – Naturally-occurring deposits of sand, clay or other minerals saturated with bitumen, found mainly in the Athabasca, Peace River and Cold Lake areas of Alberta.

Petrochemical Plant— a plant using petroleum feed stock for production of petrochemicals.

Potable Water – Water suitable for human consumption, used for drinking, cooking and other domestic use. Health Canada defines potable water as containing less than 500 mg/L of total dissolved solids.

Primary Distribution Terminals —Facilities for the storage of petroleum products normally receiving product by pipeline directly from a refinery with capacity of equal or more than 250 million litres per year.

Process Water— Water used in a process for washing or cooling and also used for production of hydrogen.

Productivity – Refers to the amount of non-saline water required to produce a unit of any good, service, or societal value.

Recycle Water– The process of using water multiple times for similar purposes.

Refinery Utilization Rate-- Represents the use of the atmospheric crude oil distillation units. The rate is calculated by dividing the gross input to these units by the operable refining capacity of the units.

Re-use Water – The process of using water that has already been used for one purpose, such as condensate.

Surface Water – Water located above ground (e.g., rivers, lakes, wetlands).

Upstream – The companies that explore for, develop and produce Canada's petroleum resources are known as the upstream sector of the petroleum industry.

Water Allocation – Amount of water that can be diverted for use, as set out in water licenses and registrations issued in accordance with the *Water Act.*

Water Diversion (or withdrawal) – Describes the amount of water being removed from a surface or groundwater source, either permanently or temporarily.

Water Use – Net water use or the difference between the amount of water diversion and the discharge flow.

Withdrawal – A volume of water removed under license from a water source.

WWTP— Waste Water Treatment Plant

8.0 Bibliography

Information to prepare this document came from many sources, some of which are not listed as they are not compiled in one specific publication. All information is available through public sources

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