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FIFTY-SEVENTH ANNUAL REPORT

TO THE

International Joint Commission

COVERING

Calendar Year 2015

International Souris River Board

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INTERNATIONAL SOURIS
RIVER BOARD

CONSEIL INTERNATIONALE
DE LA RIVIERE SOURIS

October 2016

The International Joint Commission
Ottawa, Ontario and Washington, D.C.

Commissioners:

In accordance with the Directive of January 22, 2007 (replaces Directives of April 11, 2002 and May 31, 1959), we have enclosed the Fifty-Seventh Annual Report covering calendar year 2015.

Respectively submitted,

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For the 2015 calendar year, the natural flow of the Souris River at the Sherwood Crossing was 213 777 cubic decametres (173,309 acre-feet), which represents 132 percent of the 1959-2015 long-term mean. North Dakota received 226 895 cubic decametres (183,944 acre-feet) or 106 percent of the natural flow.

Recorded runoff for the Souris River near Sherwood, North Dakota, was 224 781cubic decametres (182,230 acre-feet), or about 163 percent of the 1931-2015 long-term mean.

Net depletions in Canada were 13 118 cubic decametres (10,635 acre-feet).

The apportionment between Canada and the United States was discussed at the February 26, 2015 meeting of the International Souris River Board. The Board reviewed the spring 2015 runoff forecast hydrologic conditions and declared 2015 to be a non-flood year (less than 1:10 event).

The August 31, 2015 Determination of Natural Flow showed a surplus of 116 965 cubic decametres (94,824 acre-feet) to the United States. Calculations made after the end of the year indicated that Saskatchewan was in surplus to the United States by 141 385 cubic decametres (114,621 acre-feet). The natural flow at Sherwood exceeded 50 000 cubic decametres (40,535 acre-feet), resulting in a 60/40 sharing of the natural flow at the Sherwood Crossing.

The flow of the Souris River as it enters North Dakota at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) for the entire year. Accordingly, Canada complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 25 928 cubic decametres (21,020 acre-feet), or 82 percent of the 1959-2015 long-term mean. Recommendation No. 2 of the Interim Measures was met with a net gain in the North Dakota portion of the Long Creek basin of 4 227 cubic decametres (3,427 acre-feet).

Recorded runoff leaving the United States at Westhope during the period of June 1 through October 31, 2015, was 309 840 cubic decametres (251,167 acre-feet). The flow was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement for the June 1 to October 31 period as specified in Recommendation No. 3(a) of the Interim Measures.

The water quality of the Souris River in calendar year 2015 was generally consistent with historical data. Phosphorus levels above the water quality objective have been a concern since the 1990s and continue to be a concern in 2015. Low dissolved oxygen levels, of great concern in the past, were at or above the water quality objective of 5.0 milligrams per liter for most of the year at both boundary stations. What is noted in 2015 is that there were increases in the total number of exceedences for several parameters. Both stations had exceedences of the water quality objectives for phosphorus, sodium, sulfate, total dissolved solids, pH and iron. At the Saskatchewan/North Dakota boundary, exceedences were also observed for molybdenum, while at the Manitoba/North Dakota boundary, one exceedance for dissolved oxygen was also observed.

1.0 INTERNATIONAL SOURIS RIVER BOARD

1.1 SOURIS RIVER REFERENCE (1940)

The following excerpt describes the history of the water-apportionment program that the International Souris River Board currently maintains.

In a letter on behalf of the Government of Canada dated 20 March 1959 and a letter on behalf of the Government of the United States of America dated 3 April 1959, the International Joint Commission was informed that the Interim Measures recommended in its report of 19 March 1958, in substitution for those recommended in the report dated 2 October 1940 in response to the Souris River Reference (1940), had been accepted by both Governments.

The Governments of the United States and Canada entered into an Agreement for Water Supply and Flood Control in the Souris River Basin on October 26, 1989. Pursuant to this Agreement, the Interim Measures related to the sharing of the annual flow of the Souris River from Saskatchewan into North Dakota contained in paragraph 22(1) of the Commission's 1958 Report to the Governments were modified. In light of the modifications in 1989 and pursuant to a February 28, 1992, request from the Governments of the United States and Canada, the Commission, on April 23, 1992, directed the International Souris River Board of Control to begin applying the "Interim Measures as Modified in 1992." The measures were further modified by the Governments in December 2000. The "Interim Measures as Modified in 2000" are shown in Appendix C of this report.

1.2 INTERIM MEASURES AS MODIFIED IN 2000

In December 2000, the International Joint Commission directed the Board to implement the "Interim Measures as Modified in 2000" for the 2001 calendar year and each year thereafter. The 2000 Interim Measures, shown in Appendix C, were developed to provide greater clarification of the conditions that must prevail for the determination of the sharing of natural flow between Saskatchewan and North Dakota at the Sherwood Crossing.

In general, the Interim Measures provide that Saskatchewan shall have the right to divert, store, and use waters that originate in the Saskatchewan portion of the Souris River basin, provided that the annual runoff of the river into North Dakota is not thereby reduced to less than half of the runoff that would have occurred in a state of nature; that North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the basin together with the waters that cross the boundary from Saskatchewan; and that Manitoba shall have the right to use the waters that originate in the Manitoba portion of the basin and, in addition, that North Dakota must provide to Manitoba, except during periods of severe drought, a regulated flow of at least 0.566 cubic metres per second (20 cubic feet per second) during the months of June through October.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall as far as practicable regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metres per second (4 cubic feet per second) when that level of flow would have occurred under the conditions of water-use development prevailing in the Saskatchewan portion of the drainage basin prior to the construction of Boundary Dam, Rafferty Dam, and Alameda Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when those conditions occur, the minimum flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control.

Except in flood years, flow releases to the United States should occur in the pattern that would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the International Souris River Board that the release would not be of benefit to the State at that time.

The State of North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing, provided that any diversion, use, or storage of Long Creek water shall not diminish the annual runoff at the Eastern Crossing of Long Creek into Saskatchewan below the annual runoff of Long Creek at the Western Crossing into North Dakota.

In periods of severe drought, when it becomes impracticable for North Dakota to deliver the regulated flow of 0.566 cubic metres per second (20 cubic feet per second), North Dakota's responsibility to Manitoba will be limited to providing such flows as the Board determines to be practicable and in accordance with the objective of making water available for human and livestock consumption as well as for household use.

1.3 BOARD OF CONTROL

In May 1959, the International Joint Commission officially approved and signed a directive that created the International Souris River Board of Control. The directive charged the Board with the responsibility of ensuring compliance with the Interim Measures as set out in 1958 and of submitting such reports as the Commission may require or as the Board at its discretion may desire to file.

1.4 AMALGAMATION OF THE INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD AND INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

In 2000, the International Joint Commission directed the International Souris-Red Rivers Engineering Board to transfer its responsibilities that related to the Souris River to the International Souris River Board of Control. The Commission also changed the International Souris River Board of Control's name to the International Souris River Board.

1.5 AMALGAMATION OF THE INTERNATIONAL SOURIS RIVER BOARD AND SOURIS RIVER BI-LATERAL WATER QUALITY MONITORING GROUP

.By letter dated January 22, 2007, the International Souris River Board was officially notified by the Commission that the new directive dated January 18, 2007, replaced the previous directive dated April 11, 2002. The new directive sets out the duties of the Board as it moves toward a watershed approach in the Souris River basin and combined the duties of the International Souris River Board and Souris River Bi-Lateral Water Quality Monitoring Group. It also increased the membership of the Board to twelve members.

The Board's duties were revised to include the following:

- Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.
- Oversee the implementation of compliance with the Interim Measures as Modified for Apportionment of the Souris River as described in Appendix A of the Directive.
- Assist the Commission in the review of a Joint Water Quality Monitoring Program.
- Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.
- Report on aquatic ecosystem health issues in the watershed and regularly inform the Commission on the state and implications of aquatic ecosystem health.
- Carry out such other studies or activities as the Commission may, from time to time, request.
- Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year.
- The Board shall submit an annual report covering all of its activities at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive.
- The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year. The Board has agreed to hold the public meeting in the spring/summer and to advertise it.

In 2007 three committees were established to assist the Board administer the requirements of its enhanced mandate. The Natural Flow Methods Committee was renamed as the Hydrology Committee and charged with investigating procedures and questions on the approach and methods used to determine the natural flow of the Souris River basin. The Flow Forecasting Liaison Committee has the responsibility to ensure information sharing and coordination between the forecasting agencies in the basin. The Aquatic Ecosystem Health Committee has the responsibility to identify water quality and aquatic health concerns in the basin and to report on the adequacy of the aquatic quality monitoring program. Membership on these committees includes all affected agencies in the basin.

1.6 BOARD MEMBERS

At the end of 2015, the members of the International Souris River Board were as follow:

Russell Boals Retired (Co-Chair) Regina, Saskatchewan	Member for Canada
John Fahlman Saskatchewan Water Security Agency Moose Jaw, Saskatchewan	Member for Canada
Nicole Armstrong Manitoba Conservation & Water Stewardship Winnipeg, Manitoba	Member for Canada
Mark Lee Manitoba Conservation & Water Stewardship Regina, Saskatchewan	Member for Canada
John-Mark Davies Saskatchewan Water Security Agency Regina, Saskatchewan	Member for Canada
Jeff Woodward Environment Canada Winnipeg, Manitoba	Member for Canada
Todd Sando North Dakota State Engineer (Co-Chair) Bismarck, North Dakota	Member for the United States
Colonel Daniel Koprowski U.S. Army Corps of Engineers St. Paul, Minnesota	Member for the United States
Gregg Wiche U.S. Geological Survey Bismarck, North Dakota	Member for the United States
Megan Estep U.S. Fish and Wildlife Service Denver, Colorado	Member for the United States
Scott Gangl North Dakota Game and Fish Department Bismarck, North Dakota	Member for the United States
Dave Glatt North Dakota Department of Health Bismarck, North Dakota	Member for the United States

2.0 2015 ACTIVITIES OF THE BOARD

Since the presentation of the Fifty - Sixth Annual Report to the International Joint Commission, the International Souris River Board has held two meetings and has conducted two teleconference calls. The discussions and decisions made are summarized in the following sections.

2.1 FEBRUARY 26, 2015, MEETING - WINNIPEG, MANITOBA

Members in attendance were:

Russell Boals
Member for Canada

John Fahlman via conference call
Member for Canada

Nicole Armstrong
Member for Canada

Mark Lee
Member for Canada

Jeff Woodward
Member for Canada

John-Mark Davies
Member for Canada

Todd Sando
Member for the United States

Megan Estep
Member for the United States

Gregg Wiche via conference call
Member for the United States

Colonel Daniel Koprowski
Member for the United States

Dave Glatt
Member for the United States

Scott Gangl via conference call
Member for the United States

The Determination of Natural Flow of the Souris River at Sherwood for the period of January 1 through December 31, 2014, was presented at the February 26, 2015, meeting. Recorded flow at Sherwood was 283,455 cubic decametres (229,797 acre-feet). The final apportionment balance for the 2014 calendar year showed that Saskatchewan was in surplus to North Dakota by 173 996 cubic decametres (141,059 acre-feet). As in previous years the summary of the natural flow computations showed that there were continuous high deliveries to the United States since 2009.

The Saskatchewan Water Security Agency reported that fall 2014 precipitation in the Saskatchewan portion of the Souris Basin varied from near average in the western portion of the basin to below average in the eastern portion. However, the eastern portion, which includes the Moose Mountain Creek Basin, received extremely high precipitation in the summer. At the beginning of November cropland topsoil moisture was considered to be adequate throughout the basin with a number of relatively small areas on the east side described as being in surplus conditions. In general, subsoil conditions are expected to be near full across the basin. According to point snowfall data within the basin, the cumulative winter precipitation to date was generally slightly below average across the Saskatchewan portion of the Souris River Basin. The snow water equivalent in the existing snowpack, estimated via satellite, showed above normal; however, it was thought to be overestimated. The National Weather Service model showed near average conditions. The Saskatchewan Water Security Agency field staff observed generally below average snowpack across the basin due to several periods with melting temperatures during January and February 2015.

Boundary Reservoir was at an elevation of 560.18 metres (1,837.8 feet) on February 12, 2015, slightly above its required February 1, 2015 pre-runoff drawdown elevation of 560.0 metres (1,837.4 feet).

Rafferty Reservoir was at an elevation of 549.4 metres (1,802.8 feet) on February 12, 2015. The required February 1, 2015, drawdown for elevation as specified by the 1989 Agreement is 549.5 metres (1802.8 feet). Near median runoff was projected at this time.

Alameda Reservoir was at an elevation of 561.0 metres (1,840.50 feet) on February 12, 2015. The maximum elevation for February 1, 2015 as specified by the 1989 Canada-United States Agreement is 561.0 metres (1,840.53 feet).

The Saskatchewan Water Security Agency spring runoff forecast as of February 1, 2015, assumed average precipitation for February, March, and April and a normal melt. No additional pre-runoff flood drawdowns, beyond normal drawdowns, were required.

Based on the projected runoff volumes, the apportionment split was determined to be 60/40 according to Annex B of the 1989 International Agreement.

The United States Geological Survey reported the total volume of flow past the Long Creek at Noonan gage through December 31, 2014 calendar year was 38 358 cubic decametres (31,097 acre-feet). The volume is about 200 percent greater than the median flow for the past 54 years. The peak discharge for the reporting period January 1 to December 31, 2014 was 8.2 cubic metres per second (289 cubic feet per second), which ranks 39 in 55 years of record.

The total volume of flow recorded at the Souris River near Sherwood gage through December 31, 2014 calendar year was (283 455 cubic decametres) (229,797 acre-feet). This year's total flow is 480 percent greater than the median flow for the past 83 years. The United States Geological Survey also reported that the peak discharge at Sherwood was 36 cubic metres per second (1,270 cubic feet per second) for the reporting period January 1 to December 31, 2014.

The total volume of flow at Westhope for 2014 was 1 047 329 cubic decametres (849,069 acre-feet). The flow at Westhope was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures. The minimum flow for the period was 0.88 cubic metres per second (31 cubic feet per second), which occurred on March 7, 2014. The peak flow at Westhope was 116 cubic metres per second (4,110 cubic feet per second) on July 6, which ranks 11 in 84 years of record.

The United States Fish and Wildlife Service presented a summary of refuge operations and flows for 2014. The total provisional inflow measured at Sherwood for the first five months of the year was 101 469 cubic decametres (82,261 acre-feet). This was 98 percent of the historic January-May inflow, which was 103 022 cubic decametres (83, 520 acre-feet) for the period 1938 through 2014. The total Upper Souris Refuge pool volume increased an estimated 3 491 cubic decametres (2,830 acre-feet) during the first five months. The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2014 was 101 084 cubic decametres (81,949 acre-feet). This outflow was 116 percent of the historic record for the January-May outflow, which was 87 509 cubic decametres (70,944 acre-feet) for the period 1938-2014. Lake Darling elevation increased 0.08 metres (0.25 feet) from 486.49 metres (1596.09 feet) on January 1 to 486.56 metres (1596.34 feet) on May 31, 2014. Lake Darling was at 486.76 metres (1596.97 feet) on June 1, 2014.

Total yearly flow at Sherwood was 281 333 cubic decametres (228,077 acre-feet). This was 192 percent of the historic average annual inflow (based on calendar year), which is 146 209 cubic decametres (118,532 acre-feet) for the period of record from 1938-2014. Total yearly outflow measured at the Souris River near Foxholm on the south end of the Refuge was 256 354 cubic decametres (207,826) acre-feet for the period 1938-2014. Total outflow was 34 880 cubic decametres (28,277 acre-feet) more than total measured inflow. On December 31, 2014, Lake Darling was at an elevation of 486.56 metres (1596.31 feet).

With regards to the J. Clark Salyer National Wildlife Refuge, the total flow measured from the Souris River to the Refuge from January 1 through May 31 was 202 361 cubic decametres (164,054 acre-feet). This was 154 percent of the historic January –May inflow, which was 131 663 cubic decametres 106,739 acre-feet) for the period of 1938-2014. Pool volume on May 31 was 78,342 cubic decametres (63,512 acre-feet). This was 35 977 cubic decametres (29,167 acre-feet) above the January 1 volume. Approximately, 308 405 cubic decametres (250,024 acre-feet) was passed to Manitoba during the five-month period.

Total outflow measured at Westhope for 2014 was 965 845 cubic decametres (783,012 acre-feet). Total outflow was 426 829 cubic decametres (346,013 acre-feet) more than inflow on the Souris River at Bantry. Outflow during the June 1 to October 31 period was (19 661 cubic decametres (15,939 acre-feet) or 12 175 cubic decametres (9 870 acre-feet), which was above the 7 486 cubic decametres (6,069 acre-feet) required minimum. The flow at the Westhope gage never fell below the minimum 0.57 cubic metres per second (20 cubic feet per second) threshold during this time period. The lowest recorded daily mean flow during the June 1 to October 31 period was 15 cubic metres per second (529.7 cubic feet per second) and occurred on October 18, 2014.

Manitoba reported that precipitation in 2014 was above normal in their portion of the basin. Extreme rainfall in early July caused local tributaries to have record peak flows much higher than any previously recorded flow. Peak flows on many tributaries were 150 to 200-year events and double the previous floods of record causing overland flooding at numerous locations. The Souris River at Wawanesa remained much above normal during the summer with record high flows extending into the fall. Winter Souris River flows were at record levels in the early winter period and remained at the 90 percentile.

The Antecedent Precipitation Index for the Manitoba portion of the Souris River Basin was normal to above normal. The Antecedent Precipitation Index is a comparison of current precipitation from May to freeze-up to the historical record. Total precipitation from November 1 to February 20 was below normal for the Manitoba portion of the basin. The Manitoba Infrastructure and Transportation's Hydrologic Forecasting Centre reported that runoff potential for the Manitoba portion of the basin was below normal to normal as of February 2015.

The National Weather Service's probabilistic forecast at the North Dakota-Manitoba border (Westhope, ND) was close to the historical average at the 50 percent exceedance probability with lower than normal chances for minor to major flooding. Due to high base flows and adequate storage volumes going into freeze-up, the concern for water supply in the Manitoba portion of the basin was low.

Based on the foregoing agency reports, the Board declared Spring 2015 to be a non-flood event with normal to below normal runoff (less than 1:10 year event).

The North Dakota State Water Commission stated there were seventy-four temporary surface water permits and two temporary groundwater permits issued in 2014. The surface water allocation was 8 665 cubic decametres (7,025.3 acre-feet). The groundwater allocation was 130 cubic decametres (105.4 acre-feet) for a total of 8 795 cubic decametres (7,130 acre-feet). No conditional surface water permits were issued in 2014. Most of the water is used in oil production.

Environment Canada reported that the 2014 natural flow in general, was less than the 2013 natural flow. The total diversion in the Souris River basin was 6,034 cubic decametres (4,892 acre-feet). Recorded flow at Sherwood was 283,455 cubic decametres (229,797 acre-feet). The natural flow computed at Sherwood was 278,835 cubic decametres (226,052 acre-feet). According to the computations, the United States 40 percent share was 111,530 cubic decametres (90,417 acre-feet). The flow received by the United States was 285,526 cubic decametres which constitutes a surplus delivery of 173,996 cubic decametres (141,059 acre-feet). The annual flow requirement / apportionment at Long Creek was also met with a surplus of 17,167 cubic decametres (13,917 acre-feet).

The International Souris River Board accepted the Natural Flow Computation to December 31, 2014.

The Flow Forecasting Liaison Committee distributed a chart that indicated current members of the Committee and requested some guidance from the Board about the membership list and who to inform during flood events.

The Aquatic Ecosystem Health Committee provided an update on its activities and a summary of the 2014 water quality monitoring program. The E. coli numeric water quality objective support document was under review and was to be sent to prospective agencies for comments before being submitted to the International Souris River Board for approval.

The International Joint Commission provided the Aquatic Ecosystem Health Committee the template for an International Watershed Initiative grant proposal, which would consider updates to the current water quality objectives. The Aquatic Ecosystem Health Committee plans to conduct a literature review evaluating the need to update the existing Water Quality Objectives. During the June 25, 2014, International Souris Board meeting, it was suggested that such a review may be beneficial to other Boards.

The Aquatic Ecosystem Health Committee presented a summary of the water quality monitoring program for the Souris River at Sherwood conducted in 2014. The United States Geological Survey collected a total of eight water quality samples from Souris River in 2014 (January, twice in April, May, June, July, August, and October) at the Sherwood site.

Total Phosphorus exceeded the Water Quality Objective of 0.10 mg/L for 8 of the 8 samples (100 percent) collected in 2014, though the median value (0.25 mg/L) is down from 2012 (0.34 mg/L) and 2013(0.26 mg/L). The Total Phosphorus values ranged from 0.18 mg/L on January 23 to 0.35 mg/L on April 28.

Sodium exceeded the Water Quality Objective of 100 mg/L for 3 of the 8 samples (37.5 percent) in 2014. This was down from an 83 percent exceedance in 2012 and 50 percent exceedance in 2013. The results ranged from 61.7 mg/L on January 23 to 138 mg/L on May 29.

Total Iron exceeded the Water Quality Objective of 300 μg/L in all 8 samples again in 2014, with only two values measuring below 1000 μg/L (January 23 and August 19). The maximum value was 3230 μg/L on April 28 with the median value for 2014 being 1170 μg/L.

Sulfate met the Water Quality Objective of 450 mg/L on all occasions in 2014. The minimum sulfate value was recorded January 23 with a value of 143 and a maximum value recorded on May 29 with a value of 426. There has only been one exceedance of the sulfate standard in the last six years, and the values remain fairly consistent in the 300's throughout the year.

Total Dissolved Solids, pH, Chloride, and Total Boron met their Water Quality Objectives in all samples collected in 2014.

Dissolved Oxygen concentrations again remained well above the 5 mg/L Water Quality Objective in 2014. Concentrations ranged from 7.7 mg/L on January 23 to 12.9 mg/L on April 16.

Pesticide samples at the Sherwood site were collected as a part of an intensive statewide study conducted by the ND Department of Agriculture. Samples were collected, one per month at Sherwood, in April, May, June, July, August, and October.

95 pesticides were tested for and none were above the Water Quality Objectives, or for those not part of routine testing, none were above either aquatic life benchmarks or human health limits.

Of the pesticides Water Quality Objectives are established for, 2, 4-D and Atrazine had positive, though very low, results.

Only three parameters, total phosphorus, sodium, and iron were above water quality objectives in 2014. Most of the median values were lower than last year except for chloride, which had increased slightly.

The Aquatic Ecosystem Health Committee briefed the Board on the Pesticide Study conducted by the North Dakota Department of Agriculture. Along with the Sherwood site, the ND Department of Agriculture also sampled two other sites along the Souris River; one above Minot and one downstream of Velva. Both the number of detections and number of different pesticides detected increased as you went downstream. All detections were well below the aquatic life benchmark, which has a numeric value well below human health standards; it is worth paying attention to this information as cumulative effects are as yet unknown.

Environment Canada presented a summary of the water quality monitoring program for the Souris River at Westhope for 2014. Environment Canada collected a total of six samples at Westhope (triplicate in February, April, May, June, August, and December) and one joint sample with the United States Geological Survey at Sherwood (triplicate in August).

Total Phosphorus exceeded the Water Quality Objective of 0.10 mg/L for all samples with data currently available in 2014. The Total Phosphorus values ranged from 0.107 mg/L on May 20 to 0.34 mg/L on August 19 at Westhope.

Sodium exceeded the Water Quality Objective of 100 mg/L for 4 of 5 samples in 2014. The results ranged from 44.6 mg/L on June 10 to 159 mg/L on Feb 11.

Sulphate exceeded the Water Quality Objective of 450 mg/L on one occasion in 2014, with a value of 463 mg/L on Feb 11. In 2013, sulphate also had one exceedance with a value of 694 mg/L in January 2013. In 2012, sulphate exceeded the objective 70 percent of the time, with a maximum of 838 mg/L in December 2012. No exceedances were observed in 2011 and only one was observed in 2010.

Total Dissolved Solids exceeded the Water Quality Objective of 1000 mg/L on February 11, 2014 with a value of 1140 mg/L. The minimum value was 730mg/L on May 20, 2014.

Total Iron exceeded the Water Quality Objective of 300 μg/L once in 2014, with a value of 373 μg/L on Feb 11. Last year Total Iron exceeded the objective once, with a value of 682 in April 2013.

pH exceeded the Water Quality Objective of 8.5 pH units once in 2014 with a recorded value of 8.58 on June 10.

Dissolved Oxygen concentrations remained at or above the 5 mg/L Water Quality Objective in 2014, similar to 2013. Concentrations ranged from 7.03 mg/L to 13.09 mg/L in 2014.

Fecal coliform did not exceed the Water Quality Objective of 200 colonies/100 mL in 2014. In 2013, there was one exceedance with a value of 300 colonies/100 mL, which was the first exceedance since 2010.

E-coli exceeded the Water Quality Objective of 200 colonies/100 mL once in 2014, with a value of 2800 colonies/100 mL on June 10.

Chloride did not exceed the Water Quality Objective of 100 mg/L in 2014.

Total Boron did not exceed the Water Quality Objective of 0.50 mg/L in 2014.

As in previous years, pesticide samples were collected on the Souris River between April and August.

Similar to 2013, there were detections of 2, 4-D, Dicamba, MPCA, and Picloram. All results were below the respective Water Quality Objectives.

Indicates incomplete data – lab results pending.

General Observations:

A detailed summary of the 2014 results was not yet available because some lab results are still pending. In general, water quality for 2014 was similar to 2013 in terms of measured concentrations and guideline exceedances. In 2013 there was a Total Phosphorus value below the guideline, which was the first time since 1999 that this has occurred.
The flow at Westhope appeared to be higher than normal (median of 84 years) for most of 2014. In the past four years, it appears 2012 had significantly less flow than 2011, 2013, and 2014.

The International Souris River Board asked about the frequent water quality objectives exceedances that have been reported in the past and what these exceedances mean to them and/or what can be done about them? The Aquatic Ecosystem Health Committee responded the International Souris River Board should look at the appropriateness of the existing water quality objectives.

The United States Army Corps of Engineers gave a brief report on the activities of the 1989 Agreement Core Committee. Currently, the 1989 Agreement Core Committee is looking at the language of both Annex A and Annex B dealing with flood and non-flood aspects of the 1989 Agreement. The United States Army Corps of Engineers also provided a handout with an update that included minutes of the Core Committee. The United States Army Corps of Engineers mentioned the 1989 Agreement Core Committee plans to meet March 24-25, 2015 in Regina.

The Saskatchewan Water Security Agency was continuing its work on the Canadian Reservoirs Operations Manual.

The City of Minot reported that it was increasing the capacity of its water treatment plant from 18 to 27 million gallons per day. The city was also working on a flood mitigation project including flood wall and levy expansion, with support from Federal Emergency Management Agency.

There was a general discussion on the new Assiniboine River Basin Initiative which was established in 2014, following the Red River Basin Commission model. The Assiniboine River Basin Initiative is a grassroots organization similar to the Red River Basin Commission.

The International Joint Commission reported on its initiatives and noted that water quality objectives in use required review.

The Minot City Manager made a presentation on the National Disaster Resiliency Competition. The National Disaster Resiliency Competition is a billion-dollar national competition for disaster recovery funds that seeks new and innovative ideas to address the threats communities face as well as opportunities. Minot was one of the six cities that submitted applications under the NDRC. Phase I of the Proposal and Vision include:

- Flood protection and river management,
- Safe, affordable housing,
- Resilient transportation and infrastructure,
- Economic development, and
- Strategies to support vulnerable populations.

The United States Army Corps of Engineers led the discussion of a proposed joint meeting of the International Red River Board/International Souris River Board/International Rainy-Lake of the Woods Watershed Board. As a part of the International Watershed Initiative and the new International Joint Commission Strategic Planning, boards are encouraged to work together to address their common issues such as water quality, nutrients, aquatic invasive species, floods, and droughts.

Ducks Unlimited gave a presentation on their work in the Souris River Basin, which was focusing on estimating the effects of wetland distribution and loss on water quality and quantity in a large prairie watershed. The goal of the project is to determine the role of wetlands in mitigating nutrient export in a large hyper-eutrophic prairie watershed and to generate the necessary information to develop a methodology for targeting wetland restoration and conservation efforts in the Prairie Pothole Region. Ducks Unlimited concluded that wetland drainage has a strong impact on streamflow in flood conditions. According to their study, wetland drainage from 1958-2008 increased the 2011 flood peak by 32 percent and the 2011 yearly streamflow volume by 29 percent.

Environment Canada gave an update on Designation of Gauging Stations in International Basins. Water Survey of Canada emphasized the need to update the station list to ensure designated stations meet protocol definitions. As well, the procedures established in 1985 Procedural Guide for International Gauging Stations, and the Protocol on International Gauging Stations for Flow established in 2010 need clarification.

2.2 JUNE 19, 2015 MEETING - ESTEVAN, SASKATCHEWAN

Members in attendance were:

Russell Boals
Member for Canada

John Fahlman
Member for Canada

Mark Lee
Member for Canada

Nicole Armstrong
Member for Canada

Jeff Woodward
Member for Canada

John-Mark Davies
Member for Canada

Todd Sando
Member for the United States

Megan Estep
Member for the United States

Gregg Wiche
Member for the United States

Megan Estep
Member for the United States

Scott Gangl via conference call
Member for the United States

Environment Canada, presented the results of the natural flow computations to May 31, 2015. The total diversion in the Souris River basin was 78 675 cubic decametres (63,782 acre-feet). Recorded flow at Sherwood was 178 796 cubic decametres (144,950 acre-feet). The natural flow computed at Sherwood was 202 173 cubic decametres (163,902 acre-feet). According to the computations, the United States share at 40 percent was 80 870 cubic decametres (65,561 acre-feet). The flow received by the US was 180 219 cubic decametres (146,104 acre-feet) and constituted a surplus delivery of 99 349 cubic decametres (80,542 acre-feet). The annual flow requirement for Long Creek was also met with a surplus of 1 388 cubic decametres (1,125 acre-feet). The flow was determined to be a 1:5 event this year.

The Hydrology Committee reported that their focus was to complete the Draft Procedures Manual for Canada and the United States..

The United States Geological Survey reported that no changes were made to the current water quantity monitoring program in the United States or Canada. They made a presentation on the Sherwood Gauge showing the effects of erosion and its impact on the station and the damages resulting from the 2011 historic flood event in the basin. The repair options presented included :

- Rip-rapping cost $130,00 (materials alone),

- Soft armouring 500 feet of channel work,

- Move the gauge 2 miles further downstream for a better control, or

- Do-nothing (will continue to erode).

Environment Canada noted that moving the station downstream would be disadvantageous because it would disrupt the period of record spanning 85 years.

The Saskatchewan Water Security Agency reported that the fall precipitation in Saskatchewan varied from near average in the western portion of the basin to below average in the east. Point snowfall data indicated cumulative winter precipitation was near average across the Saskatchewan portion of the Souris River basin. The snow water equivalent (SWE) in the exiting snowpack, estimated via satellite, showed near average conditions.

Near median runoff was projected for the 2015 spring runoff forecast, based on conditions as of March 1, 2015. The projection assumes average precipitation for March and April, and a normal rate of melt.

Forecasted volumes at the Sherwood Crossing did not exceed a 1:10 year event (216 110 cubic decametres (175,200 acre-feet) unregulated, 37 000 cubic decametres (30,000 acre-feet) local, and as a result non-flood operations were in effect. Rafferty and Alameda reservoirs were drawn down approximately one metre below Full Supply Level prior to spring runoff pursuant to non-flood operations. No additional pre-runoff drawdown, beyond the normal February 1 target elevations, were expected.

Based on the projected runoff volumes, the apportionment split was projected to be 60/40 according to Annex B of the 1989 International Agreement and the maximum target flow at Sherwood was 40 cubic metres per second (1,413 cubic feet per second).

The Saskatchewan Water Security Agency reported that there was a significant warmup in January, which decreased the snowpack and produced some runoff in the western portion of the basin.

The 2015 spring runoff commenced on March 7, approximately 1 month ahead of the median. Early March saw a warm-up in the basin and above normal temperature persisted. The result was a relatively quick, sustained melt and high basin yield. Boundary, Rafferty, and Alameda absorbed the peak runoff flows and any water above FSL was discharged according to the unregulated recession. Peak flows at Sherwood were reduced from 150 cubic metres per second (5,297 cubic feet per second) in the unregulated state to approximately 50 cubic metres per second (1,766 cubic feet per second) actual, with the duration of flows at or above 50 cubic metres per second (1,766 cubic feet per second) for regulated and unregulated cases approximately equal at about 20 days. Spring runoff was a pass inflow operation for the reservoirs. With the basin drying and unless significant rain events occurred above the reservoirs, late Spring operations would move to a water conservation approach. Rafferty and Boundary outflows were reported as being near zero, while outflows from Alameda reservoir were being reduced to a minimal outflow.

The United States Geological Survey provided a summary of the 2015 flow conditions for the United States portion of the Souris Basin. The total volume of flow passing the Long Creek at Noonan gage through May 31, 2015 calendar year was 24,265 cubic decametres (19, 672 acre-feet). This volume was about 131 percent greater than the median flow for the past 56 years. Flows were in the near normal to above normal range. The peak discharge for the period January 1 to May 31, 2015 was 31.2 cubic metres per second (1,100 cubic feet per second), which ranks 22 in 56 years of record.

The United States Geological Survey reported that the total volume of flow passing the Souris River near Sherwood gage through May 31, 2015 calendar year was 178 796 cubic decametres (144,950 acre-feet). This calendar year's total flow was approximately 302 percent greater than the median flow for the past 85 years. Flows, based on the past 85 years of data were in the normal to much above normal range. The peak discharge for the period January 1 to May 31 was 53 cubic metres per second (1,870 cubic feet per second)

Flows recorded at the Souris River near Westhope gage, exceeded the long-term mean for most of the period. The minimum discharge for the period January 1 to May 31 was 0.25 cubic metres per second (9 cubic feet per second) from February 15-18. The peak discharge for the period January 1 to May 31 was 60 cubic metres per second (2,119 cubic feet per second) on April 9 and ranks 29 out of 86 years of record.

Manitoba Conservation and Water Stewardship reported the Antecedent Precipitation Index for the Manitoba portion of the basin was normal to above normal. Antecedent Precipitation Index API is a comparison of precipitation from freeze-up to the historical record. Winter precipitation was below normal for the Manitoba portion of the basin. Souris River flows were at record levels in the early winter period and remained above the 90 percentile until February.

The 2015 spring runoff began in early to mid-March, slightly earlier than usual. The Souris River peaked at Wawanesa at 127.4 cubic metres per second (4,499 cubic feet per second) on March 30. This corresponds to a 1:4 year flood event. Manitoba tributaries began rising in mid-March. The melt was interrupted by a cool period and then resumed when temperatures rose near the end of March. This resulted in two spring peaks, the first in mid-March and the second in early April. The peaks were similar in magnitude and had return periods in the range of 2-year and 5-year events.

Manitoba Conservation and Water Stewardship noted that the flow at Wawanesa was above normal since the spring freshet. Typical flow for mid-June is 11.3 to 14.2 cubic metres per second (400 to 500 cubic feet per second) and the flow at Wawanesa was approximately 96.3 cubic metres per second (3,400 cubic feet per second). Throughout the early summer of 2015, precipitation events have generated temporary rises in the Manitoba tributaries. The resulting flow was similar to, or below, the spring peaks. Overall, precipitation was above normal in the Manitoba portion of the basin. Dugouts in the area are either close to or over capacity. With high base flows and adequate storage volumes going into summer, concern for water supply in the Manitoba portion of the basin was low.

The United States Fish and Wildlife presented a summary of refuge operations and flows for the period January 1 to May 31, 2015. The United States Fish and Wildlife Service operates three national wildlife refuges within the United States portion of the Souris River Basin which include:

- Upper Souris National Wildlife Refuge near Foxholm, North Dakota, upstream of the City of Minot,

- J. Clark Salyer National Wildlife Refuge located near Upham, North Dakota, downstream of the City of Towner, and

- Des Lacs National Wildlife Refuge on the Des Lacs River (a tributary of the Souris River) near Kenmare, North Dakota.

The total provisional inflow measured at Sherwood for the first five months of the year was 177 900 cubic decametres (144,224 acre-feet). This inflow was 171 percent of the historic January-May inflow, which was 103 964 cubic decametres (84,284 acre-feet) for the period from 1938 through 2015. The total Upper Souris Refuge pool volume decreased an estimated 650 cubic decametres (527 acre-feet) during the first five months.

The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2015 was 171 157 cubic decametres (139,088 acre-feet). This outflow was 194 percent of the historic record for the January-May outflow, which was 88 579 cubic decametres (71,811 acre-feet) for the period 1938 to 2015. Lake Darling elevation increased 0.23 metres (0.74 feet) from 486.55 metres (1596.28 feet) on January 1 to 486.70 metres (1596.79 feet) on May 31, 2015. Lake Darling was at 486.77 metres (1597.02 feet) on May 31, 2015.

The total provisional flow measured from the Souris River to the J. Clark Salyer Refuge from January 1 through May 31 was 251 583 cubic decametres (203,959 acre-feet). This was 189 percent of the historic January-May inflow, which was 133 185 cubic decametres (107,973 acre-feet) for the period 1938-2015. Pool volume on May 31 was 45 822 cubic decametres (37,148 acre-feet). This was 20 231 cubic decametres (16,401 acre-feet) above the January 1 volume. Approximately 249 891 cubic decametres (202,587 acre-feet) was passed to Manitoba during the five-month period.

On January 1, 2015 Lake Darling was at 486.55 metres (1596.28 feet) with 124 622 cubic decametres (101,031 acre-feet) of storage. Releases at this time were 3.96 cubic metres per second (140 cubic feet per second). On January 31, 2015, releases were at 0.99 cubic metres per second (35 cubic feet per second) and pool elevation was at 486.44 metres (1595.92 feet). Inflows into the pool were estimated to be around 1.42 cubic metres per second (50 cubic feet per second) all month. Local runoff initiated around March 9 and was short-lived as local snow pack was minimal. Spring runoff predictions initially indicated that all three major reservoirs may not fill to summer operating levels, but unseasonable warm temperatures triggered a "flash-melt-down" and runoff came quicker than and higher than originally predicted and Lake Darling ended the month at an elevation of 486.71 metres (1596.82 feet).

The Des Lacs River peaked on March 13th at 6.12 cubic metres per second (216 cubic feet per second) and was also short lived. Lake Darling was officially declared ice free on April 9. Release plans from Lake Darling for the summer months included maintaining a minimum release of no less than 0.71 cubic metres per second (25 cubic feet per second) to maintain a live stream. Releases were adjusted based on local rainfall events, upstream releases and evaporation rates to keep Lake Darling no higher than 486.77 metres (1597.00 feet) for the summer and continued the minimum release needed to achieve the February 1 target elevation of 486.46 m (1596.0 feet).

J. Clark Salyer National Wildlife Refuge - The gates on all five dams were frozen in from January 1, 2015 through mid-March. Release plans for the summer months included maintaining the pools at their proposed operating levels while meeting the mandatory 0.57 cubic metres per second (20 cubic feet per second) flows into Canada.

It was noted that habitat was changing due to saturated soil conditions in the basin. The groundwater level was high and supporting runoff thereby exasperating the flooding problem to communities in the basin.

The Flow Forecasting Liaison Committee reported that there were three spring runoff forecasts issued in 2015, on or near February 1, February 15, and March 1. These forecasts were distributed to committee members via email. Runoff within the basin began on March 7, after which no further spring runoff forecasts were issued.

The Flow Forecasting Liaison Committee coordinated four conference calls in 2015 (March 26, April 7, April 13 and June15) to discuss operation decisions and potential runoff events. The Communication Plan for the Committee was presented to the International Souris River Board for approval.

The Aquatic Ecosystem Health Committee provided an update on their activities. As a long term goal, the Committee plans to assess watershed risks to water quality, streamline data consolidation, and determine appropriate indicators for aquatic ecosystem health. The Committee action items for 2015:

- Spill communication update-still looking for two contact alternates, but other information has been updated;

- Approval of E. coli support document – circulating for comments and agency approval;

- Changes to the way data is presented in Annual Report (2015) – More usable database, information grouped in 5 or 10 years, charts and graphs over time and with related constituents, addition of a section on invasive species, and with information provided by the IJC, begin to look at the possibility for changes to Water Quality Objectives;

- Investigate large duplicate discrepancies;

The Aquatic Ecosystem Health Committee presented a summary of the water quality monitoring program at Westhope. A total of seven samples were collected by Environment Canada in 2014 – six samples were collected at Westhope and one joint sample was collected with the USGS at Sherwood.

- Total Phosphorus exceeded its Water Quality Objective 0.10 with all samples collected in 2014

- Sodium exceeded its objective of 100 mg/L for 5 of the 7 samples reported to date.

- Sulphate exceeded its objective of 450 mg/L in 2 of the 7 samples collected in 2014.

- Total Dissolved Solids exceeded the Water Quality Objective of 1000 mg/Lin 2 of the 7 samples collected in 2014.

- Total iron exceeded its water quality objective of 300 μg/L 3 times in 2014.

- pH exceeded its Water Quality objective of 8.5 units in 1 of the 7 samples collected in 2014.

- The Dissolved Oxygen (DO) concentration was above the 5 mg/L Water Quality Objective for all samples in 2014.

- Fecal coliform exceeded its Water Quality Objective of 200 no. /100mL once in 2014 with a value of 300 colonies/100 mL. This was the first exceedance since 2010.

- Chloride did not exceed the Water Quality objective of 100 mg/L in 2014, and

- Total Boron did not exceed its objective of 0.50 mg/L in 2014.

Pesticide samples were collected between April and August of 2014. Similar to 2013, there were detections of 2,4D, Dicamba, MPCA, and Picloram had positive results, but were below their respective Water Quality Objectives.

The flow at Westhope appeared to be higher than normal (median of 84 years) for most of 2014. In the past four years, it appears 2012 had significantly less flow than 2011, 2013, and 2014.

The Aquatic Ecosystem Health Committee presented a summary of the water quality monitoring program at Sherwood. The USGS collected a total of eight water quality samples from the Souris River in 2014 at the Sherwood site. The following is a summary of the monitoring program:

- Total Phosphorus exceeded the Water Quality Objective of 0.10 mg/L for 8 of the 8 samples (100%) collected in 2014, though the median value (0.26 mg/L) is down from 2012 (0.34 mg/L) and the same as 2013. The Total Phosphorus values ranged from 0.18 mg/L on January 23 to 0.35 mg/L on April 28.

- Sodium exceeded the Water Quality Objective of 100 mg/L for 3 of the 8 samples (37.5%) in 2014. This was down from an 83% exceedance in 2013. The results ranged from 61.7 mg/L on January 23 to 138 mg/L on May 29.

- Total Iron exceeded the Water Quality Objective of 300 μg/L in all 8 samples in 2014, with only two values measuring below 1000 μg/L (January and August). Results ranged from 699 μg/L in January to 3230 μg/L in April.

- Sulfate met the Water Quality Objective of 450 mg/L on all occasions in 2014.

- Total Dissolved Solids, pH, Chloride and Total boron all met the Water Quality Objectives in 2014.

- Dissolved Oxygen concentrations remained well above the 5 mg/L Water Quality Objective in 2014. Concentrations ranged from 8 mg/L on July 21 to 12.9 mg/L on April 16.

- E. coli Bacteria was collected in 2014. Two samples were analyzed by the Laboratory Service, North Dakota Department of Health. Their values were 50 CFU/100 mL on July 21 and 20 CFU/100 mL on August 20. AEHC is currently in the process of developing Water Quality Objectives for E.coli. For reference, both samples were below North Dakota's Water Quality Standard for E. coli of a 30-day geo-mean of 126 CFU/100 mL.

- Pesticide samples at the Sherwood site were collected as a part of an intensive statewide study conducted by the ND Department of Agriculture. Samples were collected one per month at Sherwood in April, May, June, July, August, and October.

- 95 Pesticides were tested for and none were above the Water Quality Objectives, or for those not part of routine testing, none were above either aquatic life benchmarks or human health limits.

Of the pesticides Water Quality Objectives are established for, 2, 4-D and Atrazine had positive, though very low, results.

Only three parameters; total phosphorus, sodium, and iron were above water quality objectives in 2014. Most of the median values were lower than last year except for chloride, which increased only by a little bit.

It was reported the ND Department of Agriculture was conducting a Pesticide Study. Along with the Sherwood site, the ND Department of Agriculture also sampled two other sites along the Souris River in North Dakota: one above Minot and one downstream of Velva. Both the number of detections and number of different pesticides detected increased when travelled downstream. All detections were below the aquatic life benchmark, which has numeric values well below human health standards.

The Core Committee presented the status of its review of the Plan of Study for the Souris River Basin. The 1989 Agreement was written over 25 years ago. The 1989 Agreement was written assuming that all flood events would be snowmelt driven, that late spring/summer/fall rain events would only cause minor flooding.

After the 2011 flood, Saskatchewan reviewed the Probable Maximum Flood and Inflow Design Flood flows into Rafferty and Alameda reservoirs. Initial modelling shows that the pool level of the reservoirs cannot be returned to a safe level while being limited to a maximum target flow of 113 cubic metres per second (4,000 cubic feet per second).

The United States Geological Survey presented the results from a Climate Analysis project prompted by the 2011 flood and conducted by the United States Geological Survey with funding from the North

Dakota State Water Commission and the United States Geological Survey. The title of the project is, "Tree-Ring Estimates of Long-Term Seasonal Precipitation Souris River Region Saskatchewan, North Dakota, and Manitoba". The first phase of the project was to evaluate precipitation and temperature records and tree-ring climate proxy data to determine if regional climate is subject to multi-decadal to century-scale changes; and provide estimates of that variability. The goal of the project was to produce stochastic simulations of unregulated flow and a reservoir storage/flow routing model in order to approximate regulated flow to advise future flood control measures and reservoir operations. The report concludes that the Souris River region precipitation varies on long-term, multi-decadal to centennial time scales that vary with regional location and season. While an extreme flood was the motivation for this work, extreme drought is an important part of the history of the basin. The project is expected to be completed in the summer 2015 presented at the winter 2016 Board meeting.

The Minot City Manager reported that the results of the federal one-billion-dollar competition Minot would be made public in early July. There were 67 applicants and 75 stakeholders. He thanked the International Souris River Board for supporting the City of Minot's application for the federal grant. The City will advise the Board when they submit an application for the Phase II..

The manager of the Upper Souris Watershed Association gave an overview of their association and its activities. The Upper Souris Watershed Association is a non-profit organization that focuses on source water protection through promotion of environmentally, culturally, and economically sustainable practices. The Upper Souris Watershed Association was formed with representatives from rural and urban municipalities, First Nations, Metis communities, Conservation and Development Authorities, local industries, and interest groups.

The Lower Souris Basin Watershed Committee made a presentation on the activities of their activities. The Lower Souris Basin Watershed Committee was established on March 22, 2006 as part of the Saskatchewan Water Security Agency's basin planning initiative aimed at source water protection. Watershed projects support agricultural best management practices implementation, watershed education and awareness, groundwater well decommissioning and well-head protection plan, and also assist producers in planning water management projects. Project partners include the Water Security Agency, Environment Canada, Government of Saskatchewan, Government of Canada Growing Forward 2, Ducks Unlimited Canada, Saskatchewan Wildlife Federation, Lake Winnipeg Basin Initiative, Local Urban and Municipal Governments, local farmers and ranchers.

On June 16, 2015, the International Souris River Board received a letter from the International Joint Commission requesting to add four public members to the Board. The International Joint Commission requested that names of potential members be submitted by mid-September. The potential members must be public members, not associated with federal or state government agencies. Local governments could be accepted as members, similar to the Rainy-Lake of the Woods Watershed Board.

2.3 AUGUST 26, 2015, TELECONFERENCE CALL

Members in attendance were:

Russell Boals
Member for Canada

John Fahlman
Member for Canada

Mark Lee
Member for Canada

Nicole Armstrong
Member for Canada

Jeff Woodward
Member for Canada

Todd Sando
Member for the United States

Gregg Wiche
Member for the United States

The International Joint Commission requested the International Souris River Board identify four members from the public to be appointed to the International Souris River Board. The International Souris River Board asked how to define “public”. Canada and the United States have the opportunity to nominate two public members. There was discussion about engaging First Nations and Tribal Councils in the nomination process. The International Souris River Board noted that there are no tribes nor First Nations located in the Souris Basin.

The Board prepared and discussed a status report on the Plan of Study. Saskatchewan has completed work on dam safety that could be incorporated into Annex “A”.. The Core Committee proposed that the International Souris River Board form a team and task them to:

- Examine the Plan of Study,
- Inventory the work done to date, and
- Identify what additional work might be required.

The Core Committee continued its work, which was focused on operations, which was separate from the Plan of Study. The Core Committee’s work was within the confines of the current Agreement.

3.0 MONITORING

3.1 INSPECTIONS OF THE BASIN

During the year, the staff of Environment Canada, Saskatchewan Watershed Authority, the North Dakota State Water Commission, Manitoba Water Stewardship, and the United States Geological Survey carried out frequent field inspections of the Souris River basin.

3.2 GAUGING STATIONS

A list of the gauging stations operated in the Souris River basin is given in Table 1. In addition, the United States Geological Survey operated three miscellaneous stream flow-measurement sites in the vicinity of the Eaton Irrigation Project near Towner, North Dakota.

The station numbers and the locations of the hydrometric stations measuring streamflow are shown in Part I of Table 1. The gauging station numbers and the locations of the hydrometric stations located on lakes and reservoirs in the basin are shown in Part II.

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part I--Streamflow

Index Number	Stream	Location	State or Province	Operated By
05NA003	Long Creek[1]	at Western Crossing	Saskatchewan	Environment Canada
(05113360)				
05NA004	Long Creek	near Maxim	Saskatchewan	Saskatchewan Watershed Authority
05NA005	Gibson Creek	near Radville	Saskatchewan	Environment Canada
05NB001	Long Creek	near Estevan	Saskatchewan	Environment Canada
05NB011	Yellowgrass Ditch	near Yellowgrass	Saskatchewan	Environment Canada
05NB014	Jewel Creek	near Goodwater	Saskatchewan	Environment Canada
05NB017	Souris River	near Halbrite	Saskatchewan	Environment Canada
05NB018	Tatagwa Lake Drain	near Weyburn	Saskatchewan	Environment Canada
05NB021	Short Creek[1]	near Roche Percee	Saskatchewan	Environment Canada
(05113800)				
05NB031	Souris River	near Bechard[2]	Saskatchewan	Saskatchewan Watershed Authority
05NB033	Moseley Creek	near Halbrite	Saskatchewan	Environment Canada
05NB034	Roughbark Creek	near Goodwater	Saskatchewan	Environment Canada
05NB035	Cooke Creek	near Goodwater	Saskatchewan	Environment Canada
05NB036	Souris River	below Rafferty Reservoir	Saskatchewan	Environment Canada
05NB038	Boundary Reservoir Diversion Canal	near Estevan	Saskatchewan	Environment Canada
05NB039	Tributary	near Outram	Saskatchewan	Environment Canada

Index Number	Stream	Location	State or Province	Operated By
05NB040	Souris River	near Ralph	Saskatchewan	Environment Canada
05NB041	Roughbark Creek	above Rafferty Reservoir	Saskatchewan	Environment Canada
05NC001	Moose Mountain Creek	below Moose Mountain Lake	Saskatchewan	Saskatchewan Watershed Authority
05ND004	Moose Mountain Creek	near Oxbow	Saskatchewan	Environment Canada
05ND010	Moose Mountain Creek	above Alameda Reservoir	Saskatchewan	Environment Canada
05ND011	Shepherd Creek	near Alameda	Saskatchewan	Environment Canada
05NE003	Pipestone Creek	above Moosomin Reservoir	Saskatchewan	Environment Canada
05NF001	Souris River	at Melita	Manitoba	Environment Canada
05NF002	Antler River	near Melita	Manitoba	Environment Canada
05NF006	Lightning Creek	near Carnduff	Saskatchewan	Environment Canada
05NF007	Gainsborough Creek	near Lyleton	Manitoba	Environment Canada
05NF008	Graham Creek	near Melita	Manitoba	Environment Canada
05NF010	Antler River	near Wauchope	Saskatchewan	Environment Canada
05NG001	Souris River	at Wawanesa	Manitoba	Environment Canada
05NG003	Pipestone Creek	near Pipestone	Manitoba	Environment Canada
05NG007	Plum Creek	near Souris	Manitoba	Environment Canada
05NG012	Elgin Creek	near Souris	Manitoba	Environment Canada
05NG020	Medora Creek	near Napinka	Manitoba	Environment Canada
05NG021	Souris River	at Souris	Manitoba	Environment Canada
05NG024	Pipestone Creek	near Sask. Boundary	Manitoba	Environment Canada
05113520	Long Creek Tributary	near Crosby	North Dakota	U.S. Geological Survey
05113600	Long Creek[1,3]	near Noonan	North Dakota	U.S. Geological Survey
(05NB027)				
05114000	Souris River[1,3]	near Sherwood	North Dakota	U.S. Geological Survey
(05ND007)				
05116000	Souris River[3]	near Foxholm	North Dakota	U.S. Geological Survey
05116135	Tasker Coulee Tributary	near Kenaston	North Dakota	U.S. Geological Survey
05116500	Des Lacs River[3]	at Foxholm	North Dakota	U.S. Geological Survey
05117500	Souris River[3]	above Minot	North Dakota	U.S. Geological Survey
05119410	Bonnes Coulee	near Velva	North Dakota	U.S. Geological Survey
05120000	Souris River[3]	near Verendrye	North Dakota	U.S. Geological Survey
05120180	Wintering River Tributary	near Kongsberg	North Dakota	U.S. Geological Survey
05120500	Wintering River[3]	near Karlsruhe	North Dakota	U.S. Geological Survey
05122000	Souris River[3]	near Bantry	North Dakota	U.S. Geological Survey
05123300	Oak Creek Tributary	near Bottineau	North Dakota	U.S. Geological Survey
05123400	Willow Creek[3]	near Willow City	North Dakota	U.S. Geological Survey
05123510	Deep River[3]	near Upham	North Dakota	U.S. Geological Survey
05124000	Souris River[1,3]	near Westhope	North Dakota	U.S. Geological Survey
(05NF012)				

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part II--Water Level

Index Number	Stream	Location	State or Province	Operated By
05113750	East Branch Short Creek Reservoir	near Columbus	North Dakota	U.S. Geological Survey
05115500	Lake Darling	near Foxholm	North Dakota	U.S. Geological Survey
LGNN8	Souris River	at Logan	North Dakota	U.S. Corps of Engineers
				U.S. N. Weather Service
SWRN8	Souris River	at Sawyer	North Dakota	U.S. Corps of Engineers
				U.S. N. Weather Service
TOWN8	Souris River	at Towner	North Dakota	U.S. Corps of Engineers
				U.S. N. Weather Service
VLVN8	Souris River	at Velva	North Dakota	U.S. Corps of Engineers
				U.S. N. Weather Service
	Upper Souris Refuge	Dams 87 and 96	North Dakota	U.S. Fish and Wildlife
	Des Lacs Refuge	Units 1 - 8 inclusive	North Dakota	U.S. Fish and Wildlife
	J. Clark Salyer Refuge	Dams 320, 326, 332, 341, and 357	North Dakota	U.S. Fish and Wildlife
05NA006	Larsen Reservoir	near Radville	Saskatchewan	Environment Canada
05NB012	Boundary Reservoir	near Estevan	Saskatchewan	Saskatchewan Watershed Authority
05NB016	Roughbark Reservoir	near Weyburn	Saskatchewan	Environment Canada
05NB020	Nickle Lake	near Weyburn	Saskatchewan	Environment Canada
05NB032	Rafferty Reservoir	near Estevan	Saskatchewan	Environment Canada
05NC002	Moose Mountain Lake	near Corning	Saskatchewan	Environment Canada
05ND008	White Bear (Carlyle) Lake	near Carlyle	Saskatchewan	Saskatchewan Watershed Authority
05ND009	Kenosee Lake	near Carlyle	Saskatchewan	Saskatchewan Watershed Authority
05ND012	Alameda Reservoir	near Alameda	Saskatchewan	Environment Canada
05NE002	Moosomin Lake	near Moosomin	Saskatchewan	Environment Canada
05NF804	Metigoshe Lake	near Metigoshe	Manitoba	Manitoba Water Stewardship
05NF805	Sharpe Lake	near Deloraine	Manitoba	Manitoba Water Stewardship
05NG023	Whitewater Lake	near Boissevain	Manitoba	Environment Canada
05NG801	Plum Lake	above Deleau Dam	Manitoba	Manitoba Water Stewardship
05NG803	Elgin Reservoir	near Elgin	Manitoba	Manitoba Water Stewardship
05NG806	Souris River	above Hartney Dam	Manitoba	Manitoba Water Stewardship

Index Number	Stream	Location	State or Province	Operated By
05NG807	Souris River	above Napinka Dam	Manitoba	Manitoba Water Stewardship
05NG809	Plum Lake	near Findlay	Manitoba	Manitoba Water Stewardship
05NG813	Oak Lake	at Oak Lake Resort	Manitoba	Manitoba Water Stewardship
05NG814	Deloraine Reservoir	near Deloraine	Manitoba	Manitoba Water tewardship

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part III--Water Quality

Index Number	Stream	Location	State or Province	Operated By
05114000	Souris River[1 3]	near Sherwood	North Dakota	U.S. Geological Survey
(05ND007)				
05115500	Lake Darling	near Foxholm	North Dakota	U.S. Geological Survey
05116000	Souris River[3]	near Foxholm	North Dakota	U.S. Geological Survey
05116500	Des Lacs River[3]	at Foxholm	North Dakota	U.S. Geological Survey/
(380021)				N.D. Dept. of Health
05117500	Souris River[3]	above Minot	North Dakota	U.S. Geological Survey/
(380161)				N.D. Dept. of Health
05120000	Souris River[3]	near Verendrye	North Dakota	U.S. Geological Survey/
(380095)				N.D. Dept. of Health
05122000	Souris River[3]	near Bantry	North Dakota	U.S. Geological Survey
05123400	Willow Creek[3]	near Willow City	North Dakota	U.S. Geological Survey
05123510	Deep River[3]	near Upham	North Dakota	U.S. Geological Survey
	J. Clark Salyer Refuge	Pool 357	North Dakota	U.S. Fish and Wildlife
05124000	Souris River[1 3]	near Westhope (QA)	North Dakota	U.S. Geological Survey
(05NF012)				

[1] International gauging station

[2] Formerly published as Souris River below Lewvan

[3] Operated jointly for hydrometric and water-quality monitoring

4.0 TRANSBOUNDARY WATER QUALITY OBJECTIVES AND MONITORING

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formally the Souris River Bilateral Water Quality Monitoring Group) since 1990. The two sites are located at the Saskatchewan/North Dakota border near Sherwood, ND, and at the North Dakota/Manitoba border near Westhope, ND.

4.1 OVERVIEW OF WATER QUALITY

Water quality objectives are established for the two border crossings. When water quality objectives are not achieved, such conditions are referred to as "exceedences." A summary of water quality exceedences for 2015 along with historical data is reported in Appendix E.

Historically, the principal concerns regarding water quality in the Souris River basin have been related to high total dissolved solids (TDS), depleted dissolved oxygen, and high levels of nutrients, especially phosphorus. High TDS increases the hardness of water and can cause scale build up in pipes and filters. It is also detrimental to aquatic life, especially spawning fish and juveniles as it reduces water clarity. Low dissolved oxygen levels, or anoxia, can suffocate fish and other aquatic life and cause fish kills as well as mobilize trace metals. High nutrient levels like phosphorus can cause algae blooms which lead to reductions in dissolved oxygen. It can also aid in the formation of blue-green algae which can produce toxins that are harmful to humans and animals.

In 2015, concentrations of most of the historical constituents of concern showed increases in concentration and number of exceedences compared to the previous year. TDS did not meet water quality objectives in three of eight samples at the Sherwood station and exceeded the water quality objective three out of seven times reported at the Westhope station. Dissolved oxygen concentrations were well above the objective at both sites throughout the sampling year with the exception of one sample taken at the Westhope station in March 2015, when the concentration was just below the objective level. Total phosphorous was the only constituent that exceeded the water quality objective in 100% of the samples taken from each station.

At the Saskatchewan/North Dakota border crossing in Sherwood, the United States Geological Survey (USGS) conducted sampling eight times in 2015. Environment Canada undertook seven sampling events at the North Dakota/Manitoba border crossing in Westhope in the calendar year. In September 2015, the USGS and Environment Canada conducted simultaneously sampling at both sites to compare sampling methods.

At the Saskatchewan/North Dakota boundary, exceedences of specific water quality objectives included total phosphorus, sodium, sulfate, molybdenium, total dissolved solids, pH and total iron. Phosphorus again exceeded the water quality objective in all eight samples. Sodium exceeded the water quality objective in five of eight samples (62.5%), which is up from 37.5% in 2014, but down from 50% in 2013 and 83% in 2012. The maximum values for total iron was up however, with 100% exceedence of the 300 micrograms per liter objective, with only three samples measuring below 1,000 micrograms per liter. The maximum value was 5,870 micrograms per liter.

While dissolved oxygen has historically been a constituent of concern, this year again it was again above the water quality objective for all samples at Sherwood, ranging from 5.9 milligrams per liter to 11.7 milligrams per liter. This is a little lower than last year, but still supportive of aquatic life.

A concentration of less than 5.0 milligrams per liter is considered an exceedence. Sulfate values were up slightly from previous years with two of eight samples (25%) exceeding the water quality objective. Molybdenum had one sample (10.9ug/L) slightly above the water quality objective of 10.0 ug/L. pH was also slightly above the objective in one sample. Total dissolved solids showed increases in both maximum and minimum values from 2014 and had exceedences in three of eight samples.

Pesticide samples were also collected as a part of an intensive statewide study conducted by the North Dakota Department of Agriculture. Ninety-eight pesticides were tested for and none were above the water quality objectives, or for those not part of routine testing, none were above either aquatic life benchmarks of human health limits. Three pesticides (2,4-D, Atrazine, and MPCA) had positive, though very low results.

At the Manitoba/North Dakota border crossing at Westhope, N.D., Environment Canada conducted sampling a total of seven times at the Souris River in 2015. Exceedences of specific water quality objectives included total phosphorus, sodium, sulphate, total dissolved solids, total iron, pH and dissolved oxygen. Total phosphorus exceeded the water quality objective in 100% of the samples analyzed. Sodium exceeded the water quality objective in 86% of the samples and total dissolved solids exceeded the water quality objective in 43% of the samples. Sulphate exceeded the water quality objective in 57% of the samples. The total iron objective was exceeded on three occasions and pH exceeded the objective six times in 2015. Fecal coliform and E. coli* levels remained well under the water quality objectives for all samples taken in 2015 (*proposed objective).

Environment and Climate Change Canada did not provide pesticide sampling for 2015. Pesticide sampling at the Westhope station is expected to resume for 2016.

4.2 CHANGES TO POLLUTION SOURCES IN 2015

Development in the Saskatchewan/North Dakota region of the basin in connection with the oil play in the Bakken Formation has the potential to increase areas that are susceptible to erosion. 2015 saw slightly decreasing growth of the oil and gas industry in this area. The continuing decrease in oil prices lead to fewer new wells being constructed and most of the production moving south, out of the Souris River basin to a more cost effective portion of the Bakken formation.

Oil development and production has the potential of increasing storm water pollution through increases in erosion and can cause a variety of water quality impairments. However, the most prevalent source of pollution is still nonpoint source pollution arising from other sources.

The Souris River basin typically experiences short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Cropping practices that don't use soil and water conservation methods and livestock grazing near and watering in the river are the likely sources of excessive nutrient, sediment, and E.coli bacteria concentrations, along with laying the groundwork for dissolved oxygen depletion. However, this has been lessened in recent years by the installation of animal waste systems and Best Management Practices on agricultural land through a variety of watershed improvement projects throughout the basin on both sides of the border.

Dams frequently have a substantial additive affect on phosphorus loading. Large reservoirs with hypolimnetic releases generally contribute high phosphorus loads. Low head dams can contribute also as they are often loaded with nutrient rich prairie soils. The reservoirs and dams often become anoxic during the winter, releasing additional phosphorus from bottom sediments. Downstream loading at the border has historically been very high, because spring runoff occurs prior to ice out, thereby purging many of the shallow, nutrient rich ponds. The continual release of water throughout the year from the large upstream reservoirs seems to have lessened this effect.

Point sources pollution from the cities of Estevan and Minot have been reduced by advanced wastewater treatment. Smaller cities continue to discharge effluent intermittently. All wastewater treatment lagoons in North Dakota are required in their permit to meet the State's water quality standards at the point of discharge. These standards are protective of the objectives set up by the International Souris River Board.

Future impacts to water quality and aquatic ecosystem health included changing agriculture and landscape, urban development, energy development, water appropriations that reduce flows and reservoir operations.

4.3 CHANGES TO MONITORING

There were no changes to the monitoring plan for 2015 (Saskatchewan/North Dakota border). The 2015 monitoring plan can be found in Appendix F.

4.4 WINTER ANOXIA

Winter anoxia and fish kills are the result of very low concentrations dissolved oxygen that have been documented in the Souris River basin on many occasions in previous years. Factors contributing to low oxygen levels have not been definitively determined, but are thought to be increased sediment oxygen demand (as determined in North Dakota's 2010 Total Maximum Daily Load report on the reach of the Souris River from Sherwood to Lake Darling), macrophyte decomposition, organic enrichment, photosynthesis suppression, low flow, scouring of low head dams during high flow events, and low level draw downs from reservoirs.

Dissolved oxygen concentrations at both monitoring stations met the water quality objective of 5.0 milligrams per liter for all samples throughout 2015. This was the fourth consecutive year of meeting the objective. To better determine the minimum flow needed to protect these levels, the Board agrees to keep a watch on dissolved oxygen conditions and the USGS and Environment Canada will attempt to collect dissolved oxygen and ammonia samples if low flow conditions prevail during future winters.

5.0 WATER-DEVELOPMENT ACTIVITIES IN 2015

5.1 NORTHWEST AREA WATER SUPPLY PROJECT

The Garrison Diversion Municipal, Rural, and Industrial (MRI) water-supply program, passed by the United States Congress on May 12, 1986, as part of the Garrison Diversion Reformation Act of 1986, authorized the appropriation of federal funds for the planning and construction of water-supply facilities throughout North Dakota. An agreement between the North Dakota State Water Commission and the Garrison Conservancy District in 1986 provided a method through which the agencies can request funding for MRI water-system projects from the Secretary of the Interior. On the basis of this agreement, the Northwest Area Water Supply (NAWS) study was initiated in November 1987.

The NAWS project has been designed to supply a reliable source of treated water to cities, communities, and rural water systems in 10 counties in northwestern North Dakota. The project has an estimated cost of $217 million.

The water supply for the project is Lake Sakakawea, located in the Missouri River system. The annual use authorized under the State of North Dakota water permit is 18 502 cubic decametres (15,000 acre-feet).

Canada is concerned that the NAWS project could permit the interbasin transfer of non-native biota. NAWS would be the first project to divert water across the continental divide to the Hudson Bay drainage basin. The Province of Manitoba filed suit in U.S. District Court. The court required the project undergo further NEPA review, and placed an injunction on the project.

On April 15, 2005, the Court modified the injunction to allow the construction on the pipeline between Lake Sakakawea and Minot to continue.

The Draft SEIS was released in June of 2014, the Final SEIS was published in April of 2015, and the Record of Decision was signed in August of 2015.

A case management motion (briefing schedule) was submitted to and approved by the DC District Court in December of 2016. Briefings began in January 2016 and were completed in August 2016, but Manitoba may attempt to file outside of the case management motion, as they have done in the past. A motion to modify to injunction to allow design work (paper exercise only, no construction and with no federal funding or future reimbursement) was filed by the State of North Dakota which was denied by the Court in June. That decision is currently being appealed. The summary judgement for the overall case is expected in the winter of 2017.

A small contract to install a 'jockey' pump at the NAWS HSPS to better handle low flows as well as installation of electrical components and some maintenance items was performed in 2015. There are two contracts in place to encase portions of the pipeline that will be affected by road construction in the Minot area over 2016 and for changing electrical switchgear at the booster pump stations to accommodate emergency back-up power.

The NAWS distribution pipeline, utilizing groundwater supplied by the City of Minot, pumped 643 million gallons in 2013, 886 million gallons in 2014, 1.01 billion gallons in 2015, and 804 million gallons through to the end of July in 2016.

5.2 WATER APPROPRIATIONS

5.2.1 BACKGROUND

In 1995, the International Souris River Board adopted a new method for reporting minor project diversions for the purpose of determining apportionment. The new method uses a common set of criteria and ensures that the same criteria will be used in both Saskatchewan and North Dakota. It also involves taking the project lists generated by the Natural Flow Methods Committee and adding newly constructed projects or subtracting cancelled projects each year. The projects that met the criteria in 1993 are the benchmark for all future reporting.

5.2.2 SASKATCHEWAN

In 1993 there were 137 minor projects in the Saskatchewan portion of the Souris River basin that met the new criteria. These projects had an annual diversion of 5 099 cubic decametres (4,134 acre-feet). In 2015, there were 625 projects in the Saskatchewan portion of the basin with an annual diversion of 45 000 cubic decametres (36,497 acre-feet). There were also three minor use water licenses approved for industrial use, municipal supply, and track wash activity.

5.2.3 NORTH DAKOTA

In 1993 there were 12 minor projects in the North Dakota portion of the Souris River basin upstream of Sherwood that met the new criteria. The projects had an annual diversion of 1 257 cubic decametres (1,019 acre-feet). On December 31, 2015, there were 12 minor projects in the North Dakota portion of the Long and Short Creek basins. The annual diversions totaled 1 423 cubic decametres (1,154 acre-feet).

The diversion from East Branch Short Creek near Columbus, North Dakota, was estimated by correcting for precipitation, evaporation and seepage, and the storage change. The diversion in 2015 was 691 cubic decametres (560 acre-feet). The diversion from the reservoir was added to the minor project diversions for the Long and Short Creek basins to obtain the total diversion of 2 071 cubic decametres (1,679 acre-feet) by the United States.

6.0 HYDROLOGIC CONDITIONS IN 2015

The Saskatchewan Water Security Agency reported that precipitation in the fall of 2014 was near average in the Saskatchewan portion of the Souris River basin. Winter precipitation was below normal with several periods of melt in the Souris River Basin resulting in no snowpack. The estimated precipitation was 40 to 60 percent of normal.

The United States Geological Survey reported that the total volume of flow passing the Long Creek at Noonan gage in 2015 was 30 155 cubic decametres (24,447 acre-feet). This volume is about 156 percent greater than the median flow for the past 56 years. The peak discharge for the period January 1 to December 31, 2015 was 31.2 cubic metres per second (1,100 cubic feet per second), which ranks 22 in 55 years of record.

On December 31, 2015, Rafferty Reservoir was at an elevation of 549.634 metres (1803.35 feet), or 0.251 metres (0.824 feet) higher than at the beginning of the year. Total inflow to Rafferty Reservoir in 2015 was 111 595 cubic decametres (90,507 acre-feet), and the calculated diversion for 2015 was 39 607 cubic decametres (32,123 acre-feet). No water was transferred from Rafferty Reservoir to Boundary Reservoir via the pipeline in 2015.

The mainstem inflow to Alameda Reservoir (Moose Mountain Creek above Alameda Reservoir) was 93 691 cubic decametres (75,955 acre-feet), and the calculated diversion for 2015 was 1 051 cubic decametres (852 acre-feet). Alameda Reservoir was at an elevation of 561.05 metres (1,840.81 feet) on December 31, 2015, or 0.139 metres (0.456 feet) higher than at the beginning of the year.

Boundary Reservoir received an inflow of 30 155 cubic decametres (24,447 acre-feet) from Long Creek. The calculated diversion for 2015 was minus 4 299 cubic decametres (3,485 acre-feet). On December 31, 2015, Boundary Reservoir was at an elevation of 559.51 metres (1,835.75 feet), or 0.79 metres (2.59 feet) lower than at the beginning of the year.

On December 31, 2015, the estimated storage in the five major reservoirs in Saskatchewan (Boundary, Rafferty, Alameda, Nickle Lake, and Moose Mountain Lake) was 571 260 cubic decametres (463,121 acre-feet) as compared to storage of 567 680 cubic decametres (460,218 acre-feet) on December 31, 2014.

Figure 1 shows the storage contents of several reservoirs in the Canadian portion of the Souris River basin for 2014 and 2015.

Recorded runoff for the year for the Souris River near Sherwood was 224 781 cubic decametres (182,230 acre-feet), or about 163 percent of the 1931-2015 long-term mean. This total flow is 342 percent greater than the median flow for the past 86 years.

The artificially drained areas of Yellow Grass Ditch and Tatagwa Lake contributed 56 682 cubic decametres (45,952 acre-feet) during 2015.

The peak discharge for the period January 1 to December 31 2015 was 31 cubic meters per second (1,100 cubic feet per second).

Figure 2 provides a schematic representation of recorded runoff above Sherwood, North Dakota.

On December 31, 2015, the level of Lake Darling was 486.55 metres (1,596.97 feet). The 2015 year-end storage in Lake Darling was 121 692 cubic decametres (98,656 acre-feet), or approximately 8 236 cubic decametres (6,677 acre-feet) less than on December 31, 2014.

The 2015 year-end storage in the J. Clark Salyer Refuge pools was 33 617 cubic decametres (27,253 acre-feet), or 16 161cubic decametres (13,102 acre-feet) more than on December 31, 2014.
The combined year-end storage in Lake Darling and the J. Clark Salyer Refuge pools was 155 309 cubic decametres (125,909 acre-feet), well above the 66 600 cubic decametres (54,000 acre-feet) severe drought criterion.

Figure 3 shows the storage contents of the mainstem reservoirs in the United States.

Recorded runoff for the year for the Souris River at Westhope was 414 508 cubic decametres (336,042 acre-feet) or some 688 938 cubic decametres (558,522 acre-feet) more than entered North Dakota at the Sherwood Crossing. This flow is 280 percent of the median flow for the last 86 years. The minimum flow for the period was 0.26 cubic metres per second (9 cubic feet per second), which occurred from February 15 to 18, 2015. The peak discharge for the period January 1 to December 31, 2015, was 60 cubic metres per second (2,120 cubic feet per second) on April 9, which ranks 29 in 86 years of record.

Manitoba reported the spring runoff started in early to mid-March. The Souris River at Wawanesa peaked at 128.8 cubic metres per second (4,550 cubic feet per second), a 1 in 4 year flood event on March 30, then slowed due to cool weather. Runoff resumed near the end of March resulting in two spring runoff peaks. The first peak occurred in mid-March and the second peak was in early April. Summer precipitation events resulted in flows similar to the spring runoff.

The Souris River at Wawanesa was above normal for much of summer returning to close to median flows from August to mid-October.

Figure 4 shows the monthly releases from Boundary, Rafferty, Alameda, and Lake Darling Reservoirs.

7.0 SUMMARY OF FLOWS AND DIVERSIONS

7.1 SOURIS RIVER NEAR SHERWOOD

The natural runoff near Sherwood for 2015 was 213 777 cubic decametres (173,309) acre-feet). Depletions in Canada totaled 3 963 cubic decametres (3,213 acre-feet). The additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins was 56 682 decametres (45,952 acre-feet). Total depletions in Canada were 13 118 cubic decametres (10,635 acre-feet) less than the additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins. The total volume of water released from Boundary, Rafferty, and Alameda Reservoirs in Canada in 2015 was 181 623 cubic decametres (147,244 acre-feet), representing 81 percent of the recorded flow at Sherwood, or 85 percent of the computed natural runoff at Sherwood. A schematic representation of the 2015 flow volumes in the Souris River basin above Sherwood is shown in Figure 2 and the summary of the natural flow computations is provided in Appendix A. It should be noted that Saskatchewan was in surplus on December 31, 2015, by 141 385 cubic decametres (114,621 acre-feet).

The flow of the Souris River at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) for the entire year. Accordingly, Saskatchewan complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

7.2 LONG CREEK AND SHORT CREEK

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 25 928 cubic decametres (21,010 acre-feet), or 82.4 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with the increase of runoff on Long Creek between the Western and Eastern Crossings of 4,227 cubic decametres (3,427 acre-feet).

Short Creek, which rises in North Dakota, contributed 12 435 cubic decametres (10,081 acre-feet) to runoff in the Souris River above Sherwood.

7.3 SOURIS RIVER NEAR WESTHOPE

Recorded flow near Westhope during the period of June 1 through October 31, 2015, was 309 839 cubic decametres (251,186 acre-feet). Figure 5 illustrates the recorded flows at Westhope and at Wawanesa near the mouth of the Souris River in Manitoba.

According to the United States Geological Survey, flows recorded at the Souris River near Westhope gage, through December 31, 2015 calendar year, were 414 508 cubic decametres (336,042 acre-feet). The calendar year total flow is 280 percent of the median flow for the last 86 years of record.

Due to ice conditions, the flows in the Souris River near Westhope were estimated for the periods January 1 to March 31 and November 17 to December 31.

The peak daily discharge of 60.0 cubic metres per second (2,120 cubic feet per second) occurred on April 9, and ranked 29 in 85 years of discharge record.

The flow at Westhope was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures except for the period of February 13 to March 9 and for July 22.

8.0 WORKPLAN SUMMARY FOR 2015

The International Souris River Board was created by the International Joint Commission in April 2000 when it combined responsibilities previously assigned under two separate references for the Souris River. The previous references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948).

On June 9, 2005, the Board's mandate was further revised through an exchange of diplomatic notes, assigning water quality functions and the oversight for flood forecasting and operations to the Board. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

The Board determined that a workplan would be beneficial in helping the Board identify resource requirements and deliver on results. The Board agreed that the workplan should include costs related to normal Board activities such as meetings, the annual report, and special projects.

The workplan follows the four strategic initiatives of the International Watershed Initiative.

- Build shared understanding of the watershed and related transboundary issues.

- Communicate watershed issues at the local, regional and national levels to increase awareness, highlight potential issues, and identify opportunities for cooperation and resolution.

- Contribute to the resolution of watershed issues.

- Administer the existing orders and references.

Figure 1

MONTH END CONTENTS OF RESERVOIRS IN CANADA FOR THE YEARS 2014 AND 2015

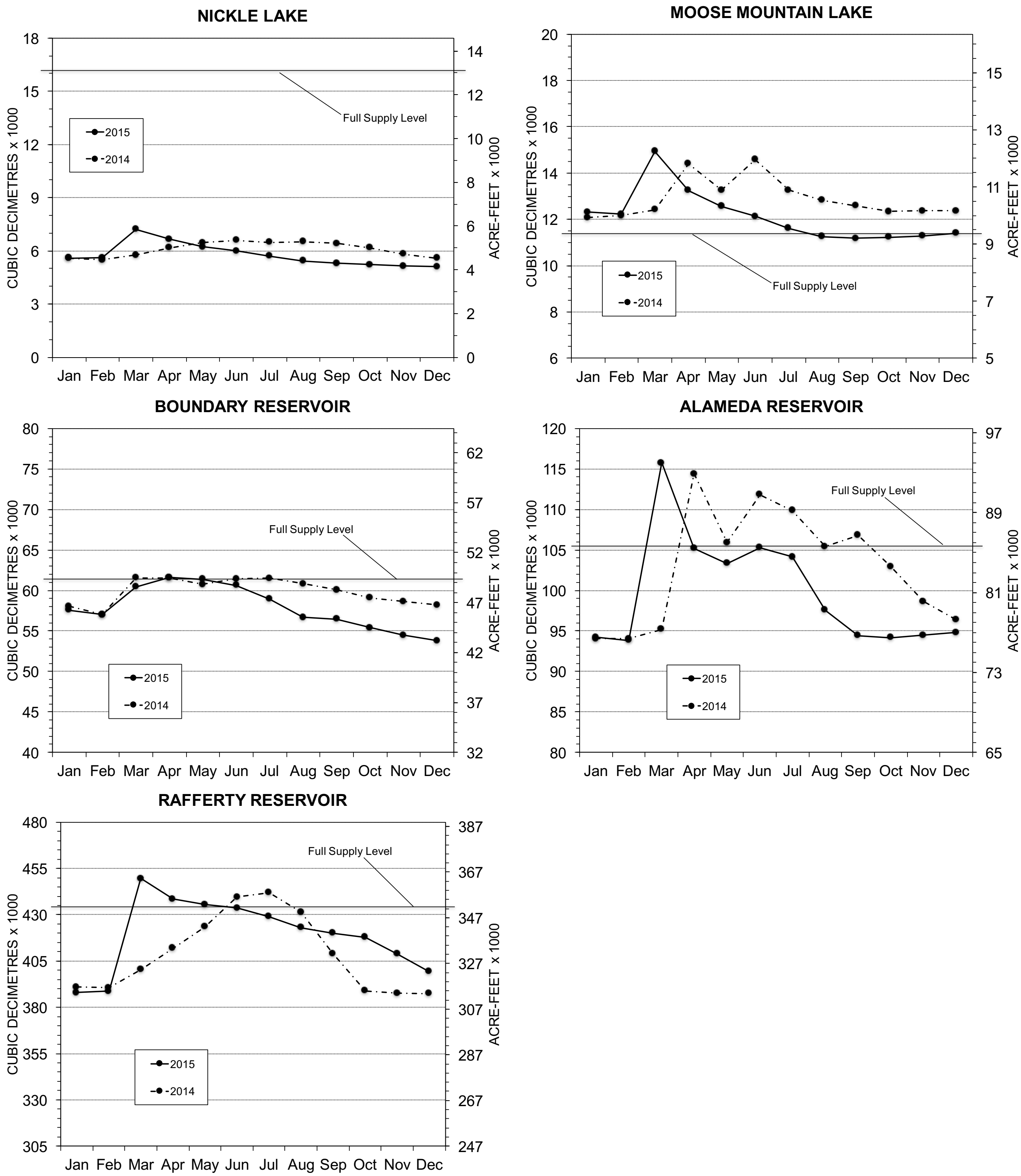


Figure 2

SCHEMATIC REPRESENTATION OF 2015 FLOWS IN THE SOURIS RIVER BASIN ABOVE SHERWOOD, NORTH DAKOTA, U.S.A.

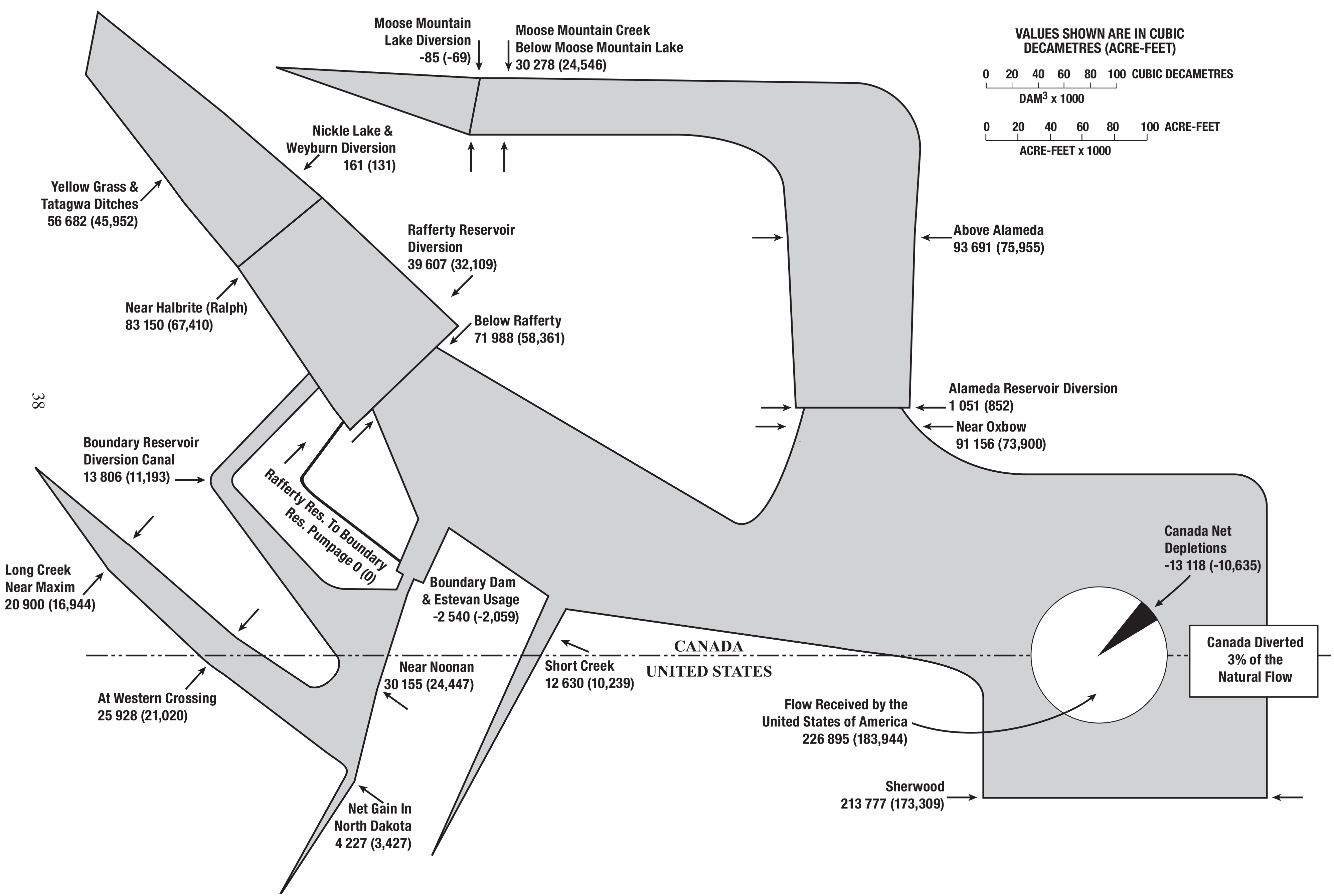
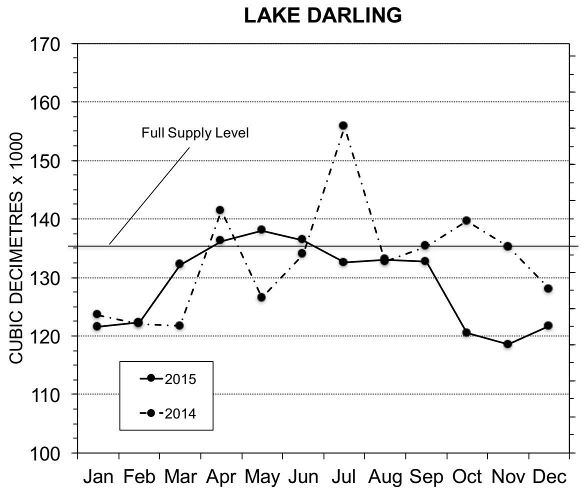
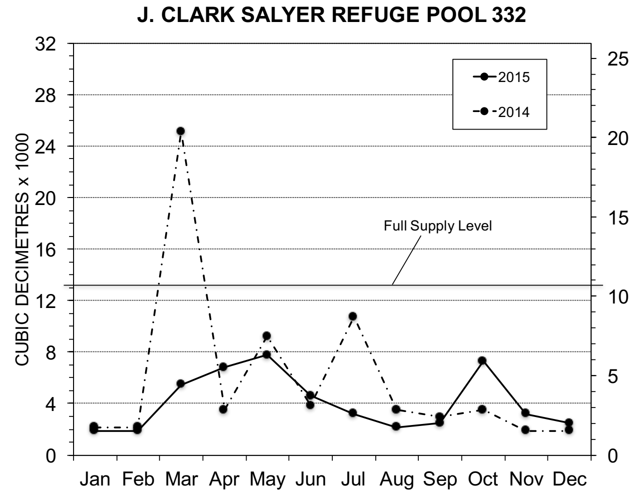
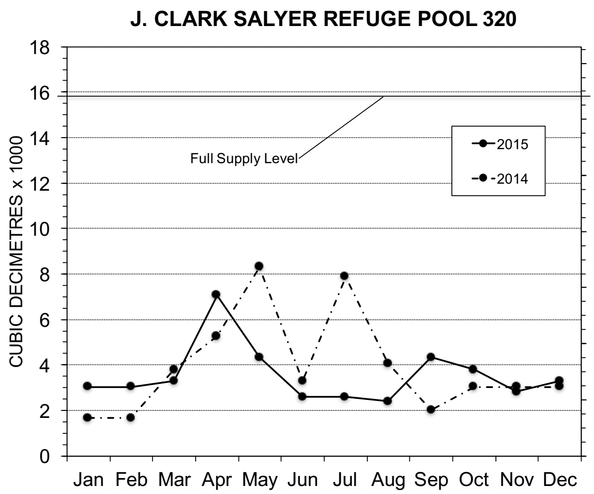


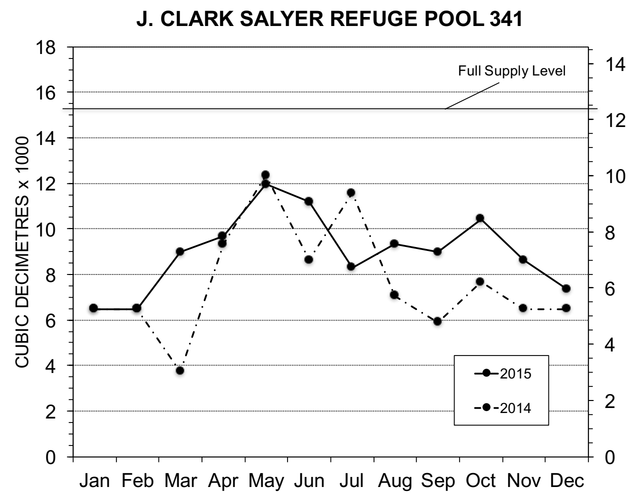
Figure 3

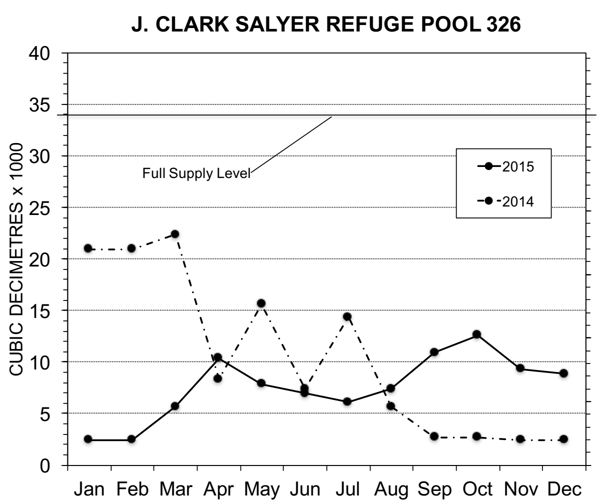
MONTH END CONTENTS OF RESERVOIRS IN USA
FOR THE YEARS 2014 AND 2015











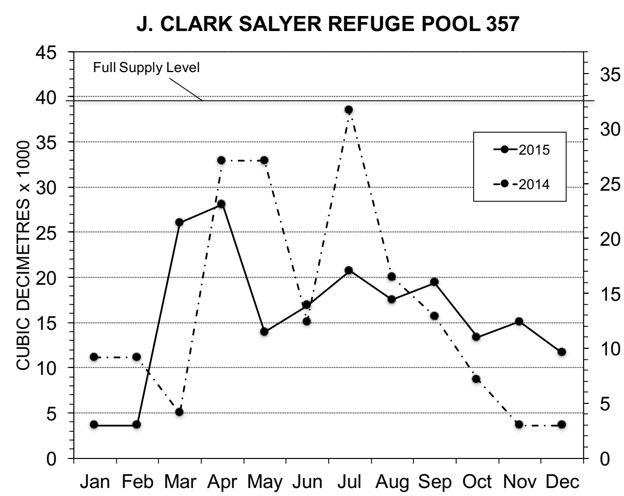


Figure 4

MONTHLY RESERVOIR RELEASES FOR THE YEAR 2015

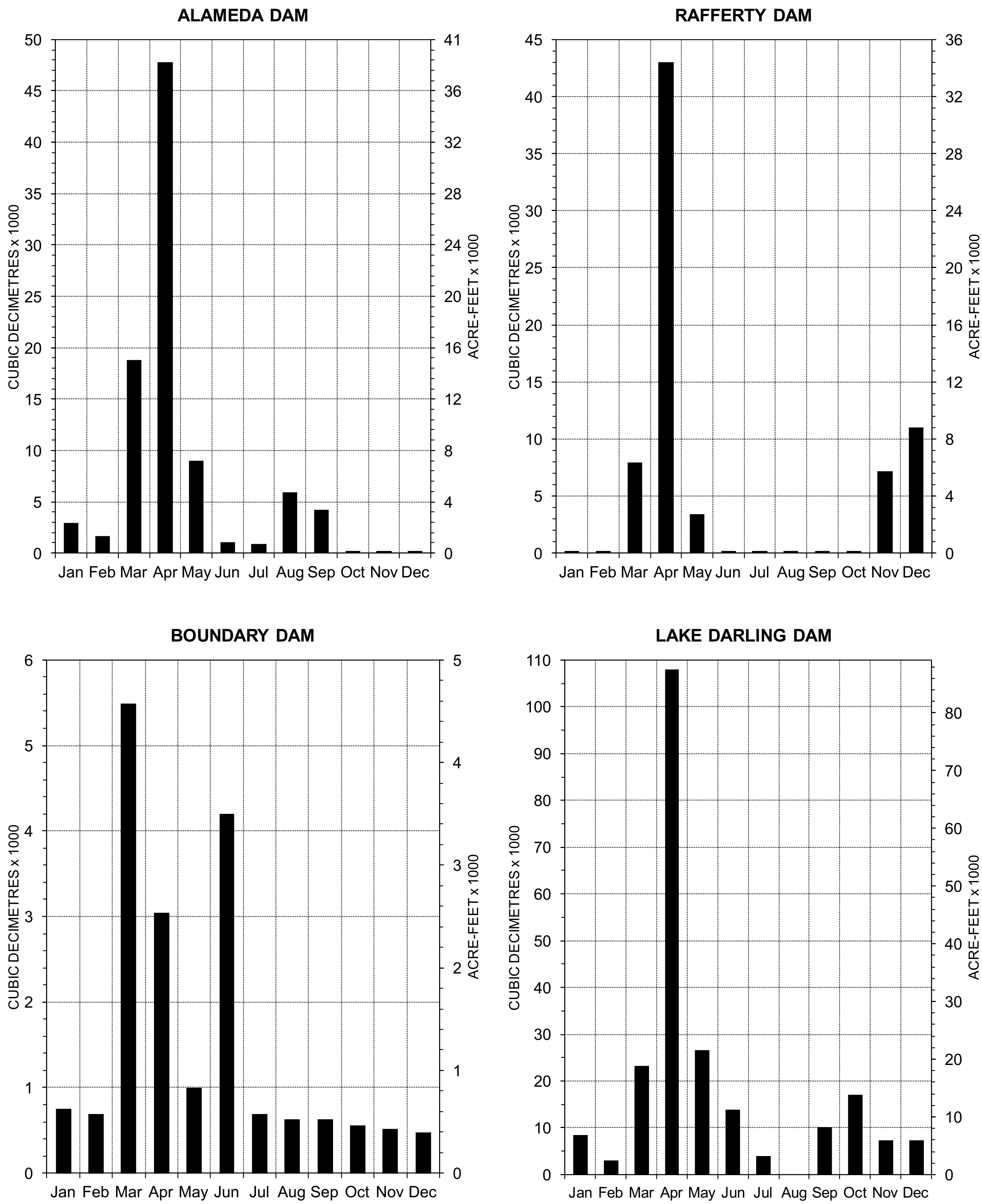
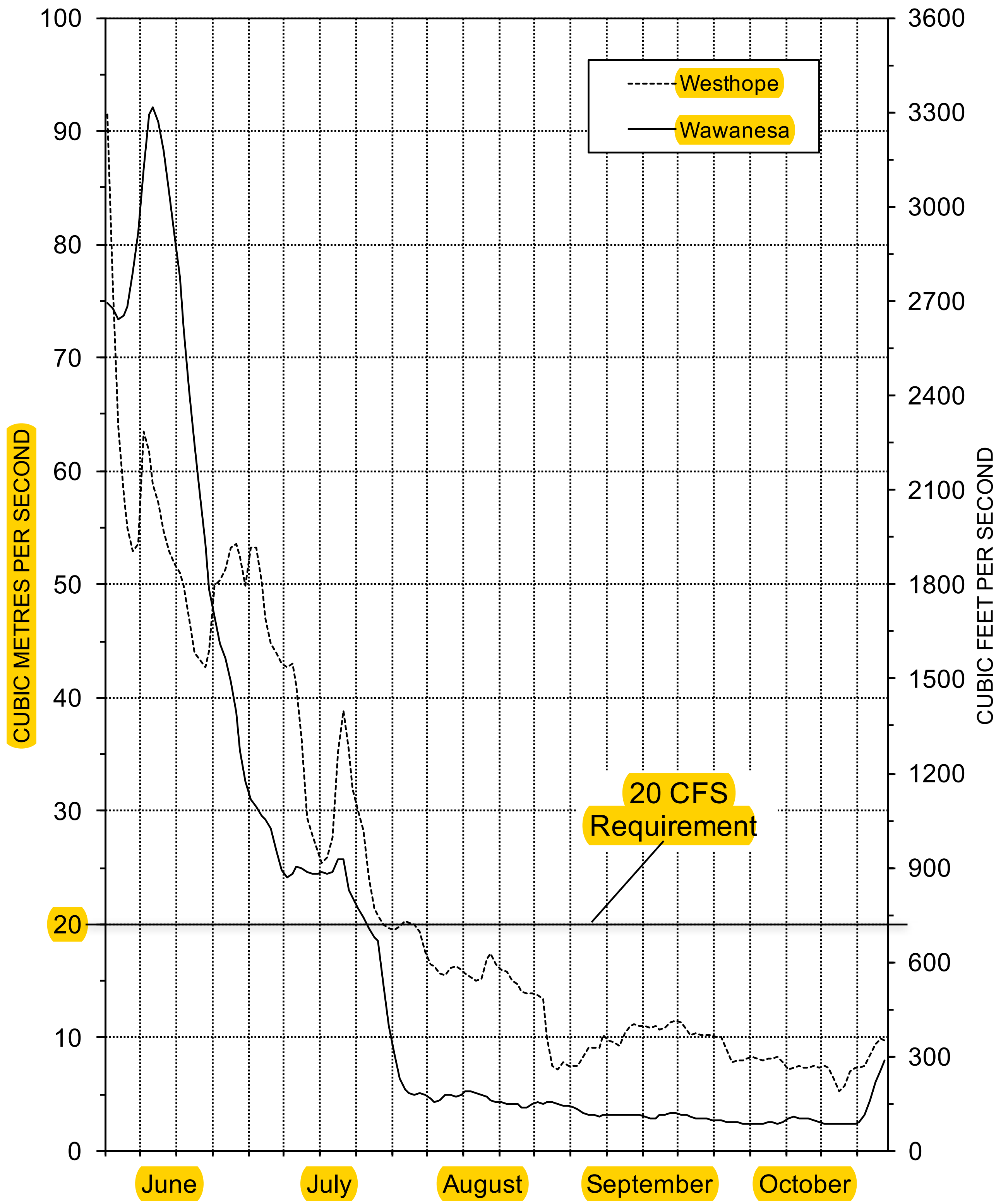
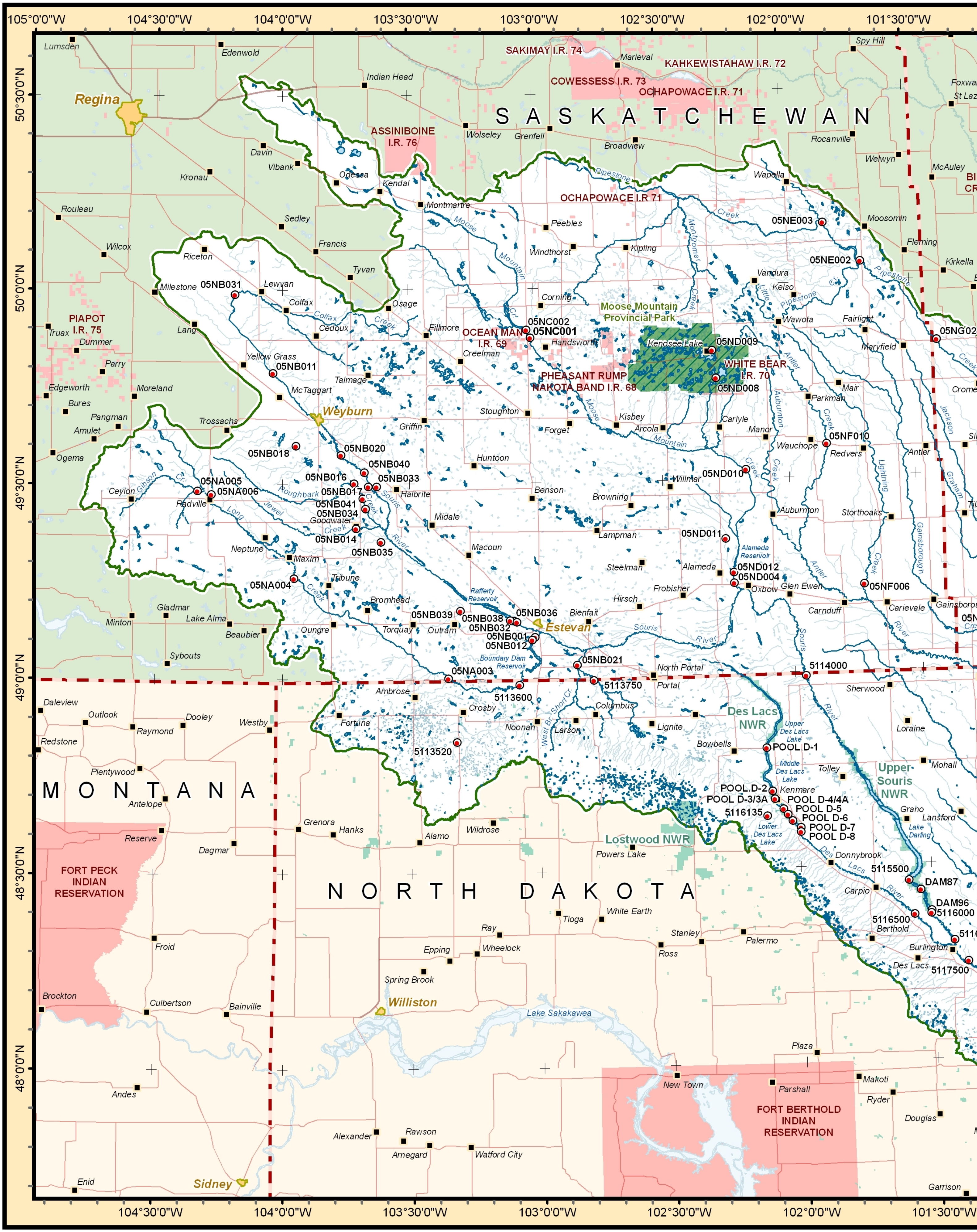


Figure 5

SOURIS RIVER NEAR WESTHOPE
AND
SOURIS RIVER NEAR WAWANESA

June 1, 2015 to October 31, 2015

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104°30'0"W
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49°30'0"N
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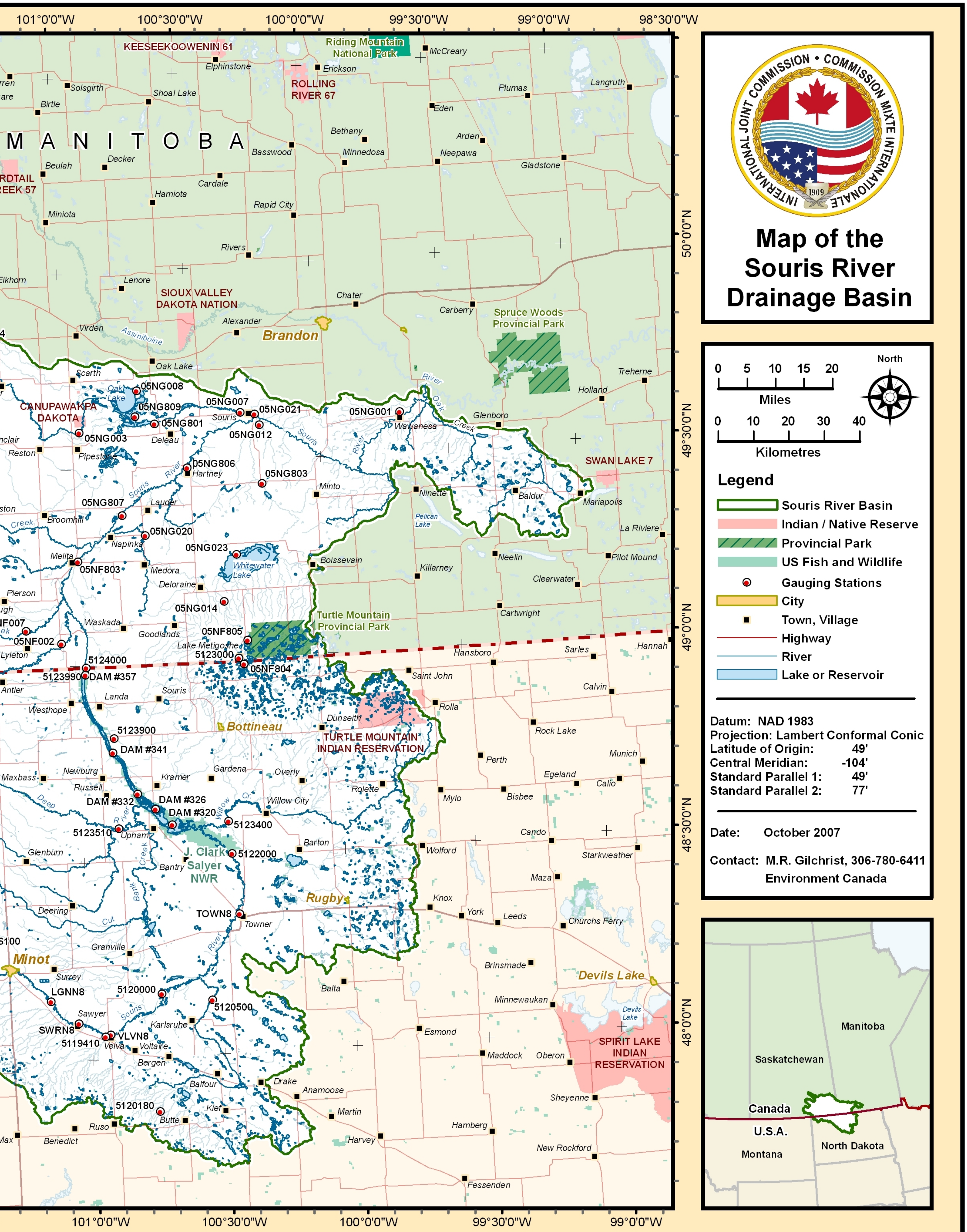
48°0'0"N
S A S K A T C H E W A N
M O N T A N A
N O R T H D A K O T A
Regina
Weyburn
Estevan
Williston
Sidney
SAKIMAY I.R. 74
KAHKEWISTAHAW I.R. 72
COWESSESS I.R. 73
OCHAPOWACE I.R. 71
ASSINIBOINE I.R. 76
OCHAPOWACE I.R 71
PIAPOT I.R. 75
OCEAN MAN I.R. 69
PHEASANT RUMP NAKOTA BAND I.R. 68
WHITE BEAR I.R. 70
Moose Mountain Provincial Park
Kenosee Lake
FORT PECK INDIAN RESERVATION
FORT BERTHOLD INDIAN RESERVATION
Des Lacs NWR
Upper Souris NWR
Lostwood NWR
Lake Sakakawea
Rafferty Reservoir
Boundary Dam Reservoir
Alameda Reservoir
Upper Des Lacs Lake
Middle Des Lacs Lake
Lower Des Lacs Lake
Lake Darling
Souris River
Moose Mountain Creek
Pipestone Creek
Long Creek
Jewel Creek
Roughbark Creek
Colfax Creek
Gibson Cr.
Antler Creek
Auburnton Creek
Lightning Creek
Graham
Gainsborough Creek
Jackson Creek
Montgomery Creek
Little Pipestone Cr.
Des Lacs River
West Br. Short Cr.
05NB031
05NB011
05NB018
05NB020
05NB040
05NB016
05NB033
05NB017
05NB041
05NB034
05NB014
05NB035
05NA005
05NA006
05NA004
05NA003
05NB039
05NB038
05NB032
05NB001
05NB012
05NB036
05NB021
05NC002
05NC001
05ND009
05ND008
05ND010
05ND011
05ND012
05ND004
05NE003
05NE002
05NF010
05NF006
05NG02
5113600
5113520
5113750
5114000
5116135
5115500
5116500
5116000
5117500
POOL D-1
POOL D-2
POOL D-3/3A
POOL D-4/4A
POOL D-5
POOL D-6
POOL D-7
POOL D-8
DAM87
DAM96
Lumsden
Edenwold
Indian Head
Marieval
Spy Hill
Foxwar
St Laz
Wolseley
Grenfell
Broadview
Rocanville
Welwyn
McAuley
Davin
Vibank
Kronau
Odessa
Kendal
Montmartre
Wapella
Moosomin
Fleming
Kirkella
Rouleau
Sedley
Francis
Peebles
Windthorst
Kipling
Wilcox
Riceton
Tyvan
Vandura
Kelso
Milestone
Lewvan
Colfax
Osage
Corning
Wawota
Fairlight
Truax
Lang
Cedoux
Fillmore
Handsworth
Maryfield
Dummer
Creelman
Parry
Yellow Grass
Talmage
Mair
Edgeworth
Moreland
McTaggart
Parkman
Bures
Pangman
Stoughton
Kisbey
Carlyle
Amulet
Trossachs
Griffin
Forget
Arcola
Manor
Wauchope
Redvers
Antler
Ogema
Huntoon
Ceylon
Radville
Halbrite
Benson
Willmar
Browning
Auburnton
Storthoaks
Goodwater
Midale
Lampman
Neptune
Maxim
Macoun
Steelman
Alameda
Tribune
Frobisher
Oxbow
Glen Ewen
Gladmar
Bromhead
Hirsch
Carnduff
Carievale
Gainsborou
Minton
Lake Alma
Beaubier
Oungre
Torquay
Outram
Bienfait
Sybouts
North Portal
Portal
Sherwood
Ambrose
Crosby
Columbus
Daleview
Outlook
Dooley
Westby
Raymond
Fortuna
Noonan
Larson
Lignite
Bowbells
Loraine
Redstone
Plentywood
Tolley
Mohall
Kenmare
Antelope
Grenora
Hanks
Alamo
Wildrose
Reserve
Dagmar
Powers Lake
Donnybrook
Carpio
Berthold
Burlington
Des Lacs
Grano
Lansford
Tioga
White Earth
Ray
Stanley
Palermo
Ross
Epping
Wheelock
Spring Brook
Froid
Brockton
Culbertson
Bainville
Plaza
New Town
Parshall
Makoti
Ryder
Douglas
Andes
Alexander
Rawson
Arnegard
Watford City
Enid
Garrison
Crome
104°30'0"W
104°0'0"W
103°30'0"W
103°0'0"W
102°30'0"W
102°0'0"W
101°30'0"W



Map of the Souris River Drainage Basin
INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE
1909
0 5 10 15 20
Miles
0 10 20 30 40
Kilometres
North
Legend
Souris River Basin
Indian / Native Reserve
Provincial Park
US Fish and Wildlife
Gauging Stations
City
Town, Village
Highway
River
Lake or Reservoir
Datum: NAD 1983
Projection: Lambert Conformal Conic
Latitude of Origin: 49'
Central Meridian: -104'
Standard Parallel 1: 49'
Standard Parallel 2: 77'
Date: October 2007
Contact: M.R. Gilchrist, 306-780-6411
Environment Canada
101°0'0"W
100°30'0"W
100°0'0"W
99°30'0"W
99°0'0"W
98°30'0"W
50°0'0"N
49°30'0"N
49°0'0"N
48°30'0"N
48°0'0"N
MANITOBA
KEESEEKOOWENIN 61
Riding Mountain National Park
ROLLING RIVER 67
SIOUX VALLEY DAKOTA NATION
CANUPAWAKPA DAKOTA
SWAN LAKE 7
Spruce Woods Provincial Park
Turtle Mountain Provincial Park
TURTLE MOUNTAIN INDIAN RESERVATION
SPIRIT LAKE INDIAN RESERVATION
J. Clark Salyer NWR
Brandon
Bottineau
Rugby
Minot
Devils Lake
05NG008
05NG809
05NG007
05NG021
05NG001
05NG801
05NG012
05NG003
05NG806
05NG803
05NG807
05NG020
05NG023
05NF803
05NG014
05NF805
05NF804
05NF002
5124000
5123000
5123990
DAM #357
5123900
DAM #341
DAM #326
DAM #320
DAM #332
5123400
5123510
5122000
TOWN8
LGNN8
5120000
5120500
SWRN8
VLVN8
5119410
5120180
Manitoba
Saskatchewan
Canada
U.S.A.
Montana
North Dakota

APPENDIX A

Determination of Natural Flow of Souris River at International Boundary (Sherwood)

DETERMINATION OF NATURAL FLOW OF SOURIS RIVER AT INTERNATIONAL BOUNDARY (SHERWOOD)

All Quantities Reported In Cubic Decametres

FOR THE PERIOD: JANUARY 1 TO Dec 31, 2015

LONG CREEK BASIN

LARSEN RESERVOIR				BOUNDARY RESERVOIR								
				INFLOW	OUTFLOW							
1	2	3	4	5 *	6	7	8	9	10	11	12 *	13
STORAGE CHANGE	EVAPORATION	DIVERSION	TOWN OF RADVILLE PUMPAGE	LONG CREEK AT EASTERN CROSSING	LONG CREEK NEAR ESTEVAN	ESTEVAN PIPELINE	DIVERSION CANAL	TOTAL (OUTFLOW)	DIVERSION	MINOR PROJECT DIVERSION	U.S.A. DIVERSION BETWEEN WESTERN & EASTERN CROSSING	TOTAL DIVERSION LONG CREEK
				30155								
-226	50	-176	30	0	18485	2163	13806	34454	-4299	840	403	-3202
		(1+2)		PIPELINE				(6+7+8)	(5-9)			(3+4+10+11+12)

UPPER SOURIS RIVER BASIN - ABOVE ESTEVAN

NICKLE LAKE RESERVOIR					ROUGHBARK RESERVOIR			RAFFERTY RESERVOIR				
14	15	16	17	18	19	20	21	22	23	24	25	26
STORAGE CHANGE	EVAPORATION	CITY OF WEYBURN PUMPAGE	DIVERSION	CITY OF WEYBURN RETURN FLOW	STORAGE CHANGE	EVAPORATION	DIVERSION	INFLOW	OUTFLOW	DIVERSION	MINOR PROJECT DIVERSION	TOTAL DIVERSION UPPER SOURIS RIVER
									71988			
-1010	1028	1902	1920	1759	2	77	79	111595	0	39607	1542	41389
			(14+15+16)				(19+20)		PIPELINE	(22-23)		(17-18+21+24+25)

LOWER SOURIS RIVER--ESTEVAN TO SHERWOOD

27	28 *	29	30
CITY OF ESTEVAN NET PUMPAGE	SHORT CREEK DIVERSIONS IN U.S.A.	MINOR PROJECT DIVERSION	TOTAL DIVERSION LOWER SOURIS RIVER
1759	1711	1603	5073
			(27+28+29)

MOOSE MOUNTAIN CREEK BASIN

MOOSE MOUNTAIN LAKE			ALAMEDA RESERVOIR				
31	32	33	34	35	36	37	38
STORAGE CHANGE	EVAPORATION	DIVERSION	STORAGE CHANGE	EVAPORATION	DIVERSION	MINOR PROJECT DIVERSIONS	TOTAL DIVERSIONS MOOSE MOUNTAIN CREEK BASIN
-1020	935	-85	-1580	2631	1051	1452	2418
		(31+32)			(34+35)		(33+36+37)

NON-CONTRIBUTORY BASINS

39	40	41
YELLOW GRASS DITCH	TATAGWA LAKE DRAIN	TOTAL ADDITIONS
52992	3690	56682
		(39+40)

* DATA CONTRIBUTED BY U.S.G.S.

SUMMARY OF NATURAL FLOW

42	43 *	44	45	46	47
TOTAL DIVERSION SOURIS RIVER BASIN	RECORDED FLOW AT SHERWOOD	NATURAL FLOW AT SHERWOOD	U..S.A. SHARE	FLOW RECEIVED BY U.S.A.	SURPLUS (+) OR DEFICIT (-) TO U.S.A.
			40% OF 44		(46-45) 40% SHARE
			85510		141385
45678	224781	213777	50% OF 44	226895	(46-45) 50% SHARE
(13+26+30+38)		(42+43-41)		(12+28+43)	

RECOMMENDATION - SECTION 2
ANNUAL FLOW OF LONG CREEK

48	49 *	50
RECORDED FLOW AT WESTERN CROSSING	RECORDED FLOW AT EASTERN CROSSING	SURPLUS (+) OR DEFICIT (-) FROM U.S.A.
25928	30155	4227
		(49-48)

APPENDIX B

Equivalents of Measurements

EQUIVALENTS OF MEASUREMENTS

The following is a list of equivalents of measurement that have been agreed to for use in reports of the International Souris River Board.

1 centimetre equals 0.39370 inch
1 metre equals 3.2808 feet
1 kilometre equals 0.62137 mile

1 hectare equals 10 000 square metres
1 hectare equals 2.4710 acres
1 square kilometre equals 0.38610 square mile

1 cubic metre per second equals 35.315 cubic feet per second

The metric (SI) unit that replaces the British acre-foot unit is the cubic decametre (dam^3), which is the volume contained in a cube 10 m x 10 m x 10 m or 1 000 cubic metres.

1 cubic decametre equals 0.81070 acre-feet
1 cubic metre per second flowing for 1 day equals 86.4 cubic decametres
1 cubic foot per second flowing for 1 day equals 1.9835 acre-feet

APPENDIX C

Interim Measures as Modified in 2000

INTERIM MEASURES AS MODIFIED IN 2000

APPENDIX A TO THE DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board. For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

   For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metre per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam, and Alameda Dam.

   Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

   a. Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.

      i. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or

      ii. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.

   b. Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decametres (40,500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of nature to try to meet existing senior water rights.

c. Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1.

   Releases will not be made by Saskatchewan Watershed Authority from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

d. Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.

e. A determination of the annual apportionment balance shall be made by the Board on or about October 1 of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.

f. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metre per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Watershed Authority, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. (a) In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

   (b) In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.

4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.

5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15, 1940, unless before that time these interim measures are qualified or modified by the Commission.

APPENDIX D

Board Directive from January 18, 2007

DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

This directive replaces the April 11, 2002 Directive to the International Souris River Board and sets out the mandate under which the Board will operate.

1. Pursuant to the Boundary Waters Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the 1989 Agreement. By letters of February 28, 1992, the Commission was requested to monitor compliance with the measures as modified in the 1989 Agreement. By letters of December 20 and 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.

3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department read a statement into the Commission's formal record that the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On April 6, 2006 at the April 2006 Commission's meeting with governments, the Department of Foreign Affairs and International Trade indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designates the entities responsible for operation and maintenance of the improvements mentioned in the 1989 Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the 1989 Agreement. The Department of Army is the entity designated responsible for flood operations within the United States. The Government of Saskatchewan is the Canadian entity designated responsible for flood operations within the Canadian Province of Saskatchewan.

5. The Board's mandate is to support the Commission's initiative to explore and encourage the development of local and regional capacity with the objective of preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Souris River and its tributaries and aquifers. This would be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Souris River basin. The Board's mandate will be accomplished by performing the tasks identified in Clause 6 below.

6. The Board's duties shall be to:

   (i) Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

   (ii) Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:
   - identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,
   - encouraging the appropriate authorities to establish and maintain hydro-climatic monitoring and information collection networks and reporting

systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance,

- informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,
- encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and
- preparing an annual report and submitting it to the Commission.

(iii) Assist the Commission in the review of a Joint Water Quality Monitoring Program (referred to hereafter as "the Program") by:

- developing recommendations on the Program and the setting of water quality objectives,
- exchanging data provided by the Program on a regular basis,
- collating, interpreting, and analyzing the data provided by the Program,
- reviewing the Program and the water quality objectives at least every five years and developing recommendations, as appropriate, to the Commission to improve the Program and the objectives, and
- preparing an annual report containing:
    - a summary of the principal activities of the Board during the year with respect to the Program,
    - a summary of the principal activities affecting water quality in the Souris River Basin during the year,
    - a summary of the collated, interpreted, and analyzed data provided by the Program,
    - a summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary,
    - a section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
    - a section discussing the water quality objectives for the Souris River at the Saskatchewan/North Dakota boundary and at the North Dakota/Manitoba boundary as established and revised pursuant to the 1989 Agreement,
    - a section summarizing other significant water quality changes and the possible causes of such changes, and
    - recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the 1989 Agreement.

(iv) Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:

- ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
- determining whether the operations under the 1989 Agreement should proceed based on the Flood Operation or Non-Flood Operation of the Operating Plan, which is Annex A to the 1989 Agreement, using its criteria and informing designated agencies of this determination;
- reporting to the Commission on any issues related to flood operations and management; and
- providing the Commission and the designated entities under the 1989 Agreement recommendations on how flood operations and coordination activities could be improved.

(v) Report on aquatic ecosystem health issues in the watershed, regularly informing the Commission on the state and implications of aquatic ecosystem health, and encourage the appropriative authorities to establish and maintain water quality and other monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of the health of the aquatic ecosystem.

(vi) Carry out such other studies or activities as the Commission may, from time to time, request.

(vii) Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year. The work plan shall be submitted annually to IJC for review.

7. The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year.

8. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin. The Board shall keep the Commission informed of these activities.

9. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs of the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.

10. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members.

11. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

12. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.

13. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.

14. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.

15. The Board shall inform the Commission in advance of plans for any meetings, or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.

16. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.

17. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.

18. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program and the work plan, as described in Section 6 above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.

19. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by the Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's web site.

20. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

21. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.

22. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this 18th day of January, 2007

Elizabeth C. Bourget
Elizabeth Bourget
Secretary
United States Section

Murray Clamen
Secretary
Canadian Section

APPENDIX E

Water Quality Data for Sherwood and Westhope

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2015 (Jan 1 - Dec 31)
SHERWOOD - STATION 05114000 - USGS

WATER QUALITY PARAMETERS	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA*				2015 ANNUAL DATA				% EXCEEDANCE
			Median	Max	Min	#samples	Median	Max	Min	#samples	
Biological Parameters											
Fecal Coliform	200/100 ml	#/100 ml	30	(8300	- <1)	196	NDA				0
E. coli	in development	#/100 ml	50	(140	- 20)	5	70	(140	- 40)	3	0
Inorganic Parameters											
Ammonia (un-ionized as NH3)	****	mg/L	0.001	(0.025	- <0.001)	222	NDA				0
Chloride	100	mg/L	41.2	(220	- 4)	355	25.35	(53	- 13.4)	8	0
Fluoride	1.5	mg/L	0.2	(1.8	- <0.1)	355	0.175	(0.26	- 0.14)	8	0
NO2+NO3 (as N) dissolved	1	mg/L	0.1	(1.4	- <0.01)	316	0.197	(0.536	- 0.097)	8	0
Phosphorus (total P)	0.1	mg/L	0.19	(1.9	- 0.02)	393	0.255	(0.48	- 0.12)	8	**100**
Sodium	100	mg/L	120	(532	- 14)	353	116	(259	- 61)	8	**62.5**
Sulfate	450	mg/L	237	(1000	- 45)	355	364	(623	- 220)	8	**25**
Arsenic (total)[a]	50	µg/L	<4.0	(28.3	- <0.1)	190	4.75	(8	- 3.5)	8	0
Barium (total)[a]	1000	µg/L	<100	(300	- 14.7)	189	98.85	(121	- 78.9)	8	0
Boron (total)[a]	500	µg/L	188.5	(3500	- 40)	186	136	(280	- 85)	8	0
Beryllium (total)[a]	100	µg/L	<10	(43.5	- <0.02)	189	0.03	(0.11	- <0.02)	8	0
Cadmium (total)[a]	***27	µg/L	<1	(<2	- <0.01)	188	0.041	(0.075	- <0.030)	8	0
Chromium (total)[a]	50	µg/L	<1	(30	- <0.3)	188	8.5	(11.7	- 5.9)	8	0
Cobalt (total)[a]	50	µg/L	0.965	(2.2	- 0.25)	188	0.965	(2.29	- 0.51)	8	0
Copper (total)[a]	***30	µg/L	2.55	(20	- <0.8)	182	3	(5.3	- 1.6)	8	0
Iron (total)[a]	300	µg/L	646	(10000	- 60)	196	1160	(5870	- 330)	8	**100**
Lead (total)[a]	***13	µg/L	<1	(4.54	- 0.1)	182	0.7	(2.46	- 0.18)	8	0
Mercury	0.5 µg/g in fish flesh	µg/L		(	)		NDA				
Molybdenum (total)[a]	10	µg/L	3	(45	- 0.48)	184	3.795	(10.9	- 2.45)	8	**12.5**
Nickel (total)[a]	***220	µg/L	4	(17	- <1)	203	4.55	(7.2	- 3.1)	8	0
Selenium (total)[a]	5	µg/L	<1	(14	- 0.211)	189	0.461	(1.32	- 0.389)	8	0
Zinc (total)[a]	30	µg/L	<30	(620	- <2)	241	6.25	(16.2	- <2.0)	8	**0**

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/MANITOBA BOUNDARY 2015 (Jan 1 - Dec 31)
SHERWOOD - STATION 05114000 - USGS

WATER QUALITY PARAMETERS	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA*				2015 ANNUAL DATA				% EXCEEDANCE
			Median	Max	Min	#samples	Median	Max	Min	#samples	
Miscellaneous											
Total Dissolved Solids	1000	mg/L	738	(2310	- 159)	255	874	(1360	- 554)	8	**37.5**
Total Suspended Solids	the lesser of 10 mg/l or 10% over ambient	mg/L	17	(256	- <1)	231	39	(256	- <15)	8	*
pH (range)	8.5-6.5	standard units	8.1	(9.2	- 6.9)	470	8.2	(8.6	- 7.8)	6	**12.5**
Dissolved Oxygen (conc.)	>5.0	mg/L	8.1	(19.4	- 0)	460	8.55	(11.7	- 5.9)	8	0
Aesthetics		visual					NDA				NDA
Oil and Grease		visual					NDA				NDA
Organic Parameters											
Atrazine	2	µg/L	<0.05	(0.03	- <0.001)	31	0.0031	(0.004	- 0.0028)	3	0
Bromoxynil	5	µg/L	<0.006	(<0.006	- <0.006)	11	<0.003	(<0.003	- <0.003)	6	0
Carbaryl	90	µg/L	<0.003	(<0.003	- <0.003)	23	<0.003	(<0.003	- <0.003)	6	0
Chlordane	0.0043	µg/L	<0.10	(0.1	- <0.10)	40	NDA				0
DDT	0.001	µg/L	<0.01	(0.02	- <0.01)	40	NDA				0
Dieldrin	0.0019	µg/L	<0.01	(0.03	- <0.01)	40	NDA				0
Dicamba	IN DEVELOPMENT	µg/L	<0.01	(<0.01	- <0.01)	22	<0.01	(<0.01	- <0.01)	6	0
Diclofop-methyl	IN DEVELOPMENT	µg/L	NDA				NDA				0
Heptachlor	0.0038	µg/L	<0.01	(0.15	- <0.01)	40	NDA				0
MCPA	0.2	µg/L	0.0031	(0.019	- <0.0023)	15	0.005	(0.005	- 0.0019)	3	0
Parathion	0.04	µg/L	<0.01	(<0.01	- <0.01)	58	<0.01	(<0.01	- <0.01)	6	0
Picloram	0.05	µg/L	<0.01	(<0.01	- <0.01)	22	<0.01	(<0.01	- <0.01)	6	0
Phenols (total)[a]	1	µg/L	<50	(<50	- <50)	233	<50	(<50	- 16)	8	NC
Polychlorinated biphenyl (total)	0.001	µg/L	<0.1	(0.3	- <0.1)	39	NDA	(<0.001	- <0.001)	5	0
Triallate	0.57	µg/L	<0.001	(0.035	- <0.001)	28	<0.001	(	-)	5	0
Trifluralin	0.1	µg/L	<0.002	(0.084	- <0.002)	17	NDA				0
2,4-D	4	µg/L	0.02	(0.013	- 0.0071)	45	0.0165	(0.021	- 0.0013)		0

Notes:

* Water Quality Objective now below detection limit
***based on hardness of 300 mg/L
****unionized ammonia is calculated using temperature and pH
NDA: No Data Available
NC: Not Calculated
< symbol represents samples where parameter was below the reporting limit.
b Due to the difficulty involved in phenol analysis, the historic data was resensored to the highest detection limit that occurred during the period of record (<50).
During this time detection limits have varied between <1 and <50. Values recorded above the method detection limit specific to each sample range from 1 to 26 during the period of record.

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/MANITOBA BOUNDARY 2015 (Jan 1 - Dec 31)
WESTHOPE - STATION 00US05NF0001 - Environment and Climate Change Canada

WATER QUALITY PARAMETERS	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA*				2015 ANNUAL DATA				% EXCEEDANCE
			Median	Max	Min	#samples	Median	Max	Min	#samples	
Biological Parameters											
Fecal Coliform	200/100 ml	#/100 ml	10	2300	0	438	10	126	2	7	0
E. coli	in development	#/100 ml	4	2800	2	58	10	74	2	7	0
Inorganic Parameters											
Ammonia (un-ionized as NH3)	****	mg/L	0.004	0.433	0	223	0.009	0.067	0.0001	7	--
Chloride	100	mg/L	28	297	1.2	589	30.7	50.2	22.9	7	0
Fluoride	1.5	mg/L	0.2	0.98	0.01	632	0.17	0.19	0.12	7	0
NO2+NO3 (as N) dissolved (from 1990)	1	mg/L	0.01	0.997	0.01	226	0.013	0.997	0.01	7	0
Phosphorus (total P) (from 1990)	0.1	mg/L	0.31	4.52	0.09	218	0.216	0.328	0.126	7	**100**
Sodium	100	mg/L	115	1040	6.4	835	146	184	86.9	7	**85.7**
Sulfate	450	mg/L	191	3490	4.8	835	458	544	310	7	**57**
Arsenic (total)[a]	50	µg/L	5.54	33.4	1.87	116	6.37	10.1	3.12	7	0
Barium (total)[a]	1000	µg/L	83	631	0.432	119	65.4	157	40.8	7	0
Boron (total)[a]	500	µg/L	197	2080	41	119	132	181	96.5	7	0
Beryllium (total)[a]	100	µg/L	0.016	0.091	0.001	118	0.01	0.023	0.009	7	0
Cadmium (total)[a]	***27	µg/L	0.022	0.12	0.006	120	0.021	0.069	0.01	7	0
Chromium (total)[a]	50	µg/L	0.293	2.36	0.01	115	0.25	0.43	0.21	7	0
Cobalt (total)[a]	50	µg/L	0.491	4.97	0.172	116	0.613	0.714	0.336	7	0
Copper (total)[a]	***30	µg/L	1.7	4.59	0.41	117	1.57	2.44	1.24	7	0
Iron (total)[a]	300	µg/L	145	14500	7	369	270	602	204	7	**42.9**
Lead (total)[a]	***13	µg/L	0.2625	5.17	0.065	116	0.248	0.552	0.191	7	0
Mercury	0.5 µg/g in fish flesh	µg/L									
Molybdenum (total)[a]	10	µg/L	2.985	35.2	0.591	116	2.655	3.05	2.02	6	0
Nickel (total)[a]	***220	µg/L	3.49	24.7	1.78	120	3.4	4.37	3.08	7	0
Selenium (total)[a]	5	µg/L	0.4	1.81	0.05	118	0.48	0.85	0.4	5	0
Zinc (total)[a]	30	µg/L	1.87	10.7	0.3	119	1.45	3.6	1	6	0

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/MANITOBA BOUNDARY 2015 (Jan 1 - Dec 31)
WESTHOPE - STATION 00US05NF0001 - Environment and Climate Change Canada

WATER QUALITY PARAMETERS	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA*				2015 ANNUAL DATA				% EXCEEDANCE
			Median	Max	Min	#samples	Median	Max	Min	#samples	
Miscellaneous											
Total Dissolved Solids	1000	mg/L	758	3821	111	426	929	1349	691	7	**42.9**
Total Suspended Solids	the lesser of 10 mg/l or 10% over ambient	mg/L	14	300	1	615	10	59	7	7	**42.9**
pH (range)	8.5-6.5	standard units	8.3	10	6.8	496	9.13	9.71	7.56	7	**86**
Dissolved Oxygen (conc.)	>5.0	mg/L	8.4	23.57	0.05	499	20.64	12.28	4.91	7	**14.3**
Aesthetics		visual					NDA				
Oil and Grease		visual					NDA				
Organic Parameters											
Atrazine	2	µg/L	0.1	46.4	0.003	141	NDA				
Bromoxynil	5	µg/L	<0.0213	0.202	0.00099	120	NDA				
Carbaryl	90	µg/L					NDA				
a-Chlordane	0.0043	µg/L	<0.003	0.003	<0.00014	238	NDA				
g-Chlordane	0.0043	µg/L	<0.002	<0.002	<0.00004	238	NDA				
o, p-DDT	0.001	µg/L	<1	<4.0	<0.00004	240	NDA				
Dieldrin	0.0019	µg/L	<0.002	<0.002	<0.00018	280	NDA				
Dicamba	IN DEVELOPMENT	µg/L	<0.03	17.3	<0.00073	157	NDA				
Diclofop-methyl[a]	IN DEVELOPMENT	µg/L	<42.3	<42.3	<7.35	132	NDA				
Heptachlor	0.0038	µg/L	<0.001	<0.56	<0.00014	274	NDA				
MCPA	0.2	µg/L	0.2	153	0.00058	276	NDA				
Parathion	0.04	µg/L	<0.0155	<0.088	<0.0155	25	NDA				
Picloram	0.05	µg/L	<42.3	<0.56	153	17.3	NDA				
Phenols (total)	1	µg/L					NDA				
Polychlorinated biphenyl (total)	0.001	µg/L	<0.00034	<0.0102	<0.00021	45	NDA				
Triallate	0.57	µg/L	<0.00864	0.072	0.0013	139	NDA				
Trifluralin	0.1	µg/L	<0.005	0.01	<0.00266	143	NDA				
2,4-D	4	µg/L	46	289	<0.03	67	NDA				

Notes:

* Water Quality Objective now below detection limit
***based on hardness of 300 mg/L
****unionized ammonia is calculated using temperature and pH
NDA: No Data Available
NC: Not Calculated
< symbol represents samples where parameter was below the reporting limit.
a Historic data calculated from 2003 due to analytical method change

APPENDIX F

Water Quality Monitoring Plan for Sherwood and Westhope

1. Sherwood Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year			
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements
1 (Mar-Jun)	2	2	2	2	2
2 (Jul-Oct)	4	4	4	4	4
3 (Nov-Feb)	1	1	1	1	1
TOTAL	7	7	7	7	7

2. Westhope Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year				
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements	Pesticides
1 (Mar-Jun)	3	3	3	2	3	3
2 (Jul-Oct)	3	3	2	3	2	1
3 (Nov-Feb)	2	2	2	2	2	
TOTAL	8	8	7	7	7	4