

**ANNUAL REPORT OF 2018 DATA FOR
THE LOWER NIOBRARA NATURAL RESOURCES DISTRICT AND
NEBRASKA DEPARTMENT OF NATURAL RESOURCES
INTEGRATED MANAGEMENT PLAN**

Prepared by the Nebraska Department of Natural Resources
For the Annual Meeting September 6, 2019

Introduction

The Lower Niobrara Resources District (LNNRD) and the Nebraska Department of Natural Resources (NeDNR) jointly adopted an Integrated Management Plan (IMP), which became effective on May 1, 2014, with the goal of jointly managing ground and surface water within the LNNRD to sustain a balance between water uses and supplies for the long term. The purpose of this report is to fulfill NeDNR's responsibilities under the IMP annual reporting obligations and provide updates to current monitoring projects or studies as outlined in the IMP.

Reporting and exchanging information gathered from monitoring projects, streamflow data, or other studies provides a basis to increase understanding of the surface water and hydrologically connected groundwater system. The data gathered through the IMP's monitoring plan is designed to evaluate and measure the success of the objectives of the IMP. This information exchange also helps to test the validity of the conclusions and information upon which the IMP is based. This report contains information from January 1 through December 31, 2018.

Data Reported by the Department

The IMP requires that NeDNR report on the following water data within the LNNRD on an annual basis:

1. Streamflow measurements;
2. Surface water permits issued and/or denied;
3. Surface water usage data such as voluntary water use reports, flow meter data, crops irrigated, and acreage irrigated;
4. Groundwater transfers approved; and
5. Offsets provided for depletions resulting from increased consumptive use related to any of the above-listed items.

Details for each of these items follow.

1. Streamflow Measurements

The one-time streamflow measurements made by NeDNR’s field office staff within the LNNRD, in one location, during 2018 are included in Table 1 below.

Table 1. Streamflow measurements taken by NeDNR staff in 2018

ID	Date	Discharge (cfs)	Stream	Location
1	9/20/18	78.4	Big Sandy Creek	SW¼NE¼ Sec. 12-33-14W
2	9/27/18	40.4	Big Sandy Creek	SW¼NE¼ Sec. 12-33-14W

The locations of streamgages yielding continuous streamflow measurements made within the LNNRD by USGS and NeDNR are shown in Figure 1. Daily streamflow measurements from these streamflow gages for calendar year 2018 are shown in Appendix 1. Also on Figure 1 are the streamgages that do not collect discharge data and the inactive gages that may have historical data. This streamflow data can be acquired from USGS’s National Water Information System at <http://waterdata.usgs.gov/>.

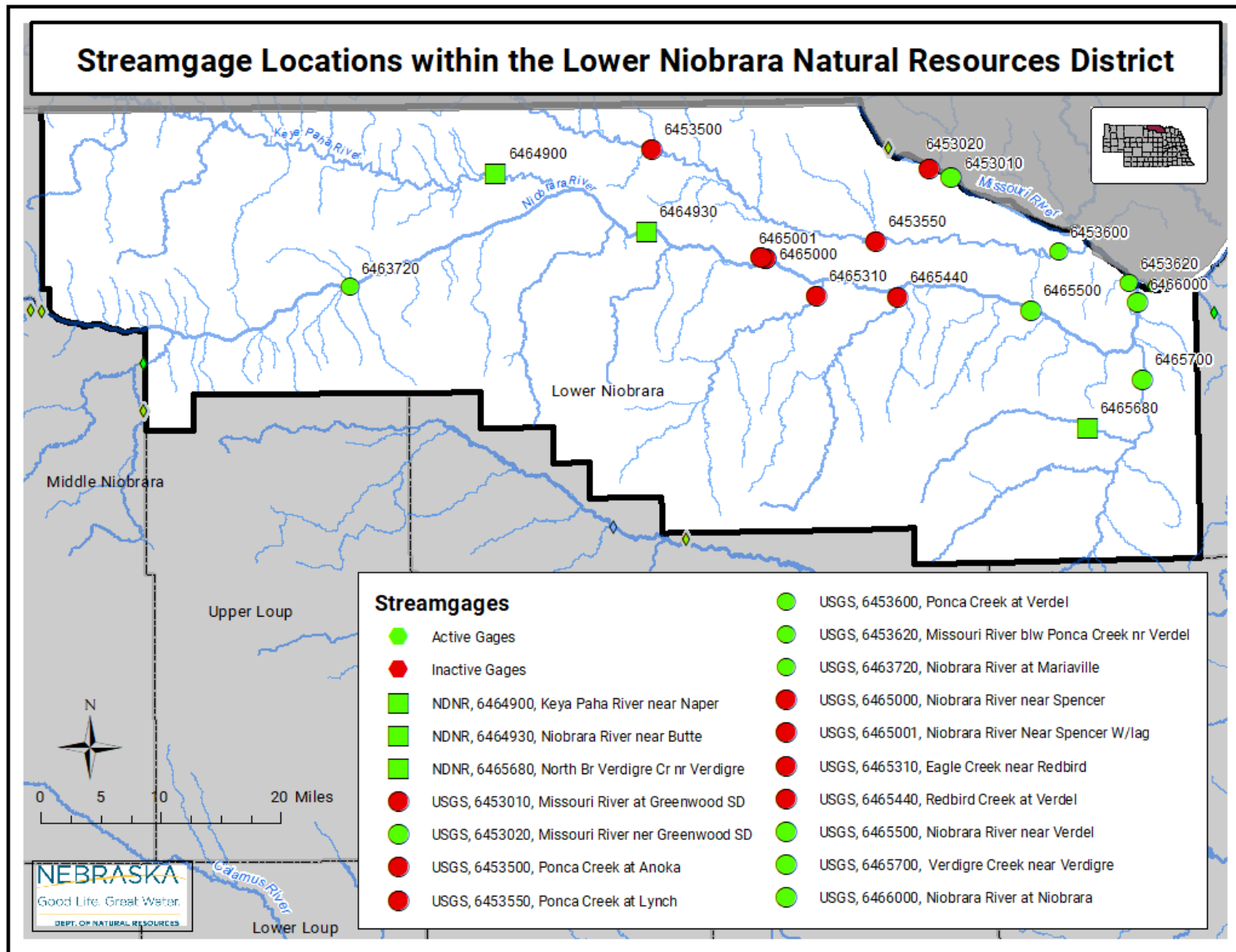


Figure 1. Streamgauge locations within the LNNRD

2. Surface Water Permitting

In 2018, three applications for permits to appropriate surface water were approved by NeDNR, and are listed below in Table 2. Two applications are to provide water for livestock, and one is a temporary permit for construction. Temporary permits are active for no longer than one year. No applications were dismissed or denied.

Table 2. Surface water applications approved during calendar year 2018 within the LNNRD

Surface Water Applications Approved in Calendar Year 2018 within the Lower Niobrara NRD									
Appropriation Number	Approval Date	Location of Diversion or Reservoir	Status	Use	Source	Acres	CFS	AF	Number of New Irrigated Acres
A-19583	5/16/2018	S12-T33N-R14W	Active	Livestock water	Sandy Creek, Big	0	0.01	NA	0
A-19584	5/16/2018	S23-T33N-R14W	Active	Livestock water	Sandy Creek, Big	0	0.01	NA	0
A-19599	6/7/2018	S18-T32N-R6W	Active	(Temporary ¹) Lagoon Construction	Niobrara River	0	0.56	10	0
Totals						0	0.58	10	0

While the IMP does not specifically require the reporting of cancelled surface water appropriations, or transfers of surface water appropriations, NeDNR is providing this information for a more complete picture of surface water permitting activities within the LNNRD.

In 2018, seven permits to irrigate using surface water from a flowing water source (IR), and four permits to irrigate using water stored in a reservoir (SO) were cancelled in-full or in-part, as summarized in Table 3. These result in cancellation of 338.8 acres previously approved for irrigation purposes using naturally flowing surface water, and 123.8 acres of irrigation using stored water. Table 3 lists the basis for NeDNR's action taken on each permit.

One surface water right was transferred in 2018 (Table 4). The transfer was an expedited transfer of the location of use, which means no increase in the number of acres and the diversion point may not change significantly.

¹ Temporary Permits are active no longer than one year.

Table 3. Surface water appropriations cancelled in full or in part during 2018 in the LNNRD

Surface Water Appropriations Cancelled in Full or in Part in Calendar Year 2018 within the Lower Niobrara NRD												
Appropriation Number	Application Approval Date	Cancellation Date	Location of Diversion or Reservoir	Status	Use	Source	Begin Acres	Cancelled Acres	Cancelled CFS	Cancelled AF	Reason for Department Action	Estimate of Last Use Date
A-9078	6/4/1958	1/18/2018	S24-T32N-R12W	Cancelled in Full	IR	Eagle Creek	30.0	30.0	0.43	NA	See Item 2 below	Many years ago
A-18854R	12/31/2014	1/29/2018	S13-T33N-R14W	Active	IR	Sandy Creek, Big	219.3	21.8	0.27	NA	See Item 3 below	Cancelled portion not used
A-18461R	12/2/2014	1/29/2018	S27-T34N-R17W	Active	IR	Oak Creek	120.0	21.1	0.30	NA	See Item 3 below	Cancelled portion not used
A-18988	12/11/2014	1/29/2018	S18-T32N-R8W	Active	IR	Steel Creek	251.9	63.9	0.91	NA	See Item 3 below	Cancelled portion not used
A-18926	12/5/2014	2/15/2018	S2-T31N-R8W	Active	SO	Knigge Reservoir West	55.9	0.5	NA	0	Amended Order ²	Cancelled portion not used
A-18929	12/5/2014	2/15/2018	S2-T31N-R8W	Active	SO	Knigge Reservoir East	74.7	18.2	NA	0	Amended Order ²	Cancelled portion not used
A-10921	9/20/1966	7/5/2018	S20-T31N-R6W	Cancelled in Full	IR	Verdigre Creek	168.0	168.0	2.40	NA	See Item 1 below	Early 1980s
A-15826	5/15/1981	9/17/2018	S17-T32N-R6W	Cancelled in Full	IR	Niobrara River	15.0	15.0	0.21	NA	See Item 1 below	Prior to 1960s

² Follow-up from the NeDNR 2018 Report: A-18926 and A-18929 were reported on in the 2018 report for 2017 activity as being cancelled in part resulting in a total of 55.9, and 56.4 acres remaining, respectively. The Department issued *Amended Order of Cancellation in Part of Water Appropriation A-18926*, and a similar order for A-18929, on February 15, 2018.

Table 3. Continued.

Surface Water Appropriations Cancelled in Full or in Part in Calendar Year 2018 within the Lower Niobrara NRD												
Appropriation Number	Application Approval Date	Cancellation Date	Location of Diversion	Status	Use	Source	Begin Acres	Cancelled Acres	Cancelled CFS	Cancelled AF	Reason for Department Action	Estimate of Last Use Date
A-19087	11/25/2015	10/18/2018	S19-T34N-R14W	Active	SO	Williamson Irrigation Reservoir	147.2	65.1	NA	0.0	See Item 3 below	Not used
A-11811	10/10/1969	11/29/2018	S35-T32N-R15W	Cancelled in Full	SO	Timmermans Reservoir	40.0	40.0	NA	11.69	See Item 2 below	Prior to 15 years ago
A-18515	12/31/2014	11/29/2018	S12-T33N-R14W	Active	IR	Sandy Creek, Big	109.0	19.0	0.27	NA	See Item 3 below	Cancelled portion not used
Totals							1,231.0	462.6	4.79	11.69	-	-

Basis for NeDNR Actions noted in Table 3

1. The Department found that the appropriation had not been used in the last five years, and the owner did not successfully contest the preliminary determination of nonuse.
 Authority upon which the action was based: *Neb. Rev. Stat. §§ 46-229.02(1) through 46-229.02(6)*: If the Department makes a preliminary determination that an appropriation has not been used for more than five consecutive years, and the owner of said appropriation does not successfully contest the determination, the Department may cancel said appropriation in whole or part.
2. The owner signed and submitted a voluntary relinquishment for the entire, or a portion of, the surface water appropriation.
 Authority upon which the action was based: *Department Rules for Surface Water, Neb. Admin. Code. Title 457, Chapter 3*: Any appropriation, or part of any appropriation, may be voluntarily relinquished. The relinquishment shall be made on a form provided by the Department.
3. The appropriator failed to perfect all or part of the appropriation in the time allowed.
 Authority upon which the action was based: *Neb. Rev. Stat. §46-229.02(7)*: A water appropriation that has not been perfected pursuant to the terms of the permit may be canceled by the department without complying with sections 46-229.01 to 46-229.04 if the owner of such appropriation fails to comply with any of the conditions of approval in the permit, except that this subsection does not apply to appropriations to which subsection (2) of section 46-237 applies.

Table 4. Surface water appropriations that were transferred during 2018 in the LNNRD

Surface Water Appropriations Transferred within the Lower Niobrara NRD									
Appropriation Number	Application Approval Date	Transfer Approval Date	Location of Diversion	Transfer Type	Use	Source	Acres	CFS	AF
A-18854R	12/31/2014	5/16/2018	S13-T33N-R14W	Expedited Transfer of the Location of Use	Irrigation	Sandy Creek, Big	197.5	2.82	NA

3. Voluntary Surface Water Usage Reporting

NeDNR received responses from 92 surface water users in the LNNRD out of a possible 393, a 25% response rate, to its voluntary surface water use reporting program in 2018. This response rate is the same as in 2017. A total of 10,044 acres were reported, categorized by irrigated vs. non-irrigated and an estimation of water use, or unknown water use. This acreage is up from the 2018 reported 9,264 acres. Crop types reported include: corn, forage/hay/grass, alfalfa, millet, CRP, fallow, soybeans, dry edible beans, and other. The reported data on water use is shown in Table 5.

Table 5. Voluntarily reported surface water use in 2018, within the LNNRD.

	Reported Acres		Reported Acres	Estimated water use in 2018
Irrigated	6,976	Irrigated, estimated water use	5,242	1,270 AF or 6.6 "/Acre
		Irrigated, no estimate of use	1,734	Not Available
Non-Irrigated	3,068	N/A		
Total Reported Acres	10,044			

4. Groundwater Transfers

NeDNR did not act on any groundwater transfer permit applications during 2018.

5. Offsets approved

No offsets were required in 2018.

Department Education and Outreach Activity and Interagency Coordination in 2018

Each year, NeDNR dedicates a portion of staff time and resources to education and outreach efforts that promote a better understanding of integrated water management and why it is important to the state’s citizens. NeDNR’s outreach efforts range from informal conversations with local citizens about how we envision and strive for collaborative water management, to more complex presentations, discussions and demonstrations about the hydrologic connection between surface and groundwater.

In 2018, NeDNR staff attended several events across Nebraska. This provided many people who otherwise may not have had direct contact with NeDNR staff an opportunity to learn about NeDNR in general and the Water Planning Division’s focus on integrated water management specifically. NeDNR staff discussed IMPs and fielded questions. The NeDNR staff set up educational booths at the Nebraska State Fair, Husker Harvest Days, the Nebraska Women in Agriculture conference, Nebraska Association of Resource Districts conferences, Nebraska State Irrigation Association/Nebraska Water Resources Association joint convention, the Nebraska Planning and Zoning Association/American Planning Association--Nebraska Planning conference.

In addition to NeDNR’s web portal, INSIGHT, which provides citizens with a convenient and user-friendly experience when they need to access water resources related information or data, the Water Planning Division debuted the first of a series of new educational interactive apps, which can be found on NeDNR’s website. Currently, for example, users can explore how the relative positions of the water table and stream levels affect the direction of flow and rate of interaction between the stream and aquifer, or how soil textures affect recharge and streamflow. The app features a tutorial, as well as a description and hydrograph of the user’s effect on streamflow. Users can transition between different simulations and conditions using the drop-down menu and slider bar.

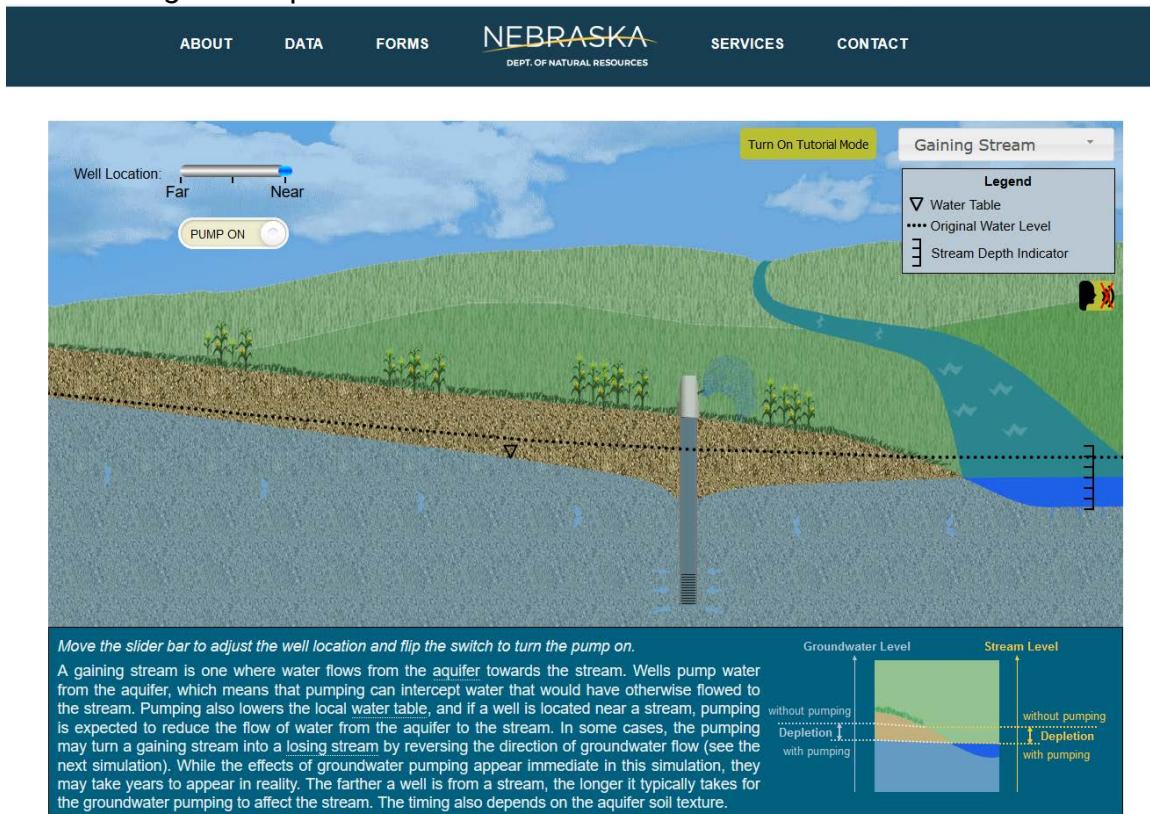


Figure 2. One of the educational interactive apps on the NeDNR website.

NeDNR staff attended the annual Niobrara basin retreat in July 2018, hosted by Middle Niobrara NRD near Valentine, Nebraska. This meeting is meant as a networking and coordination opportunity for Niobrara basin NRDs and various agencies and consultants, including NeDNR, the Nebraska Department of Environmental Quality (now the Nebraska Department of Energy and the Environment), Nebraska Association of Resources Districts, University of Nebraska-Lincoln, and others. At this meeting, NeDNR staff gave updates on various IMP-related activities in the basin.

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
1/1/2018	53	939	21.5	658	1510	110
1/2/2018	52	927	21.4	686	1510	110
1/3/2018	51	944	21.1	797	1550	111
1/4/2018	49	1060	20.8	862	1650	114
1/5/2018	47	1200	20.5	896	1800	114
1/6/2018	45	1400	20.2	825	1900	114
1/7/2018	48	1540	20.1	921	2000	114
1/8/2018	56	1680	20.2	1040	2140	120
1/9/2018	69	1830	20.3	1150	2310	124
1/10/2018	83	2040	20.2	1230	2450	126
1/11/2018	69	1960	19.9	1170	2460	125
1/12/2018	57	1750	19.8	971	2390	112
1/13/2018	54	1620	19.9	866	2220	108
1/14/2018	54	1350	20.1	1120	2050	106
1/15/2018	47	1380	20.1	1160	1950	105
1/16/2018	45	1400	19.8	983	1940	103
1/17/2018	45	1330	19.6	1040	2000	108
1/18/2018	42	1600	19.5	1150	2020	114
1/19/2018	57	1440	19.9	1350	2140	118
1/20/2018	60	1620	20.2	1470	2310	126
1/21/2018	61	1870	20.4	1460	2380	131
1/22/2018	59	2020	20.5	1410	2430	132
1/23/2018	59	1940	20.5	1340	2440	127
1/24/2018	61	1920	20.5	1320	2430	117
1/25/2018	63	1900	20.6	1380	2410	111
1/26/2018	66	1940	20.6	1440	2400	113
1/27/2018	70	1960	20.7	1450	2410	121
1/28/2018	59	1960	20.9	1360	2430	122

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Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
1/29/2018	58	1940	21.4	1270	2410	114
1/30/2018	68	1820	21.7	1320	2370	111
1/31/2018	79	1880	21.9	1410	2380	121
2/1/2018	72	1940	22	1390	2410	114
2/2/2018	94	1940	21.9	1410	2420	112
2/3/2018	113	1940	21.9	1490	2430	116
2/4/2018	98	1940	21.7	1390	2430	115
2/5/2018	93	1800	21.6	1310	2390	108
2/6/2018	88	1600	21.5	1270	2320	106
2/7/2018	83	1600	21.5	1280	2180	104
2/8/2018	80	1540	21.7	1340	2130	103
2/9/2018	70	1640	21.6	1260	2140	107
2/10/2018	65	1600	21.6	1070	2090	105
2/11/2018	65	1520	21.5	1110	2020	104
2/12/2018	61	1360	21.4	1150	1950	103
2/13/2018	71	1390	21.6	1190	1880	105
2/14/2018	92	1550	22.2	1360	1890	111
2/15/2018	93	1490	22.4	1450	1960	113
2/16/2018	91	1590	22.6	1410	2060	114
2/17/2018	93	1640	22.6	1450	2150	109
2/18/2018	108	1740	22.9	1500	2220	118
2/19/2018	102	1690	23.5	1440	2210	121
2/20/2018	95	1640	23.8	1300	2140	118
2/21/2018	92	1430	24	1020	2050	110
2/22/2018	89	1290	24.2	1090	1970	108
2/23/2018	86	1290	24.3	1160	1910	105
2/24/2018	84	1340	24.7	1270	1900	103
2/25/2018	85	1390	25.3	1380	1840	102

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Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
2/26/2018	97	1190	26	1460	1950	104
2/27/2018	99	1710	26.5	1540	2050	114
2/28/2018	99	1760	27.2	1630	2170	122
3/1/2018	107	1760	30.1	1660	2320	128
3/2/2018	116	1860	49.8	1680	2490	137
3/3/2018	130	2120	82.5	1800	2820	144
3/4/2018	148	2640	126	2100	3070	160
3/5/2018	147	2740	158	2250	3170	181
3/6/2018	142	2370	166	2010	3090	237
3/7/2018	133	2390	185	1840	2980	324
3/8/2018	153	2230	218	1900	2900	302
3/9/2018	186	2230	221	1890	2900	281
3/10/2018	220	2400	226	1940	2940	300
3/11/2018	216	2250	239	1970	2990	296
3/12/2018	288	2320	234	1970	3150	263
3/13/2018	320	2790	243	1990	3470	266
3/14/2018	417	3060	274	2040	4270	273
3/15/2018	556	3890	450	2030	4750	307
3/16/2018	680	3700	450	2080	4900	346
3/17/2018	793	3440	456	2030	4960	391
3/18/2018	834	3530	403	1980	4950	333
3/19/2018	828	3970	408	2100	5120	319
3/20/2018	812	4260	454	2200	5100	313
3/21/2018	707	3650	476	2230	5530	302
3/22/2018	666	3260	435	2230	4800	287
3/23/2018	632	3400	480	2260	4780	283
3/24/2018	737	3760	644	2230	5300	300
3/25/2018	746	3710	620	2310	4490	279

Appendix 1 – Discharge in cubic feet per second

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Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
3/26/2018	612	3640	462	2220	4690	269
3/27/2018	539	3230	378	2160	3870	276
3/28/2018	463	2960	351	2150	3550	273
3/29/2018	420	3130	333	1980	3380	262
3/30/2018	385	2720	312	1920	3160	242
3/31/2018	369	3040	285	1890	3090	212
4/1/2018	347	3020	259	1870	2660	197
4/2/2018	323	3230	238	1750	2690	205
4/3/2018	309	3030	232	1700	2840	224
4/4/2018	285	3190	218	1690	3120	213
4/5/2018	310	3220	211	1660	3220	234
4/6/2018	359	3210	209	1610	2940	201
4/7/2018	364	3200	206	1670	2710	192
4/8/2018	415	3310	202	1740	2820	205
4/9/2018	370	3050	200	1800	2730	207
4/10/2018	395	3350	194	1880	2590	207
4/11/2018	424	3420	190	1830	2420	215
4/12/2018	445	3120	188	1790	2190	207
4/13/2018	485	3090	198	1870	2480	224
4/14/2018	425	2730	276	2000	2790	272
4/15/2018	262	3430	225	1820	3170	234
4/16/2018	270	3530	200	1710	2560	235
4/17/2018	417	3610	281	1850	2470	325
4/18/2018	615	4520	420	1970	3220	365
4/19/2018	743	4600	513	2000	4220	409
4/20/2018	1170	4500	667	2000	4090	408
4/21/2018	1440	3850	905	1990	4070	336
4/22/2018	1510	3330	979	1940	3850	302

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
4/23/2018	1490	3450	1270	1840	3860	272
4/24/2018	1380	3610	1440	1770	3530	227
4/25/2018	1240	3730	1140	1680	3180	221
4/26/2018	937	3160	844	1640	3080	215
4/27/2018	643	2920	672	1630	3010	202
4/28/2018	421	2680	566	1710	2860	191
4/29/2018	335	2750	472	1770	2520	186
4/30/2018	380	2550	410	1770	2810	192
5/1/2018	478	2600	398	1730	2720	279
5/2/2018	376	2600	340	1720	2570	245
5/3/2018	313	2730	310	1890	2720	223
5/4/2018	275	2950	295	1940	2580	263
5/5/2018	260	2770	275	2030	2210	239
5/6/2018	235	2820	255	1960	2030	214
5/7/2018	212	3710	231	1880	2160	202
5/8/2018	269	3920	223	1820	2490	190
5/9/2018	285	3870	237	1820	2420	176
5/10/2018	332	3290	228	1710	2350	168
5/11/2018	368	4420	230	1750	2750	219
5/12/2018	586	3980	251	1910	2810	207
5/13/2018	365	3460	283	1780	2960	202
5/14/2018	373	3410	302	1640	2570	210
5/15/2018	589	3690	302	1710	2580	206
5/16/2018	554	3230	275	1750	2590	195
5/17/2018	446	3310	248	1670	2360	181
5/18/2018	562	3710	235	1700	2650	170
5/19/2018	968	3890	290	1790	2970	188
5/20/2018	500	3560	314	1810	3430	226

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
5/21/2018	360	3330	323	1770	3600	210
5/22/2018	359	3410	291	1820	3550	232
5/23/2018	426	3420	270	1880	3360	224
5/24/2018	578	3410	264	1990	3370	205
5/25/2018	707	2890	281	1850	3580	193
5/26/2018	992	2870	247	1860	4080	178
5/27/2018	581	2950	213	1720	4180	169
5/28/2018	346	3030	189	1680	3720	162
5/29/2018	295	3000	169	1640	3020	168
5/30/2018	375	2940	156	1590	2690	171
5/31/2018	278	2570	145	1610	2690	156
6/1/2018	231	2520	137	1680	2540	148
6/2/2018	379	2630	142	1580	3380	199
6/3/2018	682	2380	157	1220	2730	171
6/4/2018	470	2280	145	1230	2270	156
6/5/2018	272	2030	132	1370	2620	145
6/6/2018	203	1960	121	1460	3130	138
6/7/2018	198	2200	126	1480	3370	169
6/8/2018	165	2110	161	1460	2970	184
6/9/2018	255	2180	208	1530	2660	197
6/10/2018	450	2150	304	1500	2300	204
6/11/2018	498	2230	275	1510	2250	177
6/12/2018	346	2610	214	1470	2270	165
6/13/2018	231	2710	190	1440	2220	172
6/14/2018	193	2570	156	1440	2530	171
6/15/2018	172	2750	140	1440	2480	151
6/16/2018	166	2950	131	1420	2780	138
6/17/2018	164	3140	127	1430	3030	151

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
6/18/2018	185	3460	127	1690	3020	265
6/19/2018	247	3420	124	1980	3040	244
6/20/2018	875	3430	129	2150	3180	277
6/21/2018	953	3530	176	1990	3400	504
6/22/2018	927	3730	230	1930	3350	383
6/23/2018	859	3630	228	1900	3370	281
6/24/2018	743	3060	238	1960	3130	244
6/25/2018	783	3090	248	1980	3240	333
6/26/2018	1100	2820	258	1720	3890	432
6/27/2018	957	2520	278	1730	4000	289
6/28/2018	702	2390	337	1650	3800	248
6/29/2018	453	2130	254	1570	3350	216
6/30/2018	363	2130	216	1510	3220	214
7/1/2018	355	2620	239	1510	3700	275
7/2/2018	344	3120	257	1580	3280	246
7/3/2018	386	2920	214	1640	3270	210
7/4/2018	405	2920	188	1770	3280	223
7/5/2018	717	3010	274	1560	4520	410
7/6/2018	423	2440	536	1710	3870	286
7/7/2018	271	2230	303	1540	3370	238
7/8/2018	203	2230	207	1430	2840	187
7/9/2018	161	2390	158	1300	2630	177
7/10/2018	129	2370	128	1190	2480	158
7/11/2018	105	2070	108	1110	2300	152
7/12/2018	91	2200	92.1	1120	2090	149
7/13/2018	211	2980	208	1450	3420	479
7/14/2018	799	2620	584	1450	3710	314
7/15/2018	523	2140	392	1400	3350	198

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
7/16/2018	416	2320	361	1270	2770	180
7/17/2018	335	2570	286	1230	4040	176
7/18/2018	253	2240	430	1290	3180	214
7/19/2018	242	2180	1,610	1280	4210	412
7/20/2018	217	1730	1,210	1220	2560	387
7/21/2018	205	1410	623	1220	2300	275
7/22/2018	186	1470	385	1260	2310	212
7/23/2018	189	1700	271	1300	2610	178
7/24/2018	172	1690	207	1320	2680	151
7/25/2018	154	1810	177	1260	2810	141
7/26/2018	153	1940	164	1210	2330	136
7/27/2018	161	1970	141	1180	2460	143
7/28/2018	144	2050	576	1130	3370	611
7/29/2018	131	2050	1,470	1150	2550	507
7/30/2018	149	2340	553	1220	2450	330
7/31/2018	208	2270	435	1150	2540	257
8/1/2018	384	2120	320	1150	2590	214
8/2/2018	289	1930	232	1100	2690	193
8/3/2018	212	1860	204	1120	2820	203
8/4/2018	243	2110	1,090	1170	3850	330
8/5/2018	162	1530	1,030	1090	3260	289
8/6/2018	180	1690	482	1120	2400	256
8/7/2018	399	1650	325	1110	2470	219
8/8/2018	153	1470	362	1090	2540	189
8/9/2018	124	1480	273	1070	2430	172
8/10/2018	107	1460	211	1070	2270	162
8/11/2018	94	1400	176	1060	2140	170
8/12/2018	81	1330	154	1040	2060	167

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
8/13/2018	74	1210	138	1020	2050	166
8/14/2018	65	1190	125	1020	2050	185
8/15/2018	74	1300	114	1080	2040	256
8/16/2018	169	1790	120	1230	2540	277
8/17/2018	334	1750	148	1190	2590	262
8/18/2018	257	1680	172	1170	2550	214
8/19/2018	233	1740	274	1170	2360	282
8/20/2018	254	2060	257	1230	2470	282
8/21/2018	379	1970	365	1150	2210	225
8/22/2018	316	1980	272	1150	2280	206
8/23/2018	249	1790	243	1120	2190	204
8/24/2018	197	1620	211	1110	2040	198
8/25/2018	75	1600	183	1110	1840	182
8/26/2018	145	1570	162	1110	1760	163
8/27/2018	121	1550	148	1120	1810	168
8/28/2018	116	1570	141	1130	1830	188
8/29/2018	106	1570	141	1110	1750	175
8/30/2018	102	1540	132	1090	1680	155
8/31/2018	101	1530	121	1100	1650	160
9/1/2018	98	1620	111	1090	1750	166
9/2/2018	95	1630	106	1100	1800	168
9/3/2018	90	1590	99.9	1100	1810	177
9/4/2018	92	1640	101	1110	1990	224
9/5/2018	147	1750	171	1080	2500	345
9/6/2018	107	1580	156	1090	2000	267
9/7/2018	94	1520	131	1090	1690	226
9/8/2018	91	1470	117	1100	1520	213
9/9/2018	93	1500	117	1110	1470	187

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
9/10/2018	103	1580	104	1130	1570	182
9/11/2018	103	1520	96.8	1090	1750	186
9/12/2018	99	1460	91.0	1080	1620	175
9/13/2018	102	1430	81.5	1080	1550	174
9/14/2018	96	1440	76.7	1080	1560	180
9/15/2018	89	1430	75.1	1090	1600	172
9/16/2018	83	1440	69.1	1080	1660	167
9/17/2018	82	1440	62.7	1090	1680	178
9/18/2018	87	1460	60.5	1080	1660	164
9/19/2018	94	1490	60.7	1110	1700	163
9/20/2018	457	1930	149	1230	3190	271
9/21/2018	342	1600	1,090	1150	3450	258
9/22/2018	292	1480	520	1100	2770	219
9/23/2018	260	1540	323	1110	2460	199
9/24/2018	229	1650	242	1080	2300	189
9/25/2018	234	1720	207	1220	2290	184
9/26/2018	236	1600	204	1280	2280	176
9/27/2018	221	1550	207	1360	2040	172
9/28/2018	204	1720	189	1450	2240	175
9/29/2018	197	1650	171	1490	2110	177
9/30/2018	191	1580	161	1430	1880	165
10/1/2018	187	1860	153	1520	2070	172
10/2/2018	181	1710	150	1570	2220	172
10/3/2018	173	1870	147	1640	2200	166
10/4/2018	158	1840	140	1660	2070	172
10/5/2018	153	1860	139	1660	2200	218
10/6/2018	155	1960	133	1570	2170	194
10/7/2018	165	2070	127	1620	2080	175
10/8/2018	190	1940	130	1570	2330	192

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
10/9/2018	257	2050	159	1650	2640	259
10/10/2018	455	2040	389	1750	3440	470
10/11/2018	439	1950	752	1660	3010	343
10/12/2018	326	1960	538	1600	2890	254
10/13/2018	303	1820	493	1630	3240	226
10/14/2018	319	1930	410	1730	2650	233
10/15/2018	295	1850	369	1620	2690	228
10/16/2018	284	1890	344	1400	2940	211
10/17/2018	305	1760	336	1440	2660	213
10/18/2018	304	1850	305	1390	2790	206
10/19/2018	316	1710	277	1550	2530	215
10/20/2018	325	1590	250	1490	2090	200
10/21/2018	306	1450	231	1390	1880	202
10/22/2018	286	1450	219	1410	2000	195
10/23/2018	267	1550	208	1410	2950	189
10/24/2018	241	1640	203	1440	2400	176
10/25/2018	238	1940	201	1440	2430	194
10/26/2018	230	1950	214	1460	1980	210
10/27/2018	226	2010	212	1520	1970	209
10/28/2018	228	2000	201	1530	2040	211
10/29/2018	224	1930	192	1430	2140	209
10/30/2018	216	1850	183	1400	2300	197
10/31/2018	212	2010	180	1440	2260	190
11/1/2018	215	1920	175	1450	2160	191
11/2/2018	218	1870	170	1350	2140	175
11/3/2018	227	1770	173	1530	2040	194
11/4/2018	227	2080	181	1530	2290	222
11/5/2018	234	2090	189	1640	2250	218
11/6/2018	239	2170	199	1590	2410	213

Appendix 1 – Discharge in cubic feet per second

	DNR Keya Paha River @ Naper	DNR Niobrara River @ Butte	USGS Ponca Creek @ Verdel	USGS Niobrara River @ Mariaville	USGS Niobrara River @ Verdel	USGS Verdigre Creek @ Verdigre
Gage Number	6464900	6464930	6453600	6463720	6465500	6465700
11/7/2018	240	2100	194	1560	2240	200
11/8/2018	227	2220	186	1520	2250	196
11/9/2018	219	2120	181	1560	1950	198
11/10/2018	177	1450	---	1560	1220	184
11/11/2018	166	1640	Ice	1650	1820	188
11/12/2018	161	1690	---	1590	2300	192
11/13/2018	167	1270	---	1510	2300	192
11/14/2018	166	1690	---	1480	2580	205
11/15/2018	174	1920	Ice	1580	2840	208
11/16/2018	177	1680	Ice	1620	2820	204
11/17/2018	177	1670	Ice	1570	3070	206
11/18/2018	176	1370	Ice	1580	1860	185
11/19/2018	169	1700	Ice	1480	2490	192
11/20/2018	166	1370	Ice	1580	1740	184
11/21/2018	165	1390	Ice	1600	1690	185
11/22/2018	165	1420	127	1540	1590	200
11/23/2018	171	1460	116	1580	1900	203
11/24/2018	171	1900	120	1530	2440	196
11/25/2018	165	1960	125	1580	2390	181
11/26/2018	151	1690	118	1510	1910	177
11/27/2018	140	1670	Ice	1580	1970	185
11/28/2018	144	1730	Ice	1520	2130	201
11/29/2018	141	1730	109	1630	2320	218
11/30/2018	151	1730	117	1680	2100	219
12/1/2018	168	2130	156	1780	Ice	283
12/2/2018	171	2580	Ice	1790	Ice	301
12/3/2018	169	1900	---	1790	Ice	267
12/4/2018	165	1820	---	1740	Ice	255
12/5/2018	133	1720	---	1690	Ice	230

Appendix 1 – Discharge in cubic feet per second

Gage Number	DNR Keya Paha River @ Naper 6464900	DNR Niobrara River @ Butte 6464930	USGS Ponca Creek @ Verdel 6453600	USGS Niobrara River @ Mariaville 6463720	USGS Niobrara River @ Verdel 6465500	USGS Verdigre Creek @ Verdigre 6465700
12/6/2018	123	1660	Ice	1890	Ice	243
12/7/2018	81	1140	Ice	1650	Ice	238
12/8/2018	50	880	Ice	1460	Ice	225
12/9/2018	56	1090	Ice	1400	Ice	246
12/10/2018	67	1190	Ice	1390	Ice	216
12/11/2018	92	1440	Ice	1360	Ice	241
12/12/2018	117	1500	Ice	1340	Ice	259
12/13/2018	152	2160	Ice	1410	Ice	254
12/14/2018	154	1910	Ice	1370	Ice	239
12/15/2018	153	2130	Ice	1380	Ice	233
12/16/2018	148	2130	Ice	1340	Ice	229
12/17/2018	163	2100	Ice	1280	Ice	234
12/18/2018	175	2190	Ice	1280	Ice	251
12/19/2018	194	2190	Ice	1320	Ice	262
12/20/2018	177	2400	Ice	1380	Ice	277
12/21/2018	181	2330	Ice	1400	Ice	267
12/22/2018	200	2330	Ice	1400	Ice	255
12/23/2018	200	2180	Ice	1370	Ice	245
12/24/2018	200	1920	Ice	1370	Ice	234
12/25/2018	168	1870	Ice	1380	Ice	228
12/26/2018	164	1870	Ice	1390	Ice	236
12/27/2018	125	1330	Ice	1370	Ice	349
12/28/2018	83	380	Ice	1370	---	545
12/29/2018	127	490	Ice	1360	---	1,340
12/30/2018	166	570	Ice	1420	---	1,840
12/31/2018	195	1560	Ice	1450	Ice	1,820