ORIGINAL

BEFORE THE NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

In the Matter of a Public Hearing Regarding the Preliminary Determination that the Lower Platte River Basin is Fully Appropriated	)	TRANSCRIPT VOLUME I of I Pages 1 through 84 Exhibits 1-17

Fremont City Auditorium
925 North Broad Street
Fremont, NE

Convened, pursuant to notice, at 1:30 p.m., on March 12, 2009,

BEFORE:

RON THEIS, Hearing Officer.

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State of Nebraska
Department of
Natural Resources
Filed in the Department of
Natural Resources at 4:00
O'clock P M. this 19th
day of March 20 09
CB

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EXHIBITS:	Marked	Offered	Ruled On	Found
1 Notice of Preliminary Determination that the Lower Platte River Basin is Fully Appropriated (3 pages)	6	10	10	Appendix
2 Proof of Publication of Public Notice in Norfolk Daily News, Fremont Tribune, The Ord Quiz, and Lincoln Journal Star, (5 pages)	6	10	10	Appendix
3 Written Testimony of Galen Furstenau (3 pages)	6	--	--	Appendix
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5 Written Testimony of Jaron Bromm, Fennemore Craig, P.C. (50 pages)	12	12	12	Appendix
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8 USGS: Trends in Streamflow Characteristics of Selected Sites in the Elkhorn River, Salt Creek, and Lower Platte River Basins, Eastern Nebraska, 1928-2004, and Evaluation of Streamflows in Relation to Instream-Flow Criteria, 1953-2004 (125 pages)	35	35	--	Appendix
9 Written Testimony of Sand Hills Golf Club (8 pages)	62	62	--	Appendix
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15 Written Testimony of Daniel G. Crouchly, Senior Vice President, General Counsel, MUD (3 pages)	84	84	84	Appendix
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Reporter's Certificate 5

REPORTER'S CERTIFICATE:

State of Nebraska)
) ss.
County of Lancaster)

I, WENDY C. CUTTING, reporter for GENERAL REPORTING SERVICE, certify that I reported the proceedings in this matter; that the transcript of testimony is a true, accurate and complete extension of the recording made of those proceedings; that the transcript consists of:

Volume I -- Pages 1 through 84, and Exhibits 1 through 17; and further, that the disposition of said exhibits is referenced in the index hereto.

IN TESTIMONY WHEREOF, I have hereunto set my hand at Lincoln, Nebraska, this 19th day of March, 2009.

Wendy C. Cutting
Reporter

- - -

1 PROCEEDINGS:

2 (Exhibits 1 through 4 were marked for

3 identification.)

4 THE HEARING OFFICER: Good afternoon. It's March

5 12, 2009. It's 1:30 p.m. We're located at the Fremont City

6 Auditorium. My name is Ron Theis. I'm a legal counsel for

7 the Department of Natural Resources, and I'll be the hearing

8 officer for this hearing. Brian Dunnigan, the Director of

9 the Department, is unable to be here today. He is in Denver

10 for the hearings on the Republican River Basin arbitration.

11 There are a couple of other Department staff here, Susan

12 France, who's the Assistant to the Director, and Jesse

13 Bradley, who is the Integrated Water Management Analyst, one

14 of them for the Department, are here. This is Wendy

15 Cutting. She's the court reporter who will be making a

16 verbatim record of this hearing.

17 If you haven't done so already, please turn off

18 your cell phone ringers for the duration of this hearing.

19 We have also today, a number of natural resource district

20 managers. I'd like to ask the managers to please stand and

21 tell us who you are. And again, the directors in the

22 audience, if you would introduce them, please.

23 MR. MIYOSHI: I'm John Miyoshi, General Manager of

24 the Lower Platte North NRD, which is the NRD we're in right

25 now. And if the elected officials from the NRD could stand

1 up, please. Bob Meduna from Wahoo; Dean Saalfeld, our
2 chairman, from North Bend; Don Veskerna from the Ashland
3 area; Bill Taylor from the Ames area; Clint Johannes,
4 Richland area; Ralph Pieke from Newman Grove; Ray Casey from
5 Mead; Don Kavan, Morse Bluff; our Fremont crew, Rollie
6 Renter, Gene Acklie, Marv Eden, Dean Johnson; and, on the
7 end, from David City is Bob Hilger.
8 MR. TURNBULL: I'm John Turnbull, General Manager
9 of the Upper Big Blue Natural Resources District in York. I
10 don't believe I have any directors here today.
11 MR. JOHNSON: I'm Glenn Johnson, General Manager
12 of the Lower Platte South NRD, which offices in Lincoln. I
13 have several directors here, Larry Zimmerman, Dean Peterson,
14 Phyllis Hergenrader, Ron Case, Don Jacobson, and Larry
15 Swanson. I think I got all of them. Thank you.
16 MR. WINKLER: I'm John Winkler, General Manager of
17 the Papio-Missouri River NRD located in Omaha. I believe I
18 have two directors, John Conley and Director Japp. Director
19 Conley represents Omaha, Director Japp represents Washington
20 County and those north.
21 MR. SCHUETH: I'm Dennis Schueth, General Manager
22 of the Upper Elkhorn NRD, out of O'Neil. I have one
23 director with me today, Dale Wiles.
24 MR. KOEHLMOOS: I'm Butch Koehlmoos, General
25 manager of Lower Loup NRD out of Ord. We got our board of

directors here. Virgil Gellerman from Columbus, Darwin Sieh from Columbus, Brad Staab from Ord, and Darwin Anderson.

MS. BAUM: I'm Anna Baum, General Manager of the Upper Loup Natural Resources District in Thedford, Nebraska, and we don't have any directors with us today.

MR. ONNENN: I'm Mike Onnen, Manager of Little Blue NRD in Davenport, and I have one director, Mike Allen, from Hastings area.

MR. STAAB: Stan Staab, General Manager of Lower Elkhorn, headquarters out of Norfolk. We have two directors, Tim Tighe from Madison, and Gary Loftis from the Oakland-Craig area, and Elden Wesley from Oakland.

THE HEARING OFFICER: Thank you, managers. And before we close the record on the hearing tomorrow, if you could please send a list of the directors, in writing, so that we spell their names right. Thank you.

The purpose of this hearing is to take testimony on the Department's previously released preliminary determination that the Lower Platte River Basin is fully appropriated, issued December 26, 2008, pursuant to Nebraska Revised Statute 46-713. The preliminary determination was a result of the Department's Annual Evaluation of Expected Availability in Hydrologically Connected Water Supplies in accordance with the Nebraska Groundwater Management and Protection Act, generally referred to as the Annual Report.

1 It was published December 16, 2008, on the Department's
2 website, www.dnr.ne.gov.
3 For the record, in the context here, the
4 Department will be holding other similar hearings -- or has
5 held other similar hearings on the same matter. After the
6 hearing today, the last of the series, an examination of the
7 testimony and all relevant evidence, the Department will
8 make a determination whether the Platte River Basin upstream
9 of the confluence with the Missouri River, including all
10 tributary drainages in the groundwater aquifers considered
11 to be hydrologically connected to that portion of the Platte
12 River Basin will be designated as fully appropriated. The
13 authorities for these hearings and the decisions are set out
14 in Nebraska Revised Statute 47-748.
15 This is a public hearing. It is not an
16 evidentiary hearing. It's simply to gather information from
17 the public. Those testifying will not be required to be
18 sworn in. We have a sign-in sheet identifying the persons
19 wishing to testify. I'll explain at this point how we're
20 going to proceed. Testifiers will use the microphone
21 standing at this podium. If you want to testify, assemble
22 yourself to any empty spaces at this area. It's the on-deck
23 area. The sign-up sheet where you write your name and who
24 you're representing is located here. You don't have to do
25 it beforehand. You'll be able to do it immediately before

1 you make your testimony.

2 I'd also like to note that testimony at this

3 hearing may either be oral or written. Written testimony

4 regarding the preliminary determination that the Lower

5 Platte River Basin is fully appropriated may be submitted to

6 the court reporter at this hearing or may be mailed to the

7 Department. It will be accepted by the Department for

8 inclusion into the record if received by the close of

9 business, Friday, March 13th, 2009, and you state that you

10 want it included in the record.

11 At this point, I'd like to submit for the record a

12 copy of the Notice of the Preliminary Determination. It'd

13 be Exhibit 1.

14 I'd like also to submit the proof of publication

15 pursuant to Nebraska Revised Statute 84-907, stating that

16 the publication of the Department of Natural Resources

17 public hearing notice for this hearing occurred on three

18 consecutive weeks in newspapers of statewide circulation and

19 in newspapers of circulation within the basins. The

20 newspapers were The Ord Quiz, The Norfolk Daily News, The

21 Fremont Tribune, and The Lincoln Journal Star. That would

22 be identified as Exhibit No. 2, and both of those exhibits

23 are now entered into the record.

24 (Exhibits 1 and 2 were received in evidence. See

25 Index.)

1 I'd like to also note for the record, the
2 Department's report for 2009, the Annual Evaluation of the
3 Availability of Hydrologically Connected Water Supplies, as
4 published on the Department's website. This is the material
5 on the subject of this hearing, which the Department will
6 also refer to, in part, on making any final determination.
7 Would you please raise your hand, if you wish to
8 testify today, so that I can get a sense of how many?
9 I'm looking at 12 to 15. I don't see any need to
10 limit the time on the presentations because of that. We
11 will go in -- Well, we won't go in a particular order. I
12 believe there's some testimony to come in from the natural
13 resource districts. I'd like to begin with testimony from
14 the government agencies. That includes natural resources
15 districts.
16 When you come forward to testify, would you please
17 state your name and spell it for the court reporter, and
18 tell who, if anybody, you're representing, if you're
19 representing someone other than yourself. There are
20 undoubtedly going to be some individuals testifying just for
21 themselves today. If you wish to present an exhibit for the
22 record, please identify it and leave a copy for the court
23 reporter. Please speak into the microphone.
24 JARON BROMM
25 MR. BROMM: Thank you, Ron. My name is Jaron

1 Bromm, J-a-r-o-n, B-r-o-m-m. And I'm an attorney with
2 Fennemore Craig, and I, along with Curt Bromm, represent the
3 eight natural resources districts in the Lower Platte River
4 Basin in addition to the Upper Niobrara NRD, regarding the
5 Lower Platte River Basin determination.
6 I have here for the record, a letter, dated March
7 12th, 2009, from myself to Director Dunnigan that I'd like
8 to submit for the record. Included with this letter are
9 three attachments. The first attachment is a Technical
10 Review of the Preliminary Fully Appropriated Determination
11 in the Lower Platte River Basin, authored by Brown and
12 Caldwell, dated March 12th of 2009. Attachment B is an
13 Evaluation of Impacts to Days Needed to Meet 65/85
14 Requirements Under Various Scenarios, also authored by Brown
15 and Caldwell, dated today. And Attachment C is
16 Justification for the Minimal Irrigation Requirements
17 Definition that is Incorporated in the Proposed Rule for
18 Defining a Fully Appropriated Basin, which is a memorandum
19 authored by Dr. Ray Supalla, for the Department of Natural
20 Resources in the negotiated rulemaking process. I'd like to
21 submit that for the record at this time.
22 THE HEARING OFFICER: It's admitted.
23 (Exhibit 5 was marked for the record and received
24 in evidence. See Index.)
25 MR. BROMM: On December 16th of 2008, the

1 Department of Natural Resources issued a preliminary
2 determination concluding that the Lower Platte North -- or
3 Lower Platte River Basin is fully appropriated. Over the
4 past 60 to 90 days or so, we have communicated and
5 coordinated with Director Dunnigan and the DNR staff on
6 behalf of and along with several natural resources
7 districts. For the record, they are the Lower Platte South,
8 Lower Platte North, Upper Elkhorn, Lower Elkhorn, Upper
9 Loup, Lower Loup, Papio-Missouri, Upper Big Blue, and Upper
10 (sic) Niobrara. And I will collectively refer to them
11 during my testimony as the Basin NRDs.
12 Initially, we'd like to express our appreciation
13 for DNR's transparency and professionalism and partnership
14 in working with the Basin NRDs to ensure that the Director
15 has the best science available to make this final
16 determination. It is because of this working relationship
17 that, between DNR and the Basin NRDs, that we are able to
18 provide these substantive comments on the preliminary
19 determination today.
20 I'd like to note just initially for folks here
21 that the preliminary determination was based on current uses
22 plus future impacts from current uses. And that is relevant
23 to the technical discussion that will be coming in a minute,
24 but I just wanted to note that for everybody, that it's
25 current uses plus future impacts from current use.

1 I wanted to note the statutory authority for the
2 NRDs' review of this matter. And the first is in 713(d),
3 which deals with the preliminary determination and gives DNR
4 the authorization to do the preliminary determination. The
5 Legislature specifically asked the NRDs to provide relevant
6 data and information for the annual determination. Then,
7 following that annual -- following the preliminary
8 determination, the Legislature instructed the Department and
9 the natural resources districts to work with water users in
10 developing additional information for the final
11 determination.
12 Nebraska has faced many natural resources
13 challenges in the past, and we will face similar challenges
14 in the future. The Basin NRDs here today have a strong
15 history of responding to our natural resources issues with
16 local control and local solutions. Recognizing these
17 abilities and recognizing the partnership between the NRDs
18 and DNR, the Legislature gave this authority to the NRDs to
19 work with DNR on these issues. And the statutory references
20 we just looked at are an example of that authority.
21 So, the NRDs' review has been partnership focused.
22 As I mentioned, we have been working closely with DNR the
23 last 60 to 90 days in working through some of the questions,
24 some of the issues, to make sure that the Director has the
25 best available science in front of him in order to make this

1 determination. On that note, we are here today to get our
2 information in our review into the record. That said, the
3 Director has heard everything that's being presented today,
4 he's heard already. He's familiar with our concerns. He's
5 familiar with the scientific issues and the technical issues
6 and the legal issues that we've raised. And we've met with
7 him on several occasions to bring him up to speed on those
8 issues.
9 So, our review is both legal and technical. I'm
10 going to be presenting briefly the three major legal issues,
11 three major legal concerns that we have, and Julie Wright,
12 who is on my right, your left, from Brown and Caldwell will
13 be presenting the major technical issues. These do not
14 encompass the total concerns that we raise in our comments,
15 so if you would like to see the sum of our comments, please
16 see Mike Sotek after the hearing. Mike, if you could stand
17 up -- and give him your e-mail address or contact
18 information and we'll make sure you get a copy.
19 The first major legal or regulatory concern
20 relates to the Department's use of the 10/50 area, what's
21 called the 10/50 area. Under the regulation, the projected
22 future impacts from groundwater wells are supposed to be
23 based on impacts from wells located within the
24 hydrologically connected area or the 10/50 area. In
25 reviewing the preliminary determination, we found that the

1 evaluation was not limited to depletions from wells within
2 the 10/50 area. The reason that's a concern is because it
3 appears to be a violation of the regulation or inconsistent
4 with the regulation. And we've recommended to the Director
5 that in the final determination, it be based on impact
6 solely from wells within the 10/50 area.
7 The second major concern deals with the junior
8 appropriator. And under the regulations and applying the
9 65/85 rule, DNR looks at the most junior appropriators to
10 determine whether the water supply is sufficient for that
11 junior appropriator to meet the net corn crop irrigation
12 requirement. Instead of selecting the most junior
13 appropriator, which is what the regulations require, it
14 appears that the preliminary evaluation looked at a junior
15 appropriator with the highest net corn crop irrigation
16 requirement in the basin.
17 And this is a graph or a figure that shows where
18 these appropriators are. And the green dot on the far left
19 is the appropriator that was used in the evaluation, which
20 has a priority date, I believe, of 2000. The most junior in
21 the Basin is on the far right in the Elkhorn River Basin
22 with a priority date of 2007. And the analysis is very
23 sensitive to the junior appropriator chosen. If the most
24 junior in the Elkhorn would be chosen, and everything else
25 were equal, the Basin would not be fully appropriated.

1 The red dot in the middle is the most junior in
2 the Loup River Basin, and the analysis is also sensitive to
3 the use of the junior chosen over the most junior of the
4 Loup.
5 So, to sum up our second legal regulatory concern
6 is, to be consistent with the regulations, the final
7 determination needs to be based on the most junior
8 appropriator, not a junior chosen because of the highest net
9 corn crop irrigation requirement.
10 Our final legal or regulatory concern deals with
11 the Legislature's requirement that the Annual Evaluation be
12 based on the best scientific data and information currently
13 available. And I'm going to turn things over to Julie
14 Wright and I'll let her get set up while I introduce this
15 issue. And I'll summarize this issue after Julie's
16 finished, also, but the regulatory requirement or the legal
17 requirement to use the best science available requires the
18 Department to consider that science in applying its
19 methodology and make sure that that science that it's
20 applying is consistent with the analysis that is supposed to
21 be made.
22 And we've been discussing again, these issues with
23 Jesse Bradley and Jim Schneider, Director Dunnigan, and DNR
24 staff for the past 60 to 90 days and are just presenting
25 this here today for the record, and appreciate your time.

1 I'll be up after Julie's finished on the technical issues.
2 *JULIE WRIGHT*
3 MS. WRIGHT: My name is Julie Wright. I'm with
4 Brown and Caldwell, working with Fennemore Craig and the
5 Basin NRDs.
6 THE HEARING OFFICER: How do you spell your name,
7 Julie?
8 MS. WRIGHT: J-u-l-i-e, W-r-i-g-h-t.
9 I have two issues to talk about today. One
10 concerns an error in calculating groundwater pumping for the
11 predictive scenarios that were used in the Annual
12 Evaluation, and the second concerns an assumption regarding
13 80 percent irrigation efficiency.
14 Before I get into those -- the specifics of those
15 two items, I'd like to make a distinction between the
16 groundwater model as a tool, and a simulation that is run
17 with the groundwater model.
18 The Elkhorn-Loup Model was used for this
19 evaluation. It's a MODFLOW, three-dimensional MODFLOW
20 model. This shows the time line that's simulated. The
21 arrows represent different subsets of the time line, so you
22 end up getting a continuum from 1895 through 2047. The
23 model tool itself is represented on the left in this box.
24 That is the best representation of the system, as we know
25 it, through present day. So, that is the tool that I'm

1 talking about. From that you could spin off any number of
2 simulations, but that's the basic tool that you have to
3 spend so much time building. From that you can spin off
4 predictive simulations, which was what was done for the
5 Annual Evaluation looking at lag impacts into the future for
6 25 years. So, this tool was used to create assumptions for
7 the future. They also spun off a number of other
8 simulations -- From the tool, they spun off simulations that
9 strip out irrigation pumping, irrigation recharge, et
10 cetera, so that you could do a comparison between what we're
11 seeing right now, current conditions, versus what it would
12 have been like if there hadn't been the irrigation pumping.
13 So, that's just one use of the model tool to run different
14 scenarios.
15 So, what's important about this graph is that you
16 use your historic information, the best historic information
17 that you have to make predictions about the future. And
18 this page, the best information that is had is from 1940
19 through 2007. Using that, you make assumptions about the
20 future conditions and move forward to make predictions.
21 For the Annual Evaluation, we're only looking 25
22 years in the future, though in the model simulation, they're
23 not looking at 2047. They only look out as far as 2033 to
24 look at the impacts. Okay, so my next few comments relate
25 to assumptions that are made, not the model as a tool.

1 This is a graph of the inputs to the model. On
2 the top in blue you had recharge. That's natural recharge
3 and artificial recharge, meaning artificial recharge coming
4 from irrigation -- precipitation and irrigation. And in the
5 green, you have groundwater pumping through time. Both of
6 these graphs go from 1940 through 2033, the period of
7 interest for us today. You can see the variations in
8 pumping that went on up through present day. Present day is
9 about 2007-2008, and then we go into the predictive period.
10 From that graph you can see that there is -- I'm sorry, the
11 bottom graph, it shows base flow. That's the flow in the
12 river continuously through time.
13 You can see that there's a break as you transition
14 from present day into the future predictive period. It's
15 shown in the pumping by a huge increase in pumping. We went
16 up through 3.03 million acre-feet per year when we went into
17 the predictive simulation. The results of that can be
18 partially seen on the bottom where you see base flow in the
19 rivers start to drop and steadily decline down. This was
20 the focus of a lot of our technical review to figure out
21 what went on in the assumptions such that you're pumping so
22 much more than you ever had in the past.
23 These graphs are from the USGS. They show some of
24 the data that went in to their assumptions. First, in blue
25 on the top, irrigated acreage from 2004 through 2005. We're

1 just looking at our historic period that we used to make
2 assumptions about the future now. So, you can see how the
3 irrigated acreage ramped up considerably through that time
4 period. Started at about 132,000 acre-feet -- or acres,
5 excuse me, and ended up at 2.3 million acres in 2005.
6 On that same graph, you have the volume of
7 precipitation that fell on that acreage. That ramps up in
8 partnership with the acreage and you can see how that
9 varies. Those variations are caused by the natural
10 precipitation. So, those are pretty straightforward.
11 From those two graphs, you can calculate how many
12 inches or the depth of precipitation that fell on the
13 acreage. That's shown on the bottom for the same time
14 period. And that has the -- that resembles precipitation
15 patterns, because it no longer had the acreage impacting it.
16 So, you can see how much rain fell -- inches of rain fell on
17 the acreage. And the reverse of that is how much you would
18 have to pump to satisfy the crop requirements. So, that's
19 the methodology that should be used. If you don't get
20 enough precipitation, you need to pump it.
21 What happened in the error that was made in
22 calculating that future pumping volume was that they used
23 this volume precipitation -- they used a big average of the
24 volume of precipitation as opposed to an average of the
25 inches of the depth of water that fell in precipitation. It

1 makes a big difference in your calculations. I'm going to
2 show you an example of that. This example is for 1940, when
3 we only had 132,000 acres and 123,000, roughly, acre-feet of
4 water found on that acreage. When you calculate that out,
5 it's 11.2 inches, which is a pretty decent year. You've had
6 to pump maybe 14 or 15 inches in that year.
7 What they did by taking that average of the volume
8 essentially, this is what they did. They took that 132,000
9 acres of water -- acre-feet of water, and assumed that that
10 is all that fell onto that whole 2.3 million acres that we
11 have today. So, the small square -- the small blue square
12 represents the volume of water. You're assuming --
13 Implicitly, that assumes that no rain fell on the remainder
14 of those acres, so when you calculate that, then you
15 can -- if you calculate a depth from that, a depth of
16 precipitation, you get 0.6 inches. So that makes your
17 calculations skewed, completely skewed, which resulted in
18 the fact that for the predictive simulation, they were
19 pumping 3.03 million acre-feet.
20 This just outlines that and does a comparison. We
21 calculated how many inches you would have to pump for that
22 1940 through 2005 period. It's shown in green. The average
23 of that is shown in the bar, the green bar line. That's
24 approximately six inches. The assumption used in the model
25 was 15.7 inches. It's shown in the red bar. So you can see

1 how that overestimation of pumping came about.
2 Okay, I'm going to switch gears and go to the
3 second technical issue that we wanted to highlight today and
4 that is the assumption about irrigation efficiency.
5 Irrigation efficiency was an assumption in the calculation
6 of how many days are required to satisfy the net corn crop
7 requirements. It's used in the evaluation of 65/85 rule and
8 it's based on a memo written by Dr. Ray Supalla from the
9 University of Nebraska.
10 The procedure that's used is as follows: He
11 determined the net corn crop irrigation requirements
12 multiplied by 65 percent or 85 percent to get July through
13 August or the seasonal net irrigation requirements. Then
14 you divide by the irrigation efficiency. In this case, it
15 was .8 or 80 percent. And that determines the number of
16 days required.
17 We followed up with Dr. Supalla on his intent in
18 his memo, and there were some ambiguities in the memo that
19 we needed to clarify. According to Dr. Supalla, that 80
20 percent irrigation efficiency is already included in those
21 65 percent and 85 percent multipliers, so what that means is
22 that it was counted twice in the calculation. This, then,
23 becomes a gross irrigation requirement and you don't need to
24 do the second step dividing by .8, because it's already
25 considered. So, the calculations included double counting

1 of irrigation efficiency of 80 percent.
2 That summarizes my two points on the technical
3 side. I'm going to turn it back over to Jaron.
4 MR. BROMM: Julie's comments again relate to the
5 requirement to use the best scientific information available
6 to make the final determination. Having reviewed all of the
7 information, the NRDs -- the Basin NRDs met yesterday to
8 discuss the information and determine a course of action,
9 and the conclusion of that discussion is, we wish to
10 continue working with DNR in developing additional
11 information to ensure that the annual determinations on the
12 Lower Platte River Basin are based on the best science and
13 are consistent with the regulations. That is, the role that
14 has been entrusted to the Basin NRDs by the Legislature,
15 that's the role they sought to fulfill in taking on this
16 endeavor to do a technical and legal review of the
17 preliminary determination, and it's the role they continue
18 to maintain, they continue to fulfill in partnership with
19 DNR in the near and in the distant future. In that respect,
20 the NRDs, the Basin NRDs, which have asked me to emphasize,
21 in my closing remarks the importance of LB483, which is
22 Senator Langemeier's bill to address the situation where a
23 basin is preliminarily determined to be fully appropriated
24 or finally determined to be fully appropriated, and that
25 determination is ultimately reversed.

1 And the situation that's trying to be dealt with
2 there is where if a decision is reversed, there's the risk
3 of facing a flood of permit applications. I think from our
4 research and our review, there's obviously room for growth.
5 There's obviously room for development. But the Basin NRDs
6 want to make sure that that growth is responsible, and in
7 order to do that, we feel it's important that 483 gets
8 passed so that we can manage that development, manage that
9 growth. Otherwise, we run the risk of that growth in the
10 next year causing us, potentially, to be fully appropriated
11 at this time next year. So, we ask for, actually, in
12 addition, we ask for the Department's support for LB483, and
13 for public support of that, as well.
14 With that, I know there are several NRD managers
15 who wish to make a few comments. Those folks from the
16 public are welcome to come up after the NRDs are finished.
17 I think, maybe, Ron will announce that at that time. Thank
18 you.
19 MARLIN PETERMANN
20 MR. PETERMANN: Good afternoon. My name is Marlin
21 Petermann. I'm the Assistant General Manager with the
22 Papio-Missouri River Natural Resources District,
23 headquartered in Omaha. Marlin is spelled M-a-r-l-i-n,
24 Petermann, P-e-t-e-r-m-a-n-n.
25 The Papio-Missouri River Natural Resource District

1 has been a long-time partner with the Lower Platte South NRD
2 and the Lower Platte North NRD and six state agencies
3 through the Lower Platte River Corridor Alliance to protect,
4 enhance, and restore the vitality of the Lower Platte River
5 in eastern Nebraska. Helping to ensure that an adequate
6 supply of good quality water remains available for not only
7 fish and wildlife, but also for the critical municipal water
8 supplies that provide drinking water to nearly one half of
9 the state's population will continue to be a major goal of
10 the district and the Alliance.
11 The district is here today to give testimony in
12 opposition to the Department's preliminary determination
13 that the Lower Platte River Basin is fully appropriated.
14 The district agrees with the testimony you've just heard
15 from Fennemore Craig and the findings contained in the
16 report prepared for Fennemore Craig by Brown and Caldwell.
17 It is in the interest of all Nebraskans that the Annual
18 Evaluation performed by the Department be done using the
19 best available science and that the evaluation follows the
20 application -- the applicable statutes and negotiated rules.
21 When making the 2009 Annual Evaluation, the
22 Department considered approximately 120 high capacity wells
23 downstream from the Louisville gage for its calculation of
24 lag effects due to current levels of development. The
25 inclusion of these wells creates additional lag effect that

are subtracted from the streamflow upstream at Louisville. There, to us, seems to be no hydrologic basis for such a subtraction. While groundwater pumping in hydrologically connected areas along the Platte downstream of Louisville may impact the flow in that particular portion of the stream, the calculation of impacts is specific to that area of the stream and not to the flows at the Louisville gage. The inclusion of these downstream wells results in an overestimation of lag effects at the Louisville gage.

The district reviewed the geographic areas the Department designated as being hydrologically connected to surface water, and believes there are some areas that should be investigated further to see if the delineation is correct. Typically, the hydrologically connected area is within one or two miles of the Platte and Elkhorn rivers. However, there is one area near the Platte River confluence with the Missouri River where the designated area is five miles from the stream. There are also a number of areas where stream segments are not designated in the hydrologically connected area. We are providing Exhibit A, Sections to Reconsider Hydrologic Connectivity, listing the areas by section, township, and range, that the district suggests be reconsidered.

In other estimations of the lag effects, the Annual Evaluation employed a standard method for assessing

1 the impacts of high capacity wells with the single exception
2 of the Metropolitan Utilities District Platte West Well
3 Field. For high capacity wells, the Department utilized the
4 anticipated net corn crop irrigation requirement to
5 calculate those lag effects. For the Platte West Well
6 Field, the Department incorporated a lag effect of 160 cubic
7 feet per second based on an assumed pumping of 104 million
8 gallons per day. The MUD holds a Department issued
9 municipal transfer permit for 100 million gallons per day
10 for the peak production from the Platte West Well Field with
11 a maximum annual capacity of 19 billion gallons per year.
12 The 19 billion gallons per year maximum equates to a maximum
13 average daily rate of just 52 million gallons per day, far
14 less than the assumed 104 million gallons per day. The
15 Platte West Well Field is, by the Department issued
16 municipal transfer permit, restricted to pumping at a
17 maximum average daily rate of this 52 million gallons per
18 day. The incorporation of the 160 cfs of depletion effects
19 is an overestimation of the impacts of the permitted average
20 annual production from that Platte West Well Field.
21 In a related matter, the 2009 Annual Evaluation by
22 the Department does not appear to have considered other
23 municipal transfer permits in the Basin. This is a matter
24 that the district believes should be investigated, since
25 communities are relying on those permits for future growth.

1 How these permits enter into consideration during
2 development of the integrated management plan, should that
3 be necessary, also needs to be clarified.
4 The district appreciates this opportunity to
5 comment on the Lower Platte River preliminary determination
6 and looks forward to working closely with the Department on
7 these very important issues to Nebraska in the future.
8 I'd like to submit this testimony as an exhibit.
9 THE HEARING OFFICER: It's admitted.
10 (Exhibit 6 was marked for identification and
11 received in evidence. See Index.)
12 JOHN C. TURNBULL
13 MR. TURNBULL: Good afternoon. I am John C.
14 Turnbull, General Manager of the Upper Big Blue Natural
15 Resources District. That's J-o-h-n, middle initial C,
16 T-u-r-n-b-u-l-l. We're headquartered in York, Nebraska.
17 The Upper Big Blue NRD is opposed to the fully
18 appropriated determination of the Lower Platte Basin now
19 being considered. Such full appropriation is not supported
20 by best science or data, as described in the Brown and
21 Caldwell report presented to you earlier today. We also
22 concur with the Fennemore Craig legal findings.
23 The Upper Big Blue NRD plans to develop a
24 groundwater model of the area in Polk and Butler Counties
25 along the Platte River. The model will be based on and will

be an extension of the Blue River Basin groundwater model this district recently completed. The purpose will be to determine the hydrologically connected area of the Platte River and its tributaries in and near the northern portion of the Upper Big Blue NRD. That work will take some time and the results certainly will not be ready in time for your necessary decision on the matter before you. When we are confident of the work and have it peer reviewed, we intend to submit it to the Department for your consideration of the 10/50 boundaries in determinations of the Lower Platte Basin.

And I do have a letter to submit for you as an exhibit.

THE HEARING OFFICER: It's accepted, John.

(Exhibit 7 was marked for identification and received in evidence. See Index.)

JOHN MIYOSHI

MR. MIYOSHI: My name is John Miyoshi. That's M-i-y-o-s-h-i. I am the General Manager of the Lower Platte North NRD located in Wahoo, and today my testimony is in opposition to the preliminary determination to declare the Lower Platte River Basin fully appropriated.

When the Nebraska Legislature enacted LB962, there were safeguards built into the process to allow the NRDs and water users a period of time to review and make comments on

1 DNR's preliminary determinations. The Lower Platte Basin
2 NRDs greatly appreciate the open collaboration and dialog
3 we've been able to have with DNR staff. It has truly been
4 an educational process for all of us. The premise of the
5 final determination is that it will be based on the best
6 science while adhering to all state regulations governing
7 the process.
8 In 2008, our NRD closed 22 percent of our district
9 to additional irrigation development. This was not an easy
10 decision for our board, but the best science showed this was
11 the proper thing to do. This same science showed adequate
12 water supplies for continued development in the remainder of
13 our district. The Legislature has charged the NRDs with
14 locally managing our limited resources, and this action by
15 our board is a good example of local management which is
16 being repeated in NRDs across the state.
17 At some point in time, our basin water uses will
18 be in balance with available supply. At that time, Lower
19 Platte North NRD is prepared to locally manage our water
20 resource to see that this balance is maintained. Previous
21 testimony by Jaron Bromm and Julie Wright show that we have
22 not reached that point in time. The preliminary
23 determination is not supported by the best science, nor does
24 it adhere to state regulations governing the process. We
25 urge Director Brian Dunnigan and the Department to withdraw

1 their preliminary determination for the Lower Platte Basin
2 and pledge that the NRDs will continue to work with the DNR
3 on future planning and determinations. It is the
4 responsible thing to do.
5 THE HEARING OFFICER: Thank you, John.
6 STAN STAAB
7 MR. STAAB: Good afternoon. My name is Stan
8 Staab, S-t-a-a-b. I'm general manager of the Lower Elkhorn
9 Natural Resource District, headquartered in Norfolk. Thank
10 you today for the opportunity to present some data and
11 thoughts about the quantity of water in the Lower Platte
12 Basin.
13 We take our water resources management very
14 seriously. To prevent a potential run of irrigation and
15 other well development that most certainly would have
16 occurred because of the Department's preliminary
17 determination, my board took the very courageous step of
18 declaring a temporary stay in two thirds of our district
19 that is not in the hydrologically connected or 10/50 area.
20 The Lower Elkhorn will consider regulating when it is deemed
21 necessary. This is local control.
22 We ask the Department to use rigorous analysis of
23 data and careful consideration to ensure that any regulation
24 would be imposed only when there is absolute certainty that
25 is necessary. We also suggest the Department replace the

1 trigger used now, which is based on the economics of growing
2 corn or the 65/85 rule with one that is based on
3 environmental data.
4 Please keep in mind that eastern Nebraska is
5 different than western Nebraska. In our district,
6 precipitation accounts for the greatest impact on water
7 resources, maintaining supplies even with growing usage.
8 This is a reality I would like the Department to recognize
9 and consider in its final determination of our appropriation
10 status. Aside from the almost unavoidable temporary stay
11 imposed by the Lower Elkhorn NRD, we prefer to base any
12 future regulatory action on environmental data that we and
13 other entities collect.
14 The Lower Elkhorn Natural Resource District, like
15 other NRDs in the state, has been actively monitoring
16 groundwater since 1976. We measure the depth-to-groundwater
17 in approximately 247 irrigation wells throughout our
18 district each spring and fall to detect groundwater quantity
19 changes, trends, or problems. Of these, 126 wells are in
20 the 10/50 area.
21 Hydrographs of the wells that we measure in the
22 10/50 area will be delivered to your office tomorrow as part
23 of the official record and of my testimony.
24 (See Exhibit 16.)
25 The hydrographs show that the cyclical pattern

1 that is common in most of the district, which is the
2 groundwater levels drop, but then will rebound. Our
3 groundwater levels are remarkably stable.
4 Generally speaking, it is not necessary for
5 farmers to irrigate extensively each year in much of eastern
6 Nebraska because of adequate precipitation and our
7 fine-textured soils. We now require new wells to be
8 equipped with flow meters so that after a few years, we will
9 have even more data to verify this observation.
10 Many people in our area have observed there is
11 more water in the streams in northeast Nebraska than in the
12 past. Our own informal analysis of stream flow data
13 revealed an upward trend at numerous stream gages, so the
14 Upper and Lower Elkhorn NRDs asked the U.S. Geological
15 Survey to perform a statistical analysis of trends in
16 streamflow. Their report presents an analysis of streamflow
17 trends in the Elkhorn and Lower Platte Basins, which will
18 soon be published on their website. I am including "Trends
19 in Streamflow Characteristics of Selected Sites in the
20 Elkhorn River, Salt Creek, and the Lower Platte River
21 Basins, Eastern Nebraska from 1928 to 2004 and the
22 Evaluation of Streamflows in Relation to Instream-Flow
23 Criteria, 1953 to 2004," and that's the title, by the U.S.
24 Geological Survey staff. It's a manuscript of the report
25 submitted as part of this testimony that you have in your

1 hand.

2 THE HEARING OFFICER: Are you offering that for

3 evidence, Stan?

4 MR. STAAB: That should be an exhibit, thank you.

5 (Exhibit 8 was marked for identification.)

6 I cannot do justice -- do the report justice in my

7 brief summary here, as they have performed many assessments

8 that complement the trend analysis. I urge the Department

9 to carefully read this report. Statistically, significant

10 upwards trends were detected in stream flow at eight sites,

11 the Platte River near Duncan, the Platte River at North

12 Bend, the Elkhorn River at Neligh, the Logan Creek near

13 Uehling, the Maple Creek near Nickerson, the Elkhorn River

14 at Waterloo, and the Salt Creek at Greenwood, and,

15 interestingly, the Platte River at Louisville. The other

16 gages in the study show no significant trends, which means

17 there were no downward trends detected in the analysis.

18 For the past few decades, water use in the Basin

19 has increased, yet it appears that water resources in the

20 area have remained stable. Perhaps some common assumptions

21 of the relationship between groundwater pumping and surface

22 water flows are faulty. For this reason, we feel the

23 groundwater level and streamflow trends need to be used in

24 the Department analysis of the Lower Platte Basin and should

25 be a major consideration in the final determination of our

appropriation status. Thank you very much for the opportunity to testify.

THE HEARING OFFICER: Thank you, Stan.

DENNIS SCHUETH

MR. SCHUETH: I'm Dennis Schueth, D-e-n-n-i-s, S-c-h-u-e-t-h. I'm the General Manager of the Upper Elkhorn Natural Resource District located at 301 North Harrison, O'Neill, Nebraska.

The Upper Elkhorn NRD is aware of the importance of ground and surface water to the state of Nebraska. Due to this awareness, we are continuously monitoring the ground and surface water for quality and quantity parameters. Over the years, the Upper Elkhorn NRD has partnered with various landowners, local, state, and federal agencies in gathering this information to better understand numerous water-related issues. After the passage of LB962, the Upper Elkhorn NRD joined a group of NRDs, state, and federal agencies that had a goal of developing better science to determine the impacts of current and future ground and surface water uses. This partnership created the Elkhorn Loup Model, and as the ELM project moves forward, we will continue to learn more about the interaction between groundwater and surface water.

The ELM project played a part, as well as the Jenkins Model, Nebraska laws, and DNR's own rules and regulations in labeling the Lower Platte River as fully

1 appropriated. Due to the importance of existing and future
2 water uses in the Basin, we joined nine NRDs in the task of
3 evaluating the science and the criteria behind the Lower
4 Platte Basin designation.
5 Based on the testimony and the documents presented
6 by Jaron Bromm from Fennemore Craig, and Julie Wright of
7 Brown and Caldwell, the Upper Elkhorn NRD is opposing the
8 Nebraska Department of Natural Resources designation of the
9 Lower Platte River Basin as fully appropriated.
10 The Upper Elkhorn NRD will continue to be an
11 active partner with individuals, local, state, and federal
12 agencies in maximizing and protecting current and future
13 ground and surface water uses. Thank you for your time.
14 I'd like to submit this.
15 THE HEARING OFFICER: Thank you, Dennis.
16 GLENN JOHNSON
17 MR. JOHNSON: Good afternoon. My name is Glenn
18 Johnson. J-o-h-n-s-o-n, and Glenn with two N's. I'm the
19 general manager of the Lower Platte South NRD in Lincoln,
20 and I'm presenting testimony today concerning the
21 preliminary designation of the Lower Platte River Basin as
22 fully appropriated and the extent of the area where the
23 surface and groundwater supplies are hydrologically
24 connected.
25 The Lower Platte South NRD has been participating

1 with the eight other natural resource districts in the Lower
2 Platte Basin in the review of the 2008 Report on the Lower
3 Platte Basin. The district concurs in the findings of the
4 technical review prepared by Fennemore Craig and Brown and
5 Caldwell, and the conclusion that the designation of fully
6 appropriated is not warranted based on the information
7 available.
8 Another issue of concern, and one shared by the
9 City of Lincoln, is the apparent disregard in the analysis
10 and recommendation for a fully appropriated designation of
11 the City's municipal groundwater transfer permits and the
12 induced discharge permit the City also holds. This induced
13 recharge permit, which was approved by the Department
14 previously, includes streamflow amounts sufficient to supply
15 the water needs of the City for the next 25 years, as
16 provided for in the statutes. The district requests the
17 Department recognize and incorporate the amount in this
18 permit -- of this permit in their consideration and that
19 they require no additional offsets up to the permitted
20 amount in the deliberation of your final determination.
21 We appreciate the opportunity to provide this
22 testimony and I place this in the record.
23 THE HEARING OFFICER: Thank you, Glenn.
24 JARON BROMM
25 MR. BROMM: Just for the record, this is Jaron

1 Bromm, again. Any other NRD folks that want to testify?
2 (No response.)
3 One of the things I just want to clarify. I know
4 it's correct in the record, but for folks here, it was
5 brought to my attention that maybe I got confused between
6 too many uppers and too many lowers, as far as the NRDs that
7 are involved. So, I want to make sure we got it clear that
8 it's the Platte NRDs, Lower Platte North, Lower Platte
9 South; the Loup NRDs, Upper Loup and Lower Loup; the Elkhorn
10 NRDs, Upper Elkhorn, Lower Elkhorn; Upper Big Blue; and
11 Lower Niobrara. And I was told maybe I said Upper Niobrara,
12 but it's actually Lower Niobrara. So, thank you.
13 THE HEARING OFFICER: Thank you, Jaron.
14 Any other testimony? Please come forward.
15 DON ADAMS
16 MR. ADAMS: Good afternoon. My name is Don Adams.
17 I'm Executive Director of Nebraskans First, a statewide
18 coalition of groundwater irrigators dedicated to protecting
19 Nebraska's groundwater for agriculture.
20 Well, this is it, the grand finale, round four.
21 Let's review what has happened so far. Based on the
22 hearings in Norfolk, Lincoln, and Ord, and so far at this
23 one today, there's been about five hours of opposition
24 testimony compared to one minute of testimony in support of
25 DNR's fully appropriated determination. That one minute was

1 give by an employee of the U.S. Fish and Wildlife Service
2 out of Grand Island.
3 What has happened is remarkable, but mysterious as
4 well. We know there are various environmental groups and
5 government agencies, including the Game and Parks
6 Commission, who support DNR's determination. Where are
7 they? Why have they opted to stay on the sidelines in this
8 most important matter? Are they afraid of facing the public
9 and voicing their views? Or, have they been advised to lay
10 low, keep quiet and let the hearing process run out having
11 been assured that the DNR will not be moved off their
12 position no matter how much public opposition there is to
13 it. I'm sorry to say, I believe such is the case and that
14 this public hearing process has been compromised.
15 To date, the DNR has heard opposition testimony
16 from NRD managers and directors, well drillers, center pivot
17 dealers, individual farmers and ranchers, all of whom live
18 and work in this basin. They are credible, knowledgeable,
19 and care more about this basin's water than anyone in
20 Lincoln or Omaha can comprehend. They know that what the
21 DNR is proposing to do will hurt them and their communities.
22 They have told you that the DNR's determination, if it is
23 made final, will cost jobs, devalue productive land, and
24 stifle economic development and growth.
25 The DNR has heard from NRD experts as such today

1 and others, including our group, who can read and understand
2 groundwater maps from the Conservation and Survey Division
3 and streamflow charts from the U.S.G.S. The data presented
4 and entered into the record is factual, irrefutable, and
5 conclusive. Groundwater levels in the Basin are up, way up,
6 from 2007 to 2008, and up even for the 50-plus-year period
7 from predevelopment to 2008. The same goes for streamflows.
8 Data from the gage at Louisville, which is the definitive
9 location for assessing what is happening in the Loup,
10 Elkhorn, and Lower Platte River Basins, reveals that for
11 water year 2008, the flows are at 10-year highs. Same goes
12 for North Bend, Pierce, Waterloo, Genoa, West Point, and St.
13 Paul gage readings.
14 The DNR uses a 25-year lag effect. Twenty-five
15 years ago, in 1984, the vast majority of the wells in the
16 Basin were in and pumping. Now, 25 years later, with the
17 lag effect given its chance to impact streamflows, what has
18 happened? Streamflows are at 10-year highs. Where is the
19 lag effect?
20 The 65/85 and the 10/50 rules are not in the
21 statutes, but rather they are arbitrary numerical limits set
22 by the DNR. These arbitrary limits have sucker-punched
23 groundwater irrigators, NRDs, and even the Water Policy Task
24 Force. The truth is that all the DNR really has to do, and
25 in fact, in this basin has done, is keep granting service

1 water appropriations to the point that it becomes a near
2 certainty that the most recent or the junior appropriation
3 will trigger the 65/85 rule. At that point, the DNR can
4 say, "Don't blame us. Our hands are tied." Such
5 manipulation of this system to stop groundwater development
6 is transparent and contrived.
7 A respected economist recently analyzed the
8 economic impact of the fully appropriated determination if
9 it becomes permanent, and he calculated that over a 20-year
10 period, it would result in a $1.2 billion loss of output
11 into the Nebraska economy and more than $43 million in
12 foregone property taxes, most of which would have gone to
13 the Basin's public schools. Over 2,200 jobs will be lost.
14 These numbers are substantial and chilling, particularly
15 given the woeful economic environment we are now mired in.
16 Any such anti-job state program must only be imposed if the
17 science and the facts warrant such a Draconian government
18 intrusion into businesses and livelihoods of those to be
19 harmed. The science must be rock solid and bulletproof.
20 Such is clearly not the case here, as you heard from the
21 experts earlier.
22 The Governor has promised to fight for every
23 Nebraska job one at a time. Now is the time for him to step
24 in and protect jobs in the Lower Platte River Basin. He has
25 the authority to do this and it is an act of leadership he

1 must take now before it is too late.

2 Finally, we remain hopeful that the DNR is taking

3 these hearings and the information presented seriously. The

4 DNR has before it a golden opportunity to restore

5 credibility and faith in state government and the public

6 hearing process. Show us you can be flexible, fair, and

7 responsive. Do the right thing. Do what the law allows you

8 to do and reevaluate your preliminary determination and

9 reverse it based on the irrefutable evidence provided you.

10 Do so knowing you will be protecting jobs, land values, and

11 local economies. We all make mistakes and the DNR has made

12 one with this determination. Fortunately, this is a mistake

13 that can be rectified. Thank you.

14 THE HEARING OFFICER: Thank you, Don.

15 Next testifier, please.

16 DENNIS SCHULTZ

17 MR. SCHULTZ: My name is Dennis Schultz,

18 D-e-n-n-i-s, S-c-h-u-l-t-z. I'm a farmer from Wisner in

19 Cuming County and a member of the Nebraska Farm Bureau

20 Federation. I would like to submit these written comments

21 on behalf of the Nebraska Farm Bureau for the Department's

22 consideration in regards to the preliminary designation of

23 the Lower Platte River Basin as fully appropriated.

24 THE HEARING OFFICER: Is that the letter from Mr.

25 Olsen?

1 MR. SCHULTZ: Yes.
2 THE HEARING OFFICER: We have received that. It
3 will be admitted. Thank you.
4 (Exhibit 4 was received in evidence. See Index.)
5 MR. SCHULTZ: Okay, you don't need it, then?
6 In summary, it can't be emphasized enough that the
7 water is the lifeblood of agriculture in Nebraska. While
8 Nebraska Farm Bureau certainly supports sound management
9 decisions in regards to the state's water resources,
10 unnecessarily restricting water will undermine economic
11 opportunities for farmers, ranchers, and communities.
12 Unnecessary restrictions do come with an economic cost and
13 given the potential of economic impact, of a fully
14 appropriated designation, it is imperative for the
15 Department's analysis to justify a fully appropriated
16 determination.
17 Since the preliminary designation was made in
18 December, a number of questions, concerns, and issues have
19 been raised concerning that data and methodologies employed
20 in the Department's evaluation. So much so, that the
21 Nebraska Farm Bureau does not believe a fully appropriated
22 determination is warranted or justified at this time.
23 Farm Bureau policy states that the Department of
24 Natural Resources determinations should be based on sound
25 science, which is subject to an independent peer review. To

1 that end, Farm Bureau encourages the Department to work with
2 the NRDs in the Lower Platte River Basin to create a work
3 group to seek a peer review by independent technical experts
4 of the data, analysis, and methodologies used in the report.
5 Farm Bureau is confident the Department and NRDs working
6 together with independent experts can develop a sound
7 methodology for an evaluation of the Basin. In the
8 meantime, we're hopeful passage of LB483 by the Legislature
9 can provide the NRDs and the DNR the tools necessary to
10 manage new uses to allow time for such a technical review to
11 move forward. Thank you.
12 THE HEARING OFFICER: Thank you.
13 ART BECCARD
14 MR. BECCARD: My name is Art Beccard, last name,
15 B, as in boy, e-c-c-a-r-d. I'm employed by Thompson,
16 Dreessen and Dorner in Omaha. We're under contract to be
17 city engineers for the City of Papillion, Nebraska. We are
18 opposed to, as the City of Papillion, to the designation of
19 the Lower Platte River as being fully allocated --
20 appropriated, excuse me.
21 Papillion is concerned about the methodology used
22 by the DNR to determine the extent of the fully appropriated
23 area. We don't really, from what we can tell, it's not
24 really appropriate for the geologic setting that Papillion
25 Well Field is in.

1 Papillion is a city of the first class in Sarpy
2 County. It has a well field along the north side of the
3 Platte River about nine miles upstream from the confluence
4 with the Missouri River. It is downstream of the Louisville
5 water gaging station. Papillion is one of the fastest
6 growing cities in the State of Nebraska. We have, over the
7 last 10 years, added about an extra 300 to 500 new water
8 services a year to our water system and the restrictions on
9 new growth or having to offset water elsewhere could put a
10 very undue hardship on the City of Papillion.
11 Papillion went through and developed a water
12 master plan to identify the area that they need to provide
13 for their future growth areas. They've gone through and
14 either acquired or leased a well field's capacity to provide
15 that amount of water. And these restrictions, again, would
16 prevent using that well field or cause us to go elsewhere to
17 buy offsets requiring the resources of Papillion to be spent
18 in an area that has no benefit at all to the citizens of
19 Papillion.
20 We did a hydrologic evaluation of our well field,
21 again, to make sure we had the capacity there to serve the
22 ultimate service zone. And that showed that it had very,
23 very minimal impact on the Platte River, less than 30 cfs at
24 ultimate maximum pumping conditions, which only happens two
25 or three days a year for our area.

1 Our request is that the 10/50 -- Also, to be
2 involved with the integrated management plans would
3 restrict, from the best we can tell, our NRD has no current
4 groundwater management program. To get one underway would
5 take two to three years. That would put us in limbo for
6 that period of time in order to be able to develop new
7 sources and supply in order to serve our growing population.
8 And lastly, we request that the extreme Lower
9 Platte River, downstream of Louisville, be removed from this
10 10/50 area. Thank you again for your time.
11 THE HEARING OFFICER: Thank you, Art.
12 JOHN HANSEN
13 MR. HANSEN: Good afternoon. For the record, my
14 name is John Hansen, J-o-h-n, Hansen, H-a-n-s-e-n. I'm the
15 President of Nebraska Farmers Union. Thank you for this
16 opportunity to share our thoughts on where we're at in this
17 process. I come to this process as a result of 35 years of
18 being involved with natural resource districts, both as a
19 director for 14 years, and since then as the President of
20 Nebraska Farmers Union.
21 As we look at our natural resource district system
22 and our system of resource management in this state, we are
23 the only state in the United States that has a process and a
24 regulatory system as the one that we have here in Nebraska.
25 There are some that are kind of similar, but they really

1 aren't as far-reaching and as comprehensive as our NRD
2 system. And as we have looked at all of the things that we
3 have done, from the very beginning, we have been able to do
4 what we've done because we have been committed to being
5 fair, having a good process, having good research. So, when
6 my home NRD of the Lower Elkhorn NRD -- I think we were the
7 first in the state to develop a groundwater quantity and
8 quality monitoring program, because we knew, at the end of
9 the day, when the crisis came, it was going to be critical
10 for us to have good, sound facts and information on which to
11 make decisions, rather than to rely on emotion and the
12 fervor of the day. How do we make decisions? Let that be
13 on good facts.
14 And so, as we've gone forward, we have done a lot
15 of good things in our state. We are the only state in the
16 nation that actually spends more local and state money on
17 conservation than we get in in federal cost-share dollars.
18 That's a remarkable thing. And I continue to sing the
19 praises of NRDs in my work at the national level. But we
20 are at a place now, looking at the ramifications of the
21 temporary declaration relative to appropriation where, I
22 think, we really need to look at what the facts are and, I
23 believe, as I look at these, that it's critical that we get
24 these right, because it's obvious that the economic
25 consequences are so enormous. And if we're going to do

1 something of this magnitude, we better have the facts right
2 and we better have the process right.
3 And as we look at where we're at now, we strongly
4 support LB483, and we also believe that based on our reading
5 of the process, and I have spent way too many perfectly good
6 nights reading environmental impact statements and
7 hydrologic studies and geologic studies and all of those
8 kinds of things down through my years. But, as I look at
9 the information, I do not believe that the facts support the
10 temporary declaration as it has been made this far. I
11 believe what the appropriate things to do would be, in our
12 judgment, for DNR to withdraw their preliminary declaration
13 of being fully appropriated in this basin and that we go
14 back, get better facts, and use the process that is set
15 forth in LB962, woe be it the fact that it doesn't, in our
16 view, properly include economic impacts. It includes
17 science. We realize that.
18 And so we, all of that being said, would like to
19 thank the NRDs for them doing their job, as I believe they
20 were set up to do, and would respectfully request the DNR
21 withdraw this declaration. Thank you very much for your
22 time and consideration.
23 THE HEARING OFFICER: Thank you, John.
24 Next testifier, please.
25 DAVE NABITY

1 MR. NABITY: Good afternoon. My name is Dave
2 Nabity. I am from Omaha, Nebraska. I have a company called
3 Omaha -- or Nabity Business Advisors, and I have a political
4 action committee called the Nebraska Alliance for the
5 Private Sector.
6 So, you might be asking yourself, why is a guy
7 from Omaha here talking about this issue. And, actually, I
8 became pretty aware of how government can mess up the
9 economics of a state by living in Nebraska a long time and
10 watching a lot of political actions and bureaucratic actions
11 impact our state's ability to survive economically. And
12 when my friend, Don Adams, gave me a call and said, "Nabity,
13 you need to look at this," you know, I'm thinking in my own
14 mind that every square mile of this state needs to be
15 productive. It needs to be making money. There needs to be
16 taxes generated off the land, and that we all need to be
17 able to stay in business and be successful in order for the
18 entire state to be healthy. So, I thought, well, okay,
19 well, maybe the DNR has got something to this. Maybe
20 there's something here that we just need to understand.
21 So, I started doing a little bit of research as a
22 businessman would do some research. And I looked at
23 climatology reports, streamflow reports, groundwater change
24 level charts from a whole series of different organizations.
25 And what I found is the streamflows in Nebraska today,

1 compared to what they were like predevelopment, before
2 anybody started digging wells, is either the same or higher
3 than it was 100 years ago. So, I'm thinking to myself,
4 there's got to be something wrong here.
5 So, then, I start looking at the groundwater level
6 changes going back 100 years compared to today. And the
7 changes are actually in the same or positive. And I'm
8 saying, "Wait a minute. Something's got to be wrong here."
9 And then I started looking at where we dammed up water,
10 where we've stored water, how those areas of the state saw
11 pretty significant increases in groundwater. And I'm
12 thinking, okay, we've got the Department of Natural
13 Resources using some model of some type. What's going on
14 here? And, as I began to look into it, to me, it looked
15 like there was a mistake being made somewhere. And today we
16 found out where. I think it's ironclad that the way the
17 Department of Natural Resources was going about determining
18 a model to shut down the river basin was flawed. It's an
19 error and I urge the Department of Natural Resources to look
20 at that, admit that there is a mistake, and back off the
21 fully appropriated designation. It doesn't make a lot of
22 sense to me as I look at it.
23 But, furthermore, what really fascinates me about
24 all this is where's the real solution. You know, if we have
25 a problem with streamflows and we have a problem with water,

1 what could be a solution? Instead of shutting down the
2 whole economy of the state, why isn't the Department of
3 Natural Resources saying, you know what? We got a fix. Why
4 don't we build some more dams? What don't we find ways to
5 store more water, and then, move water to areas of need when
6 it's needed and store it when it's not needed?
7 What you can learn from the Calamus Reservoir and
8 Sherman Reservoir is that when you store water, you build
9 groundwater levels. It's documented. It's a fact. And so,
10 what I want to encourage the Department of Natural Resources
11 to do is to back off of shutting down the whole economy in
12 the northeastern part of the state and think about 21st
13 century solutions, of storing more water and being able to
14 transfer water to places of need when it's needed. The
15 stats show that about two million acre-feet of water come
16 into Nebraska from Colorado and Wyoming. About eight
17 million acre-feet of water leave Nebraska and go into Kansas
18 and the Gulf of Mexico. That means that through springs and
19 rainfall, we get about six million acre-feet that if we got
20 innovative and thought about more ways to store and manage
21 the water, we would never have this discussion. We wouldn't
22 have wasted everybody's time and we'd have a 21st century
23 solution that helps Nebraska stay in business. And I think
24 that's critically important.
25 And I'd just like to see how many of you --

1 THE HEARING OFFICER: Mr. Nabity?
2 MR. NABITY: Yes.
3 THE HEARING OFFICER: Please don't encourage
4 feedback. We're here to hear your testimony.
5 MR. NABITY: I was just curious. Okay, well, I
6 was just curious as to how many here are in favor of this
7 DNR ruling, but he doesn't want me to do that. Let me just
8 mention one other thing.
9 AUDIENCE MEMBER: Nobody.
10 (Applause.)
11 MR. NABITY: Well, the reason I wanted to ask the
12 question is I would have the sense that this room is
13 probably unanimously against this, and so, what it ends up
14 meaning is, we're all talking to ourselves. And if you
15 don't think that government can go ahead and make changes
16 that will harm you whether you want it to happen or not, I
17 think we're all kidding ourselves. And so the one thing I
18 want to encourage the people that are here to do is to band
19 together, write letters, get organized, and don't sit this
20 one out. Thank you.
21 THE HEARING OFFICER: Thank you.
22 (Applause.)
23 JEFF LAMBRECHT
24 MR. LAMBRECHT: Good afternoon. My name is Jeff
25 Lambrecht, J-e-f-f, L-a-m-b-r-e-c-h-t. Thank you for

1 allowing me to testify here today.
2 I was going to originally send a letter into the
3 State, the DNR, to oppose their fully appropriated
4 determination decision, but I felt compelled to come here
5 today and actually read this out loud and state my opinion.
6 Again, my name is Jeff Lambrecht and I am a
7 farmer, a farm owner/operator, located west of Pierce,
8 Nebraska. I am located within the DNR's boundaries that are
9 affected by the December 16th, 2008, ruling. I wanted to
10 briefly explain my situation and state why I am opposed to
11 the DNR's decision to temporarily halt the drilling of any
12 new irrigation wells, the halt on use of wells previously
13 drilled but not yet put into service, and the halt of
14 expansion of irrigated acres.
15 I had hopes of using an existing irrigation well
16 located on my property that was used to supply water to an
17 older water drive system and was also used to flood irrigate
18 additional acres with gravity pipe. I planned on adding
19 more efficient center pivots to replace the existing water
20 systems. I had located a couple of center pivots that were
21 fairly close to my property. On December 16th, I called the
22 dealer I was going to work with and purchase the pivots
23 from, when he informed me of the DNR's decision to halt the
24 expansion of new wells, irrigated acres, et cetera. I was
25 fortunate that I was not stuck with a couple of pivots that

1 it did not look like I could possibly use. I do not have
2 the dollars spent that some of the people with new wells do,
3 but I did grid sample the farm last fall and had fertilizer
4 applied at irrigated rates. I have also spent a fair amount
5 of time trying to relocate potential pivots, line up
6 installation of underground pipe and wiring, and attended as
7 many of the local NRD and DNR meetings as possible.
8 I know a lot of facts, personal experience, and
9 observations have been cited at many of these meetings. I
10 have had the opportunity to listen to a number of
11 landowners, farmers, and those related to the agriculture
12 industry, and I have gained respect for many of those
13 individuals. I am a small-time producer compared to the
14 average farmer/rancher in the state, but I feel I share
15 something with all of them, and that is passion. Passion
16 (sic) is not an easy, get-rich-quick occupation. In my
17 opinion, the dedication required and sacrifices made, make
18 it one of the more challenging careers in the business
19 world. The individuals involved strive to do their best in
20 the most cost-efficient, productive, and environmentally
21 friendly way possible. They do this not only because of the
22 passion they have inside for making their living off of the
23 land, but because it is a necessity. I say this because we
24 can easily see how difficult things can be financially,
25 especially during today's economic crisis. This is where

one of, if not the most important, business components come into play, management. Management is critical in the success of any business, and the agriculture sector is no exception. We do our best to manage inputs we purchase, as well as those we depend on from the land, especially surface and groundwater. Those who wish to abuse or neglect these management situations will eventually force themselves out due to lack of success.

Another concern I have related to this subject is the lack of involvement from persons outside of the agriculture sector. I apologize if I am incorrect in my interpretation of the DNR statements, but it would appear to me that this water issue will affect more than just the farmer's water rights. The way I understand the issue, the cities in our state will face possible water cutbacks and regulations as well. It seems that this has been targeted as a rural agricultural issue and not urban. I honestly believe that many people are not aware of how this potentially affects them.

I have not been able to attend all the public meetings, but I did attend the meeting in Norfolk, and no one there openly spoke in favor of the DNR's current decision. I also spoke with someone that attended the public meeting held in Lincoln and was told only one person spoke in favor of the DNR's current ruling, and that was due

1 to concerns over how it would affect certain fish and
2 wildlife species. I'm afraid that people who enjoy the
3 sprinkler-irrigated golf courses and lawns, city pools and
4 water parks, and even recreational activities enjoyed at our
5 state lakes, rivers, and streams, do not understand the
6 impact this will have on everyone, not solely the ag sector.
7 In closing, I would also like to make one final
8 request. I realize that the DNR has 30 days after the last
9 public hearing to make its decision whether or not this
10 temporary ruling becomes permanent. I assume that all
11 information, testimony, and concerns will be reviewed and
12 analyzed, and I would hope for and expect nothing less.
13 However, time is becoming a real concern as we are now into
14 spring. Decisions must be made for our operations to be as
15 successful as possible. I am already getting a little
16 nervous that when a decision is made by the DNR, I may have
17 lost some opportunities to help me reach my operations goals
18 for this year.
19 I ask that the staff of DNR continue to work on
20 this issue in a thorough and timely manner to make their
21 decision on this critical issue as soon as possible and to
22 alert the public of their decision so that we can move ahead
23 with our operational plans. Thank you to the DNR for the
24 dedication and passion you have shown in our state's water
25 supply and quality. I anxiously await your decision. Thank

you.

THE HEARING OFFICER: Thank you, Mr. Lambrecht. Next testifier, please.

ED TRICKER

MR. TRICKER: Good afternoon. My name is Ed Tricker. I'm with the Woods & Aitken Law Firm in Lincoln, and I'm here on behalf of the Sand Hills Golf Club. Sand Hills Golf Club is located in Hooker County.

THE HEARING OFFICER: Ed, would you spell your name, please?

MR. TRICKER: Yeah. It's Tricker, T, like in Tom, r-i-c-k-e-r, first name Ed.

Sand Hills Golf Club is located in Hooker County within the Upper Loup Natural Resources District. Sand Hills Golf Club strongly opposes the DNR's preliminary determination of fully appropriated, and does so because it does not believe that such determination reflects the best scientific data information or methodologies which are readily available, and obviously, which are required by Nebraska statute.

The Sand Hills also questions whether or not all of the available scientific data and information has been made available to the public. We have made several requests, and we question whether or not we have received everything that the DNR utilized in coming up with their

1 December determination.
2 One of the things that we have done is to try to
3 compare the various reports that have been done by the DNR.
4 What we concluded and based upon that comparison is that the
5 2009 report does not identify any significantly different
6 results with respect to the amount of water historically or
7 currently available for junior surface water appropriation.
8 The amount of water necessary to meet the net corn crop
9 irrigation requirement or the amount of water available for
10 diversion at North Bend or Louisville. Indeed, what our
11 comparisons reveal is that the conditions that currently
12 existed when the December determination was made public is
13 that each of those factors would be less likely to lead to
14 the determination that the Platte River Basin is fully
15 appropriated than what existed in 2008. In other words, the
16 conclusions that are in the 2009 report are just the
17 opposite of what one would expect based upon the factual
18 information that is gleaned by that type of comparison.
19 What that comparison also revealed is that despite
20 the fact that the current and historical information shows
21 that more water is available now than when the 2008 report
22 was prepared and that both the 2008 and 2009 reports state
23 there's been no statistically significant trend in
24 participation over the past 50 years, the 2009 report still
25 concludes that the future streamflows 25 years from now will

1 be insufficient. We can't see in the reports or any of the
2 data that's been made available to us, in response to our
3 request, that there's any factual basis that would
4 rationally lead to that conclusion. Rather, it appears to
5 us that it's merely unsupported guesswork or junk science.
6 Simply put, this situation appears to be one in which
7 mathematics or formulas were used to get a desired result as
8 opposed to the correct result.
9 The other information that we looked at focused
10 more specifically on Hooker County and portions within the
11 Upper Loup NRD. One of the other bits of information we
12 looked at was the U.S. Geological Survey Circular 1243.
13 That information, in our analysis of that, also led us to
14 the conclusion that there is no basis from which the DNR
15 could make its determination of fully appropriated with
16 respect to either the Upper Loup NRD, or in particular,
17 Hooker County.
18 What the circular showed us is that from
19 predevelopment to 2000, the water level in Nebraska rose by
20 almost one foot, when looking at the average area-weighted
21 water level change. Furthermore, when there was a measuring
22 of the water storage in the high plains for that same
23 period, the amount in Nebraska rose by four million
24 acre-feet. Again, this really brings into question whether
25 or not there is any basis for the determination that the NRD

1 made in December.
2 Finally, we looked at the information that was
3 available on the U.S.G.S. website, with respect to Hooker
4 County and surrounding areas. When we looked at the
5 U.S.G.S. data, which was gathered on the Dismal River in the
6 area near Thedford, which is in Thomas County, a county just
7 east of Hooker, the reality is that the streamflows are 12.9
8 percent higher as of 2008 than they were in 1967. So, it's
9 just the opposite of what would glean from the DNR's
10 determination. Furthermore, when we look at the average of
11 the discharge from this same river, the discharge is 5.4
12 percent higher in 2008 than it's been over the past 41
13 years. Again, the DNR's determination makes no sense and is
14 not supported.
15 Finally, we looked at water levels in the nine
16 wells that are monitored by the U.S.G.S. in Hooker County.
17 Once again, there's no support for the DNR's determination.
18 In seven of those nine wells, the water levels, as reflected
19 by the U.S.G.S. reports, show that the levels rose an
20 average of 13 feet and that of those water levels -- excuse
21 me, that three of these wells had water levels that rose by
22 more than 16 feet.
23 The Sand Hills doesn't object to a determination
24 by the DNR that is based on the best scientific data,
25 information, and methodologies which are readily available.

1 Unfortunately, from everything that we can look at and
2 analyze, that didn't happen and, in fact, the data that is
3 available to the DNR, as it was to us, shows it's just the
4 contrary. So, as a consequence, we would strongly urge the
5 DNR to reverse its determination both in general and in
6 particular with respect to the Upper Loup NRD in Hooker
7 County. And I would like to place my comments into the
8 record at this time.
9 (Exhibit 9 was marked for identification.)
10 That's all I have. Thank you for your time.
11 THE HEARING OFFICER: Thank you, Ed.
12 Next testifier, please.
13 CINDY AND DAVID PIEKE
14 MS. PIEKE: Good afternoon. We're Cindy and David
15 Pieke. C-i-n-d-y, D-a-v-i-d, P-i-e-k-e. Our NRD is Lower
16 Platte North. David and I have been renting two farms in
17 Madison County, Nebraska, from Opal Benson for over 25
18 years. We were contacted in December of '07 that she needed
19 to sell two 80's to pay for her assisted living. Her
20 attorney and tax man came up with a figure. For tax
21 purposes, she would sell the first Shell Creek Precinct
22 7-21-4 (sic). First installment would be December 27th,
23 2007. The second installment would be January 30th, 2008,
24 which are approximately 30 days apart. The second 80-acre
25 tract is Shell Creek Precinct 7-21-4. First installment is

1 December 27th, 2009, final payment March 1st, 2010. The loan
2 has been approved on the condition that the real estate
3 would be developed for irrigation. When we received the
4 deed on the first tract, we got a permit that spring from
5 the NRD to dig a well.
6 The 80 to the north is owned by Kent Lee. We told
7 Kent that if the well would be good enough, that we would
8 custom irrigate his 80. A hailstorm came and totaled his
9 beans out. He just took the settlement. There was no
10 reason to irrigate his land. Now we are asking if we could
11 irrigate approximately 68 acres for Kent in Section 17-21-4.
12 The well, pump, meter, et cetera, are in place. This
13 project has been finished and approved by the State. It was
14 used on our 80 in 2008. The well pumped 750 gallons a
15 minute. We set the pivot up for 500 gallons a minute. We
16 feel that the 500 gallons is more than adequate in this day
17 and age with no-till. We are asking to irrigate a full
18 circle, roughly 136 acres.
19 Section 7-21-4, coming this fall, we have our
20 third installment to Opal Benson. In March of 2010 we have
21 to make our final installment. Our loan has been approved
22 that the real estate would be irrigated. We will not
23 receive a deed until March of 2010, so we will not get a
24 drilling permit until March of 2010. Since this, my uncle,
25 LeRoy Pieke, contacted us to purchase the original home

1 property. This property has a well in the same section. We
2 contacted the bank in September and said we would irrigate
3 the adjoining 80 acres, which would save us digging a well
4 on the 80's of Opal. The bank has based their approval of
5 purchase on assumption that the ground will be irrigated
6 from an irrigation well located on the W½SW¼ of 7-21-4, in
7 Madison County, Nebraska, that we are purchasing from Opal
8 Benson.
9 On December 11th, the DNR put a moratorium, and in
10 the Shell Creek Watershed, it was fully appropriated. No
11 wells, no more acres. Where does that put us? We signed a
12 purchase agreement in December of '07, to a 97-year-old
13 landlord that is in assisted living, and we have been
14 dividing the land payments out between December of '07,
15 through March of 2010 before we get possession of this
16 second partial. The loan has been approved from our lending
17 institution on the condition that the real estate would be
18 developed for irrigation. Now the DNR has stopped that. We
19 are not asking for a new well. We are asking for an
20 additional 62 acres to be irrigated off of an existing well
21 that we purchased from my uncle.
22 In closing, we started this process, it was
23 December of 2007, and will continue on through March of
24 2010. Our lending institution, at that time, approved this
25 loan under the condition that the real estate would be

1 developed for irrigation. Our contract that was signed with
2 Opal Benson states that if the buyers default not only in
3 payment, but in the performance of any other terms of this
4 contract, that the seller may, at their option, declare the
5 amount of the initial or earnest money paid as liquidated
6 damages and retain said amounts or take any other action,
7 including specific performance, afforded to the sellers
8 under Nebraska law. Thank you.
9 THE HEARING OFFICER: Thank you, David and Cindy.
10 David and Cindy, did you want all this material entered?
11 MR. PIEKE: Yeah, you can.
12 THE HEARING OFFICER: Thank you.
13 (Exhibit 10 was marked for identification.)
14 SCOTT JAPP
15 MR. JAPP: Good afternoon. My name is Scott Japp,
16 S-c-o-t-t, J-a-p-p, from Arlington, Nebraska.
17 I went on the DNR's website to pull up on your own
18 website who has ground surface water rights in the Lower
19 Platte River. The counties that's involved is Douglas,
20 Sarpy, Cass, Lancaster, and Saunders County. There are 14
21 permits for junior and senior rights. All of these permits
22 are for lakes only. The lakes range in size from a half an
23 acre to 46 acre-feet. Two of these lakes are for housing
24 developments, three of them are for NRDs, seven of them are
25 personal lakes, one is a Boy Scout lake, and one is the

1 State of Nebraska. Other people that have stream rights is
2 the State of Nebraska down at Schram Park, which has three
3 permits for stream flows, and there's also seven permits for
4 groundwater-induced, and they're for the City of Omaha and
5 Lincoln.
6 My question and concern is, how can we be -- the
7 Lower Platte be in violation of the 65/85 rule, since
8 there's no farmers pulling water out of the river?
9 THE HEARING OFFICER: Thank you, Scott.
10 Before you begin, may I ask how many people are
11 still wishing to testify?
12 Thank you, sir. Go ahead.
13 ROGER KOERTNER
14 MR. KOERTNER: Good afternoon. My name is Roger
15 Koertner, R-o-g-e-r, K-o-e-r-t-n-e-r. I'm here today
16 representing the Pathfinder Company, farm management and
17 real estate firm, and our landowners who have property
18 within the watersheds that are being impacted here.
19 I'm here in opposition to this determination. The
20 reasoning behind that is, in LB962, the DNR was directed to
21 use the best sound science available. The best sound
22 science also takes into consideration the best available
23 information in order to limit errors within that in the
24 development of those assumptions. It is my opinion, based
25 upon previous hearings that the DNR has had in past years

1 when I served as a director on the NRD board, that there are
2 gross assumptions that are not accurate within the models
3 that are being applied. One of those assumptions is that
4 the highest crop use is applied net corn crop use. Well,
5 that's not true. All acres within the watersheds are not
6 all planted to corn acres. There's a lower crop use being
7 applied on soybean acres. So, I think that it's grossly
8 overstating the actual pumping use that's being -- occurring
9 in the watersheds.
10 Furthermore, in the past studies, the assumption
11 is based that future development is going to occur within
12 the same areas as the existing development has occurred.
13 Well, if 640 acres in a section is all developed, future
14 development is not going to occur in that same area. So,
15 again, I believe that the models that are being run
16 overstate the actual use that agricultural interests are
17 using and I believe it's overstated. I would challenge the
18 DNR and the NRDs to obtain accurate crop use information
19 from those areas and to consider which areas within the
20 watersheds are currently fully developed and that they
21 consider the future development occurs outside of those
22 areas, not making the assumption that it's going to be
23 occurring in the same area.
24 I do not believe that this determination is based
25 upon the best science available, and I don't believe that we

1 have valid assumptions that come out as a result of this.
2 So, I would ask that you reconsider this.
3 THE HEARING OFFICER: Thank you, Roger.
4 Next testifier, please.
5 BILL BRABEC
6 MR. BRABEC: Good afternoon. My name is Bill
7 Brabec, B-r-a-b-e-c. I'm a farmer in the Fremont area.
8 I just have two quick questions. I'll be very
9 brief. My first question is, if every single NRD that
10 should be working with the DNR to make this determination of
11 fully appropriated is opposed to this, how did this ever
12 happen? And secondly, if -- you know, the last time I
13 checked, we live in the United States of American, and I
14 would never, ever presume to come to your house, your home,
15 whatever, and tell you what you can or cannot do with your
16 property. And how, over time, has DNR attained the right or
17 the power to tell me what I can or cannot do with mine?
18 That's all I have, thank you.
19 THE HEARING OFFICER: Thank you, Bill.
20 DAN GOULD
21 MR. GOULD: My name is Dan Gould, D-a-n,
22 G-o-u-l-d, and we're tenant for Norman Miner, N-o-r-m-a-n,
23 M-i-n-e-r. And this farm is located northeast of Laurel,
24 about five miles. And originally, we had a well permit on
25 it, but because of the area where the well was going to be

1 placed, it was felt to be more cost-effective to do it in
2 the fall, because of the high water table, it'd be easier to
3 drill and so forth. And so we went ahead and got estimates
4 and equipment on it for a center pivot to put on here, and
5 we cleared a -- began site clearing last fall. But in the
6 meantime, our original permit ran out and we thought we
7 would wait and get a year -- another year permit that would
8 give us a window of spring or fall to put the well in. And
9 in the meantime, the moratorium came along and put a halt to
10 that. And so we haven't committed or anything, so, if we
11 get a permit, we would like to know that -- or reissuance of
12 a permit, that -- if that would be possible. We had a
13 permit on this land previous, and so we seek a reissuance.
14 We know that a major investment is a long-term investment,
15 and so we'd like that to be the case, and follow through on
16 that for this particular area. And this is out of the 10/50
17 area. There was a permit issued once before, so that is our
18 particular situation at this time.
19 THE HEARING OFFICER: Thank you, Dan.
20 HARRY MUHLBACH
21 MR. MUHLBACH: My name is Harry Muhlbach, last
22 name M-u-h-l-b-a-c-h. And I farm in Lower Platte South, in
23 one of the Loup NRDs. And I'm going to say I'm from the old
24 school. If I had turned in a math problem and didn't get
25 the right answer, my teacher would tell me to go back and

1 redo it or you're not going to get a passing grade. And I
2 think right now, the DNR is showing that they're
3 manipulating the figures to support special interest groups,
4 and I want to remind the DNRD that human consumption of
5 water is first, and second is agriculture or for the
6 production of food. But for some reason, the production of
7 food has gotten moved down the chain. It's not as important
8 as other Fish and Wildlife, and the Game and Parks. Well,
9 believe it or not, farmers go fishing and camping and they
10 use them same facilities and they respect them and they're
11 not out to destroy them. They're out there -- they pay
12 taxes on the land that they live on. Most farmers, if you
13 went to town and you told somebody in town that you were a
14 farmer, them people wouldn't say, "Oh, my God. I feel sorry
15 for you." Well, we, the farmers, are doing a lot of service
16 for the state, the economy, and the national debt. And I'd
17 be -- For the foreign trade, agriculture is one of the most
18 important things in our deficit -- helping the deficit of
19 our country.
20 And I think that the DNR needs to go back and
21 review what they've done. And it's not too late to review
22 it. And one reason I'm going to say this is because, I came
23 from a farm when we drilled a well in 1949. And when we
24 watered back then, it was just, boy, just put as much water
25 on as you can. Well, irrigation has modernized so much

1 where you only put on the amount that that crop needs. And
2 what we were watering in the '50s, we could probably water
3 five quarters with that amount of water now, because the
4 farmers have increased the efficiency of the use of water.
5 Just because there's 10 new wells doesn't mean they're using
6 as much water as they did 10 years ago. Them 10 new wells
7 may be doing what 50 wells were using before. And so, on
8 this formula, we have not stretched out our 25 years of what
9 the efficiency of our application of this groundwater is.
10 And another thing that was brought up today was
11 about, we haven't done anything about recharging water.
12 I've heard a couple comments. Around Grand Island at one
13 time, they were recharging groundwater because they were
14 flooding all the time, and when they were dewatering it or
15 whatever. We can recharge. That formula wasn't put into
16 this, too. Whenever it floods, that's water that's given to
17 us free by nature. And at times, we should be using that,
18 because maybe they're throwing that, is being put on our
19 earth to be, "Here, take it and use it wisely, because it's
20 free."
21 And I wasn't going to speak, but I just had to say
22 something. And that's it.
23 THE HEARING OFFICER: Thank you, Harry.
24 (Applause.)
25 Next testifier, please.

1 VIRGIL WAGNER

2 MR. WAGNER: My name is Virgil Wagner, V-i-r-g-i-l
3 W-a-g-n-e-r. My son and I farm northwest of town up by
4 Hooper. Thank you for the privilege of appearing before
5 you today to express my concerns regarding your preliminary
6 determination of fully appropriated water -- of the use of
7 the water along the Loup and the Lower Platte and the
8 Elkhorn.

9 According to your published summary of LB962
10 activities, this determination will trigger a moratorium on
11 new surface and groundwater uses. At that point in time, no
12 one can expand the number of historically irrigated acres
13 without an exemption. The point being, it's not only about
14 water. It's also about control of irrigated acres and
15 expansion of irrigated acres.

16 The Lower Elkhorn NRD, in its 2008 winter
17 newsletter says, "This groundwater level data reveals that
18 since the district began these measurements in 1976,
19 groundwater levels fall and rise over time closely following
20 precipitation cycles, and so far, groundwater levels have
21 remained sufficient and no protective measures have been
22 required." Data from the United States Geological Service,
23 the real-time water data, confirms that median water flow at
24 West Point for March 5th to March 11th of 2009, this past
25 week, has been above the median flow of 1,040 cubic feet per

1 second. The minimum was 369 cubic feet per second, in 1981,
2 and the maximum was 12,900 cubic feet per second in 1993.
3 It was in between those two extremes when it flooded Highway
4 275 last month.
5 The Platte River at North Bend has been running at
6 about 4,080 cubic feet per second, which is below the
7 median, but above the minimum of 2,500 cubic feet per second
8 in 1950, and below the maximum of 61,400 in 1993. Even the
9 Maple Creek at Nickerson has shown variability from 3.75
10 feet of flow to 6.6 feet and then back to 4 feet, just over
11 this past week. The point is that surface water flows are
12 directly tied to snow melt, ice breakup, and rain since it's
13 the rivers and streams that drain off the excess which the
14 water -- which the ground cannot absorb.
15 Dr. Elwin Taylor from Iowa State University, their
16 climatologist, observed that it takes between 24 and 26
17 inches of moisture per year to raise a crop of corn.
18 Fremont, Nebraska, on the average, gets 30 inches of
19 rainfall per year. The extra four inches would be the
20 normal base flow of water flowing down the river, plus the
21 run-off from the streets, and the roads, and the ditches.
22 So, for example, if we got 32 inches of rainfall in a given
23 year, this would increase streamflows by 50 percent. It
24 doesn't sound like much, but the point here is that in Iowa
25 there's a 100-year flood someplace every year. Des Moines

had it last year. Will this year be a year of drought or flood?

The U.S. Seasonal Drought Outlook from the Climate Prediction Center does not forecast a drought. U.S. Geological Service has Nebraska's current water resources conditions at above normal. Groundwater recharge levels have increased from the spring of 2007. So the question is, why is the DNR in a hurry to declare this water fully appropriated?

I could go into some data on this model that was presented earlier, this computer model. The only point I'd like to make about that particular item was that a computer is great for realistic simulation, but it can predict outcomes based on estimated or hypothetical data to predict what comes and that may not be realistic and it can be devastating. In so many words, we can run a lot of simulations, but if we don't put in the right data, if we assume data, if we just use hypothetical data, it's not going to come up with the right conclusion.

By declaring Nebraska water fully appropriated, you've given yourself complete leverage where you cannot be wrong, because you can take any scenario and make yourself look right. There's no rush to make this determination. New drought resistant hybrids are being developed. No-till and residue management are reducing the supplementary water

1 reusage that's required. Rotations are water use effective.
2 And the point that Roger just made is not all land is in
3 corn, which is a supposition for the model that was created.
4 Few farmers, especially in this area, put on 10,
5 12, or 15 inches of water. Most are in the 6 to 9, 8-inch
6 area. Higher pumping costs and lower commodity prices are
7 limiting the amount of water applied. And why limit the
8 acres that can be irrigated from a given well? Limit the
9 river water users, if you want to retain the flow in the
10 river. My main concern is that once a declaration is made,
11 it's never rescinded. New innovation, individual choice and
12 freedom to develop will be stifled. This policy then just
13 becomes another cap and trade, a tax and control by
14 government.
15 Why would we limit the number of irrigated acres
16 when the world is going to greatly need this production in
17 the years ahead? Why would we waste resources by curtailing
18 the one resource, which in production agriculture is its
19 greatest limiting resource, namely water?
20 The data you currently present is limited and
21 could improve dramatically over the next several years. The
22 power to regulate and control is shifting away from those
23 who risk the money and pay for the development to those who
24 want to have it without cost.
25 So, I'd appeal to you not to make a hasty decision

1 that will severely limit the future development of Nebraska
2 for both agriculture and industry.
3 THE HEARING OFFICER: Thank you, Mr. Wagner.
4 DOUGLAS P. NELSON
5 MR. NELSON: Douglas P. Nelson, s-o-n, Wayne,
6 Nebraska. I'd like to present you a hard copy of my
7 previous testimony, and read just a brief summary of what
8 I've testified to earlier.
9 THE HEARING OFFICER: You mean, at other hearings,
10 sir?
11 MR. NELSON: Yes.
12 The earth is not a static object. It's rotating
13 and revolving. It's heating and cooling. There are oceans
14 and tides, earthquakes and volcanoes, forest fires and
15 sunspots. This thing's bigger than a fish, a farmer, and
16 any government agency that thinks otherwise. Boys,
17 somewhere in this country, someone has got to produce some
18 legitimate profit to pay the taxes needed to pay the
19 illegitimate public debt. Using water is just that. It's
20 not like coal or oil. Water is nonpolluting and totally
21 indestructible. Every molecule is always here, no matter
22 how many times you use it. Folks, protect your right to use
23 your water. Do not allow it to be eliminated or converted
24 to a tax. Call Governor Dave, 471-2244. Thank you.
25 THE HEARING OFFICER: Thank you, Mr. Nelson.

1 CHARLES A. "CHUCK" FOLSOM

2 MR. FOLSOM: I'm Charles A. "Chuck" Folsom,
3 F-o-l-s-o-m. And I'm farm-raised, country school-educated,
4 have a significant farming operation between here and
5 Nickerson, some of the ground that I was raised on. I was
6 gone for 31 years, World War II through Vietnam, as a
7 Marine. I returned after 31 years, being placed on the
8 Marine Corps' permanent disability retired list to enter
9 back into the farming operation.
10 Thirty-six years ago, when my mother died, I
11 bought out the other half of the operation, paid some 20
12 percent interest about 27 years ago, too. It's been a tough
13 life. Some of this ground is very difficult ground. I've
14 increased the operation about 300 percent. We've gone from
15 two old water drives and some gravity to almost all
16 electrics. They're all old. My newest pivot is 28 years
17 old. I got down off a pivot to come here.
18 What I'm concerned with, I watched the DNR, and
19 I've got two short pivots sitting out here that I need wells
20 for. I bought them a little less than a year ago. What I'm
21 concerned about, and I became concerned about it about 30
22 years ago. We live in a democracy, a representative form of
23 government. Now, I've served at the city and the district
24 and the state level. I did 15 years on the Lower Platte
25 North NRD, and didn't run again, because I believe in term

1 limits. During my last tour, I was the Lower Platte Basin's
2 representative, elected representative, to the Natural
3 Resources Commission. And as a commissioner, I saw a lot of
4 various operations including the DNR's. But what really
5 concerns me about this, and the reason I'm standing here
6 right now, is because I, some years ago, listened to one of
7 the water czars, Ann Bleed to be exact, talk about gravity
8 irrigation being more efficient and better than pivot
9 irrigation. Nobody called her on it. What I'm really
10 concerned about is that you are not a democratic
11 organization. And had you a board of directors, partially
12 elected from whatever source, the NRDs, maybe, as the
13 Commission and partially appointed by the Governor, as the
14 Natural Resources Commission is, we wouldn't be having this
15 problem right now, because it would have run the way that it
16 should have, openly, with input from elected
17 representatives, and the knowledge of the public. Thank you
18 for the opportunity to speak.
19 THE HEARING OFFICER: Thank you.
20 (Applause.)
21 LARRY ANDERSON
22 MR. ANDERSON: My name's Larry Anderson. I'm a
23 farmer, and a father, from Antelope County, the Upper
24 Elkhorn NRD. I have two sons who've gone to college and
25 come back to the farm as my brothers and I have. There is

1 room on these farming operations in Nebraska for our
2 children because, and only because, of irrigation. Since my
3 father put in the first wells in the early 1960s, the same
4 wells today on those same farms, we've nearly doubled the
5 yield using approximately 60 percent of the water. When
6 these wells were first put in, the old Valley water drives
7 would take over 40 hours to make a round. They ran 24 hours
8 a day, seven days a week, if we could keep them running.
9 Today, the majority of our wells are under the
10 NPPD's low control system. They come on 10:00 at night.
11 They shut off at 10:00 in the morning, automatically, 12
12 hours a day. The Nebraska farmers are probably some of the
13 most efficient people in the United States in the use of
14 water, to conserve the water under their land, the water
15 that belongs to them by constitutional law in Nebraska, the
16 water under our land is our property. It's an appurtenance
17 to that land and we're guaranteed the lawful use of that
18 water by the Nebraska State Constitution. If you want our
19 water, you can have it, but you're going to pay us for it.
20 We're going to keep that.
21 Who makes this decision? Ultimately, who's the
22 gentleman who makes the decision? That's a question. I
23 don't know your name.
24 THE HEARING OFFICER: When you finish, I have some
25 statements and I'll explain that.

1 MR. ANDERSON: Well, who is the man who makes the
2 decision?
3 THE HEARING OFFICER: The Director of the
4 Department.
5 MR. ANDERSON: Are you the Director? I don't know
6 who you are, sir. Are you the Director?
7 THE HEARING OFFICER: No, sir.
8 MR. ANDERSON: Is he here today?
9 THE HEARING OFFICER: No, sir.
10 MR. ANDERSON: Where's he at today? Where's the
11 Director at today?
12 THE HEARING OFFICER: The Director is in Denver at
13 the Republican River Basin arbitration.
14 MR. ANDERSON: I'm curious why he wasn't here
15 today. I think, as a citizen adversely impacted by this, I
16 have a right to testify directly to the man who's making the
17 decision. In a court of law, it's deemed that a judge has
18 an opportunity, not only to see the witnesses, but to hear
19 their testimony that he might weigh equitably the validity
20 of that testimony. I wonder if we're conducting these
21 hearings only as a formality. Certainly, you knew that the
22 Denver meeting was scheduled and was in conflict with this
23 hearing here today. I think that you need to reschedule
24 this hearing. I think that the people who've come here
25 today have a right to testify in front of the Director who's

1 going to make this decision. I applaud the United States
2 Marine who preceded me here at this podium and a man who
3 stood up for our rights as Americans to protect our
4 property.
5 I have here a copy of a recent article in the
6 Norfolk Daily News, Friday, February 13th, about the time of
7 your hearing up there. The headline states, "Water Demand
8 Outpacing Supply." Over in the left column, U.S. Highway
9 275 was closed because the Elkhorn River is running water
10 three foot over the flood stage, down the Lower Platte, out
11 into the sewer going down to New Orleans, and they've got
12 plenty of water down there now, I hear. We don't have a
13 water deficit in Nebraska. We have a deficit of leadership.
14 Men to be studied, the men whose names are Kingsley,
15 McConaughy, Norden, Norris, these men and the history that
16 we had in grammar school are known because of their efforts
17 to build reservoirs of their foresight, to impound this
18 water has been referred to by these gentlemen ahead of me
19 here today. I'm not going to advocate the 20,000-acre lake
20 at Ashland, but we need to consider seriously building a 2-
21 or 3,000-acre lake there to ensure domestic water supplies,
22 for the Lower Platte region. That lake would stop some of
23 the water that the leadership in Nebraska is wasting by
24 letting it run down the river.
25 You people have got to be a little surprised at

1 all of the people who've showed up to resist this. You
2 didn't have this in Republican River or the Upper Platte.
3 People will go with you if they believe what you're telling
4 them. The American people will follow their leaders if they
5 believe you. The people in the Republican River and the
6 Upper Platte could look out their window of their pickup and
7 they could see the rivers were running dry. I took my sons
8 to Lake McConaughy that they could see that lake drying up.
9 They'll see that lake run over again. A few short years
10 ago, NPPD was afraid they were going to lose that lake,
11 because the water was threatening to run over the top of
12 that dam. That cycle will repeat itself.
13 I have another headline here. "They're ominous
14 signs in the earth's weather. Patterns have begun to change
15 dramatically and these changes portend a drastic decline in
16 food production. The evidence in support of these
17 predictions has now begun to accommodate so massively that
18 meteorologists are hard pressed to keep up with them." This
19 is a headline from a 1975 Newsweek magazine. We don't hear
20 that garbage anymore, because now we're worried about global
21 warming.
22 Everybody pays attention when Warren Buffett
23 speaks. A couple weeks ago, Warren Buffett had an
24 interesting observation. "Beware of geeks with computer
25 models." And that's all this is.

1 Now, you people have been polite, but I'm going to
2 repeat what I said. Is this just a formality? Where is the
3 Director? Aren't we important? All of these people took
4 time out of their day to come here. Aren't they important
5 enough? Doesn't our testimony merit directly to the
6 Director? Thank you.
7 (Applause.)
8 THE HEARING OFFICER: Thank you all. I will
9 assure you that your testimony is important to the Director.
10 There being no further testimony, the Department
11 received a couple of pieces of written testimony prior to
12 the hearing. It was from the Farm Bureau, and an
13 individual, Mr. Furstenau from Tilden.
14 It is now a quarter to 4:00 p.m., and the hearing
15 is closed. The record will remain open, however, through
16 the close of business Friday, March 13th, 2009, for receipt
17 of any additional written testimony which should be mailed
18 to the Department and identified as testimony for this
19 hearing.
20 Once the record is closed, the Director of the
21 Department will consider the testimony and the exhibits
22 presented at this hearing and at other hearings held
23 previously, before making his final determination on whether
24 to go forward with the preliminary determination, or to
25 reconsider the preliminary determination and issue a

1 different preliminary determination and schedule further
2 hearings.
3 Thank you all very much for attending.
4 (Whereupon, at 4:47 p.m., on March 12, 2009, the
5 proceedings were concluded.)
6 (Exhibits 11 through 16 were marked for
7 identification and received in evidence. See Index.)
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Exh.
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NOTICE OF PRELIMINARY DETERMINATION THAT THE LOWER PLATTE RIVER BASIN IS FULLY APPROPRIATED

NOTICE TO THE UPPER NIOBRARA-WHITE NATURAL RESOURCES DISTRICT, THE MIDDLE NIOBRARA NATURAL RESOURCES DISTRICT, THE LOWER NIOBRARA NATURAL RESOURCES DISTRICT, THE UPPER LOUP NATURAL RESOURCES DISTRICT, THE UPPER ELKHORN NATURAL RESOURCES DISTRICT, TWIN PLATTE NATURAL RESOURCES DISTRICT, LOWER LOUP NATURAL RESOURCES DISTRICT, CENTRAL PLATTE NATURAL RESOURCES DISTRICT, UPPER BIG BLUE NATURAL RESOURCES DISTRICT, LOWER ELKHORN NATURAL RESOURCES DISTRICT, LOWER PLATTE NORTH NATURAL RESOUCES DISTRICT, LOWER PLATTE SOUTH NATURAL RESOURCES DISTRICT, LEWIS AND CLARK NATURAL RESOURCES DISTRICT, AND PAPIO MISSOURI RIVER NATURAL RESOURCES DISTRICT

The Nebraska Department of Natural Resources has completed its annual evaluation of expected availability of hydrologically connected water supplies in accordance with the Nebraska Ground Water Management and Protection Act ("Act") and has made a preliminary determination that the Lower Platte River Basin is fully appropriated. As required by the Act, the Department hereby gives notice of its determination to each of the natural resources districts that encompasses a portion of the geographic area involved.

NOTICE

1. The Department has made a preliminary determination that the portion of the Lower Platte River Basin depicted on the enclosed map is fully appropriated. The fully appropriated portion of the basin includes the surface watershed of the Platte River and its tributaries from the confluence upstream of the Missouri River and the ground water aquifers considered to be hydrologically connected to that portion of the Lower Platte River and its tributaries.

2. The Department has placed an immediate stay on the issuance of any new surface water appropriations in the fully appropriated portions of the Lower Platte River Basin.

3. Upon receipt of this notice, and in accordance with Neb. Rev. Stat. Section 46-714(1), an immediate stay on the issuance of water well construction permits takes effect in the area in which the surface water and groundwater are hydrologically connected in the Lower Platte River Basin ("the hydrologically connected area"). A map and the legal description of the hydrologically connected area are enclosed.

EXHIBIT
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3pp.
3-12-09 WC

ADDITIONAL INFORMATION

On December 26, 2008, the following additional stays take effect:

1. No new water wells may be constructed in the hydrologically connected area unless a construction permit for the water well was issued by a natural resources district prior to December 16, 2008, and the permit contains conditions that meet the objectives of Neb. Rev. Stat. Section 46-715. Any well constructed pursuant to such a permit must be completed in accordance with Neb. Rev. Stat. Section 46-738.

2. No existing water well in the hydrologically connected area may be used to increase the number of acres historically irrigated.

3. No surface water appropriation in the fully appropriated area may be used to increase of the number of acres historically irrigated.

The stays shall remain in effect at least until the Department has made a final determination about whether this portion of the Lower Platte River Basin is fully appropriated. One or more public hearings on the preliminary determination will be held on or before March 16, 2009. The Department will make a final decision on whether or not this portion of the Lower Platte River Basin is fully appropriated on or before April 15, 2009. A decision whether or not to continue the surface water stays will also be made at that time. The natural resources districts will then have to decide whether or not to continue the stays on the construction of new wells or the use of existing wells to increase the acres irrigated beyond historic use.

Brian P. Dunnigan

Brian Dunnigan, Director
Department of Natural Resources

NOTICE OF PUBLIC HEARINGS
ON THE PRELIMINARY DETERMINATION THAT
THE LOWER PLATTE RIVER BASIN IS FULLY APPROPRIATED

The Nebraska Department of Natural Resources will hold public hearings on the preliminary determination at four locations and dates:

RESCHEDULED: The hearing previously scheduled for Friday, February 13, 2009 in Ord, Nebraska is rescheduled, below, due to weather.

Tuesday, February 17, 2009 at 1:30 P.M. at the Learning Center of Northeast Nebraska Community College, 601 East Benjamin Avenue, Norfolk, Nebraska

Tuesday, February 24, 2009 at 1:30 P.M. in Room A on the Lower Level of the State Office Building, 301 Centennial Mall South, Lincoln, Nebraska

Wednesday, March 11, 2009 at 1:30 P.M. at the Valley County Ag Complex, East Highway 11, Ord, Nebraska

Thursday, March 12, 2009 at 1:30 P.M. in the Fremont City Auditorium, 925 North Broad Street, Fremont, Nebraska

Any interested person may appear at these hearings and present written or oral testimony and evidence concerning the appropriation status of the Lower Platte River Basin, the department's preliminary conclusions about the extent of the area within which the surface water and ground water supplies for the river basin, subbasin, or reach are determined to be hydrologically connected, and whether stays on new uses should be terminated. Information on the preliminary determination, maps of the areas affected, and maps and legal descriptions of the geographic area within which the ground water is hydrologically connected to surface water for purposes of a fully appropriated determination of the Lower Platte Basin are located on the department's web site, www. dnr.ne.gov

Brian P. Dunnigan, Director
Nebraska Department of Natural Resources

Exh.
2

Norfolk Daily News

OWNED BY THE HUSE PUBLISHING COMPANY
NORFOLK, NEBRASKA

PROOF OF PUBLICATION

THE STATE OF NEBRASKA
Madison County

Debbie Warneke, being first duly sworn on oath says that she is the Business Manager of **The Huse Publishing Company**, a corporation, publishers of the **Norfolk Daily News**, a legal daily newspaper published at Norfolk, Madison County, Nebraska, and of general circulation in said county; that a notice entitled

NOTICE OF PUBLIC HEARINGS ON THE PRELIMINARY DETERMINATION THAT THE LOWER PLATTE RIVER BASIN IS FULLY APPROPRIATED

The Nebraska Department of Natural Resources will hold public hearings on the preliminary determination at four locations and dates:

Friday, February 13, 2009 at 1:30 P.M. at the Lower Loup Natural Resources District Office, 2620 Airport Drive, Ord, Nebraska

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Brian P. Dunnigan, Director
Nebraska Department of Natural Resources

(January 15, 22, 29, 2009)

Lower Platte; a true copy as printed in said paper, is hereto attached and made a part hereof, was published in every issue of said paper for each **Thursday;** each week for **three** consecutive weeks, the first publication being on **January 15, 2009** and the last day of publication being **January 29, 2009** said newspaper was published daily in the City of Norfolk within said County for more than 52 consecutive weeks immediately prior to the commencement of the publication of said notice and every week consecutively since that time; and during all of said time said newspaper had a bona fide circulation of more than 300 copies daily and was printed wholly in the English language and in whole or in part in an office maintained by the publisher at said place of publication.

Debbie Warneke

Subscribe 29 day of January . 2009

Lori J Brummels

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GENERAL NOTARY - State of Nebraska
LORI J. BRUMMELS
My Comm. Exp. Oct. 4, 2011

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DEPARTMENT OF NATURAL RESOURCES

EXHIBIT
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FEB 03 2009

DEPARTMENT OF NATURAL RESOURCES

Proof of Publication

STATE OF NEBRASKA, }
VALLEY COUNTY. } ss.

Lynn Gibbs, being first duly sworn, on oath deposes and says that he is Publisher of THE ORD QUIZ, a legal weekly newspaper under the Statutes of The State of Nebraska, printed and published in whole (or in part) once each week at its office in the City of Ord, Valley County, Nebraska; that he has knowledge of the facts set forth herein; that the notice, a true and correct printed copy of which is hereto attached and made a part hereof, was printed and published in each and in all of the regular and entire weekly issues of every publication of said newspaper and not in a supplement thereof, 3 consecutive, successive weeks, namely in the issues of the 14 day of Jan, 2009, the 21 day of Jan 2009, the 28 day of Jan, 2009 and the ..... day of ....., 20..... and the ..... day of ..... 20.....

Printer's Fees $ 74.28

Subscribed in my presence and sworn to before me this 29 day of January, 2009.

(SEAL)

Corinna K. Nickels, Notary Public,

GENERAL NOTARY - State of Nebraska
CORINNA K. NICKELS
My Comm. Exp. Aug. 15, 2011

3

NOTICE OF PUBLIC HEARINGS ON THE PRELIMINARY DETERMINATION THAT THE LOWER PLATTE RIVER BASIN IS FULLY APPROPRIATED

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Brian P. Dunnigan, Director
Nebraska Department
of Natural Resources

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AFFIDAVIT OF PUBLICATION

State of Nebraska } ss.
LANCASTER COUNTY,

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Brian P. Dunn[illegible]

The undersigned, being first duly sworn, deposes and says that she/he is a Clerk of the Lincoln Journal Star, legal newspaper printed, published and having a general circulation in the County of Lancaster and State of Nebraska, and that the attached printed notice was published in said newspaper two successive time(s) the first insertion having been on the 22 day of January A.D., 2009 and thereafter on 29, 2009 and that said newspaper is the legal newspaper under the statutes of the State of Nebraska. The above facts are within my personal knowledge and are further verified by my personal inspection of each notice in each of said issues.

Rebecca Coulter

Subscribed in my presence and sworn to before me this _____ day of January 30 2009

Juana Nordmeyer Notary Public

Printer's Fee, $ _____

GENERAL NOTARY - State of Nebraska
JULANA NORDMEYER
My Comm. Exp. Jan. 28, 2012

5466180

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AFFIDAVIT OF PUBLICATION

State of Nebraska } ss.
LANCASTER COUNTY,

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Friday, February 13, 2009 at 1:30 P.M., at the Lower Loup Natural Resources District Office, 2620 Airport Drive, Ord, Nebraska

Tuesday, February 17, 2009 at 1:30 P.M., at the Learning Center of Northeast Nebraska Community College, 601 East Benjamin Avenue, Norfolk, Nebraska

Tuesday, February 24, 2009 at 1:30 P.M., in Room A on the lower level of the State Office Building, 301 Centennial Mall South, Lincoln, Nebraska

Any interested person may appear at these hearings and present written or oral testimony and evidence concerning the appropriation status of the Lower Platte River Basin, the department's preliminary conclusions about the extent of the area within which the surface water and ground water supplies for the river basin, subbasin, or reach are determined to be hydrologically connected, and whether stays on new uses should be terminated. Information on the preliminary determination, maps of the areas affected, and maps and legal descriptions of the geographic area within which the ground water is hydrologically connected to surface water for purposes of a fully appropriated determination of the Lower Platte Basin are located on the department's web site, www.dnr.ne.gov.

Brian P. Dunnigan, Director
Nebraska Department of
Natural Resources

#5459959 3t Jan. 15, 22, 29 29-01-00

The undersigned, being first duly sworn, deposes and says that she/he is a Clerk of the Lincoln Journal Star, legal newspaper printed, published and having a general circulation in the County of Lancaster and State of Nebraska, and that the attached printed notice was published in said newspaper one successive time(s) the first insertion having been on the 15 day of January A.D., 2009 and thereafter on _____, 20___ and that said newspaper is the legal newspaper under the statutes of the State of Nebraska. The above facts are within my personal knowledge and are further verified by my personal inspection of each notice in each of said issues.

Rebecca Coulter

Subscribed in my presence and sworn to before me this 26 day of January, 2009

Janice Krueger Notary Public

Printer's Fee, $ _____

GENERAL NOTARY-State of Nebraska
JANICE KRUEGER
My Comm. Exp. Jan. 30, 2009

5459959

Proof of Publication

STATE OF NEBRASKA
County of Dodge

ss.

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DEPARTMENT OF NATURAL RESOURCES

William Vobejda being duly sworn, deposes and says he is Publisher of the FREMONT TRIBUNE, a newspaper printed and published daily except Sunday in Dodge County, State of Nebraska, and of general circulation in Dodge County; that said newspaper has a bona fide circulation of more than 300 copies daily, has been published within said County for more than 52 successive weeks immediately prior to the first publication of the annexed notice, and is printed wholly in an office maintained at the place of publication.
And that the annexed notice has been published in one issue for 3 consecutive weeks in said newspaper.

CASE TITLE Lower Platte River
NOTICE of February and March Public Hearings

ENVELOPE NO.	LINES	RATE	DATE	CHARGES
67176	76	.30680	01/17/09	
67176	76	.26860	01/24/09	
67176	76	.26860	01/31/09	

Publication Fee $64.14

and said notice was published each week on the same day of the week as the first publication.

Subscribed in my presence and sworn before me this 31st January, 2009

Cynthia Schinstock
Notary Public

My commission expires April 5, 2012.

GENERAL NOTARY-State of Nebraska
CYNTHIA C. SCHINSTOCK
My Comm. Exp. April 5, 2012

NOTICE OF PUBLIC HEARINGS ON THE PRELIMINARY DETERMINATION THAT THE LOWER PLATTE RIVER BASIN IS FULLY APPROPRIATED

The Nebraska Department of Natural Resources will hold public hearings on the preliminary determination at four locations and dates:
Friday, February 13, 2009 at 1:30 P.M. at the Lower Loup Natural Resources District Office, 2620 Airport Drive, Ord, Nebraska.
Tuesday, February 17, 2009 at 1:30 P.M. at the Learning Center of Northeast Nebraska Community College, 601 East Benjamin Avenue, Norfolk, Nebraska.
Tuesday, February 24, 2009 at 1:30 P.M. in Room A on the Lower Level of the State Office Building, 301 Centennial Mall South, Lincoln, Nebraska.
Thursday, March 12, 2009 at 1:30 P.M. in the Fremont City Auditorium, 925 North Broad Street, Fremont, Nebraska.
Any interested person may appear at these hearings and present written or oral testimony and evidence concerning the appropriation status of the Lower Platte River Basin, the department's preliminary conclusions about the extent of the area within which the surface water and ground water supplies for the river basin, subbasin, or reach are determined to be hydrologically connected, and whether stays on new uses should be terminated. Information on the preliminary determination, maps of the areas affected, and maps and legal descriptions of the geographic area within which the ground water is hydrologically connected to surface water for purposes of a fully appropriated determination of the Lower Platte Basin are located on the department's web site, www. dnr.ne.gov
Brian P. Dunnigan,
Director
Nebraska Department of Natural Resources
(1:17,24,31)09(67176)

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March 11, 2009

Dear Sir:

I am a farmer, rancher and landowner in Tilden, NE. My concern is the recent ruling by the Nebraska Department of Natural Resources that declares the lower Platte basin "fully appropriated". This means, as of December 22, 2008, landowners here in most of Northeast Nebraska would no longer be allowed to drill irrigation wells. Wells for towns and new industry like ethanol plants would also be banned. Dam building like the one proposed south of Oakdale, NE or other erosion control dams may also be affected.

The reason for the moratorium is that a "new" computer model states " stream flows on the Elkhorn River may be too low at entry into the Platte River to sustain 4 endangered species". Facts show stream flows on the Platte at 10 year highs. Another factor which affects stream flows today is improved farming and conservation practices that lend to less runoff into rivers. No till farming, terraces, dams, improved ground cover through irrigation, farmer education through the University of Nebraksa extension service, and CRP acres are all factors that keep the water on the soil and not in the rivers. Stream flows are also affected by drought which we have had the last 8 of 10 years.

My father owns 320 acres of which he was considering irrigating. Because of the current moratorium prohibiting drilling, he cannot develop the land. This affects his income & his net worth because dry land is not worth what irrigated land sells for. The ability of my son, his grandson, who farms this land, to make a sufficient income is also impaired. The following figures list the economic impact this ruling by the State NRD has on his 320 acres.

My Father's 320 acres

Irrigated Land				Dryland	
Per Acre Value		$3,500		Per Acre Value	$1,000
Irrig. Pivot-new		375			
Irrig well & motor		375			
		$4,250			$1,000
New Equipment for add'tl production		$500			
Fert,fuel,seed,interest		465			300
Rent		300			110
Income	200 bu x 3.50 =	700		100 bu x 3.50 =	350
Taxes		50			13
Yearly Impact		$2015	versus		$773

The irrig well, pivot, fert, fuel, seed and all other added inputs that are necessary to raise irrigated crops will be purchased locally. When that money is spent and multiplied 8 times, the local impact alone is great without even considering state and national impact.

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The 240 dryland acres adjoining his land sold in Dec 2008 for $3400/acre. Because the buyers applied for a well permit before the moratorium went into effect they can now irrigate this land. My father has no permit, therefore will not be allowed to irrigate his land. His 320 acres is now worth $1000/acre versus the $3400/acre of the like ground adjoining his property. Is it fair that his value has now dropped $768,000 because of a highly contested computer model and the uninformed biased decision of the Nebraska State NRD?? As one considers many other dryland acres in Northeast Nebraska , the economic effect becomes far greater.

In 2007 a study ,the COHYST (Cooperative Hydrology Study) was released. It was partnered by several large central Nebraska cities, The Audubon Society, Farm Bureau, Platte River Whooping Crane Trust, and other state associations. This study states "that if all irrigation wells were shut down, the average gain back to the river (North Platte River) would be minimal."

The reason the Elkhorn basin is even being considered for the restrictions is because the Elkhorn river empties into the Platte River just several thousand feet before the Platte empties into the Missiouri River. The Platte flow is being monitored because of 4 endangered species. The inflow at this point into the Platte has very little impact on these species.

A new US Geological Survey and also a study done by Mark Burbach, an assistant in the UNL School of Natural Resources, shows groundwater levels are remaining fairly constant. The US study was commissioned by the Lower and Upper Elkhorn NRD, and "showed stream flows are stable or trending upward, according to data analyed from 1953 to 2005". The regional NRD's have done studies that do not support the State moratorium decision. The studies and recommendations made by the regional NRD's are more concentrated on the local causes and effects than the broader State studies. The regional NRD's work with and monitor daily water issues , but are being ignored by the State NRD. Who has the best knowledge of what's happening locally? At the current time the regional NRD's have filed suit against the State NRD contesting their moratorium on well development because they simply do not agree with the moratorium decision.

One of the more upsetting factors in this decisions is how can one department official, Brian Dunnigan, and his department, the Nebraska Department of Natural Resources, make such a determination that affects the economy of many and so much.

I remember one statement my high school science teacher always made—"it is impossible to destroy one drop of water." Pumping of groundwater does not destroy water. Most of it is returned to the soil to percolate back to the groundwater. Some water runs off into the streams, and the remainder evaporates to return as rain. Many factors affect stream flow as I have mentioned.

In conclusion, how can so few people make such a huge decision without using all the facts and factors. The state's,regional NRD's, the COHYST study, groundwater tables, and the proven economic impact of such a decision have to be considered. We, the people of Nebraska, are loosing our rights as land owners and water users to the inconclusive computer model predicting stream flows 25 years from now. We, as farmers, ranchers, and local residents are concerned about our livelihood.

Please consider these facts to help return well drilling to freedom of choice as before the moratorium. We, owners and users of these wells, need this water for crop production and feeding of the world. We first hand understand waters importance. Please thoughtfully consider this and exert influence on the Nebraska Department of National Resources to reverse their moratorium decision. Restrictions are not needed at this time on well development within Northeast Nebraska. It is vital to the State and our economy to overturn this decision.

Respectfully,

Galen Furstenau
84996 532 Ave
Tilden, NE 68781

Phone (402) 368-2198
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Exh.
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nebraska farm bureau federation®
5225 S. 16th St., P.O. Box 80299, Lincoln, NE 68501 Phone: (402) 421-4400, FAX# (402) 421-4432

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DEPARTMENT OF NATURAL RESOURCES

March 9, 2009

Mr. Brian Dunnigan, Director
Nebraska Department of Natural Resources
P.O. Box 94676
301 Centennial Mall South, 4th Floor
Lincoln, NE 68509

Dear Mr. Dunnigan:

The Nebraska Farm Bureau Federation (NFBF), the state's largest farm organization, would like to offer these comments on the Department of Natural Resources' (DNR) report, 2009 Annual Evaluation of Availability of Hydrologically Connected Water Supplies (the report). Farm Bureau would ask that these comments be included in the administrative record and considered by DNR when developing is final decision on the appropriated status of the Lower Platte River Basin.

NFBF disagrees with the DNR's preliminary finding the Lower Platte River Basin is fully appropriated. NFBF would ask DNR to reconsider its preliminary determination the Lower Platte River Basin is fully appropriated and issue a final determination the basin is not fully appropriated.

NFBF supported passage of LB 962 which established the requirement the DNR each year issue a report on the status of the availability of hydrologically connected water. NFBF also participated in the negotiating rulemaking process used to develop the rules and regulations under which the DNR conducts its analysis. NFBF policy shares the underlying goal of the sustainable management of our water resources over the long-term.

It can't be emphasized enough that water is the lifeblood of agriculture in Nebraska. While NFBF certainly supports sound management decisions in regards to the state's water resources, unnecessarily restricting water use will undermine economic opportunities for farmers, ranchers and communities. Unnecessary restrictions do come with an economic cost.

A report released in October 2005 by the Nebraska Policy Institute study showed irrigation contributed $4.5 billion to Nebraska's economy in 2003, or $2,646 for each Nebraskan. Another study released by researchers at Colorado State University and the University of Michigan showed rural areas with irrigation have performed better economically over the past 100 years than rural areas without irrigation. According to the report, rural areas with irrigation have done

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surprisingly well, sustained by increases in production of crops and livestock. A recent study of the economic impact on agriculture of declaring the Lower Platte River Basin fully appropriated by Dr Rosenbaum suggests lost output to Nebraska over 20 years could be over $1.2 billion.

A fully appropriated finding in the Lower Platte River Basin would have economic consequences for individual farmers and ranchers. Mother Nature's whims, particularly rainfall, are uncontrollable, but the reality is farmers must deal with them. Irrigation is a risk management tool farmers can utilize to minimize risk. Reducing risk improves producers' revenue stability and profitability. Given the benefits of irrigation to Nebraska's economy and farmers, it is imperative for DNR to be absolutely certain, and the analysis justify a fully appropriated determination.

In its 2005 comments on the adoption of the rule regarding the designation of fully appropriated basins, NFBF expressed concerns with how stream flow depletions from groundwater use would be estimated. The concerns still exist with the preliminary designation in the 2009 report. Given the extremely complex relationship between groundwater use and impacts to stream flows, and the many variables involved, accurate estimates of stream flow depletions can be problematic. Geology, geography and changes in land use, precipitation, cropping patterns, seed technology, management practices, and water use, among other things, can influence the impacts groundwater use has on stream flows over time. Changes in these factors should be included in an analysis of stream flow depletions from ground water use but it is unclear whether DNR's evaluation accounts for these variables and whether DNR tested the sensitivity of its findings to changes in these factors.

The report states estimates of groundwater depletions to stream flows are made utilizing the Elkhorn-Loup Model (ELM) and the stream depletion factor (SDF) methodology. Models and the SDF methodology can be useful tools and provide unique insights into the relationship of ground and surface water. Both rely on many assumptions and neither is without a margin of error. DNR's findings show the average number of days available for diversion for a junior surface water appropriation is slightly below the minimum necessary with 25 years of lag impacts. It would appear the shortfall might well be within the margin of error for ELM and the SDF methodology. Moreover, the shortfall might easily be erased with slight changes to the assumptions used in ELM and SDF methodology.

The report, though, does not provide information as to whether DNR tested the sensitivity of the stream flow depletions estimates to changes in the underlying assumptions in ELM and the SDF methodology. NFBF's fear is given the average number of days available for diversion for a junior surface water appropriation is slightly below the minimum necessary, the shortfall could easily be within the margin of error that can be present with the models and methodologies employed. Thus, a real possibility exists a fully appropriated designation would unnecessarily limit new water uses and economic growth.

NFBF also has concerns whether the evaluation of junior surface water rights is appropriate. First, the report states the right chosen for the analysis was granted in 2000, yet the report does not provide any supporting documentation showing the junior right chosen is the most junior right. Second, at the time the right was granted in 2000, a specific level of groundwater development had already occurred in the basin. Thus, some erosion of the right from pre-existing groundwater use should have been expected to occur over time. NFBF believes DNR's evaluation of the lag effects on the junior right should be limited to the lag effect which result from groundwater uses begun after the junior right was granted. To do so otherwise seeks to protect the junior right from erosion that was to be expected when the right was granted, and unduly places restrictions other potential users in the basin.

Finally, NFBF continues to have concerns that DNR does not have the staff or budgetary resources to perform its necessary functions as required by law. The lack of staff and funding manifests itself in two ways in the report. First, NFBF understands DNR has not had the budget or staff to adjudicate surface water rights. Surface water appropriations may have been granted, but in reality have not been utilized for years. An adjudication in the Lower Platte River Basin could help determine actual water usage for purposes of a fully appropriated designation. Second, DNR technical staff is being asked to perform many complex, hydrological analyses to address challenges in Republican River basin, implement the Platte River program, develop integrated management plans in cooperation with NRDs, and issue the annual evaluation of the availability of hydrologically connected water supplies. NFBF is concerned DNR does not have the staff and resources necessary to sufficiently perform the evaluation required.

In closing, NFBF asks DNR to reconsider its preliminary determination the Lower Platte River Basin is fully appropriated and issue a final determination the basin is not fully appropriated. Given the potential economic impact of a fully appropriated designation, and the questions that exist concerning the data and methodologies employed in the report, NFBF does not believe a fully appropriated determination is warranted or justified.

NFBF policy states DNR's determinations should be based on sound science which is subject to an independent peer review. To that end, NFBF encourages the DNR to work with NRDs in the Lower Platte River Basin to create a work group to seek a peer review by independent technical experts of the data, analysis, and methodologies used in the report. Such a review should examine the models utilized, the assumptions made, and the sensitivity of the analysis to variability in land use changes, precipitation, groundwater recharge rates, etc. NFBF is confident DNR and NRDs, working together with independent experts, can develop a sound methodology for an evaluation.

Sincerely,

Keith R Olsen

Keith R. Olsen
President

Exh.
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FENNEMORE CRAIG, P.C.

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March 12, 2009

VIA HAND DELIVERY

Brian P. Dunnigan, P.E., Director
Nebraska Department of Natural Resources
301 Centennial Mall South, 4th Floor
Lincoln, NE 68509

Re: 2009 Annual Evaluation of Availability of Hydrologically Connected Water Supplies – Lower Platte River Basin

Dear Director Dunnigan:

On December 16, 2008, the Nebraska Department of Natural Resources ("DNR") issued a preliminary determination concluding that the Lower Platte River Basin ("Basin") is fully appropriated. *See 2009 Annual Evaluation of Availability of Hydrologically Connected Water Supplies*, DNR (Dec. 16, 2008) ("2009 Annual Evaluation"). Over the past several weeks, we have communicated and coordinated with you and your staff on behalf of and along with the following Natural Resources Districts ("NRD"): Lower Platte South NRD; Lower Platte North NRD; Upper Elkhorn NRD; Lower Elkhorn NRD; Upper Loup NRD; Lower Loup NRD; Papio-Missouri NRD, Upper Big Blue NRD; and Upper Niobrara NRD (collectively referred to as the "Basin NRDs").

Initially, we express our appreciation for DNR's transparency, professionalism, and partnership in working with the Basin NRDs to ensure that you have the best science available to make the final determination. It is because of this working relationship between DNR and the Basin NRDs that we are able to provide these substantive comments on the preliminary determination.

On behalf of the Basin NRDs, we are submitting comments concerning Chapter 7.0 of the 2009 Annual Evaluation, which constitutes DNR's preliminary determination that the Basin is fully appropriated. These comments consist of the following:

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-Attachment A: *Technical Review of the Preliminary Fully Appropriated Determination in the Lower Platte River Basin*, Brown and Caldwell (March 12, 2009) ("B&C Technical Review");

-Attachment B: *Evaluation of Impacts to Days Needed to Meet 65/85 Requirements Under Various Scenarios*, Brown and Caldwell (March 12, 2009) (compare with Table 7-9, 2009 Annual Evaluation at 108);

-Attachment C: *Justification for the Minimal Irrigation Requirements Definition that is Incorporated in the Proposed Rule for Defining a Fully Appropriated Basin*, Dr. Ray Suppala (undated).

We ask that DNR include these materials in the administrative record and consider them in connection with developing the final decision on the availability of hydrologically connected water supplies in the Basin.

1. Summary of Preliminary Determination

The 2009 Annual Evaluation makes the preliminary determination that the Basin is fully appropriated upstream of the confluence with the Missouri River without the initiation of additional uses. According to the report, this determination is based on two factors: (1) "the current level of development will result in lag impacts such that the future water supply will be insufficient for junior surface water appropriations upstream of North Bend to satisfy the 65/85 rule completely;" and (2) "those same junior surface water appropriations are currently receiving less water than was available at the time the appropriations were granted (i.e., they have been eroded)." 2009 Annual Evaluation at 84; *id.* at 113.

2. The Legislature Gave the NRDs a Significant Role in Reviewing DNR's Preliminary Determinations.

Nebraska has faced many natural resources challenges in the past, and will continue to face similar challenges in the future. Our NRDs have a strong history of responding to our natural resources issues with local control and local solutions. Recognizing these abilities, and recognizing the partnership between the NRDs and DNR, the Legislature gave the NRDs a significant role in the fully and over appropriated determination process.

For example, the Legislature instructed the NRDs to "provide relevant data and information in their possession" to DNR for use in the annual determinations. The Legislature also set up a review system following a preliminary determination to assure the final

determination is based on the best science. The NRDs, in partnership with DNR, are to play a significant role in this review:

> Within the time period between the dates of the preliminary and final determinations, the department and the affected natural resources districts shall consult with ... water users and stakeholders as deemed appropriate by the department or the natural resources districts.

Neb. Rev. Stat. § 46-714(4). The NRDs take this role very seriously, and appreciate the opportunity to work with DNR on these important issues.

3. Overview of Comments

The majority of these comments relate to the application of the 65/85 rule, which include both scientific and legal components. The Basin NRDs are concerned that the preliminary determination is not based on the best scientific data available and, in some cases, does not comply with the agency's regulations. For these reasons, explained in detail below, the preliminary determination is not legally defensible if adopted in its current form. The Basin NRDs recommend that DNR apply the best science consistent with the agency regulations to reach a final determination. Based upon the current information available to the Basin NRDs, a determination of not fully appropriated is the necessary conclusion utilizing the best science in accordance with the regulations.

4. Background on the 65/85 Rule.

DNR adopted the 65/85 rule at the culmination of the negotiated rule-making process, which included the Basin NRDs as stakeholders. 457 Neb. Admin. Code § 24.001.01A. The purpose of the rule is to assist DNR in evaluating the sufficiency of the hydrologically connected water supplies to meet the "then-current uses of hydrologically connected surface water and ground water." DNR describes the rule as follows:

> In short, the [65/85 rule] states that the surface water supply is deemed to be insufficient if, at current levels of development, the most junior right in the basin ... has been unable to divert sufficient surface water over the last twenty years to provide 85% of the amount of water a corn crop needs (the net corn crop irrigation requirement, or NCCIR) during the irrigation season (May 1 through September 30), or if the most junior irrigation right in a basin ... is unable to divert 65% of the amount of water a corn

> crop needs during the key growing period of July 1 through August 31.

2009 Annual Evaluation at 14.

To apply the rule, DNR must have the following information: (a) the hydrologically connected area; (b) current levels of development; (c) the most junior right in the basin; (d) the NCCIR for the most junior right; (e) the most junior right's ability or inability to divert over the last twenty years; (f) the current hydrologically connected water supply; and (g) the lag effect from existing groundwater pumping in the hydrologically connected area that will deplete the water supply within the next 25 years. If any of these inputs are incorrect, the conclusion will not be accurate.

5. Concerns Relating to the Application of the 65/85 Rule.

(a) The Regulations Limit Consideration of Impacts to Wells Inside the Hyrdologically Connected Area.

DNR's regulations provide that the sufficiency of a basin's water supply to meet demand will be determined based on "the current uses of *hydrologically connected* surface water and ground water." 457 Neb. Admin. Code § 24.001. In particular, the annual evaluation must consider "the impact of the lag effect from existing groundwater pumping *in the hydrologically connected area* that will deplete the water supply within the next 25 years." *Id.* at § 24.002.01A. Similarly, "[t]he projected future impacts from ground water wells to be included shall be the impacts from ground water wells located *in the hydrologically connected area* that will impact the water supply over the next 25 year period." *Id.* at § 24.002.01A.

The term "hydrologically connected area" is used consistently throughout the Nebraska Ground Water Management and Protection Act, Neb. Rev. Stat. § 46-701 to -753, and throughout DNR's regulations. The term is defined as "the area within which pumping of a well for 50 years will deplete the river or a base flow tributary thereof by at least 10% of the amount pumped in that time." 457 Neb. Admin. Code § 24.001.02. This definition establishes what is now commonly referred to at the "10/50 area."

The 2009 Annual Evaluation for the Basin included impacts from all wells in the Basin – not just those within the 10/50 area. This approach does not appear to be defensible under DNR's regulations, and should be amended prior to issuance of the final determination.

(b) The Regulations Identify "The Most Junior Appropriator" as the Trigger for the 65/85 Rule.

The 65/85 rule requires an evaluation of whether "the most junior irrigation right" will be able to meet the 65/85 rule. 457 Neb. Admin. Code § 24.001.01A. That section also refers to "the most junior surface water appropriator" and "the most junior surface water appropriation" as the right against which the 65/85 rule should be applied.

The 2009 Annual Evaluation for the Basin did not evaluate the 65/85 rule against "the most junior appropriator." Instead, it used "a junior surface water appropriation" above the North Bend gage. 2009 Annual Evaluation at 95. The right selected has a net corn crop irrigation requirement, or NCCIR, of 27.9 days annually to meet the 65% requirement from July to August. *See* Attachment B. In contrast, the NCCIR for the most junior appropriator in the Basin equates to 18.06 days to meeting the 65% requirement. *See* Attachment B and B&C Technical Review at 1-2.

The use of *a* junior – rather than the *most* junior – does not appear to be defensible under DNR's regulations, and should be amended prior to issuance of the final determination.

(c) Consideration of 10% Downtime Is Inconsistent With Regulations.

The 65/85 rule is based on the ability of the surface water user to divert enough water to meet the NCCIR. 457 Neb. Admin. Code § 24.001.01A. This rule, however, does not include an adjustment for downtime. The concept of downtime is that, although water is available for diversion, the user cannot irrigate because of some mechanical failure or other cause.

DNR added a 10% downtime assumption to its application of the 65/85 rule for the Basin. This assumption is inconsistent with the regulations, and is irrelevant to the evaluation of whether water is available for diversion. The evaluation should focus on whether water is available – not whether the appropriator's system is able to divert otherwise available water. Stated differently, a basin should not be declared fully appropriated based on mechanical failures. This preliminary determination was very sensitive to the downtime assumption and, all things being equal, the Basin would not be fully appropriated without that assumption. B&C Technical Review at 1-3.

6. Regulatory Concerns Relating to the Erosion Rule.

DNR adopted the erosion rule in 2006 through the negotiated rule-making process. That rule is intended to prevent a basin from becoming fully appropriated through the issuance of a new surface water right that could not meet the 65/85 rule when it was granted. As such, the rule's application is limited to those scenarios where, "at the time of the priority date of the most junior appropriation, the surface water appropriation could not have diverted surface water a

sufficient number of days on average for the previous 20 years to satisfy the requirements of 001.01A," which is the 65/85 rule. 457 Neb. Admin. Code § 24.001.01C.

The application of the erosion rule in the 2009 annual evaluation is confusing. DNR applies the 65/85 rule in Section 7.7.1, and ultimately concludes that the 65/85 rule cannot be met based on future impacts from current uses. 2009 Annual Evaluation at 105. In the following section, then, DNR applies the erosion rule. 2009 Annual Evaluation at 108. Table 7-11 demonstrates that, at the time that the junior surface water appropriation DNR evaluated was granted, flows were sufficient to meet the 65/85 rule. Under the erosion rule, that is the end of the analysis.

Nevertheless, the report goes on to conclude that "the junior irrigation rights have been eroded." This conclusion is then used as a basis for the preliminary determination of fully appropriated. 2009 Annual Evaluation at 113 ("The designation is based on two factors. ... The second factor is that those same junior surface water appropriations are currently receiving less water than was available at the time the appropriations were granted (i.e., they have been eroded)"). Read without the rule, this conclusion appears to find the Basin fully appropriated through application of both the 65/85 and erosion rules as independent factors. But they are not independent tests; either the erosion rule or the 65/85 rule applies.

DNR should rework this analysis in future annual evaluations to avoid this confusion. The first step should be whether the 65/85 rule is satisfied. If it is not, the second step is to determine whether the 65/85 rule could be satisfied when the right was granted. If it could, then that is the end of the matter – the 65/85 rule applies and whether the appropriations have been eroded does not matter. If the 65/85 rule could not be satisfied when the right was granted, *then* the erosion rule applies and whether the right has been eroded is relevant.

7. The Annual Evaluations Must Use the Best Science.

DNR must "rely on the best scientific data, information, and methodologies readily available to ensure that the conclusions and results contained in the [annual] report are reliable." As discussed in the attached technical review by Brown and Caldwell, significant concerns exist regarding whether the preliminary determination for the Lower Platte River Basin meets this requirement.

One primary concern relates to the calculation of lag impacts and baseflow depletions from the Elkhorn Loup Model ("ELM"). Brown & Caldwell notes the importance of maintaining the distinction between the basic tool, the ELM, and simulations and runs made from the basic tool. This concern relates to the simulation DNR used, not to the tool. The tool

remains the best science available to calculate the 10/50 area and streamflow depletions, but the tool must be used properly.

DNR relied on USGS's assumptions and methodology to calculate future streamflow depletions from current uses. USGS used 3.03 million acre-feet of pumping within the ELM area as the "current use" from which to predict future depletions. This assumption far exceeds the level of pumping needed for the 2.3 million acres currently irrigated in the ELM area.

Figure 16 of the ELM Phase 1 report depicts the estimated historic annual groundwater pumping for crop irrigation in the Elkhorn and Loup River Basins from 1940 to 2005. The highest estimated pumping in those 65 years occurred in 2002, at about 1.8 million acre-feet pumped from the entire ELM area. The estimates in Figure 16 exceed 1.5 million acre-feet only five times over that entire history. This information led DNR and the NRDs to make additional inquiries of USGS to explain its assumptions.

After reviewing information from USGS, the pumping assumption results from an apparent error in calculating the average effective precipitation. The average effective precipitation is important because it is used to calculate how much pumping is required to meet the weighted average crop water requirement of 25.1 inches for the ELM area. In other words, by subtracting the average effective precipitation from 25.1, one can calculate how many inches of pumping is needed to meet the weighted average crop requirement. USGS calculated the average effective precipitation for the ELM area to be 9.39 inches, causing a dramatic over-estimation of the required pumping. In reality, the ELM report data demonstrates an average effective precipitation of 19.14 inches from 1940 to 2005. Subtracting this average from 25.1 inches equals 5.96 inches of groundwater that would need to be pumped. Spread across the 2.3 million irrigated acres in the ELM area, this totals 1.15 million acre feet of pumping annually, compared with the 3.03 million acre feet of pumping used in the USGS simulation. B&C Technical Review at 3-1 to 3-4.

DNR adopted USGS's assumption of 3.03 million acre feet of pumping to calculate the streamflow depletions from the ELM area in the 2009 Annual Evaluation. This level of pumping in the ELM area does not reflect pumping from current conditions or current levels of development.

8. Conclusion.

The preliminary determination that the Lower Platte River Basin is fully appropriated is inconsistent with DNR's regulations and is not supported by the best scientific data, information, and methodologies readily available. The Basin NRDs appreciate the opportunity to provide

these comments, and will continue working with DNR to assure the final determination is based on the best available science and is consistent with the regulations.

Sincerely,

FENNEMORE CRAIG, P.C.

Jaron Bromm

JABR
Enclosures

JBROMM/2173284.1

Attachment A

TECHNICAL REVIEW OF THE PRELIMINARY FULLY APPROPRIATED DETERMINATION IN THE LOWER PLATTE RIVER BASIN

Prepared for

Fennemore Craig, P.C.
Denver, Colorado

March 12, 2009

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TECHNICAL REVIEW OF THE PRELIMINARY FULLY APPROPRIATED DETERMINATION IN THE LOWER PLATTE RIVER BASIN

Prepared for
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Appendix A MODFLOW Water Budgets from the Nebraska Department of Natural Resources Simulations

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LIST OF ACRONYMS

afd	acre-feet per day
afy	acre-feet per year
cfs	cubic feet per second
CALMIT	*Center for Advanced Land Management Information Technologies*
ELM	Elkhorn Loup Model
N.A.C.	Nebraska Administrative Code
NCCIR	Net Corn Crop Irrigation Requirements
NDNR	Nebraska Department of Natural Resources
NGWI	No Groundwater Irrigation
NRD	Natural Resources District
USGS	United States Geological Survey

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1. REGULATORY

Brown and Caldwell reviewed the Nebraska Department of Natural Resources (NDNR) Rules for Surface Water (Nebraska Administrative Code [N.A.C.] Title 457, Chapter 24) and compared the regulations contained in these rules with the calculation procedures that were carried out for the 2009 Annual Evaluation of Availability of Hydrologically Connected Water Supplies ("2009 Annual Evaluation") (NDNR, 2008). This review was limited to NDNR's preliminary determination for the Lower Platte River Basin. Four primary issues were identified in the regulatory aspect of this review, and are discussed below.

This document sets forth the results of Brown and Caldwell's independent review of the Nebraska Department of Natural Resources 2009 Annual Evaluation of the Availability of Hydrologically Connected Water Supplies. During the course of this work, methods and models used by the USGS and used by the State of Nebraska were evaluated. Brown and Caldwell's review was based on compilation and interpretation of pre-existing information from third parties or the client, which information has not been independently verified by Brown and Caldwell unless explicitly stated herein.

1.1 Future Depletions from Groundwater Pumping in Hydrologically Connected Areas

It is clearly stated in 457 N.A.C. 24 that future streamflow depletions from current levels of groundwater development will be estimated for wells within hydrologically connected areas. References to estimating depletions for wells within hydrologically connected areas can be found in the first sentence of Paragraph 001, in the first sentence of Paragraph 001.01A, and in the last sentence of Paragraph 001.01A.

The geographic extent of hydrologically connected areas is defined in Paragraph 001.02 as the area within which a well pumped for 50 years will deplete the baseflow of a river or tributary by 10 percent of the amount pumped over that time, also referred to as the 10/50 area.

The 2009 Annual Evaluation included estimates of future lagged depletions from all current irrigation wells in the basin rather than only those wells within the 10/50 area. This resulted in estimating more future lagged depletions than what is prescribed in 457 N.A.C. 24. Future lagged depletions resulting from current well development that were estimated by the Elkhorn Loup Model (ELM) model and by the Jenkins method should have only included impacts from those wells located within the 10/50 area.

1.2 Most Junior Appropriator

It is clearly stated in 457 N.A.C. 24 that the 65/85 and erosion rules will be evaluated against the most junior irrigation right in the basin (for an explanation of the 65/85 and erosion rules, see NDNR, 2008). References to the most junior irrigation right are made in the first, fourth, and fifth sentence of Paragraph 001.01A, Paragraph 001.01B, and the first sentence of Paragraph 001.01C.

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The 2009 Annual Evaluation used a junior irrigation right for its evaluation of the 65/85 and erosion rules that was not the most junior irrigation right. The junior irrigation right that was used (A-17900) is an active irrigation right that is junior to the priority date of the instream flow rights in the Platte River (November 30, 1993), and has the highest net corn crop irrigation requirement (NCCIR) of the junior irrigation rights in the Loup and Elkhorn Basins. This irrigation right has a priority date of August 3, 2000 and is used to irrigate approximately 32 acres in southeast Custer County (Figure 1). The NCCIR corresponding to this location is 10.52 inches. In the Loup Basin, there are 122 active irrigation rights junior to November 30, 1993. In the Elkhorn Basin, there are 65 active irrigation rights junior to November 30, 1993.

The most junior irrigation right in both the Loup and Elkhorn Basins is number A-18534 (Figure 1). This irrigation right has an appropriation date of September 4, 2007, and irrigates 132.8 acres in southwest Washington County. The location of this irrigation right corresponds to an NCCIR of approximately 6.8 inches. If this NCCIR were adopted, the number of days necessary to meet the 65/85 rule would be 18.06 and 23.62, respectively.

The most junior irrigation right in the Loup Basin is number A-18422 (Figure 1). It irrigates 65.1 acres in southeast Sherman County and has a priority date of September 15, 2006. The NCCIR corresponding to the location of this irrigation right is approximately 9.6 inches per year. If this value were adopted, the number of days necessary to meet the 65/85 rule would be 25.49 and 33.34, respectively.

1.3 Assumption of 80 Percent Efficiency

In the 2009 Annual Evaluation, the NCCIR for the junior water right is multiplied by 65 percent and 85 percent to calculate the number of days necessary to meet the July-August and seasonal requirements, respectively. These numbers are then divided by 0.8 to account for an assumed irrigation efficiency of 80 percent. The 2009 Annual Evaluation considers the resulting numbers to be gross irrigation amounts that are necessary to meet July-August and seasonal irrigation requirements. The NDNR adopted this calculation procedure based on a memorandum written by Dr. Ray Supalla (undated). Dr. Supalla's memorandum was written to document and to justify the 65/85 rule and its application to assessments of full appropriation.

Dr. Supalla's memorandum refers to the 65 percent and 85 percent as amounts of gross irrigation as a proportion of the NCCIR that is needed to meet July-August and seasonal irrigation requirements, respectively. It appears that NDNR misinterpreted the 65 percent and 85 percent as net irrigation requirements rather than gross irrigation requirements, which is why an adjustment for 80 percent irrigation efficiency was included in their calculation procedure. Dr. Supalla confirmed that the irrigation efficiency of 80 percent was included in the 65/85 multipliers (Supalla, personal communication, 2009). Because the 65 percent and 85 percent multipliers already incorporate an assumed irrigation efficiency of 80 percent, the additional irrigation efficiency adjustment over-estimates the number of days in the 65/85 calculation, adding 6 and 7 days, respectively.

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1.4 Assumption of 10 Percent Downtime

In the 2009 Annual Evaluation, it is assumed that an irrigation system will be shut down for approximately 10 percent of the time when there is adequate streamflow to divert. The NDNR adopted the 10-percent downtime factor based on the memorandum written by Dr. Ray Supalla (undated).

The memo does not describe considerations that resulted in the 10-percent downtime assumption, although it is a rule of thumb that is used in irrigation system design. There are more detailed ways to evaluate or estimate downtime. Considerations of time necessary for repair and maintenance, and for load control, frequently factor in to more specific estimates of downtime. If irrigators are on load control or have extensive problems with system clogging and other frequent maintenance issues, then the 10-percent downtime assumption is probably realistic. However, Brown and Caldwell understands from conversations with Natural Resources Districts' (NRD's) staff that it is unlikely that there are many junior surface irrigators that are on load control. This makes sense because irrigators who are frequently shut down due to surface water administration will not likely subject themselves to additional shutdowns from load control. In addition, it seems probable that irrigators who are subject to shutdowns from surface water administration will save regular repair and maintenance activities for periods when they cannot irrigate because of a senior call.

The 2009 Annual Evaluation for the Lower Platte River Basin is sensitive to the downtime assumption; it adds 3 and 4 days, respectively, to the 65/85 calculation. Given the sensitivity of the 2009 Annual Evaluation to the downtime assumption, it should be reviewed with respect to the general irrigation practices in the Loup and Elkhorn Basins.

Findings:

- The 2009 Annual Evaluation considered impacts for wells outside of the 10/50 area.
- The 2009 Annual Evaluation assessed the 65/85 rule against an irrigator that is not the most junior irrigator in the basin.
- The 2009 Annual Evaluation used a calculation procedure that effectively adjusts for irrigation efficiency twice, and over-estimates the number of days required for the 65/85 rule.
- The 2009 Annual Evaluation assumes a 10-percent downtime assumption in the calculation of the number of days required to meet the 65/85 rule.

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2. EVALUATION OF THE TECHNICAL TOOLS

2.1 Jenkins Method

2.1.1 Best Available Science

The NDNR relies on the Jenkins (1968) method as the best approach to calculate stream depletion for the purposes of determining the availability of hydrologically connected water supplies in regions where no numerical groundwater flow model exists. It is argued that the Jenkins method is especially useful when key hydrological data are unknown. Yet, this methodology is outdated, because it is based on overly simplistic assumptions leading to over-estimates of streamflow depletions. More recent and commonly applied analytical solutions provide much more realistic estimates. Thus, the Jenkins method for determining stream depletion factors is no longer the best available science.

The three main simplifying assumptions of the Jenkins method that consistently cause the overestimation of stream depletion at the basin scale are: (1) there is no groundwater recharge; (2) there is no constraint on water interchanges between groundwater and surface water due to diminished vertical hydraulic conductivity (conductance) of the streambed; and (3) the streambed fully penetrates the aquifer system. Newer analytical and semi-analytic methods require fewer assumptions.

The Jenkins method is essentially an overly conservative "end-member" solution for the quantification of streamflow depletion. It will always produce a higher estimate of streamflow depletion due to pumping relative to the more advanced analytical solutions developed by Hunt (1999) and Zlotnick (2004).

2.1.2 Other Sources of Groundwater Recharge

The Jenkins method assumes that the only source of groundwater to satisfy pumping within a basin is streamflow. As time increases, this solution assumes that stream depletions will eventually satisfy 100 percent of all groundwater pumping. However, both areal recharge and evapotranspiration also comprise portions of a groundwater basin water budget and are known to be additional sources of groundwater that can be captured by pumping. If these other components of the water budget are not negligible relative to the net loss of streamflow, then results from the Jenkins solution overestimate streamflow depletion (Chen and Shu, 2002). The magnitude of the errors in both the estimated extents of the 10/50 demarcations as well as the 25-year quantified volumes of future stream depletions can be significant when there is non-negligible recharge. This is the situation in the Lower Platte River Basin, as documented by the United States Geological Survey (USGS) in their description of the ELM water budget (Peterson et al., 2008).

One of the important features of groundwater systems in northeastern Nebraska is the ability for water-level recovery in years with high rainfall and reduced pumping. Such complexity is not accommodated by the Jenkins method. In other words, in a basin where groundwater is in

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connection with the surface water system, years with higher precipitation can restore groundwater levels that may have been reduced by drought and/or groundwater pumping back to pre-pumping conditions (Chen and Shu, 2002). This "restoration" of groundwater levels could lead to baseflow levels comparable to pre-depletion levels. The lack of consideration of the cyclicity and impacts of "wet" years or seasons will also cause the significant overestimation of the magnitude of streamflow depletion over time periods as large as 25 years. Powerful numerical models like MODFLOW can include (1) all sources of groundwater recharge, and (2) the natural variability in precipitation and recharge. In the absence of a suitable numerical model to calculate streamflow depletions, the best available science includes the more advanced analytical solutions that do not make the oversimplifying assumptions inherent in the Jenkins method.

2.1.3 Advanced Analytical Methods

The Jenkins method assumes that the stream unit is in full connection with the underlying aquifer system and fully penetrates it. It ignores the possibility of disconnection or limited connection between the stream and underlying aquifer system, even though this condition is present to some degree in practically all river systems. The use and application of the analytical solutions provided by Hunt (1999) and Zlotnik (2004) address these shortcomings of the Jenkins method through their inclusion of streambed conductivity values and consideration of the partial penetration of streams relative to the depth and thickness of typical well pumping intervals. Although these analytical solutions also neglect groundwater recharge and capture, they can be readily used in lieu of the overly simplistic Jenkins method to provide more realistic and accurate estimates of hydrologically connected areas and future streamflow depletion.

Analyses and graphs presented by Zlotnik and Tartakovsky (2005), the USGS (Reeves, 2008), and Butler et al., (1999) show that even the simplistic consideration of streambed conductivity and partial stream penetration, which are included in all recently derived analytical solutions, will always result in lower estimates of streamflow depletion as compared to the Jenkins method. In order to remove this overly conservative, mathematical bias with respect to streamflow depletion and be more representative of realistic stream and groundwater conditions, it is proposed that at a minimum the Hunt solution (Hunt, 1999) be used instead of the Jenkins method.

The data requirements and mathematical application of the Hunt solution are not time- or cost-prohibitive, and streambed conductivity estimates can readily be inferred from available field data, literature values, analogous systems, or commonly accepted horizontal to vertical conductivity ratios. Estimates of streambed conductance from work recently performed in the Blue River Basin and along Platte River would provide a data source to begin this process (Chen, personal communication, 2009). Even the inclusion of conservative estimates of streambed conductivity values would necessarily reduce the mathematical overestimation of streamflow depletion estimates from the use of the outdated Jenkins method.

2.2 Elkhorn-Loup Model

The evaluation of water supplies in the Loup and Elkhorn Basins was based on results from the Phase I ELM (Peterson et al., 2008). Modeling a region the size of the Loup and Elkhorn Basins is a formidable challenge given the complexity of the physical setting and the groundwater/surface water interactions. An appropriate scientific evaluation of the water resources within these basins requires

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a modeling tool with the power and flexibility to handle these complexities. This capability is provided by the numerical, finite difference, MODFLOW modeling package. In this respect then, the Phase I ELM represents an important step in evaluating the hydrologic response to pumping.

The ELM is being developed over a period of years through two additional phases of work that are designed to provide refinements to the model and to incorporate new hydrologic data that will be collected in the two basins. The present review of the Phase I ELM has identified a number of opportunities for improving the ELM in subsequent phases.

2.2.1 Calibration

To provide confidence in future predictions, the ELM must demonstrate the capability to predict the historical behavior of groundwater and surface water systems. The model in its present form has made progress in this respect. However, as shown in Figure 2, the simulated groundwater levels in the ELM do not satisfactorily capture the magnitudes of groundwater levels or temporal patterns of change. In addition, calibrating to water level change versus water level magnitude is not appropriate for the stated purpose of simulating baseflow, as it can lead to unacceptable errors in simulated groundwater levels. Errors in simulated groundwater levels will lead to errors in predicted inflows and outflows from the streams.

Clearly, a better calibration of groundwater conditions is required to be confident that the ELM is a valid representation of the actual hydrogeologic setting. This issue of calibration appears to be an important aspect of work planned for the follow-on phases of the ELM project.

2.2.2 Conceptual Model and Estimates of Baseflow

Mathematical models like ELM are built around what is known as a conceptual model, which provides a simplified understanding of how the hydrologic system works. For a model like ELM to be successful, the conceptual model needs to capture key details about the hydrologic system. One area where refinements to the ELM conceptual model are required relates to the present treatment of baseflow. The Phase I ELM uses ranges of baseflows (Figure 3) as part of the calibration exercise. Peterson et al. (2008) theorized that this single range of baseflows for various rivers can be used in the calibration of the pre-1940 simulation and the 1940-2005 simulations. Thus, the ELM model is calibrated with the implicit assumption that baseflows in 1940 and 2005 should be similar. This assumption is valid for upstream reaches rising in the sand hills but likely invalid for downstream reaches. To provide baseflows in 2005 that are comparable to those of 1940 required the addition of "additional recharge" that was almost identical to the irrigation pumpage. Beyond meeting the assumption of similar baseflow, there is little justification provided for the magnitude of the additional recharge. A revised conceptual model should treat variable baseflow in a more realistic manner.

The analysis of the impacts of pumping on baseflow from the ELM, shown on Figures 4 and 5, must be viewed as extremely preliminary. The issue is that the 1940-2005 simulation is being calibrated to provide some expected quantity of baseflow: the ELM inputs are being adjusted to finally produce a value of baseflow in the 1940-2005 simulation that fits the modeler's conceptualization. Having obtained this final value of baseflow, it is not appropriate then to analyze the predictive baseflow estimates from the model as though they were independent variables.

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Figure 6 displays baseflow from 1940 to 2033 for the case with no groundwater irrigation (NGWI). Note particularly the baseflow from 1940 to 2005, which increased by approximately 250,000 acre-feet per year (afy) over this period. This almost linear increase in baseflow appears to be an artifact of the model design rather than actual conditions in the natural system. Considering that precipitation has no statistically significant trend from 1940-2005, recharge should behave similarly. With no groundwater irrigation pumping, there is no reason to expect that the ELM should simulate an increase in baseflow of this magnitude.

The scope of the Phase I ELM study apparently precluded a detailed analysis of baseflow trends (Peterson et al., 2008, pg. 17). It will be essential in future phases of the ELM to look carefully and specifically at baseflow behavior both seasonally and interannually. The baseflow behavior of the streams in response to complex patterns of precipitation and pumping provides key data available to constrain the choice of parameter values during calibration. The simplified treatment of baseflow conditions in the Phase I ELM translates specifically into uncertainty with respect to the regulatory outcome of the predictive simulations. Clearly, a critical purpose of the modeling must be to understand how much water is flowing in the rivers under various conditions of recharge and pumping. With the present simplified conceptualization of baseflow behavior, estimates of baseflow, as well as baseflow depletion, are therefore highly speculative in this Phase I of the ELM project.

2.2.3 The Best Tool Available

The regulations emphasize the importance of employing the best science available to make decisions about the management of water resources in Nebraska. The difficulty in analyzing hydrologic systems of the size and complexity represented by the ELM cannot be overemphasized. By its very nature, numerical modeling is an iterative process moving from conceptualization, simulation, evaluation, to new data collection and back again (Domenico and Schwartz, 1998).

The ELM is a clear improvement over the Jenkins method for delineating the 10/50 area and calculating future streamflow depletions. These improvements are based on the fact that the ELM considers (1) streambed conductance, (2) other sources of recharge, (3) complex basin boundaries, and (4) fluctuations in recharge and pumping over time. Improvements planned in Phases II and III will refine the ELM and improve its value to the NDNR in performing their yearly assessments of hydrologically connected water supplies. In the interim, the ELM is the best available scientific tool for the Annual Evaluation, relative to any simplified analytical solutions.

Findings:

- The Hunt solution overcomes one of the major limitations of the Jenkins method and is readily available. It is a better scientific tool than the Jenkins method for the area outside of the ELM region.
- Numerical groundwater flow models are the best available science for calculating the 10/50 area and baseflow depletions. NDNR's decision to use the ELM is the correct selection of the best available tool.
- Improvements to the ELM model construction and calibration, as well as the refinements of the conceptual model and estimates of the various water budget components, will provide greater accuracy and reliability in future estimates of streamflow depletion.

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3. LAG IMPACTS AND BASEFLOW DEPLETION – ELKHORN LOUP MODEL

This section addresses the assumptions and approach used by the NDNR to calculate 25-year lag impacts, or baseflow depletions, with the ELM. This section differs from the evaluation of the ELM as a tool (Section 2.2), as it is focused on the use of that tool to predict baseflow depletion in the future. In this discussion, the distinction between the numerical model itself (referred to as the ELM) and simulations that are run with this model (referred to as simulations, scenarios, or model runs) is important. Multiple scenarios were run with the ELM, incorporating a number of different timelines and assumptions about inputs.

The ELM was developed by the USGS and was completed in 2008 (Peterson et al., 2008). The USGS version of the model was calibrated through 2005. For purposes of the appropriation determination analysis, the ELM was updated by the NDNR to continue through 2006 and 2007 before transitioning to a predictive timeline beginning in 2008. In this update, the NDNR added 2006 and 2007 pumping and recharge estimates based on actual precipitation measurements. The predictive simulations to support the analysis of baseflow depletion begin in 2008 and end in 2033, accounting for 25 years of future conditions. (Note: the predictive simulation actually ended in 2047, but output from 2033 was used in the course of the 2009 Annual Evaluation.)

The approach used to calculate future baseflow depletion was to run the model with groundwater irrigation (Base Simulation) and without groundwater irrigation (NGWI Simulation), and calculate depletion by subtracting the respective baseflows. The NGWI Simulations are therefore the standard of comparison for baseflow depletion. The timeline for the NDNR simulations are shown in Table 3-1.

Table 3-1. Time Periods for the NDNR Simulations with the Elkhorn Loup Model

Simulation Period	Base Simulation	NGWI Simulation
1940 to 2007	Base thru Present Day	NGWI thru Present Day
2008 to 2047*	Base Predictive	NGWI Predictive

NDNR = Nebraska Department of Natural Resources
NGWI = No Groundwater Irrigation
**Output for the period from 2008 to 2033 was used for the 2009 Annual Evaluation.*

Input and output from model simulations performed by both the USGS and NDNR were examined during the course of this technical review. Two major concerns were identified with respect to (1) the pumping/recharge assumptions in the predictive simulations, and (2) the method of calculating the 25-year lag impacts by comparison with the NGWI simulation.

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3.1 Pumping/Recharge Assumptions in the 25-Year Predictive Simulations

Large water budget changes occur in the Base Simulation runs between 2007 and 2008. This time period represents the transition from present-day conditions to predictive conditions. A summary of the MODFLOW-generated water budgets for the NDNR simulations that were used for the appropriation determination are provided as Appendix A. Comparing the cumulative budgets in Table A-1 for the Base Simulations (1940-2007 versus 2008-2047), the overall water budget drops from 5.1 to 4.8 million acre-feet because a net recharge approach was used to account for pumping. However, the net recharge for the predictive simulation time period was inconsistent with net recharge for the period from 1940 through 2007.

After review of the pumping and recharge inputs that were used to calculate the net values found in the 2008-2047 water budget, it was found that a total of 3.03 million acre-feet of groundwater pumping was assumed every year for all years in the predictive Base Simulation, whereas recharge inputs totaled 4.70 million afy. This assumed future rate of pumping is extremely high, particularly when compared with pumping assumptions for prior years, as shown on Figure 7. The highest rate of pumping in the historic period was approximately 1.8 million afy.

The method of calculating pumping for the predictive simulation was discussed with the USGS and NDNR. The future pumping was estimated based on 2005 irrigated acreage (Center for Advanced Land Management Information Technologies [CALMIT], 2007), the average effective precipitation for the growing season, and net crop irrigation requirements. Estimated 2005 acreage for each crop and the net crop water requirements are shown in Table 3-2. Groundwater pumping was calculated to be the difference between the average effective precipitation for the growing season and the crop requirements. A similar approach was reportedly used for groundwater pumping assumptions for 1940 through 2007.

Table 3-2. Estimated 2005 Acreage in the ELM Region and Crop Water Requirements Used in Calculating Pumping for Predictive Simulations

Crop	2005 Crop Acreage in the ELM Region	Percent of Total Acreage	Crop Water Requirement (Inches)
Corn	1,468,941	63.4%	25.5
Soybeans	633,948	27.4%	22.0
Sorghum	3,775	0.2%	20.5
Small grains	12,770	0.5%	17.0
Dry Edible beans	6,442	0.3%	15.5
Potatoes	762	0.0%	23.2
Alfalfa Hay	188,319	8.1%	33.5
Sunflower	1,272	0.1%	17.0
TOTAL	**2,316,230**	**100.0%**	**25.1***

**Weighted Average*
ELM = Elkhorn Loup Model

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Total irrigated acreage from the CALMIT data was estimated to be 2.3 million acres (Peterson et al., 2008). Applying the irrigation pumping in the predictive simulation to this acreage results in an average of 15.7 inches of water. As the most prevalent crop within the model domain is corn, the 15.7 inches was compared to the NCCIR values developed using the CROPSIM model (Martin, 2005). The NCCIR values within the ELM region range from approximately 13.5 inches in the west down to 8 inches in the east (Figure 8), and are based on daily calculations of the soil water balance for the growing season, using the period from 1950 through 2004. A comparison of the ELM assumptions versus these NCCIR values in calculating future groundwater pumping is presented in Table 3-3.

Table 3-3. Comparison of the ELM Assumptions for Predictive Pumping versus Pumping Calculated Based on a Range of NCCIR

Source	Inches per Acre	Acres	Groundwater Pumping (afy)
ELM Assumption	15.7	2,316,230	3,030,401
NCCIR Low Value	8.0	2,316,230	1,544,153
NCCIR High Value	13.5	2,316,230	2,605,759

afy = acre-feet per year
ELM = Elkhorn Loup Model
NCCIR = Net Corn Crop Irrigation Requirement

The comparison in Table 3-3 presents a range of values for total groundwater pumping for the predictive streamflow depletion simulations, making a simplifying assumption that all crops are corn. These calculations do not account for the location of the irrigated lands; however, the CALMIT land use pattern shows that the distribution of irrigated lands in the ELM region are concentrated in the east, coinciding with the lower values of NCCIR.

The level of pumping assumed in the predictive simulation was estimated as a long-term average, which suggests that much greater levels of pumping could be expected immediately in the future. The maximum possible groundwater pumping would be approximately 4.85 million afy, corresponding to zero rainfall and total crop water requirements satisfied by groundwater. The estimate of 3.03 million afy is much larger than an average of the range of possible groundwater pumping scenarios, and appears to assume very dry conditions for all future years.

Spreadsheets, calculations, and numbers used in developing the pumping assumptions for the future predictive simulation were requested from and provided by the USGS. Figure 9 presents effective precipitation and groundwater-irrigated acreages assumed for the period from 1940 through 2005. The ramp-up in the number of acres under irrigation is evident on the top graph; the bottom graph normalizes the effective precipitation to depict the number of inches of effective precipitation by acre. The average effective precipitation for this historic period is 19.14 inches (note: precipitation values capped at 25.1 inches). Subtracting this average from the weighted crop requirement of 25.1 inches (Table 3-2) equals 5.96 inches of groundwater that would have to be pumped.

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Figure 10 presents the effective precipitation in inches per year from the ELM (top graph), and the amount of groundwater in inches per year that would have to be pumped (bottom graph) to satisfy a net crop requirement of 25.1 inches for each year. The average of this historic groundwater demand is 5.96 inches (note: average calculation assumed zero groundwater pumping in years of precipitation higher than 25.1 inches). Also shown on this graph is the 15.7 inches that was used in the ELM for 25 years in the future, which is almost 10 inches higher than the average for the historic period.

The USGS provided the steps they took to calculate and estimate future groundwater pumping that resulted in 15.7 inches of demand. Instead of using the normalized groundwater demand in inches of water, the annual *volume* of effective precipitation that fell on the irrigated acreage was averaged from 1940 through 2005 and then applied to the present-day acreage. The effect of calculating an average based on the volume of effective precipitation can be illustrated using 1940 as an example: 132,038 acres were irrigated in 1940 using 123,366 acre-feet of groundwater. Applying 123,366 acre-feet to 2,316,230 acres currently under development results in less than 1 inch of water provided by precipitation, the rest would have to be pumped. This essentially was the calculation made for every year from 1940 through 2005. Because the volume of effective precipitation is highly dependent upon the number of acres, the calculation was skewed downward by the early time period with small numbers of acreage.

This mistake in calculating an average effective precipitation led to the over-estimate of future pumping. Using the annual average of 5.96 inches for the historic period and the 2005 irrigated acreage (2,316,230 acres), groundwater pumping for future simulations would be 1,150,394 afy.

An alternative approach to estimating future groundwater pumping would be using the NCCIR contours developed by Martin (2005). The daily soil water balance model developed to produce the NCCIR contours provides a solid basis for future predictions of groundwater demand during the growing season. Moreover, the NCCIR is the standard used for other elements of the Annual Evaluations, thus there is a good precedent for its use in the ELM simulations for the Elkhorn and Loup Basins as well.

Findings:

- Although the ELM is the best tool available, its use in a predictive sense requires a clear understanding of: (1) the limitations of the model in its preliminary state and (2) all assumptions regarding pumping and recharge that are used for the predictive simulations.
- An error was made in the methodology to calculate average groundwater pumping for the predictive simulations used in the 2009 Annual Evaluation. This error resulted in over-estimating groundwater pumping by a factor of three.

3.2 Calculating Lag Impacts Using the NGWI Simulation

The approach used to calculate lag impacts, or future streamflow depletions for 25 years, involved (1) using the ELM to simulate conditions both with groundwater irrigation (Base Simulation) and without groundwater irrigation (NGWI Simulation), and (2) calculating depletions by subtracting baseflows from each respective simulation (Table 3-1). The NGWI Simulations are therefore the standard of comparison for baseflow depletion.

In the upper reaches of the basins, within the sand hills, streamflow and by extension baseflow, is relatively consistent, varying little over time. Downstream of the sand hills, more variability is seen

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in stream hydrographs, reflecting the close relationship between baseflow and precipitation. Thus, one would expect alternating highs and lows in baseflow that mimic to some extent the precipitation patterns. One would not expect the system to reflect a steady increase in baseflow through time as that pattern would indicate a potential issue related to the magnitude of estimated recharge in the model input.

Figure 6 depicts the trends in baseflow in the NGWI Simulation from 1940 through 2033. Large increases in baseflow are observed from 1940 through 2004. Between 2004 and 2005, model assumptions and/or inputs change, and baseflow no longer increases at the previous rate although it does continue to rise. The lower graph in Figure 6 highlights the predictive simulation period in the NGWI Simulation, and shows the low but steadily increasing rate of baseflow from 2008 through 2033.

Because the NGWI Simulation is used as the point of comparison or "yardstick" to measure the impacts of irrigation on baseflow, a continuous rate of rise in a simulation that does not include pumping and recharge for irrigation is problematic. For the predictive period from 2008 to 2033, the increased baseflow amounts to 30.7 acre-feet/day (afd) or 15.5 cubic feet per second (cfs). In the context of the water budget for a regional model, this is not a significant amount; in the context of the appropriation determination and calculations of daily baseflow volumes available for irrigators, it is significant.

Because the changes in baseflow attributable to groundwater pumping for irrigation are derived from subtracting the NGWI Simulation baseflow from the Base Simulation baseflow in both 2008 and 2033, the additional 15.5 cfs of increased baseflow in the NGWI run shows up as additional streamflow depletion. This "augmentation" to the model-estimated, 25-year streamflow depletion is not due to groundwater pumping at all, but rather due solely to the simulated increase seen in baseflow over a time period when the NGWI Simulation should instead be showing relatively steady-state and non-changing conditions. The actual 25-year streamflow depletion estimate due to groundwater pumping should be determined solely from the consideration of the simulated baseflows from the predictive Base Simulation in 2008 and 2033. The method as it currently is being applied is artificially predicting too much streamflow depletion.

Findings:

- The NGWI Simulation, which is used as a point of comparison, introduces a 15.5-cfs bias into calculations of baseflow depletion.

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4. LAG IMPACTS AND BASEFLOW DEPLETION – JENKINS METHOD

This section addresses the assumptions and approach used by the NDNR to calculate 25-year lag impacts, or baseflow depletions, outside of the ELM region using the Jenkins method. Apart from the issue of including wells located outside of the hydrologically connected area (Section 1.1), a discrepancy in the calculation of the baseflow depletions at the Louisville gage was identified.

Baseflow depletions at the Louisville gage were calculated to be 870 cfs after 25 years (NDNR, 2008). Of this amount, 25 cfs was attributed to regions outside of the ELM region, and was calculated using the Jenkins method. A review of the Geographic Information System files provided electronically with the 2009 Annual Evaluation revealed that approximately 121 wells *downstream* of the Louisville gage were included in the calculation of depletions at the gage. This downstream reach extends for approximately 15 river miles. The calculation of stream depletions caused by these wells was based on the distance to the closest downstream segment, not the distance back to the Louisville gage. This approach carries downstream impacts back to a point several miles upstream, over-estimates streamflow depletions, and, consequently, under-estimates the number of days available for diversion based on gage records.

Findings:

- Streamflow depletion calculations at the Louisville gage included wells in a 15-mile reach downstream of the gage location. These calculations used the distance to the closest stream segment instead of the distance back to the Louisville gage. This approach over-estimates streamflow depletions at the gage.

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5. CONCLUSION

The Preliminary Determination of Fully Appropriated in the Lower Platte River Basin is not supported by the best science.

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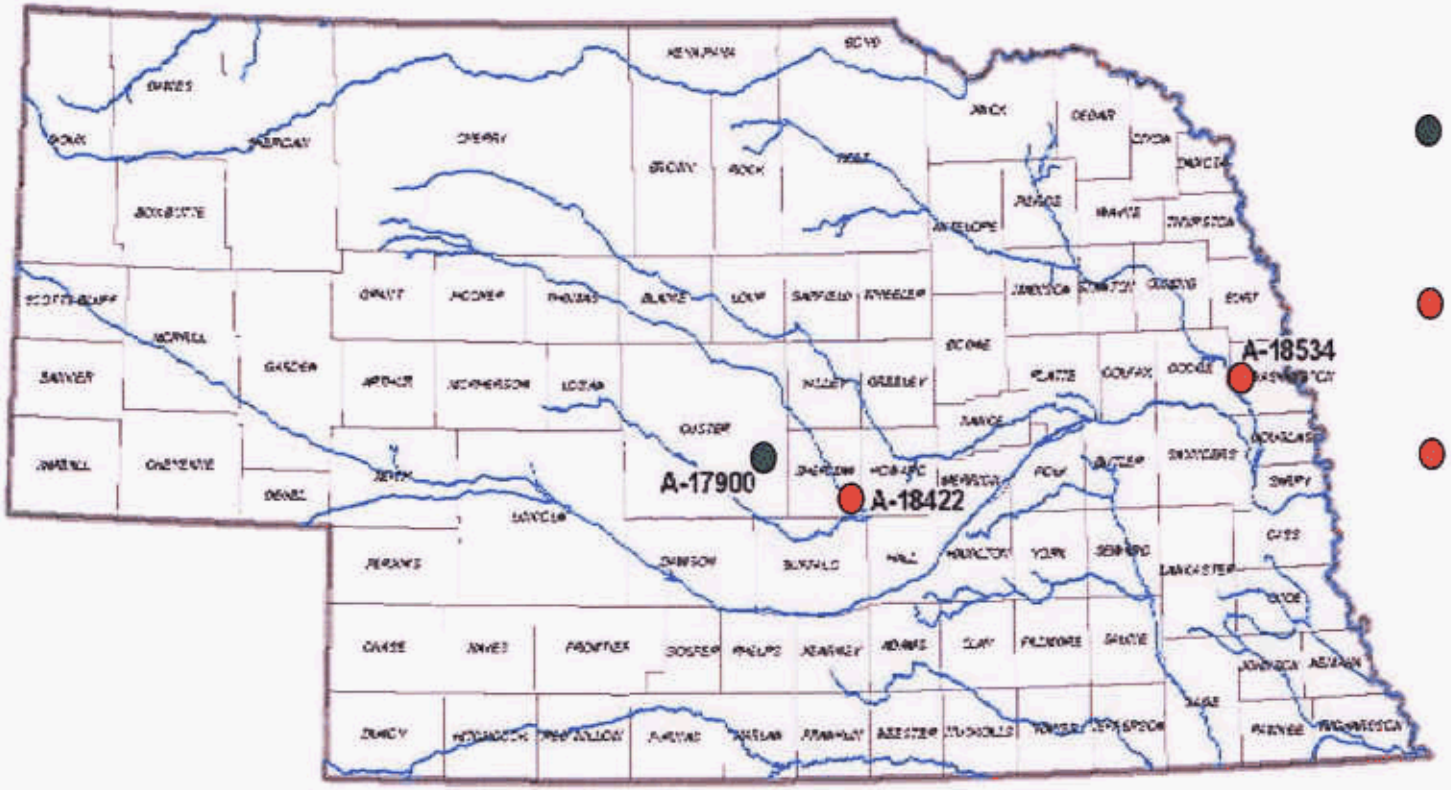

- **A-17900**: Junior Irrigation Right used by NDNR in the 2009 Evaluation of Water supplies
- **A-18534**: The Most Junior Irrigation Right in both the Loup and Elkhorn Basins
- **A-18422**: The Most Junior Irrigation Right in the Loup Basin

FIGURE 1
MOST JUNIOR IRRIGATION WATER RIGHTS
IN THE LOUP AND ELKHORN BASINS, NEBRASKA
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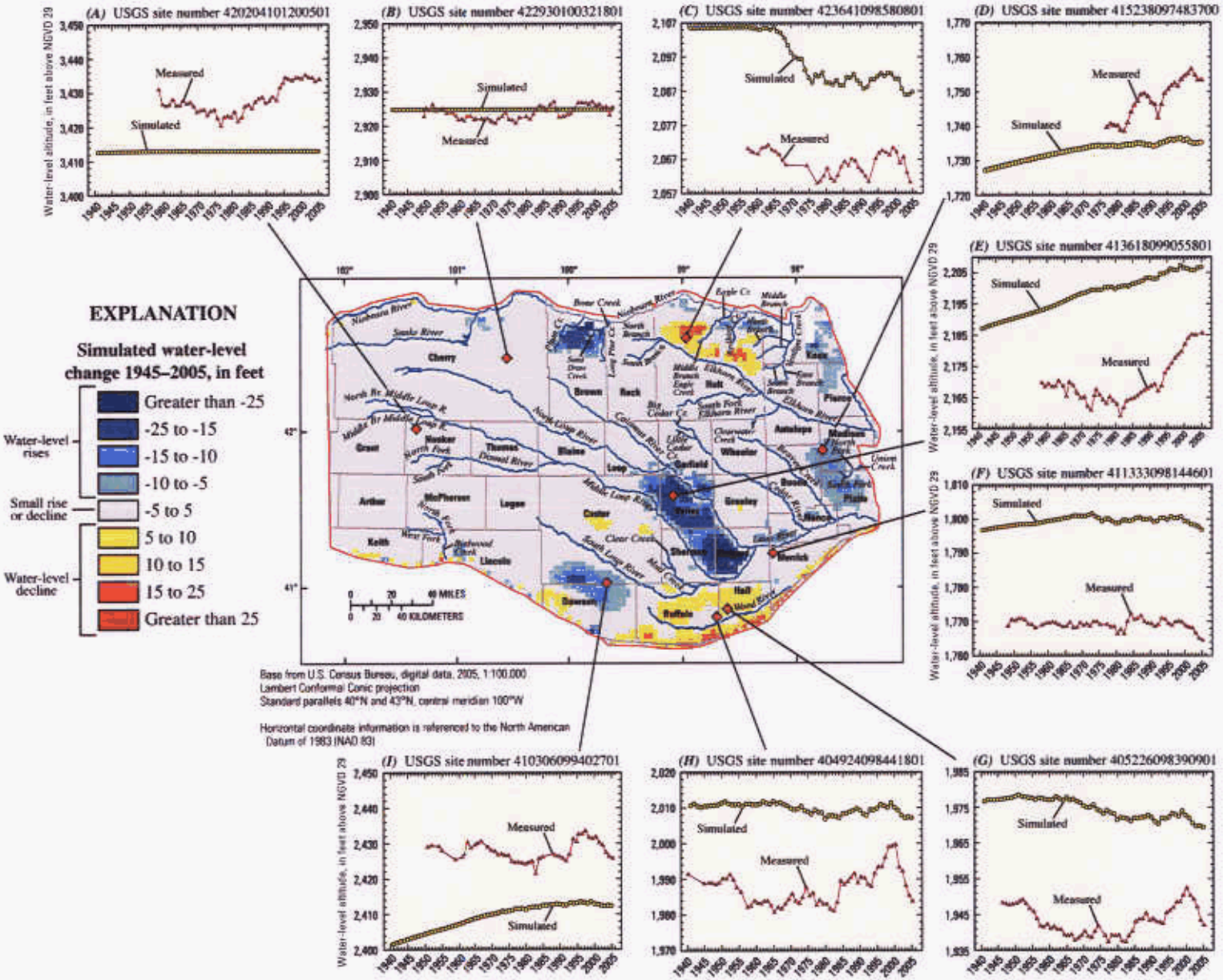


FIGURE 2 - Calibration results for the 1940 through 2005 simulation, Elkhorn and Loup River Basins, Nebraska (Figure 25, Peterson, et al., 2008)

[( ) number in parentheses indicates that stream had a net loss of water to the aquifer]

U.S. Geological Survey streamflow-gaging station and number	Estimated long-term base flow, in acre-feet per year		Period of record (start year, end year, number of years of data)	Simulated base flow, in acre-feet per year	
	Minimum	Maximum		To streams in 1940	To streams in 2005
Niobrara River Basin					
Snake River above Merritt Reservoir (06459200)	135,000	138,000	(1963, 1980, 18)	135,000	139,000
Elkhorn River Basin					
Elkhorn River at Ewing (06797500)	21,500	60,000	(1947, 2003, 56)	53,100	45,200
South Fork Elkhorn River at Ewing (06798000)	21,200	23,000	(1947, 1990, 32)	19,000	18,400
Clearwater Creek near Clearwater (06798300)	16,400	17,100	(1961, 1990, 17)	10,300	9,290
Elkhorn River at Neligh (06798500)	9,530	44,800	(1931, 1992, 60)	28,700	29,200
Elkhorn River at Norfolk (06799000)	59,000	94,000	(1896, 2003, 59)	57,100	60,300
North Fork Elkhorn River near Pierce (06799100)	22,300	23,800	(1960, 2003, 43)	16,700	18,100
Union Creek at Madison (06799230)	9,350	10,100	(1979, 1992, 14)	4,400	6,090
Loup River Basin					
Middle Loup River at Dunning (06775500)	276,000	283,000	(1946, 2003, 58)	279,000	280,000
Dismal River near Thedford (06775900)	138,000	140,000	(1967, 2003, 37)	140,000	141,000
Middle Loup River at Arcadia (06779000)	85,000	240,000	(1937, 1995, 57)	126,000	153,000
Mud Creek near Sweetwater (06783500)	7,750	7,900	(1946, 1994, 48)	15,400	14,600
South Loup River at St. Michael (06784000)	100,000	131,000	(1944, 2003, 60)	139,000	132,000
Middle Loup River at St. Paul (06785000)	(101,000)	182,000	(1928, 2003, 75)	42,900	78,700
North Loup River at Taylor (06786000)	303,000	321,000	(1937, 2003, 67)	305,000	312,000
Calamus River near Burwell (06787500)	179,000	192,000	(1941, 1995, 55)	175,000	179,000
North Loup River at Ord (06788500)	47,000	114,000	(1952, 1994, 42)	31,400	55,500
North Loup River near St. Paul (06790500)	18,500	64,000	(1928, 2004, 75)	53,700	78,000
Cedar River near Spalding (06791500)	92,400	96,000	(1945, 1994, 47)	86,400	87,100
Loup River near Genoa (06793000)	(80,000)	97,500	(1929, 2003, 63)	61,000	63,700
Beaver Creek at Genoa (06794000)	46,700	49,100	(1941, 2003, 63)	52,900	56,300
Platte River Basin					
Birdwood Creek near Hershey (06692000)	98,500	102,000	(1931, 1990, 59)	103,000	104,000

FIGURE 3

Estimated Minimum and Maximum Baseflow Compared with Simulated 1940 and 2005 Baseflow, Elkhorn and Loup River Basins, Nebraska (Table 2 from Peterson et al., 2008)

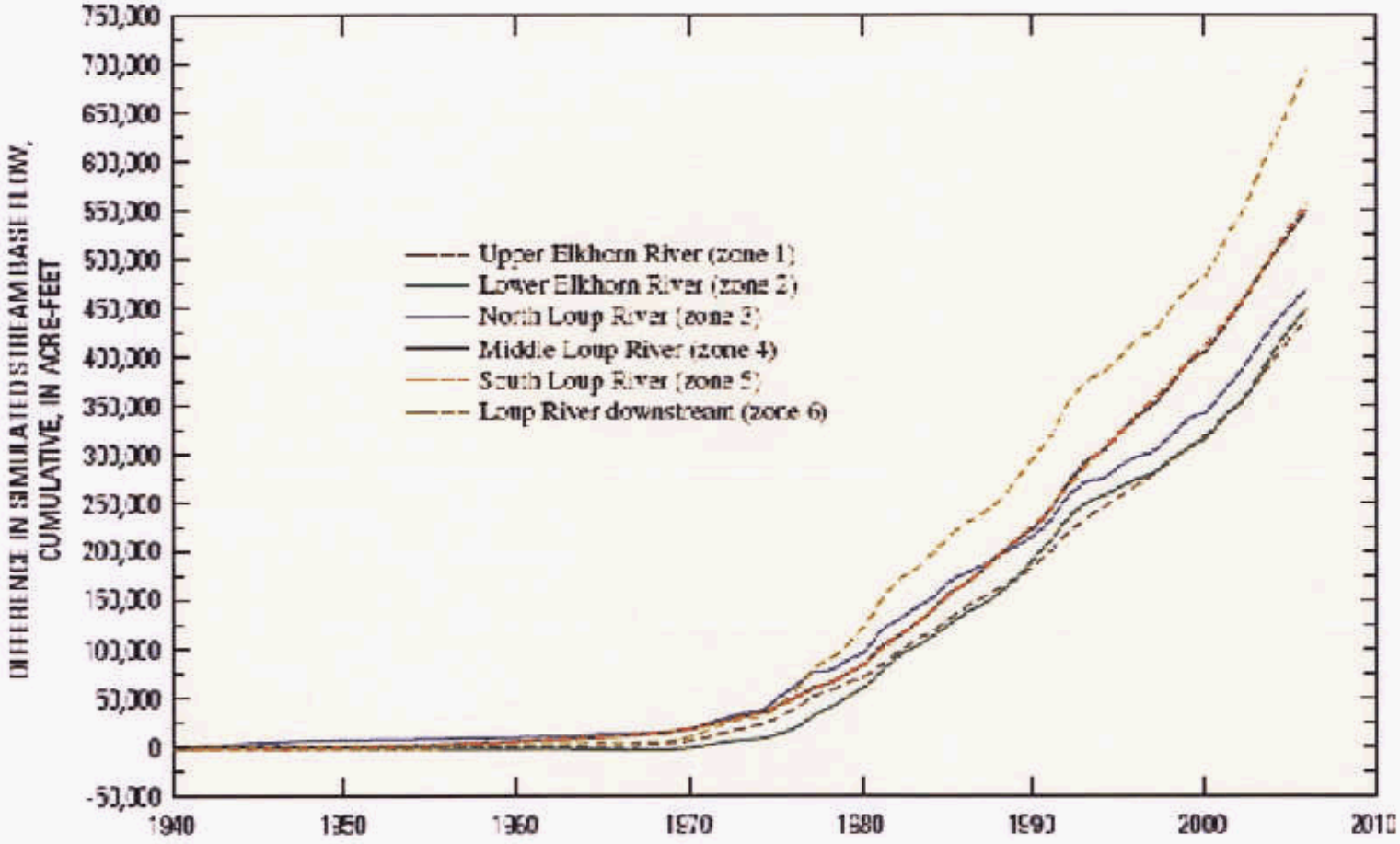


FIGURE 4 - Cumulative Effects of Groundwater Irrigation on Simulated Base Flow, Elkhorn and Loup River Basins, Nebraska, 1940 through 2005. (Figure 31 from Peterson, et al., 2008)

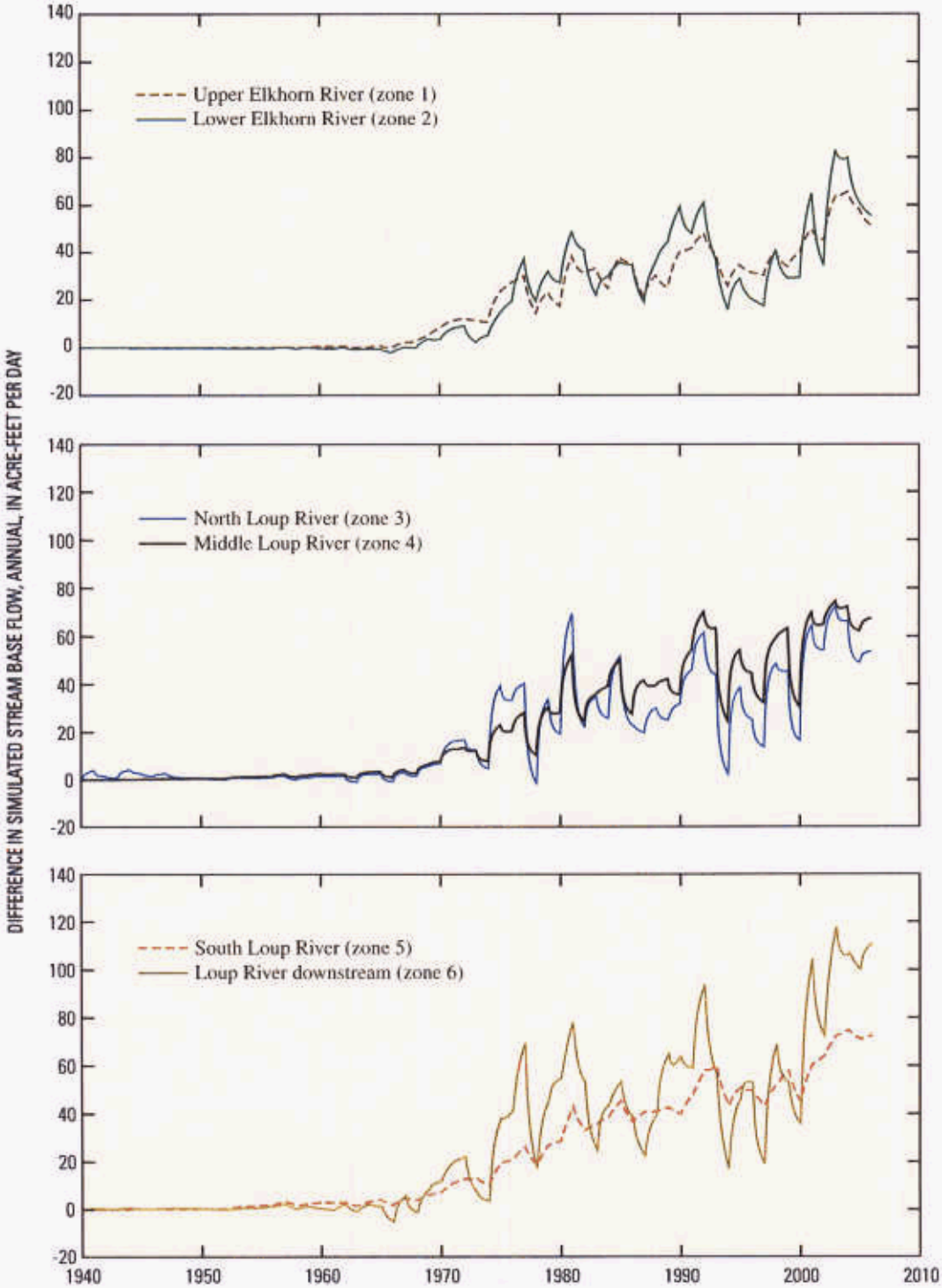
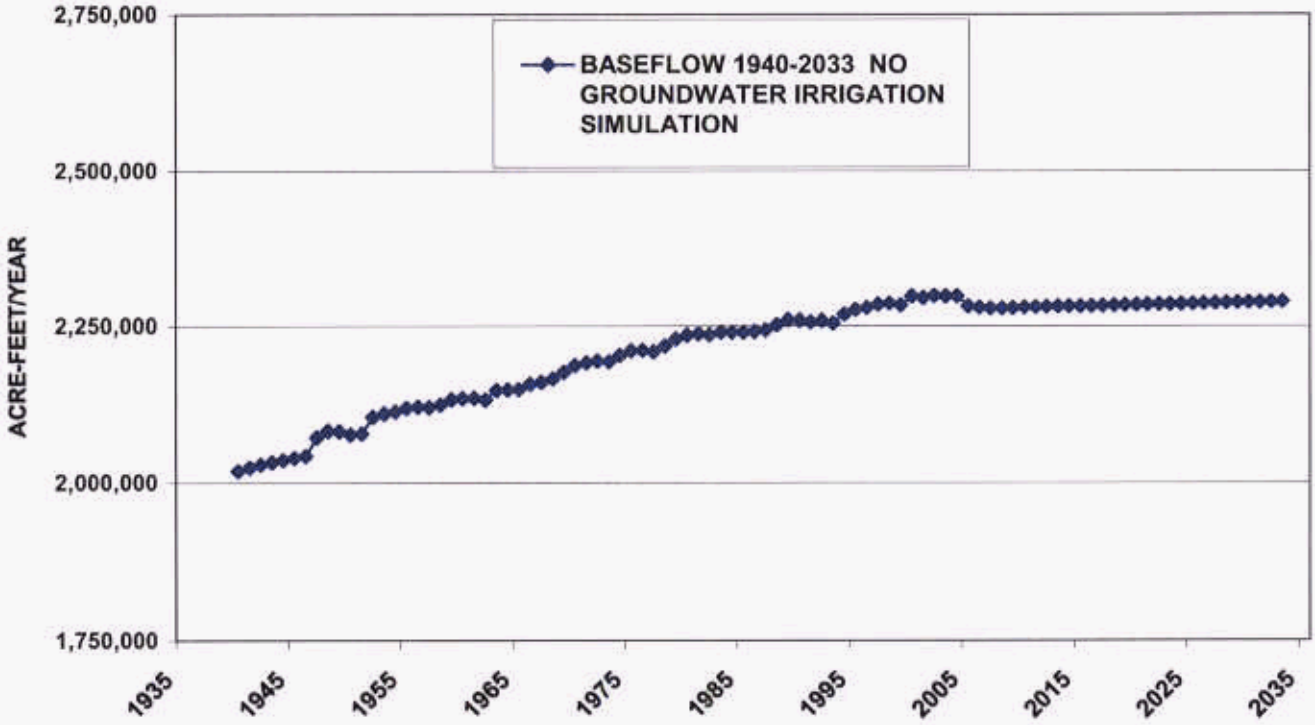


FIGURE 5 - Annual Rate of Effects of Groundwater Irrigation on Simulated Base Flow, Elkhorn and Loup River Basins, Nebraska, 1940 through 2005.
(Figure 32 from Peterson, et al., 2008)



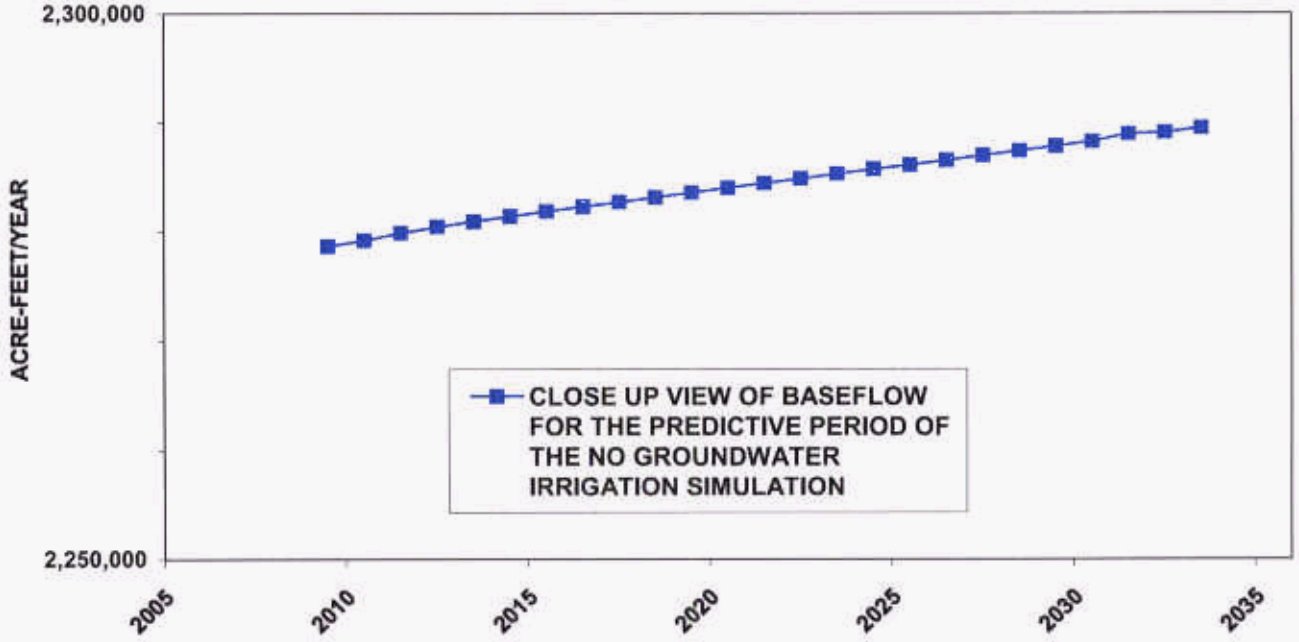


FIGURE 6
RISE IN BASEFLOW SIMULATED IN THE NO GROUNDWATER IRRIGATION SIMULATION 1940 - 2033
LOWER PLATTE TECHNICAL REVIEW
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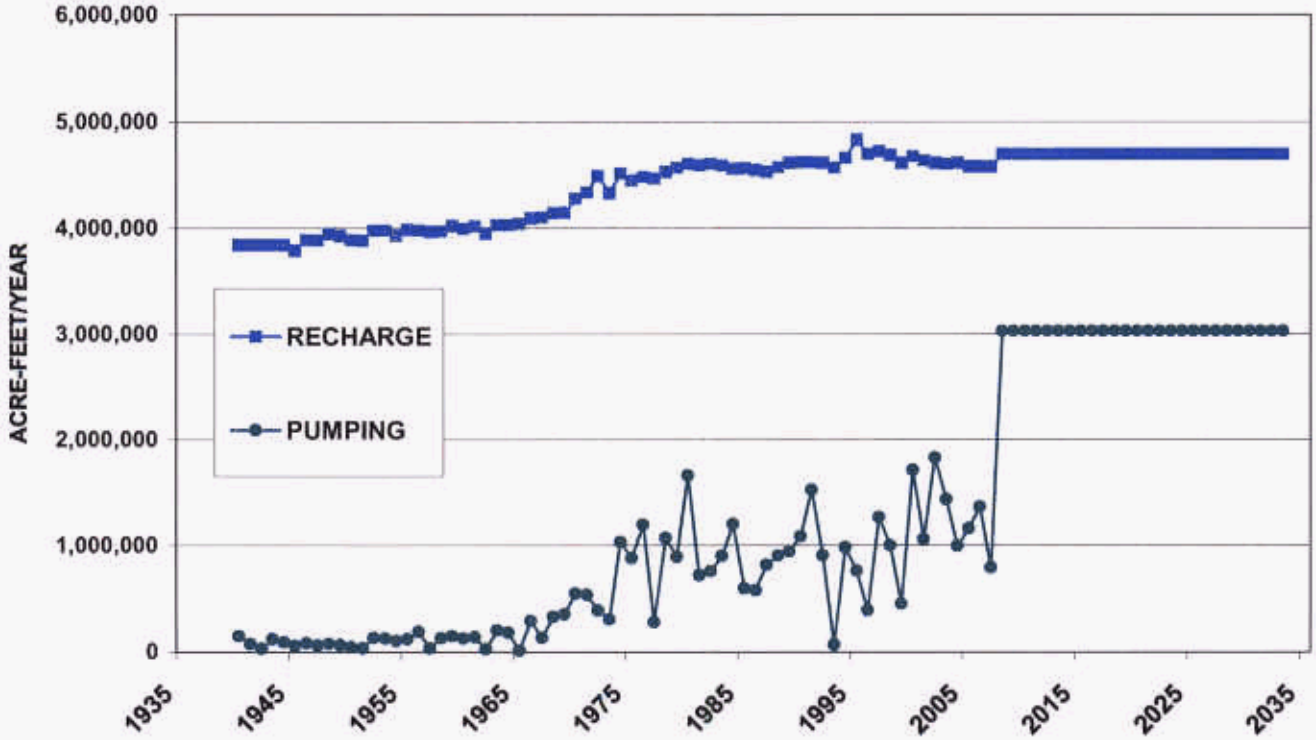

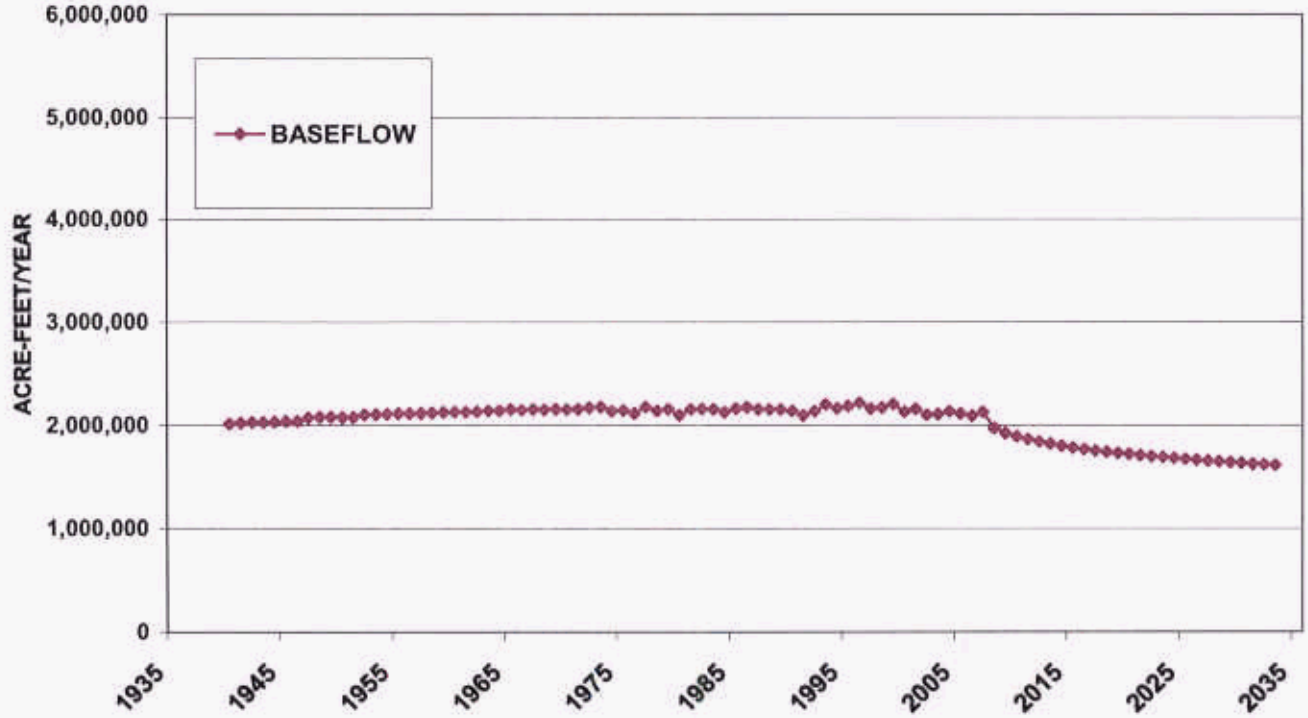

FIGURE 7
TOTAL PUMPING, TOTAL RECHARGE AND RESULTING BASEFLOW BASE SIMULATION 1940 - 2033
LOWER PLATTE TECHNICAL REVIEW
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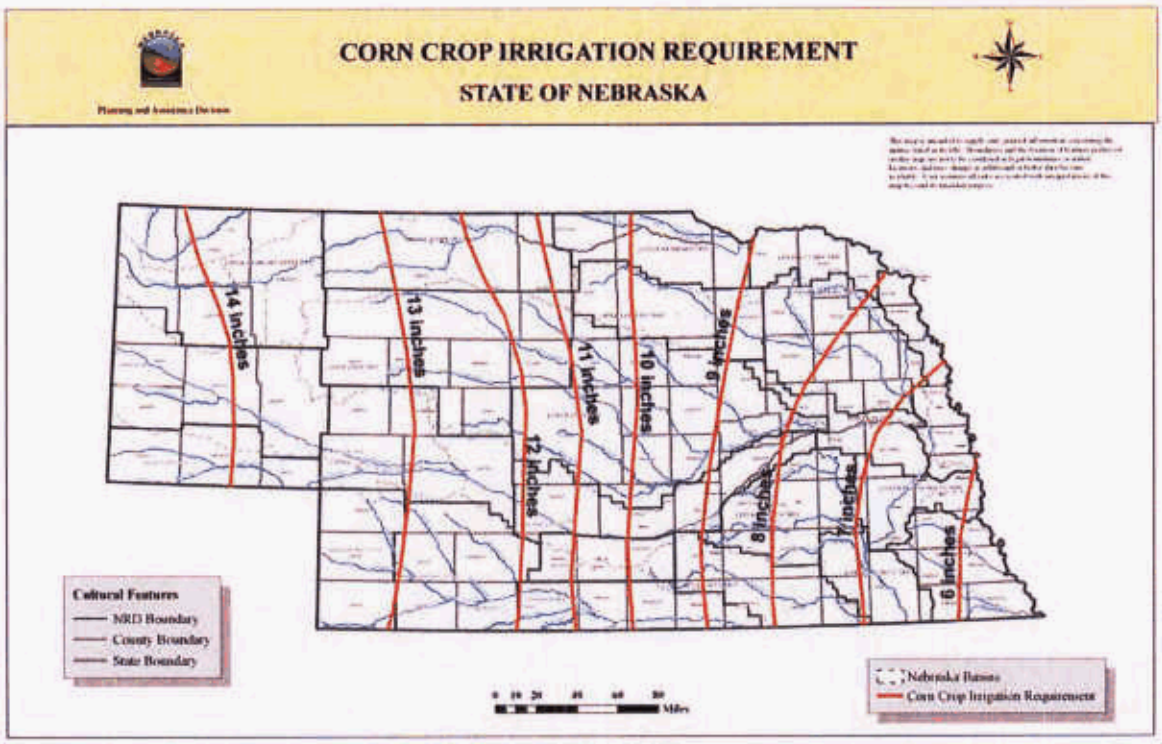
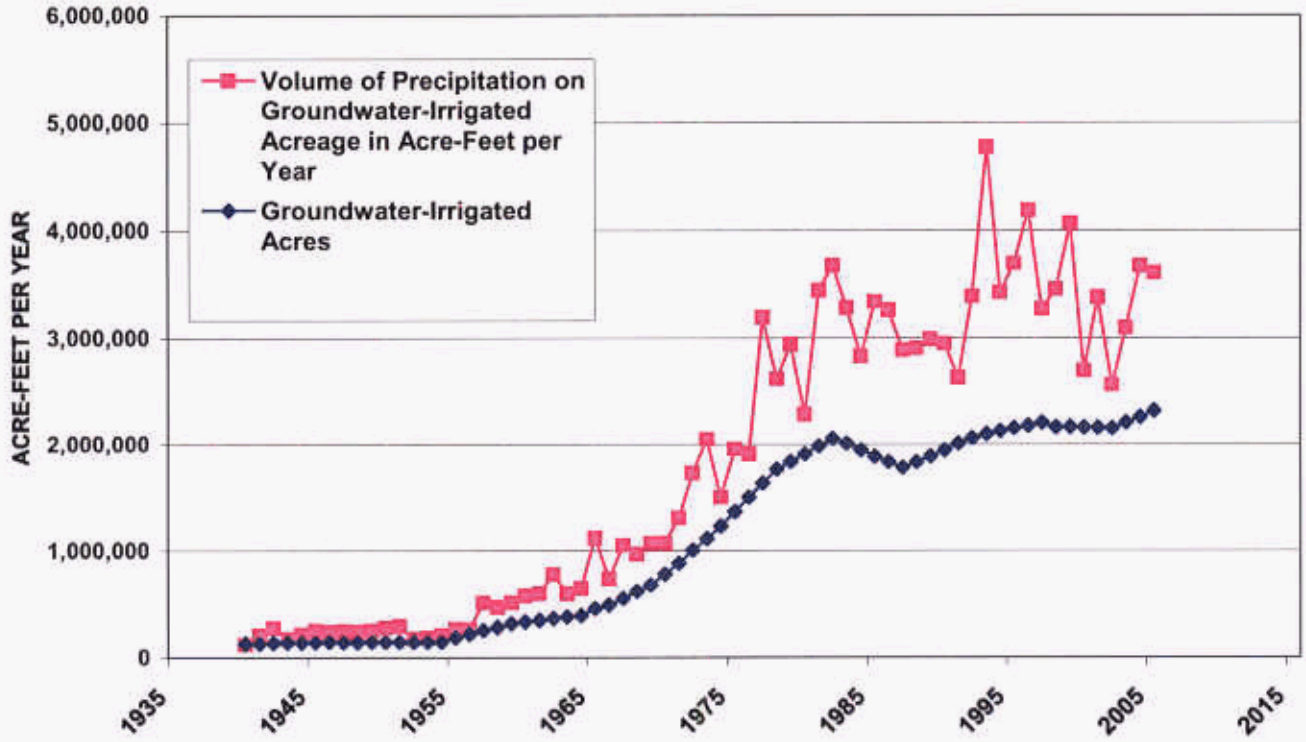
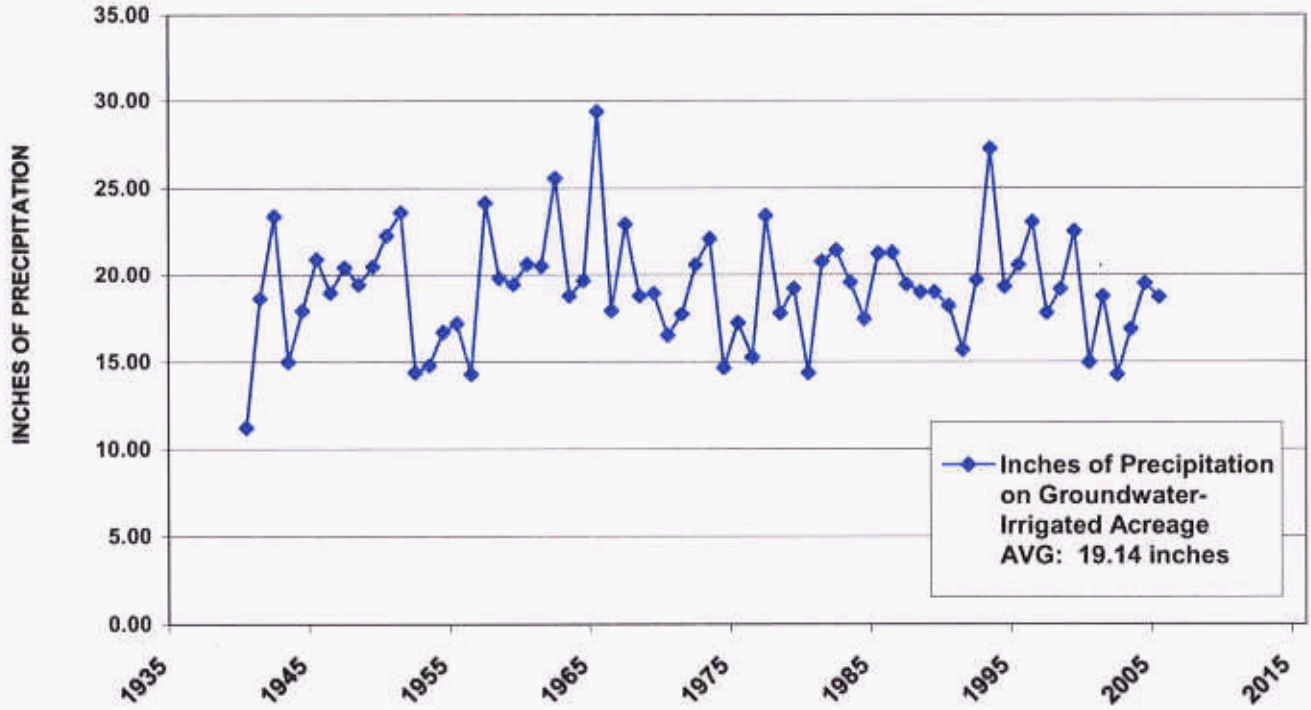


FIGURE 8 - Map of Net Irrigation Requirements (inches/year) for Corn Grown on Fine Sandy Loam (Figure 4 from Martin, 2005)





Compiled by J. Stanton and S. Peterson, from unpublished data associated with simulations documented in USGS Scientific Investigations Report 2008-5143. Date of compilation: 3/6/2009

FIGURE 9
EFFECTIVE PRECIPITATION AND GROUNDWATER-IRRIGATED ACREAGE IN THE ELM 1940 - 2005
LOWER PLATTE TECHNICAL REVIEW
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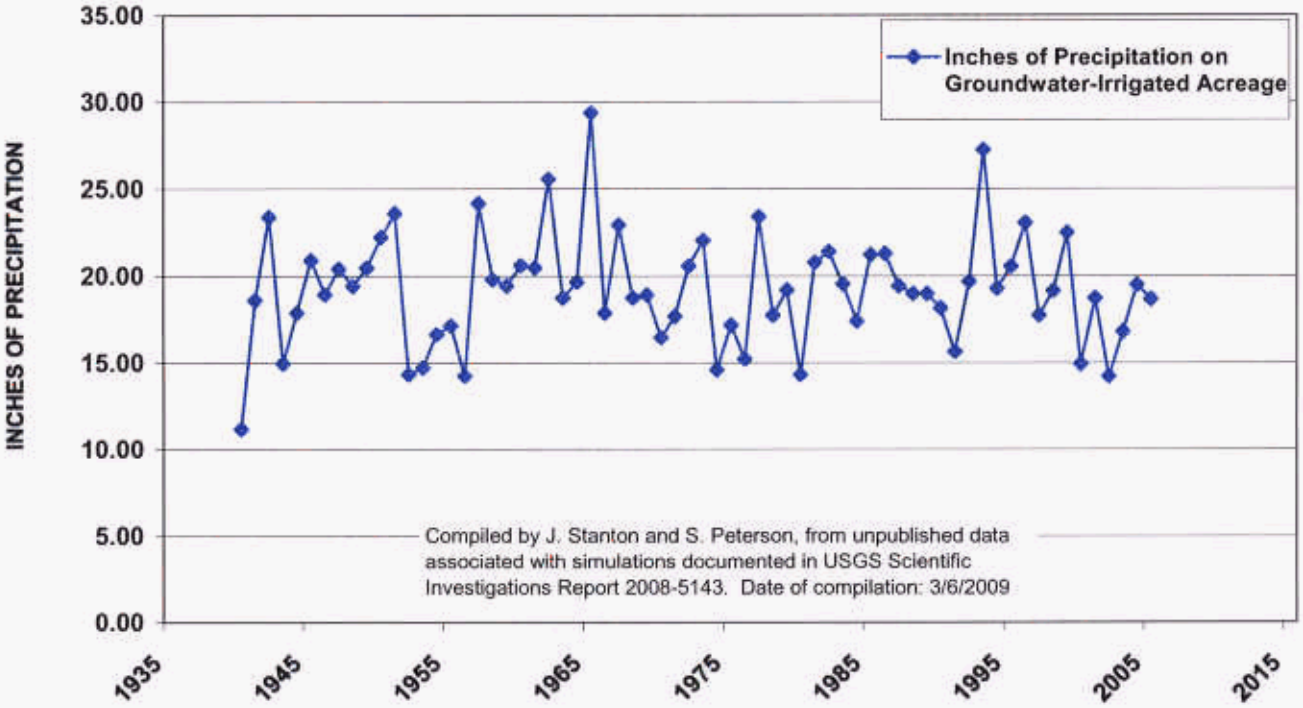

Annual Groundwater Pumping Calculation:
Net Crop Requirement of 25.1 inches *Minus* Effective Precipitation (Graph Above)

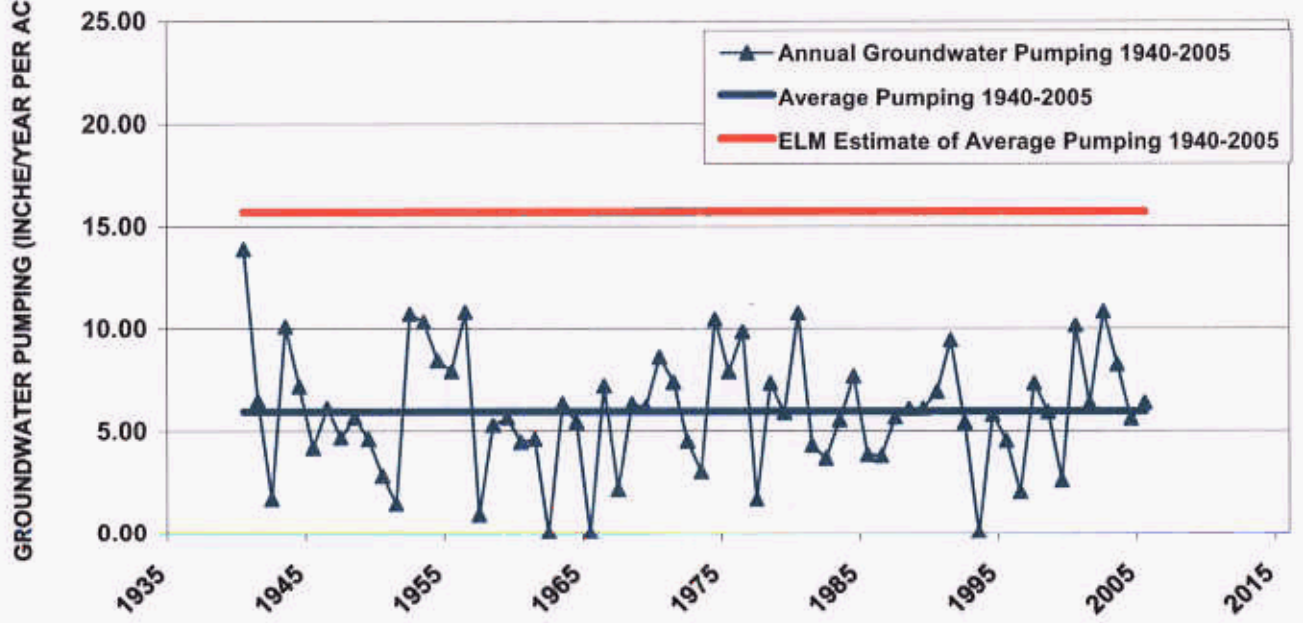

FIGURE 10
GROUNDWATER PUMPING BASED ON EFFECTIVE PRECIPITATION 1940 - 2005
LOWER PLATTE TECHNICAL REVIEW
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APPENDIX A

MODFLOW Water Budgets from the Nebraska Department of Natural Resources Simulations

TABLE A-1
MODFLOW WATER BUDGET SUMMARY
NEBRASKA DEPARTMENT OF NATURAL RESOURCES
BASE SIMULATIONS 1940 - 2047

	1940-2007		2008-2047		2007		2047	
	CUMULATIVE	ANNUALIZED	CUMULATIVE	ANNUALIZED				
IN:	ft3	afy	ft3	afy	ft3/day	afy	ft3/day	afy
STORAGE =	5.36E+11	181,102	2.14E+12	1,226,412	15,133,659	126,809	109761536	919,719
CONSTANT HEAD =	1.30451E+11	44,040	1.45066E+11	83,257	4,802,980	40,245	11218506	94,003
WELLS =	0	0		0	0	0		0
DRAINS =	0	0	0	0	0	0	0	0
ET =	0	0	0	0	0	0	0	0
HEAD DEP BOUNDS =	67273453568	22,712	63387013120	36,379	668,381	5,601	1039622.438	8,711
RECHARGE =	1.28E+13	4,307,446	4.99E+12	2,865,416	547,236,736	4,585,432	341728288	2,863,426
STREAM LEAKAGE =	1.5354E+12	518,352	9.7616E+11	560,239	61,325,988	513,866	66622344	558,245
TOTAL IN =	**1.50E+13**	**5,073,799**	**8.31E+12**	**4,771,694**	**629,167,744**	**5,271,952**	**530370304**	**4,444,104**
OUT:								
STORAGE =	6.59341E+11	222,594	73190244352	42,005	29,941,950	250,891	255912.5	2,144
CONSTANT HEAD =	9.41853E+11	317,970	3.59687E+11	206,432	39,393,200	330,085	21976596	184,147
WELLS =	1.6927E+12	571,457		0	94,485,320	791,716		0
DRAINS =	9.19264E+11	310,344	4.60756E+11	264,438	36,617,696	306,829	29154824	244,295
ET =	2.71E+12	913,716	1.31E+12	750,000	105,200,776	881,503	81801488	685,435
HEAD DEP BOUNDS =	2.76189E+11	93,242	1.60071E+11	91,868	8,493,130	71,166	8091636	67,802
RECHARGE =	0.00E+00	0	2.04E+12	1,170,455	0	0	137474976	1,151,937
STREAM LEAKAGE =	7.83E+12	2,644,189	3.91E+12	2,246,843	315,107,232	2,640,361	251667040	2,108,780
TOTAL OUT =	**1.50E+13**	**5,073,462**	**8.31E+12**	**4,772,039**	**629,239,296**	**5,272,551**	**530422464**	**4,444,541**
IN - OUT =	727,711,744	246	-603455488	-346	-71,552	-600	-52160	-437
PERCENT DISCREPANCY =	0		-0.01		0		-0.01	

ft3 = cubic feet

afy = acre-feet per year

TABLE A-2
MODFLOW WATER BUDGET SUMMARY
NEBRASKA DEPARTMENT OF NATURAL RESOURCES
NO GROUNDWATER IRRIGATION (NGWI) SIMULATIONS 1940 - 2047

	1940-2007		2008-2047		2007		2047	
	CUMULATIVE	ANNUALIZED	CUMULATIVE	ANNUALIZED				
IN:	ft3	afy	ft3	afy	ft3/day	afy	ft3/day	afy
STORAGE =	5.88E+10	19,855	8.06E+10	46,282	9,022,687	75,603	861,515	7,219
CONSTANT HEAD =	20176738304	6,812	7.76E+10	44,528	4,192,868	35,133	5,244,111	43,942
WELLS =	0	0	0	0	0	0	0	0
DRAINS =	0	0	0	0	0	0	0	0
ET =	0	0	0	0	0	0	0	0
HEAD DEP BOUNDS =	67159523328	22,673	6.02E+10	34,564	635,833	5,328	921,955	7,725
RECHARGE =	1.19E+13	4,010,358	6.98E+12	4,003,271	477,435,936	4,000,554	477,435,936	4,000,554
STREAM LEAKAGE =	1.5198E+12	513,085	8.76937E+11	503,293	60,287,208	505,161	59,910,368	502,004
TOTAL IN =	**1.37E+13**	**4,640,320**	**8.07E+12**	**4,631,944**	**551,574,528**	**4,621,779**	**544,373,888**	**4,561,443**
OUT:								
STORAGE =	84159664128	28,412	1.78878E+11	102,662	10,590,789	88,743	5,387,309	45,142
CONSTANT HEAD =	1.0233E+12	345,467	5.64735E+11	324,113	45,767,760	383,499	38,261,200	320,600
WELLS =	30982676480	10,460	1.82E+10	10,460	1,247,444	10,453	1,247,444	10,453
DRAINS =	36538013696	12,335	5.77968E+11	331,708	39,308,924	329,379	39,755,528	333,121
ET =	2.80E+12	945,180	1.70E+12	976,641	113,904,840	954,437	117,091,896	981,142
HEAD DEP BOUNDS =	77230387200	26,073	1.64991E+11	94,692	8,608,322	72,131	8,815,859	73,870
RECHARGE =	9.70E+06	3	1.29E+08	74	8,859	74	8,859	74
STREAM LEAKAGE =	7.99E+12	2,698,239	4.86E+12	2,792,068	332,231,168	2,783,847	333,834,176	2,797,279
TOTAL OUT =	**1.37E+13**	**4,639,983**	**8.07E+12**	**4,632,404**	**551,668,096**	**4,622,563**	**544,402,304**	**4,561,681**
IN - OUT =	1,095,761,920	370	-817364992	-469	-93,568	-784	-28416	-238
PERCENT DISCREPANCY =	0		-0.01		0		-0.01	

ft3 = cubic feet

afy = acre-feet per year

Attachment B

Evaluation of Impacts to Days Needed to Meet 65/85 Requirements Under Various Scenarios

	Number of Days to Meet 65 Rule	Number of Days to Meet 85 Rule
2009 Annual Evaluation	27.9	36.5
Using Most Junior Loup Irrigator	25.5	33.3
Using Most Junior Loup Irrigator and Eliminating Irrigation Efficiency Adjustment	20.4	26.7
Using Most Junior Loup Irrigator and Eliminating Irrigation Efficiency and Downtime Adjustments	18.4	24.0

Attachment C

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Justification for the Minimal Irrigation Requirement Definition that is Incorporated in the Proposed Rule for Defining a Fully Appropriated Basin[1]

The proposed rule defines a basin as fully appropriated if the amount of water available under a surface water irrigation water right is less than the amount required to produce an acceptable rate of return on a new irrigation investment. An analysis of the economics of irrigation found that under most Nebraska conditions the annual amount of applied irrigation water that was necessary for economic feasibility was about 85 percent of the consumptive irrigation requirement (CIR) for corn. Further consideration of crop water use found that the applied water requirement from July 1 to August 31 was at least 65 percent of the annual CIR.

Economic Analysis

The economic analysis upon which this rule was based assumed that new irrigation using surface water would most likely involve center pivots pumping directly from a river, that corn was the most likely crop because it now accounts for over 80 percent of all irrigated acres in Nebraska and that the minimum acceptable rate of return was 6.0 percent. The analysis was based on a 130 acre system requiring an investment of $70,000 exclusive of land costs. These and other key data inputs and assumptions are summarized in Table 1 for conditions in West Central Nebraska. Cost estimates were based on crop budgets published by the Nebraska Cooperative Extension Service. The corn price is a typical producer average for the last five years. The CIR and dryland ET estimates used in this example are mid-range values for the soil and climatic conditions found in West Central Nebraska. Crop yields were based on a combination of county averages published by the Nebraska Agricultural Statistics Service and yield trials conducted by Institute of Agricultural and Natural Resources, University of Nebraska–Lincoln.

The estimated dryland returns assumed that corn was the best dryland option in those areas where rainfall was high enough to generate dryland yields that resulted in at least a $40 net return to corn. If the net return to corn was less than $40, the best dryland option was assumed to be wheat or a wheat-corn-fallow rotation that produced a minimum net return of $40 per acre.

These inputs and assumptions were used to compute the average annual gross irrigation application that would be required to sustain a six percent rate of return on investment for a range of CIR levels that characterize Nebraska.[2] For example in a case where the CIR was 15

---

[1] Prepared by Raymond J. Supalla, Professor of Agricultural and Natural Resource Economics, University of Nebraska–Lincoln.

[2] The CIR is defined for this analysis as the amount of water consumed by a fully watered crop that comes from irrigation. It is equal to total crop evapotranspiration (ET) less effective rainfall and is sometimes called the net irrigation requirement. The CIR divided by an efficiency parameter equals the gross irrigation requirement which is the amount of water that must be applied to the crop to meet the CIR. The efficiency parameter used in this analysis is called water use efficiency and is defined as the proportion of the gross irrigation amount that is consumed by the crop.

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Table 1. Data Inputs and Assumptions for Economic Analysis

Data Inputs and Assumptions	
CIR for Corn, Inches/Acre	15
Dryland ET for Corn	16
Fully Watered Yield, Bushels Acre	215
Non-Irrigated Yield	60
Water Use Efficiency	0.8
Yield/Inch of ET (Corn)	12.5
Crop Price, $/Bushel	$2.35
Variable Irrigation Cost, $/Inch	$6.00
Irrigation Start-up Costs, $/System	$1,500
Variable Production Costs for Corn, $/Acre	$140
Yield Dependent Costs, $/Bushel	$0.50
Dryland ROVC, $/Acre	$40
Irrigation Investment, Center Pivot System	$70,000
Acres per System	130
Interest Rate, Decimal	0.06
Amortization Period (Years)	15

inches, the estimated minimum gross irrigation requirement (break-even point) was found to be 13 inches, which is 86 percent of the CIR (Table 2). This relationship between the CIR for corn and the minimum amount of water required to make irrigation economically feasible was found to be surprisingly consistent across the state, with the exception of Eastern Nebraska where rainfall is relatively high. In this area the CIR may be so small that the amount of gross irrigation required to justify an irrigation investment is more than 85 percent of the CIR. Results from the economic analysis suggest that a gross irrigation application of at least six inches is necessary to justify a sprinkler irrigation investment.

Computing the CIR

The CIR for corn varies primarily as a function of effective precipitation. In Nebraska it varies from less than 6 inches in Southeast Nebraska to over 20 inches in Northwest Nebraska. Estimates are available from several sources, including the Irrigation Guide published by the Natural Resources Conservation Service, U.S. Department of Agriculture (NRCS, USDA) and from the Institute of Agriculture and Natural Resources, University of Nebraska–Lincoln (IANR, UNL). The estimates used in this analysis were provided by Derrel Martin, IANR, UNL based on results from a simulation model called CROPSIM.

Table 2. Example Break Even Analysis for a 130 Acre Center Pivot Irrigation Investment When the Consumptive Irrigation Requirement for Corn is 15 Inches

Inches Applied	Irrigated Yield Bu/Acre	Annual Net Return to Irrigation Investment $/Acre	Present Value of Net Returns to Irrigation Investment $/System	Present Value of Net Returns to Irrigation Irrigation Investment $/Acre
1	70	-68	-155,289	-1,195
2	80	-55	-139,227	-1,071
3	90	-42	-123,515	-950
4	100	-30	-108,170	-832
5	110	-18	-93,210	-717
6	119	-7	-78,657	-605
7	129	4	-64,533	-496
8	138	15	-50,867	-391
9	147	26	-37,690	-290
10	155	36	-25,039	-193
11	164	45	-12,959	-100
12	172	54	-1,504	-12
14	187	71	19,233	148
15	194	78	28,305	218
16	201	84	36,291	279
17	207	89	42,899	330
18	212	93	47,525	366

Temporal Distribution of the Seasonal Irrigation Requirement

Defining the minimum water supply that is necessary to justify an irrigation investment requires consideration of when the water is available during the season as well as the total amount available. Water timing requirements depend on the crop, the soil and the climate. In July and August crop water requirements are high, while rainfall and stream flows are low relative to earlier in the season. Therefore, the suggested procedures for defining a minimum water supply incorporate a minimum gross irrigation requirement for July and August as well as for the entire season. The proposed rule sets the July-August requirement at 65 percent of the seasonal CIR. This means for our example case that if we have a seasonal CIR of 15 inches, the minimum required gross irrigation application for the season is 12.75 inches (85 percent of 15) and the minimum for July and August is 9.75 inches (65 percent of 15). This insures that enough of the seasonal water supply is available during critical crop growth stages to produce the grain yield responses to water that are necessary to justify an irrigation investment.

Calculation of Stream Flow Requirement

The stream flow required to provide enough water to make irrigation economically feasible depends on the amount required at the field, the design flow rate, the losses if any between the stream and the field and an allowance for expected down time. The illustrative case depicted in Table 3 assumes: a design flow rate of 1 cfs per 70 acres, which is widely used when

Table 3. Conversion of Minimum Irrigation Requirement in Inches per Acre to Days of Required Stream Flow.

Assumptions and Data Inputs		Value
CIR, Inches per Acre		15
Water Use Efficiency, Proportion		0.8
Required Break-even Seasonal Field Delivery, Inches per Acre	15 x .85 =	12.75
Required Break-even July-August Delivery, Inches per Acre	15 X .65 =	9.75
Delivery Flow Rate, cfs	130*1/70	1.86
System Downtime Proportion		0.1
Days Required to Meet Break-even Seasonal Requirement*		42
Days Required to Meet Break-even July-August Requirement*		32
Total Seasonal Gross Irrigation Requirement, Inches per Acre**	15/.8 =	18.75
Days Required to Meet Total Seasonal Requirement	1.86cfs for 130	
acres *1.98= 3.69 af/day/130 acres * 12 in/ft = .339 ac-in/ac per day	Need 18.75	61
in/.339 = 55 day / .9 for down time = 61 days		
Total July-August Gross Irrigation Requirement***	9.75/.8 = 12.2	12.2
Days Required to Meet Total July-August Requirement* 12.2in		
required/.339in/day = 35 day/.9 for down time = 40 days		40

* Inches per acre were converted to days required by dividing the total field volume required by the amount of water that could be delivered in a day at the design flow rate and assuming the system was down 10 percent of the time.
** The seasonal gross irrigation requirement was calculated by dividing the CIR by the water use efficiency.
*** The total July and August demand was assumed to be 65 percent of the seasonal gross irrigation requirement.

1. Red = ab additions

administering surface water rights in Nebraska; zero losses between the river and the field, which is equivalent to pumping directly from the river; and a system downtime factor of 10 percent. With these assumptions further irrigation development is likely to be economically feasible in a basin where the CIR for corn is 15 inches if a junior appropriator could divert water for a minimum of 42 days from May 1 to September 30, with 32 of these days occurring between July 1 and August 31.

The final question concerns how frequently this requirement must be met for irrigation to be considered economically feasible. Does it have to be met every year? To what extent does applying more than the minimum average requirement in good water supply years offset poor water supply years? This issue was analyzed for two example basins, the Elkhorn and the Loop. It was found that the break-even water requirement, when computed as a proportion of the average annual CIR as described in Table 1, 2 and 3, adequately reflected the economic implications of high and low flow years. What this finding means is that the 85 and 65 percent criteria can be applied to the historical flow regime to determine the economic feasibility of further irrigation development without regard to the annual variance in water availability.

In total this analysis suggests that if irrigation feasibility is used to determine if a basin is fully appropriated, then the following calculations are appropriate. First, determine the CIR for corn. Second, calculate the number of days that water must be available to a junior appropriator

during the season (May to September) and during July and August before an irrigation investment is economically feasible. Third, calculate the number of water supply days required to meet the average annual full irrigation requirement for corn and the number of days required to meet the full requirement for July and August. Fourth, compute the number of days each year that water would have been available to a junior appropriator during the season and during July and August, using the appropriate historical period of record. Fifth, compute the average number of water supply days for the historical period using the observed number of days for each year or the number of days required for full irrigation, whichever is less. Sixth, if the results from step five are equal to or greater than the results from step two, irrigation can be considered economically feasible.

Exh.
6

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
8901 S. 154th Street
Omaha, NE 68138-3621
402-444-6222
www.papionrd.org

March 12, 2009

Brian Dunnigan P.E., Director
The Nebraska Department of Natural Resources
301 Centennial Mall South
Lincoln, Nebraska 68509-4676

RE: Preliminary Determination that the Lower Platte River Basin is Fully Appropriated

Dear Director Dunnigan:

The Papio-Missouri River Natural Resources District (District) has been a long time partner with the Lower Platte South and Lower Platte North NRDs and six state agencies, through the Lower Platte River Corridor Alliance, to protect, enhance and restore the vitality of the Lower Platte River in eastern Nebraska. Helping to insure that an adequate supply of good quality water remains available for not only fish and wildlife, but also for the critical municipal water supplies that provide drinking water to nearly one-half of the state's population will continue to be a major goal of the District and the Alliance.

The District is here today to give testimony in opposition to the Nebraska Department of Natural Resources (Department) preliminary determination that the Lower Platte River Basin is fully appropriated. The District agrees with the testimony given by Fennemore Craig and the findings contained in the report prepared for Fennemore Craig by Brown and Caldwell. It is in the interest of all Nebraskans that the annual evaluation performed by the Department be done using the best available science and that the evaluation follows the applicable state statutes and negotiated rules.

When making the 2009 annual evaluation, the Department considered approximately 120 high capacity wells downstream of the Louisville gage for its calculation of lag effects due to current levels of development. The inclusion of these wells creates additional lag effects that are subtracted from the streamflow upstream at Louisville. There is essentially no hydrologic basis for such a subtraction. While groundwater pumping in hydrologically connected areas along the Platte, downstream of Louisville, may impact the flow in that particular portion of the stream, the calculation of impacts is specific to that area of the stream and not to the flows at the Louisville gage. The inclusion of these downstream wells results in an over estimation of lag effects at the Louisville gage.

The District reviewed the geographic areas the Department designated as being hydrologically connected to surface water and believes there are some areas that should be investigated further to see if the delineation is correct. Typically the hydrologically connected area is within one to two miles of the Platte and Elkhorn Rivers. However there is one area near the Platte River confluence with the Missouri River where the designated area is five miles from the stream. There are also a number of areas where stream segments are not designated in the

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App.
3-12-09 WC

Papio – Missouri River Natural Resource District Board of Directors
Larry Bradley Fred Conley John Conley Tim Fowler Scott Japp David Klugg
Rick Kolowski Dorothy Lanphier John Schwope Richard Tesar Jim Thompson
John Winkler, General Manager

hydrologically connected area. We are providing Exhibit A – Sections to Reconsider Hydrologic Connectivity, listing the areas (section-township-range) the District suggests be reconsidered.

In other estimations of the lag effects, the annual evaluation employed a standard method for assessing the impacts of high capacity wells with the single exception of the Metropolitan Utilities District (MUD) Platte West Well Field. For high capacity wells, the Department utilized the anticipated Net Corn Crop Irrigation Requirement (NCCIR) to calculate lag effects. For the Platte West Well Field, the Department incorporated a lag effect of 160 cubic feet per second (CFS) based on an assumed pumping rate of 104 million gallons per day (MGD). The MUD holds a Department issued municipal transfer permit for 104 MGD for the peak production from the Platte West Well Field with a maximum annual capacity of 19 billion gallons per year (BGY). The 19 BGY maximum equates to a maximum average daily rate of 52 MGD, far less than the assumed 104 MGD. The Platte West Well Field is, by the Department issued municipal transfer permit, restricted to pumping at a maximum average daily rate of 52 MGD. The incorporation of the 160 cfs of depletion effects is an overestimation of the impacts of the permitted average annual production from the Platte West Well Field.

In a related matter, the 2009 annual evaluation by the Department does not appear to have considered other municipal transfer permits in the basin. This is a matter that the District believes should be investigated, since communities are relying on those permits for future growth. How these permits enter into consideration during development of an Integrated Management Plan, should that be necessary, also needs to be clarified.

The District appreciates this opportunity to provide comment on the Lower Platte River preliminary determination and looks forward to working closely with the Department on these very important issues to Nebraska in the future.

Sincerely,

John Winkler

General Manager

Papio-Missouri River Natural Resources District

Cc: P-MRNRD Directors

Enclosures: Exhibit A

Exhibit A - Sections to Reconsider Hydrologic Connectivity

County	Section	Township	Range
DOUGLAS			
	02	14	10
	02	15	10
	03	14	10
	03	16	10
	10	14	10
	10	16	10
	13	15	10
	24	15	10
	26	15	10
	35	15	10
SARPY			
	01	12	10
	02	12	10
	02	12	11
	03	12	10
	03	13	13
	07	12	11
	09	12	11
	10	12	11
	10	13	13
	12	12	10
	13	13	13
	14	13	13
	15	13	13
	15	14	10
	16	13	13
	21	13	13
	22	13	10
	22	13	12
	22	13	13
	22	14	10
	23	13	12
	23	13	13
	24	13	12
	24	13	13
	25	13	11
	26	13	11
	27	13	10
	34	13	10
	34	14	10
	35	13	11

3

County	Section	Township	Range
WASHINGTON			
	02	17	09
	05	18	09
	08	18	09
	12	17	09
	17	17	10
	17	18	09
	18	17	10
	20	17	10
	21	18	09
	28	17	10
	28	18	09
	32	19	09
	33	17	10
	34	18	09

Exh.
7

UPPER BIG BLUE
Natural Resources District

105 N. Lincoln Ave.
York, Nebraska 68467

402-362-6601
Fax: 402-362-1849
www.upperbigblue.org

March 12, 2009

Brian Dunnigan
Director Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, NE 68509-4676

Dear Mr. Dunnigan,

The Upper Big Blue NRD is opposed to the Fully Appropriated determination of the Lower Platte Basin now being considered. Such full appropriation is not supported by best science or data, as described in the Brown and Caldwell report presented to you earlier today.

The Upper Big Blue plans to develop a groundwater model of the area in the Polk and Butler County area along the Platte River. The model will be based on and will be an extension of the Blue River Basin groundwater model this district recently completed. The purpose will be to determine the hydrologically connected area of the Platte River and its tributaries in and near the northern portion of the Upper Big Blue NRD. That work will take some time and the results certainly will not be ready in time for your necessary decision on the matter before you. When we are confident of the work and have it peer reviewed, we intend to submit it to the Department for your consideration of the 10/50 boundaries in determinations of the Lower Platte Basin.

Sincerely,

John C. Turnbull
General Manager

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3-12-09

Exh.
8

Manuscript copy: Approved by Bureau Approving Official on 12/31/2008

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science for a changing world

In cooperation with
The Upper Elkhorn Natural Resources District
The Lower Elkhorn Natural Resources District

Trends in Streamflow Characteristics of Selected Sites in the Elkhorn River, Salt Creek, and Lower Platte River Basins, Eastern Nebraska, 1928-2004, and Evaluation of Streamflows in Relation to Instream-Flow Criteria, 1953-2004

By Benjamin J. Dietsch, Julie A. Godberson, and Gregory V. Steele

Scientific Investigations Report XXXX–XXXX

U.S. Department of the Interior
U.S. Geological Survey

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U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Meyers, Director

U.S. Geological Survey, Reston, Virginia 2008

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
square foot (ft^2)	0.09290	square meter (m^2)
square inch (in^2)	6.452	square centimeter (cm^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
	Flow rate	
acre-foot per day (acre-ft/d)	0.01427	cubic meter per second (m^3/s)
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
cubic feet per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
foot per second (ft/s)	0.3048	meter per second (m/s)

Vertical coordinate information is referenced to the insert datum name (and abbreviation) here, for instance, "North American Vertical Datum of 1988 (NAVD 88)"

Horizontal coordinate information is referenced to the insert datum name (and abbreviation) here, for instance, "North American Datum of 1983 (NAD 83)"

Altitude, as used in this report, refers to distance above the vertical datum.

6

Trends in Streamflow Characteristics of Selected Sites in the Elkhorn River, Salt Creek, and Lower Platte River Basins, Eastern Nebraska, 1928-2004, and Evaluation of Streamflows in Relation to Instream-Flow Criteria, 1953-2004

By Benjamin J. Dietsch, Julie A. Godberson, and Gregory V. Steele

Abstract

The Nebraska Department of Natural Resources approved instream-flow appropriations on the Platte River to maintain fish communities, whooping crane roost habitat, and wet meadows used by several wild bird species. In the lower Platte River region, the Nebraska Game and Parks Commission owns an appropriation filed to maintain streamflow for fish communities between the Platte River confluence with the Elkhorn and the mouth of the Platte River. Because Elkhorn River flow is an integral part of the flow in the reach addressed by this appropriation, the Upper Elkhorn and Lower Elkhorn Natural Resources Districts are involved in overall management of anthropogenic effects on the availability of surface water for instream requirements.

The Physical Habitat Simulation System (PHABSIM) and other estimation methodologies were used previously to determine instream requirements for Platte River biota, which led to the filing of five water appropriations applications with Nebraska Department of Natural Resources in 1993 by Nebraska Game and Parks Commission. One of these requested instream-flow appropriations of 3,700 cubic feet per second was for the reach from the Elkhorn River to the mouth of the Platte River. Four appropriations were granted with modifications in 1998, by the Nebraska Department of Natural Resources.

Comment [GVS1]: By whom??

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Daily streamflow data for the periods of record were summarized for 17 streamflow-gaging stations in Nebraska to evaluate streamflow characteristics, including low-flow intervals for consecutive durations of 1, 3, 7, 14, 30, 60, and 183 days. Temporal trends in selected streamflow statistics were not adjusted for variability in precipitation. Results indicated significant positive temporal trends in annual flow for the period of record at eight streamflow-gaging stations – Platte River near Duncan (06774000), Platte River at North Bend (06796000), Elkhorn River at Neligh (06798500), Logan Creek near Uehling (06799500), Maple Creek near Nickerson (06800000), Elkhorn River at Waterloo (06800500), Salt Creek at Greenwood (06803555), and Platte River at Louisville (06805500). In general, sites in the Elkhorn River Basin upstream from Norfolk showed fewer significant trends than did sites downstream from Norfolk and sites in the Platte River and Salt Creek Basins, where trends in low flows also were positive.

Historical Platte River streamflow records for the streamflow-gaging station at Louisville, Nebraska, were used to determine the number of days per water year (Sept. 30 to Oct. 1) when flows failed to satisfy the minimum criteria of the instream-flow appropriation prior to its filing in 1993. Before 1993, the median number of days the criteria were not satisfied was about 120 days per water year. During 1993 through 2004, daily mean flows at Louisville, Nebraska, have failed to satisfy the criteria for 638 days total (median value equals 21.5 days per year). Most of these low-flow intervals occurred in summer through early fall. For water years 1953 through 2004, of the discrete intervals when flow was less that the criteria levels, 61 percent were 3 days or greater in duration, and 38 percent were 7 days or greater in duration. The median duration of intervals of flow less than the criteria levels was 4 consecutive days during 1953 through 2004.

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Introduction

Instream-flow protection is a complex legislative and technical issue that is implemented in various ways throughout the United States. The Nebraska Department of Natural Resources (NDNR) approved appropriations on the Platte River to provide instream-flow protection primarily to maintain fish communities, whooping crane roost habitat, and wet meadows used by several migratory bird species. Instream-flow Appropriation A-17331, filed and owned by the Nebraska Game and Parks Commission (NGPC), was established to maintain streamflow for fish communities in the Platte River between its confluence with the Elkhorn River and the mouth of the Platte. The Elkhorn River flow is an integral part of the streamflow addressed in this appropriation. As such, the Upper Elkhorn Natural Resources District (UENRD) and the Lower Elkhorn Natural Resources District (LENRD) are collecting data and developing water-management strategies to assist with water-resources planning. Of particular interest are the effect of anthropogenic stresses on the availability of surface-water resources, and the interaction of ground water and surface water in the Elkhorn River Basin. Specifically, the UENRD and the LENRD are concerned with the effects of precipitation, surface-water withdrawals, ground-water withdrawals, streambed-elevation changes, and tile drains on the availability of surface water and the long-term effects of these processes (R. Wozniak, Lower Elkhorn Natural Resources District oral commun., 2005).

Comment [GVS2]: The title includes "stream" with flow, but including it is your call. Just be consistent with terminology (I don't know that you aren't).

In 2005 the U.S. Geological Survey (USGS), the UENRD, and the LENRD began a cooperative study to investigate instream flow as it pertains to Appropriation A-17331. This study was undertaken to (1) review and assess the methods used to determine the flows granted by NDNR in Appropriation A-17331, (2) to provide information on temporal trends in streamflow at 17 gaging stations located on the lower Platte River or within the basins of the Elkhorn River and Salt Creek, (3) to assess the sufficiency of historical streamflow data to meet the requirements of A-17331, and (4) to evaluate the adequacy of the streamflow records for the gaging station at Louisville, Nebraska.

Purpose and Scope

The primary purpose of this report is to present the trends in streamflow characteristics from 1928 to 2004 at selected sites in Elkhorn River, Salt Creek, and lower Platte River basins. Also, this report describes streamflows in relation to instream flow criteria for 1953 to 2004 Findings for seven study objectives are presented: (1) review the technical literature to determine how Appropriation A-17331 was applied to maintain fish communities, and to identify the methods used to establish Appropriation A-17331 and similar flow appropriations for the maintenance of flow for fish and wildlife; (2) review the input conditions and applicability of the Physical Habitat Simulation System (PHABSIM) model used in establishment of Appropriation A-17331; (3) analyze long-term records of streamflow at gaging stations to detect annual and seasonal variations, including those during the months of June, July, and August, and to determine long-term streamflow trends; (4) compute 1- and 7-day low flows for each year to determine long-term surface-water trends; (5) summarize historical occurrences of daily streamflow values in the Elkhorn River Basin and the Platte River at Louisville, Nebraska, that would be considered insufficient, as defined by the Appropriation A-17331, to maintain the fish community between the Platte River confluences with the Elkhorn River and the Missouri River; (6) determine the number of days that flows in the Elkhorn River Basin and at the Platte River at Louisville stream-gaging station would be considered insufficient, as defined by the Appropriation A-17331, since November 1993 (the beginning date of the appropriation) and identify the dates when junior water rights would have been suspended as a result of water shortages for Appropriation A-17331; and (7) provide quality-assurance data on the accuracy of the streamflow measurements at the Platte River at Louisville stream-gaging station and its effect on the adequacy of the Louisville streamflow-gaging station for management of the instream-flow appropriation.

The scope of the study includes the available streamflow data at 17 stream-gaging stations in the Elkhorn River, Platte River, and Salt Creek basins.

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Study Area Description

Confluences with two principal tributaries of the Platte River—the Elkhorn River and Salt Creek—are located within the reach defined by Appropriation A-17331. The Elkhorn River, which drains 7,000 square miles (mi^2), flows east-southeast through the Sand Hills in north-central Nebraska and the glaciated rolling hills of northeast Nebraska to its confluence with the Platte River about 20 miles downstream from Fremont, Nebraska (fig. 1). Logan Creek, a principal tributary of the Elkhorn River that drains much of the glaciated area of northeast Nebraska, enters the Elkhorn River north of Fremont. The flow regimes of the eastern and western parts of the Elkhorn River Basin contrast because of the differences in the sediment composition and the increasing gradient of precipitation from west to east (Bentall and others, 1971). Streamflows in the Sand Hills or western part, which is characterized by extremely permeable sediments, are derived primarily from ground water. In contrast, streamflows in the eastern part, where loess-capped glacial deposits generally are less permeable, more variable, and responsive to precipitation events.

Fig 1. near here

Surface-water use in the Elkhorn River Basin includes irrigation, livestock, and recreational supplies. As of January 30, 2005, 362 surface-water appropriations with application dates later than 1970 were listed in the NDNR database (Nebraska Department of Natural Resources, 2005). These appropriations together are listed as irrigating about 29,000 acres in the Elkhorn River Basin; however, the database does not include the number of appropriations or acreages adjudicated during this same period.

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Salt Creek, whose confluence with the Platte River is about 7 mi downstream from the confluence of the Elkhorn and Platte Rivers, flows north to northeast through southeast Nebraska. Its 1,650-mi^2 basin generally slopes from southwest to northeast. Wahoo Creek, a principal tributary of Salt Creek, enters Salt Creek near Ashland, or upstream from the confluence with the Platte River.

The Platte River is a braided stream that begins at the confluence of the North Platte and South Platte Rivers near North Platte, Nebraska, and has a drainage area of about 71,000 mi^2 at the USGS Platte River at Louisville, Nebraska, streamflow-gaging station (06805500). The recorded extremes for discharge at the Louisville streamflow-gaging station (for brevity, when referring to a Platte River streamflow-gaging station, hereinafter, only the geographic location will be used) range from 124,000 cubic feet per second (ft^3/s) on March 30, 1960, to 131 ft^3/s on September 3, 1976. From 1953 through 2005, the mean annual discharge was 6,966 ft^3/s (U.S. Geological Survey, 2006).

Comment [GVS3]: Are these on figure 1? If not they need added to the figure.

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Background

Trends in streamflow have been studied extensively on large scales within the United States (Lins and Slack, 1999; McCabe and Wolock, 2002; Milly, 2005). Lins and Slack (1999) detected positive trends in the annual minimum and median streamflow for 395 climate-sensitive streamgaging sites within the conterminous United States from 1944 through 1993 using the non-parametric Mann-Kendall test (Helsel and Hirsch, 1992). McCabe and Wolock (2002) used Kendall's Tau test (herein referred to as Kendall's Tau) to determine trends in minimum and median daily streamflow at sites within the conterminous United States. McCabe and Wolock found that the number of sites with positive trends was dependent on the time period analyzed. McCabe and Wolock stated that although monotonic trend tests such as Kendall's Tau cannot distinguish a gradual change from an abrupt change in a single data sequence, the temporal pattern of Kendall's Tau for many time periods supported the hypothesis of an abrupt step change in streamflow around 1970 being the dominant feature of temporal changes during the 1941–99 time period. McCabe and Wolock concluded that annual streamflows showed a "step" increase around 1970 rather than a gradual trend, and noted that these increases coincided with increased precipitation in the eastern United States as indicated by Karl and Knight (1998). Milly (2005) investigated trends in the water budget within the Mississippi River Basin since 1949 and detected positive trends in precipitation that coincided with positive trends in runoff, but the trends in runoff also may have been emphasized at downstream sites by declines in the rate of filling of surface-water reservoirs constructed in the 1950s and 60s.

In Nebraska, instream flows for fish and wildlife purposes have been legally recognized as a beneficial use following the passage of legislation since 1984 (Aiken, 1989). Chapter 46-2 of the Nebraska State Statutes contains many of the provisions for acquiring an instream-flow appropriation. Instream-flow appropriations may be obtained by the NGPC or a Natural Resources District (NRD). The NGPC, NRD, or other state agencies must conduct detailed studies to quantify the amount of flow requested for a specific stream reach prior to requesting approval by NDNR (Aiken, 1989; Nebraska Revised State Statutes Section 46-2, 109). The director of NDNR may approve instream appropriation applications only after determining that: (1) unappropriated water is available for appropriation at a level that the species of interest can tolerate; (2) the appropriation is necessary to preserve the instream uses for which the appropriation has been requested; (3) the appropriation will not interfere with senior surface-water appropriations; (4) the rate and timing of flows are those required to maintain the instream use for which the appropriation has been requested; (5) and the instream flow is of public interest (Aiken, 1989; Nebraska Revised State Statutes Section 46-2,115). Instream-flow appropriations are administered in the same manner as other appropriations with the exception that releases for reservoirs with senior water rights are not required to provide sufficient water for instream-flow appropriations (Nebraska Revised State Statutes Section 46-2, 119).

Overview of methods to estimate instream-flow requirements

Habitat model simulations are commonly used to determine instream-flow requirements. Examples include the PHABSIM and modules of various hydraulic models. The PHABSIM is a habitat-simulation model developed using principles contained within the Instream Flow Incremental Methodology (IFIM) (Bovee, 1982; Bovee and others, 1998). Similar habitat models exist; however, those models were not used to determine instream-flow requirements for Appropriation A-17331 (Nebraska Department of Natural Resources, 1998, available at *http://www.dnr.state.ne.us/legal/decision1.htm*, accessed January 30, 2005). Because PHABSIM was used to estimate instream-flow requirements for Appropriation A-17331 (Nebraska

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Department of Natural Resources, 1998), discussion of habitat models in this report primarily will focus on PHABSIM.

The PHABSIM and similar models use hydraulic principles to simulate water depths and velocities that are based on cross-section measurements made along the stream reach. Inputs for PHABSIM include channel geometry, substrate classification, vegetative cover indices, and habitat suitability curves. Velocities and depths generated by the hydraulic part of the model are combined with cover and substrate information and habitat suitability criteria. These data were used to produce quality and quantity tables of usable habitat area for selected species at designated streamflows. In PHABSIM, criteria for favorable habitat are expressed as suitability index curves. A decimal scale ranging from 0 (entirely unsuitable) to 1 (completely suitable) is used to relate these index curves to physical measures such as depth, velocity, substrate, and cover to score microhabitat suitability. Experts possessing knowledge of favorable habitat conditions for species in the studied reaches may be called upon to collect data, perform habitat analyses, and use professional judgment to determine suitability index curves. More than one suitability index curve may exist for a particular reach; suitability index curves may be developed for multiple combinations of species, life stage, and season. The PHABSIM uses each suitability index curve for a particular reach to generate a series of relations of discharge to habitat areas. The habitat area, called weighted usable area (WUA), relations to discharge are developed for each suitability index and then reported as square feet of usable habitat per 1,000 feet of stream length for a given discharge. The WUA can be combined for all considered species by first expressing the useable habitat as the percentage of optimum habitat (POH) to eliminate bias in favor of species with large WUAs. The POH is the quotient of WUA divided by the maximum WUA simulated for each species or life stage. Where each species and life stage is given equal importance, POH values for each discharge can be averaged to determine a combined POH. Alternatively, a weighted-averaging scheme can be used to place greater emphasis on species assigned a greater importance. The flow with the greatest combined POH

can be selected as the single recommended flow for a particular reach; however, the greatest combined POH may occur at an unrealistic or low-frequency discharge, and other criteria for selecting a recommended flow may be required to provide a solution practical for stakeholders involved in implementing the recommended flow.

The Tennant standard-setting method (Tennant, 1976), sometimes called the Montana method, is another widely used method for estimating instream-flow requirements (table 1). Flows are computed as fixed percentages of mean annual streamflow for general regimes. The method requires streamflow data from a gage on or near the stream reach being investigated. The Tennant method relies on the assumption that optimum habitat conditions occur near the mean annual streamflow.

Table 1. Tennant standard-setting method for estimating instream-flow requirements (Tennant, 1976).

	Instream flow	
Flow description	October-March, (Winter), as a percentage of mean annual streamflow	April-September (Summer), as a percentage of mean annual streamflow
Flushing or maximum	200	200
Optimum range	60-100	60-100
Outstanding	40	60
Excellent	30	50
Good	20	40
Fair or degrading	10	30
Poor or minimum	10	10
Severe degradation	0-10	0-10

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A wide variety of additional methods and habitat modeling techniques exist for estimating habitat availability and for quantifying required instream flows. Methods developed by Poff and others (1997), range of variability approaches (Richter and others, 1997), and the Hydroecological Integrity Assessment Process (HIP) software tools (Henriksen and others, 2006) utilize the components of a flow regime such as magnitudes, frequencies, durations, timing, and rate of change to correlate with biological data to determine flows suitable for maintaining fish and wildlife habitat. The MesoHABSIM habitat model integrates the use of flow regime characteristics with other hydrological models to define community-specific thresholds (Annear and others, 2004). The R2CROSS and Wetted-Perimeter methods (Espegren, 1996) use channel geometry to determine flow-regime characteristics. Computer Aided Simulation Model for Instream Flow Requirements (CASIMIR) is another modular simulation model (Jorde and others, 2001).

Comment [BJD4]: OBJECTIVE 2

Overview of Appropriation A-17331

For the purpose of protecting habitat for fish and wildlife on the Platte River in central and eastern Nebraska, on November 30, 1993, the NGPC filed five applications for water appropriations with the NDNR among which was the application for Appropriation A-17331. The initial application requested 4,000 ft^3/s (September 16 through January 31), 5,800 ft^3/s (February 1 through June 15), and 4,000 ft^3/s (June 16 through September 15) (R. Wozniak, Lower Elkhorn Natural Resources District, written commun., 2007). Efforts to estimate instream-flow requirements using PHABSIM and other estimation methodologies resulted in the revised flow-magnitude requests for the three applications listed in table 2 and described below (Nebraska Department of Natural Resources, 1998).

Table 2. Summary of Nebraska Game and Parks Commission applications for instream-flow appropriations, Platte River, Nebraska (Nebraska Department of Natural Resources, 1998, available at *http://www.dnr.state.ne.us/legal/decision1.htm*, accessed January 30, 2005).

Appropriation number	Purpose	Platte River reach	Time	Flow requested, in cubic feet per second
A-17329	Maintain fish community	Kearney Canal diversion downstream to Loup Power Canal return	All Year	1,000
A-17330	Maintain fish community	Loup Power Canal return to confluence with Elkhorn River	All Year	1,800
A-17331	Maintain fish community	Confluence with Elkhorn River to confluence with Missouri River	All Year	3,700

PHABSIM was implemented by Twelve Nine, Inc. (1990), Hardy and Associates (1992), and Schainost and others (1993). Inputs to PHABSIM included suitability index curves developed by Peters and others (1989) and Chadwick and Associates (written commun., 1994) for 12 fish species of the lower Platte River. Hydraulic data including surveyed channel elevations, water depth and velocity measurements, and habitat data including cover and substrate size distribution, were collected on the Platte River in 1985, 1987, and 1988 by an interagency team composed of federal, state, university, and agency personnel.

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For instream-flow requests for the Platte River, the potential bias in favor of species with large WUA values was removed by converting each WUA-discharge relation to a POH-discharge relation per species or life stage. A simple average giving equal importance to all fish species and life stages was used to develop an overall POH value per discharge (Zuerlein and others, 2001). Analysis of the PHABSIM results for all fish species indicated that habitat availability in the lower Platte River rapidly declines as flows decrease below 2,000 ft^3/s. Based on PHABSIM analysis, the NGPC requested instream-flow appropriations of 1,800 ft^3/s and 3,700 ft^3/s for the Platte River reaches from the Loup River to the Elkhorn River (A-17330) and from the Elkhorn River to the mouth of the Platte (A-17331), respectively (Zuerlein and others, 2001). Criticism during the application review process concerned use of the fixed-bed assumption in the PHABSIM model for the sandy, shifting bed of the Platte River, and whether or not an adequate number of study sites were included in the analysis (Nebraska Department of Natural Resources, 1998). However, proponents of PHABSIM argued that the relatively long reach of the Platte River was in dynamic equilibrium, and losses of microhabitat because of sediment erosion in some parts of the reach were offset by sediment deposition in other parts of the reach, and that study sites included in the analysis were representative of the river (Milhouse and others, 1984; Nebraska Department of Natural Resources, 1998). Further evaluations of PHABSIM output failed to provide conclusive evidence validating or invalidating its flow recommendations (Nebraska Department of Natural Resources, 1998). Of the five applications filed by NGPC for the purpose of protecting fish and wildlife habitat in the central and eastern Platte River, four were approved for instream water appropriations by the NDNR. The following sections describe the criteria, process, and approval status of the five NGPC appropriation applications with emphasis on A-17329, A-17330, and A-17331.

Appropriation A-17329— Johnson Power Plant return to Loup Power Canal return. Water-temperature criteria were used for selecting recommended flows on the Platte River for Appropriation A-17329. NGPC was concerned that low flows and shallow depths in the central Platte River during summer months might result in increased water temperatures and reduced concentrations of dissolved oxygen, which stress fish and potentially result in fish kills (Nebraska Department of Natural Resources, 1998). NGPC requested a 1,000 ft^3/s appropriation because additional analysis using the Tennant (1976) method, a U.S. Fish and Wildlife (USFWS) fish guild PHABSIM study, a habitat richness analysis, and a water temperature compared to discharge analysis indicated that 650 ft^3/s would be insufficient to protect the resources (Zuerlein and others, 2001).

Comment [GVS5]: I'm wondering about this being superfluous. Why is th needed for this report? We are discussing A-13371, but this is way upstream.

Appropriation A-17330 — Loup Power Canal return to confluence with Elkhorn River; and Appropriation A-17331— Confluence with Elkhorn River to confluence with Missouri River. Both appropriations (table 2) were requested for protection of fish communities through maintenance of streamflow levels. Flow recommendations were estimated through analysis of PHABSIM simulations (Milhous and others, 1984). Based on those results, NGPC requested instream-flow appropriations of 1,800 ft^3/s for the reach from the Loup River to the Elkhorn River, and 3,700 ft^3/s for the reach from the Elkhorn River to the mouth of the Platte (Zuerlein and others, 2001).

Comment [GVS6]: I have a hard tir finding the importance of these discussions also. Let's discuss.

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In a June 26, 1998, decision issued by NDNR, the five NGPC applications for instream appropriations were approved, modified, or denied. Appropriation A-17329 was approved such that the NGPC appropriation, combined with the senior Central Platte Natural Resources District (CPNRD) instream appropriation, would equal 1,000 ft^3/s in June and July (table 3). During August, the combined appropriated flow would equal 800 ft^3/s at Odessa, Nebraska, and 900 ft^3/s near Duncan, Nebraska. The August flow values were selected such that appropriated flow would achieve a 20-percent exceedance threshold seasonally (appropriated flow is exceeded more than 20 percent of the time for the given time period). Appropriation A-17330 was approved by NDNR as requested (table 3). Appropriation A-17331 was modified to account for the senior Metropolitan Utilities District (MUD) water right of 500 ft^3/s and to meet the 20-percent threshold flow-duration value.

Comment [GVS7]: Delete?

Table 3. Platte River instream flows appropriated by the Nebraska Department of Natural Resources to the Nebraska Game and Parks Commission on June 26, 1998 (Zuerlein and others, 2001).

[ft^3/s, cubic feet per second; –, appropriation not applicable; CPNRD, Central Platte Natural Resources District; MUD, Metropolitan Utilities District]

				Seasonal appropriated flow, in ft^3/s			
				Central Platte River reach		*Lower Platte River reach*	
Appropriation number and approved flow (except for specified seasons)	**Benefit**	**River segment**	**Season**	**Odessa and Grand Island gages**	**Duncan gage**	**North Bend gage**	**Louisville gage**
A-17329	Fish community	Kearney Canal diversion downstream to Loup Power Canal return	Sept - May	1,000	1,000	–	–
			June 1-June 23	500[a]	500[a]	–	–
			June 24-July 31	400[a]	400[a]	–	–
			Aug 1- Aug 22	200[b]	300[c]	–	–
			Aug 23-Aug 31	300[b]	400[c]	–	–
A-17330	Fish community	Loup Power Canal return downstream to confluence with Elkhorn River	Entire year	–	–	1,800	–
A-17331	Fish community	Elkhorn River downstream to mouth of Platte River	January	–	–	–	3,100[d]
			Feb-July	–	–	–	3,700[d]
			August	–	–	–	3,500[d]
			September	–	–	–	3,200[d]
			Oct -Dec	–	–	–	3,700[d]

[a]Combined appropriated flows with CPNRD equal 1,000 ft^3/s

[b]Combined appropriated flows with CPNRD equal 800 ft^3/s

[c]Combined appropriated flows with CPNRD equal 900 ft^3/s

[d]Appropriated flows reduced from 3,700 ft^3/s requested for entire year to account for a MUD senior water right and to meet a 20-percent exceedance flow-duration threshold

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Methods of Study

Historical Streamflow Characteristics

To evaluate streamflow characteristics, statistical summaries were computed for 17 stream-gaging stations in the Elkhorn River, Platte River, and Salt Creek drainage basins (table 4). Periods of stream gage operation ranged from 1896 to present (September 30, 2004) in the Platte River and Elkhorn River Basins and from the 1950s to present in the Salt Creek Basin. Periods of daily streamflow records used for statistical calculations and trends analysis ranged from 1928 to 2004 and included data from the 2005 water year (WY) if published records were available at the time of analysis. A water year begins October 1 of each calendar year and ends September 30 of the following calendar year.

Table 4. Periods of operation of U.S. Geological Survey and Nebraska Department of Natural Resources stream-gaging stations in the Elkhorn River, Salt Creek, and Platte River Basins, Nebraska.

Comment [BJD8]: Need to fix table

Streamflow-gaging station number	Station name	Date of gage establishment[1]	Years of record[2]
06774000	Platte River near Duncan, Nebraska	4/1/1941	63
06796000	Platte River at North Bend, Nebraska	4/1/1949	55
06796500	Platte River near Leshara, Nebraska	6/29/1994	10
06796973	Elkhorn River near Atkinson, Nebraska	10/1/1982	22
06797500	Elkhorn River at Ewing, Nebraska	8/1/1947	57
06798000	South Fork Elkhorn River at Ewing, Nebraska	8/1/1947	57
06798500	Elkhorn River at Neligh, Nebraska	10/1/1930	75
06799000	Elkhorn River at Norfolk, Nebraska	8/1/1896	63
06799100	North Fork Elkhorn River near Pierce, Nebraska	8/1/1960	44
06799350	Elkhorn River at West Point, Nebraska	10/1/1972	32
06799385	Pebble Creek at Scribner, Nebraska	10/1/1978	27
06799500	Logan Creek near Uehling, Nebraska	4/1/1941	63
06800000	Maple Creek near Nickerson, Nebraska	10/1/1951	53
06800500	Elkhorn River at Waterloo, Nebraska	9/1/1928	76
06803555	Salt Creek at Greenwood, Nebraska	11/1/1951	53
06804700	Wahoo Creek at Ashland, Nebraska	8/31/1990	14
06805500	Platte River at Louisville, Nebraska	6/1/1953	51

[1] All gages were operational in 2004.

[2] Years of record may not match years computed from period of operation because of missing annual mean streamflow values or periods of temporary inactivity.

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Flow duration tables describe the percentage of time specified flows were exceeded during a given period, and non-exceedance duration hydrographs graphically describe flow percentiles for each day of the calendar year based on historical daily mean flows (for example, table 5 and figure 2). Flow duration tables provide broad summaries of streamflow data for a given period and are particularly useful for comparing different sites during similar time periods; however, duration tables do not preserve the chronological characteristics of flow. Duration hydrographs represent the flow percentiles for each calendar day in a compact plot, and are useful for evaluating seasonal variations in streamflow for the period of record. Flow duration tables and duration hydrographs provide useful tools for interpreting flows during the period included in the tables and plots but inadequately represent the sequential occurrences of low-flow events from year to year.

Table 5. Flow duration table for Platte River at Louisville, Nebraska, for water years 1953 through 2004.

[ft^3/s, cubic feet per second; %, percent]

	Daily mean streamflow, in ft^3/s, equaled or exceeded for indicated percentage of time																					
[illegible]	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
[illegible]4	12,992	12,387	11,378	10,369	9,360	8,351	7,457	6,898	6,339	5,781	5,313	4,860	4,407	4,021	3,656	3,290	2,896	2,503	2,008	1,479	1,003	725

FIGURE 2 NEAR HERE

Daily mean streamflows were used to identify extreme low-flow periods for specific numbers of consecutive days, or *n*-day low flows for each year. Low-flow values most often are computed as the annual minimum mean flows for *n* consecutive days during a climatic year (April to March). For example, the annual 7-day low flow describes the lowest mean flow among all periods of 7 consecutive days during a year (fig. 3). Climatic years, as used in these analyses, typically are used in low-flow analyses because low flows in much of the United States often occur in late summer and early fall, and the designation of the flow period by WY (October-September) may separate one low-flow period into 2 water years. Low-flow values were determined for the 17 selected sites in the study area for consecutive durations of 1-, 3-, 7-, 14-, 30-, 60-, and 183-days for the available period of record through September 30, 2004 or later if published data were available at the time of analysis.

Figure 3 NEAR HERE

Low-flow probability values were computed for consecutive low-flow periods using log-Pearson type III analysis (Interagency Advisory Committee on Water Data, 1982). Low-flow probability values provide an estimate of the probability of occurrence for a particular minimum *n*-day flow during any single year. For instance, 7-day low-flow probability values indicate that, for the 5-percent annual chance, the indicated minimum average flow for *n*-days of the climatic year is likely to occur 5 times, on average, during a given 100-year period. The recurrence interval (equation 1) is defined as the inverse of the percent annual chance (*P*), which in the previous example is equal to 20 years.

$$\text{recurrence interval} = \frac{100\,percent}{P} \qquad (1)$$

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Generally, the measured streamflow of the Platte River at Louisville, Nebraska, is the sum of streamflows measured at gages on the Elkhorn River at Waterloo, Salt Creek at Greenwood, Wahoo Creek at Ashland, and Platte River at Ashland, plus any unmeasured inflows minus any outflows between these gages and the Louisville gage. Annual streamflow records for the stream gages at Elkhorn River at Waterloo, Salt Creek at Greenwood, and Wahoo Creek at Ashland were compared to streamflows measured at the Platte River at Louisville stream gage to estimate the effects of the Salt Creek and Elkhorn River Basins on the flows of the Platte River at Louisville.

Comment [BJD9]: Objective 3

Streamflow Trends

Kendall's Tau test is widely used to detect trends in time-series data (Helsel and Hirsch, 1992). Kendall's Tau was used to detect temporal trends in selected streamflow statistics at 17 sites in the study area (all sites are located in Nebraska). The Tau statistic is a measure of the level of upward or downward change in a data set; a Tau value of +1 indicates each element in the series is greater than the previous element in the series, and -1 indicates each element in the series is less than the previous element in the series. The statistic represented by p is used to quantify the probability that the available evidence to conclude for a trend slope different from zero could have arisen when there actually was no temporal trend. A significance level of 0.95 (p-value < 0.05) was used to declare the presence of a trend. Kendall's Tau was performed for annual mean flows, monthly mean flows for each month of the year, and annual low flows (1-, 3-, 7-, 14-, 30-, 60-, and 183-day) for the period of record at each site. The streamflow values were not adjusted to remove the effect of precipitation variation.

Linear regression analyses were used to estimate the trend slope in time-series data for sites with significant temporal trends. A best-fit line (least-squares regression) was determined for the streamflow data, and the trend slope was computed using SWSTAT (Lumb and others, 1990). This slope represents the median magnitude of the annual increase or decrease in the respective streamflow statistic over the period analyzed.

Historical Streamflow Characteristics

In order to illustrate annual and seasonal variations in streamflows, flow duration tables, duration hydrographs, and low-flow probability values are presented for each selected stream-gaging station in Appendix 1.

At the streamflow gage at Louisville, Nebraska, flows generally were greatest in the winter and spring, but declined through the summer. During parts of October through December, flow criteria required for Appropriation A-17331 generally fall between the 10th and 50th non-exceedance percentiles (fig. 2). In January, flow criteria required for Appropriation A-17331 are near the 30th percentile. During February through June, flow criteria required for Appropriation A-17331 are generally less than the 30th percentile, but fall within the range from less than the minimum recorded streamflow to the 10th percentile for many calendar days. During July through parts of October, flow criteria required for Appropriation A-17331 generally fall between the 30th and 70th percentiles.

The duration table (table 5) indicates that criteria required for Appropriation A-17331 were exceeded from 65 to 70 percent of the time at the Platte River at Louisville streamflow gage. A comparison of the duration hydrographs for the streamflow gages at Platte River near Duncan and Platte River at Louisville indicated that streamflow 1 ft^3/s or less occurred more frequently at the Platte River near Duncan streamflow gage during its period of available streamflow data (1928 to 2004) than at the Platte River at Louisville streamflow gage during its period of available streamflow data (1953 to 2004). The duration hydrograph for Platte River near Duncan gage indicates that flows not exceeding 1 ft^3/s occur within the minimum to 10th percentile range during parts of November, December, January, June, and July; within the 10th to 20th percentile range during parts of October, July, August, and September; and within the 20th to 30th percentile range during parts of August and September (Appendix 1).

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The flows recorded at the Salt Creek at Greenwood gage and the Elkhorn River at Waterloo gage contribute part of the flow recorded at the Platte River at Louisville gage. The remainder of the flow recorded at the Platte River at Louisville gage can be attributed to the Platte River upstream from the mouth of the Elkhorn River, Wahoo Creek, minor inflows and outflows between the mouth of the Elkhorn River and the Platte River at Louisville gages, and minor inflows and outflows between the mouth of the Elkhorn River and the Elkhorn River at Waterloo gage. During WY 1954 through 2004, about 21 percent of the annual mean flows recorded at the Platte River at Louisville gage was measured in the Elkhorn River at Waterloo gage (table 6). Annual flows of the Elkhorn River at Waterloo gage ranged from about 12 to 30 percent of annual mean flows recorded at the Platte River at Louisville gage with a standard deviation of about 4 percent. During this period, flow recorded at the Salt Creek at Greenwood gage composed, on average, 5 percent of the annual flow recorded at the Platte River at Louisville gage, with a range of about 2 to 10 percent and a standard deviation of about 2 percent. In the years prior to the application for Appropriation A-17331 (WY 1954 through 1992), 19 percent of the annual mean flows recorded at the Platte River at Louisville gage was measured in the Elkhorn River at Waterloo. In the years after the application for Appropriation A-17331 (WY 1993 through 2004), 25 percent of the annual mean flows measured at the Platte River at Louisville gage was measured in the Elkhorn River at Waterloo gage.

Table 6. Summary statistics for annual mean streamflow expressed as a percentage of the annual mean streamflow at the U.S. Geological Survey stream gage on Platte River at Louisville, Nebraska (station 06805500), for water years 1954 through 2004.

	Streamflow statistic, as a percentage of Louisville gage mean annual flow				
Source of streamflow	Mean	Median	Maximum	Minimum	Standard deviation
06803555 Salt Creek at Greenwood, Nebraska	4.7	4.8	9.7	2.5	1.6
06800500 Elkhorn River at Waterloo, Nebraska	20.5	20.6	30.5	11.9	4.3
Other sources including the Platte River upstream from the mouth of the Elkhorn River	74.6	74.5	83.6	65.1	4.6

Results of Kendall's Tau for temporal trends in annual mean flows for the full period of record are presented in table 7 (also appendix 2). Positive trends were found for annual mean flows at eight sites: Platte River near Duncan; Platte River at North Bend; Elkhorn River at Neligh; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; Salt Creek at Greenwood; and Platte River at Louisville. A negative trend was found for annual mean flows at the Platte River near Leshara gage, though this temporal trend may be strongly influenced by the short period of available data for this site. Trends in annual mean flows were not significant at these sites: Elkhorn River near Atkinson; Elkhorn River at Ewing; South Fork Elkhorn River at Ewing; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Elkhorn River at West Point; Pebble Creek at Scribner; and Wahoo Creek at Ashland.

Sites that showed positive trends for annual minimum 1-day low flows included: Platte River near Duncan; South Fork Elkhorn River at Ewing; Elkhorn River at Neligh; Pebble Creek at Scribner; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; Salt Creek at Greenwood; and Platte River at Louisville. There were no sites with negative trends in annual minimum 1-day low flows. Trends in annual minimum 1-day low flows were not significant at these sites: Platte River at North Bend; Elkhorn River near Atkinson; Elkhorn River at Ewing; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Elkhorn River at West Point; Platte River near Leshara; and Wahoo Creek at Ashland.

Sites that showed positive trends for annual minimum 7-day low flows included: Platte River near Duncan; South Fork Elkhorn River at Ewing; Elkhorn River at Neligh; Pebble Creek at Scribner; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; Salt Creek at Greenwood; and Platte River at Louisville. There were no sites with negative trends in 7-day low flows. Trends in 7-day low flows were not significant at these sites: Platte River at North Bend; Elkhorn River near Atkinson; Elkhorn River at Ewing; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Elkhorn River at West Point; Platte River near Leshara; and Wahoo Creek at Ashland.

Sites with positive trends in June mean flows included: Elkhorn River near Atkinson; Elkhorn River at Neligh; Logan Creek near Uehling; and Elkhorn River at Waterloo. Negative trends were indicated at the Platte River near Leshara site. Trends were not significant at: Platte River near Duncan; Platte River at North Bend; Elkhorn River at Ewing; South Fork Elkhorn River at Ewing; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Elkhorn River at West Point; Pebble Creek at Scribner; Maple Creek near Nickerson; Salt Creek at Greenwood; Wahoo Creek at Ashland; and Platte River at Louisville.

Sites with positive trends in July mean flows included: South Fork Elkhorn River at Ewing; Elkhorn River at Neligh; Elkhorn River at West Point; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; and Platte River at Louisville. Negative trends were indicated at Platte River near Leshara; Elkhorn River near Atkinson; and Wahoo Creek at Ashland. Trends were not significant at: Platte River near Duncan; Platte River at North Bend; Elkhorn River at Ewing; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Pebble Creek at Scribner; and Salt Creek at Greenwood.

Sites with positive trends in August mean flows included: Platte River near Duncan; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; Platte River at Louisville. Negative trends were indicated at: Platte River near Leshara Elkhorn River near Atkinson; and Pebble Creek at Scribner. Trends were not significant at: Platte River at North Bend; Elkhorn River at Ewing; South Fork Elkhorn River at Ewing; Elkhorn River at Neligh; Elkhorn River at Norfolk; North Fork Elkhorn River near Pierce; Elkhorn River at West Point; Salt Creek at Greenwood; and Wahoo Creek at Ashland.

In the Elkhorn River Basin, sites upstream from Norfolk, Nebraska, had fewer significant trends, whereas, generally, sites downstream from Norfolk and sites in the Platte River and Salt Creek Basins showed positive trends. Positive trends for streamflow during extended low-flow periods indicated that there generally is increasing water availability during the lowest flow periods of the year. Significant negative trends for flows during low-flow periods resulted only for the Leshara gaging station, where the period analyzed was limited by a short period of record.

Table 7. Median slope of significant low-flow trends at selected sites in the Elkhorn River, Salt Creek, and Platte River Basins, Nebraska.
[Significant trends had p-values less than 0.05; I, insignificant trend; in cubic feet per second per year; POS, positive trend, slope not calculated]

U.S. Geological Survey streamflow-gaging station number and name		Period analyzed for annual mean flow (see appendix 2 for period analyzed for other streamflow statistics)	Annual mean flow	Annual: 1-day low flow	Annual: 2-day low flow	Annual: 3-day low flow	Annual: 7-day low flow	Annual: 14-day low flow	Annual: 30-day low flow	Annual: 60-day low flow	Annual: 90-day low flow	Annual: 183-day low flow	1-day low flow (Oct-Nov)	3-day low flow (Oct-Nov)	7-day low flow (Oct-Nov)	14-day low flow (Oct-Nov)	30-day low flow (Oct-Nov)	60-day low flow (Oct-Nov)	June mean flow	July mean flow	August mean flow
06774000	Platte River near Duncan, Nebr.	1929-2003	+13	+1.1	+1.2	+1.3	+1.6	+2.5	+4.8	+7.5	+11	+12	+8.2	+8.7	+10	+12	+13	+14	I	I	+21
06796000	Platte River at North Bend, Nebr.	1949-2003	+26	I	I	I	I	I	+14	+19	+22	+23	+18	+24	+23	+25	+27	+30	I	I	I
06796500	Platte River near Leshara, Nebr.	1994-2004	-510	I	I	I	I	I	I	-380	-450	-430	-280	I	-330	-350	-390	-450	-1100	-610	-530
06796973	Elkhorn River near Atkinson, Nebr.	1983-2003	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	+1	-3.5	-1.3
06797500	Elkhorn River at Ewing, Nebr.	1947-2003	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
06798000	South Fork Elkhorn River at Ewing, Nebr.	1947-2003	I	+0.2	+0.2	+0.1	+0.1	I	I	I	I	I	+0.2	+0.1	I	I	I	I	I	+2.1	I
06798500	Elkhorn River at Neligh, Nebr.	1931-2003	+2.6	+0.5	+0.5	+0.5	+0.6	I	I	+0.6	+0.7	+0.8	+2.2	I	I	I	I	+0.7	+1.4	+3.1	I
06799000	Elkhorn River at Norfolk, Nebr.	1896-2003	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
06799100	North Fork Elkhorn River near Pierce, Nebr.	1960-2003	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
06799350	Elkhorn River at West Point, Nebr.	1973-2003	I	I	I	I	I	I	+7.2	+9.1	+9.8	+9.7	I	I	I	I	+8.3	I	I	+35	I
06799385	Pebble Creek at Scribner, Nebr.	1979-2003	I	+0.5	+0.5	+0.5	+0.5	+0.6	+0.8	+0.7	I	I	+0.8	+0.8	I	I	I	I	I	I	-18
06799500	Logan Creek near Uehling, Nebr.	1941-2003	POS	+1.4	+1.3	+1.3	+1.4	+1.4	+1.5	+1.6	+1.8	+1.8	+1.7	+1.7	+1.6	+1.6	+1.5	+1.7	POS	POS	POS

Table 7. Median slope of significant low-flow trends at selected sites in the Elkhorn River, Salt Creek, and Platte River Basins, Nebraska.—Continued

[Significant trends had p-values less than 0.05; I, insignificant trend; in cubic feet per second per year; POS, positive tren. slope not calculated]

U.S. Geological Survey streamflow-gaging station number and name	Period analyzed for annual mean flow (see appendix 2 for period analyzed for other streamflow statistics)	Annual mean flow	Annual									Nov								
			1-day low flow	2-day low flow	3-day low flow	7-day low flow	14-day low flow	30-day low flow	60-day low flow	90-day low flow	183-day low flow	1-day low flow (Oct-Nov)	3-day low flow (Oct-Nov)	7-day low flow (Oct-Nov)	14-day low flow (Oct-Nov)	30-day low flow (Oct-Nov)	60-day low flow (Oct-Nov)	June mean flow	July mean flow	August mean flow
06800000 Maple Creek near Nickerson, Nebr.	1952-2003	+1.2	+0.2	+0.2	+0.2	+0.2	+0.3	+0.4	+0.6	+0.6	+0.7	+0.4	+0.4	+0.4	+0.4	+0.5	+0.6	I	+3.4	+1.6
06800500 Elkhorn River at Waterloo, Nebr.	1928-2003	+15	+4.1	+4.3	+4.4	+4.8	+5.4	+6	+6.6	+7.1	+7.4	+5.6	+5.5	+6.1	+6.3	+6.2	+7.8	+22	+22	+9.3
06803555 Salt Creek at Greenwood, Nebr.	1952-2003	+2.9	+1.7	+1.7	+1.7	+1.7	+1.7	+2	+2	+2	+2.2	+1.5	+1.5	+1.5	+1.7	+2	+2.6	I	I	I
06804700 Wahoo Creek at Ashland, Nebr.	1990-2004	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	-28	I
06805500 Platte River at Louisville, Nebr.	1954-2004	+70	+24	+27	+27	+28	+35	+45	+54	+57	+59	+53	+55	+58	+57	+63	+69	I	+96	+57

Figure 3 shows annual mean streamflow of the Platte River at Louisville for water years 1954 through 2003. Kendall's Tau for this site was positive indicating an upward trend. The median slope of this trend is 70 ft^3/s per year (table 7).

Comment [BJD10]: Objectives 4 & 5

Streamflows Not Exceeding Instream-Flow Criteria Levels

Historical Platte River streamflow records for the streamflow gage at Louisville, Nebraska, were used to determine the number of days per water year that would not have satisfied criteria flows corresponding to the minimum requirements of instream Appropriation A-17331 before it was filed in 1993. The following minimum criteria for the instream flow appropriation were compared to the historical record: 3,700 ft^3/s for October through December; 3,100 ft^3/s for January; 3,700 ft^3/s for February through July; 3,500 ft^3/s for August; and 3,200 ft^3/s for September. Intervals of consecutive days for which the daily mean streamflow was less than or equal to the level corresponding to the respective criteria were determined for the Platte River at Louisville for WY 1953 through 2004.

The number of days per water year for which the daily mean streamflow was less than or equal to minimum criteria corresponding to instream flow Appropriation A-17331 are listed in table 8. For the period of record before 1993, the median number of days that did not exceed the minimum flow level was 120 days per water year, with 39 days during the July 1-August 31 season, and 76 days during the May 1- September 30 season (table 9).

TABLE 8 near here.

The intervals during which daily mean streamflows of the Platte River at Louisville gage failed to exceed the minimum flow criteria levels of Appropriation A-17331 were further summarized (table 9). During WY 1993 through 2004, 48 separate intervals of streamflow less than the criteria levels occurred. Of these intervals, 67 percent were 3 days or greater in duration and 40 percent were 7 days or greater in duration. The median duration of intervals when streamflow was less than the criteria values was 4 consecutive days.

During 1993 through 2004, daily mean flows of the Platte River at Louisville gage failed to satisfy the minimum flow levels required by Appropriation A-17331 on a total of 638 days. Most of these low-flow intervals occurred in summer through early fall. During WY 1993 through 2004, the median annual number of days not exceeding the criteria levels was 21.5 days, with 14 days during the July 1 through August 31 season, and no additional days, on average, during the May 1 through September 30 season.

Table 9 near here

During WY 1953 through 1992, 458 separate intervals of streamflow less than the criteria levels occurred. Of these, 61 percent were 3 days or greater in duration and 38 percent were 7 days or greater in duration. The median duration of intervals of flow less than the criteria levels was 4 consecutive days. The longest interval of consecutive daily mean streamflow below Appropriation A-17331 criteria levels occurred during WY 1976 and 1977, when 143 consecutive days were recorded as having flows that failed to satisfy the minimum streamflow levels (table 8) required by Appropriation A-17331 (not enacted until 1998).

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Table 8. Summary by water year of intervals in which daily mean streamflow at the U.S. Geological Survey stream-gaging station on the Platte River at Louisville, Nebraska, (06805500) did not satisfy instream-flow criteria levels, 1953-2004.

[ft^3/s, cubic feet per second; instream-flow criteria levels are as follows: 3,700 ft^3/s during October through December; 3,500 ft^3/s in January; 3,700 ft^3/s from February through July; 3,500 ft^3/s in August; 3,200 ft^3/s in September]

Water year	Total number of days in non-exceedance intervals	Non-exceedance days from July 1 through August 31 (percent of 2-month period in parentheses)	Non-exceedance days from May 1 through September 30 (percent of 5-month period in parentheses)	Longest consecutive non-exceedance period beginning in water year (number of days)
1953	95	58 (95)	95 (63)	8/10/53-11/10/53 (93)
1954	163	53 (87)	86 (57)	8/26/54-10/28/54 (64)
1955	247	59 (97)	129 (85)	7/17/55-11/23/55 (130)
1956	253	56 (92)	124 (82)	9/06/56-12/29/56 (115)
1957	197	39 (64)	60 (39)	1/09/57-2/12/57 (35)
1958	96	17 (28)	45 (30)	9/20/58-11/14/58 (56)
1959	185	33 (54)	71 (47)	8/19/59-9/19/59 (32)
1960	116	29 (48)	47 (31)	10/13/59-10/30/59 (18)
1961	148	59 (97)	79 (52)	7/02/61-8/21/61 (51)
1962	81	13 (21)	27 (18)	12/10/61-12/25/61 (16)
1963	121	60 (98)	91 (60)	7/02/63-8/30/63 (60)
1964	111	37 (61)	52 (34)	10/04/63-11/05/63 (33)
1965	145	33 (54)	39 (26)	10/01/64-11/16/64 (47)
1966	97	41 (67)	77 (51)	1/20/66-2/04/66 (16)
1967	180	22 (36)	82 (54)	4/18/67-5/31/67 (44)
1968	142	56 (92)	97 (64)	7/07/68-9/01/68 (57)
1969	113	36 (59)	64 (42)	8/03/69-9/01/69 (30)
1970	108	54 (89)	80 (53)	7/09/70-9/18/70 (72)
1971	122	45 (74)	75 (49)	7/18/71-10/19/71 (94)
1972	119	39 (64)	73 (48)	8/12/72-9/10/72 (30)
1973	65	30 (49)	34 (22)	8/20/73-9/04/73 (16)
1974	100	62 (100)	99 (65)	6/24/74-10/30/74 (129)
1975	170	52 (85)	95 (63)	7/28/75-11/06/75 (102)
1976	198	62 (100)	121 (80)	6/30/76-11/19/76 (143)
1977	153	38 (62)	40 (26)	11/27/76-1/13/77 (48)
1978	126	50 (82)	83 (55)	9/22/78-10/25/78 (34)
1979	206	36 (59)	77 (51)	11/29/78-2/26/79 (90)
1980	138	59 (97)	89 (59)	8/20/80-10/16/80 (58)
1981	206	35 (57)	101 (66)	7/04/81-7/29/81 (26)
1982	48	15 (25)	15 (10)	1/08/82-1/20/82 (13)

Table 8. Summary by water year of intervals in which daily mean streamflow at the U.S. Geological Survey stream-gaging station on the Platte River at Louisville, Nebraska, (06805500) did not satisfy instream-flow criteria levels, 1953-2004.—Continued

[ft^3/s, cubic feet per second; instream-flow criteria levels are as follows: 3,700 ft^3/s during October through December; 3,500 ft^3/s in January; 3,700 ft^3/s from February through July; 3,500 ft^3/s in August; 3,200 ft^3/s in September]

Water year	Total number of days in non-exceedance intervals	Non-exceedance days from July 1 through August 31 (percent of 2-month period in parentheses)	Non-exceedance days from May 1 through September 30 (percent of 5-month period in parentheses)	Longest consecutive non-exceedance period beginning in water year (number of days)
1983	5	0 (0)	0 (0)	12/29/82-1/02/83 (5)
1984	24	13 (21)	18 (12)	8/12/84-8/23/84 (12)
1985	18	13 (21)	18 (12)	7/10/85-7/18/85 (9)
1986	7	0 (0)	0 (0)	11/21/85-11/26/85 (6)
1987	14	14 (23)	14 (9)	7/26/87-8/07/87 (13)
1988	97	52 (85)	84 (55)	8/20/88-9/15/88 (27)
1989	121	47 (77)	104 (68)	7/23/89-9/03/89 (43)
1990	111	44 (72)	74 (49)	8/23/90-10/23/90 (62)
1991	136	52 (85)	82 (54)	7/18/91-10/31/91 (106)
1992	49	0 (0)	0 (0)	11/02/91-11/11/91 (10)
1993	0	0 (0)	0 (0)	None
1994	4	3 (5)	4 (3)	8/30/94-8/31/94 (2)
1995	15	9 (15)	9 (6)	8/14/95-8/22/95 (9)
1996	18	0 (0)	0 (0)	1/21/96-1/27/96 (7)
1997	25	19 (31)	19 (13)	7/24/97-8/11/97 (19)
1998	0	0 (0)	0 (0)	None
1999	1	0 (0)	0 (0)	12/23/98-12/23/98 (1)
2000	56	27 (44)	70 (46)	8/06/00-9/28/00 (54)
2001	52	28 (46)	35 (23)	7/31/01-8/17/01 (18)
2002	124	57 (93)	121 (80)	6/21/02-8/21/02 (62)
2003	146	51 (84)	107 (70)	7/13/03-9/11/03 (61)
2004	197	40 (66)	75 (49)	9/17/03-11/03/03 (48)

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Table 9. Comparison by period of intervals in which daily mean streamflow at the U.S. Geological Survey stream-gaging station on the Platte River at Louisville, Nebraska, (station 06805500) did not exceed instream-flow criteria *levels, 1953-2004*

[ft^3/s, cubic feet per second; instream-flow criteria levels are as follows: 3,700 ft^3/s during October through December; 3,500 ft^3/s in January; 3,700 ft^3/s from February through July; 3,500 ft^3/s in August; 3,200 ft^3/s in September]

	Summary time period, in water years		
Summary statistic	1953-2004	1953-1992	1993-2004
Total number of intervals	506	458	48
Average length of each intervals, in days	10	11	10
Median length of each intervals, in days	4	4	4
Intervals 3 or more days in length, as percentage of period	61%	61%	67%
Intervals 7 or more days in length, as percentage	38%	38%	40%
Total number of non-exceedance days	5469	4831	638
Median number of non-exceedance days per water year	112	120	21.5
Median number of non-exceedance days from July 1 through Aug. 31 per water year	36.5	39	14
Median number of non-exceedance days from May 1 through Sept. 30 per water year	72	76	14

Quality Assurance of Streamflow Measurements and Stage Records for the Platte River at Louisville, Nebraska

For this study, the quality-assurance measures used for processing and publishing of stage and streamflow data at the Platte River at Louisville, Nebraska, gage (068805500). were reviewed and summarized. Discharge, or streamflow, measurement data were retrieved from the USGS National Water Information System database (http://waterdata.usgs.gov/nwis) and summarized.

The USGS gaging station on the Platte River at Louisville, Nebraska, gage (06805500), is located on the left bank approximately 50 ft upstream from the State Highway 50 bridge (fig. 1). The gage presently collects stage data at 15-minute intervals and is included in the USGS Nebraska Water Science Center Surface-Water Quality-Assurance Plan (P.J. Soenksen, U.S. Geological Survey, written commun., 2006). A reference wire-weight gage is located on the downstream side of the Highway 50 bridge. The station instrumentation is capable of recording stage data accurately to ±0.01 ft. Occasional instrumentation drift requires recalibration. Corrections, called datum corrections, are applied to stage data values recorded by the datalogger to compensate for differences between the readings of the reference and recording gages (Rantz and others, 1982a). Periodically, level surveys are conducted to check the reference gage for vertical movement (Rantz and others, 1982a). Datum corrections for the periods between level survey checks are applied to the stage record to account for these changes, if vertical movement exceeds 0.02 ft (Rantz and others, 1982a).

Standard USGS protocols require hydrographers to assign qualitative assessments of conditions affecting accuracy to individual discharge measurements--excellent, good, fair, or poor (Rantz and others, 1982a). These qualitative ratings are determined by the hydrographer based on subjective evaluation of an objectively determined suite of factors affecting measurement accuracy, which includes: number and distribution of verticals, average velocity, uniformity of flow, regularity and firmness of channel bottom, steadiness of stage and discharge during the measurement, and presence or absence of ice or debris in the flow (Sauer and Meyer, 1992).

Since the Platte River at Louisville station was established in May of 1953, more than 550 measurements have been made using standard USGS discharge measurement techniques and equipment (Corbett and others, 1943; Rantz and others, 1982a). All measurement computations were checked by USGS personnel for mathematical accuracy following methods listed in Kennedy (1983).

Discharge measurements collected before the start of WY 1985 were not computerized. Therefore, the summaries of measurements were limited to WY 1985 through 2004. Of the 268 direct discharge measurements collected during that period, 93 percent of measurements were collected from the Highway 50 bridge; the remaining measurements were collected by wading or as ice measurements. The measurements of streamflows within 10 percent of the range of flows not exceeding the present criteria for minimum instream flows were summarized (table 10). During WY 1985 through 2004, 55 measurements of discharges less than 4,000 ft^3/s were made. The lowest flow measured during WY 1985 through 2004 was 911 ft^3/s on August 7, 2002. The highest flow measured during WY 1985 through 2004 was 125,000 ft^3/s on March 10, 1993. Many measurements at this site, especially low-flow measurements, required the use of horizontal-angle coefficients to adjust measured velocities when the flowlines were not normal to the measuring section. Qualitative ratings indicate that 84 percent of measurements made at discharges less than 4,000 ft^3/s and 87 percent overall are considered to be accurate to within 5 percent of the true discharge.

Table 10. Summary of discharge measurements from water years (WY) 1985 through 2004 for U.S. Geological Survey stream-gaging station on the Platte River at Louisville, Nebraska, (06805500).

[ft^3/s, cubic feet per second; %, percent; columns may not round to 100% because of rounding]

Qualitative rating of conditions affecting measurement accuracy	Measured discharge less than 4,000 ft^3/s (percent of all such measurements in parentheses)	All discharge measurements within period (percent of all measurements in parentheses)
Excellent (within 2 percent of the actual "true" discharge)	1 (2%)	2 (1%)
Good (within 5 percent)	45 (82%)	231 (86%)
Fair (within 8 percent)	4 (7%)	23 (9%)
Poor (measured discharge 8 percent greater or less than the actual discharge)	3 (5%)	10 (4%)
Not rated	2 (4%)	2 (1%)

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For the Louisville streamflow gage, stage-discharge relations were developed, modified, and applied following standard procedures described in (Rantz and others, 1982a; Rantz and others, 1982b; Kennedy, 1983; and Kennedy, 1984). These stage-discharge relations can be represented by tables and also, graphically, as rating curves. Here the Platte River is a wide channel with a sand and gravel bed that shifts readily with changes in stage. Therefore, stage-discharge rating tables are routinely adjusted by applying adjustments to stage values known as ratings shifts and as described by Kennedy (1984). During WY 1985 through 2004, five rating curves have been developed for the Platte River at Louisville gage. Shift adjustments among all measurements during the period ranged from -1.95 to 1.50 ft. Shift adjustments of large magnitudes generally were associated with ice measurements or moderate to higher streamflows capable of scouring and filling the sandy streambed within a short time period during and after the higher flow occurred. For measurements of discharges less than 4,000 ft^3/s not affected by ice, shift adjustments ranged from -0.18 to 0.40 ft. The shift adjustments for measurements of flows less than 4,000 ft^3/s were routinely applied to adjust the rating table for the effects of shifting sand and seasonal changes in vegetation.

The USGS follows standard procedures for collecting and adjusting continuous stage data and periodic discharge data, and for processing those data to produce continuous records of discharge. Those procedures include, but are not limited to, making stage-reference measurements to adjust stage records, documenting non-perpendicular flow angles in the cross-section to adjust discharge measurements accordingly, and comparing computed discharge records with those for other stations that are hydrologically similar. The discharge records are assigned a qualitative rating of accuracy based on a number of factors, including some of those listed in Sauer and Meyer (1992), and then are independently checked and reviewed. On this basis, the published discharge records for the Platte River at Louisville station are considered to be accurate within the assigned limits indicated by the qualitative rating (table 10) (P.J. Soenksen, U.S. Geological Survey, written commun., 2008).

Comment [BJD11]: stopped here

Summary and Conclusions

Instream-flow protection is a complex legislative and technical issue. The Nebraska Department of Natural Resources established appropriations on the Platte River to provide instream-flow protection primarily to maintain the fish community, whooping crane roost habitat, and wet meadows. In 2005, the USGS, in cooperation with the Upper Elkhorn Natural Resources District and the Lower Elkhorn Natural Resources District, initiated a cooperative study to review the methods used to calculate the streamflow requirements for the Nebraska Game and Parks Commission instream appropriation on the Platte River in Nebraska, to review the historical streamflow records for the Platte River at Louisville, and to indicate the quality of the data for the Platte River at Louisville gage for managing flows on the appropriated reach of the Platte River from its confluence with the Elkhorn River to the mouth.

Confluences with two principal tributaries of the Platte River—the Elkhorn River and Salt Creek—are located within the reach regulated by Appropriation A-17331. The Elkhorn River flows east-southeast from the Sand Hills in north-central Nebraska through the glaciated rolling hills of northeast Nebraska to its confluence with the Platte River just downstream from Fremont, Nebraska. Streamflows in the Sand Hills in the western part of the drainage basin originate principally from ground water; streamflows in the eastern part of the basin generally are more variable and responsive to precipitation events. Salt Creek flows into the Platte River from the south just downstream from the confluence of the Elkhorn and Platte Rivers.

Surface-water use in the Elkhorn River Basin includes irrigation, livestock, and recreational supplies. As of January 30, 2005, 362 surface-water appropriations were listed in the NDNR database with application dates later than 1970 (Nebraska Department of Natural Resources, 2005). These appropriations are listed as irrigating about 29,000 acres in the Elkhorn River Basin.

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The Platte River has a drainage area of about 71,000 mi^2 at the USGS stream-gaging station at Louisville, Nebraska. Extremes for discharge at this station have ranged from a low of 131 ft^3/s to a high of 124,000 ft^3/s, and the mean discharge (1953 through 2005) was 6,966 ft^3/s.

PHABSIM, a habitat simulation model, and other estimation methodologies had been used in previous studies to estimate instream-flow requirements of the fish community of the lower Platte River . To estimate instream-flow requirements, PHABSIM uses hydraulic principles to simulate water depths and velocities on the basis of empirical data, such as channel geometry, substrate classification, vegetative cover indices, and other measurements collected along the stream reach. In PHABSIM, criteria for favorable habitat are expressed as suitability index curves, which relate physical features to a microhabitat-suitability score.

Efforts to estimate instream-flow requirements using PHABSIM and other estimation methodologies resulted in the flow magnitude requests in five applications for instream appropriations filed by NGPC in 1993 for the purpose of maintaining fish and wildlife in the central and eastern Platte River. Analysis of PHABSIM results for all fish species indicated that habitat availability rapidly declines as flows fall below 2,000 ft^3/s.

Based on results of PHABSIM analysis, NGPC requested an instream-flow appropriation (Appropriation A-17331) of 3,700 ft^3/s for the reach from the Elkhorn River to the mouth of the Platte River. This appropriation was granted with modifications in 1998, having been modified to account for the Metropolitan Utilities District's senior water right of 500 ft^3/s and to meet a 20-percent exceedance flow-duration threshold.

Statistical summaries were computed for 17 selected stream-gaging stations in the study area for an analysis of streamflow characteristics. Streamflow records from 1928 through 2004 in the Platte River and Elkhorn River Basins and from the 1950s through 2004 in the Salt Creek Basin were summarized. From WY 1954 through 1992, an average of 19 percent of the mean annual flows at the Platte River at Louisville was measured at the Elkhorn River at Waterloo gage. From WY 1993 through 2004, an average of 25 percent of the mean annual flow at the Platte River at Louisville gage was measured at the Elkhorn River at Waterloo gage.

Generally, the streamflow of the Platte River at Louisville is the sum of streamflows of the Elkhorn River; Salt Creek; Wahoo Creek; and the Platte River at Ashland, Nebraska; plus ungaged inflows minus outflows between the gages on these streams and the Louisville gage. Annual mean flow of the Elkhorn River at Waterloo gage ranged from 12 to 30 percent of the annual mean flow at the Platte River at Louisville gage during WY 1954 through 2004, with a standard deviation of 4.3 percent.

Daily mean streamflows were used to identify extreme low-flow periods of various durations, or *n*-day low flows. Annual low-flow values were computed as the minimum mean flows for *n* consecutive days during a climatic year (April to March), for durations of 1, 3, 7, 14, 30, 60, and 183 days for 17 selected stream gages in the study area.

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Kendall's Tau test was used to detect temporal trends in selected flow statistics. The streamflow values were not adjusted to remove the precipitation variation. In this study, analysis of the results of Kendall's Tau for trends in annual streamflow indicated significant *p*-values and the presence of positive trends for the period of record at eight sites – Platte River near Duncan; Platte River at North Bend; Elkhorn River at Neligh; Logan Creek near Uehling; Maple Creek near Nickerson; Elkhorn River at Waterloo; Salt Creek at Greenwood; and Platte River at Louisville. Generally, fewer significant positive trends resulted for sites in the Elkhorn River Basin upstream from Norfolk, whereas results for sites in the Elkhorn River Basin downstream from Norfolk, on the Platte River, and in Salt Creek Basin indicated generally positive trends for annual mean flow and *n*-day low flows.

Historical streamflow records at the USGS streamflow gage at the Platte River at Louisville, Nebraska, were used to determine the number of days per water year that discharge would not have satisfied instream-flow criteria levels corresponding to the minimum requirements of Appropriation A-17331 before it was filed. The following criteria levels for instream flow were compared to the historical record: 3,700 ft^3/s for October through December; 3,500 ft^3/s for January; 3,700 ft^3/s for February through July; 3,500 ft^3/s for August; and 3,200 ft^3/s for September. For the period of record before 1993, the median number of days that discharge failed to exceed the criteria levels was 120 days per water year, with 39 days during the July 1-August 31 period, and 76 days during the May 1-September 30 period.

Of the 458 periods of consecutive days in which the daily mean flow did not exceed criteria levels corresponding to instream flow appropriation A-17331 at the Platte River at Louisville streamflow gage (WYs 1953-1992), 61 percent were 3 days or greater in duration, and 38 percent were 7 days or greater in duration. The median duration of flow less than the threshold was 4 consecutive days for WYs 1953-92 and also for 1993 through 2004. The longest period of flow below the threshold levels occurred during WYs 1976 through 1977, when for 143 consecutive days the recorded daily mean streamflow was at or below the minimum streamflow later required by Appropriation A-17331.

Since 1993, daily mean flows for 638 days have failed to exceed the minimum flow requirements of A-17331 at the at the Platte River at Louisville, Nebraska, USGS streamflow gage. Most of these low-flow periods occurred in summer through early fall. For WYs 1993 through 2004, the median number of days that did not exceed the flow criteria was about 21 days per water year, with 14 days during the July 1-August 31 period, and no additional days during the May 1- September 30 period.

Since the Platte River at Louisville streamgage was established in May 1953, more than 550 streamflow measurements have been made. Summaries of streamflow measurements were limited to WY 1985 through 2004. Of the 268 discharge measurements during that period, 93 percent were collected from the Highway 50 bridge, whereas the remaining measurements were made in or on the water (wading or ice measurements). During WY 1985 through 2004, 55 measurements of discharges less than 4,000 ft^3/s were made, with the lowest flow measured as 911 ft^3/s on August 7, 2002. Qualitative ratings indicate that 84 percent of measurements made at discharges less than 4,000 ft^3/s, and 87 percent overall, are considered to be accurate to within 5 percent of the true discharge.

Stage-discharge relations were developed as rating tables and rating curves, modified, and applied following standard USGS procedures, and stage-discharge rating tables were routinely adjusted by applying adjustments to stage called ratings shifts. During WYs 1985 through 2004, shift adjustments ranged from -1.95 to 1.50 ft among all measurements, and from -0.18 to 0.40 ft for measurements of discharge less than 4,000 ft^3/s.

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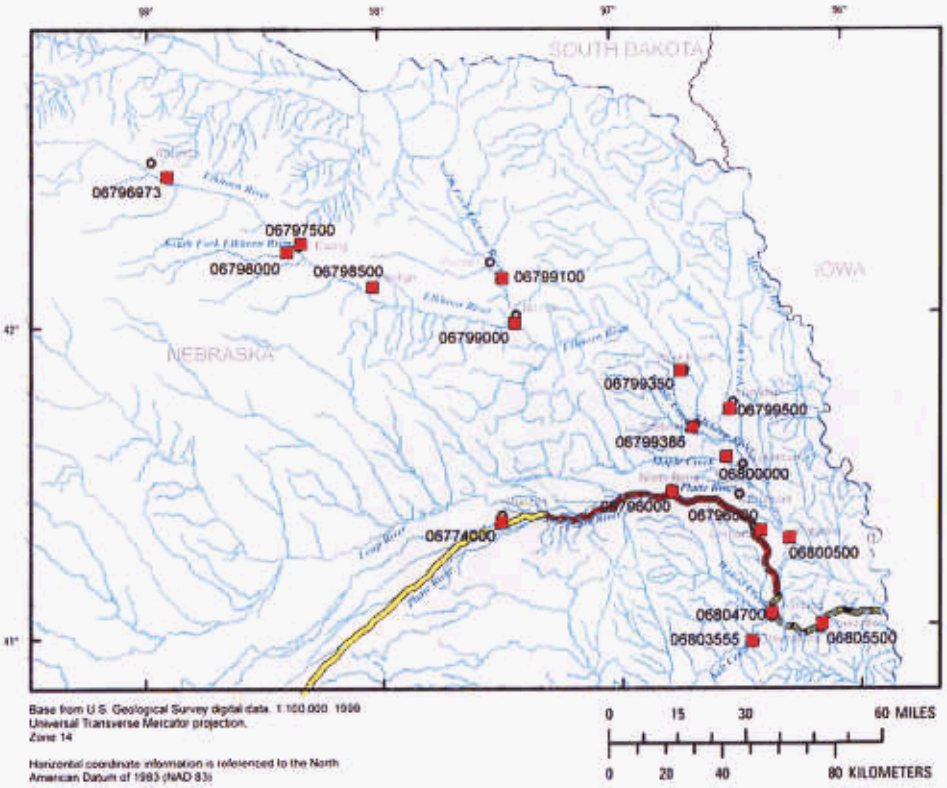

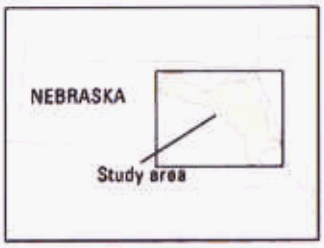

Index map

EXPLANATION

06796973 ■ **Stream-gaging station and number**

Streams

Reach defined by Appropriation A-17329

Reach defined by Appropriation A-17330

Reach defined by Appropriation A-17331

Figure 1. Study area and streamflow-gaging stations in the Elkhorn River, Salt Creek, and Platte River basins, Nebraska.

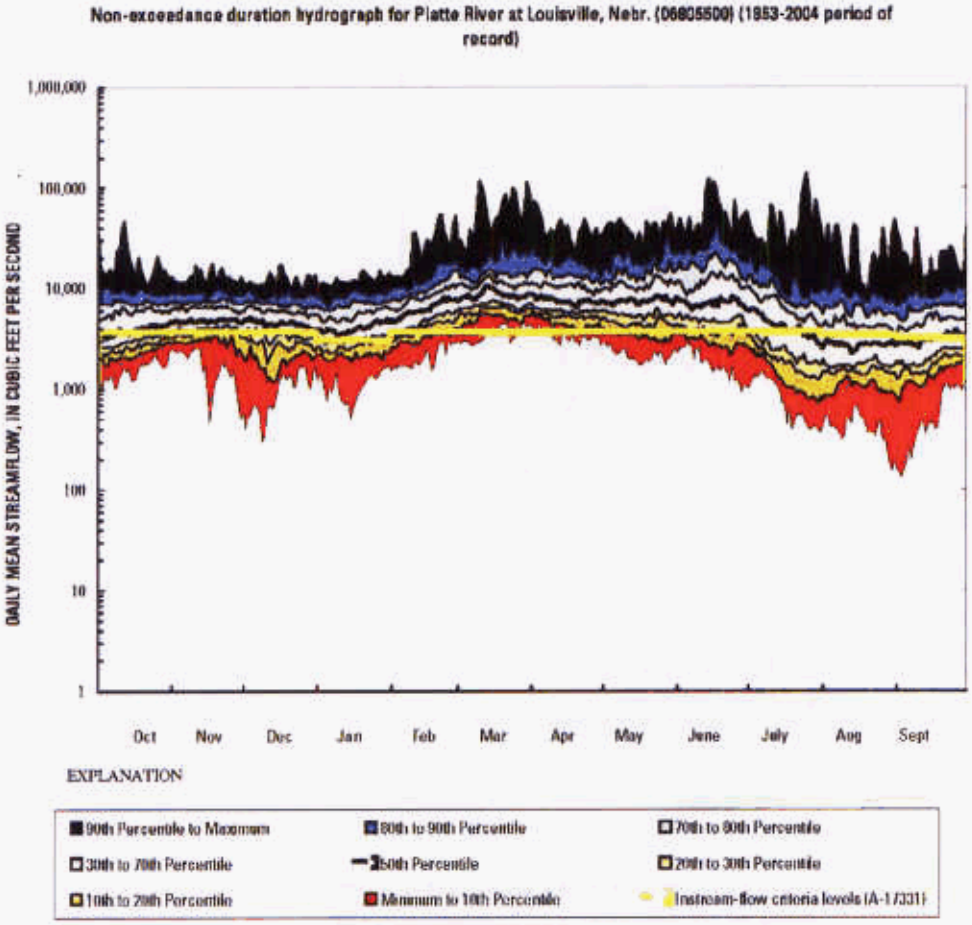

Figure 2. Non-exceedance duration hydrograph for Platte River at Louisville, Nebraska, for 1953-2004.

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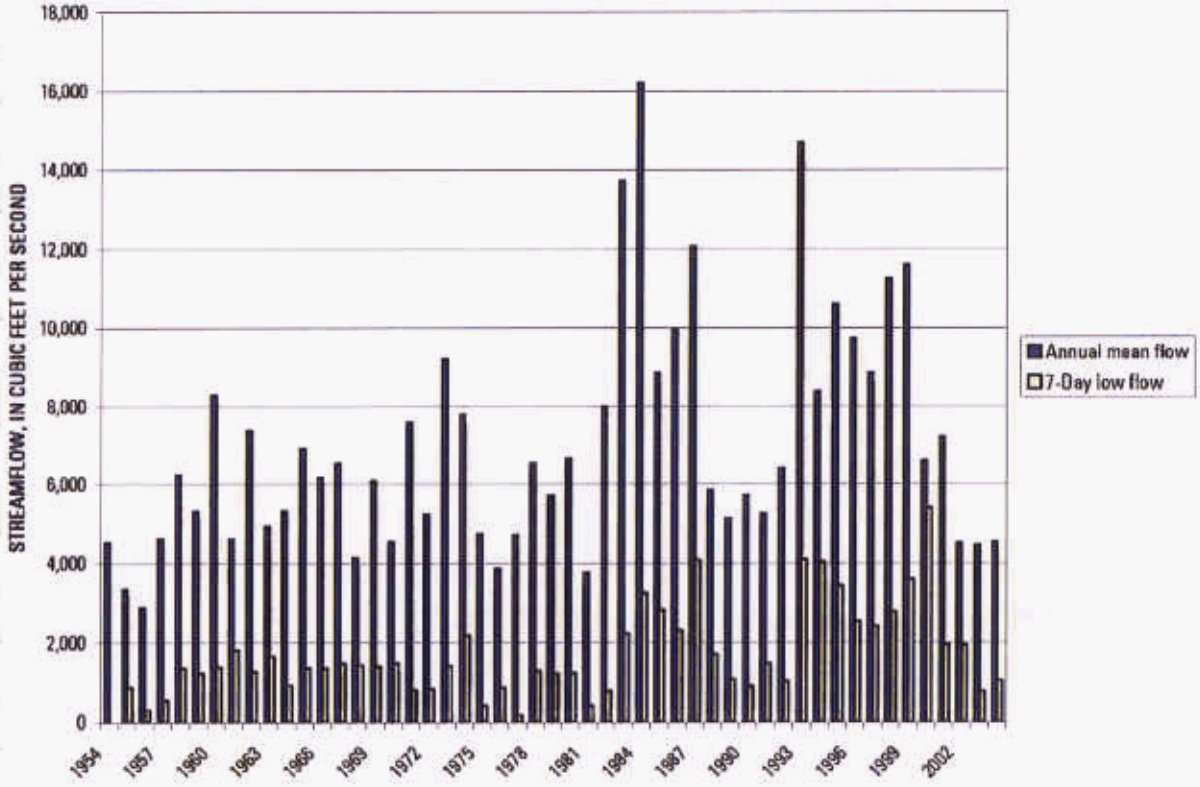


Figure 3. Annual mean streamflow and 7-day low flow of Platte River at Louisville, Nebraska, for 1954-2004.

APPENDIX 1 – Streamflow characteristics

06774000 PLATTE RIVER NEAR DUNCAN, NEBR.

LOCATION.--Lat 41°22'06", long 97°29'43", in SE ¼ SW ¼ sec.12, T.16 N., R.2 W., Platte County, Hydrologic Unit 10200103, on left bank near northwest corner of county bridge, 1.5 mi south of Duncan, and 15.3 mi upstream from Loup River, and at mile 114.

DRAINAGE AREA.--59,300 mi² of which 4,670 mi² probably is noncontributing.

STREAMFLOW RECORDS

PERIOD OF RECORD.--June 1895 to December 1909 (irrigation seasons only 1885-1900). July 1910 to December 1911 (gage heights and streamflow measurements only), April 1912 to September 1915, June 1928 to current year. Published as "near Columbus" 1895-1915.

REVISED RECORDS.--WSP 956: 1935. WSP 1390: 1897, 1899-1901, 1903-05, 1929-32, 1935(M), 1936. WDR NE-94-1: Drainage area.

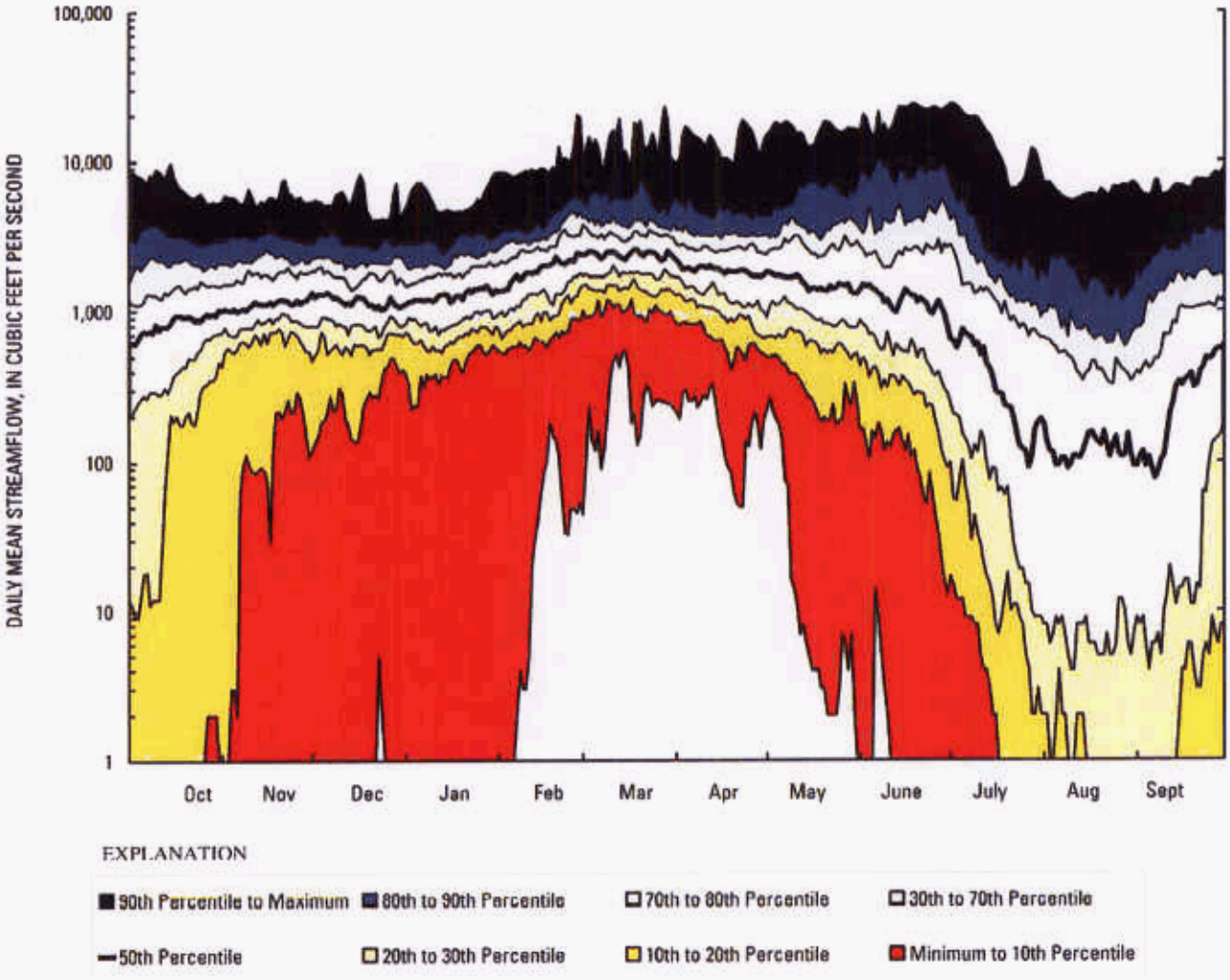
GAGE.--Water-stage recorder with satellite telemetry. Datum of gage is 1,476.82 ft above sea level. June 1895 to December 1909, April 1912 to September 1915, and June to October 1928, non-recording gage at site 7 mi downstream at different datums. Oct. 25, 1928, to Feb. 20, 1935, non-recording gage, and Feb. 20, 1935 to Mar. 21, 1984, recording gage both at present site at 2.00 ft higher datum. Mar. 22, 1984, to Mar. 4, 1987, at site 300 ft downstream at present datum. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor. Natural flow of stream affected by transmountain diversions, storage reservoirs, power developments, ground-water withdrawals and diversions for irrigation, and return flow from irrigated areas.

EXTREMES FOR PERIOD OF RECORD.--1895-1909, 1912-15, 1928-84: Maximum streamflow observed, 44,100 ft³ June 23, 1905 (gage height, 6.50 feet, site and datum then in use); no flow at times in 1931, 1933-42, 1944, 1952-57, 1959, 1963, 1974, 1976, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum streamflow, 44,100 ft³/s June 23, 1905, gage height 6.50 ft, site and datum than in use. No flow at times in 1896, 1902, 1904-05, 1910-11, 1913-14, 1928, all at site downstream, 1931, 1933-41.

Non-exceedance duration hydrograph for Platte River near Duncan, Nebr. (06774000) (1928-2004 period of record)



06774000 PLATTE RIVER NEAR DUNCAN, NEBR.

Monthly and annual streamflow, 1942-2005

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	6,673	0	1,334	1,340	1.00
November	5,617	0	1,491	1,089	0.73
December	5,107	16	1,475	961	0.65
January	5,603	45	1,541	953	0.62
February	8,795	269	2,248	1,413	0.63
March	9,531	714	2,839	1,582	0.56
April	13,410	362	2,437	1,943	0.80
May	15,450	150	2,551	2,635	1.03
June	18,320	11	2,784	3,426	1.23
July	12,590	0	1,371	1,969	1.44
August	6,135	0	629	1,012	1.61
September	6,785	0	922	1,289	1.40
Annual	6,652	287	1,798	1,192	0.66

Magnitude and probability of annual low flow based on period of record, 1928-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	38	5	2	1	0	0
2	37	6	2	1	0	0
3	39	5	2	1	0	0
7	40	4	1	0	0	0
14	57	4	1	0	0	0
30	81	8	2	1	0	0
60	200	16	3	0	0	0
90	361	44	10	2	0	0
183	1,025	165	30	5	0	0
			October-November			
1	493	87	26	8	2	1
2	532	95	28	9	2	1
3	561	100	29	9	2	1
7	684	103	25	6	1	0
14	851	147	39	10	2	0
30	1,008	143	30	6	1	0
60	1,588	282	55	9	1	0

Duration of daily mean flow based on period of record, 1928-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
10590	8553	5545	3948	3141	2688	2326	2029	1779	1564	1359	1187	1026	875	729	585	427	258	98	10	1	0	0

06796000 PLATTE RIVER AT NORTH BEND, NEBR.

LOCATION.--Lat 41°27'10", long 96°46'32", in SE ¼ SE ¼ sec.7, T.17 N., R.6 D., Dodge County, Hydrologic Unit 10200201, on left bank 80 ft upstream from bridge on State Highway 79, 1 mi south of North Bend, 5 mi downstream from Shell Creek, and at mile 73.0.

DRAINAGE AREA.--70,400 mi² of which 12,600 mi² probably is noncontributing.

STREAMFLOW RECORDS

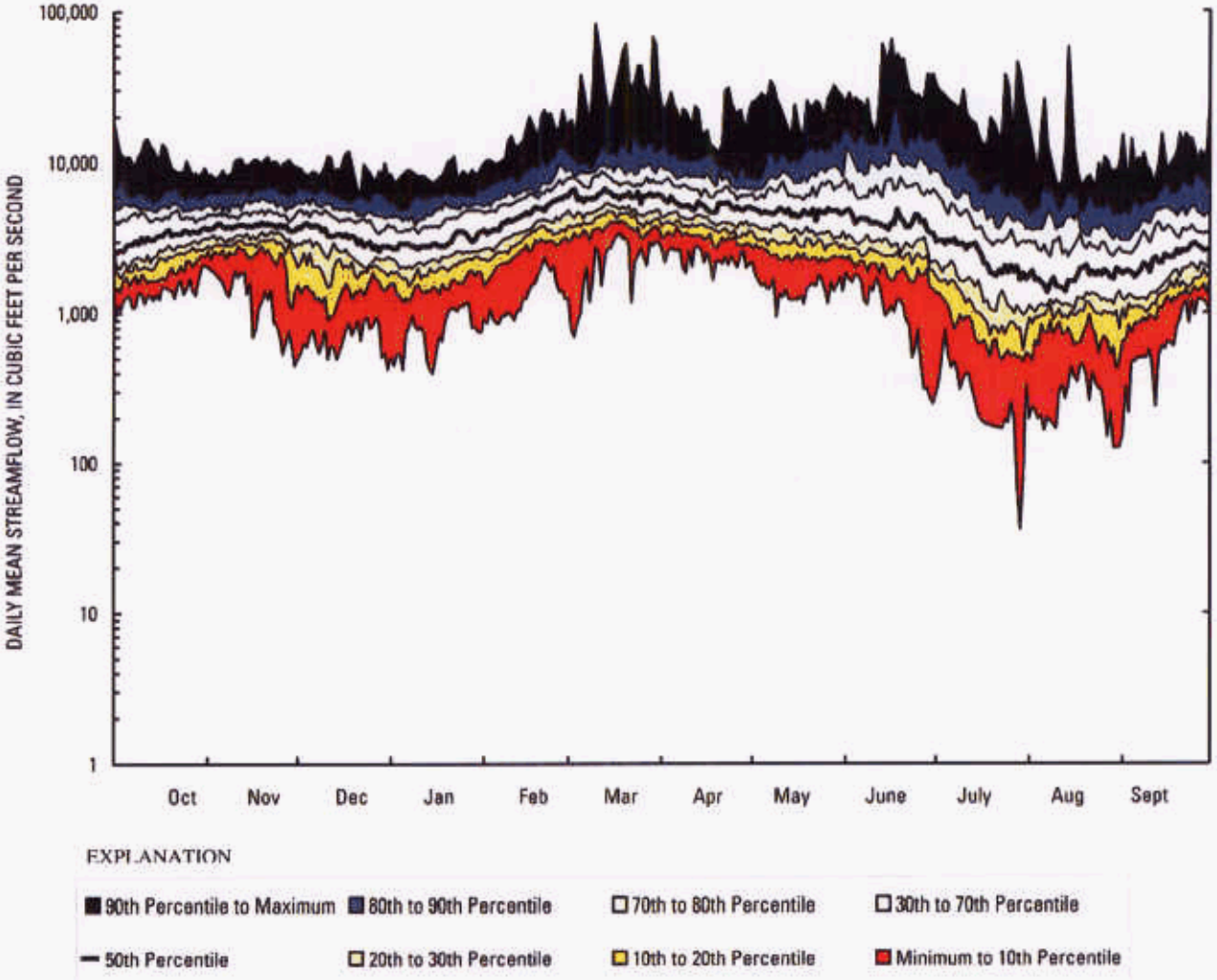
PERIOD OF RECORD.--April 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,262.32 ft above sea level. Prior to Sept. 12, 1951, nonrecording gage and Sept. 12, 1951 to Sept. 30, 1970 water-stage recorder, at present site at datum 2.00 ft higher. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor. Natural flow of stream affected by trans-mountain diversions, storage reservoirs, power developments, ground-water withdrawals and diversions for irrigation, and return flow from irrigated areas.

EXTREMES FOR PERIOD OF RECORD.--Maximum streamflow, 112,000 ft³ March 29, 1960 (gage height, 10.04 feet); maximum gage height, 15.55 feet, March 19, 1978 (backwater from ice); minimum daily streamflow, 36 ft³ July 29, 1974.

Non-exceedance duration hydrograph for Platte River at North Bend, Nebr. (06796000) (1949-2004 period of record)



06796000 PLATTE RIVER AT NORTH BEND, NEBR.

Monthly and annual streamflow, 1949-2005

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	10,130	1,624	3,762	1,755	0.47
November	9,462	1,938	4,130	1,453	0.35
December	8,581	1,413	3,558	1,356	0.38
January	7,361	932	3,377	1,419	0.42
February	11,850	2,689	5,217	1,994	0.38
March	16,870	3,683	7,210	2,970	0.41
April	19,400	2,672	5,982	2,738	0.46
May	21,770	1,952	5,868	3,301	0.56
June	25,340	1,932	6,490	4,960	0.76
July	17,070	381	3,606	3,162	0.88
August	8,021	442	2,461	1,697	0.69
September	9,022	936	3,020	1,934	0.64
Annual	10,850	2,201	4,635	4,635	

Magnitude and probability of annual low flow based on period of record, 1949-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	619	318	209	142	88	63
2	678	359	243	171	111	82
3	716	384	263	187	123	92
7	842	474	340	253	179	140
14	1,087	618	443	330	232	181
30	1,402	825	610	468	343	277
60	1,816	1,127	865	690	530	442
90	2,154	1,417	1,137	947	771	672
183	2,859	2,078	1,778	1,571	1,375	1,262
	October-November					
1	1,899	1,132	849	663	498	408
2	2,131	1,288	968	756	565	461
3	2,213	1,364	1,042	826	631	524
7	2,467	1,706	1,416	1,218	1,032	925
14	2,804	2,010	1,701	1,487	1,283	1,165
30	3,218	2,345	1,996	1,751	1,514	1,376
60	3,619	2,730	2,387	2,149	1,923	1,792

Duration of daily mean flow based on period of record, 1949-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
11977	11598	10459	8562	7184	6342	5600	5179	4759	4339	4037	3746	3456	3179	2919	2658	2386	2095	1780	1418	1012	656	483

06796500 PLATTE RIVER NEAR LESHARA, NEBR.

LOCATION.--Lat 41°19'12", long 96°24'14", in NW ¼ NW ¼ sec.34, T.16 N., R.9 E., Douglas County, Hydrologic Unit 10200202, on left bank 25 ft downstream from bridge on Nebraska Highway 64, 1.0 mi southeast of Leshara, NE.

DRAINAGE AREA.—

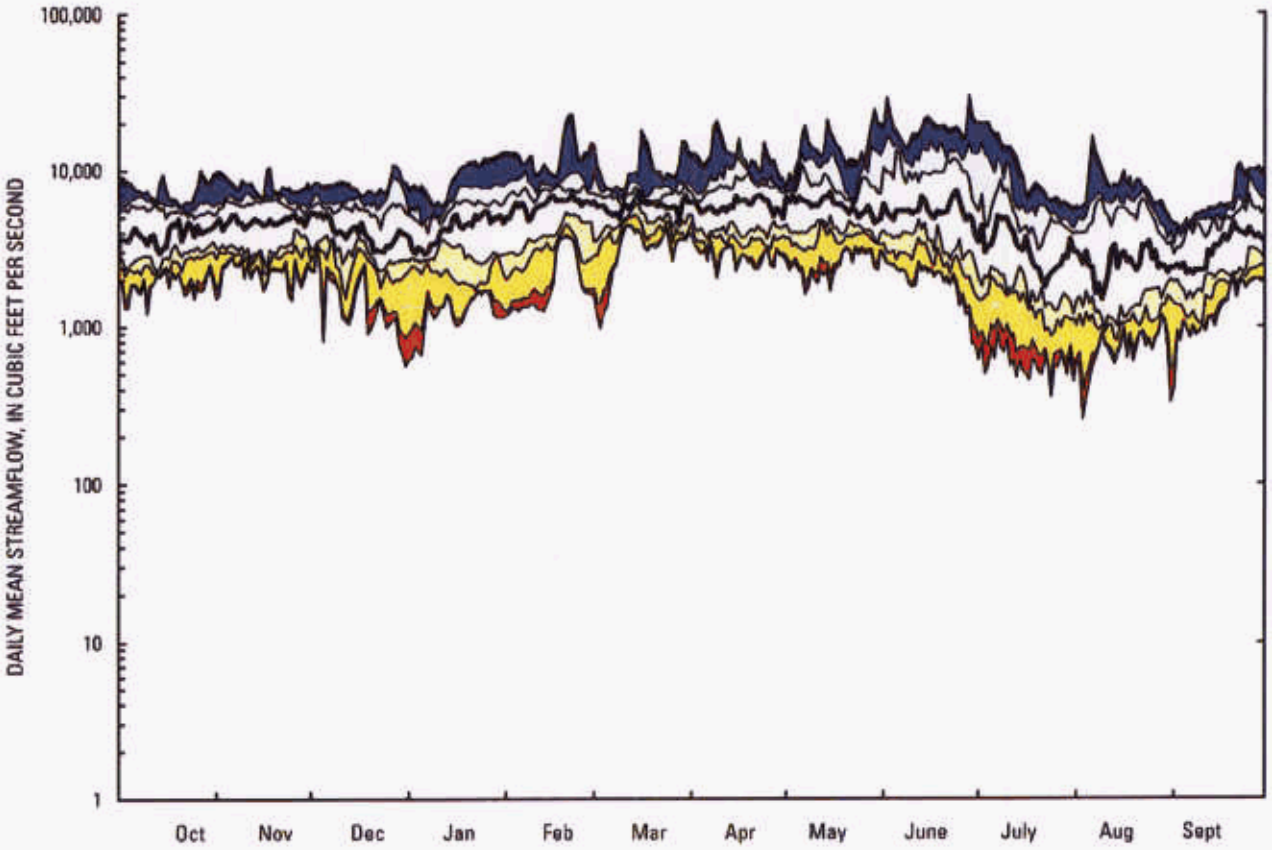
STREAMFLOW RECORDS

PERIOD OF RECORD.--June 1994 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,143.86 ft above sea level. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Platte River near Leshara, Nebr. (06796500) (1994-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06796500 PLATTE RIVER NEAR LESHARA, NEBR.

Monthly and annual streamflow, 1994-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	6,733	1,924	4,282	1,726	0.40
November	7,784	2,324	4,798	1,754	0.37
December	6,762	1,984	4,372	1,643	0.38
January	7,552	1,276	3,957	1,914	0.48
February	10,040	2,984	5,741	2,335	0.41
March	7,960	4,079	5,999	1,374	0.23
April	11,300	3,054	6,348	2,681	0.42
May	10,650	3,180	6,585	2,487	0.38
June	17,460	2,446	7,444	4,991	0.67
July	10,540	595	4,089	2,901	0.71
August	7,163	948	3,171	2,126	0.67
September	6,793	1,710	3,390	1,654	0.49
Annual	7,444	2,703	4,994	1,878	0.38

Magnitude and probability of annual low flow based on period of record, 1994-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	904	484	339	248	172	133
2	966	524	377	285	207	166
3	1,047	602	449	352	267	222
7	1,233	733	562	452	356	303
14	1,552	897	667	520	391	322
30	1,947	1,080	773	577	410	323
60	2,444	1,324	930	682	472	366
90	2,884	1,699	1,259	971	715	579
183	3,550	2,350	1,871	1,539	1,227	1,051
	October-November					
1	2,907	1,920	1,519	1,241	979	830
2	3,065	2,035	1,616	1,324	1,048	891
3	3,140	2,114	1,701	1,414	1,141	985
7	3,391	2,335	1,903	1,599	1,307	1,138
14	3,571	2,496	2,055	1,743	1,443	1,269
30	3,912	2,720	2,225	1,874	1,535	1,339
60	4,282	3,007	2,473	2,094	1,725	1,511

Duration of daily mean flow based on period of record, 1994-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																							
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
11872	11568	10658	9141	7624	7133	6658	6183	5708	5332	4958	4584	4212	3849	3485	3145	2829	2513	2155	1752	1232	857	666

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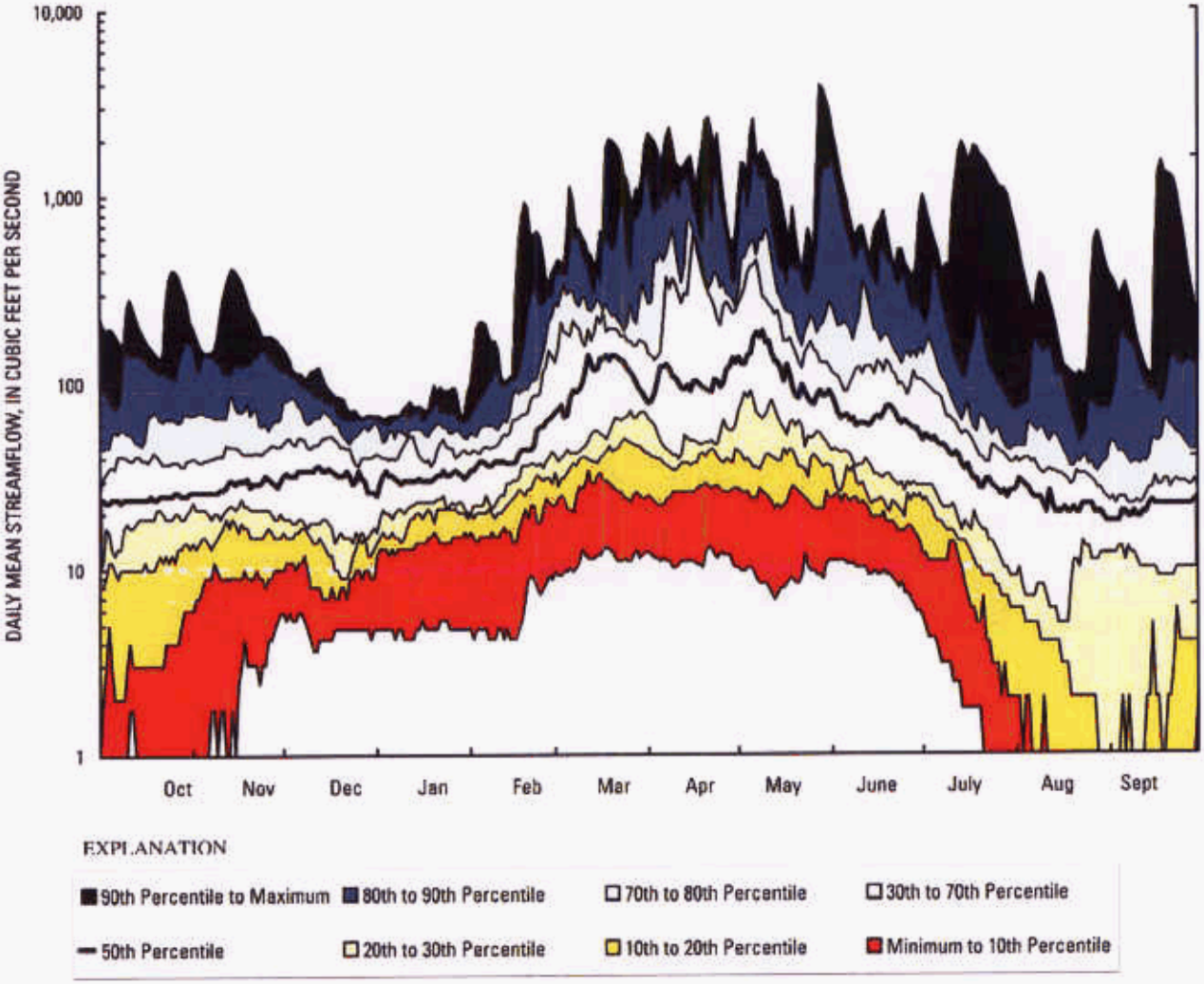
06796973 ELKHORN RIVER NEAR ATKINSON, NEBR.

LOCATION.--Lat 42°29'12", long 98°54'43", Holt County, Hydrologic Unit 10220001
DRAINAGE AREA.--586 mi².

STREAMFLOW RECORDS

PERIOD OF RECORD.--October 1982 to current year.
GAGE.-- Datum of gage is 2042 ft above sea level.
REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Elkhorn River near Atkinson, Nebr. (06796973) (1982-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06796973 ELKHORN RIVER NEAR ATKINSON, NEBR.

Monthly and annual streamflow, 1982-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	213	1	42	49	1.19
November	220	3	48	52	1.07
December	92	7	38	26	0.68
January	74	7	35	19	0.53
February	288	14	68	63	0.92
March	760	23	186	182	0.98
April	1,010	21	274	294	1.07
May	1,332	17	241	281	1.17
June	566	19	136	160	1.17
July	1,040	3	95	218	2.30
August	215	1	38	54	1.44
September	448	1	50	96	1.92
Annual	303	11	105	77	0.73

Magnitude and probability of annual low flow based on period of record, 1982-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	9	2	1	0	0	0
2	9	2	1	0	0	0
3	10	2	1	0	0	0
7	10	3	1	0	0	0
14	11	3	1	1	0	0
30	13	4	1	1	0	0
60	17	5	2	1	0	0
90	20	6	3	1	1	0
183	25	11	7	4	3	2
			October-November			
1	18	5	2	1	0	0
2	18	6	3	1	1	0
3	19	6	3	1	1	0
7	21	7	3	2	1	0
14	22	7	4	2	1	0
30	25	9	4	2	1	1
60	28	11	7	4	3	2

Duration of daily mean flow based on period of record, 1982-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
1333	852	420	229	146	109	85	69	58	49	44	39	34	30	27	24	21	18	15	10	4	1	0

06797500 ELKHORN RIVER AT EWING, NEBR.

LOCATION.--Lat 42°16'07", long 98°20'22", in NW ¼ SW ¼ sec.35, T.27 N., R.9 W., Holt County, Hydrologic Unit 10220001, on left bank 10 ft downstream from bridge on State Highway L-45B, 0.8 mi north of Ewing, 1.5 mi upstream from South Fork Elkhorn River, and at mile 199.

DRAINAGE AREA.--1,400 mi², of which 660 mi² probably is noncontributing.

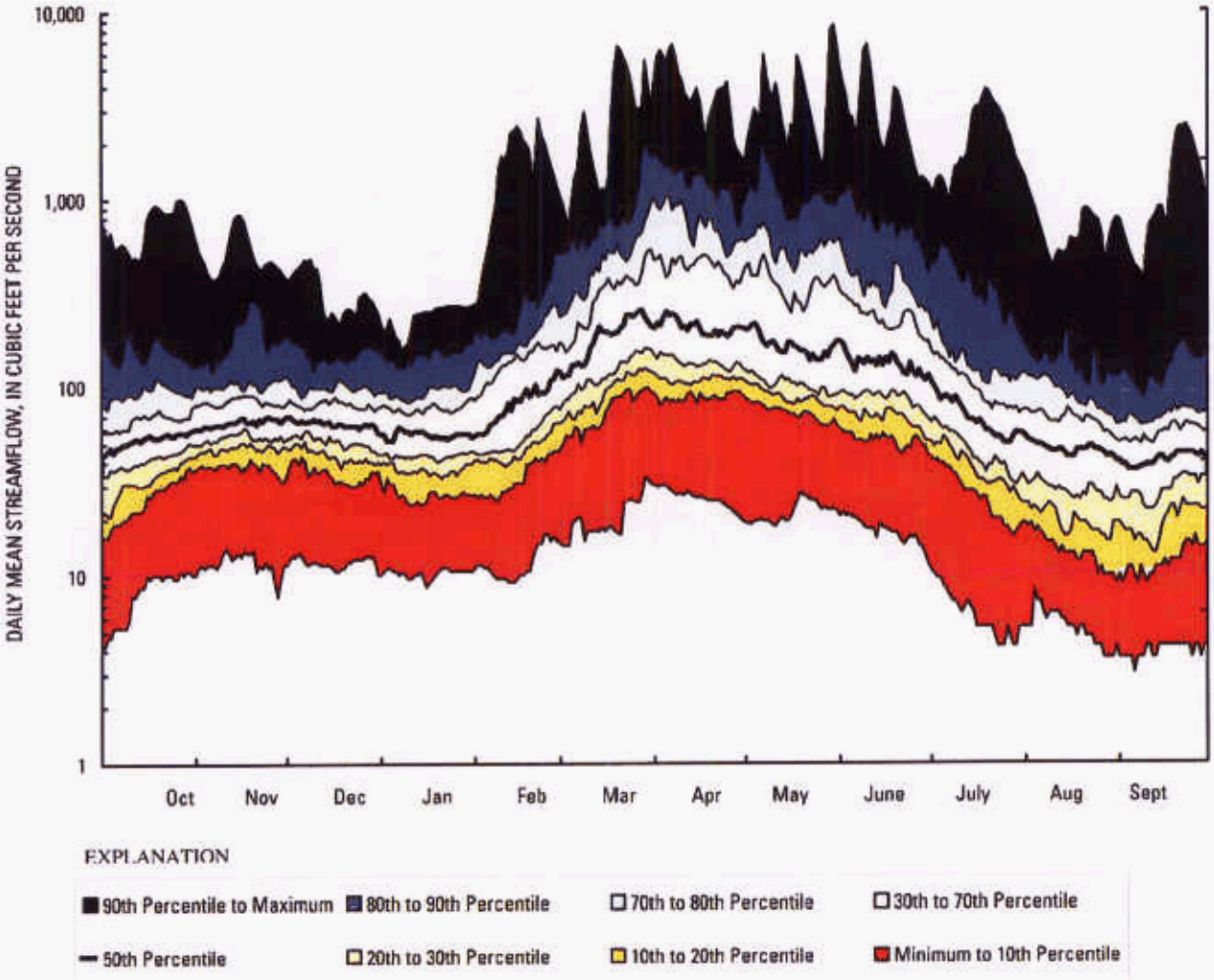
STREAMFLOW RECORDS

PERIOD OF RECORD.--August 1947 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,836.24 ft above sea level, levels by Nebraska Department of Roads. From August 1, 1947 to October 22, 1952 at site 300 ft downstream at same datum. From October 23, 1952 to Sept. 30, 1996 at site 500 ft downstream at same datum. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Elkhorn River at Ewing, Nebr. (06797500) (1947-2004 period of record)



06797500 ELKHORN RIVER AT EWING, NEBR.

Monthly and annual streamflow, 1947-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	671	15	86	117	1.36
November	443	23	92	85	0.92
December	250	24	80	52	0.65
January	226	19	70	44	0.62
February	1,172	26	137	175	1.27
March	2,144	61	344	349	1.01
April	2,081	60	488	536	1.10
May	2,243	52	408	435	1.07
June	2,690	46	305	426	1.40
July	1,993	11	159	292	1.83
August	444	11	74	89	1.20
September	882	6	75	132	1.75
Annual	543	43	194	143	0.74

Magnitude and probability of annual low flow based on period of record, 1947-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	904	484	339	248	172	133
2	966	524	377	285	207	166
3	1,047	602	449	352	267	222
7	1,233	733	562	452	356	303
14	1,552	897	667	520	391	322
30	1,947	1,080	773	577	410	323
60	2,444	1,324	930	682	472	366
90	2,884	1,699	1,259	971	715	579
183	3,550	2,350	1,871	1,539	1,227	1,051
	October-November					
1	36	20	15	12	9	8
2	37	21	15	12	9	8
3	38	21	16	12	10	8
7	42	24	18	14	11	9
14	45	26	20	17	14	12
30	50	32	26	23	20	19
60	59	38	33	29	27	26

Duration of daily mean flow based on period of record, 1947-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
2065	1389	760	410	268	198	160	134	113	99	87	79	70	64	58	53	48	42	37	30	20	13	10

06798000 SOUTH FORK ELKHORN RIVER AT EWING, NEBR.

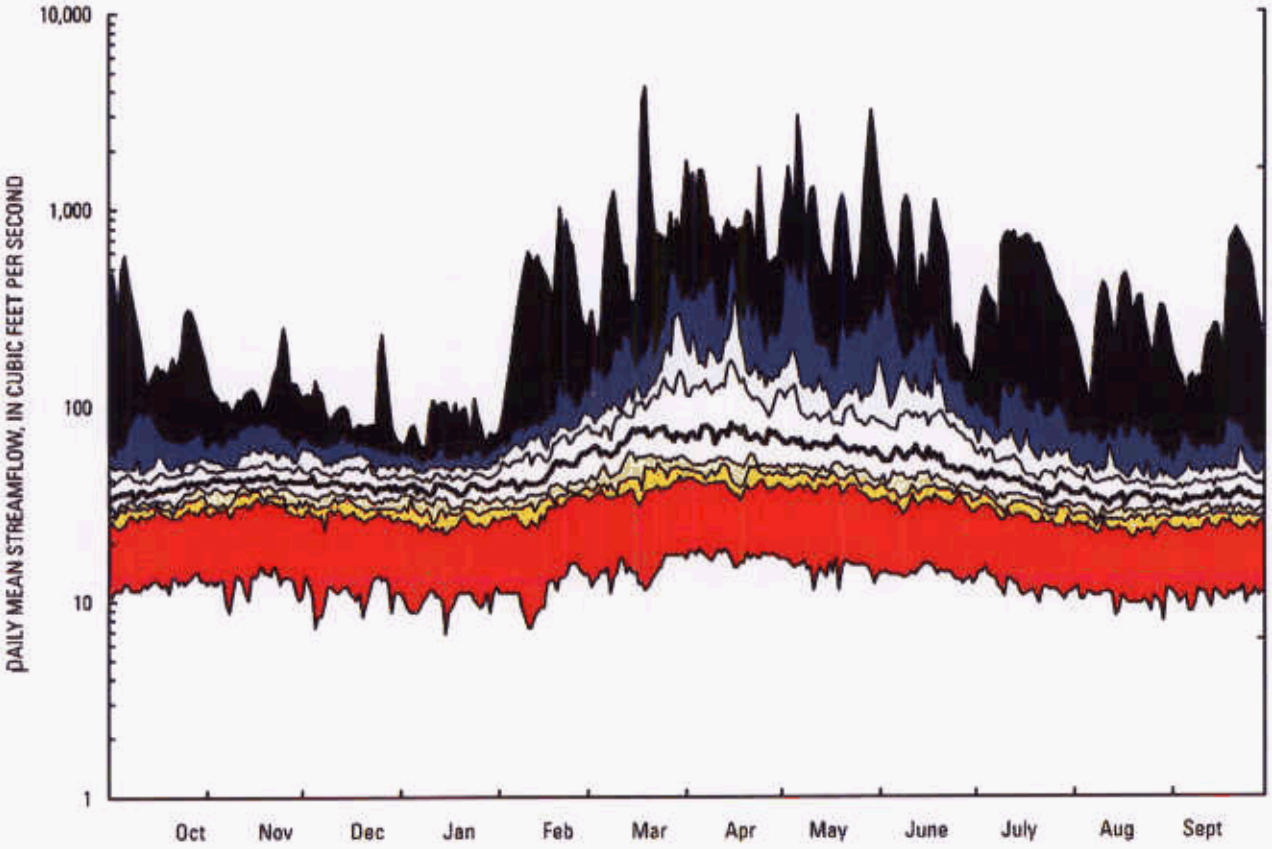
LOCATION.--Lat 42°14'29", long 98°23'54", in SE ¼ NE ¼ sec.7, T.26 N., R.9 W., Holt County, Hydrologic Unit 10220001, on right bank 7 feet downstream and 80 feet landward from bridge on county highway, 3.1 mi southwest of U.S. highway 275 bridge at Ewing, and 5.5 mi upstream from mouth.

DRAINAGE AREA.--314 mi², approximately, of which about 190 mi² contributes directly to surface runoff.

STREAMFLOW RECORDS

PERIOD OF RECORD.—October 1947 to September 1953, August 1960 to September 1972, October 1977 to present.

Non-exceedance duration hydrograph for South Fork Elkhorn River at Ewing, Nebr. (06798000) (1947-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06798000 SOUTH FORK ELKHORN RIVER AT EWING, NEBR.

Monthly and annual streamflow, 1948-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	203	31	52	46	0.88
November	87	30	43	13	0.29
December	61	25	37	8	0.22
January	47	21	34	8	0.22
February	306	26	57	63	1.10
March	411	36	116	101	0.86
April	449	42	113	100	0.88
May	323	37	96	79	0.83
June	421	36	99	95	0.96
July	275	28	56	56	1.00
August	159	23	46	36	0.78
September	134	24	44	31	0.70
Annual	127	35	66	31	0.48

Magnitude and probability of annual low flow based on period of record, 1948-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	22	17	14	13	11	10
2	22	18	15	14	12	11
3	23	18	16	15	13	12
7	25	20	18	17	15	14
14	26	22	20	18	17	16
30	29	24	22	21	19	18
60	31	26	24	23	22	21
90	32	28	26	25	25	24
183	36	31	30	29	29	29
October-November						
1	27	21	19	17	16	15
2	28	22	20	19	17	17
3	29	23	21	20	19	18
7	31	26	24	23	22	21
14	34	28	26	25	24	24
30	36	30	29	28	27	27
60	40	33	31	30	29	29

Duration of daily mean flow based on period of record, 1948-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
621	414	198	115	86	74	64	59	54	49	47	45	42	40	38	36	34	32	30	28	24	22	19

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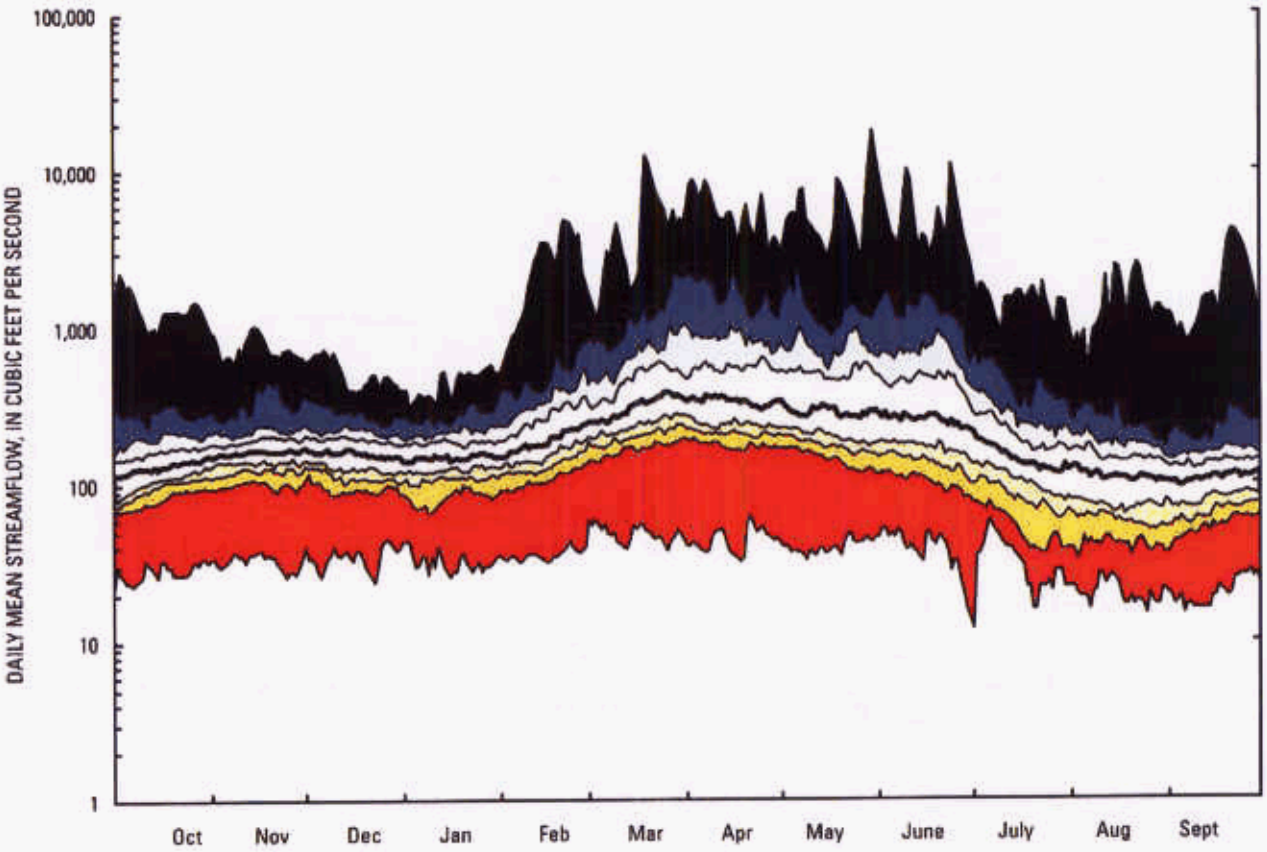
06798500 ELKHORN RIVER AT NELIGH, NEBR.

LOCATION.--Lat 42°07'23", long 98°02'37", in NW ¼ SW ¼ sec.20, T.25 N., R.6 W., Antelope County, Hydrologic Unit 10220001, at State Highway 14 bridge, 0.9 mi southwest of Neligh, 1.2 mi downstream from Hail Creek, and 1.5 mi downstream from Antelope Creek.

DRAINAGE AREA.--2,200 mi², of which 1,000 mi² probably is noncontributing.

Non-exceedance duration hydrograph for Elkhorn River at Neligh, Nebr. (06798500) (1930-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06798500 ELKHORN RIVER AT NELIGH, NEBR.

Monthly and annual streamflow, 1931-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	1,189	71	179	192	1.07
November	616	85	176	88	0.50
December	479	86	163	63	0.39
January	324	67	152	52	0.34
February	1,617	96	230	227	0.99
March	2,008	183	432	369	0.85
April	3,141	176	520	515	0.99
May	2,589	126	490	483	0.99
June	3,387	86	544	675	1.24
July	1,043	45	220	238	1.08
August	1,060	28	150	176	1.17
September	877	30	132	132	1.00
Annual	935	108	282	181	0.64

Magnitude and probability of annual low flow based on period of record, 1931-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	61	35	26	19	14	11
2	63	36	26	20	14	12
3	64	37	27	21	15	12
7	68	41	30	23	17	14
14	75	46	35	27	21	17
30	84	52	40	31	24	20
60	96	60	47	38	29	25
90	106	68	53	44	35	30
183	128	87	73	64	56	51
October-November						
1	99	64	50	40	32	27
2	102	66	52	42	33	29
3	105	68	53	43	34	29
7	113	73	58	48	39	33
14	122	79	64	53	44	39
30	134	89	73	63	53	48
60	151	99	82	71	61	56

Duration of daily mean flow based on period of record, 1931-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
2906	1895	1063	606	440	346	296	258	233	208	191	178	165	152	140	130	119	107	94	76	53	36	30

06799000 ELKHORN RIVER AT NORFOLK, NEBR.

LOCATION.--Lat 42°00'14", long 97°31'22", in SW ¼ SW ¼ sec.34, T.24 N., R.1 W., Madison County, Hydrologic Unit 10220001, on left bank 200 ft downstream from U.S. Highway 81 bridge, 1 mi south of intersection of U.S. Highways 81 and 275, and 3.6 mi upstream from North Fork Elkhorn River, and at mile 129.

DRAINAGE AREA.--2,790 mi² of which 1,000 mi² probably is noncontributing.

STREAMFLOW RECORDS

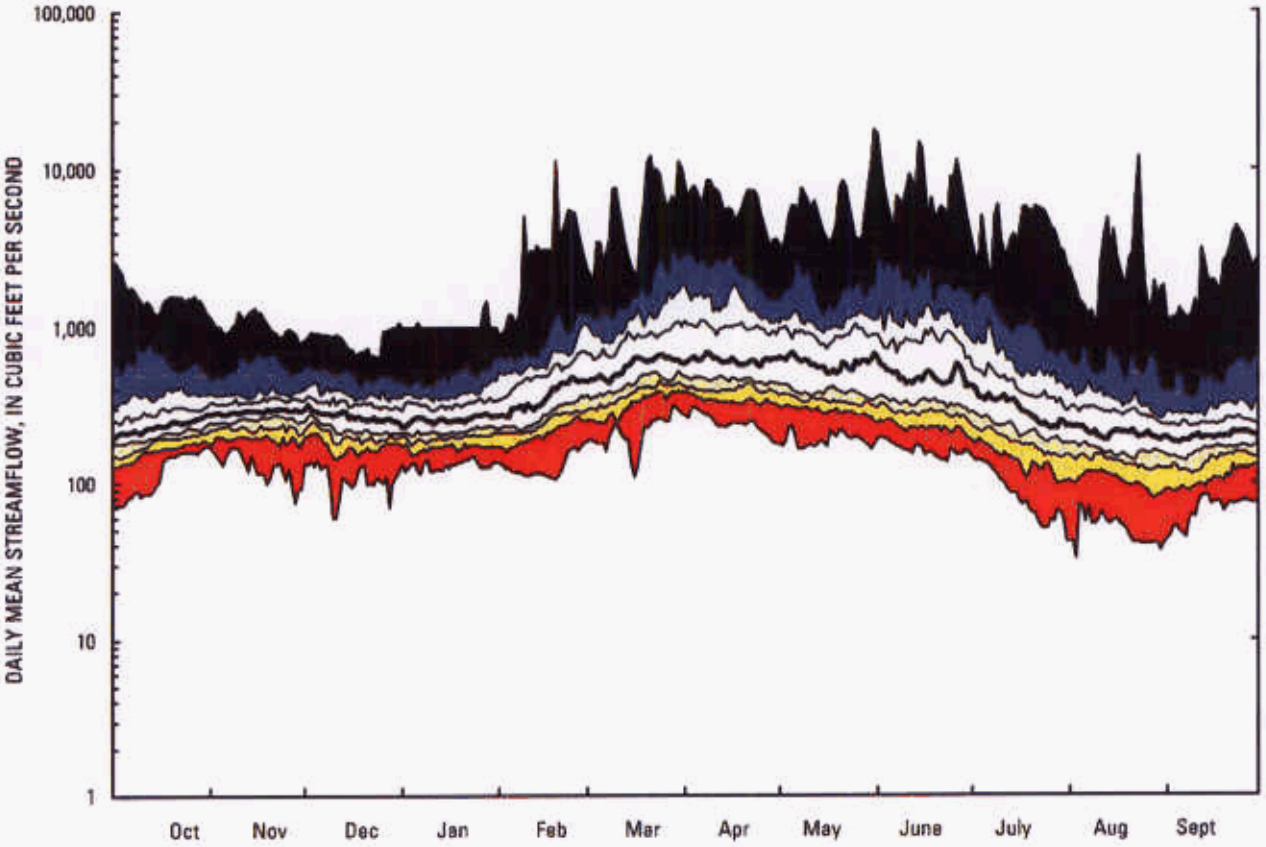
REVISED RECORDS.--WSP 1390: 1898-1900. WSP 1730: Drainage area.

PERIOD OF RECORD.--July 1896 to November 1903 (no winter records), October 1945 to current year. Gage height records collected at site 200 ft upstream from May 10, 1941 to Sept. 26, 1945 are contained in reports of U.S. Weather Bureau. Published as "near Norfolk" from October 1957 to September 1977.

GAGE.--Water-stage recorder. Datum of gage is 1,500.95 ft above sea level. See WSP 1918 for history of changes prior to Aug. 30, 1958. Aug. 30, 1958, to July 27, 1978, water-stage recorder at site 3.2 mi upstream at datum 19.88 ft higher and July 28, 1978 to Mar. 18, 1987, present site at datum 4.00 ft higher. Mar. 19, 1987, to Mar. 31, 1995, present site at datum 2.00 ft higher. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Elkhorn River at Norfolk, Nebr. (06799000) (1896-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06799000 ELKHORN RIVER AT NORFOLK, NEBR.

Monthly and annual streamflow, 1945-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	1,418	140	327	280	0.86
November	847	169	310	127	0.41
December	607	156	273	95	0.35
January	1,000	158	289	156	0.54
February	1,862	213	481	327	0.68
March	2,360	320	813	502	0.62
April	3,338	341	930	740	0.80
May	2,682	246	789	566	0.72
June	4,673	227	1,000	1,012	1.01
July	1,479	125	470	358	0.76
August	1,398	91	330	306	0.93
September	1,323	87	268	216	0.81
Annual					

Magnitude and probability of annual low flow based on period of record, 1945-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	113	76	60	49	38	32
2	118	79	62	51	40	34
3	122	81	64	52	41	34
7	134	88	69	56	44	37
14	145	95	75	61	48	40
30	161	109	88	73	58	50
60	184	129	107	92	78	69
90	202	144	122	108	94	86
183	240	182	164	152	143	138
			October-November			
1	175	126	107	94	82	75
2	179	131	113	101	89	83
3	184	135	116	104	92	86
7	200	146	126	114	102	95
14	215	156	136	123	111	104
30	236	179	160	149	139	135
60	264	202	184	173	165	161

Duration of daily mean flow based on period of record, 1945-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
4105	2885	1644	1067	805	662	558	477	428	386	347	324	301	277	258	240	223	205	184	162	131	99	81

06799100 NORTH FORK ELKHORN RIVER NEAR PIERCE, NEBR.

LOCATION.--Lat 42°08'54", long 97°28'43", in NE ¼ NW ¼ sec.18, T.25 N., R.1 W., Pierce County, Hydrologic Unit 10220002, on right bank 4 ft downstream and 25 ft from end of bridge, 4.5 mi southeast of Pierce, and at mile 20.8.

DRAINAGE AREA.--701 mi² of which 30 mi² probably is noncontributing.

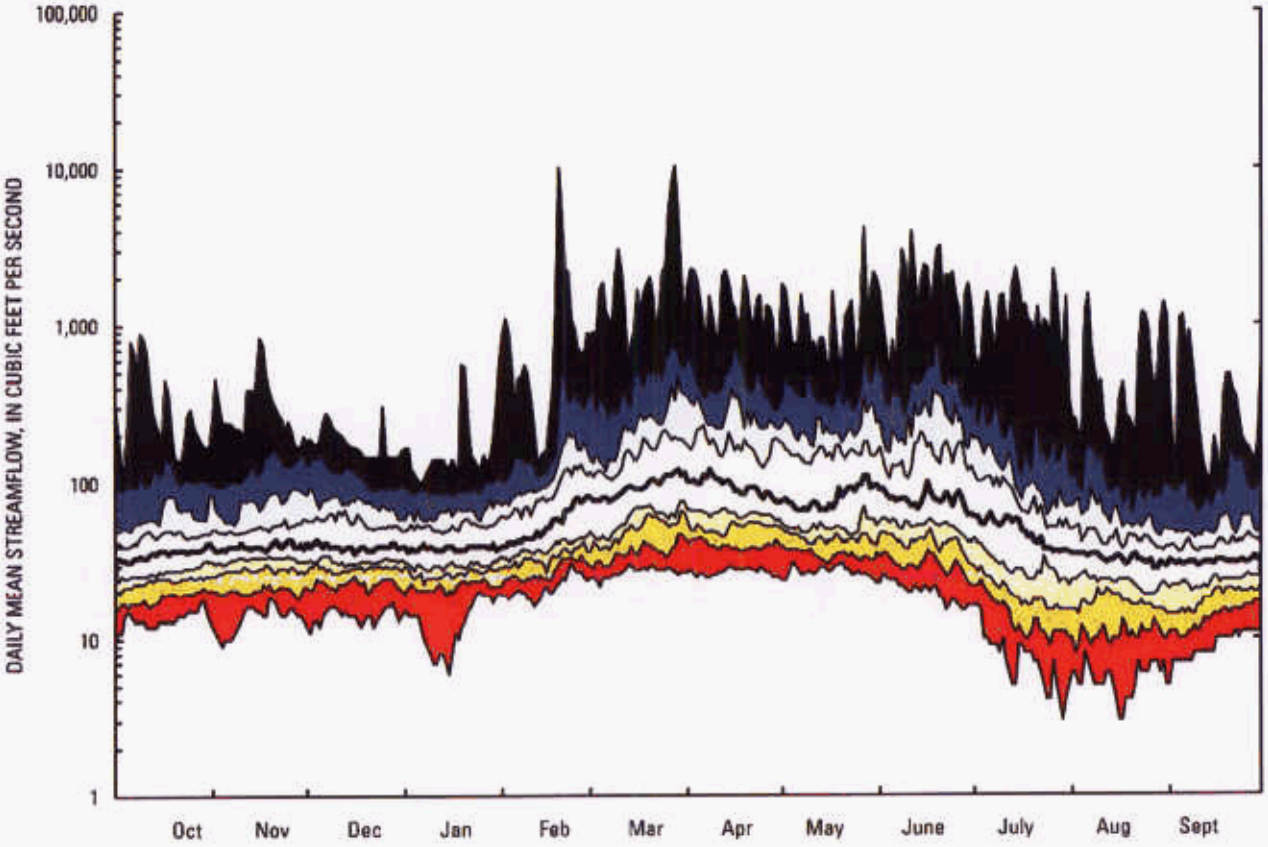
STREAMFLOW RECORDS

REVISED RECORDS.--WDR NE-94-1: Drainage area.

PERIOD OF RECORD.--August 1960 to current year. GAGE.--Water-stage recorder. Datum of gage is 1,542.88 ft above sea level (U.S. Weather Service levels). Aug. 19, 1960 to Oct. 7, 1997, water-stage recorder at site 2 mi upstream at datum 10.19 ft higher. Data collection platform at station.

REMARKS.--Record good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for North Fork Elkhorn River near Pierce, Nebr. (06799100) (1960-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06799100 NORTH FORK ELKHORN RIVER NEAR PIERCE, NEBR.

Monthly and annual streamflow, 1960-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	241	14	52	46	0.88
November	233	15	59	50	0.85
December	156	15	53	34	0.63
January	111	16	49	26	0.53
February	834	24	113	149	1.32
March	1,120	30	200	205	1.03
April	1,004	29	187	189	1.01
May	663	28	162	140	0.87
June	799	22	181	174	0.96
July	834	12	99	140	1.41
August	226	7	54	53	0.99
September	191	10	46	43	0.94
Annual	287	22	104	66	0.64

Magnitude and probability of annual low flow based on period of record, 1960-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	18	9	6	4	3	2
2	19	10	6	4	3	2
3	20	10	7	5	3	2
7	21	11	8	6	4	3
14	23	13	9	7	5	4
30	26	15	11	9	6	5
60	29	18	13	10	8	6
90	32	19	15	12	9	8
183	39	24	19	16	13	11
			October-November			
1	28	19	16	13	11	10
2	29	19	16	14	12	11
3	29	20	16	14	12	11
7	31	20	17	15	13	12
14	33	22	18	16	14	13
30	36	23	19	17	15	14
60	41	25	21	18	15	14

Duration of daily mean flow based on period of record, 1960-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
1056	655	354	201	143	112	94	81	69	61	54	49	45	41	38	35	32	29	26	22	16	11	9

06799350 ELKHORN RIVER AT WEST POINT, NEBR.

LOCATION.--Lat 41°50'22", long 96°43'38", in SW ¼ NW ¼ sec.34, T.22 N., R.6 E., Cuming County, Hydrologic Unit 10220003, on right bank near right downstream wingwall of bridge on State Highway 32, 1 mi west of West Point, and at mile 79.8.

DRAINAGE AREA.--4,676 mi² of which 576 mi² probably is noncontributing.

STREAMFLOW RECORDS

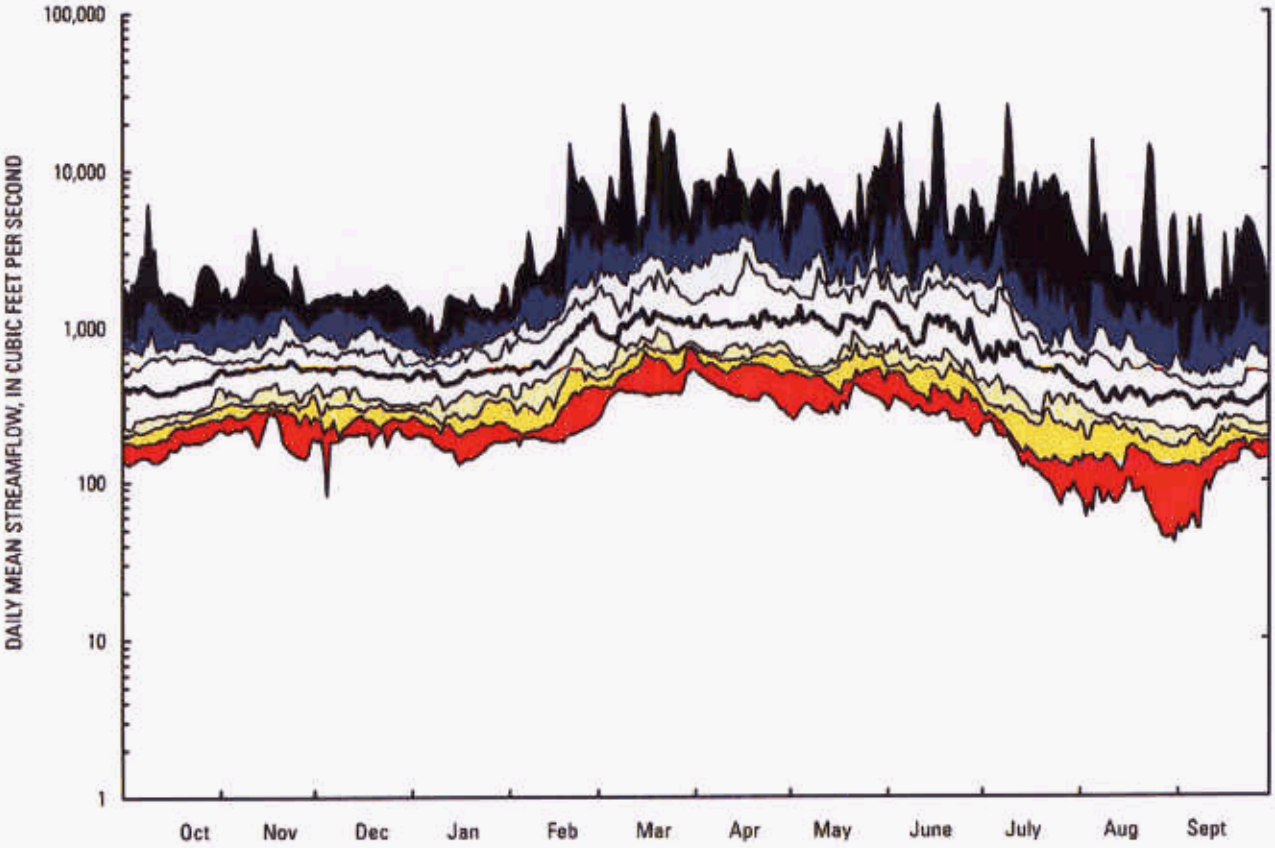
PERIOD OF RECORD.--October 1972 to current year. March 1960 to September 1972 (no winter records 1960-68)in files of Corps of Engineers. Gage-height records collected since 1940 are in reports of U.S. Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 1,291.26 ft above sea level. Prior to May 18, 1976, at site on left bank 50 ft upstream from bridge at same datum. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor. Some small diversions above station for irrigation.

EXTREMES FOR PERIOD OF RECORD.--Maximum streamflow estimated 33,000 ft³, June 25, 1969, gage height 13.21 feet; minimum daily, 41 ft³, Aug. 31, 1976. Flood of March 31, 1960, reached a stage of 16.09 feet, backwater from ice; observed by Corps of Engineers. Flood stage is 12.00 feet gage datum.

Non-exceedance duration hydrograph for Elkhorn River at West Point, Nebr. (06799350) (1972-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06799350 ELKHORN RIVER AT WEST POINT, NEBR.

Monthly and annual streamflow, 1972-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	1,606	174	542	357	0.66
November	1,802	241	631	353	0.56
December	1,314	203	588	310	0.53
January	1,106	168	537	236	0.44
February	2,744	201	1,022	664	0.65
March	5,256	411	1,739	1,229	0.71
April	6,171	378	1,786	1,428	0.80
May	5,618	325	1,627	1,073	0.66
June	3,844	339	1,529	980	0.64
July	6,945	154	1,000	1,235	1.23
August	1,994	90	593	518	0.87
September	1,646	137	476	354	0.74
Annua	2,253	333	1,000	510	0.51

Magnitude and probability of annual low flow based on period of record, 1972-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	188	113	84	64	47	37
2	193	116	87	67	49	39
3	199	119	88	67	49	39
7	218	130	95	73	53	42
14	240	141	103	78	56	44
30	272	166	125	98	74	60
60	329	203	156	124	96	81
90	374	228	176	142	111	94
183	457	288	228	188	152	132
			October-November			
1	303	201	162	136	112	99
2	310	206	166	139	115	100
3	318	210	169	141	115	101
7	345	221	175	145	117	101
14	373	234	185	152	123	107
30	406	260	209	176	147	130
60	491	313	250	210	173	153

Duration of daily mean flow based on period of record, 1972-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
7169	5428	3190	2071	1599	1301	1097	956	815	740	667	599	551	503	455	405	354	314	276	234	188	145	116

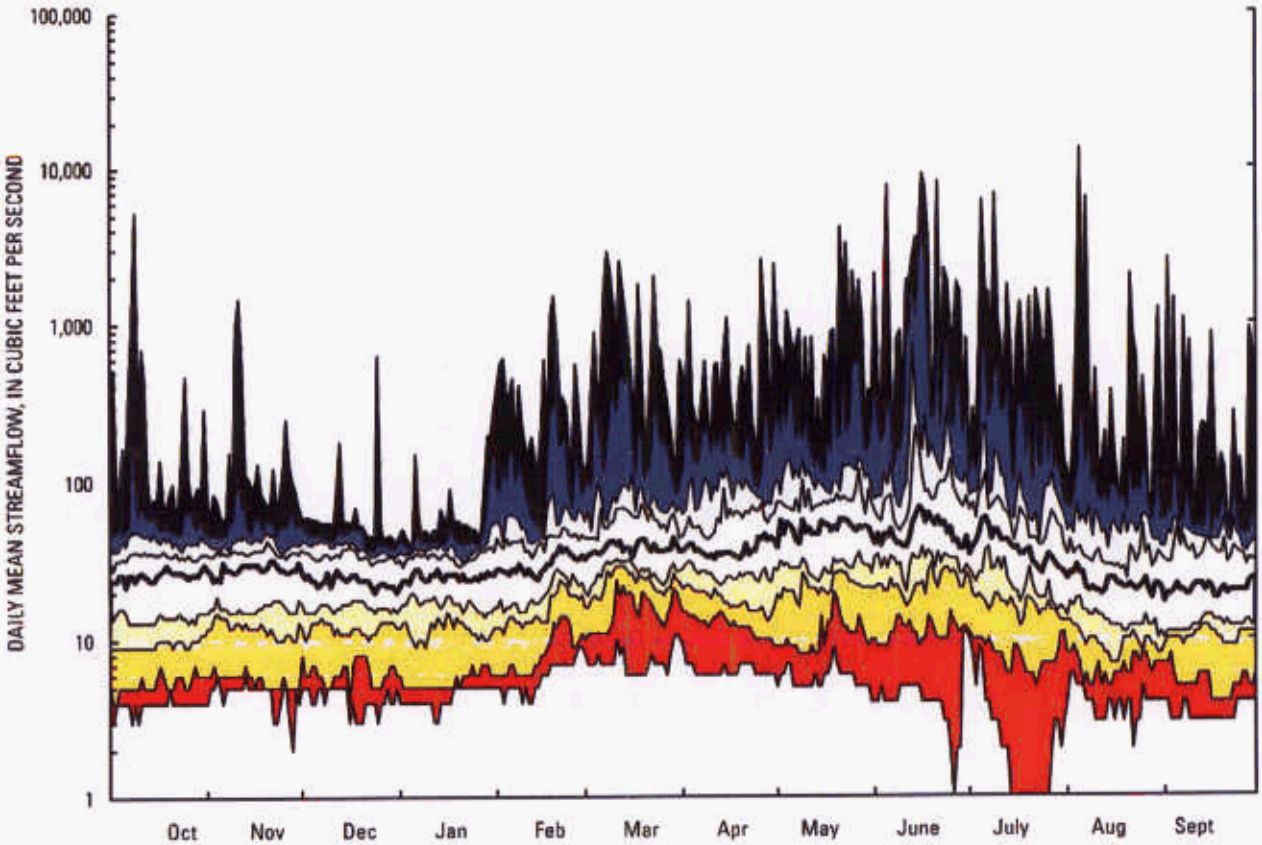
06799385 PEBBLE CREEK AT SCRIBNER, NEBR..

LOCATION.--Lat 41°39'32", long 96°41'03", in SW ¼ NW ¼ sec.34, T.22 N., R.6 E., Dodge County, Hydrologic Unit 10220003.

STREAMFLOW RECORDS

PERIOD OF RECORD.--October 1993 to current year.

Non-exceedance duration hydrograph for Pebble Creek at Scribner, Nebr. (06799385) (1978-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06799385 PEBBLE CREEK AT SCRIBNER, NEBR..

Monthly and annual streamflow, 1978-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	55	12	34	14	0.42
November	108	13	41	25	0.62
December	51	13	33	12	0.35
January	48	13	34	11	0.33
February	103	27	52	22	0.43
March	130	26	62	30	0.48
April	206	32	74	53	0.72
May	257	28	123	75	0.61
June	496	27	187	160	0.86
July	399	22	110	108	0.98
August	549	14	113	172	1.52
September	131	12	40	34	0.84
Annual	144	38	75	39	0.52

Magnitude and probability of annual low flow based on period of record, 1978-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	13	5	2	1	0	0
2	13	5	2	1	1	0
3	14	5	3	1	1	0
7	14	6	3	2	1	0
14	15	7	4	2	1	1
30	16	8	5	4	2	2
60	20	11	7	5	3	2
90	22	12	8	6	4	3
183	28	14	10	7	4	3
October-November						
1	17	8	5	3	2	1
2	17	8	5	3	2	1
3	17	8	5	4	2	2
7	18	9	6	4	3	2
14	20	10	6	4	3	2
30	22	11	7	5	3	2
60	26	12	8	6	4	3

Duration of daily mean flow based on period of record, 1978-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
932	497	181	96	69	57	49	44	39	36	34	31	28	25	22	20	17	15	12	8	5	4	4

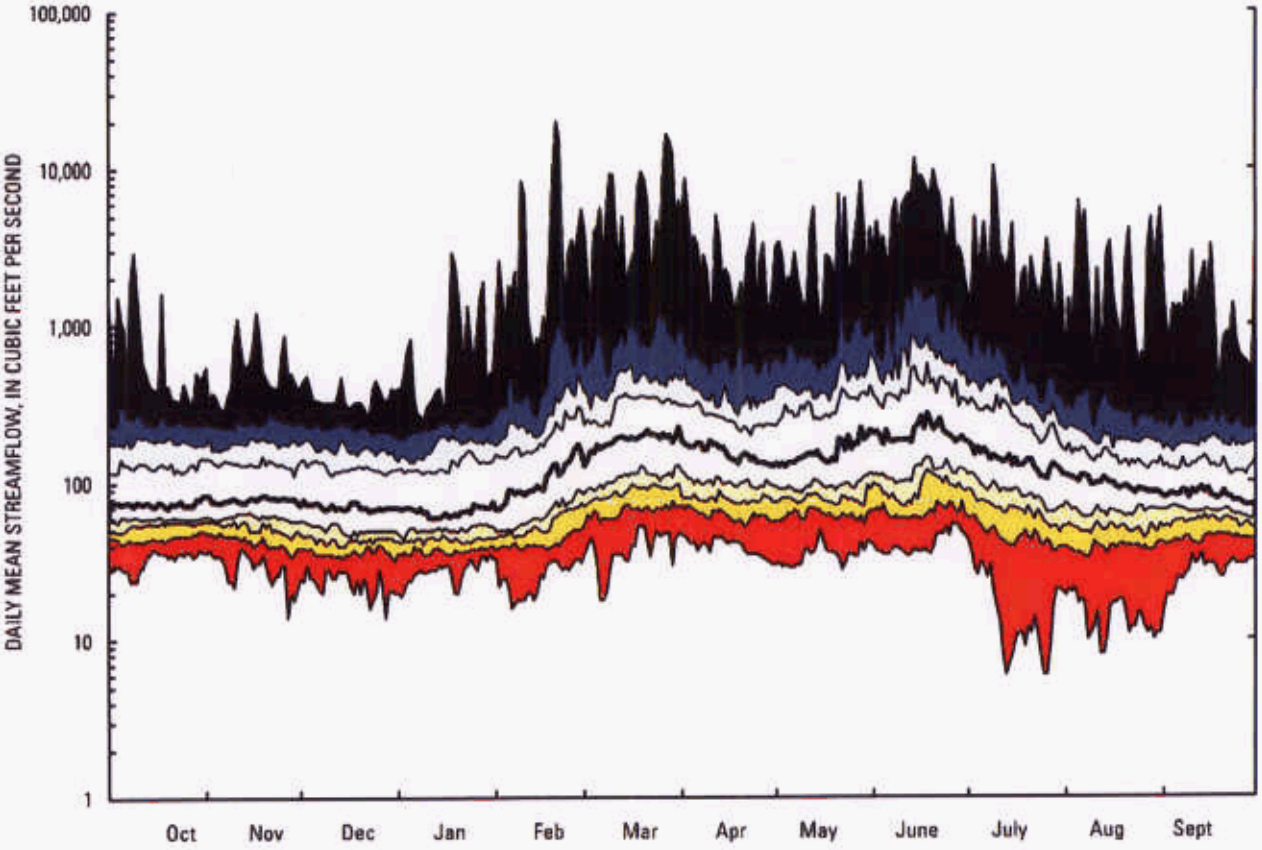
06799500 LOGAN CREEK NEAR UEHLING, NEBR.

LOCATION.--Lat 41°42'46", long 96°31'19", in SE ¼ SE ¼ sec.9, T.20 N., R.8 E., Dodge County, Hydrologic Unit 10220004, near left bank on upstream side of bridge on county road, 2 mi southwest of Uehling and 8.8 mi upstream from mouth.
DRAINAGE AREA.--1015 mi².

STREAMFLOW RECORDS

REVISED RECORDS.--WDR NE-94-1: Drainage Area.
PERIOD OF RECORD.--March 1941 to current year. GAGE.--Water-stage recorder. Datum of gage is 1,208.73 ft above sea level. See WSP 1918 for history of changes prior to July 15, 1963. July 16, 1963 to Mar. 27, 1989, near right bank on downstream side of bridge at present site and datum. Mar. 28, 1989 to Mar. 22, 1990, 250 ft upstream on left bank at same datum. Data collection platform at station.
COOPERATION.--Records provided by Nebraska Department of Natural Resources and reviewed by the U.S. Geological Survey.
REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Logan Creek near Uehling, Nebr. (06799500) (1941-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06799500 LOGAN CREEK NEAR UEHLING, NEBR.

Monthly and annual streamflow, 1941-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	499	33	123	99	0.80
November	453	38	118	87	0.74
December	337	32	103	73	0.70
January	583	34	111	95	0.85
February	2,177	38	263	320	1.22
March	2,388	57	409	408	1.00
April	1,742	43	287	318	1.11
May	1,417	40	324	272	0.84
June	2,766	57	502	492	0.98
July	1,843	17	266	271	1.02
August	1,056	15	165	179	1.08
September	613	32	133	115	0.87
Annual	710	66	234	141	0.60

Magnitude and probability of annual low flow based on period of record, 1941-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	44	24	17	13	10	8
2	45	25	18	14	11	9
3	46	26	19	15	11	9
7	50	29	22	17	13	12
14	55	31	24	19	15	13
30	61	37	29	24	20	18
60	69	42	33	27	22	20
90	74	46	37	31	26	23
183	88	54	43	36	30	27
October-November						
1	62	35	26	21	16	14
2	64	37	28	22	17	15
3	66	38	29	24	19	17
7	70	42	34	28	24	21
14	74	46	37	32	27	24
30	80	51	42	36	31	28
60	90	56	45	38	33	30

Duration of daily mean flow based on period of record, 1941-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
2427	1474	729	427	319	259	223	191	166	144	125	108	96	85	78	71	64	58	52	45	39	31	28

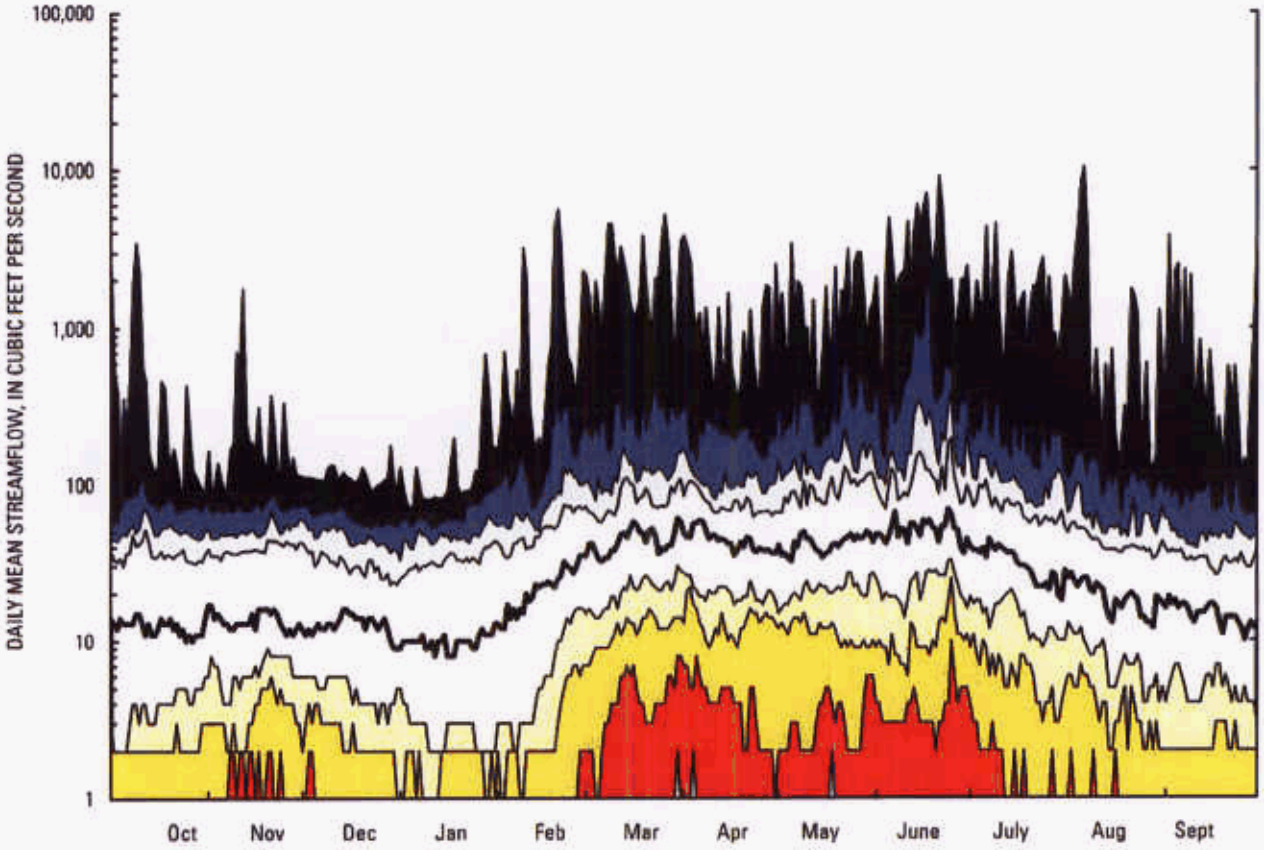
06800000 MAPLE CREEK NEAR NICKERSON, NEBR.

LOCATION.--Lat 41°33'37", long 96°32'27", in SW ¼ NW ¼ sec.4, T.18 N., R.8 E., Dodge County, Hydrologic Unit 10220003, on right bank 8 ft downstream from county road bridge 2 mi upstream from U.S. Highways 77 and 275, 5 mi northwest of Nickerson, and 4 mi upstream from mouth.
DRAINAGE AREA.--368 mi².

STREAMFLOW RECORDS

REVISED RECORDS.--WSP 1630: 1957-58. WDR NE-98: Drainage area.
PERIOD OF RECORD.--October 1951 to current year.
GAGE.--Water-stage recorder. Datum of gage is 1,211.62 ft above sea level. Prior to July 28, 1960, non-recording gage at highway bridge, July 28, 1960 to July 28, 1987, water-stage recorder 180 ft upstream from highway bridge and July 29, 1987 to July 23, 1991 water-stage recorder 30 ft downstream from highway bridge. All at/near U.S. Highway 77 bridge, 2 mi downstream from present gage, at datum 17.06 ft lower. Data collection platform at station.
REMARKS.--Records good except for estimated daily streamflows, which are poor.
EXTREMES FOR PERIOD OF RECORD.--Maximum streamflow, 13,700 ft³, Aug. 6, 1996, (gage height 17.33 feet, (gage datum)); maximum gage height, 17.65 feet, (gage datum), June 17, 1984 from flood mark, minimum daily streamflow, 0.1 ft³, Jan. 15, 16, 1956.

Non-exceedance duration hydrograph for Maple Creek near Nickerson, Nebr. (06800000) (1951-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06800000 MAPLE CREEK NEAR NICKERSON, NEBR.

Monthly and annual streamflow, 1951-2005

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	323	0	37	55	1.50
November	158	1	30	35	1.16
December	102	1	24	25	1.07
January	83	0	24	25	1.06
February	446	1	69	82	1.19
March	674	1	131	153	1.17
April	590	1	94	122	1.30
May	642	1	124	134	1.08
June	1,252	3	212	273	1.28
July	1,023	1	102	159	1.56
August	762	1	67	124	1.85
September	383	0	46	72	1.57
Annual	264	5	79	60	0.76

Magnitude and probability of annual low flow based on period of record, 1951-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	3	1	0	0	0	0
2	3	1	0	0	0	0
3	3	1	0	0	0	0
7	3	1	0	0	0	0
14	4	1	0	0	0	0
30	6	1	1	0	0	0
60	8	2	1	1	0	0
90	10	3	1	1	0	0
183	15	4	2	1	0	0
			October-November			
1	6	1	1	0	0	0
2	6	2	1	0	0	0
3	7	2	1	0	0	0
7	8	2	1	0	0	0
14	9	2	1	1	0	0
30	11	3	1	1	0	0
60	15	4	2	1	1	0

Duration of daily mean flow based on period of record, 1951-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
1208	589	254	135	94	75	62	53	45	38	31	25	20	15	12	9	6	4	2	1	1	0	0

06800500 ELKHORN RIVER AT WATERLOO, NEBR.

LOCATION.--Lat 41°17'36", long 96°17'02", in SE ¼ SW ¼ sec.3, T.15 N., R.10 E., Douglas County, Hydrologic Unit 10220003, on right bank at Nebraska Highway 64 bridge at north edge of Waterloo, 3.5 mi downstream from Rawhide Creek, and at mile 13.8.

DRAINAGE AREA.--6,900 mi² of which 1,030 mi² probably is noncontributing.

STREAMFLOW RECORDS

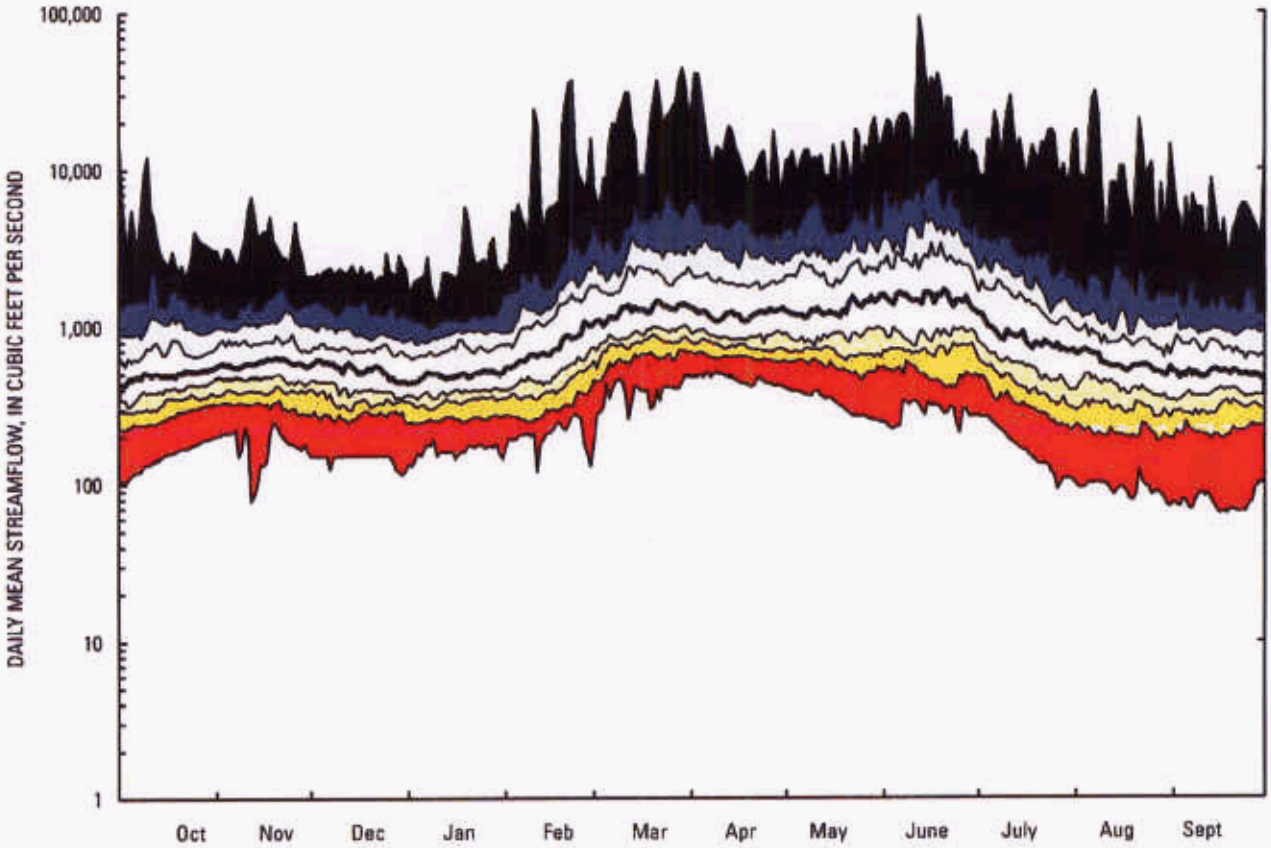
REVISED RECORDS.--WSP 1390: 1914 (M), 1915, 1936, 1943(M). WDR NE-94-1: Drainage area. PERIOD OF RECORD.--April 1899 to November 1903, May 1911 to September 1915, August 1928 to current year. Published as "at Arlington" 1899-1903, July 1913 to September 1915. Monthly streamflow only for some periods, published in WSP 1310.

GAGE.--Water-stage recorder. Datum of gage is 1,104.73 ft above sea level. Oct. 1, 1960, to July 27, 1978, at datum 2.00 ft higher. See WSP 1918 for history of changes prior to Oct. 1, 1960. July 28, 1978 to Nov. 17, 1993, at site 800 ft downstream at present datum. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor. Some small diversions above station for irrigation.

EXTREMES FOR PERIOD OF RECORD.--1899 to 1903, 1911-15, 1928-65: Maximum streamflow, 100,000 ft³ June 12, 1944 (gage height, 16.6 feet, from flood mark in the gage well, site and datum then in use), from rating curve extended from above 22,000 ft³, on the basis of current meter measurements of the peak flow in the main channel and velocity/area studies of the overflow section; minimum observed, 50 ft³ Nov. 12, 1940. Stage and streamflow of the flood of June 12, 1944, are the greatest known since at least 1880.

Non-exceedance duration hydrograph for Elkhorn River at Waterloo, Nebr. (06800500) (1928-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06800500 ELKHORN RIVER AT WATERLOO, NEBR.

Monthly and annual streamflow, 1928-2005

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	2,780	150	725	566	0.78
November	2,792	240	761	482	0.63
December	1,803	150	669	388	0.58
January	1,650	180	631	353	0.56
February	6,439	257	1,205	1,018	0.84
March	8,082	489	2,237	1,774	0.79
April	10,450	512	2,060	1,878	0.91
May	7,565	327	2,100	1,530	0.73
June	11,950	405	2,830	2,484	0.88
July	11,470	173	1,444	1,506	1.04
August	4,755	117	943	943	1.00
September	2,705	88	725	557	0.77
Annual	3,870	417	1,359	774	0.57

Magnitude and probability of annual low flow based on period of record, 1928-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	245	147	114	93	74	64
2	256	153	118	96	76	65
3	263	158	121	98	78	66
7	293	174	133	106	82	69
14	329	194	146	115	87	72
30	373	223	169	134	102	85
60	431	268	210	171	137	118
90	477	306	246	207	172	152
183	562	365	298	255	216	195
			October-November			
1	368	223	172	138	109	93
2	382	233	181	146	115	98
3	392	241	187	151	120	102
7	432	269	212	174	140	121
14	472	297	236	197	162	142
30	520	333	269	228	191	171
60	585	375	306	262	223	202

Duration of daily mean flow based on period of record, 1928-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
10190	7506	4316	2784	2076	1686	1388	1216	1064	952	840	756	683	610	559	509	459	410	362	308	243	186	150

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06803555 SALT CREEK AT GREENWOOD, NEBR.

LOCATION.--Lat 40°57'56", long 96°27'16", in SW ¼ NE ¼ sec.31, T.12 N., R.9 E., Cass County, Hydrologic Unit 10200203, on right bank just downstream from county road bridge, 0.5 mi west of Greenwood, and at mile 13.0.

DRAINAGE AREA.--1050 mi².

STREAMFLOW RECORDS

REVISED RECORDS.--WDR NE-94-1: Drainage area.

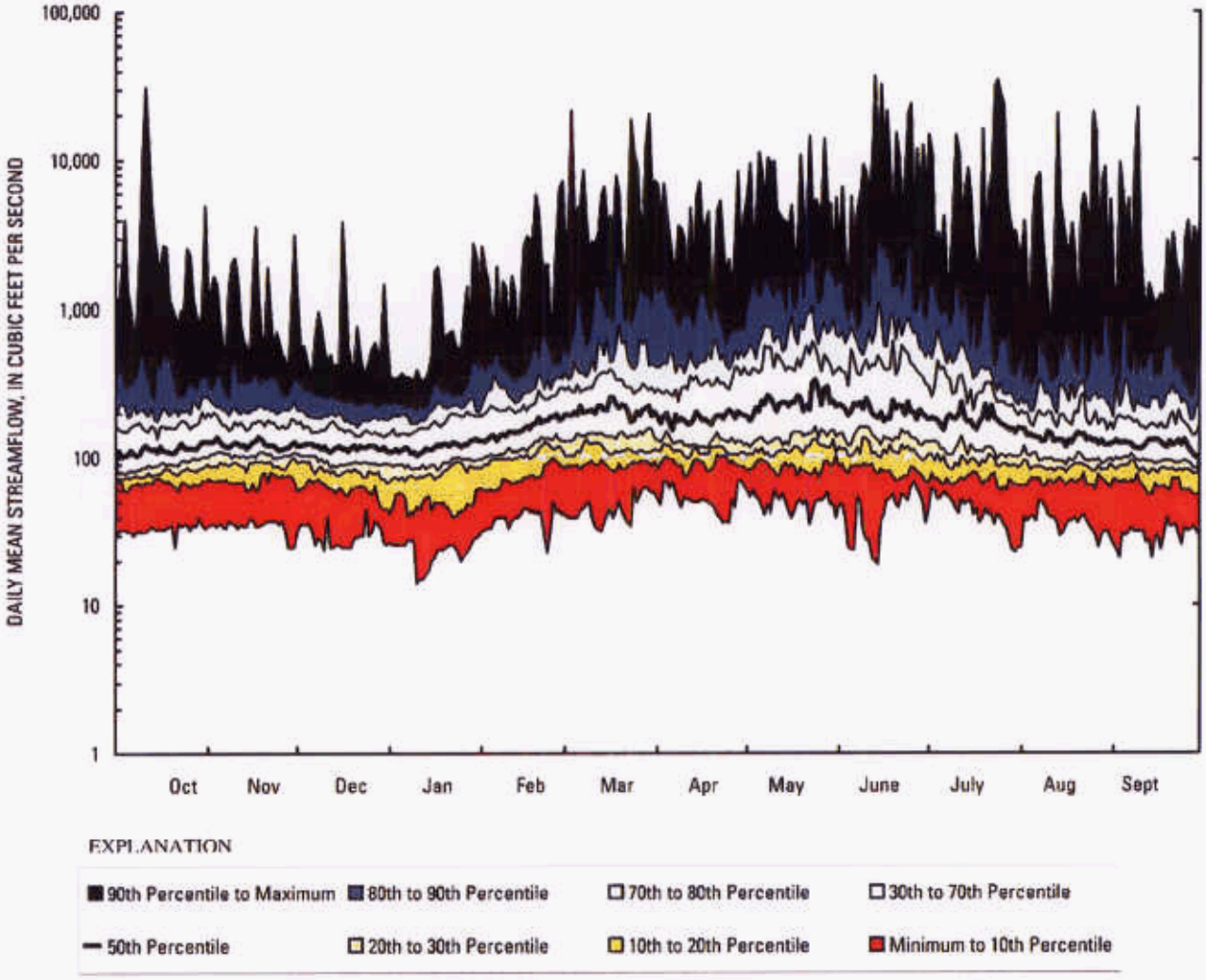
PERIOD OF RECORD.--November 1951 to current year. Records furnished by Corps of Engineers prior to Oct. 1, 1972.

GAGE.--Water-stage recorder. Datum of gage is 1,066.14 ft above sea level. Datum lowered 2.00 ft Feb. 6, 2002. Prior to Nov. 5, 1964, non-recording gage at same site. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor.

EXTREMES FOR PERIOD OF RECORD.--Maximum streamflow 41,000 ft³, June 24, 1963, G.H. 23.46 feet; maximum gage height, 23.50 feet, Oct. 11, 1973, from flood mark; minimum daily streamflow 14 ft³, Jan. 10, 1957.

Non-exceedance duration hydrograph for Salt Creek at Greenwood, Nebr. (06803555) (1951-2004 period of record)



06803555 SALT CREEK AT GREENWOOD, NEBR.

Monthly and annual streamflow, 1951-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	2,681	36	247	450	1.82
November	638	35	176	116	0.66
December	465	37	146	89	0.61
January	520	26	157	105	0.67
February	952	41	261	182	0.70
March	3,481	51	489	602	1.23
April	2,023	58	397	421	1.06
May	2,383	55	591	591	1.00
June	4,101	66	698	768	1.10
July	5,461	56	501	781	1.56
August	1,748	43	307	340	1.11
September	1,534	53	251	262	1.05
Annua	1,054	108	350	223	0.64

Magnitude and probability of annual low flow based on period of record, 1951-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	69	41	30	23	17	13
2	71	42	31	24	17	13
3	73	43	32	24	17	14
7	78	48	36	28	20	16
14	83	53	40	32	24	20
30	94	60	47	37	29	24
60	108	72	57	47	38	32
90	116	77	62	52	42	36
183	140	91	73	62	52	46
			October-November			
1	89	57	45	36	29	25
2	90	59	47	39	32	28
3	92	60	48	41	33	29
7	95	63	52	44	36	32
14	103	69	56	47	39	35
30	118	77	63	53	44	39
60	138	87	73	65	58	55

Duration of daily mean flow based on period of record, 1951-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
3979	2439	1109	581	411	324	267	234	201	182	164	148	138	128	117	108	100	92	83	72	57	40	33

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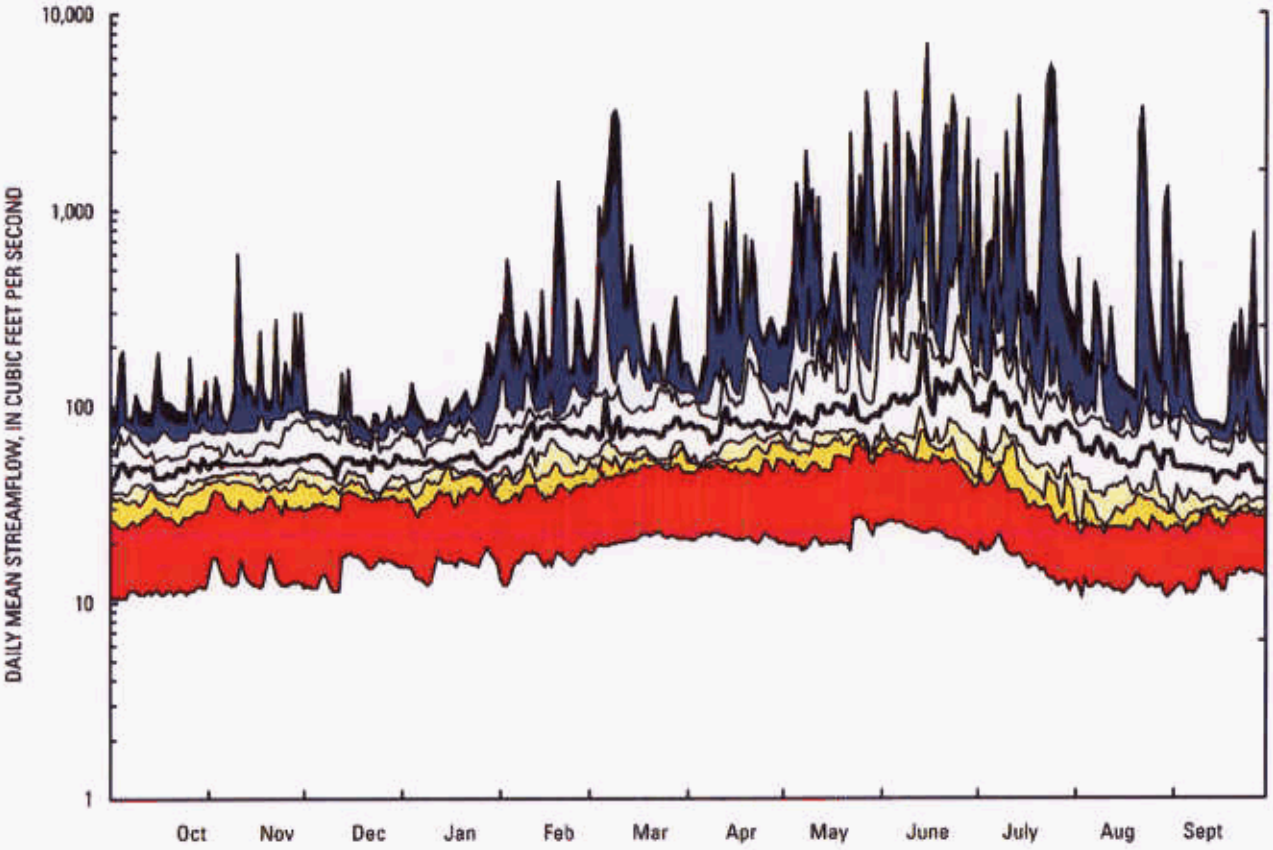
06804700 WAHOO CREEK AT ASHLAND, NEBR.

LOCATION.--Lat 41°03'13", long 96°22'04", in SW ¼ NW ¼ sec.36, T.13., R.9 E., Saunders County, Hydrologic Unit 10200203, at right upstream side of bridge near end of guard rail on State Highway 63, 1 mi north of Ashland, and at mile 2.6.
DRAINAGE AREA.--416 mi².

STREAMFLOW RECORDS

REVISED RECORDS.--WDR NE-99-1: Datum.
PERIOD OF RECORD.--September 1990 to current year.
GAGE.--Water-stage recorder. Datum of gage is 1,048.77 ft above sea level.
REMARKS.--Records good except for estimated daily streamflows, which are poor.

Non-exceedance duration hydrograph for Wahoo Cr at Ashland, Nebr. (06804700) (1990-2004 period of record)



EXPLANATION

90th Percentile to Maximum	80th to 90th Percentile	70th to 80th Percentile	30th to 70th Percentile
50th Percentile	20th to 30th Percentile	10th to 20th Percentile	Minimum to 10th Percentile

06804700 WAHOO CREEK AT ASHLAND, NEBR.

Monthly and annual streamflow, 1990-2004

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	98	29	53	18	0.35
November	125	36	62	25	0.41
December	86	37	56	17	0.30
January	92	36	58	19	0.32
February	199	36	88	45	0.51
March	581	47	130	136	1.05
April	247	47	109	63	0.57
May	552	68	187	154	0.82
June	1,031	56	299	276	0.92
July	1,032	34	179	246	1.37
August	341	23	90	86	0.96
September	150	28	55	32	0.58
Annual	223	50	114	54	0.48

Magnitude and probability of annual low flow based on period of record, 1990-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	32	24	21	19	17	16
2	33	25	22	19	17	16
3	33	25	22	20	18	16
7	35	27	23	21	19	18
14	38	29	25	22	19	17
30	43	31	27	23	20	18
60	48	36	30	26	22	20
90	49	37	32	28	25	22
183	56	42	36	32	28	25
October-November						
1	40	29	24	21	18	16
2	41	29	25	21	18	16
3	42	30	25	22	18	16
7	43	31	26	22	19	17
14	45	33	27	24	20	18
30	48	35	29	25	21	18
60	53	38	32	28	23	21

Duration of daily mean flow based on period of record, 1990-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																					
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
1277	600	278	166	129	106	95	85	80	75	70	65	61	57	53	50	46	43	39	35	29	24	22

06805500 PLATTE RIVER AT LOUISVILLE, NEBR.

LOCATION.--Lat 41°00'55", long 96°092'8", in NW ¼ NW ¼ sec.14, T.12 N., R.11 E., Sarpy County, Hydrologic Unit 10200202, on the left bank at the upstream side of bridge on Nebraska Highway 50, 1 mi north of Louisville, and at mile 16.5.

DRAINAGE AREA.--85,329 mi² of which 14,329 mi² probably is noncontributing.

STREAMFLOW RECORDS

REVISED RECORDS.--WDR NE-97-1: Drainage area, 1995.

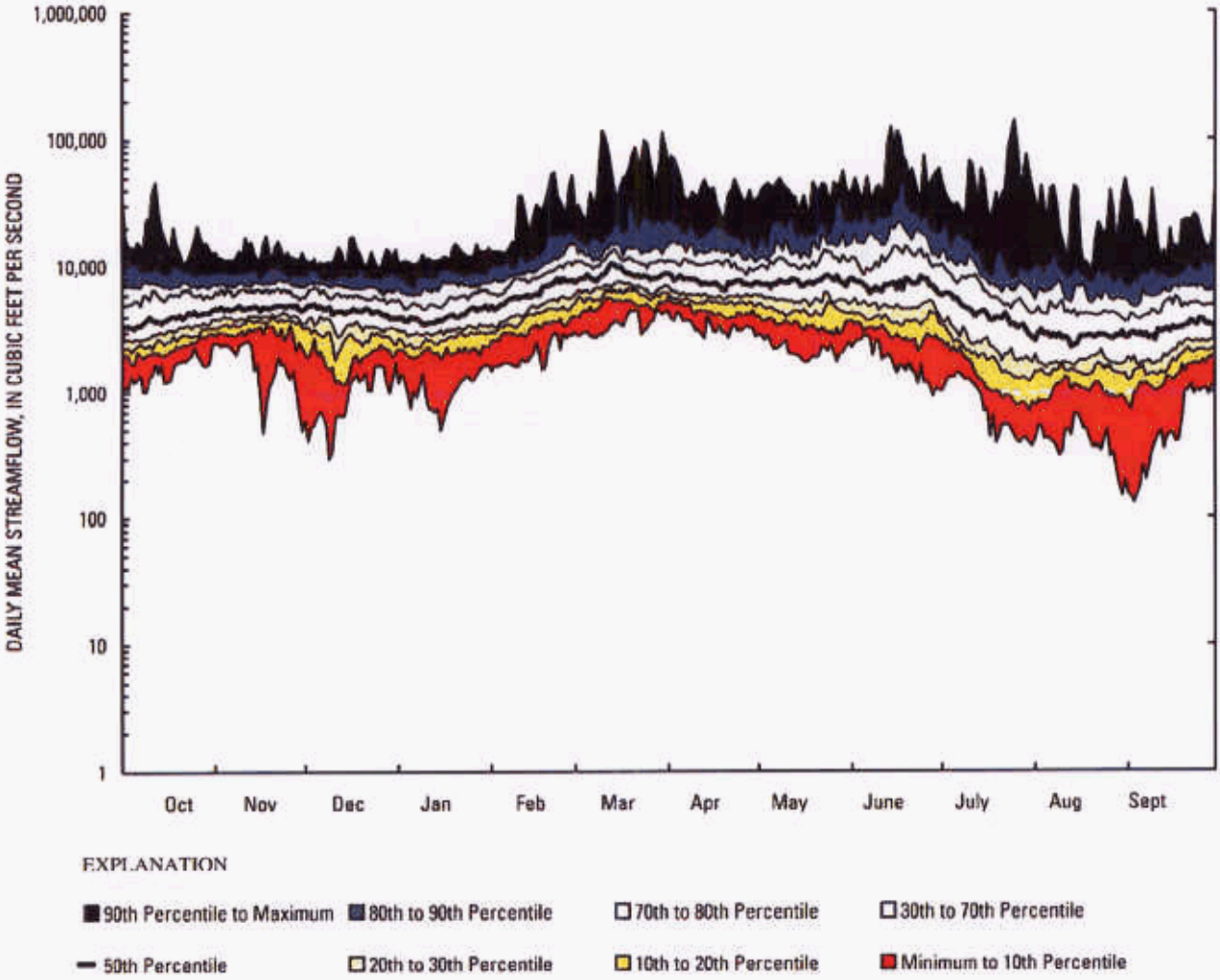
PERIOD OF RECORD.--May 1953 to current year. October 1961 to September 1973 published as Platte River at South Bend.

GAGE.--Water-stage recorder. Datum of gage is 1,007.10 ft above sea level. Dec. 5, 1961 to Sept. 30, 1973 at site 7 mi upstream at datum 31.43 ft higher. Data collection platform at station.

REMARKS.--Records good except for estimated daily streamflows, which are poor. Natural flow of stream affected by storage reservoirs, power developments, ground-water withdrawals and diversions for irrigation, and return flow from irrigated areas.

EXTREMES FOR PERIOD OF RECORD.--Maximum streamflow, 124,000 ft³ Mar. 30, 1960, gage height, 12.45 feet; minimum daily, 131 ft³ Sept. 3, 1976. Flood stage is 9.0 feet, gage datum.

Non-exceedance duration hydrograph for Platte River at Louisville, Nebr. (06805500) (1953-2004 period of record)



06805500 PLATTE RIVER AT LOUISVILLE, NEBR.

Monthly and annual streamflow, 1953-2005

	Maximum (ft^3/s)	Minimum (ft^3/s)	Mean (ft^3/s)	Standard deviation	Coefficient of variation
October	15,630	1,604	5,064	2,998	0.59
November	10,580	2,234	5,456	2,125	0.39
December	10,910	1,456	4,870	2,020	0.41
January	10,810	1,822	4,711	2,121	0.45
February	17,270	3,237	7,441	3,184	0.43
March	27,010	4,898	10,907	5,264	0.48
April	34,250	3,701	9,782	5,736	0.59
May	35,350	2,548	9,802	5,818	0.59
June	39,430	2,493	11,075	8,175	0.74
July	43,440	978	6,148	6,302	1.02
August	13,890	519	4,029	3,027	0.75
September	12,870	975	4,196	2,925	0.70
Annual	16,210	2,885	6,967	2,947	0.42

Magnitude and probability of annual low flow based on period of record, 1953-2004

Period (consecutive days)	Streamflow, in ft^3/s, for indicated recurrence interval, in years, and non-exceedance probability, in percent					
	2	5	10	20	50	100
	50%	20%	10%	5%	2%	1%
1	1,136	602	420	307	213	165
2	1,202	637	445	326	227	176
3	1,266	673	470	344	238	185
7	1,492	792	545	391	263	198
14	1,778	942	647	463	309	233
30	2,208	1,221	869	645	454	355
60	2,829	1,664	1,229	944	691	556
90	3,204	1,997	1,548	1,249	977	828
183	4,017	2,758	2,279	1,954	1,648	1,474
	October-November					
1	2,779	1,576	1,131	843	594	464
2	2,864	1,688	1,253	968	715	580
3	2,966	1,815	1,385	1,100	842	701
7	3,253	2,128	1,709	1,427	1,166	1,020
14	3,641	2,440	1,989	1,684	1,401	1,241
30	4,084	2,801	2,317	1,987	1,679	1,504
60	4,649	3,302	2,804	2,469	2,157	1,980

Duration of daily mean flow based on period of record, 1953-2004

Streamflow, in ft^3/s, which was equaled or exceeded for indicated percentage of time																						
1%	2%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	98%	99%
13194	12992	12387	11378	10369	9360	8351	7457	6898	6339	5781	5313	4860	4407	4021	3656	3290	2896	2503	2008	1479	1003	725

APPENDIX 2 – Trends in streamflow

Table 1. Trends in streamflow of Platte River at Duncan, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06774000 PLATTE RIVER AT DUNCAN, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1942-2004	0.108	0.103	--
November mean flow	1942-2004	0.059	0.378	--
December mean flow	1942-2004	0.135	0.042	18
January mean flow	1942-2004	0.161	0.016	18
February mean flow	1942-2004	0.065	0.331	--
March mean flow	1942-2004	0.020	0.759	--
April mean flow	1942-2004	0.023	0.732	--
May mean flow	1942-2004	0.064	0.335	--
June mean flow	1942-2004	0.024	0.721	--
July mean flow	1942-2004	0.048	0.474	--
August mean flow	1942-2004	0.148	0.026	21
September mean flow	1942-2004	0.131	0.049	20
Annual mean flow	1929-2003	0.201	0.011	13
1-day low flow	1930-2004	0.397	< 0.001	1.1
2-day low flow	1930-2004	0.391	< 0.001	1.2
3-day low flow	1930-2004	0.394	< 0.001	1.3
7-day low flow	1930-2004	0.389	< 0.001	1.6
14-day low flow	1930-2004	0.401	< 0.001	2.5
30-day low flow	1930-2004	0.444	< 0.001	4.8
60-day low flow	1930-2004	0.412	< 0.001	7.5
90-day low flow	1930-2004	0.361	< 0.001	11
183-day low flow	1930-2004	0.307	< 0.001	12
1-day low flow (Oct-Nov)	1928-2003	0.274	< 0.001	8.2
2-day low flow (Oct-Nov)	1928-2003	0.261	0.001	8.4
3-day low flow (Oct-Nov)	1928-2003	0.260	0.001	8.7
7-day low flow (Oct-Nov)	1928-2003	0.267	0.001	10
14-day low flow (Oct-Nov)	1928-2003	0.270	0.001	12
30-day low flow (Oct-Nov)	1928-2003	0.244	0.002	13
60-day low flow (Oct-Nov)	1928-2003	0.225	0.004	14

Table 2. Trends in streamflow of Platte River at North Bend, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06796000 PLATTE RIVER AT NORTH BEND, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1949-2004	0.200	0.029	29
November mean flow	1949-2004	0.190	0.038	27
December mean flow	1949-2004	0.239	0.009	29
January mean flow	1949-2004	0.176	0.055	--
February mean flow	1949-2004	0.032	0.729	--
March mean flow	1949-2004	-0.036	0.692	--
April mean flow	1949-2004	0.057	0.534	--
May mean flow	1949-2004	0.044	0.631	--
June mean flow	1949-2004	0.045	0.621	--
July mean flow	1949-2004	0.062	0.497	--
August mean flow	1949-2004	0.129	0.162	--
September mean flow	1949-2004	0.170	0.064	--
Annual mean flow	1949-2003	0.194	0.039	26
1-day low flow	1950-2004	0.104	0.264	--
2-day low flow	1950-2004	0.087	0.353	--
3-day low flow	1950-2004	0.099	0.289	--
7-day low flow	1950-2004	0.134	0.151	--
14-day low flow	1950-2004	0.156	0.095	--
30-day low flow	1950-2004	0.192	0.039	14
60-day low flow	1950-2004	0.201	0.031	19
90-day low flow	1950-2004	0.184	0.048	22
183-day low flow	1950-2004	0.230	0.014	23
1-day low flow (Oct-Nov)	1948-2003	0.198	0.033	18
2-day low flow (Oct-Nov)	1948-2003	0.228	0.014	23
3-day low flow (Oct-Nov)	1948-2003	0.230	0.014	24
7-day low flow (Oct-Nov)	1948-2003	0.231	0.013	23
14-day low flow (Oct-Nov)	1948-2003	0.236	0.011	25
30-day low flow (Oct-Nov)	1948-2003	0.226	0.015	27
60-day low flow (Oct-Nov)	1948-2003	0.235	0.012	30

Table 3. Trends in streamflow of Platte River near Leshara, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06796500 PLATTE RIVER NEAR LESHARA, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1995-2005	-0.600	0.010	-400
November mean flow	1995-2005	-0.564	0.016	-380
December mean flow	1995-2005	-0.564	0.016	-390
January mean flow	1995-2005	-0.582	0.012	-410
February mean flow	1995-2005	-0.455	0.052	--
March mean flow	1995-2005	-0.273	0.243	--
April mean flow	1995-2005	-0.418	0.073	--
May mean flow	1995-2005	-0.418	0.073	--
June mean flow	1995-2005	-0.527	0.024	-1100
July mean flow	1995-2005	-0.600	0.010	-610
August mean flow	1995-2005	-0.491	0.036	-530
September mean flow	1995-2005	-0.709	0.002	-420
Annual mean flow	1994-2004	-0.511	0.049	-510
				0
1-day low flow	1995-2005	-0.378	0.152	--
2-day low flow	1995-2005	-0.378	0.152	--
3-day low flow	1995-2005	-0.378	0.152	--
7-day low flow	1995-2005	-0.467	0.074	--
14-day low flow	1995-2005	-0.467	0.074	--
30-day low flow	1995-2005	-0.467	0.074	--
60-day low flow	1995-2005	-0.511	0.049	-380
90-day low flow	1995-2005	-0.511	0.049	-450
183-day low flow	1995-2005	-0.600	0.020	-430
1-day low flow (Oct-Nov)	1994-2005	-0.491	0.043	-280
2-day low flow (Oct-Nov)	1994-2005	-0.455	0.062	--
3-day low flow (Oct-Nov)	1994-2005	-0.455	0.062	--
7-day low flow (Oct-Nov)	1994-2005	-0.491	0.043	-330
14-day low flow (Oct-Nov)	1994-2005	-0.527	0.029	-350
30-day low flow (Oct-Nov)	1994-2005	-0.600	0.013	-390
60-day low flow (Oct-Nov)	1994-2005	-0.673	0.005	-450

Table 4. Trends in streamflow of Elkhorn River near Atkinson, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06796973 ELKHORN RIVER NEAR ATKINSON, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1983-2004	-0.600	0.010	-1.2
November mean flow	1983-2004	-0.564	0.016	0.0
December mean flow	1983-2004	-0.564	0.016	-0.2
January mean flow	1983-2004	-0.582	0.012	-0.6
February mean flow	1983-2004	-0.455	0.052	--
March mean flow	1983-2004	-0.273	0.243	--
April mean flow	1983-2004	-0.418	0.073	--
May mean flow	1983-2004	-0.418	0.073	--
June mean flow	1983-2004	-0.527	0.024	1.0
July mean flow	1983-2004	-0.600	0.010	-3.5
August mean flow	1983-2004	-0.491	0.036	-1.3
September mean flow	1983-2004	-0.709	0.002	-4.2
Annual mean flow	1983-2003	-0.158	0.347	--
1-day low flow	1984-2004	-0.195	0.242	--
2-day low flow	1984-2004	-0.200	0.230	--
3-day low flow	1984-2004	-0.200	0.230	--
7-day low flow	1984-2004	-0.189	0.256	--
14-day low flow	1984-2004	-0.179	0.284	--
30-day low flow	1984-2004	-0.200	0.230	--
60-day low flow	1984-2004	-0.221	0.183	--
90-day low flow	1984-2004	-0.221	0.183	--
183-day low flow	1984-2004	-0.200	0.230	--
1-day low flow (Oct-Nov)	1982-2003	-0.157	0.333	--
2-day low flow (Oct-Nov)	1982-2003	-0.157	0.334	--
3-day low flow (Oct-Nov)	1982-2003	-0.157	0.334	--
7-day low flow (Oct-Nov)	1982-2003	-0.152	0.349	--
14-day low flow (Oct-Nov)	1982-2003	-0.152	0.349	--
30-day low flow (Oct-Nov)	1982-2003	-0.152	0.349	--
60-day low flow (Oct-Nov)	1982-2003	-0.200	0.216	--

Table 5. Trends in streamflow of Elkhorn River at Ewing, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06797500 ELKHORN RIVER AT EWING, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1948-2004	0.014	0.874	--
November mean flow	1948-2004	0.081	0.374	--
December mean flow	1948-2004	0.100	0.273	--
January mean flow	1948-2004	0.150	0.100	--
February mean flow	1948-2004	0.150	0.098	--
March mean flow	1948-2004	0.023	0.799	--
April mean flow	1948-2004	-0.009	0.923	--
May mean flow	1948-2004	0.050	0.582	--
June mean flow	1948-2004	-0.048	0.596	--
July mean flow	1948-2004	-0.025	0.783	--
August mean flow	1948-2004	-0.100	0.274	--
September mean flow	1948-2004	-0.053	0.558	--
Annual mean flow	1947-2003	0.091	0.326	--
1-day low flow	1948-2004	-0.072	0.437	--
2-day low flow	1948-2004	-0.077	0.404	--
3-day low flow	1948-2004	-0.069	0.458	--
7-day low flow	1948-2004	-0.064	0.493	--
14-day low flow	1948-2004	-0.077	0.408	--
30-day low flow	1948-2004	-0.068	0.462	--
60-day low flow	1948-2004	-0.053	0.572	--
90-day low flow	1948-2004	-0.023	0.805	--
183-day low flow	1948-2004	0.032	0.729	--
1-day low flow (Oct-Nov)	1946-2003	0.018	0.852	--
2-day low flow (Oct-Nov)	1946-2003	0.018	0.853	--
3-day low flow (Oct-Nov)	1946-2003	0.029	0.751	--
7-day low flow (Oct-Nov)	1946-2003	0.061	0.504	--
14-day low flow (Oct-Nov)	1946-2003	0.038	0.680	--
30-day low flow (Oct-Nov)	1946-2003	0.028	0.762	--
60-day low flow (Oct-Nov)	1946-2003	0.033	0.720	--

Table 6. Trends in streamflow of South Fork Elkhorn River at Ewing,

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06798000 SOUTH FORK ELKHORN RIVER AT EWING, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1948-2004	0.088	0.395	--
November mean flow	1948-2004	-0.078	0.451	--
December mean flow	1948-2004	0.052	0.618	--
January mean flow	1948-2004	0.344	0.001	0.4
February mean flow	1948-2004	0.064	0.538	--
March mean flow	1948-2004	-0.358	0.001	-2.0
April mean flow	1948-2004	-0.208	0.044	-1.5
May mean flow	1948-2004	-0.043	0.674	--
June mean flow	1948-2004	0.099	0.338	--
July mean flow	1948-2004	0.224	0.030	2.1
August mean flow	1948-2004	0.197	0.053	--
September mean flow	1948-2004	0.091	0.373	--
Annual mean flow	1947-2003	-0.012	0.917	--
1-day low flow	1948-2004	0.290	0.009	0.2
2-day low flow	1948-2004	0.263	0.017	0.2
3-day low flow	1948-2004	0.235	0.034	0.1
7-day low flow	1948-2004	0.219	0.047	0.1
14-day low flow	1948-2004	0.178	0.108	--
30-day low flow	1948-2004	0.118	0.289	--
60-day low flow	1948-2004	0.108	0.334	--
90-day low flow	1948-2004	0.095	0.395	--
183-day low flow	1948-2004	0.100	0.370	--
1-day low flow (Oct-Nov)	1946-2003	0.210	0.043	0.2
2-day low flow (Oct-Nov)	1946-2003	0.217	0.036	0.2
3-day low flow (Oct-Nov)	1946-2003	0.214	0.039	0.1
7-day low flow (Oct-Nov)	1946-2003	0.192	0.064	--
14-day low flow (Oct-Nov)	1946-2003	0.123	0.237	--
30-day low flow (Oct-Nov)	1946-2003	0.127	0.221	--
60-day low flow (Oct-Nov)	1946-2003	0.098	0.348	--

Table 7. Trends in streamflow of Elkhorn River at Neligh, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06798500 ELKHORN RIVER AT NELIGH, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1931-2002	0.346	< 0.001	0.9
November mean flow	1931-2002	0.444	< 0.001	1.5
December mean flow	1931-2002	0.498	< 0.001	1.1
January mean flow	1931-2002	0.473	< 0.001	1.3
February mean flow	1931-2002	0.225	0.009	3.0
March mean flow	1931-2002	0.101	0.240	--
April mean flow	1931-2002	0.287	0.001	9.7
May mean flow	1931-2002	0.300	0.001	7.4
June mean flow	1931-2002	0.182	0.035	1.4
July mean flow	1931-2002	0.214	0.013	3.1
August mean flow	1931-2002	0.162	0.061	--
September mean flow	1931-2002	0.282	0.001	1.4
Annual mean flow	1931-2003	0.234	0.004	2.6
1-day low flow	1932-2004	0.178	0.032	0.5
2-day low flow	1932-2004	0.172	0.038	0.5
3-day low flow	1932-2004	0.172	0.039	0.5
7-day low flow	1932-2004	0.191	0.022	0.6
14-day low flow	1932-2004	0.158	0.058	--
30-day low flow	1932-2004	0.162	0.051	--
60-day low flow	1932-2004	0.178	0.032	0.6
90-day low flow	1932-2004	0.177	0.033	0.7
183-day low flow	1932-2004	0.208	0.012	0.8
1-day low flow (Oct-Nov)	1931-2004	0.213	0.009	2.2
2-day low flow (Oct-Nov)	1930-2003	0.129	0.112	--
3-day low flow (Oct-Nov)	1930-2003	0.140	0.084	--
7-day low flow (Oct-Nov)	1930-2003	0.140	0.085	--
14-day low flow (Oct-Nov)	1930-2003	0.144	0.077	--
30-day low flow (Oct-Nov)	1930-2003	0.157	0.053	--
60-day low flow (Oct-Nov)	1930-2003	0.188	0.021	0.7

Table 8. Trends in streamflow of Elkhorn River at Norfolk, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06799000 ELKHORN RIVER AT NORFOLK, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1946-2004	0.037	0.676	--
November mean flow	1946-2004	0.124	0.164	--
December mean flow	1946-2004	0.185	0.038	1.6
January mean flow	1946-2004	0.157	0.080	--
February mean flow	1946-2004	0.103	0.250	--
March mean flow	1946-2004	-0.016	0.860	--
April mean flow	1946-2004	0.021	0.814	--
May mean flow	1946-2004	0.106	0.234	--
June mean flow	1946-2004	-0.043	0.633	--
July mean flow	1946-2004	0.014	0.875	--
August mean flow	1946-2004	-0.020	0.824	--
September mean flow	1946-2004	-0.034	0.700	--
Annual mean flow	1896-2003	0.066	0.464	--
1-day low flow	1897-2004	-0.004	0.968	--
2-day low flow	1897-2004	-0.005	0.957	--
3-day low flow	1897-2004	0.004	0.968	--
7-day low flow	1897-2004	-0.027	0.773	--
14-day low flow	1897-2004	-0.041	0.658	--
30-day low flow	1897-2004	-0.026	0.778	--
60-day low flow	1897-2004	0.048	0.601	--
90-day low flow	1897-2004	0.056	0.537	--
183-day low flow	1897-2004	0.049	0.592	--
1-day low flow (Oct-Nov)	1895-2003	0.045	0.606	--
2-day low flow (Oct-Nov)	1895-2003	0.042	0.631	--
3-day low flow (Oct-Nov)	1895-2003	0.050	0.572	--
7-day low flow (Oct-Nov)	1895-2003	0.039	0.662	--
14-day low flow (Oct-Nov)	1895-2003	0.032	0.716	--
30-day low flow (Oct-Nov)	1895-2003	0.024	0.785	--
60-day low flow (Oct-Nov)	1895-2003	0.063	0.474	--

Table 9. Trends in streamflow of North Fork Elkhorn River near

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06799100 NORTH FORK ELKHORN RIVER NEAR PIERCE, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1961-2004	-0.025	0.808	--
November mean flow	1961-2004	0.122	0.245	--
December mean flow	1961-2004	0.172	0.099	--
January mean flow	1961-2004	0.106	0.311	--
February mean flow	1961-2004	0.085	0.418	--
March mean flow	1961-2004	0.073	0.485	--
April mean flow	1961-2004	0.111	0.288	--
May mean flow	1961-2004	0.212	0.042	3.6
June mean flow	1961-2004	0.066	0.531	--
July mean flow	1961-2004	0.145	0.166	--
August mean flow	1961-2004	0.040	0.700	--
September mean flow	1961-2004	-0.023	0.824	--
Annual mean flow	1960-2003	0.136	0.202	--
1-day low flow	1961-2004	0.065	0.543	--
2-day low flow	1961-2004	0.063	0.558	--
3-day low flow	1961-2004	0.047	0.668	--
7-day low flow	1961-2004	0.040	0.714	--
14-day low flow	1961-2004	0.040	0.714	--
30-day low flow	1961-2004	0.011	0.925	--
60-day low flow	1961-2004	0.034	0.754	--
90-day low flow	1961-2004	0.045	0.675	--
183-day low flow	1961-2004	0.081	0.451	--
1-day low flow (Oct-Nov)	1959-2003	0.042	0.693	--
2-day low flow (Oct-Nov)	1959-2003	0.037	0.731	--
3-day low flow (Oct-Nov)	1959-2003	0.026	0.808	--
7-day low flow (Oct-Nov)	1959-2003	-0.006	0.960	--
14-day low flow (Oct-Nov)	1959-2003	-0.019	0.863	--
30-day low flow (Oct-Nov)	1959-2003	-0.005	0.968	--
60-day low flow (Oct-Nov)	1959-2003	0.044	0.678	--

Table 10. Trends in streamflow of Elkhorn River at West Point, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06799350 ELKHORN RIVER AT WEST POINT, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1973-2004	0.230	0.065	--
November mean flow	1973-2004	0.258	0.038	13
December mean flow	1973-2004	0.335	0.007	16
January mean flow	1973-2004	0.250	0.044	8.4
February mean flow	1973-2004	0.133	0.284	--
March mean flow	1973-2004	-0.044	0.721	--
April mean flow	1973-2004	0.056	0.650	--
May mean flow	1973-2004	0.222	0.074	--
June mean flow	1973-2004	0.157	0.206	--
July mean flow	1973-2004	0.331	0.008	35
August mean flow	1973-2004	0.181	0.144	--
September mean flow	1973-2004	0.210	0.092	--
Annual mean flow	1973-2003	0.209	0.103	--
1-day low flow	1974-2004	0.155	0.227	--
2-day low flow	1974-2004	0.151	0.241	--
3-day low flow	1974-2004	0.163	0.202	--
7-day low flow	1974-2004	0.204	0.110	--
14-day low flow	1974-2004	0.191	0.135	--
30-day low flow	1974-2004	0.260	0.041	7.2
60-day low flow	1974-2004	0.320	0.012	9.1
90-day low flow	1974-2004	0.295	0.021	9.8
183-day low flow	1974-2004	0.316	0.013	9.7
1-day low flow (Oct-Nov)	1972-2003	0.185	0.140	--
2-day low flow (Oct-Nov)	1972-2003	0.179	0.154	--
3-day low flow (Oct-Nov)	1972-2003	0.202	0.108	--
7-day low flow (Oct-Nov)	1972-2003	0.242	0.054	--
14-day low flow (Oct-Nov)	1972-2003	0.242	0.054	--
30-day low flow (Oct-Nov)	1972-2003	0.262	0.036	8.3
60-day low flow (Oct-Nov)	1972-2003	0.242	0.054	--

Table 11. Trends in streamflow of Pebble Creek at Scribner, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06799385 PEBBLE CREEK AT SCRIBNER, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1980-2004	-0.382	0.102	--
November mean flow	1980-2004	-0.164	0.484	--
December mean flow	1980-2004	-0.491	0.036	-2.3
January mean flow	1980-2004	-0.273	0.243	--
February mean flow	1980-2004	-0.491	0.036	-3.8
March mean flow	1980-2004	-0.091	0.697	--
April mean flow	1980-2004	0.018	0.938	--
May mean flow	1980-2004	0.200	0.392	--
June mean flow	1980-2004	-0.273	0.243	--
July mean flow	1980-2004	-0.382	0.102	--
August mean flow	1980-2004	-0.527	0.024	-18
September mean flow	1980-2004	-0.564	0.016	-5.0
Annual mean flow	1979-2003	0.053	0.726	--
1-day low flow	1980-2004	0.287	0.047	0.5
2-day low flow	1980-2004	0.293	0.042	0.5
3-day low flow	1980-2004	0.297	0.040	0.5
7-day low flow	1980-2004	0.320	0.027	0.5
14-day low flow	1980-2004	0.327	0.023	0.6
30-day low flow	1980-2004	0.413	0.004	0.8
60-day low flow	1980-2004	0.287	0.047	0.7
90-day low flow	1980-2004	0.240	0.097	--
183-day low flow	1980-2004	0.127	0.388	--
1-day low flow (Oct-Nov)	1978-2003	0.323	0.022	0.8
2-day low flow (Oct-Nov)	1978-2003	0.317	0.024	0.8
3-day low flow (Oct-Nov)	1978-2003	0.314	0.026	0.8
7-day low flow (Oct-Nov)	1978-2003	0.262	0.064	--
14-day low flow (Oct-Nov)	1978-2003	0.243	0.086	--
30-day low flow (Oct-Nov)	1978-2003	0.212	0.134	--
60-day low flow (Oct-Nov)	1978-2003	0.138	0.332	--

Table 12. Trends in streamflow of Logan Creek near Uehling, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant; NC, slope not calculated]

06799500 LOGAN CREEK NEAR UEHLING, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1941-2004	0.351	< 0.000	NC
November mean flow	1941-2004	0.446	< 0.000	NC
December mean flow	1941-2004	0.501	< 0.000	NC
January mean flow	1941-2004	0.474	< 0.000	NC
February mean flow	1941-2004	0.238	0.005	NC
March mean flow	1941-2004	0.103	0.226	NC
April mean flow	1941-2004	0.305	< 0.000	NC
May mean flow	1941-2004	0.317	< 0.000	NC
June mean flow	1941-2004	0.180	0.034	NC
July mean flow	1941-2004	0.202	0.017	NC
August mean flow	1941-2004	0.181	0.033	NC
September mean flow	1941-2004	0.300	< 0.000	NC
Annual mean flow	1941-2003	0.285	0.001	NC
1-day low flow	1942-2004	0.475	< 0.001	1.4
2-day low flow	1942-2004	0.457	< 0.001	1.3
3-day low flow	1942-2004	0.458	< 0.001	1.3
7-day low flow	1942-2004	0.445	< 0.001	1.4
14-day low flow	1942-2004	0.438	< 0.001	1.4
30-day low flow	1942-2004	0.462	< 0.001	1.5
60-day low flow	1942-2004	0.458	< 0.001	1.6
90-day low flow	1942-2004	0.450	< 0.001	1.8
183-day low flow	1942-2004	0.361	< 0.001	1.8
1-day low flow (Oct-Nov)	1940-2003	0.487	< 0.001	1.7
2-day low flow (Oct-Nov)	1940-2003	0.477	< 0.001	1.7
3-day low flow (Oct-Nov)	1940-2003	0.471	< 0.001	1.7
7-day low flow (Oct-Nov)	1940-2003	0.467	< 0.001	1.6
14-day low flow (Oct-Nov)	1940-2003	0.434	< 0.001	1.6
30-day low flow (Oct-Nov)	1940-2003	0.420	< 0.001	1.5
60-day low flow (Oct-Nov)	1940-2003	0.395	< 0.001	1.7

Table 13. Trends in streamflow of Maple Creek near Nickerson, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06800000 MAPLE CREEK NEAR NICKERSON, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1953-2004	0.229	0.016	0.9
November mean flow	1953-2004	0.347	< 0.001	1.2
December mean flow	1953-2004	0.342	< 0.001	1.0
January mean flow	1953-2004	0.306	0.001	0.9
February mean flow	1953-2004	0.173	0.068	--
March mean flow	1953-2004	0.165	0.080	--
April mean flow	1953-2004	0.241	0.011	1.5
May mean flow	1953-2004	0.261	0.006	2.5
June mean flow	1953-2004	0.118	0.214	--
July mean flow	1953-2004	0.231	0.014	3.4
August mean flow	1953-2004	0.198	0.036	1.6
September mean flow	1953-2004	0.258	0.006	0.9
Annual mean flow	1952-2003	0.275	0.004	1.2
1-day low flow	1953-2004	0.345	< 0.001	0.2
2-day low flow	1953-2004	0.341	< 0.001	0.2
3-day low flow	1953-2004	0.334	< 0.001	0.2
7-day low flow	1953-2004	0.321	0.001	0.2
14-day low flow	1953-2004	0.318	0.001	0.3
30-day low flow	1953-2004	0.345	< 0.001	0.4
60-day low flow	1953-2004	0.360	< 0.001	0.6
90-day low flow	1953-2004	0.380	< 0.001	0.6
183-day low flow	1953-2004	0.311	0.001	0.7
1-day low flow (Oct-Nov)	1951-2003	0.294	0.002	0.4
2-day low flow (Oct-Nov)	1951-2003	0.292	0.002	0.4
3-day low flow (Oct-Nov)	1951-2003	0.291	0.002	0.4
7-day low flow (Oct-Nov)	1951-2003	0.279	0.003	0.4
14-day low flow (Oct-Nov)	1951-2003	0.271	0.004	0.4
30-day low flow (Oct-Nov)	1951-2003	0.274	0.004	0.5
60-day low flow (Oct-Nov)	1951-2003	0.293	0.002	0.6

Table 14. Trends in streamflow of Elkhorn River at Waterloo, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06800500 ELKHORN RIVER AT WATERLOO, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1929-2004	0.301	< 0.001	10
November mean flow	1929-2004	0.392	< 0.001	11
December mean flow	1929-2004	0.431	< 0.001	11
January mean flow	1929-2004	0.397	< 0.001	9.3
February mean flow	1929-2004	0.353	< 0.001	17
March mean flow	1929-2004	0.204	0.009	18
April mean flow	1929-2004	0.315	< 0.001	29
May mean flow	1929-2004	0.303	< 0.001	27
June mean flow	1929-2004	0.196	0.012	22
July mean flow	1928-2004	0.256	0.001	22
August mean flow	1929-2004	0.180	0.021	9.3
September mean flow	1929-2004	0.201	0.010	7.9
Annual mean flow	1928-2003	0.341	< 0.001	15
1-day low flow	1929-2004	0.383	< 0.001	4.1
2-day low flow	1929-2004	0.385	< 0.001	4.3
3-day low flow	1929-2004	0.381	< 0.001	4.4
7-day low flow	1929-2004	0.355	< 0.001	4.8
14-day low flow	1929-2004	0.361	< 0.001	5.4
30-day low flow	1929-2004	0.363	< 0.001	6.0
60-day low flow	1929-2004	0.380	< 0.001	6.6
90-day low flow	1929-2004	0.398	< 0.001	7.1
183-day low flow	1929-2004	0.393	0.000	7.4
1-day low flow (Oct-Nov)	1927-2003	0.381	< 0.001	5.6
2-day low flow (Oct-Nov)	1927-2003	0.382	< 0.001	5.5
3-day low flow (Oct-Nov)	1927-2003	0.376	< 0.001	5.5
7-day low flow (Oct-Nov)	1927-2003	0.376	< 0.001	6.1
14-day low flow (Oct-Nov)	1927-2003	0.352	< 0.001	6.3
30-day low flow (Oct-Nov)	1927-2003	0.331	< 0.001	6.2
60-day low flow (Oct-Nov)	1927-2003	0.358	< 0.001	7.8

Table 15. Trends in streamflow of Salt Creek at Greenwood, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06803555 SALT CREEK AT GREENWOOD, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1953-2004	0.257	0.007	2.5
November mean flow	1953-2004	0.472	< 0.001	3.4
December mean flow	1953-2004	0.478	< 0.001	2.4
January mean flow	1953-2004	0.380	< 0.001	1.9
February mean flow	1953-2004	0.141	0.137	--
March mean flow	1953-2004	0.102	0.283	--
April mean flow	1953-2004	0.191	0.044	3.0
May mean flow	1953-2004	0.277	0.003	11
June mean flow	1953-2004	0.131	0.165	--
July mean flow	1953-2004	0.159	0.093	--
August mean flow	1953-2004	0.101	0.286	--
September mean flow	1953-2004	0.145	0.125	--
Annual mean flow	1952-2003	0.198	0.039	2.9
1-day low flow	1953-2004	0.560	< 0.001	1.7
2-day low flow	1953-2004	0.541	< 0.001	1.7
3-day low flow	1953-2004	0.526	< 0.001	1.7
7-day low flow	1953-2004	0.498	< 0.001	1.7
14-day low flow	1953-2004	0.488	< 0.001	1.7
30-day low flow	1953-2004	0.480	< 0.001	2.0
60-day low flow	1953-2004	0.495	< 0.001	2.0
90-day low flow	1953-2004	0.498	< 0.001	2.0
183-day low flow	1953-2004	0.419	0.000	2.2
1-day low flow (Oct-Nov)	1951-2003	0.449	< 0.001	1.5
2-day low flow (Oct-Nov)	1951-2003	0.446	< 0.001	1.5
3-day low flow (Oct-Nov)	1951-2003	0.435	< 0.001	1.5
7-day low flow (Oct-Nov)	1951-2003	0.429	< 0.001	1.5
14-day low flow (Oct-Nov)	1951-2003	0.428	< 0.001	1.7
30-day low flow (Oct-Nov)	1951-2003	0.463	< 0.001	2.0
60-day low flow (Oct-Nov)	1951-2003	0.391	< 0.001	2.6

Table 16. Trends in streamflow of Wahoo Creek at Ashland, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06804700 WAHOO CREEK AT ASHLAND, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1991-2005	-0.181	0.347	--
November mean flow	1991-2005	-0.181	0.347	--
December mean flow	1991-2005	-0.210	0.276	--
January mean flow	1991-2005	-0.295	0.125	--
February mean flow	1991-2005	-0.086	0.656	--
March mean flow	1991-2005	-0.276	0.151	--
April mean flow	1991-2005	-0.181	0.347	--
May mean flow	1991-2005	0.067	0.729	--
June mean flow	1991-2005	-0.276	0.151	--
July mean flow	1991-2005	-0.581	0.003	-28
August mean flow	1991-2005	-0.276	0.151	--
September mean flow	1991-2005	-0.371	0.054	--
Annual mean flow	1990-2004	-0.333	0.127	--
1-day low flow	1991-2005	-0.090	0.714	--
2-day low flow	1991-2005	-0.090	0.714	--
3-day low flow	1991-2005	-0.090	0.714	--
7-day low flow	1991-2005	-0.103	0.669	--
14-day low flow	1991-2005	-0.103	0.669	--
30-day low flow	1991-2005	-0.154	0.502	--
60-day low flow	1991-2005	-0.179	0.428	--
90-day low flow	1991-2005	-0.179	0.428	--
183-day low flow	1991-2005	-0.282	0.200	--
1-day low flow (Oct-Nov)	1989-2004	-0.229	0.254	--
2-day low flow (Oct-Nov)	1989-2004	-0.219	0.275	--
3-day low flow (Oct-Nov)	1989-2004	-0.210	0.298	--
7-day low flow (Oct-Nov)	1989-2004	-0.200	0.322	--
14-day low flow (Oct-Nov)	1989-2004	-0.200	0.322	--
30-day low flow (Oct-Nov)	1989-2004	-0.257	0.198	--
60-day low flow (Oct-Nov)	1989-2004	-0.219	0.276	--

Table 17. Trends in streamflow of Platte River at Louisville, Nebr.

[period analyzed is given as water years; p-value quantifies the probability of the available evidence to conclude for a trend slope different from zero could have arisen when there was actually no temporal trend; ft^3/s, cubic feet per second; <, less than; --, not significant]

06805500 PLATTE RIVER AT LOUISVILLE, NEBR.

Streamflow statistic	Period analyzed	Kendall's tau	p-value	Median slope of trend, in ft^3/s per year ($p < 0.05$)
October mean flow	1954-2004	0.229	0.016	63
November mean flow	1954-2004	0.347	< 0.001	63
December mean flow	1954-2004	0.342	< 0.001	66
January mean flow	1954-2004	0.306	0.001	68
February mean flow	1954-2004	0.173	0.068	--
March mean flow	1954-2004	0.165	0.080	--
April mean flow	1954-2004	0.241	0.011	72
May mean flow	1954-2004	0.261	0.006	100
June mean flow	1954-2004	0.118	0.214	--
July mean flow	1954-2004	0.256	0.001	96
August mean flow	1954-2004	0.180	0.021	57
September mean flow	1954-2004	0.201	0.010	56
Annual mean flow	1954-2004	0.282	0.004	70
1-day low flow	1954-2004	0.344	< 0.001	24
2-day low flow	1954-2004	0.354	< 0.001	27
3-day low flow	1954-2004	0.334	0.001	27
7-day low flow	1954-2004	0.291	0.003	28
14-day low flow	1954-2004	0.252	0.010	35
30-day low flow	1954-2004	0.260	0.008	45
60-day low flow	1954-2004	0.267	0.006	54
90-day low flow	1954-2004	0.276	0.005	57
183-day low flow	1954-2004	0.314	0.001	59
1-day low flow (Oct-Nov)	1952-2003	0.357	< 0.001	53
2-day low flow (Oct-Nov)	1952-2003	0.357	< 0.001	54
3-day low flow (Oct-Nov)	1952-2003	0.351	< 0.001	55
7-day low flow (Oct-Nov)	1952-2003	0.365	< 0.001	58
14-day low flow (Oct-Nov)	1952-2003	0.322	0.001	57
30-day low flow (Oct-Nov)	1952-2003	0.311	0.001	63
60-day low flow (Oct-Nov)	1952-2003	0.315	0.001	69

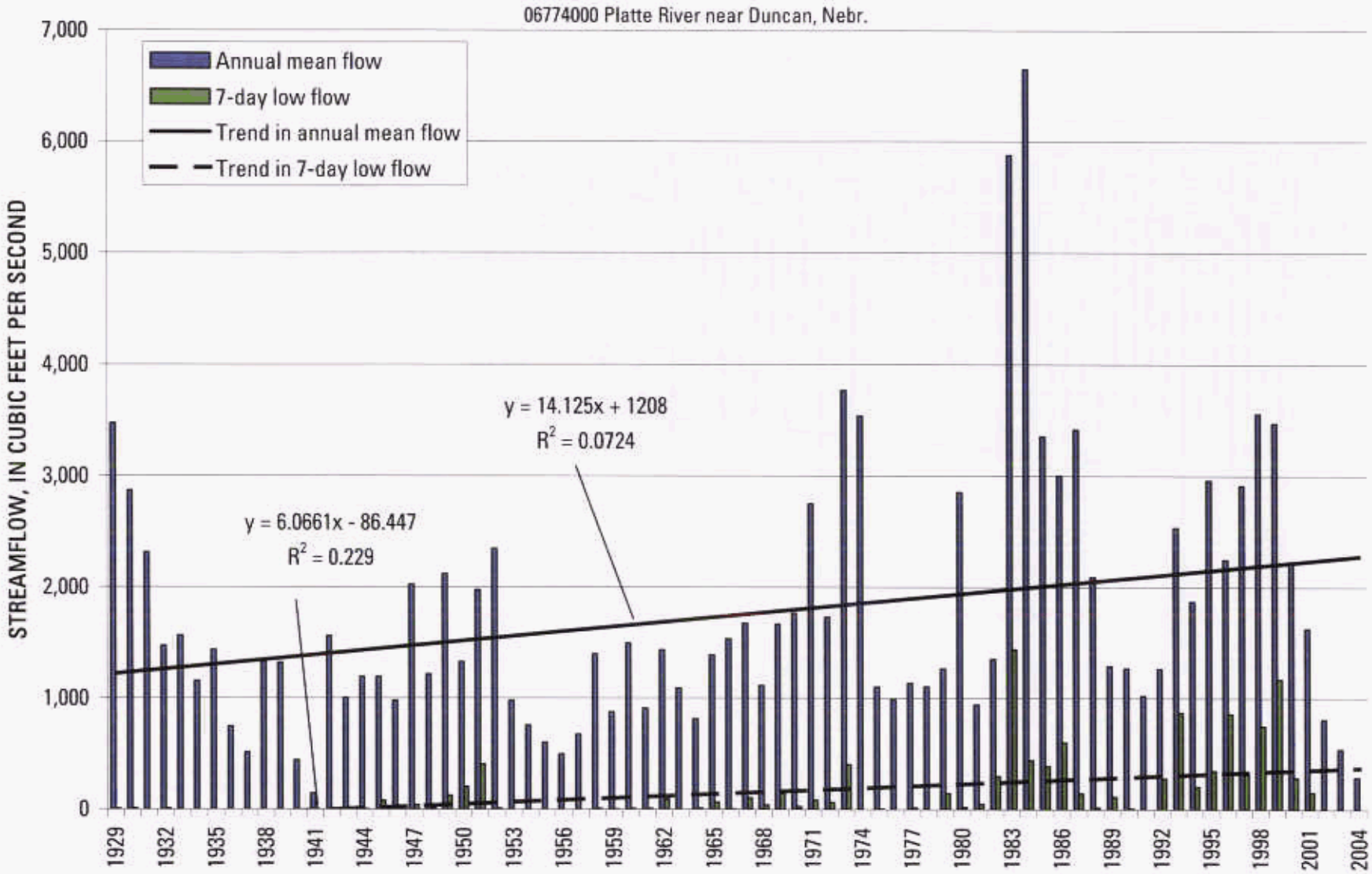


Figure 1. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Platte River near Duncan, Nebr.

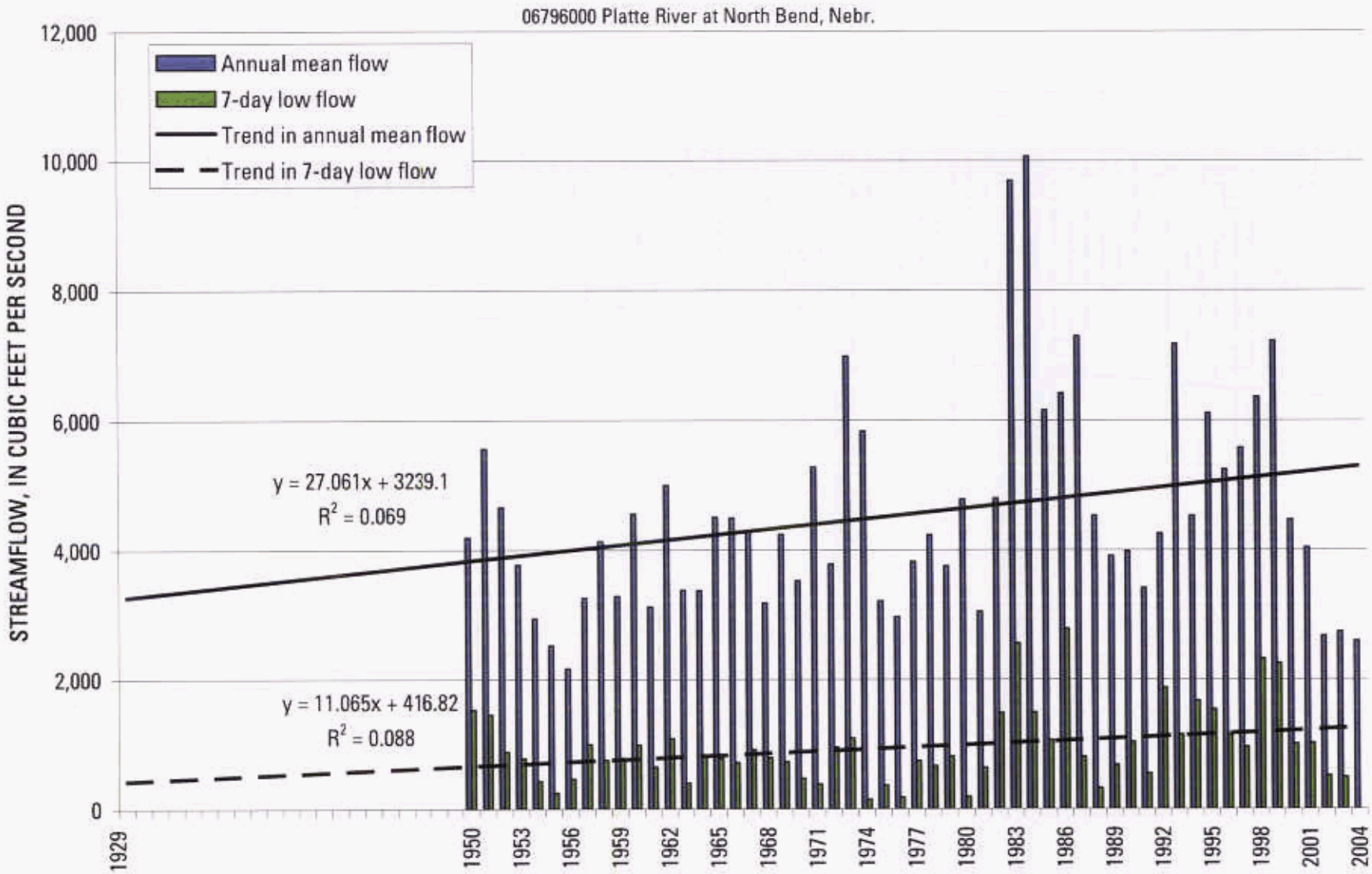


Figure 2. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Platte River at North Bend, Nebr.

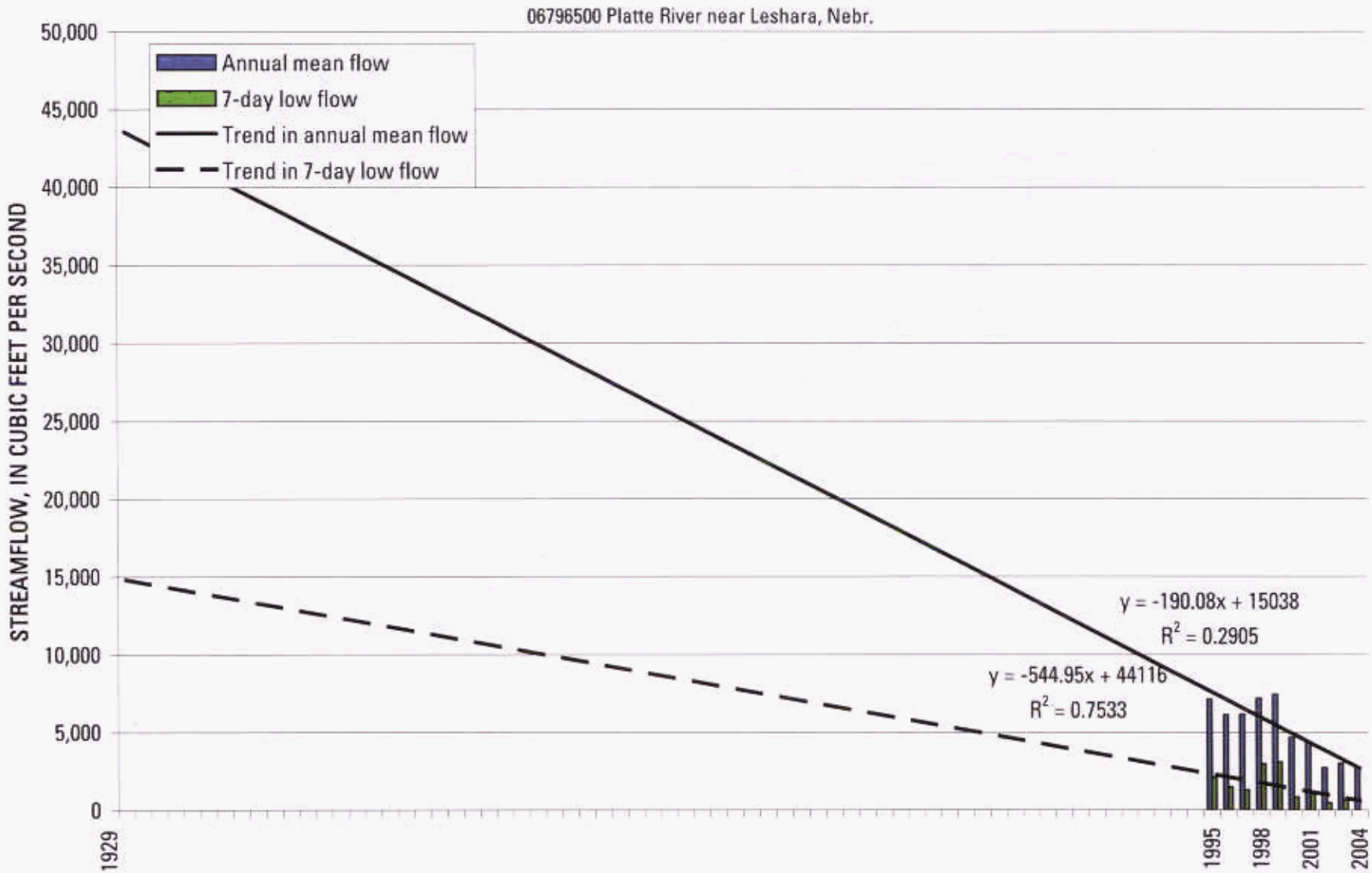


Figure 3. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Platte River near Leshara, Nebr.

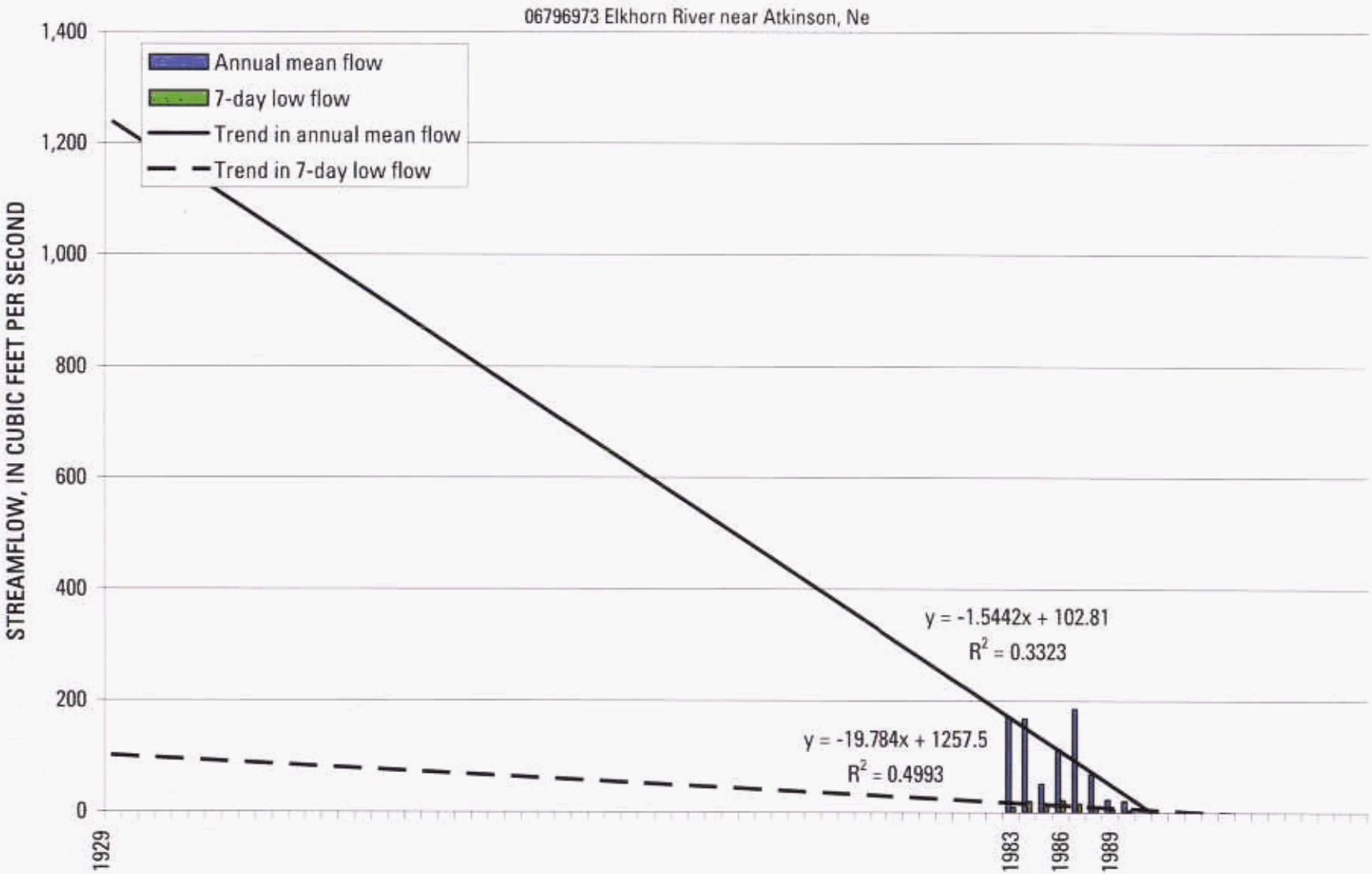


Figure 4. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River near Atkinson, Ne

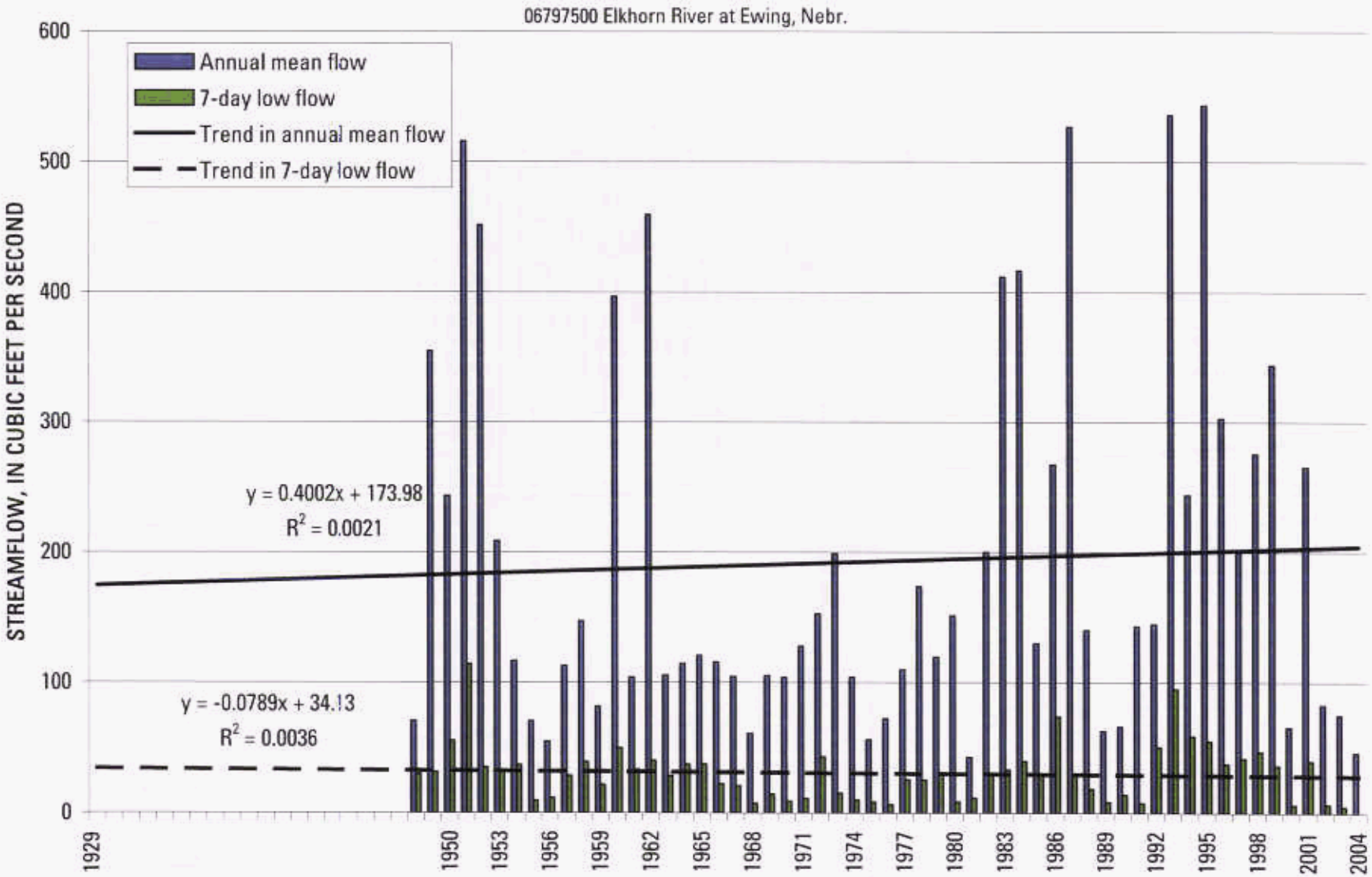


Figure 5. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River at Ewing, Nebr.

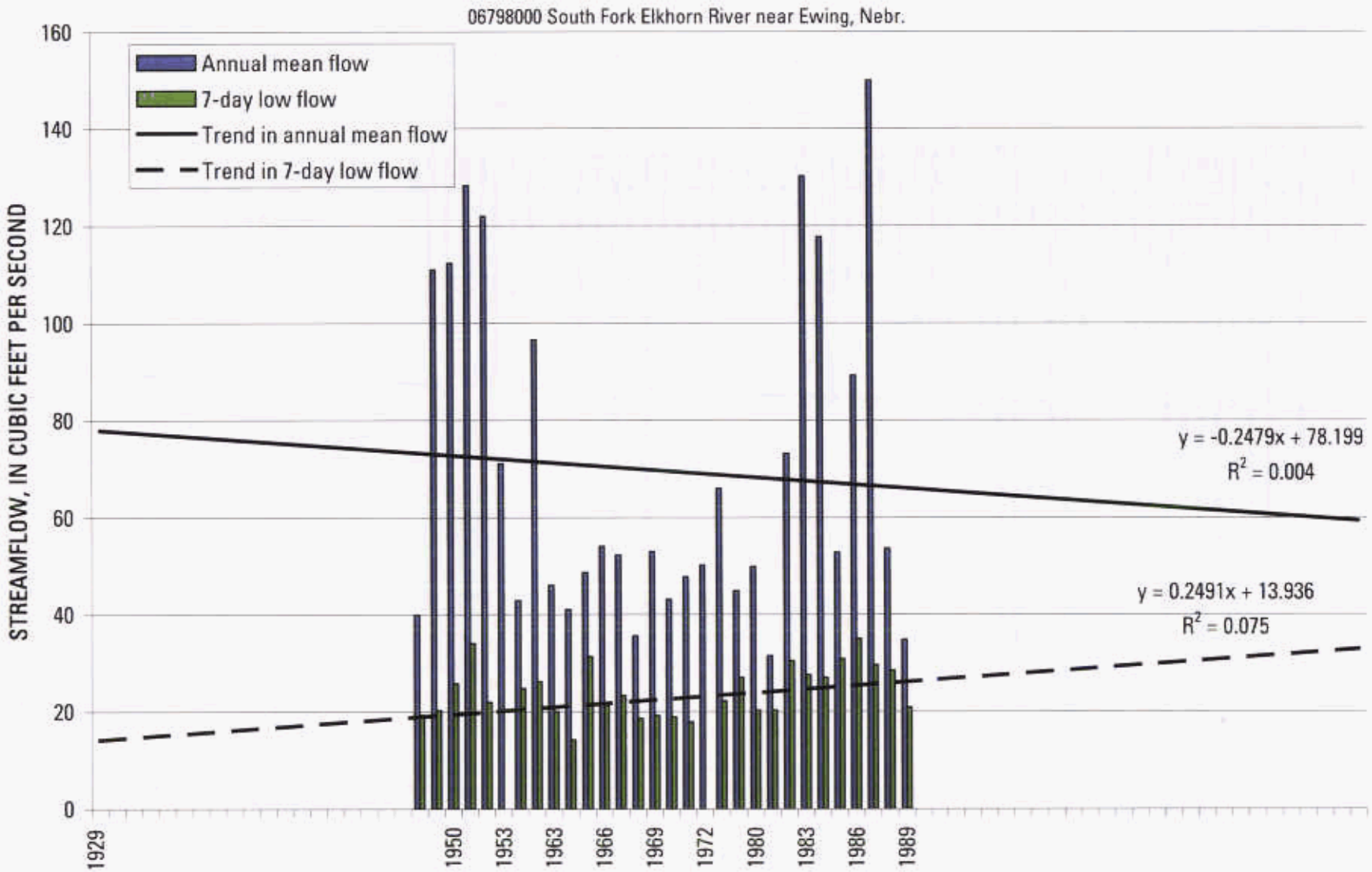


Figure 6. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of South Fork Elkhorn River near Ewing, Nebr.

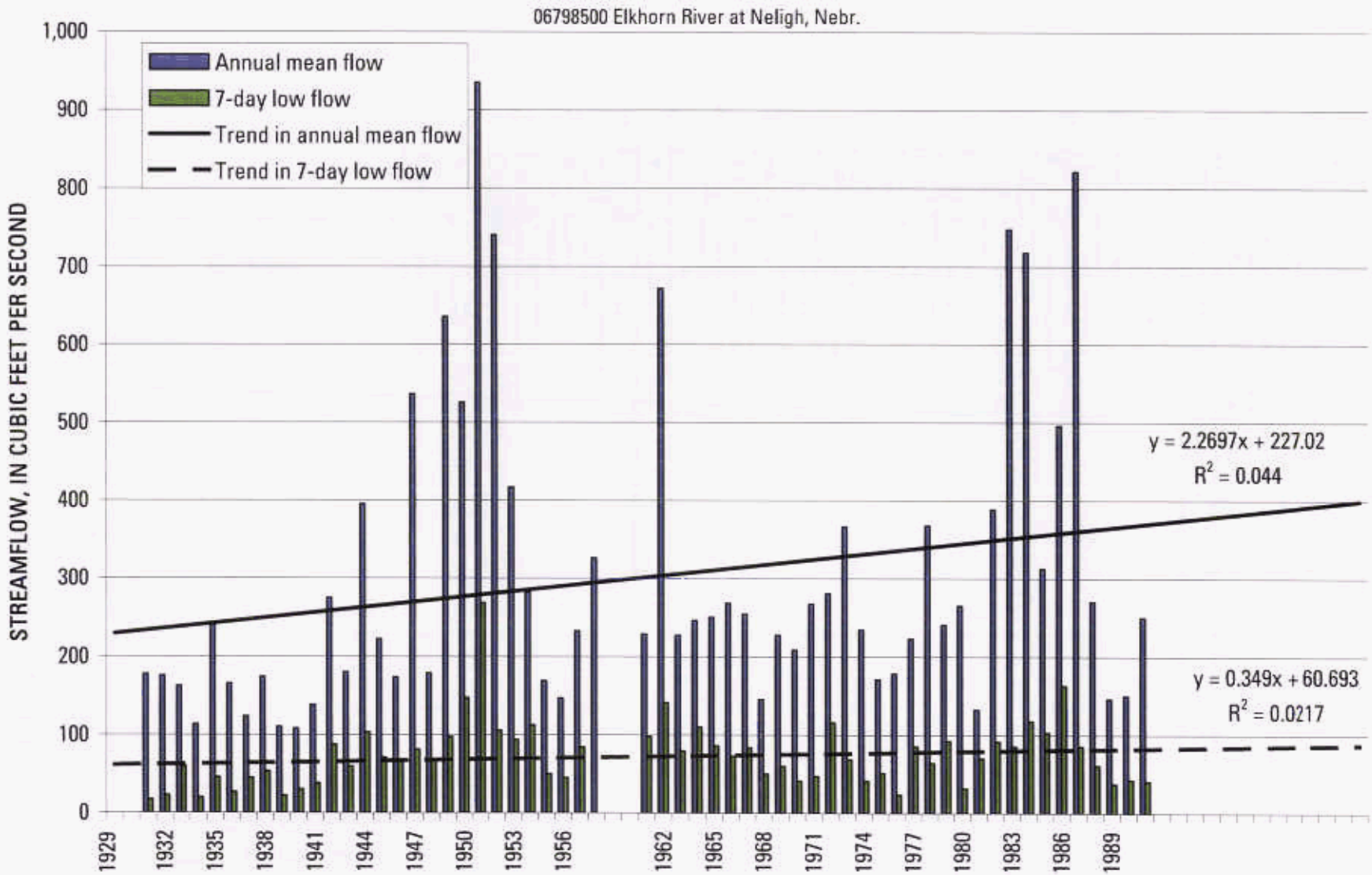


Figure 7. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River at Neligh, Nebr.

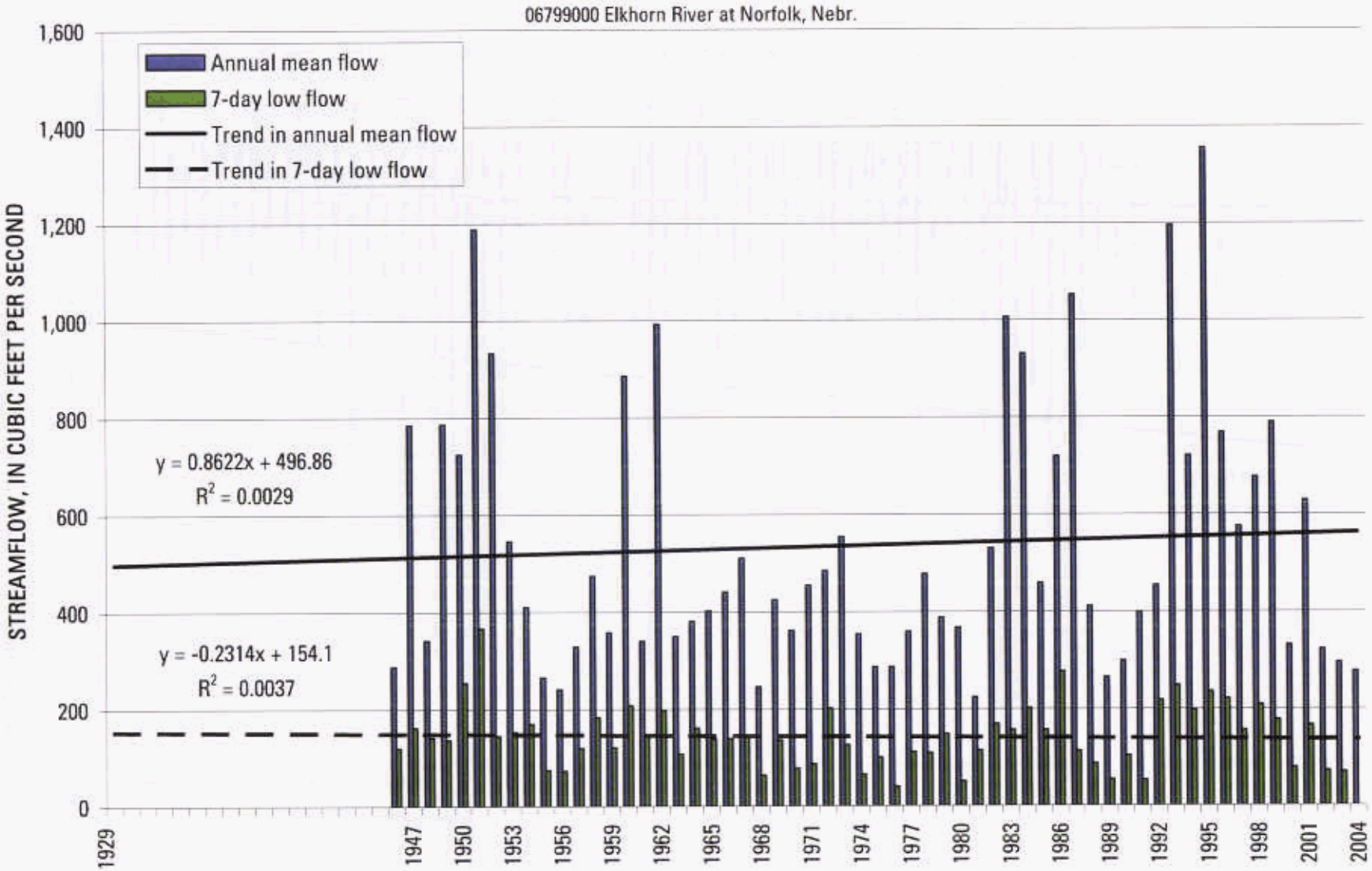


Figure 8. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River at Norfolk, Nebr.

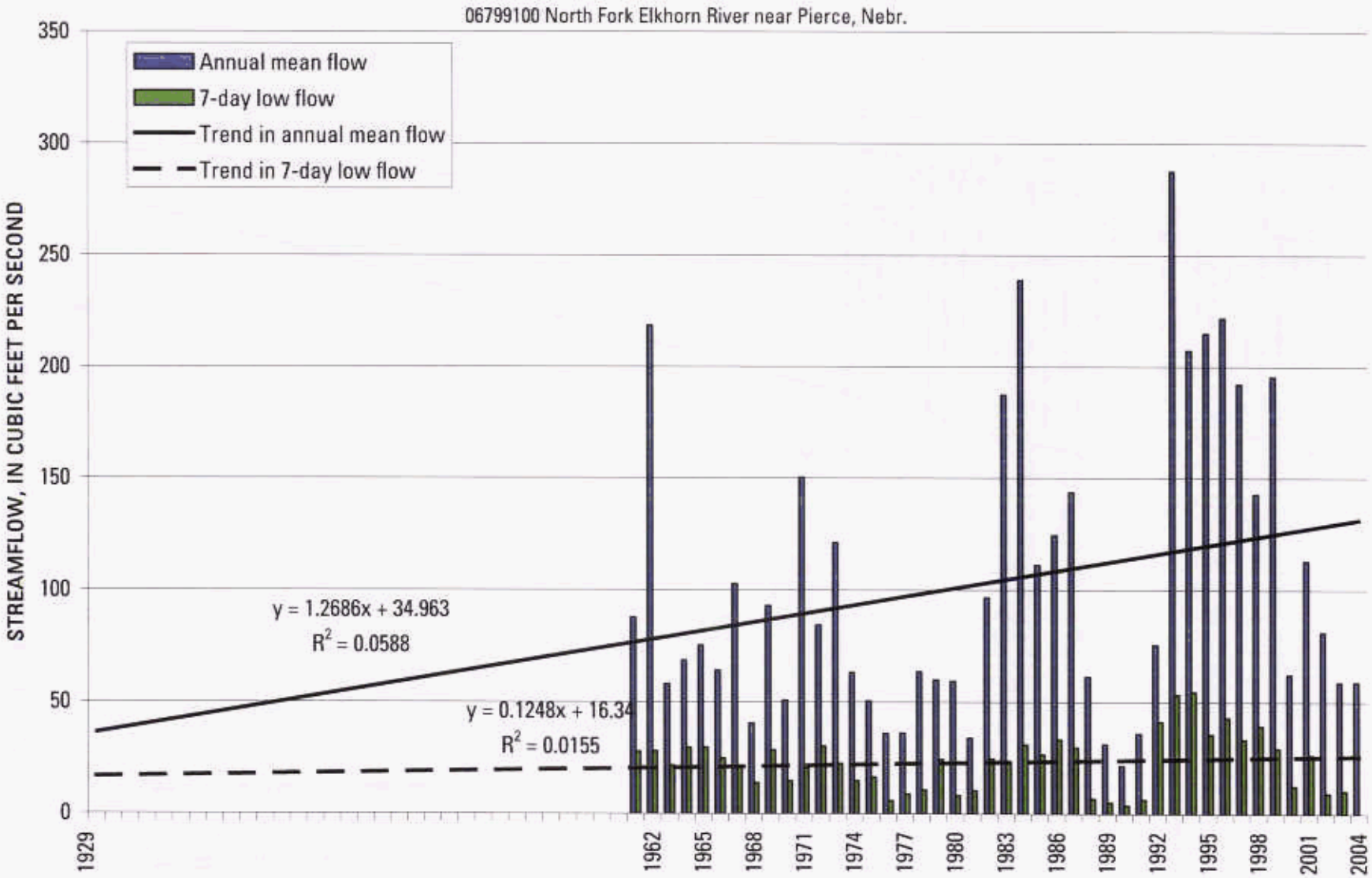


Figure 9. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of North Fork Elkhorn River near Pierce, Nebr.

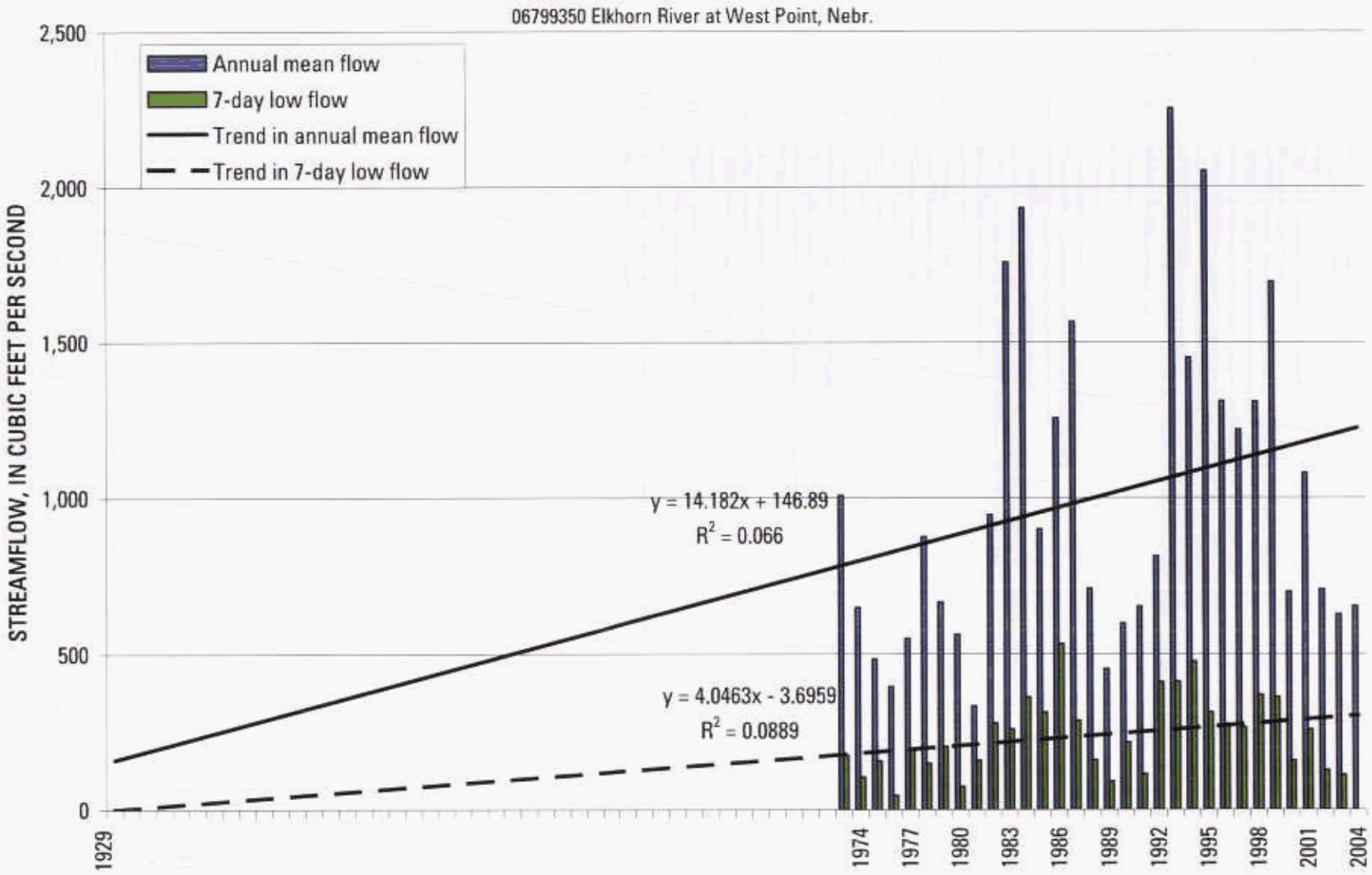


Figure 10. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River at West Point, Nebr.

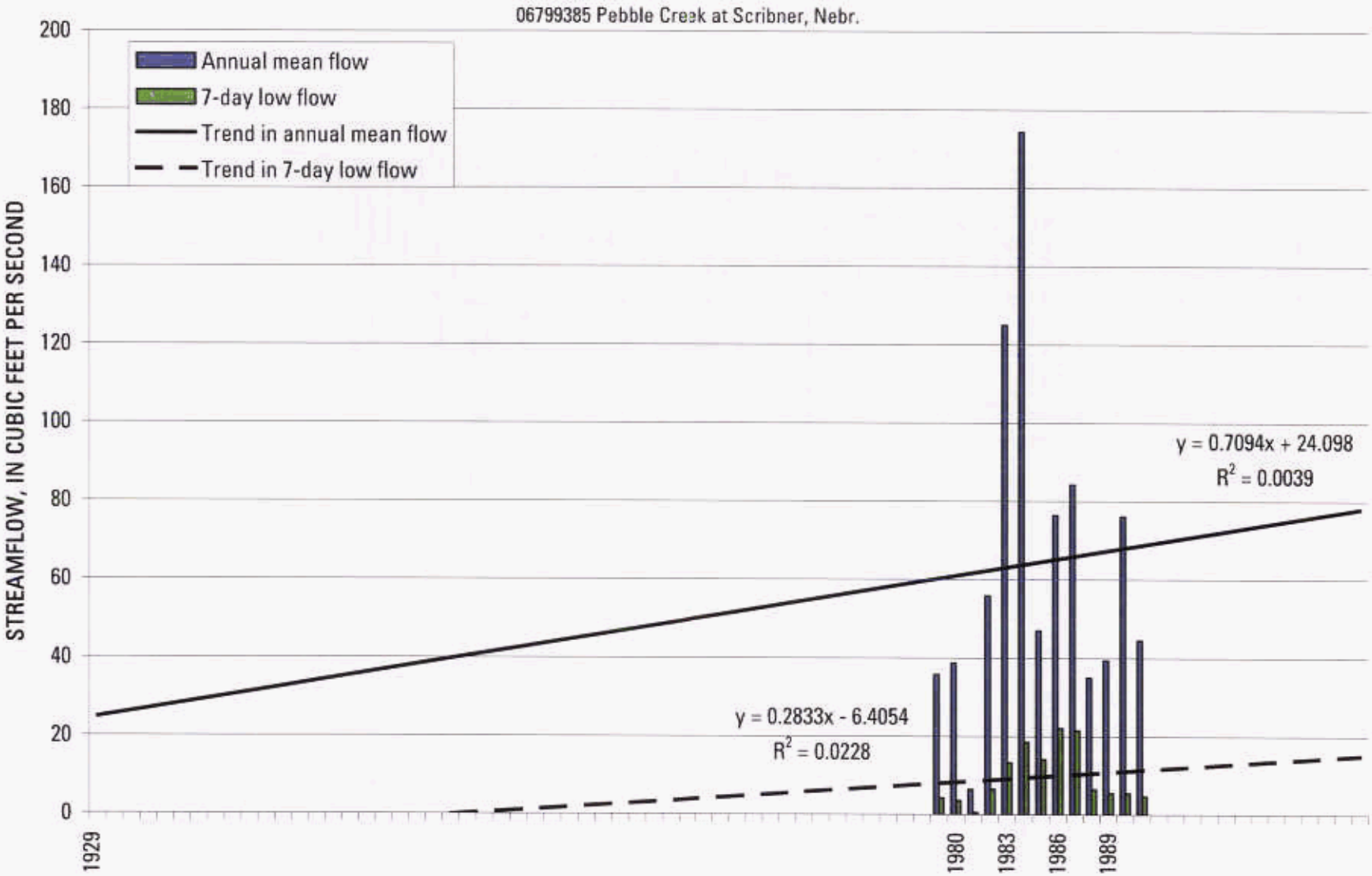


Figure 11. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Pebble Creek at Scribner, Nebr.

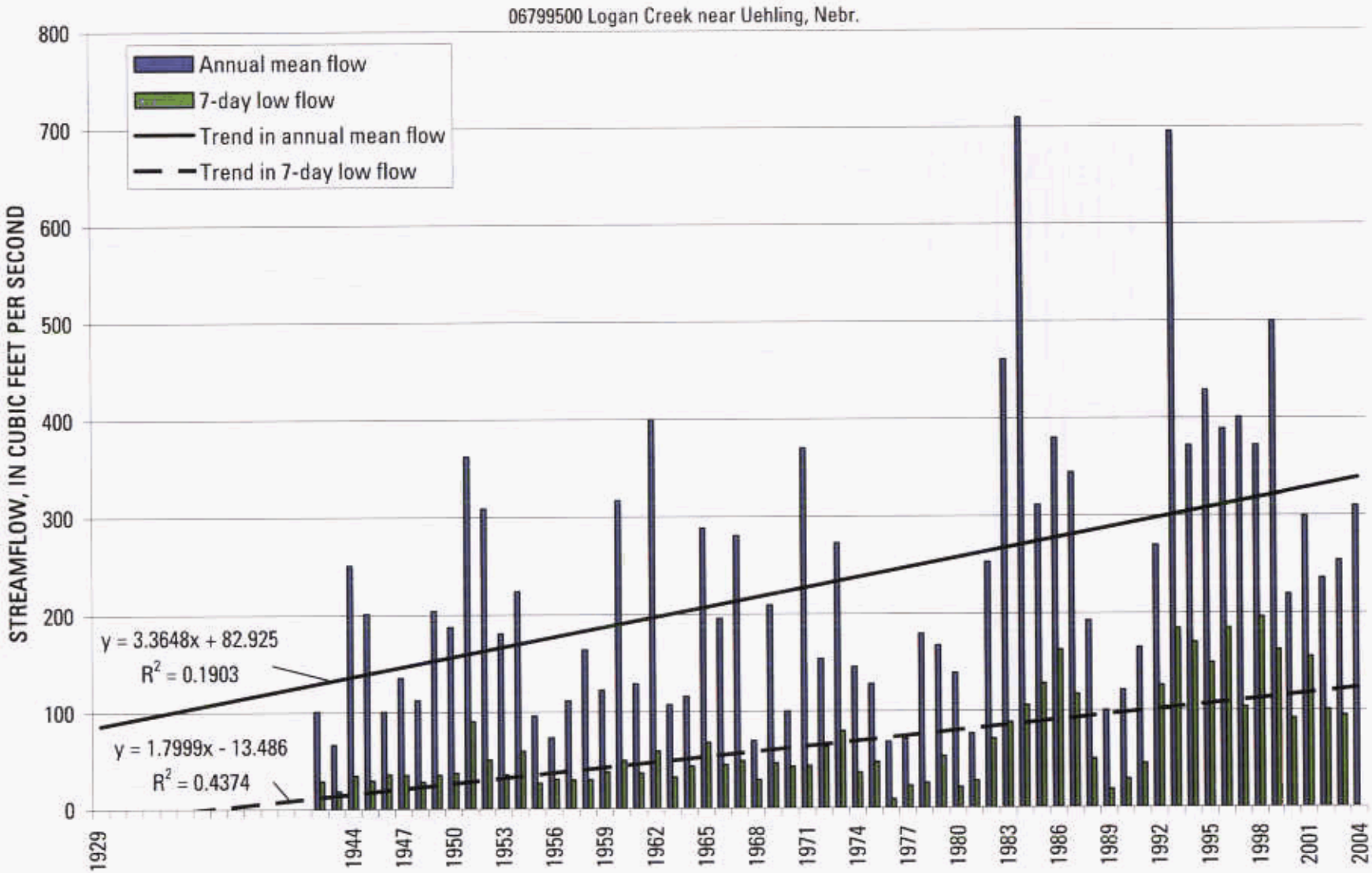


Figure 12. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Logan Creek near Uehling, Nebr.

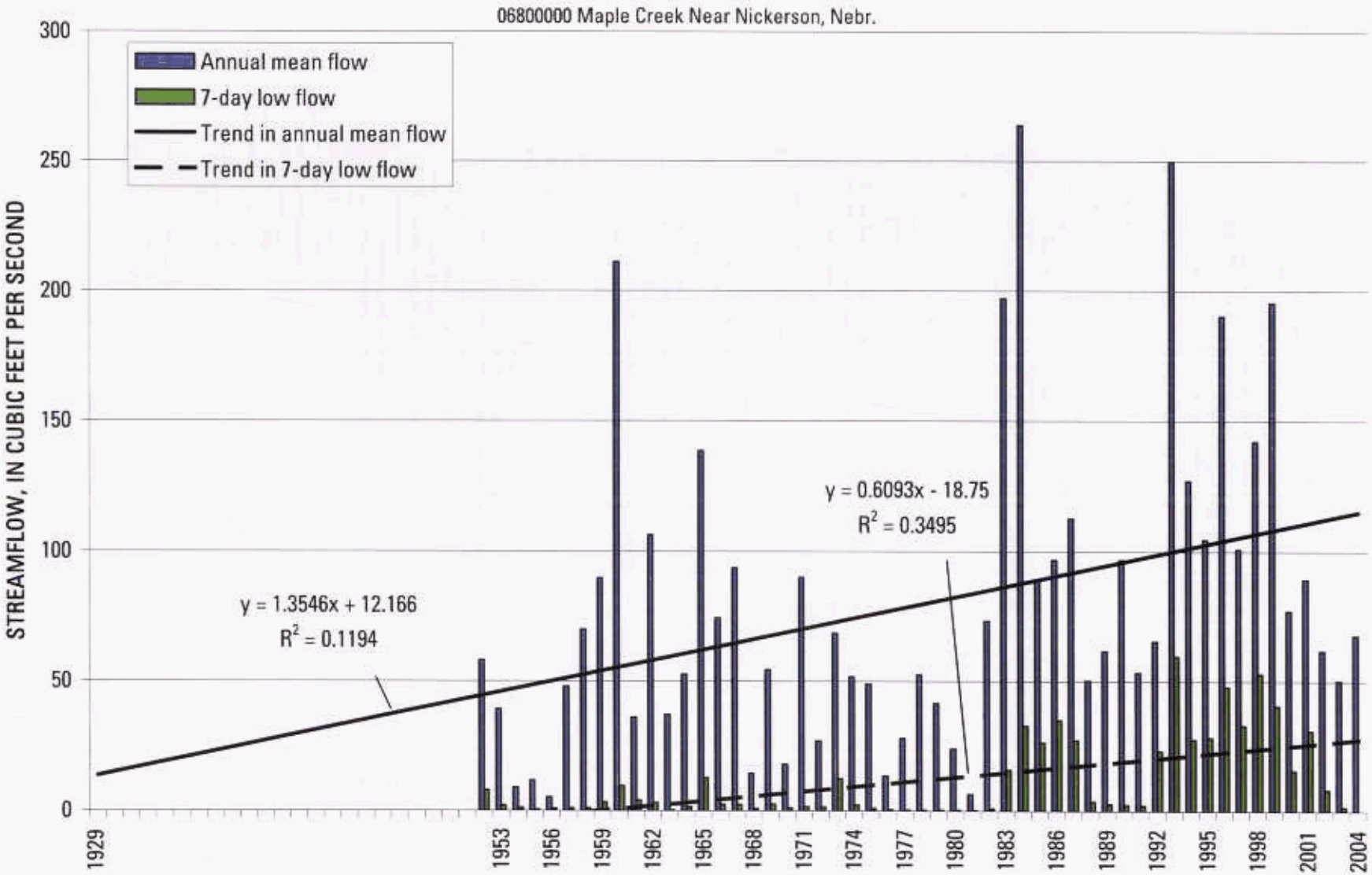


Figure 13. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Maple Creek Near Nickerson, Nebr.

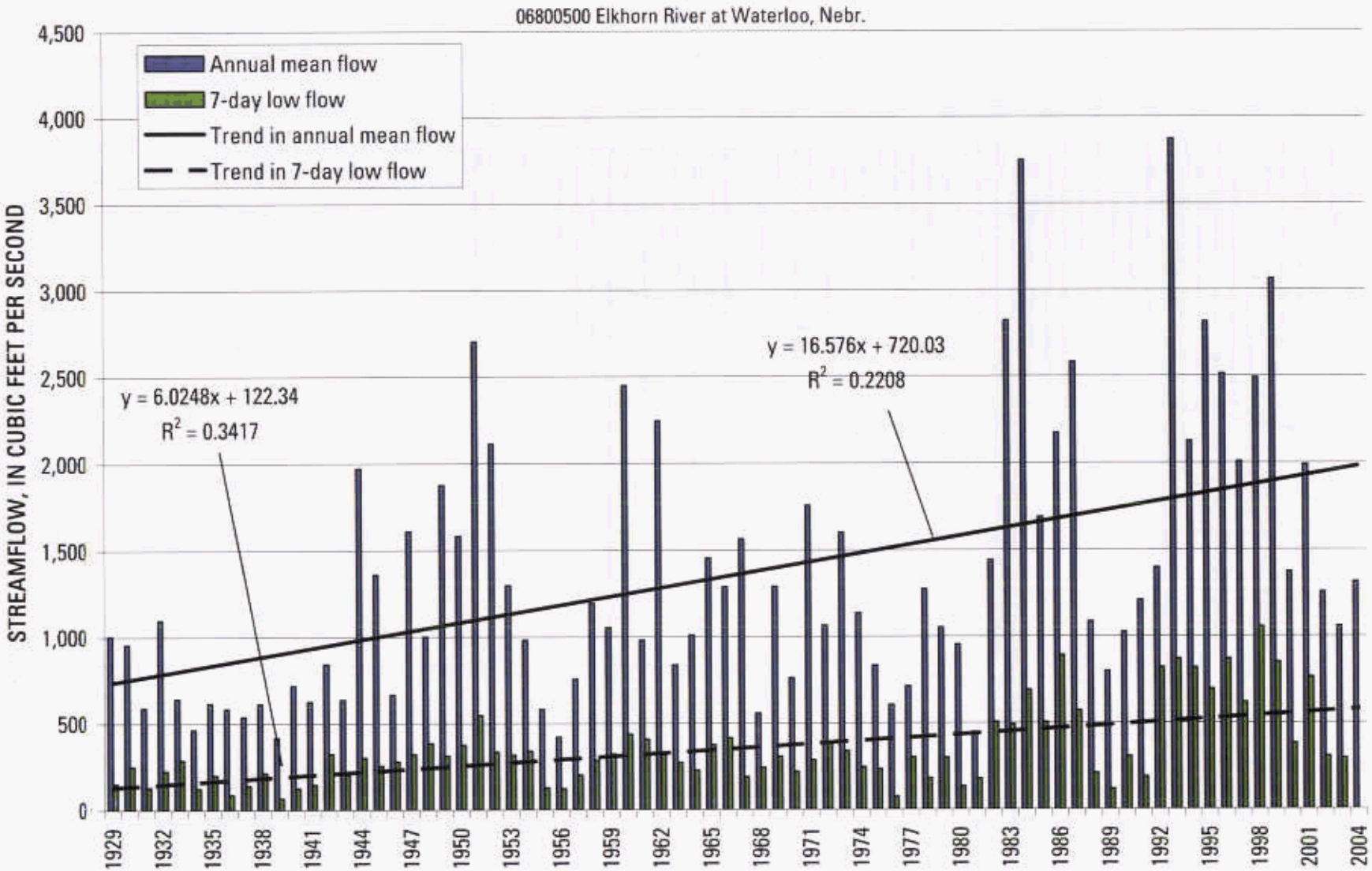


Figure 14. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Elkhorn River at Waterloo, Nebr.

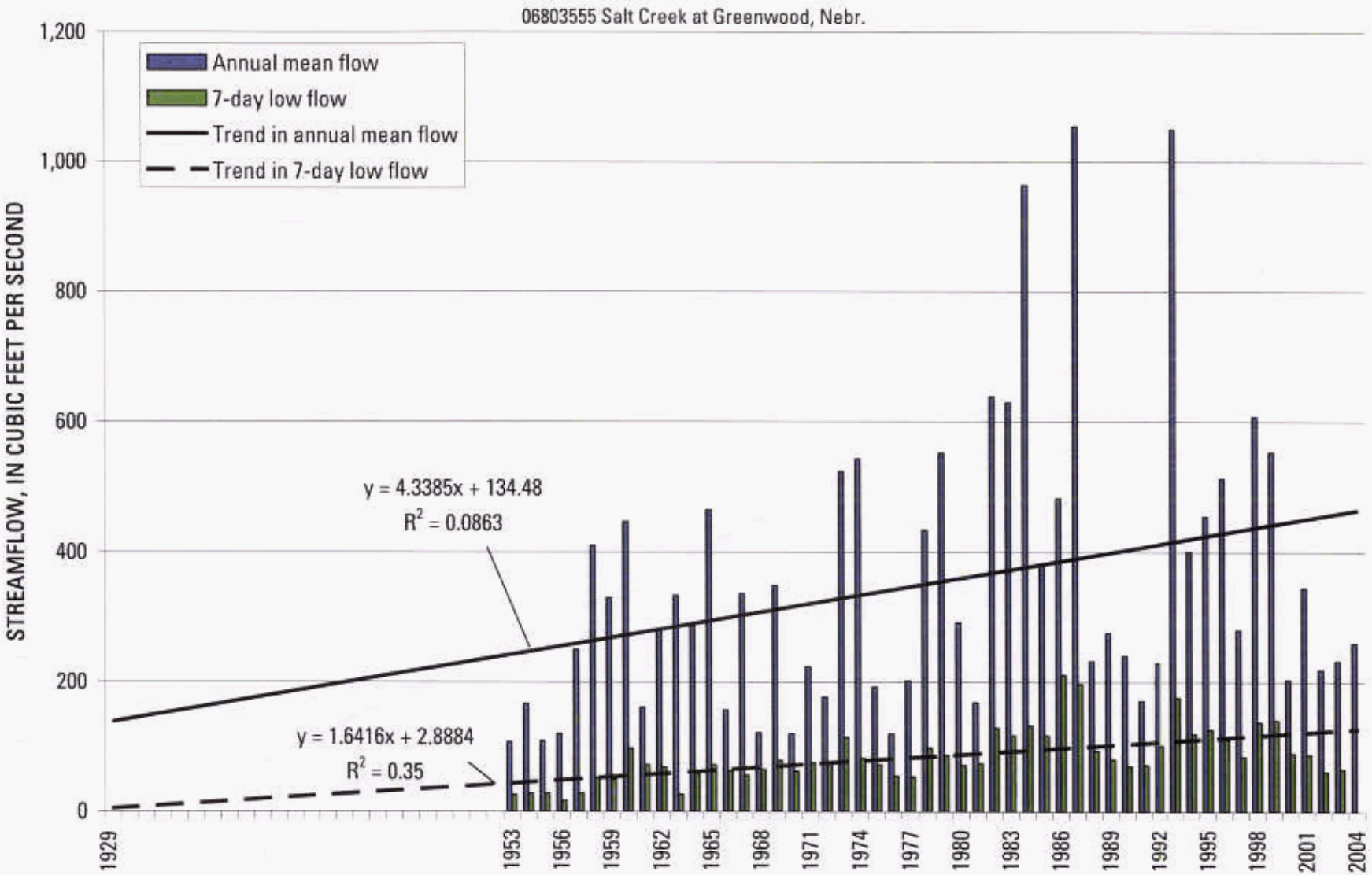


Figure 15. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Salt Creek at Greenwood, Nebr.

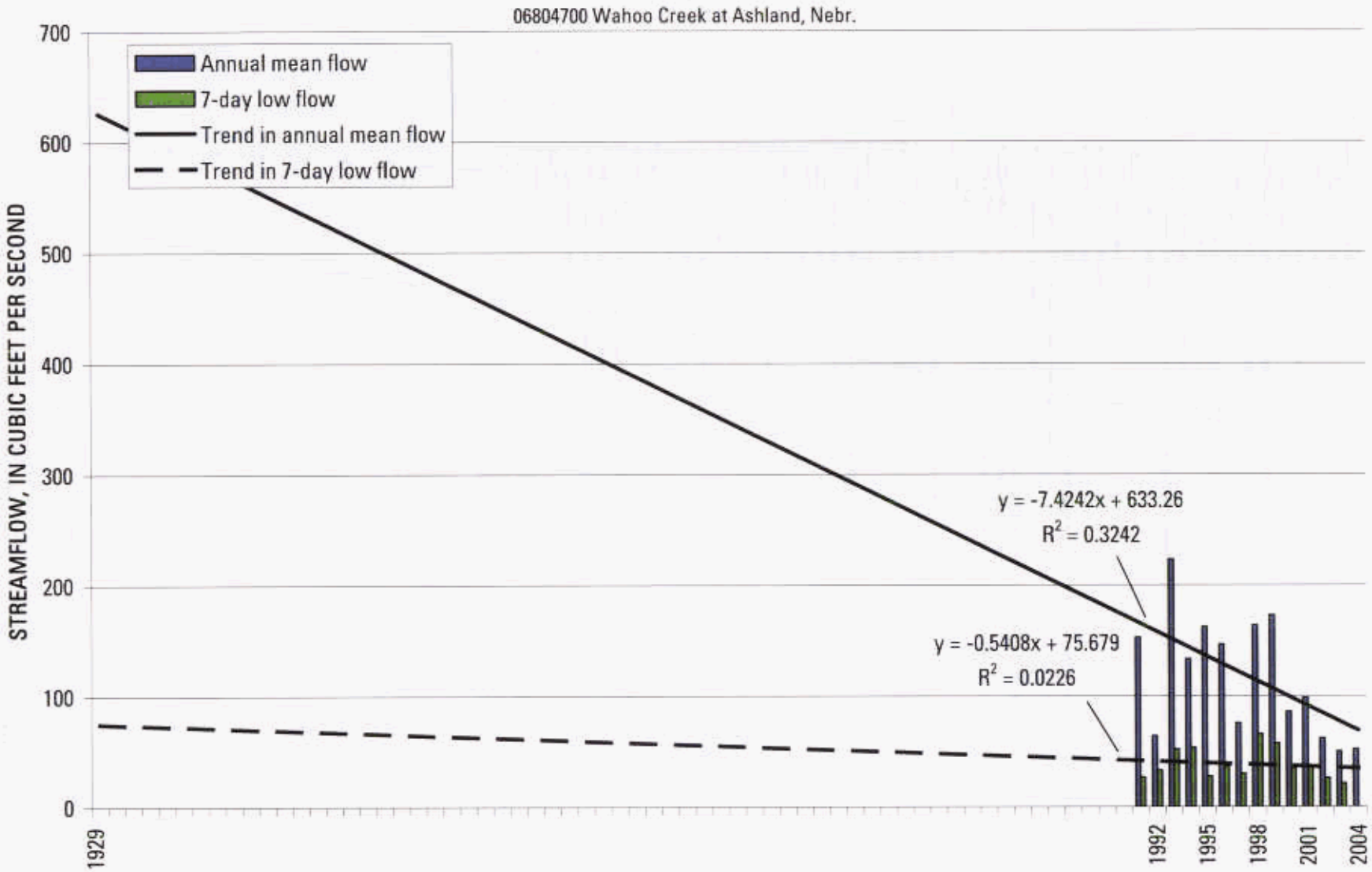


Figure 16. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Wahoo Creek at Ashland, Nebr.

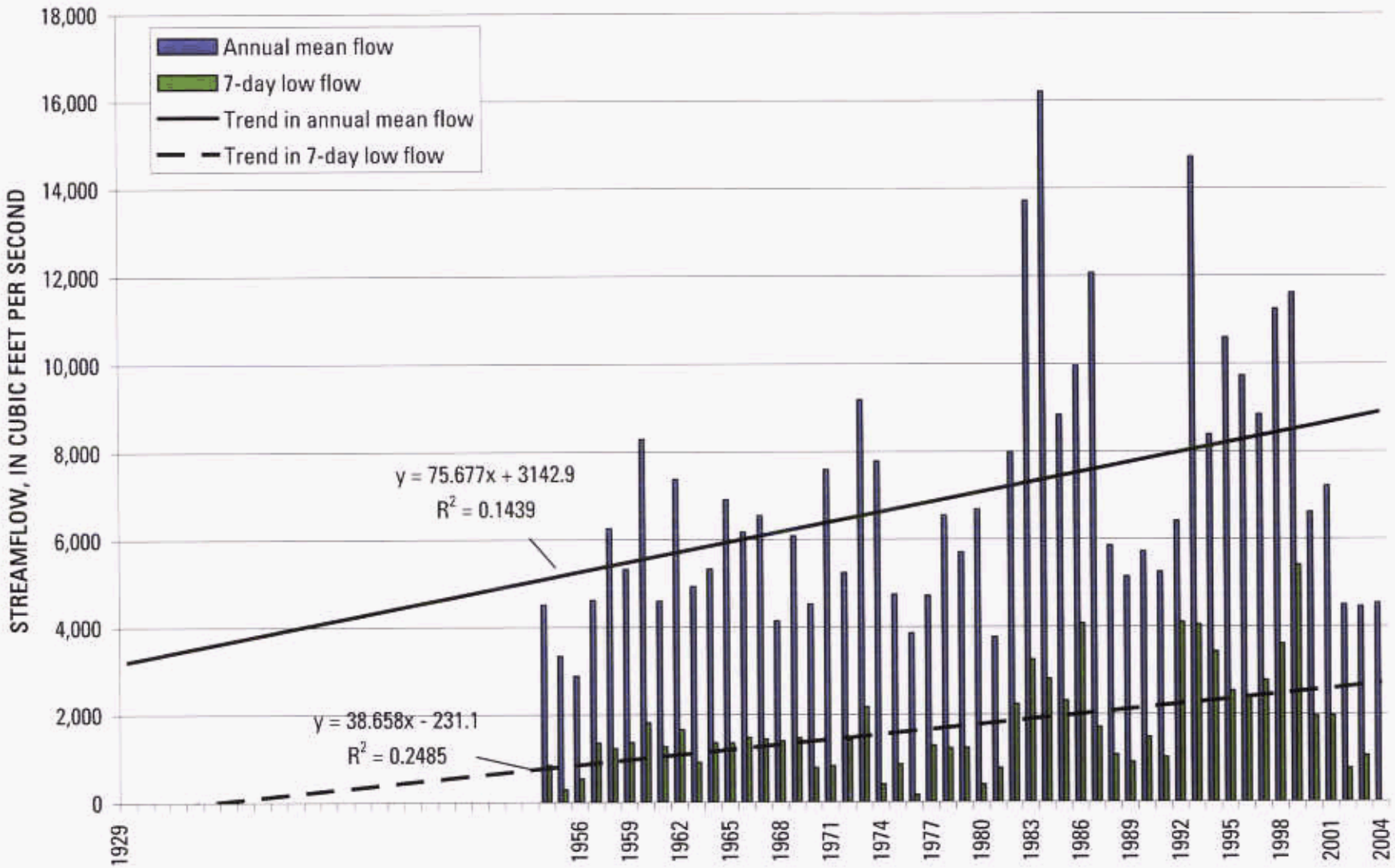


Figure 17. Annual mean flow, 7-day lowflow, trend in annual mean flow, and trend in 7-day low flow of Platte River at Louisville, Nebr.

Exh.
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Comments by Sand Hills Golf Club

Department of Natural Resources Hearing on the Preliminary Determination that the Lower Platte River Basin is Fully Appropriated

Fremont, Nebraska
March 12, 2009

Comparison of the DNR's Reports

The Sand Hills Golf Club, which is located in Hooker County and within the Upper Loup Natural Resources District (the "ULNRD"), strongly believes that the Department of Natural Resources' *2009 Annual Evaluation of Availability of Hyrologically Connected Water Supplies* ("*2009 Report*") does not reflect the best scientific data, information, and methodologies readily available to ensure that the conclusions and results contained in the *2009 Report* are reliable. The Sand Hills also believes that there must be additional scientific data and information that the Department of Natural Resources ("DNR") has not made available to the public despite multiple requests.

First, the *2009 Report* does not identify significantly different results with regard to the amount of water historically or currently available for junior surface water appropriators, the amount of water necessary to meet the net corn crop irrigation requirement, or the amount of water available for diversion at North Bend and Louisville. Indeed, our comparisons of the *2009 Report* to the *2008 Annual Evaluation of Availability of Hyrologically Connected Water Supplies* ("*2008 Report*") reveals that the conditions are currently such that those factors would be <u>*less*</u> likely to lead to a determination that the Platte River Basin is fully appropriated than in 2008. In other words, the conclusions reached in the *2009 Report* are just the opposite of what one would expect based upon the available factual information. For instance, as compared to the *2008 Report*:

- Junior Surface Water Appropriations
  - The junior surface water appropriations above North Bend would have been closed for two less days in the prior 20 years.
  - The junior surface water appropriations downstream of North Bend, but upstream of Louisville would have been closed for six less days in the prior 20 years.
- Net Corn Crop Irrigation Requirement
  - It took 0.4 fewer days to divert 65% of the Net Corn Crop Irrigation Requirement.
  - It took 0.5 fewer days to divert 85% of the Net Corn Crop Irrigation Requirement
- Current Water Supply
  - Above North Bend
    - There are 1.1 more days currently available for diversion between July 1 and August 31.
    - There are 1.6 more days currently available for diversion between May 1 and September 30.

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- Above Louisville
  - There are 0.3 more days currently available for diversion between July 1 and August 31.
  - There are 1.8 more days currently available for diversion between May 1 and September 30

Indeed, despite the facts that (1) the current and historical information in the *2009 Report* shows that more water is available now than was available when the *2008 Report* was prepared and (2) both the *2008* and *2009 Reports* state that there has been no statistically significant trend in precipitation over the past 50 years, the DNR's *2009 Report* still concludes that future streamflows 25 years from now will be insufficient. We can discern no factual information or scientific data which rationally supports such conclusion. Rather it appears to be merely unsupported guess work or "junk" science. Simply put, this situation appears to be one in which mathematics were used to get a *desired* result rather than used to get the correct result.

In this case, the DNR's modified results showed that future streamflows 25 years from now would be reduced by 445 cubic feet per second at North Bend (as opposed to reductions ranging from 158 – 270 cfs in the three prior reports). Similarly, at Louisville, future streamflows supposedly will be reduced by 870 cubic feet per second (as opposed to reductions ranging from 391 – 530 cfs in the three prior reports). If nothing else, such wide variations in these numbers clearly demonstrate that the models utilized by DNR in the *2009 Report* are not reliable enough to determine that the Lower Platte River Basin is fully appropriated, the economic harm that this determination will cause is not justified, and the DNR failed to use the best scientific data, information, and methodologies readily available.

Information Outside of the Reports

U.S. Geological Survey Circular 1243: Water in Storage and Approaches to Ground Water Management, High Plains Aquifer, 2000

Notably, basic information readily available from the USGS office also does not support the conclusions reached in the *2009 Report*. For instance, the *U.S. Geological Survey Circular 1243: Water in Storage and Approaches to Ground Water Management, High Plains Aquifer, 2000*, recently analyzed the High Plains (or Ogallala) Aquifer underlying Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. From "pre-development" to 2000, the water level in Nebraska rose by 0.7 feet when looking at the average area-weighted water level change. When measuring water in storage in the High Plains, the amount in Nebraska rose by 4 million acre-feet. Given that these statistics compare the status of the aquifer after development had begun to before any development and that this data shows the water levels in Nebraska, on average, have risen, the DNR's *2009 Report* and the models it used to reach its conclusions are brought even more in question.

Information in Hooker County and Surrounding Areas

The USGS study reflects the current situation in Hooker County, the area where the Sand Hills Golf Club is located. First, if one looks at USGS data gathered on the Dismal River in the area near Thedford, Thomas County (a county just to the east of Hooker County), the reality is that streamflows

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are 12.9 percent higher as of 2008 than they were in 1967. A copy of such data is attached. Looking at the average discharge from this river, the discharge is 5.4 percent higher in 2008 than it has been over the past 41 years. Again, the DNR's results simply do not make any sense and are unsupported by the data.

The Dismal River Near Thedford
1967: Discharge was 190.0 cubic feet per second

Average between 1967 and 2008: 206.3 cubic feet per second

2008: Discharge was 218.1 cubic feet per second
- 12.9 % more than the discharge in 1967
- 5.4% more than the average discharge for the river

Likewise, the water levels in the nine wells monitored by the USGS in Hooker County also do not support the results found in the DNR's *2009 Report.* In seven of the nine wells, the water levels as reflected on the attached summary rose by an average of 13.254 feet. Three of those water levels rose by more than 16 feet. All of those seven wells rose by more than 4 ½ feet.

Conclusion

The Sand Hills Golf Club does not object to a determination that is based on the best scientific data, information, and methodologies readily available. That's the standard that the Unicameral set when these laws were first passed six years ago, and that is the standard that the DNR must be governed by in making its determination that the Lower Platte River Basin is or is not fully appropriated. Currently, it is clear that the DNR has not adhered to the statutory mandate in that it has failed to utilize the best science available with respect to the inclusion of the ULNRD in its preliminary determination .

Rather, given the unexplained change in models, the comparisons of the *2009 Report* with prior reports produced by the DNR, and the information that is readily available on the USGS website, the DNR's preliminary report simply does not support a finding that the Lower Platte River Basin—in particular, Hooker County and the ULNRD—is fully appropriated. Until the DNR is able to fully support such a conclusion and make all of such scientific data and other materials available to the public for proper analysis and scrutiny, neither the Lower Platte River Basin nor the ULNRD can be declared fully appropriated as any such determination would be contrary to Nebraska law. Accordingly, Sand Hills vigorously objects to any final determination that the ULNRD at a minimum, and the Lower Platte River Basin in general, is fully appropriated.

Dismal River near Thedford, Nebraska

Source: U.S. Geological Survey (http://water.usgs.gov/)

Thomas County, Nebraska
Hydrologic Unit Code 10210002
Latitude 41°46'43", Longitude 100°31'31" NAD83
Drainage area 966.00 square miles
Contributing drainage area 30.00 square miles

Water Year	00060, Discharge, cubic feet per second
1967	190.0
1968	193.1
1969	192.2
1970	188.4
1971	191.6
1972	192.3
1973	192.1
1974	189.1
1975	188.8
1976	191.3
1977	192.9
1978	193.2
1979	191.1
1980	197.0
1981	195.3
1982	201.0
1983	198.8
1984	200.0
1985	206.1
1986	210.5
1987	211.0

Water Year	00060, Discharge, cubic feet per second
1988	207.6
1989	199.2
1990	207.0
1991	210.7
1992	204.2
1993	202.8
1994	214.0
1995	220.6
1996	217.5
1997	230.8
1998	222.3
1999	225.5
2000	231.2
2001	225.1
2002	213.5
2003	221.6
2004	217.1
2005	221.8
2006	224.7
2007	222.0
2008	218.1

Hooker County Well Data

Source: U.S. Geological Survey (http://water.usgs.gov/)

Site Number: 414506101101440 1—Along the border of Hooker and McPerson Counties

- Ground Water Levels: Water Table has Risen 16.39 feet in the past 35 years
  - October of 1973: Ground water was 135 feet below land.
  - November of 2008: Ground water was 118.61 feet below land.

Site Number: 414939101100201—Between the North and South Forks of the Dismal River

- Ground Water Levels: Water Table has Risen 4.72 feet in the past 21 years
  - November of 1989: Ground water was 78 feet below land.
  - November of 2008: Ground water was 73.28 feet below land.

Site Number: 415532101135801—*Central Hooker County (Just east of Site Number* 415545101152501)

- Ground Water Levels: Water Table has Risen 4.86 feet in the past 31 years
  - November of 1977: Ground water was 18.41 feet below land.
  - November of 2008: Ground water was 13.55 feet below land.

Site Number: 415545101152501—Central Hooker County (Just west of Site Number 415532101135801)

- Ground Water Levels: Water Table has Risen 4.91 feet in the past 32 years
  - July of 1976: Ground water was 20.50 feet below land.
  - November of 2008: Ground water was 15.59 feet below land.

Site Number: 415740100510601—Along the border of Thomas and Hooker Counties

- Ground Water Levels: Water Table has Risen 37.53 feet in the past 32 years
  - January of 1976: Ground water was 137.20 feet below land.
  - November of 2008: Ground water was 99.67 feet below land.

Site Number: 415945101120501—Northwest Hooker County (Just west of Site Number: 420035101081501)

- Ground Water Levels: Water Table has Risen 5.89 feet in the past 31 years
  - May of 1977: Ground water was 52.02 feet below land.
  - November of 2008: Ground water was 46.13 feet below land.

Site Number: 420035101081501 (Northwest Hooker County (Just east of Site Number: 415945101120501)

- Ground Water Levels: Water Table has Risen 18.48 feet in the past 31 years
  - May of 1977: Ground water was 120.44 feet below land.
  - November of 2008: Ground water was 101.96 feet below land.

Surrounding County Well Data

Source: U.S. Geological Survey (http://water.usgs.gov/)

Thomas County

Site Number: 420508100343501—Border of Thomas and Cherry Counties

- Ground Water Levels: Water Table has Risen 5.12 feet in the past 31 years
  - April of 1977: Ground water was 83.63 feet below land.
  - October of 2008: Ground water was 78.51 feet below land.

Site Number: 420207100434601—Northwest Thomas County

- Ground Water Levels: Water Table has Risen 4.08 feet in the past 33 years
  - December of 1975: Ground water was 81.05 feet below land.
  - November of 2008: Ground water was 76.97 feet below land.

Site Number: 420031100201701—Northeast Thomas County

- Ground Water Levels: Water Table has Risen 4.57 feet in the past 36 years
  - December of 1972: Ground water was 74.40 feet below land.
  - October of 2008: Ground water was 69.83 feet below land.

Site Number: 420123100183201—Northeast Thomas County

- Ground Water Levels: Water Table has Risen 7.07 feet in the past 32 years
  - December of 1976: Ground water was 89.16 feet below land.
  - October of 2008: Ground water was 82.09 feet below land.

Site Number: 420149100203401—Northeast Thomas County

- Ground Water Levels: Water Table has Risen 7.01 feet in the past 32 years
  - December of 1976: Ground water was 74.27 feet below land.
  - October of 2008: Ground water was 67.26 feet below land.

Blaine County

Site Number: 415936100022601—Northwest Blaine County (Just south of North Loup River and Goose Creek)

- Ground Water Levels: Water Table has Risen 4.06 feet in the past 32 years
  - December of 1976: Ground water was 7.52 feet below land.
  - October of 2008: Ground water was 3.46 feet below land.

Site Number: 415918099485201—North-central Blaine County (Just north of North Loup River)

- Ground Water Levels: Water Table has Risen 5.93 feet in the past 32 years
  - December of 1976: Ground water was 7.90 feet below land.
  - October of 2008: Ground water was 1.97 feet below land.

Site Number: 420022099523701—North-central Blaine County (Just north of North Loup River)

- Ground Water Levels: Water Table has Risen 7.43 feet in the past 32 years
  - December of 1976: Ground water was 14.64 feet below land.
  - October of 2008: Ground water was 7.21 feet below land.

Site Number: 415801099420701—Northeast Blaine County (Just north of North Loup River)

- Ground Water Levels: Water Table has Risen 7.89 feet in the past 32 years
  - December of 1976: Ground water was 14.99 feet below land.
  - October of 2008: Ground water was 7.10 feet below land.

Site Number: 414934099593501—South Central Blaine County (Just north of Middle Loup River)

- Ground Water Levels: Water Table has Risen 1.5 feet in the past 31 years
  - March of 1977: Ground water was 9.70 feet below land.
  - October of 2008: Ground water was 8.20 feet below land.

Logan County

Site Number: 414231100241201—North-Central Logan County

- Ground Water Levels: Water Table has Risen 9.05 feet in the past 33 years
  - July of 1975: Ground water was 50.43 feet below land.
  - November of 2008: Ground water was 41.38 feet below land.

Site Number: 412823100401501—Southwest Logan County (By the South Loup River)

- Ground Water Levels: Water Table has Risen 2.62 feet in the past 32 years
  - November of 1976: Ground water was 15.26 feet below land.
  - November of 2008: Ground water was 12.64 feet below land.

McPherson County

Site Number: 413813100454101—Northeast McPherson County

- Ground Water Levels: Water Table has Risen 9.30 feet in the past 32 years
  - November of 1976: Ground water was 59.86 feet below land.
  - November of 2008: Ground water was 50.56 feet below land.

Site Number: 413935101151601—Northwest McPherson County

- Ground Water Levels: Water Table has Risen 1.6 feet in the past 32 years
  - February of 1976: Ground water was 4.50 feet below land.
  - November of 2008: Ground water was 2.90 feet below land.

Cherry County

Site Number: 420956101095201—South Central Cherry County (Right above the Middle Loup River)

- Ground Water Levels: Water Table has Risen 3.12 feet in the past 28 years
  - December of 1980: Ground water was 101.00 feet below land.
  - November of 2008: Ground water was 97.88 feet below land.

Site Number: 421519101173601—South Central Cherry County (Right above the Middle Loup River)

- Ground Water Levels: Water Table has Risen 3.75 feet in the past 31 years
  - May of 1977: Ground water was 20.42 feet below land.
  - November of 2008: Ground water was 16.67 feet below land.

Grant County

Site Number: 415534101383501—Central Grant County

- Ground Water Levels: Water Table has Risen 0.54 feet in the past 32 years
  - December of 1976: Ground water was 14.10 feet below land.
  - November of 2008: Ground water was 13.56 feet below land.

Site Number: 420101101313301—Northeast Grant County (South of Highway 2)

- Ground Water Levels: Water Table has Risen 2.37 feet in the past 32 years
  - December of 1976: Ground water was 9.51 feet below land.
  - November of 2008: Ground water was 7.14 feet below land.

Site Number: 414518101445401—South-Central Grant County (West of Highway 61)

- Ground Water Levels: Water Table has Risen 0.43 feet in the past 31 years
  - December of 1977: Ground water was 9.15 feet below land.
  - November of 2008: Ground water was 8.72 feet below land.

Brown County

Site Number: 421837099480601—South-Central Brown County

- Ground Water Levels: Water Table has Risen 24.61 feet in the past 32 years
  - December of 1976: Ground water was 29.00 feet below land.
  - October of 2008: Ground water was 4.39 feet below land.

Site Number: 422248099531801—South-Central Brown County

- Ground Water Levels: Water Table has Risen 3.66 feet in the past 37 years
  - June of 1971: Ground water was 12.00 feet below land.
  - October of 2008: Ground water was 8.34 feet below land.

Site Number: 422005099502701—South-Central Brown County

- Ground Water Levels: Water Table has Risen 9.59 feet in the past 37 years
  - June of 1971: Ground water was 15.00 feet below land.
  - October of 2008: Ground water was 5.41 feet below land.

Exh.
10

Pathway Bank

December 4, 2007

David Pieke
Cindy Pieke
83110 Hwy 45
Newman Grove NE 68758

Dear David and Cindy

This letter is to inform you that Pathway Bank has approved the purchase of the SW1/2NW1/4 of 17-21-4 in Madison County, Nebraska, from Opal Benson. The purchase price is in two installments:

$[redacted] due December 27, 2007 and
$[redacted] due January 30, 2008.

We also have approved the purchase of the W1/2SW1/4 of 7-21-4 in Madison County, Nebraska, from Opal Benson. The purchase price is also in two installments:

$[redacted] due December 27, 2009 and
$[redacted] due March 1, 2010.

The loan has been approved on the condition that the real estate would be developed for irrigation.

Sincerely,

Scott A Moss, LO

Scott Moss
Loan Officer

EXHIBIT
10
3-12-09 EDC
13pp.

AGREEMENT FOR SALE OF REAL ESTATE

THIS AGREEMENT made between OPAL P. BENSON, TRUSTEE OF THE OPAL P. BENSON TRUST DATED JANUARY 14, 1998 hereinafter called the SELLER, and DAVID PIEKE and CINDY PIEKE, husband and wife as joint tenants, hereinafter called the BUYERS.

1. **Description**. The Seller agrees to sell to the Buyers and the Buyers agree to purchase from the Seller, all of the Seller's interest in the following real property:

South Half of the Northwest Quarter (S ½ NW ¼) of Section Seventeen (17), Township Twenty-one (21) North, Range Four (4) West of the 6th P.M., Madison County, Nebraska.

2. **Acreage**. The approximate acreage of the above-described real estate is 80 acres. Such acreage is approximate and estimated. The real estate is sold as a whole and the acreage is not guaranteed or warranted by Sellers to Buyers.

3. **Consideration**. The Buyers covenant and agree to pay to the Seller, the sum of $[redacted].

4. **Place and Method of Payment**. The payments will be made to Seller at the times designated. Larry D. Bird, P.C., Attorneys at Law, 140 South 4th Street, Albion, NE 68620, is the attorneys for the Seller. The payments will be made at the times designated, payable as follows:

(1) [redacted] Dollars ($1[redacted]) by December 27, 2007.

(2) [redacted] Dollars ($[redacted]) payable on January 30, 2008.

5. **Abstract or Title Insurance**. Seller will furnish title insurance showing marketable title of record in the Seller. Title Insurance will be available on the date of closing.

6. **Type of Title**. The Seller will execute and convey a Warranty Deed. The Grantee in the Deed is hereby specified by Buyers as follows: David Pieke and Cindy Pieke, husband and wife as joint tenants.

7. **Taxes**. The 2007 and all prior real estate taxes will be paid by the Seller. The 2008 real estate taxes will be paid by the Buyer.

8. **Possession - Closing**. Possession of the real property will be given the Buyers by the Seller on closing of the transaction. Closing of the transaction will be on or before January 30, 2008. The place of closing will be at the office of Larry D. Bird, P.C., Albion, Nebraska or at another place designated by Seller.

2

9. **Title**. Title to the real property and any personal property conveyed will remain in Seller until closing.

10. **Transfer Tax**. The Seller agrees to pay the transfer tax as required by the State of Nebraska on the purchase price at the time of closing.

11. **Liens and Encumbrances**. All parties agree to keep the property described free from any liens and encumbrances unless otherwise stated.

12. **Default**. It is agreed that if the Buyers default in the payments or in the performance of any other terms of this contract for a period of ten (10) days after any of the payments are due, the Sellers may at their option, elect to declare the amount of the initial or earnest money paid as liquidated damages and retain said amounts or take any other action, including specific performance, afforded to the Sellers under Nebraska Law.

13. **Assignment**. The Buyers may assign their interest in this contract as collateral.

14. **Agricultural Lease**. This agreement is subject to the agricultural lease with the Buyer that expires on February 28, 2008.

15. **Covenants**. It is mutually agreed that all of the covenants contained shall extend to and be obligatory upon the heirs, personal representatives and assigns of the parties.

16. **Time of Essence.** Time is and shall be of the essence of this agreement and any indulgence or waiver of due performance or of any other breach of any agreement or covenant of this contract by the Buyers shall not be deemed or construed as a waiver by the Sellers of any other or subsequent breach, nor shall indulgence by the Seller in extending the time of performance in any given instance be deemed or construed as a waiver of the provision that time is of the essence as to any other or subsequent breach or breaches.

17. **Allocation of Expenses of Sale**. The parties agree that the expenses of closing the sale transaction shall be allocated as follows:

Purchase Contract – Seller
Preparation of Deed and Transfer Statement - Seller
Recording of Deed - Buyer
Title Insurance - 50% Buyer, 50% Seller
Lender's premium - Buyer
Closing Fee – 50% Buyer, 50% Seller

3

18. **Funds at Closing**. STATE LAW NOW REQUIRES BUYER AND SELLER TO REMIT PURCHASE PRICE AND CLOSING COSTS BY GOOD FUNDS ONLY. THIS MEANS THAT ALL FUNDS NEEDED AT CLOSING MUST BE IN THE FORM OF A CASHIER'S CHECK, MONEY ORDER, CASH OR CERTIFIED BANK DRAFT. PERSONAL CHECKS WILL NOT BE ACCEPTED AT CLOSING AND WILL RESULT IN THE DELAY OF CLOSING.

IN WITNESS WHEREOF the parties have hereunto executed this agreement in duplicate original counterparts on the dates as shown by their respective signatures.

Dated: [redacted]

Opal P. Benson
OPAL P. BENSON, TRUSTEE OF THE OPAL P. BENSON TRUST DATED JANUARY 14, 1998 - SELLER
SSN or EIN: _____

Dated: [redacted]

David Pieke
DAVID PIEKE - BUYER
SSN: 508-94-1122

Dated: [redacted]

Cindy Pieke
CINDY PIEKE - BUYER
SSN: 508-02-9923

4

STATE OF NEBRASKA)
) ss:
COUNTY OF MADISON)

Before me, a notary public duly qualified for said county, personally came Opal P. Benson, Trustee of the Opal P. Benson Trust dated January 14, 1998, known to me to be the identical person who signed the foregoing instrument and acknowledged the execution thereof to be her voluntary act and deed.

WITNESS my hand and notary seal on the 19 day of DECEMBER, 2007.

NOTARY PUBLIC

STATE OF NEBRASKA)
) ss:
COUNTY OF BOONE)

Before me, a notary public duly qualified for said county, personally came David Pieke and Cindy Pieke, husband and wife, known to me to be the identical persons who signed the foregoing instrument and acknowledged the execution thereof to be their voluntary act and deed.

WITNESS my hand and notary seal on the 20 day of DECEMBER, 2007.

NOTARY PUBLIC

PREPARED BY:

LARRY D. BIRD, P.C.
140 South 4th Street
Albion, NE 68620
(402) 395-2516

BensonPiekeAgreement

5

AGREEMENT FOR SALE OF REAL ESTATE

Opal P. Benson, Trustee of the Opal P. Benson Trust hereby agrees to sell the following real estate to-wit:

> West Half of the Southwest Quarter (W½SW¼) of Section Seven (7), Township Twenty-one (21) North, Range Four (4) West of the 6th P.M., Madison County, Nebraska

to David Pieke and Cindy Pieke, husband and wife as joint tenants under the following terms:

1. **Description**. The Seller agrees to sell to the Buyers and the Buyers agree to purchase from the Seller, all of the Seller's interest in the following real property:

> West Half of the Southwest Quarter (W½SW¼) of Section Seven (7), Township Twenty-one (21) North, Range Four (4) West of the 6th P.M., Madison County, Nebraska.

2. **Acreage**. The approximate acreage of the above-described real estate is 80 acres. Such acreage is approximate and estimated. The real estate is sold as a whole and the acreage is not guaranteed or warranted by Sellers to Buyers.

3. **Consideration**. The Buyers covenant and agree to pay to the Seller, the sum of $[redacted]

4. **Place and Method of Payment**. The payments will be made to the firm of Larry D. Bird, P.C., Attorneys at Law, 140 South 4th Street, Albion, NE 68620 (402) 395-2516 at the times designated. Such law firm are the attorneys for the Seller. The payments will be made at the times designated, payable as follows:

(1) [redacted] Dollars ($[redacted]) on December 27, 2009

(2) [redacted] Dollars ($[redacted]) upon Closing. Closing of this transaction will be on March 1, 2010. However, if Opal P. Benson dies prior to that date, Closing will be within 30 days of the death of Opal P. Benson and the entire purchase price of $[redacted] will be paid at Closing.

5. **Abstract or Title Insurance**. Seller will furnish title insurance showing marketable title of record in the Seller.

6. **Type of Title**. The Seller will execute and convey a Warranty Deed. The Grantee in the Deed is hereby specified by Buyers as follows: David Pieke and Cindy Pieke, husband and wife as joint tenants.

7. **Taxes**. The 2009 and all prior real estate taxes will be paid by the Seller. The 2010 real estate taxes will be paid by the Buyer.

6

8. **Possession - Closing**. Possession of the real property will be given the Buyers by the Seller on closing of the transaction. Closing of the transaction will be on March 1, 2010. The place of closing will be at the office of Larry D. Bird, P.C., Albion, Nebraska or at another place designated by Seller.

9. **Title**. Title to the real property and any personal property conveyed will remain in Seller until closing.

10. **Transfer Tax**. The Seller agrees to pay the transfer tax as required by the State of Nebraska on the purchase price at the time of closing.

11. **Liens and Encumbrances**. All parties agree to keep the property described free from any liens and encumbrances unless otherwise stated.

12. **Default**. It is agreed that if the Buyers default in the payments or in the performance of any other terms of this contract for a period of ten (10) days after any of the payments are due, the Sellers may at their option, elect to declare the amount of the initial or earnest money paid as liquidated damages and retain said amounts or take any other action, including specific performance, afforded to the Sellers under Nebraska Law.

13. **Covenants**. It is mutually agreed that all of the covenants contained shall extend to and be obligatory upon the heirs, personal representatives and assigns of the parties.

14. **Allocation of Expenses of Sale**. The parties agree that the expenses of closing the sale transaction shall be allocated as follows:

Purchase Contract – Seller
Preparation of Deed and Transfer Statement - Seller
Recording of Deed - Buyer
Title Insurance - 50% Buyer, 50% Seller
Lender's premium - Buyer
Closing Fee – 50% Buyer, 50% Seller

15. **Funds at Closing**. STATE LAW NOW REQUIRES BUYER AND SELLER TO REMIT PURCHASE PRICE AND CLOSING COSTS BY GOOD FUNDS ONLY. THIS MEANS THAT ALL FUNDS NEEDED AT CLOSING MUST BE IN THE FORM OF A CASHIER'S CHECK, MONEY ORDER, CASH OR CERTIFIED BANK DRAFT. PERSONAL CHECKS WILL NOT BE ACCEPTED AT CLOSING AND WILL RESULT IN THE DELAY OF CLOSING.

7

IN WITNESS WHEREOF, the parties as mentioned above have executed this lease and agreement for sale of real estate on the 19 day of DECEMBER, 2007.

Opal P. Benson

OPAL P. BENSON, TRUSTEE OF OPAL P. BENSON TRUST - OWNER

David Pieke

DAVID PIEKE - LESSEE

Cindy Pieke

STATE OF NEBRASKA)
) ss.
COUNTY OF MADISON)

On this 19 day of DECEMBER, 2007, before me, the undersigned a Notary Public qualified in said county, personally appeared Opal P. Benson, Trustee of Opal P. Benson Trust, to me known to be the identical person whose name is affixed to the foregoing instrument and acknowledged the execution thereof to be her voluntary act and deed.

WITNESS my signature and notarial seal on the above date.

LARRY D. BIRD GENERAL NOTARY COMMISSION EXPIRES

NOTARY PUBLIC

STATE OF NEBRASKA)
) ss.
COUNTY OF BOONE)

On this 20 day of DECEMBER, 2007, before me, the undersigned, a Notary Public qualified in said county, personally came David Pieke, Cindy Pieke to me known to be the identical persons whose name is affixed to the foregoing instrument and acknowledged the execution thereof to be his voluntary act and deed.

WITNESS my signature and notarial seal on the above date.

LARRY D. BIRD GENERAL NOTARY COMMISSION EXPIRES

NOTARY PUBLIC

bensonlease08

8

Pathway Bank

P.O. BOX 435/355 SOUTH HIGH STREET - CAIRO, NE 68824-0420 . PHONE: 800.406.4038 • FAX: 308.485.4235

September 10, 2008

David Pieke
Cindy Pieke
83110 Hwy 45
Newman Grove, NE 68758

Dear David and Cindy,

Pathway Bank has approved your purchase of the following tracts of real estate:

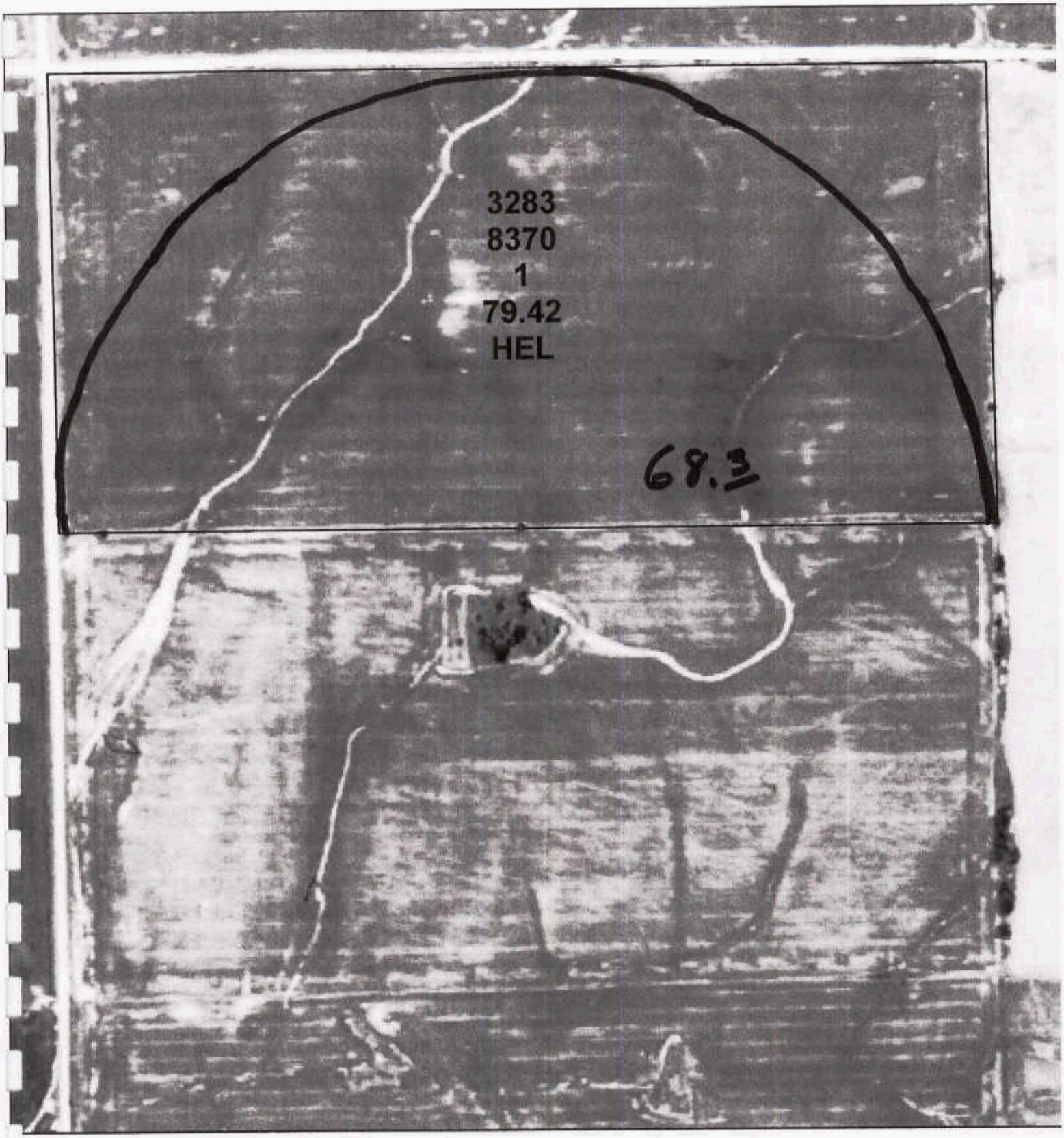
(1) S1/2S1/2NW1/4 of 7-21-4
(2) E1/2SW1/4 of 7-21-4
(3) SE1/4 of 7-21-4

The above mentioned real estate is all located in Madison County, Nebraska and will be purchased from LeRoy Pieke.

The bank has based their approval of purchase on the assumption that the ground will be irrigated from an irrigation well located on the W1/2SW1/4 of 7-21-4 in Madison County, Nebraska, that you are purchasing from Opal Benson.

Sincerely,

Scott Moss
Loan Officer



USDA United States Department of Agriculture
Farm Service Agency

17-21-4W

Boone County, NE

1:4,469 inch equals 372.4 feet 1 inch equals 372.4 feet

2009 Crop Year-2007 Compliance Imagery-Not Official

March 09, 2009

Wetland Legend

fsa_gis_layers.SDE.wet_p_ne011

Wetland Determination Identifiers

- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

isclaimer: Wetland identifiers do not represent the size, shape or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact wetland boundaries and determinations, or contact NRCS.

COPY

BILL OF SALE

KNOW ALL MEN BY THESE PRESENTS:

THAT LeRoy A. Pieke and Mary J. Pieke, husband and wife, ("Grantor"), in consideration of the consideration set forth in a Purchase Agreement dated September 3, 2008, paid to Grantor, at or before the delivery of these presents, by David Pieke and Cindy Pieke, husband and wife, as joint tenants ("Grantee"), the receipt of which is hereby acknowledged, does hereby grant and convey unto Grantee, their heirs, personal representatives, successors and assigns, the personal property set forth on Exhibit "A", attached hereto and made a part hereof, free and clear of all encumbrances and taxes now due and payable.

TO HAVE AND TO HOLD the same unto the said Grantee, their personal co-representatives, successors and assigns, forever, and covenant and agree to and with said Grantee, their personal co-representatives, successors and assigns, to warrant and defend the sale of said property, goods and chattels hereby made, unto Grantee, their personal co-representatives, successors and assigns, against the claims of all and every person and persons whomsoever.

In witness whereof the undersigned have executed this Bill of Sale this 5th day of January, 2009.

LeRoy A. Pieke

Mary J. Pieke

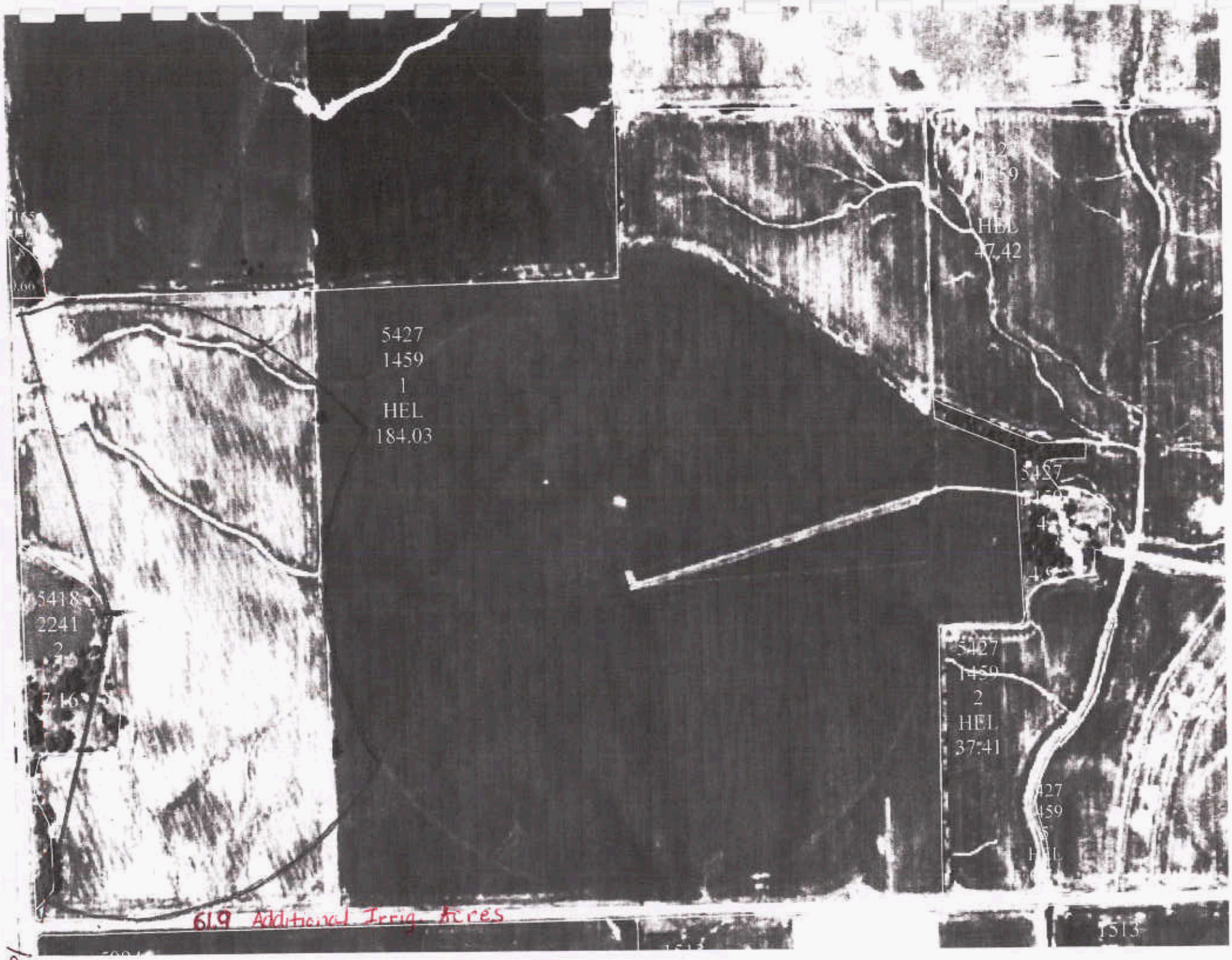
STATE OF NEBRASKA)
) ss.
COUNTY OF MADISON)

The foregoing instrument was acknowledged before me this 5th day of January, 2009, by LeRoy A. Pieke and Mary J. Pieke, husband and wife, Grantor.

GENERAL NOTARY-State of Nebraska
DENNIS W. COLLINS
My Comm. Exp. July 27, 2012

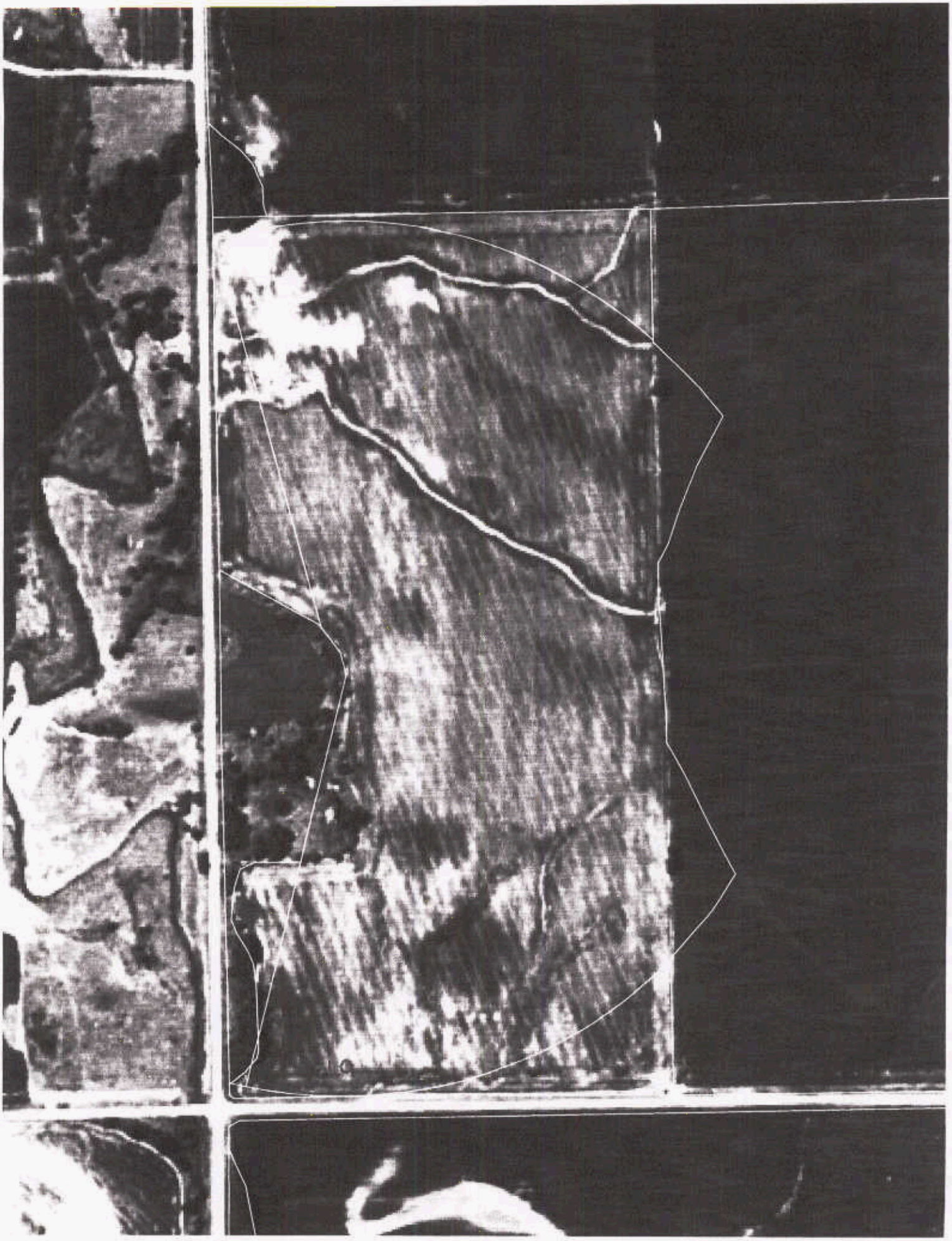
Notary Public

GENERAL NOTARY-State of Nebraska
DENNIS W. COLLINS
My Comm. Exp. July 27, 2012



61.9 Additional Irrig. Acres

12



Exh.
11

March 12, 2009

Dear NDNR Director Brian Dunnigan, Governor Dave Heineman,
and others this may concern:

I am submitting this statement in opposition to the Nebraska Department of Natural Resources preliminary determination that the Lower Platte River Basin, including parts of the Elkhorn and Loup River Basins, is "Fully Appropriated."

I farm north of Schuyler, and the majority of what I currently farm is irrigated land. I do see the groundwater that I pump and the surface water that flows through my land as a very valuable resource. There definitely is the need to closely monitor the quantity and the quality of the water resources in our state, and I am grateful for the NDNR and the NRD's that do this work. However, I question the timing and necessity of the well drilling moratorium that would result from a final "Fully Appropriated" determination.

To become better informed, I attended both the informational meeting in Norfolk on January 9, 2009, and the Norfolk hearing on February 17, 2009. Besides the information provided by the representatives of the NDNR, ALL of the comments, statements, testimonies, and facts opposed this preliminary determination of "Fully Appropriated." Of the 300 plus people in attendance at both meetings, NO ONE, except for NDNR representatives, spoke in favor of this determination.

This decision will have a huge impact on many Nebraskans lives. I'm sure you have already received a large number of testimonies supporting this statement. With such an important decision to be made, shouldn't we be certain that the "best science" that we are using to make the decision is actually the "best science"? I question the value and validity of "best science," "methodology," and "computer models" when actual data such as stream flow levels and static groundwater levels DO NOT support the findings of the NDNR.

I have included two maps that put into question the "best science" used by the NDNR. The first is a map of the State and Lower Elkhorn NRD Moratorium areas, and the second is a map of the section in which I own land. This section is considered "hydrologically connected" to the Platte River and therefore would be affected by a state imposed moratorium. After visiting with Susan Olafsen Lackey, a hydrogeologist with the University of Nebraska, I understand that soil structure and formations were used to determine how the flow of ground water is connected, and eventually connected to the Platte River. This is important, but if surface water is considered, the inclusion of Sect. 7 (the section in which I own land) does not make any sense. The sections to the north, east, and west of Sect. 7 are not included in the proposed state moratorium. Surface water runs west to east through Sect. 7 through the Kasal Ditch and the Dry Creek. The water flows out of the section to the west, into Sect. 7, and then to the section to the east, but neither of theses other two sections are included in the proposed state moratorium. Common sense, not a computer model, tells me that something is flawed, and that the "best science" is flawed.

Please consider this information when making such an important decision that will affect so many Nebraskans. Thank you.

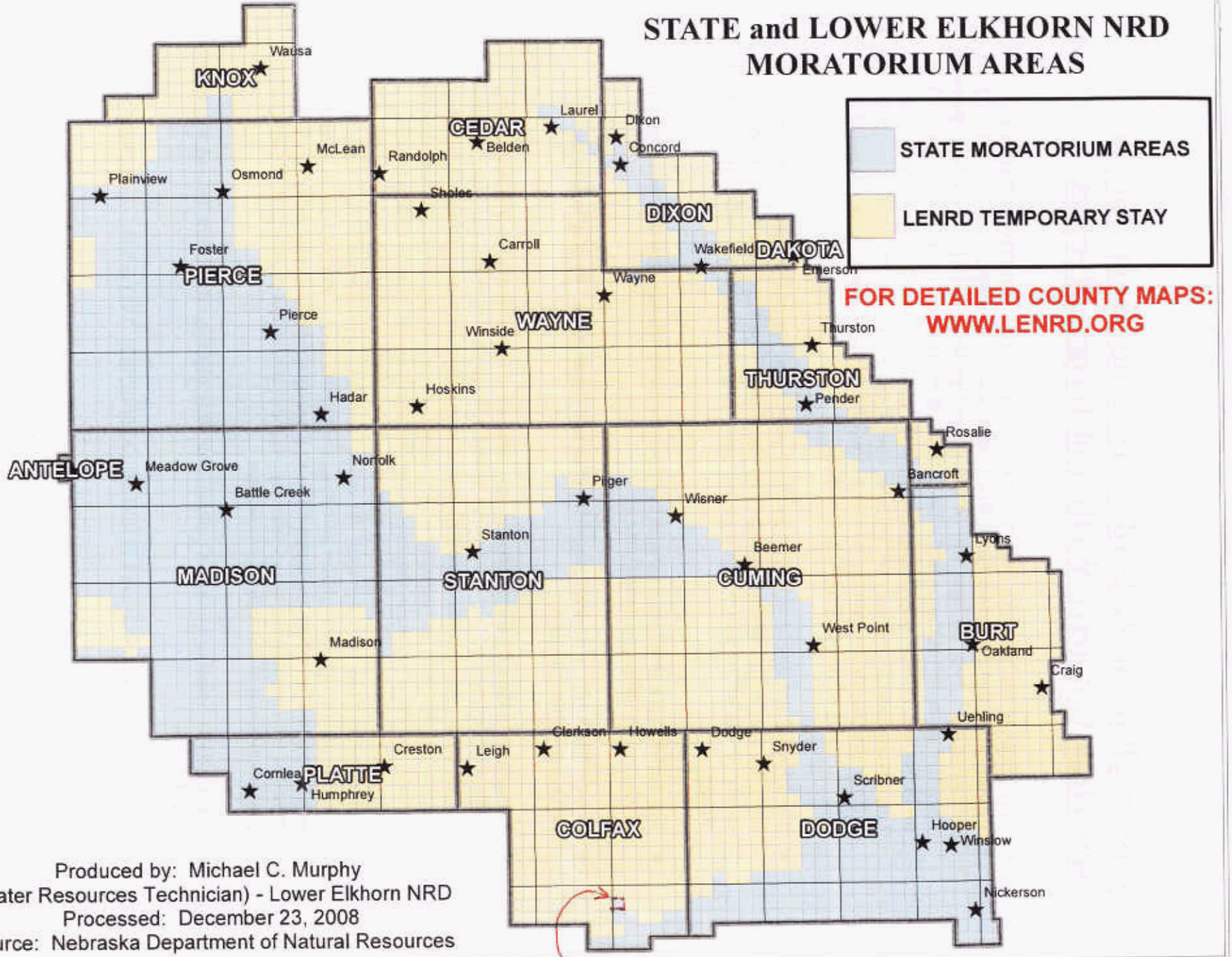
Sincerely,

Brian Vavricek

Brian Vavricek

EXHIBIT
11
3-12-09 App.

STATE and LOWER ELKHORN NRD MORATORIUM AREAS



Produced by: Michael C. Murphy
(Water Resources Technician) - Lower Elkhorn NRD
Processed: December 23, 2008
Source: Nebraska Department of Natural Resources

Section 7 T18N R4E

8

Lower Elkhorn NRD 180 Day Temporary Stay on New High Capacity Wells and Irrigated Acres

- In response to the Nebraska Department of Natural Resources (DNR) preliminary determination that the Lower Platte River Basin was fully appropriated, which includes a portion of the Lower Elkhorn Natural Resources District (LENRD), the LENRD Board of Directors passed a resolution at the Dec. 22, 2008 regular meeting that placed into effect an immediate 180 day stay (moratorium) on the construction of any new high-capacity water well, issuance of new well permits, and on the increase of the number of acres historically irrigated within the portion of the LENRD not subject to the preliminary determination of fully appropriated by the DNR.

- The LENRD is required to hold at least one public hearing on the matter within the district during such 180 days, and give notice of such hearing, as provided by law, prior to any determination as to imposing a permanent stay or any other conditions provided by statute.

- The LENRD is authorized to grant exceptions to the temporary stay (moratorium) within 45 days of the aforementioned hearing.

- The LENRD, if it so desires, may rescind or renew the temporary stay before the expiration of the 180 days

- Exceptions to the LENRD temporary stay shall exist for (a) test holes, (b) dewatering wells with an intended use of one year or less, (c) monitoring wells, (d) wells constructed pursuant to a ground water remediation plan under the Environmental Protection Act, (e) water wells designed and constructed to pump fifty gallons per minute or less, except that no two or more water wells that each pump fifty gallons per minute or less may be connected to serve a single project such that the collective pumping would exceed fifty gallons per minute, (f) water wells for range livestock, (g) water wells necessary to alleviate an emergency situation involving the provision of water for human consumption or public health or safety, (h) water wells defined by the NRD as replacement wells, provided the consumptive use of such replacement well is not greater than the historic consumptive use of the well it is to replace

- The LENRD Board of Directors conducts monthly meetings the fourth Thursday of each month

- For more information call the LENRD office at (402)371-7313 or visit our website at www.lenrd.org

3

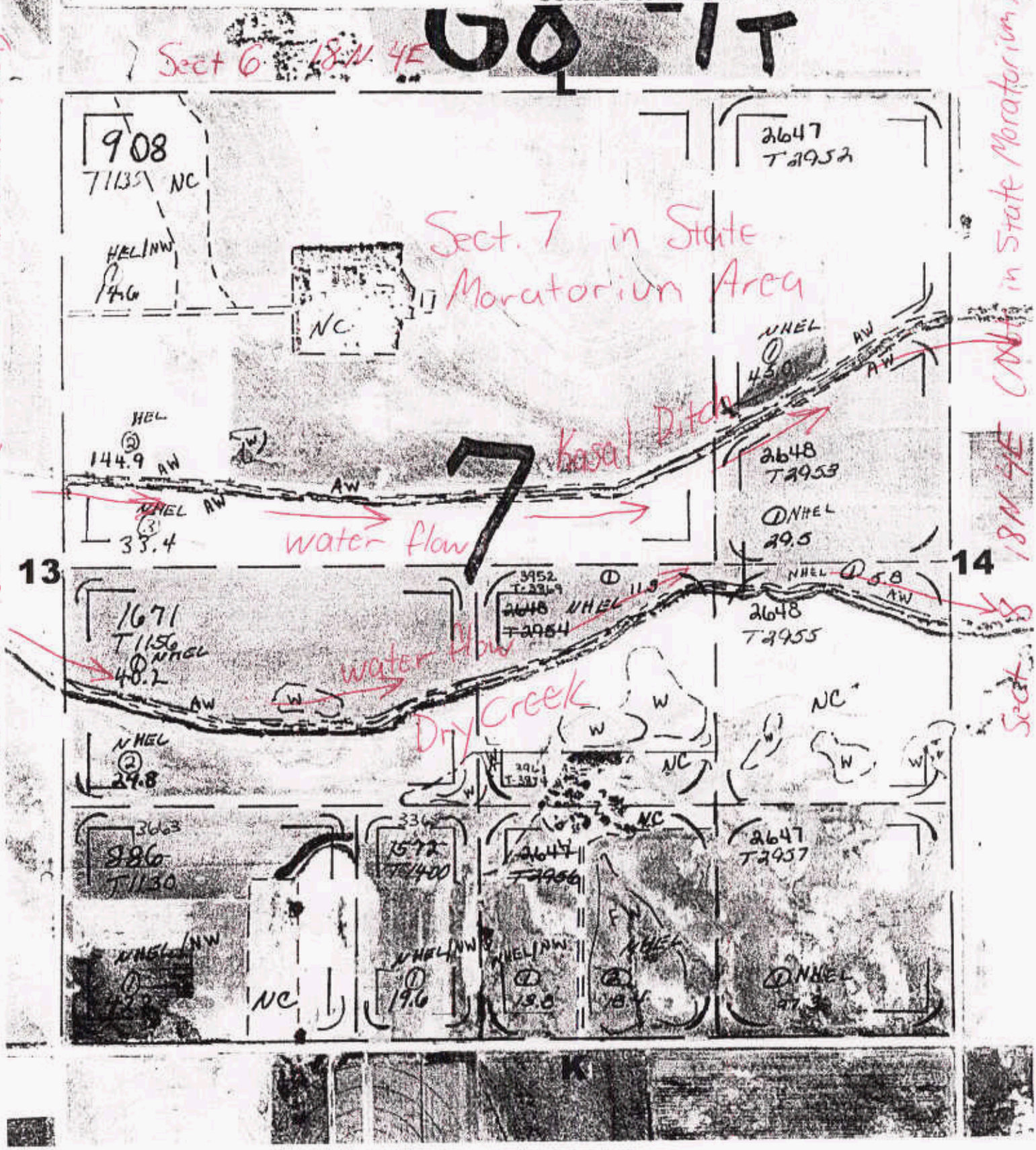
COLFAX TOWNSHIP

NOT TO SCALE

Colfax County 1988 Photo G6

T-18-N R-4-E 50 Sec. 7

Colfax Co. T-18-N R-4-E Sec. 7



Exh.
12

March 4, 2009

TO: Nebraska Department of Natural Resourses
301 Centennial Mall South
Lincoln, NE 68509

I am writing regarding the ban on new irrigation development in the Lower Platte River Basin.

I am opposed to a ban that covers the entire basin. My mother and I both own farms south of Ord, Nebraska. I have an irrigation well and the last reading showed a water level higher than when the original well was drilled. I know that in some areas of Valley County the water table has risen so much that farmers are having trouble farming the land. This is probably due to seepage from the Calamus Dam, a man made disaster.

Also, I was deceived by Butch Koehlmoos. I went to his office just prior to the moratorium and inquired as to when any moratorium might be put in place. He advised that they were planning a two year study and would make a determination as to establishing a moratorium after the study was completed. Very shortly thereafter the moratorium was put in place without any advanced notice. This was handled in a very dictatorial manner and was very costly to some landowners. For example my elderly mothers farm has topography that is very adaptable for irrigation development. I asked a local realtor how much the moratorium affected the value of development land and was advised at least by $700.00 per acre. My mother was effectively robbed of $112,000.00 because of the deceit by Butch Koehlmoos. That was a time when crop prices were low and the difference between dry land and irrigated values is much greater now.

It is totally illogical to have a moratorium on an entire basin when some portions have very stable and even rising water levels. This past moratorium at least in part is unnecessary Government intervention and very detrimental to economic development. Please insert some common sense into any moratorium and begin to treat landowners with a little respect and compassion.

Sincerely;

H. Eugene Cook

H. Eugene Cook
2200 Larchdale Drive
Lincoln, NE 68506

State of Nebraska
Department of
Natural Resources
Filed in the Department of
Natural Resources at 9:20
O'clock A M. this 6th
day of MARCH 20 09
L. Gower
No Fee Received

EXHIBIT
12
3-13-09 WC

LINCOLN NE 685

04 MAR 2009 PM 1 T

USA FIRST-CLASS FOREVER

RECEIVED

MAR 06 2009

DEPARTMENT OF NATURAL RESOURCES

Nebraska Department of Natural Resources
301 Centennial Mall South
Lincoln, NE 68509

68508+3523

Exh.
13

Bacon&Vinton LLC
ATTORNEYS AT LAW

416 10th Street
P.O. Box 208
Gothenburg, NE 69138

Phone: (308) 537-7161
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ljorgenson@bacon-vinton.com

*also licensed in the State of Kansas

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MAR 13 2009
DEPARTMENT OF NATURAL RESOURCES

March 10, 2009

Mr. Brian Dunnigan, Director
Nebraska Department of Natural Resources
P.O. Box 94676
301 Centennial Mall South, 4th Floor
Lincoln, NE 68509

Dear Mr. Dunnigan:

I am writing you this letter as a concerned land owner and businessman. I own ranchland in Hooker County, Nebraska, which is located in the Upper Loup Natural Resources District. I would like to offer these comments on the Department of Natural Resources' (DNR) report, 2009 Annual Evaluation of Availability of Hydrologically Connected Water Supplies (the report). I would ask that these comments be included in the administrative record and considered by DNR when developing its final decision on the appropriated status of the Lower Platte River Basin. Nebraska Statute §46-713 (1) provides that the DNR shall arrive at a preliminary conclusion for each river basin, sub-basin and reach evaluated as to whether such basin is fully appropriated and that in preparing the report, DNR shall rely on the best scientific data and information readily available. DNR is further required to consider relevant data and information in your possession from water users and stakeholders. For this reason, I believe that my concerns in this matter should be considered.

I disagree with the DNR's preliminary finding the Lower Platte River Basin is fully appropriated. I would ask DNR to reconsider its preliminary determination the Lower Platte River Basin is fully appropriated and issue a final determination the basin is not fully appropriated.

As a practicing attorney, I am always concerned that sufficient evidence exists to support a decision. I do not believe sufficient evidence exists to support the finding that the Lower Platte River Basin is fully appropriated. I know from personal experience that ground water levels in Hooker County, have not varied significantly, despite the fact that precipitation on an annual basis has been less than average for a majority of the recent years.

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App.

It can't be emphasized enough that water is the lifeblood of agriculture in Nebraska. While I certainly support sound management decisions in regards to the state's water resources, unnecessarily restricting water use will undermine economic opportunities for farmers, ranchers and communities. Unnecessary restrictions do come with an economic cost.

A fully appropriated finding in the Lower Platte River Basin would have economic consequences for individual farmers and ranchers. Obviously, rainfall is uncontrollable, and farmers and ranchers must deal with weather risks. Irrigation is a risk management tool farmers and ranchers can utilize to minimize risk. Reducing risk improves producers' revenue stability and profitability. Given the benefits of irrigation to Nebraska's economy and its farmers and ranchers, it is imperative for DNR to be absolutely certain, prior to reaching a fully appropriated determination.

I also have concerns that DNR does not have the staff or budgetary resources to perform its necessary functions as required by law. DNR technical staff is being asked to perform many complex, hydrological analyses to address challenges in Republican River basin, implement the Platte River program, develop integrated management plans in cooperation with NRDs, and issue the annual evaluation of the availability of hydrologically connected water supplies. I am concerned DNR does not have the staff and resources necessary to sufficiently perform the evaluation required.

In closing, please reconsider the preliminary determination that the Lower Platte River Basin is fully appropriated and issue a final determination that the basin is not fully appropriated. Given the potential economic impact of a fully appropriated designation, and the questions that exist concerning the data and methodologies employed in the report, I do not believe a fully appropriated determination is warranted or justified. DNR's determinations should be based on sound science which is subject to an independent peer review. To that end, I encourage the DNR to work with NRDs including the Upper Loup NRD to create a work group to seek a peer review by independent technical experts of the data, analysis, and methodologies used in the report. Such a review should examine the models utilized, the assumptions made, and the sensitivity of the analysis to variability in land use changes, precipitation, groundwater recharge rates, etc.

Thank you for your consideration of my comments.

Sincerely

Steven P. Vinton
SPV/kkp

Exh.
14

3-10-09

Marvin Bodlak
428 13 to Rd
Emerson NE 68733

Subject: Lower Platte Basin Fully Appropriated

Mr. Dunnigan:

Please ~~see~~ consider the enclosed Facts.

The only logical conclusion is not fully appropriated. Using the facts (water levels + streamflows are up over 50 yrs. ago) and projecting 25 yrs into the future we'll have stable to up water resources. One other ~~factor~~ mistaken factor I use 5.5 inches of irrigation water in growing fully irrigated corn + soybean rotational crops not the 11.5 inches alloted in the projections.

Thank you for your consideration.

Respectfully,
MB

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Registration shows 20 feet
Highest Spring: 9.35 feet - 1984
Lowest Spring: 23.73 feet - 1982
Highest Fall: 10.96 feet - 2007
Lowest Fall: 24.82 feet - 1981

Legal	Date	Level
26N 5E24DABD1	6/22/1976	23.23
26N 5E24DABD1	10/21/1976	23.56
26N 5E24DABD1	5/11/1977	23.62
26N 5E24DABD1	11/2/1977	23.72
26N 5E24DABD1	5/10/1978	21.50
26N 5E24DABD1	11/2/1978	23.30
26N 5E24DABD1	5/14/1979	19.62
26N 5E24DABD1	11/13/1979	21.79
26N 5E24DABD1	4/30/1980	21.86
26N 5E24DABD1	11/7/1980	23.27
26N 5E24DABD1	4/21/1981	23.63
26N 5E24DABD1	11/12/1981	24.82
26N 5E24DABD1	5/11/1982	23.73
26N 5E24DABD1	11/15/1982	15.93

Well Drilled 1956
Pre-Development Water 20'
Avg 1976-1985 19.63
Avg 1986-1998 16.64
Avg 1999-2008 15.76

Water Level UP + 3.75' over last 23 yrs + since ~~since~~ Pre-development 52 yrs ago

Using Best Science up another 3.75' in the next 25 yrs?

As you can determine this well is in the moratorium area of Logan Creek and has no help ~~from~~ recharging from water impoundments ETC. Even less water to be pumped due to No Till + Crop genetics in the future.

It looks to me using science we're headed for higher Groundwater and Stream flows in the next 25 yrs. Please consider the only facts we have in considering your decisions.

26N 5E24DABD1	5/26/1983	11.01
26N 5E24DABD1	12/9/1983	17.02
26N 5E24DABD1	5/23/1984	9.35
26N 5E24DABD1	11/8/1984	13.64
26N 5E24DABD1	5/20/1985	11.54
26N 5E24DABD1	11/1/1985	16.57
26N 5E24DABD1	5/12/1986	13.00
26N 5E24DABD1	11/13/1986	15.55
26N 5E24DABD1	4/30/1987	12.54
26N 5E24DABD1	11/5/1987	16.69
26N 5E24DABD1	5/12/1988	17.82
26N 5E24DABD1	11/10/1988	22.58
26N 5E24DABD1	5/2/1989	21.46
26N 5E24DABD1	11/14/1989	23.74
26N 5E24DABD1	4/26/1990	23.65
26N 5E24DABD1	10/31/1990	21.85
26N 5E24DABD1	5/2/1991	22.31

26N 5E24DABD1	11/15/1991	23.84
26N 5E24DABD1	4/30/1992	22.03
26N 5E24DABD1	11/17/1992	15.73
26N 5E24DABD1	5/13/1993	11.20
26N 5E24DABD1	11/2/1993	11.85
26N 5E24DABD1	5/9/1994	13.72
26N 5E24DABD1	10/27/1994	12.43
26N 5E24DABD1	5/20/1995	9.98
26N 5E24DABD1	11/7/1995	15.03
26N 5E24DABD1	4/23/1996	15.51
26N 5E24DABD1	10/28/1996	14.27
26N 5E24DABD1	4/21/1997	12.44
26N 5E24DABD1	10/28/1997	16.75
26N 5E24DABD1	4/22/1998	13.77
26N 5E24DABD1	10/15/1998	13.10
26N 5E24DABD1	4/29/1999	10.31
26N 5E24DABD1	10/25/1999	14.72

26N 5E24DABD1	3/30/2000	16.15
26N 5E24DABD1	10/10/2000	19.17
26N 5E24DABD1	4/16/2001	15.06
26N 5E24DABD1	10/19/2001	16.60
26N 5E24DABD1	4/19/2002	16.33
26N 5E24DABD1	10/15/2002	18.53
26N 5E24DABD1	4/23/2003	18.44
26N 5E24DABD1	10/30/2003	17.30
26N 5E24DABD1	4/12/2004	14.14
26N 5E24DABD1	10/19/2004	16.27
26N 5E24DABD1	4/6/2005	16.97
26N 5E24DABD1	10/17/2005	18.10
26N 5E24DABD1	4/20/2006	17.03
26N 5E24DABD1	10/19/2006	18.76
26N 5E24DABD1	4/16/2007	13.47
26N 5E24DABD1	10/25/2007	10.96
26N 5E24DABD1	4/21/2008	11.29

10/15/2008 15.63

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USGS 06796000 Platte River at North Bend, Nebr.

Available data for this site | Time-series: Annual statistics | GO

Dodge County, Nebraska
Hydrologic Unit Code 10200201
Latitude 41°27'10", Longitude 96°46'32" NAD83
Drainage area 70,400.00 square miles
Contributing drainage area 57,800.00 square miles
Gage datum 1,262.32 feet above sea level NGVD29

Output formats
- HTML table of all data
- Tab-separated data
- Reselect output format

Water Year	00060, Discharge, cubic feet per second
1950	4,190
1951	5,562
1952	4,660
1953	3,768
1954	2,937
1955	2,525
1956	2,168

1950-1959 Avg 3648 CFS

1999-2008 Avg 3852 CFS

106 %

Uptrending Water Flows?

I'm sure surface irrigation needs in 2009 are significantly less than 1959.

6

Water Year	00060, Discharge, cubic feet per second
1957	3,256
1958	4,132
1959	3,284
1960	4,558
1961	3,120
1962	5,002
1963	3,380
1964	3,376
1965	4,508
1966	4,496
1967	4,285
1968	3,181
1969	4,243
1970	3,523
1971	5,280
1972	3,779
1973	6,984
1974	5,834
1975	3,213
1976	2,967
1977	3,820
1978	4,233
1979	3,751
1980	4,785
1981	3,048
1982	4,801
1983	9,692
1984	10,070
1985	6,157

7

Water Year	00060, Discharge, cubic feet per second
1986	6,417
1987	7,298
1988	4,530
1989	3,907
1990	3,975
1991	3,391
1992	4,254
1993	7,177
1994	4,528
1995	6,107
1996	5,245
1997	5,576
1998	5,360
1999	5,450
2000	4,468
2001	4,038
2002	2,674
2003	2,733
2004	2,593
2005	3,115
2006	2,519
2007	4,301
2008	4,857
** No Incomplete data have been used for statistical calculation	

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USGS 06805500 Platte River at Louisville, Nebr.

Available data for this site | Time-series: Annual statistics | GO

Sarpy County, Nebraska
Hydrologic Unit Code 10200202
Latitude 41°00'55", Longitude 96°09'28" NAD83
Drainage area 85,370 square miles
Contributing drainage area 71,000.00 square miles
Gage datum 1,007.10 feet above sea level NGVD29

Output formats
- HTML table of all data
- Tab-separated data
- Reselect output format

Water Year	00060, Discharge, cubic feet per second
1954	4,509
1955	3,338
1956	2,885
1957	4,615
1958	6,253
1959	5,319
1960	8,286

Avg yearly CFS
1954-1980 - 5916 CFS
1982-2008 - 8757 CFS
Last 26 yrs = 148%

A Problem? (I don't think so)

The only Reasonable Decision is NO decision

What will we do with extra Water?

9

Water Year	00060, Discharge, cubic feet per second
1961	4,595
1962	7,371
1963	4,929
1964	5,324
1965	6,910
1966	6,170
1967	6,537
1968	4,144
1969	6,077
1970	4,525
1971	7,589
1972	5,240
1973	9,183
1974	7,779
1975	4,737
1976	3,855
1977	4,712
1978	6,548
1979	5,700
1980	6,678
1981	3,768
1982	7,989
1983	13,710
1984	16,210
1985	8,836
1986	9,950
1987	12,060
1988	5,852
1989	5,142

Water Year	00060, Discharge, cubic feet per second
1990	5,721
1991	5,251
1992	6,408
1993	14,710
1994	8,386
1995	10,600
1996	9,727
1997	8,840
1998	11,250
1999	11,610
2000	6,608
2001	7,214
2002	4,496
2003	4,454
2004	4,529
2005	5,144
2006	4,161
2007	8,286
2008	10,550
** No Incomplete data have been used for statistical calculation	

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METROPOLITAN UTILITIES DISTRICT
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March 13, 2009

VIA FACSIMILE & U.S. MAIL

Ron Theis, Hearing Officer
Nebraska Department of Natural Resources
301 Centennial Mall South
Lincoln, Nebraska 68509

RE: Comments of the Metropolitan Utilities District of Omaha Regarding Preliminary Determination of the Lower Platte as Fully Appropriated

Dear Mr. Theis:

The Metropolitan Utilities District of Omaha (M.U.D.) offers the following comments regarding the DNR's preliminary designation of the Lower Platte River as fully appropriated. M.U.D. would like these comments included in the record.

M.U.D. recently completed its Platte West Treatment Facility supplied by 42 wells located along the Platte River in Douglas County and Saunders County. The use of these wells for municipal purposes began in the latter half of 2008. There is no baseline history of water use for this wellfield. The cost of the wellfield and treatment facility was approximately $350,000,000.

On December 10, 1998, the Department of Natural Resources (DNR) granted a permit under the Municipal and Rural Domestic Ground Water Transfer Act for 52 MGD average and 104 MGD maximum for the Platte West well field (A-17356). The DNR also granted an induced groundwater recharge permit of 1,000 cfs to M.U.D. (A-17318). M.U.D. also has a municipal permit and an induced groundwater recharge permit at its Platte South well field.

The DNR's processing of each of these permit applications over a number of years involved extensive analysis by the Department of the future use of the well field to provide the municipal water uses of the Omaha area for many years to come. It is apparent that a municipal permit and an induced recharge permit related thereto must have a future use increase inherent in them.

In 2006, after LB 1226 was passed, amending Neb. Rev. Stat Sec. 46-740, I asked DNR Director, Dr. Ann Bleed, whether the M.U.D. permitted amount at

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3-13-09 3pp. WC

Platte West was included in the determination that the Lower Platte was not fully appropriated that year. Ann Bleed advised me that the M.U.D. permitted amount was included and that the Lower Platte remained not fully appropriated. M.U.D relied upon that representation as it proceeded with its project.

As testified to by PMRNRD Assistant Manager Marlin Petermann at the March 12, 2009 public hearing in Fremont, DNR's Depletion Analysis at Section 7.7.3 includes 160 cfs from M.U.D.'s Platte West wellfield in depletions at Louisville. One Hundred Sixty (160) cfs equates to 104 MGD, which is Platte West's maximum single day use. However, M.U.D. is prohibited from using more than a 52 MGD average and a higher use will, therefore, never occur. As a result, the study includes depletion relating to the Platte West wellfield at twice the amount that is possible. As Mr. Petermann said, this is an "extreme overestimation".

M.U.D. is concerned that the Department intends to measure M.U.D.'s future use with no consideration of its permitted amount in the administration of Neb. Rev. Stat. 46-740. We believe strongly that the permitted amount should not result in an offset requirement. This issue may, however, be more appropriately dealt with in the IMP process.

If DNR has included M.U.D.'s Platte West permitted use in its calculation since 2006, as was represented to M.U.D., then the Lower Platte has avoided designation as fully appropriated since then, while including M.U.D.'s depletion.

M.U.D. believes that NDNR must consider the future component that is inherent in a municipal permit, and consider that permitted amount without offset. In the case of M.U.D.'s Platte West, a new facility, that future use is reflected by the full permit amount. As former Director Ann Bleed advised me, the Lower Platte was not fully appropriated even when the total of Platte West's permit amount was considered. The DNR should have considered this in its current review. To require offsets for a permitted use that has not caused a fully appropriated designation in past years would result in a "payback" for water already allowed and counted as a valid use.

It also appears that no consideration of M.U.D.'s induced recharge permit of 1,000 cfs was included in the determination.

M.U.D. is familiar with the results of the Brown and Caldwell technical review and shares the concerns of the involved NRDs regarding its findings.

I am aware that the Department has received the comments of Greg MacLean, City of Lincoln Director of Public Works. Though M.U.D. and Lincoln's

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situations may vary somewhat, M.U.D. fully agrees with the position of the City of Lincoln and adopts Lincoln's position regarding the use of permitted amounts of water in determining uses in the Lower Platte. M.U.D. intends to oppose fully any requirement that M.U.D or the NRDs involved must offset any depletion that is cause by uses within M.U.D. permitted amounts.

Very truly yours,

Daniel G. Crouchley
Senior Vice President, General Counsel

DGC/sms

Exh.
16

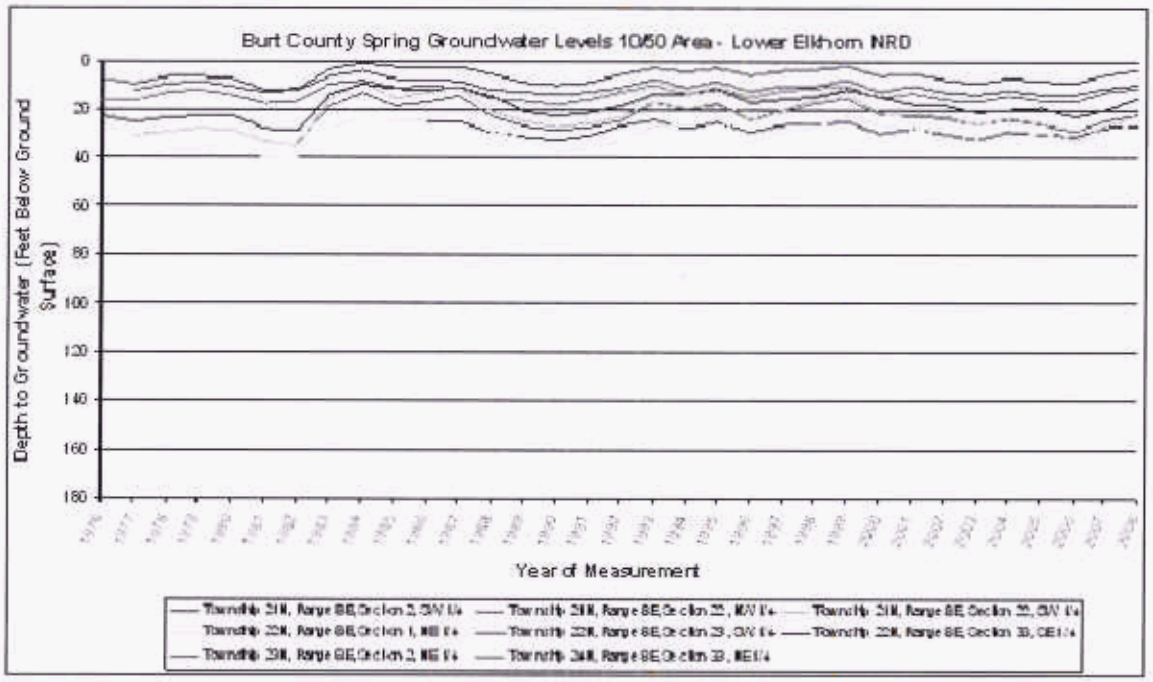
General Reporting Service

From: Theis, Ron [ron.theis@nebraska.gov]
Sent: Friday, March 13, 2009 5:22 PM
To: General Reporting Service
Subject: addendum to recorded testimony, 3-12-09 ATTN WENDY
Attachments: _AVG certification_.txt

From: Rick Wozniak [mailto:rwozniak@LENRD.ORG]
Sent: Friday, March 13, 2009 5:01 PM
To: Theis, Ron
Subject: Testimony for the Fully Appropriated Basins

Hello Mr. Theis,

Pleas add this information to the testimony of Stan Staab, General Manager of the Lower Elkhorn Natural Resources District. He testified yesterday and referred to these graphs.



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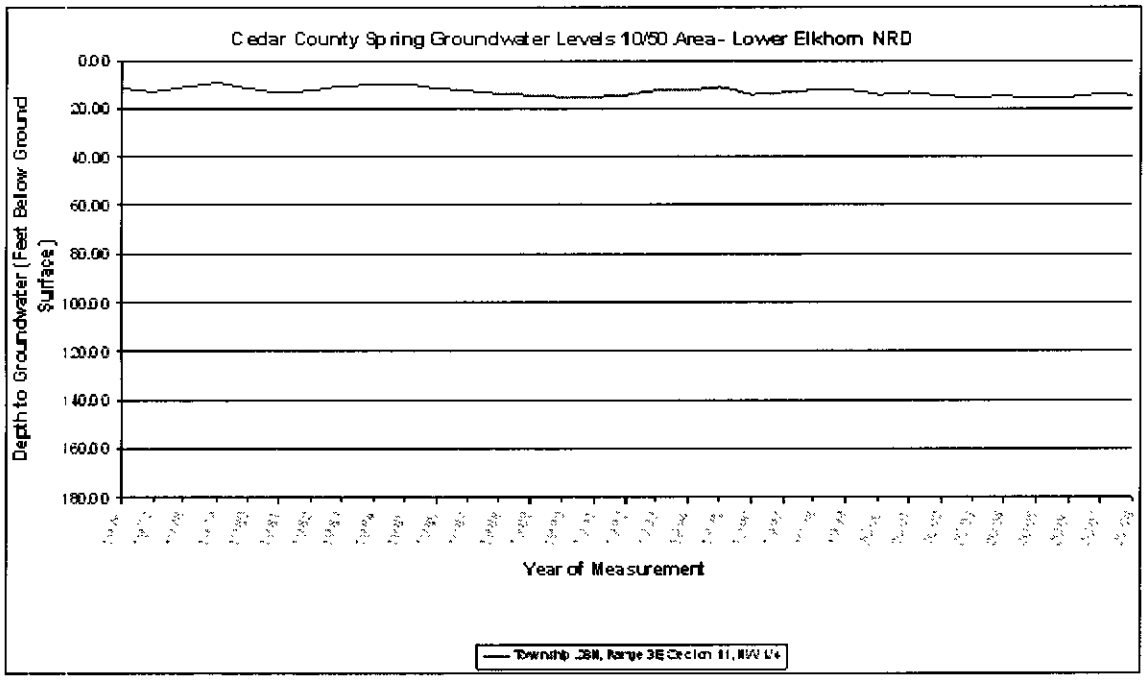
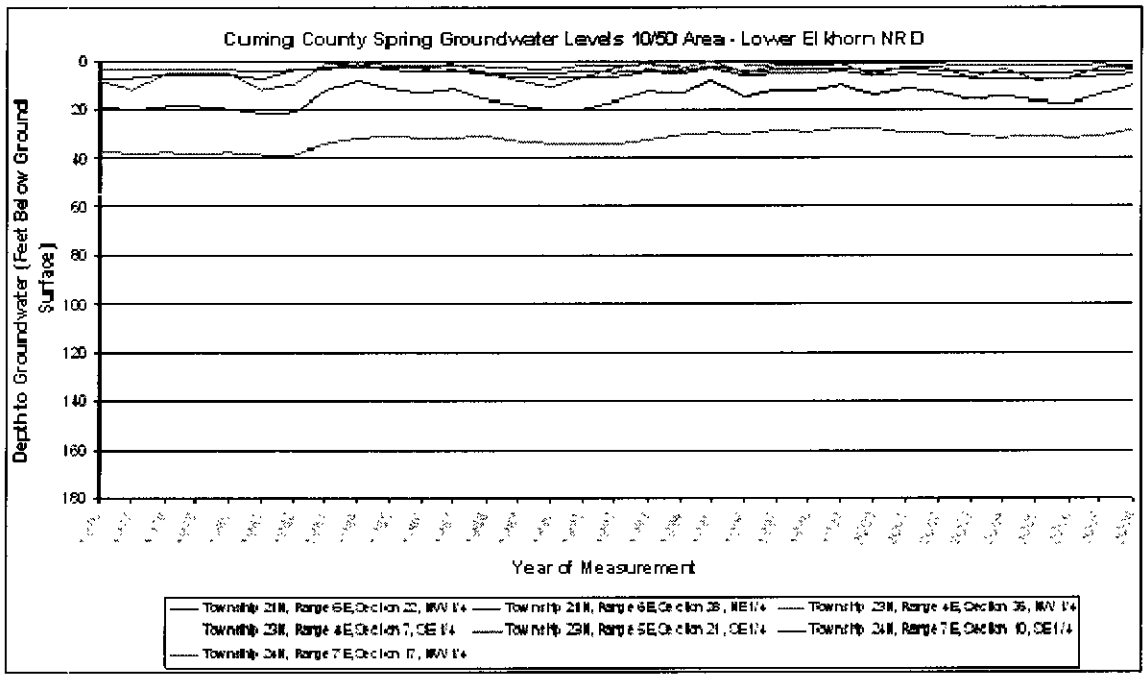
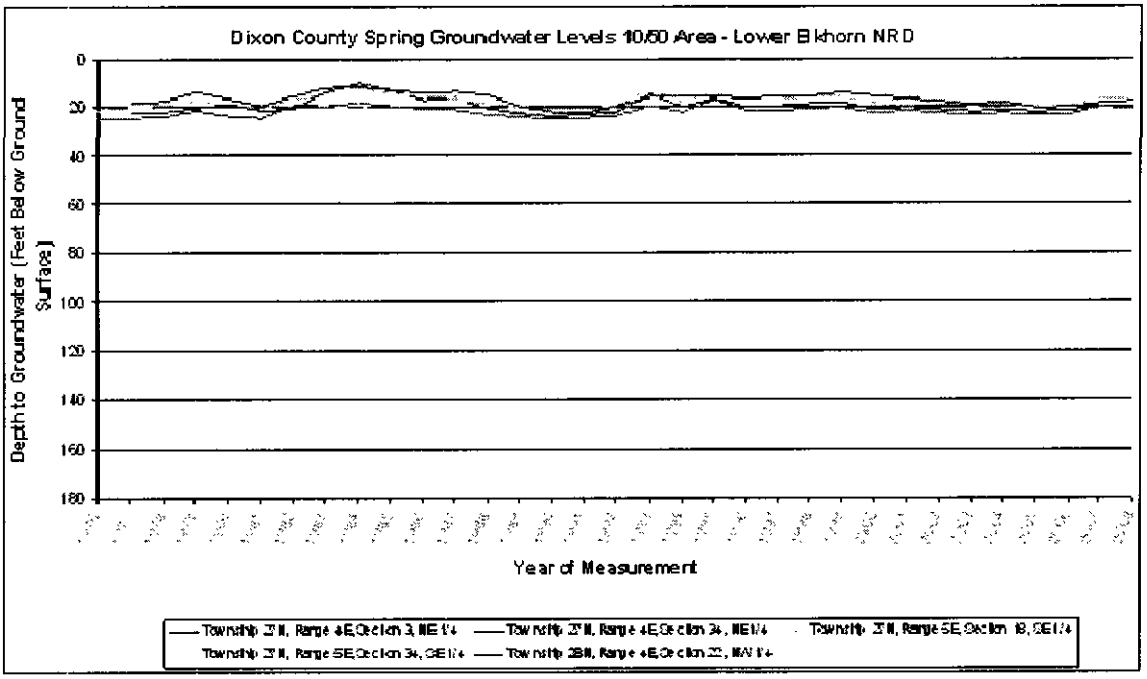
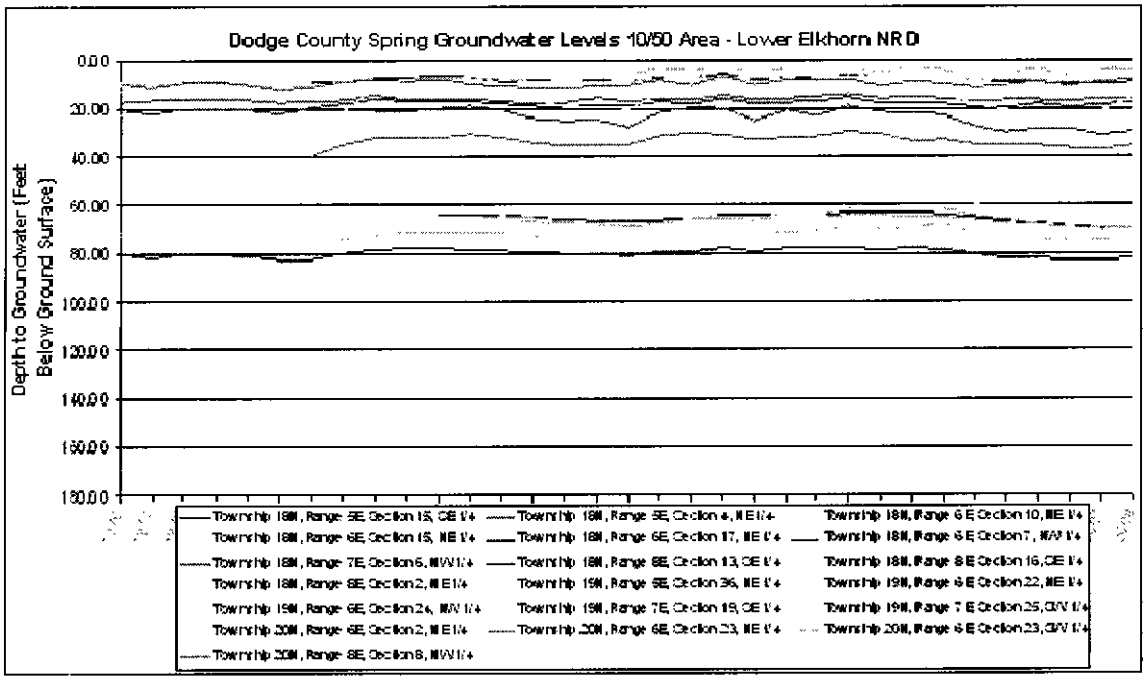
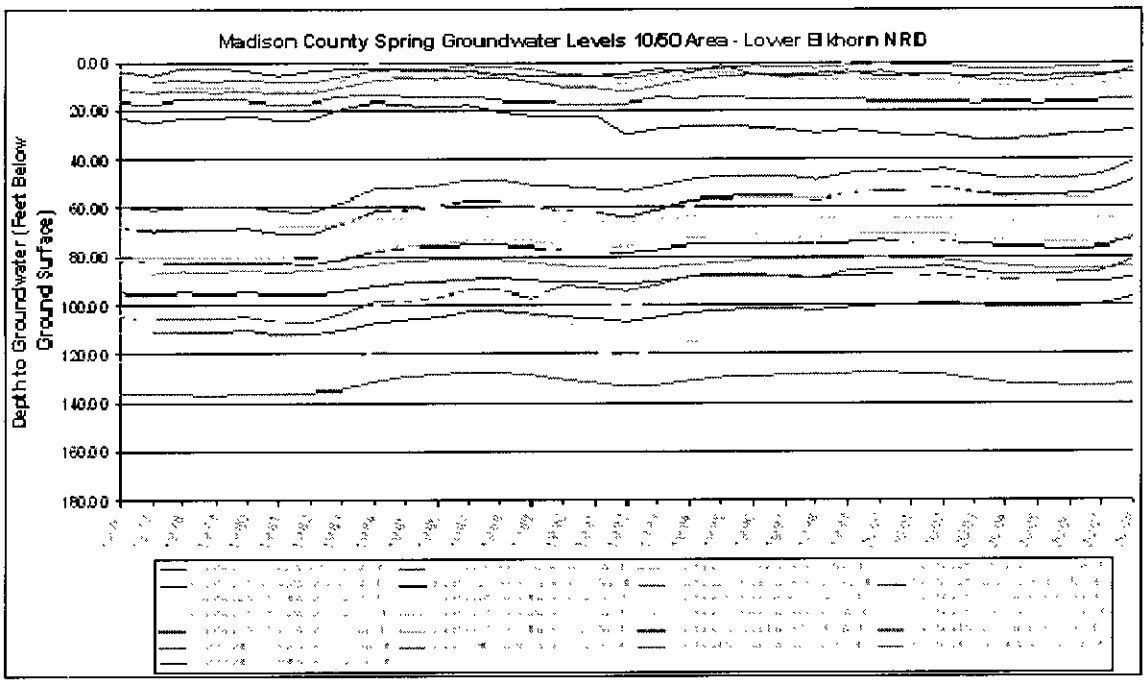
3-13-09 WC

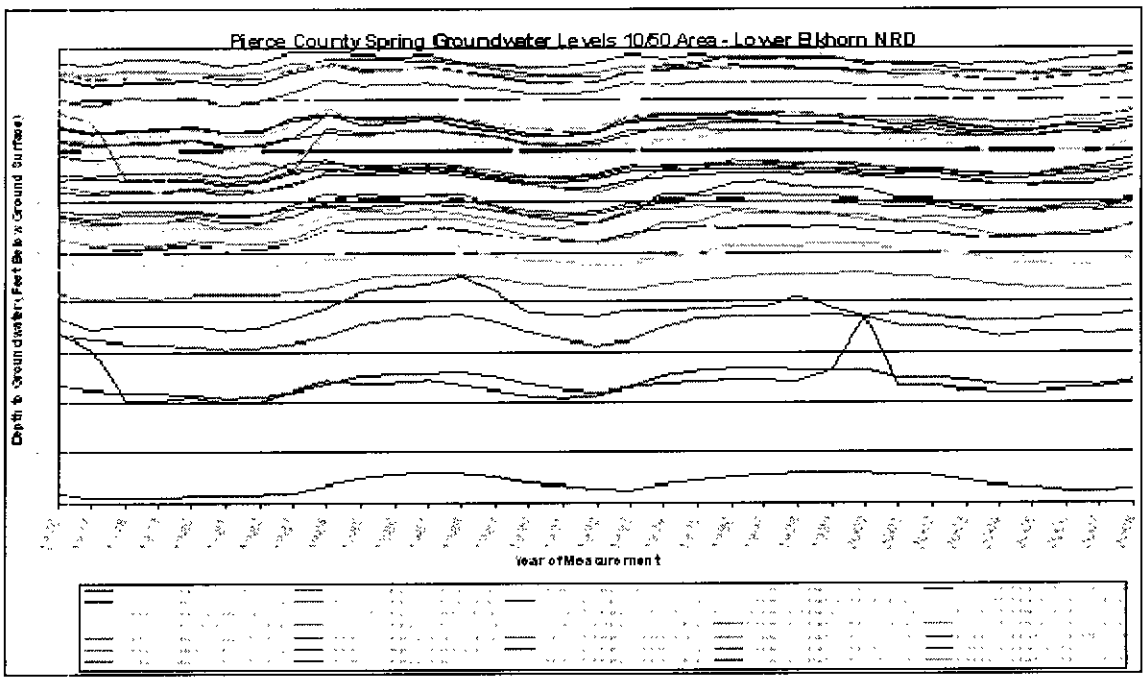

Cedar County Spring Groundwater Levels 10/50 Area- Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Year of Measurement


Cuming County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
0
20
40
60
80
100
120
140
160
180
Year of Measurement

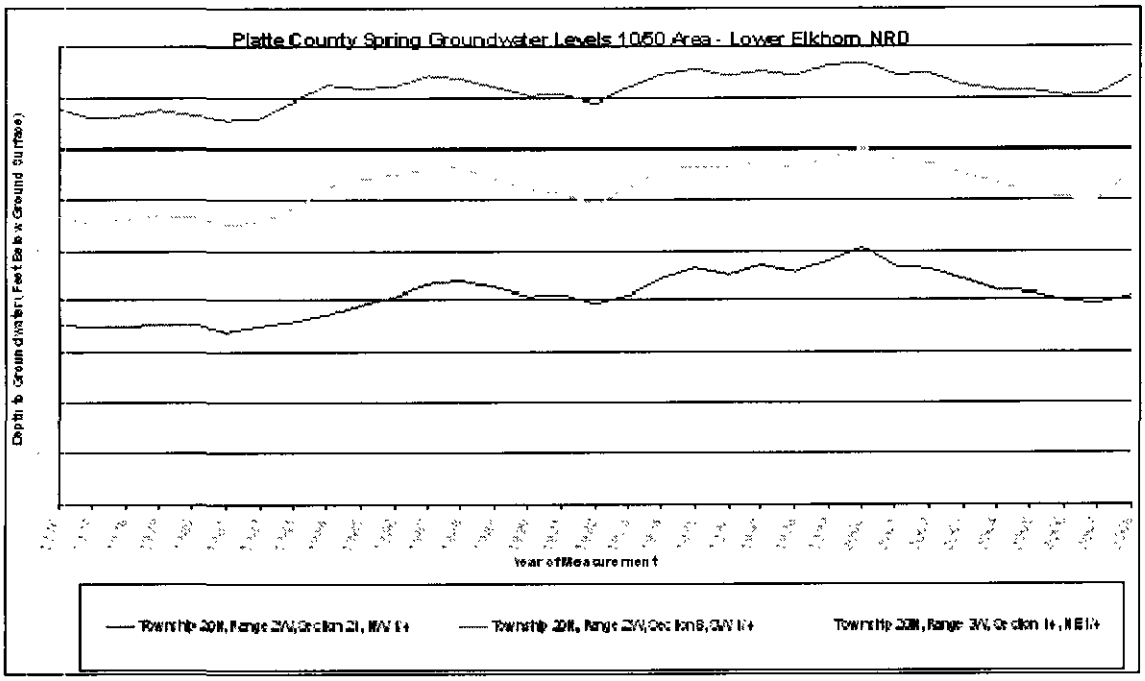

Dixon County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
0
20
40
60
80
100
120
140
160
180
Year of Measurement

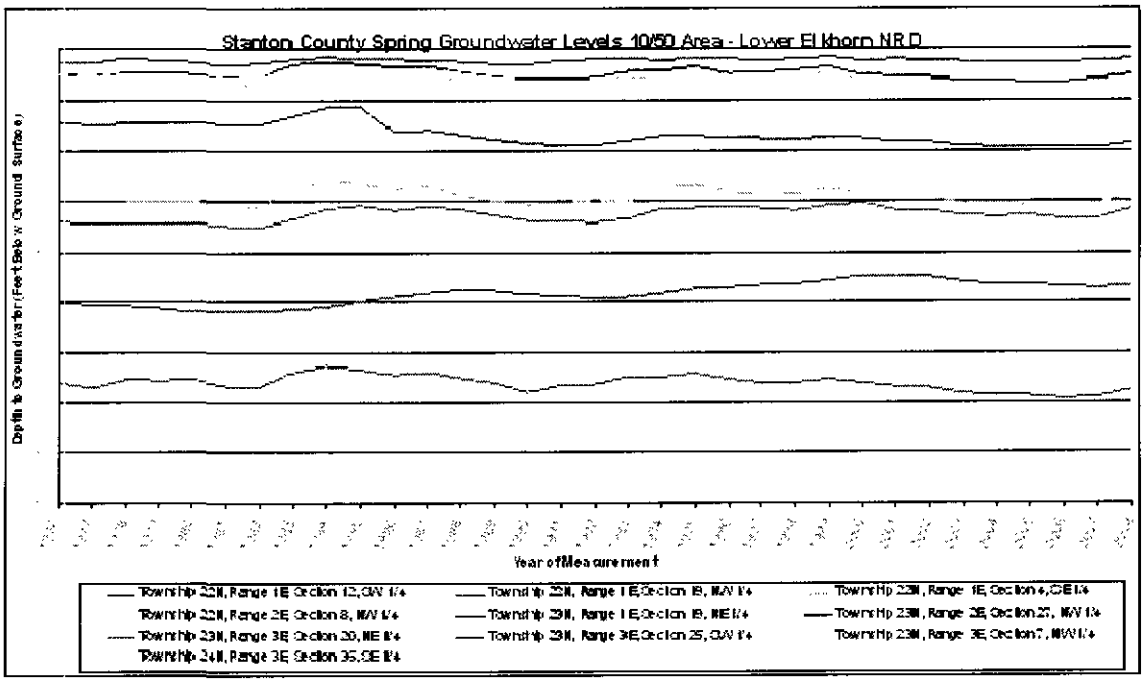

Dodge County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00


Madison County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00

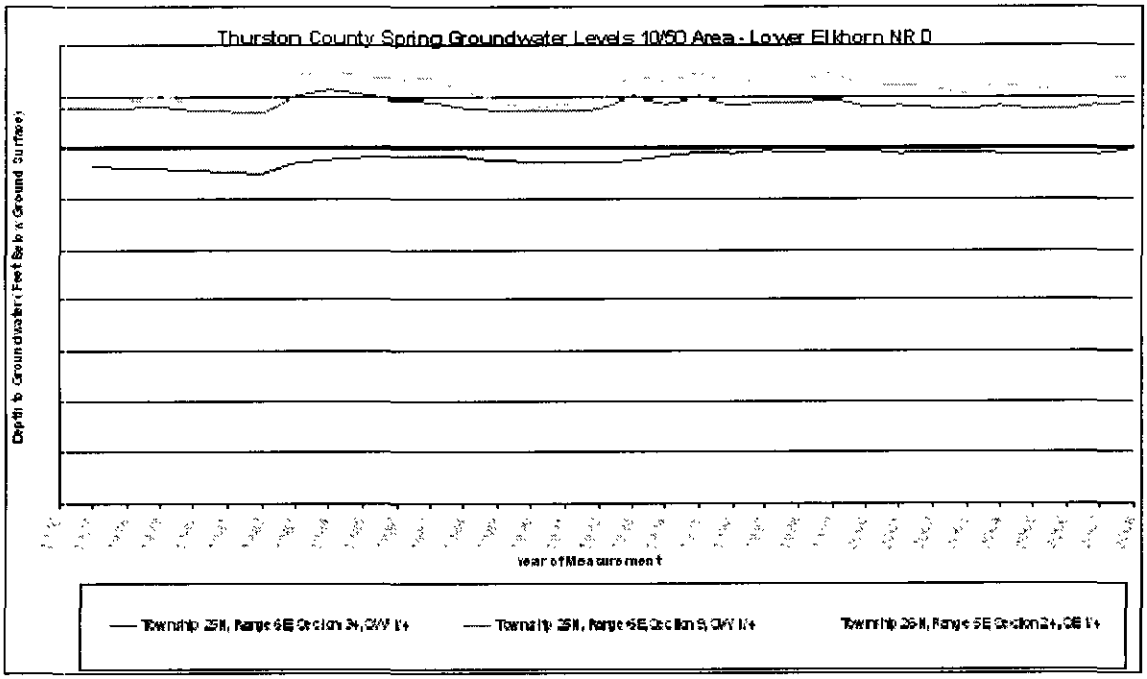

Pierce County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
Year of Measurement

4


Platte County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
Year of Measurement
Township 20N, Range 2W, Section 21, NW 1/4
Township 20N, Range 2W, Section 8, SW 1/4
Township 22N, Range 3W, Section 14, NE 1/4


Stanton County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
Year of Measurement
Township 22N, Range 1E, Section 12, SW 1/4
Township 22N, Range 1E, Section 19, NW 1/4
Township 22N, Range 1E, Section 4, SE 1/4
Township 22N, Range 2E, Section 8, NW 1/4
Township 23N, Range 1E, Section 19, NE 1/4
Township 23N, Range 2E, Section 27, NW 1/4
Township 23N, Range 3E, Section 20, NE 1/4
Township 23N, Range 3E, Section 25, SW 1/4
Township 23N, Range 3E, Section 7, NW 1/4
Township 24N, Range 3E, Section 35, SE 1/4

5


Thurston County Spring Groundwater Levels 10/50 Area - Lower Elkhorn NRD
Depth to Groundwater (Feet Below Ground Surface)
Year of Measurement
Township 25N, Range 6E Section 34, OW 1+
Township 25N, Range 6E Section 9, OW 1+
Township 25N, Range 5E Section 24, OB 1+

6

Exh.
17

If you would have used the previous method would we have been ordered fully appropriated? If not them why are we using an unproven method that have 2 more years of studying before completion for the study.

I have a list of surface right water users for the Lower end of the Platte River.
This includes the County of Dodge, Douglas, Saunders, Cass and Sarpy County.
Not one of these water users is using this water for farming!

In a Nebraska Supreme Court case Sorensen VS Lower Niobrara Natural Resource District
The NRD wanted to drill wells for a rural water system.
The NRD stated construction of wells and the withdrawal of ground water are reasonable, are not contrary to the conservation and beneficial use of ground water, and is not otherwise detrimental to the public welfare. If it was detrimental to the ground water then permits should have not be issued.

State Statutes also state
The owner of land is entitled to appropriate subterranean water found under his land, but he can not extract and appropriate them in excess of a reasonable and beneficial use upon the land which he owns.

The Municipal and Rural Domestic Ground Water Transfers Permit Act state
To assure a public water supplier's uninterrupted transfer and transportation of ground water, supplies a remedy of compensatory damages for a permittee's injury to another's land or water rights, I contrast with injunctive relief available under common law. Nevertheless concerning landowners without a permit under the act, the common law still governs use of ground water inasmuch as such use is a limited private property right in Nebraska.

The Nebraska Supreme Court stated
It is clear that right to use ground water is an attribute of owning fee simple title to land overlying a source of ground water and is inseparable from the land to which it applies. We conclude that the rights of an owner of overlying land to use ground water is an appurtenance constituting property protected by the Nebraska Constitution. The property of no person shall be taken or damaged for public use without just compensation.

How will the tax payer of ~~Omaha and Lincoln~~ NEBRASKA compensate the water users of this state for the damages that they will occur if we do not immediately suspend the temporary moratorium?

Scott Japp
4752 County Road 15
Arlington, Nebraska
68002

~~402~~
~~471 541~~
~~1052~~

EXHIBIT
17
3-12-09 Japp.

Dodge	sr	1 acre		Schmale
Saunders	sr	28 acre feet	lake	Walla
Saunders	jr	0.6 acre		Ritthaler
Saunders	jr	0.7 acre		Ritthaler
Saunders	sr	18 acre feet	lake	Mid Amerrica Council
Douglas	sr	30 acre feet	lake	Housing Development
Douglas	sr	3.5 acre feet	lake	Hauptman
Sarpy	sr	29 acre feet	lake	Housing Development
Sarpy	sr	2 acre feet	lake	State of Nebraska
Sarpy	sr	25 acre feet	lake	Harvey
Sarpy	sr	18 acre feet	lake	NRD
Cass	sr	20 acre feet	lake	Wolkins
Cass	sr	46 acre feet	lake	NRD
Cass	sr	17 acre feet	lake	NRD

14 lake

Saunders	instream flow	State of Nebraska
Saunders	instream flow	State of Nebraska
Cass	instream flow	State of Nebraska

3

2 house
3 NRD lake
7 personal
1 boy scout
1 State of Neb

Saunders	induced ground water	City of Lincoln
Saunders	induced ground water	City of Lincoln
Saunders	induced ground water	City of Lincoln
Saunders	induced ground water	City of Lincoln
Saunders	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Omaha
Sarpy	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Lincoln
Sarpy	induced ground water	City of Omaha
Sarpy	induced ground water	City of Omaha
Sarpy	induced ground water	City of Omaha
Sarpy	induced ground water	City of Omaha

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Dodge County

App Number Priority Date Water Division	Use Status Date Can / Dism	Source POD Facility Name County	Cur Tot Acres Grant Rate GPM	Footnotes Annotation	App Name Address Additional Names/POD
A-15030 R 7/13/1977 2A	IR Active / /	Platte River Sec: 7 T: 17 R: 5 E Pump Dodge	59.7 0.85 70 381	P-466	Leigh A & Lynn K Schmale 209 Nebraska Street Murdock NE 68407 Additional Names/POD

Saunders County

App Number Priority Date Water Division	Use Status Date Can / Dism	Source POD Facility Name County	Cur Tot Acres Grant Rate GPM	Footnotes Annotation	App Name Address Additional Names/POD
A-11181 6/19/1967 2A	ST Active / /	Platte River, Trib. To Sec: 28 T: 17 R: 5 E Walla Reservoir Saunders	- 27.9 AF - -	#	Elaine Walla RR 1 BOX 160 Linwood NE 68036 Additional Names/POD
A-7244 3/19/1955 2A	IR Active 05/ 14/ 1998	Platte River, Trib. To Sec: 21 T: 17 R: 6 E Pump Saunders	1 0.01 140 4	K	Robert & Minam Schueike RR 1 BOX 94 Morse Bluff NE 68648 Additional Names/POD
A-12070 9/2/1970 2A	IR Active / /	Platte River Sec: 21 T: 17 R: 7 E Pump Saunders	40 0.57 70 255		Herbert Ritthaler RR 2 BOX 240 Fremont NE 68025 Additional Names/POD
A-12069 9/2/1970 2A	IR Active / /	Platte River, Trib. To Sec: 21 T: 17 R: 7 E Pump Saunders	45.1 0.64 70 287	K	K Douglas Ritthaler 2538 County Road 13 Fremont NE 68025 Additional Names/POD
A-5529 9/1/1953 2A	ST Active / /	Platte River, Trib. To Sec: 23 T: 17 R: 7 E Camp Cedars Reservoir Saunders	- 17.8 AF - -		Mid America Council 12401 W Maple Road Omaha NE 68164 Additional Names/POD
A-17318 10/6/1993 2A	IG Active / /	Platte River Sec: 7 T: 14 R: 10 E Begin Wellfield Saunders	- 1000 CFS - 448800		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-17330 11/30/1993 2B	IF Active / /	Platte River Sec: 5 T: 13 R: 10 E End of Reach Saunders	- - - -	2	State of Nebraska INTERAGENCY PO Box 30370 Lincoln NE 68503 Additional Names/POD
A-17331 11/30/1993 2B	IF Active / /	Platte River Sec: 5 T: 13 R: 10 E Start of Reach Saunders	- - - -	2	State of Nebraska INTERAGENCY PO Box 30370 Lincoln NE 68503 Additional Names/POD
A-17312A 1/21/1964 2B	IG Active / /	Platte River Sec: 18 T: 13 R: 10 E Wellfield-Start of Reach Saunders	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508

146 Records

Surface Water R

App Number Priority Date Water Division	Use Status Date Can / Dism	Source POD Facility Name County	Cur Tot Acres Grant Rate GPM	Footnotes Annotation	App Name Address Additional Names/POD
A-17312B 1/1/1970 2B	IG Active / /	Platte River Sec: 18 T: 13 R: 10 E Wellfield-Start of Reach Saunders	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312C 1/1/1980 2B	IG Active / /	Platte River Sec: 18 T: 13 R: 10 E Wellfield-Start of Reach Saunders	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312D 1/1/1990 2B	IG Active / /	Platte River Sec: 18 T: 13 R: 10 E Wellfield-Start of Reach Saunders	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312E 1/1/1993 2B	IG Active / /	Platte River Sec: 18 T: 13 R: 10 E Wellfield-Start of Reach Saunders	- - - -	# 4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD

Douglas County

A-18387 4/3/2006 2A	ST Active / /	Platte River, Trib. To Sec: 25 T: 15 R: 9 E Venice Woods Lake Douglas	- 292 AF - -	Venice Woods Inc 11301 Davenport Street Omaha NE 68154 Additional Names/POD
A-18166 5/14/2003 2A	ST Active / /	Platte River, Trib. To Sec: 36 T: 15 R: 9 E Hauptman's Pond Douglas	- 3.45 AF - -	Frank S Hauptman 27607 West Center Rd Waterloo NE 68069 Additional Names/POD

Sarpy County

App Number Priority Date Water Division	Use Status Date Can / Dism	Source POD Facility Name County	Cur Tot Acres Grant Rate GPM	Footnotes Annotation	App Name Address Additional Names/POD
A-17318 10/6/1993 2A	IG Active / /	Platte River Sec: 20 T: 14 R: 10 E End Wellfield Sarpy	- 1000 CFS - 448800		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-17312A 1/21/1964 2B	IG Active / /	Platte River Sec: 4 T: 12 R: 10 E Wellfield-End of Reach Sarpy	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312B 1/1/1970	IG Active	Platte River Sec: 4 T: 12 R: 10 E	- -	4	City of Lincoln City Hall Room 401

4

23	/ /	Wellfield-End of Reach Sarpy	- -		Lincoln NE 68508 Additional Names/POD
A-17312C 1/1/1980 2B	IG Active / /	Platte River Sec: 4 T: 12 R: 10 E Wellfield-End of Reach Sarpy	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312D 1/1/1990 2B	IG Active / /	Platte River Sec: 4 T: 12 R: 10 E Wellfield-End of Reach Sarpy	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-17312E 1/1/1993 2B	IG Active / /	Platte River Sec: 4 T: 12 R: 10 E Wellfield-End of Reach Sarpy	- - - -	4	City of Lincoln City Hall Room 401 Lincoln NE 68508 Additional Names/POD
A-10178 4/17/1963 2B	ST Active / /	Platte River, Trib. To Sec: 2 T: 12 R: 10 E Thousand Oaks Lake Sarpy	- 29.1 AF - -		S J Armbrust Gretna NE 68028
A-12543 3/14/1972 2B	ST Active / /	Platte River, Trib. To Sec: 12 T: 12 R: 10 E Gretna Fish Hatchery Sarpy	- 1.89 AF - -		State of Nebraska INTERAGENCY PO Box 30370 Lincoln NE 68503 Additional Names/POD
A-17310B 1/1/1990 2B	IG Active / /	Platte River Sec: 31 T: 13 R: 13 E Begin Wellfield Sarpy	- - - -		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-17310A 1/1/1970 2B	IG Active / /	Platte River Sec: 31 T: 13 R: 13 E Begin Wellfield Sarpy	- - - -		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-17310A 1/1/1970 2B	IG Active / /	Platte River Sec: 32 T: 13 R: 13 E End Wellfield Sarpy	- 480 - 215424		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-17310B 1/1/1990 2B	IG Active / /	Platte River Sec: 32 T: 13 R: 13 E End Wellfield Sarpy	 20 - 8976		Metropolitan Utilities District of Omaha 1723 Harney Street Omaha NE 68102 Additional Names/POD
A-15101 9/1/1977 2B	ST Active / /	Platte River, Trib. To Sec: 13 T: 13 R: 12 E Harvey Reservoir Sarpy	 24.9 AF - -		Jack Harvey 14611 Frances Circle Omaha NE 68144 Additional Names/POD
A-17877 6/23/2000 2B	ST Active / /	Platte River, Trib. To Sec: 22 T: 13 R: 13 E Hanson Lake Sarpy	 18.1 AF - -		Papio Missouri River NRD 8901 South 154th Street Omaha NE 681383621

A-18314 6/8/2005 2B	ST Active / /	Platte River, Trib. To Sec: 34 T: 13 R: 12 E Raven's Nest East Lake Cass	- 19.2 AF - -		Don Wolkins 19541 Pleasant Lane Louisville NE 68037 Additional Names/POD
A-17385 7/14/1994 2B	ST Active / /	Platte River, Trib. To Sec: 11 T: 12 R: 12 E Timmerman Farms Res. Cass	- 45.8 AF - -		Lower Platte South Natural Resources District 3125 Portia Street PO Box 83581 Lincoln NE 685083581 Additional Names/POD
A-17539 9/11/1996 2B	ST Active / /	Platte River, Trib. To Sec: 12 T: 12 R: 12 E Ranch Road Reservoir 12-12-12Cass	- 17 AF - -		Lower Platte South Natural Resources District 3125 Portia Street PO Box 83581 Lincoln NE 685083581 Additional Names/POD
A-17331 11/30/1993 2B	IF Active / /	Platte River Sec: 31 T: 13 R: 14 E End of Reach Cass	- - - -	2	State of Nebraska INTERAGENCY PO Box 30370 Lincoln NE 68503 Additional Names/POD