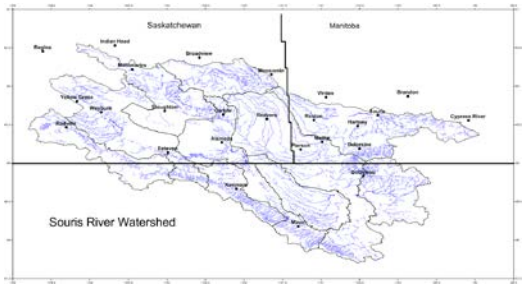


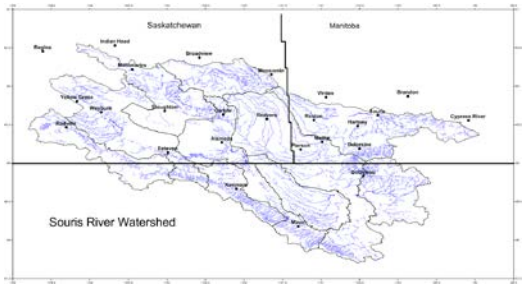
Past, Present and Future Climatic Extremes and the Vulnerability to the Energy Sector in the Canadian Portion of the Souris River Watershed.

The electrical power generation and oil and gas sectors are an important component of the Saskatchewan and Canadian economy but the overall impact of extreme climate changes to these industries is not well understood or documented. The purpose of this project was to determine what possible future adaptation actions the energy sector can do both locally and nationally to capitalize on the potential opportunities and reduce their risks for a changing climate by examining both the historic and future climate extremes and variability. The Canadian side of Souris River watershed was chosen to be the case study region because it contains both the electrical power generation and oil and gas industries and has had numerous climatic extremes in the past.

Understanding the historic climatic variability and extremes assists with adaptive risk management strategies of many sectors including the electrical generation and oil and gas sectors. The climate in the Souris River watershed has changed during the 20th and early 21st centuries. For example, all four seasons have increasing average temperatures, and the annual temperature has increased by more than 2°C between 1902 and 2014. Precipitation is highly variable on a yearly, seasonal and daily basis. Through time series analysis it was determined four periods of high precipitation amounts occurring in the 1950s, 1970s, 1990s and the 2010s and three low precipitation periods occurred in the 1930s, late 1950s/early1960s and the 1980s. The early 2000s also had low precipitation levels.

Temperature and precipitation assessed individually only supply partial information. Using climatic indices such as the standardized precipitation evapotranspiration index (SPEI) allow for incorporation of multiple climatic variables. SPEI is the index emphasized because it has the longest period of record. SPEI shows the year to year fluctuations over the 1901-2011 hydrologic year however many of the drought and excessive moisture events occurred in clusters. For example, multiple extreme drought years occurred in the 1930s, late 1950s/early 1960s, and 1980s. Excessive moisture events also happened in clusters such as the 1920s, 1950s, 1970 and the 2010s. This is important because single year events may not have as much impact on society as multi-year events and thus requiring different levels and types of adaptation.

The historic weather and climate events tended to be the motivators of change in both industries. For example, the flooding that occurred in the 2010 to 2015 period resulted in negative impacts to the oil rigs and equipment. This posed potential risks to the workforce, potential public health and safety concerns and resulted in the oil companies examining alternative procedures and making modifications to their risk management plans. An example of a lesson learned by electrical power industry relates to a past drought event in the 1980s when the adaptation strategy implemented a non-traditional water source for usage in electrical production because the traditional source of water was not sufficient.



While past events assist with determining what possible impacts will occur in the industries, developing adaptation actions based on historic climatic and hydrologic averages does not necessarily equate to what will occur in the future. This is due to the climates' uncertainty and variability as well as the industries requirement for long-term assets and planning. It is therefore important to examine future climate and projected extremes. In the Souris River watershed, on average, the region will be warmer for all seasons with more precipitation. In terms of projected extremes, the number of hot days, those with temperatures greater than 30°C, will increase. On the precipitation side, the number of 1, 3 and 7-day precipitation extremes will also increase. It should be noted that climate change models and value-added data keep evolving and it is imperative that the most up-to-date information is utilized, when possible.

In general, the oil and gas industry believe they are fairly well situated to adapt to the changing climate with some modifications to their future development such as developing future oil rigs above the flood prone region. The provincial electrical power industry also in general believes it is able to deal with future climatic issues at the power plants. The main source of concern is the infrastructure to supply power to the costumers after the power has been generated.

This document is a brief summary of two research reports:

Wittrock, V. 2016. Risks to the Energy Sector from Historic Extreme Climate Events: Case Study of the Souris River Watershed, Canada. Prepared for Environmental Systems Assessment Canada Ltd as part of the Natural Resources Canada Adaptation Platform Energy Working Group. Saskatchewan Research Council (SRC), Saskatoon SK. SRC Publication # 13757-2E16.

Wittrock, V. 2016. Climatic Extremes and the Energy Sector's Vulnerability: Now and in the Future - Focus on the Canadian Portion of the Souris River Watershed: A Literature Review. Prepared for Environmental Systems Assessment Canada Ltd as part of the Natural Resources Canada Adaptation Platform Energy Working Group. Saskatchewan Research Council (SRC), Saskatoon SK. SRC Publication # 13757-1E16.

V. Wittrock
Saskatchewan Research Council
SRC Publication No. 13757-3E16
January 2016