Exhibit 8

KANSAS DEPARTMENT OF AGRICULTURE
Division of Water Resources
MEMORANDUM

TO: David Barfield, George Austin and Lee Rolfs

FROM: Sam Perkins

DATE: July 6, 2007 (updated version of June 25 memo)

RE: Comparison of impacts on Republican River flows with respect to virgin water supply and base cases

This memo, a follow-up to one dated June 27, compares approaches to evaluating impacts on Republican River flows. The current approach is with respect to the base case, in which the impacts of cases a-d (defined in Table 1, below) are evaluated separately with respect to the base case.

The second approach to evaluating impacts on Republican River flows is with respect to a virgin water supply case (case z, as identified in Table 1). The four analogous impact cases with respect to the virgin water supply are listed in Table 1 as cases bcd, acd, abd and abc. These correspond to including only one of the four impact components (Colorado pumping, Kansas pumping, Nebraska pumping or Platte R imports, respectively).

A third approach, advocated by Nebraska groundwater modeler Jim Schneider for evaluating net Nebraska impacts, is a hybrid of the above two, and is given by the sum of the impact of Nebraska pumping with respect to the virgin water supply case (case abd vs. z) and the impact of the mound imports (case d) with respect to the base case. The three approaches to evaluating net Nebraska impacts were compared in the previous memo (June 27). Here, the first two approaches are compared for all three states, and not only for Nebraska. In order to carry out these comparisons, additional cases bcd and acd were constructed and run. An Appendix lists batch files that were used to help set up and run these cases, and to evaluate the impacts for all four components.

Table 1. Cases of the RRCA model used to compare impacts

case	description
base	base case: historical pumping and irrigation recharge from Platte River (mound) imports
a	no Colorado pumping
b	no Kansas pumping
c	no Nebraska pumping; retain commingled irrigation area within Platte R mound extent
d	no Platte R mound imports (return flow from surface water irrigation) ; retain commingled irrigation area within Platte R mound extent
bcd	CO pumping only (no KS, NE pumping, and no Platte R mound imports; exclude commingled irrigation area within Platte R mound extent)
acd	KS pumping only (no CO, NE pumping, and no Platte R mound imports; exclude commingled irrigation area within Platte R mound extent)
abd	NE pumping only (no CO, KS pumping, and no Platte R mound imports; retain commingled irrigation area within Platte R mound extent)
abc	no CO, KS, NE pumping; retain commingled irrigation area within Platte R mound extent)
z	virgin water supply case: no CO, KS, NE pumping, no mound, and exclude commingled irrigation area within mound

Mainstem and tributary components of the basin are shown in the map, below. Impacts with respect to the virgin water supply and base cases were extracted using program acct_mo, a version of Willem Schreuder's program acct. Parameter files used for input to this program are listed at the end of this memo. Tables of impacts by year (1918-2056) and by account, with sums for mainstem, tributary and total components of the Republican River Basin were imported into Excel file vws_vs_base_impact_tables.xls, which has the following sheets: separate: impacts with respect to

base case; separate_vws: impacts with respect to virgin water supply; differences_vws_vs_base: impact differences. As explained below, the differences are evaluated as net sums over the two versions of impacts. Graphs were composed in a separate version of the Excel file [vws_vs_base_impacts.xls].

Results: comparison of impacts with respect to virgin water supply and base case
We'll examine annual and five-year average annual impacts over the historical period (1918-2000, 12p model, and 2001-2006, 12s model) and for one selected sequence of future years (2007-2056, sequence id=50; for details, see memo dated 4/25/2007.) Before looking at these trends, we'll examine values for the years 2000 and 2006 as shown in Tables 2a and 2b.

Table 2a. Impacts on computed streamflow in 2000 (acre-feet).

term	impact on base case (1)	impact on virgin water supply case (2)	net sum (3)
CO pumping	22178	-28841	-6663
KS pumping	12398	-24541	-12143
NE pumping	184022	-194860	-10838
NE mound	-18664	26428	7764
NE net (pumping + mound)	165358	-168432	-3074
Net (all impacts)	199934	-221814	-21880

Table 2b. Impacts on computed streamflow in 2006 (acre-feet).

term	impact on base case (1)	impact on virgin water supply case (2)	net sum (3)
CO pumping	24585	-31602	-7017
KS pumping	11400	-25996	-14596
NE pumping	198860	-208454	-9594
NE mound	-12192	28738	16546
NE net (pumping + mound)	186668	-179716	6952
Net (all impacts)	222653	-237314	-14661

Pumping impacts on computed streamflow with respect to the base case are positive (col. 1 of Tables 2a and 2b), since cases a-c represent removal of pumping from the model for each state. Pumping impacts with respect to the base case are negative (col. 2), since the corresponding cases represent addition of pumping to the model. Similarly, removal of Platte R mound imports from the base case decreases streamflow, showing a negative impact (col. 1), and addition of mound imports to the virgin water supply case increases streamflow, showing a positive impact (col. 2). The sign of the net sum of the impacts with respect to the base and virgin water supply cases (col. 3) shows which of the two versions of impacts is greater. For example, note the sign change in col. 3 of Nebraska's net pumping impact difference from 2000 to 2006. The impact with respect to the virgin water supply is greater than the impact with respect to the base case by 3074 AF in 2000, but less by 6952 AF in 2006.

Similarly, trends in differences between the two versions of net impacts for each state are shown in Fig. 1, in which annual and 5-year average annual net sums [impact with respect to base case + impact with respect to virgin water supply case] are plotted for the entire Republican River basin and for each state within the Republican River basin. Fig. 1 shows that, after about 1956, computed impacts with respect to the virgin water supply are greater than those with respect to the base case for the total

Republican River Basin. The Colorado and Kansas components of the basin also show this, and so does Nebraska until recent years; after 2002, the five-year average for Nebraska shows a net impact with respect to the base case exceeding that with respect to the virgin water supply case by the neighborhood of 10,000 AFY for the future scenario period 2007-2056.

The trends shown in Fig. 1 for Colorado and Kansas might be explained by differences between the base and virgin water supply case: more streamflow should be available for depletion for the virgin water supply case than for the base case. The trend reversal shown by the net Nebraska impact is examined more closely in Figs. 2-3. In Fig. 2, the sum over the net Nebraska impacts with respect to the virgin water supply and base cases is broken down into Republican River Basin mainstem and tributary components. Fig. 2 shows that the trend reversal is associated with impacts on flows in the mainstem.

Fig. 3 takes this a step further by showing the components associated with Nebraska pumping and mound imports. Fig. 3 shows the reversal appears to be due to mainstem mound impact differences.

The net sums over impacts with respect to the virgin water supply and base cases shown in Fig. 3 are further broken down into the separate impacts of pumping with respect to the virgin water supply case (Fig. 4a) and the base case (Fig. 4b), and mound imports with respect to the virgin water supply case (Fig. 5a) and the base case (Fig. 5b). Comparison of Figs. 5a and 5b shows that the mound impact on streamflow is strongly affected by pumping.

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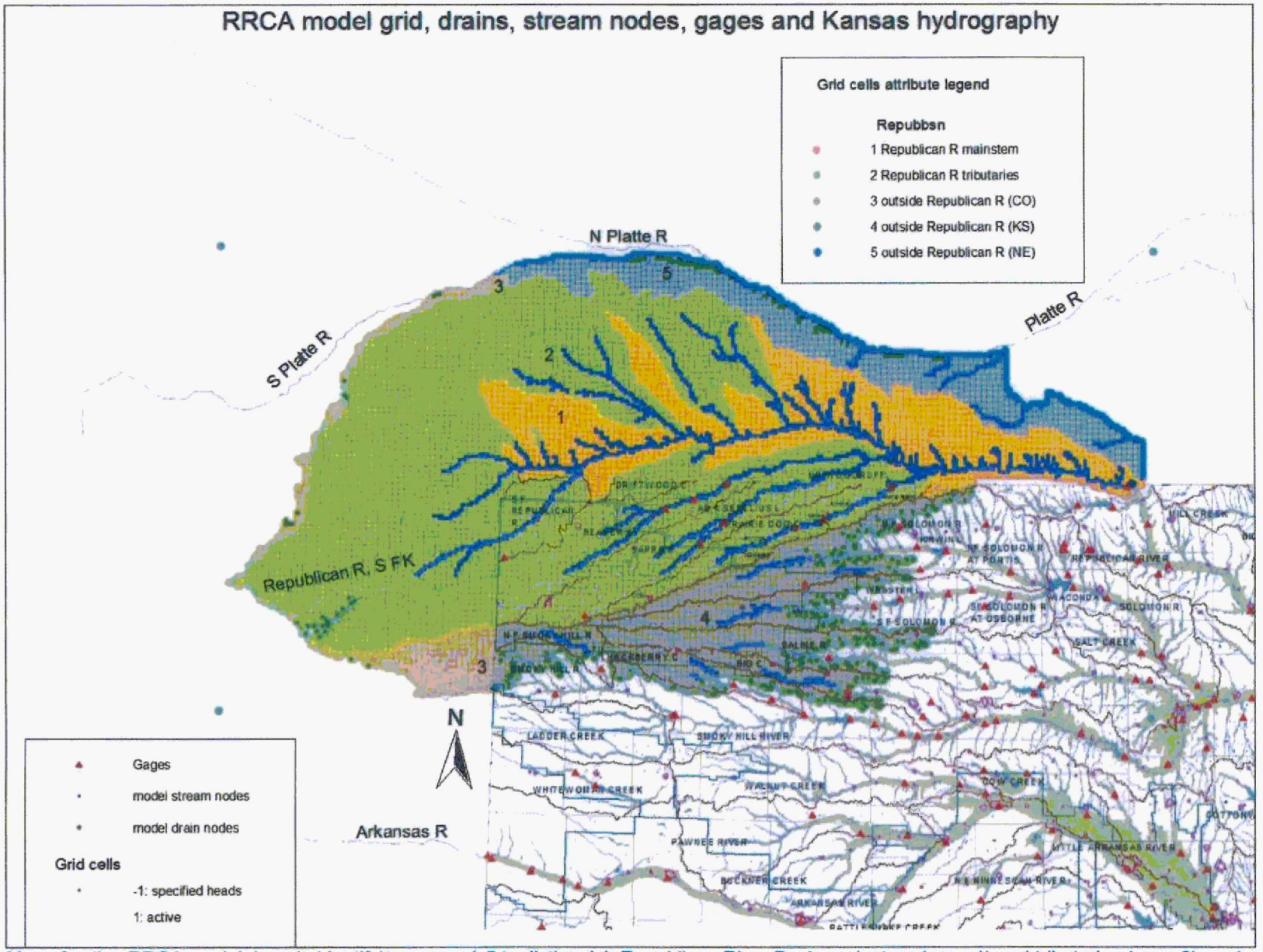
File Memo_RRCA_model_comparisons_vws_vs_base_case_impacts_spp_2007Jul06.doc



Map of active RRCA model domain identifying zones 1-5 to distinguish Republican River Basin mainstem (zone 1) and tributaries (zone 2), and areas outside the Republican River Basin in Colorado (zone 3), Kansas (zone 4) and Nebraska (zone 5). [file rrca_active_grid_repub_r_basins.jpg]

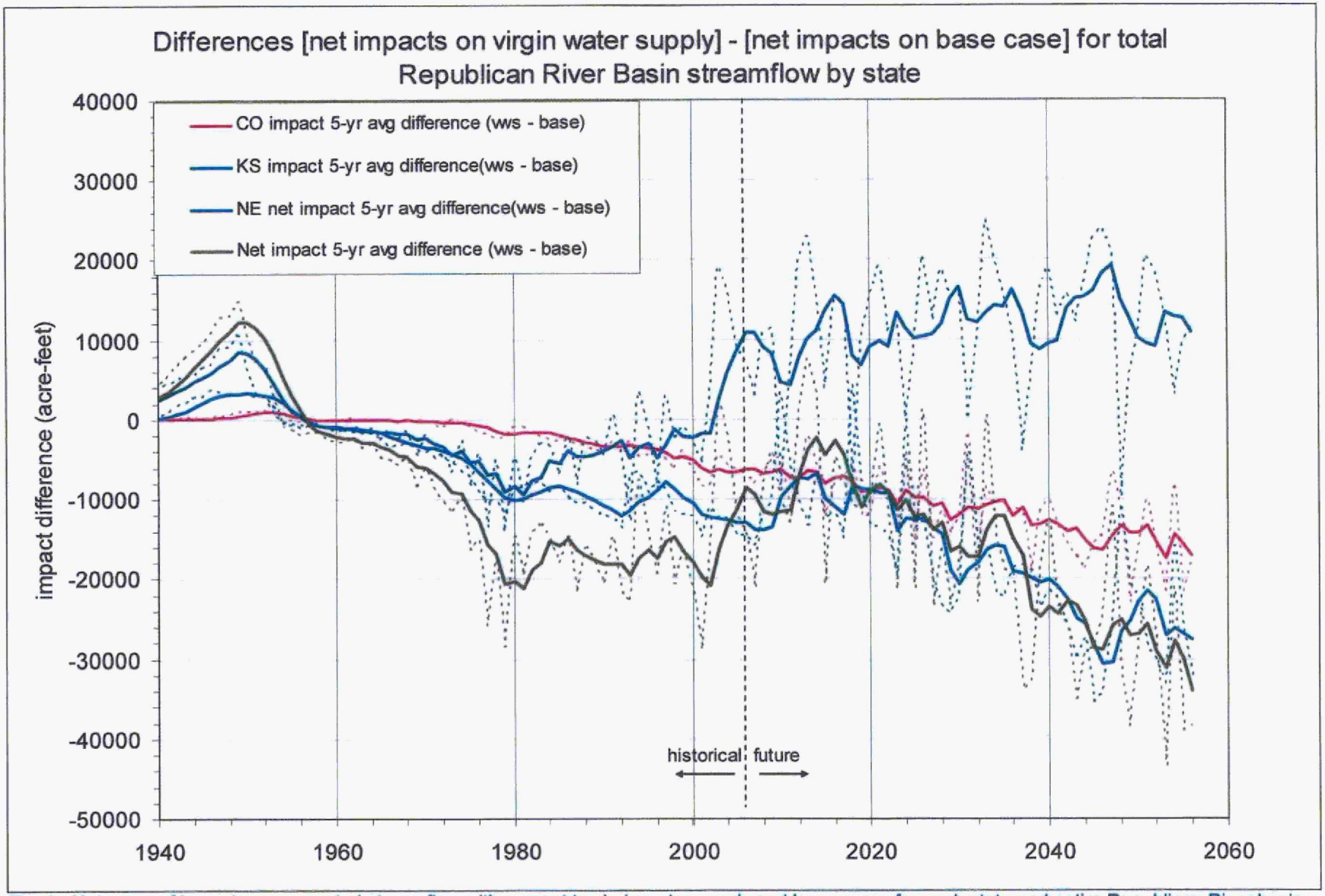


Fig. 1. Net sums of impacts on computed streamflow with respect to virgin water supply and base cases for each state and entire Republican River basin. [ChNet_state_impact_differences in vws_impacts_vs_base_impacts.xls]

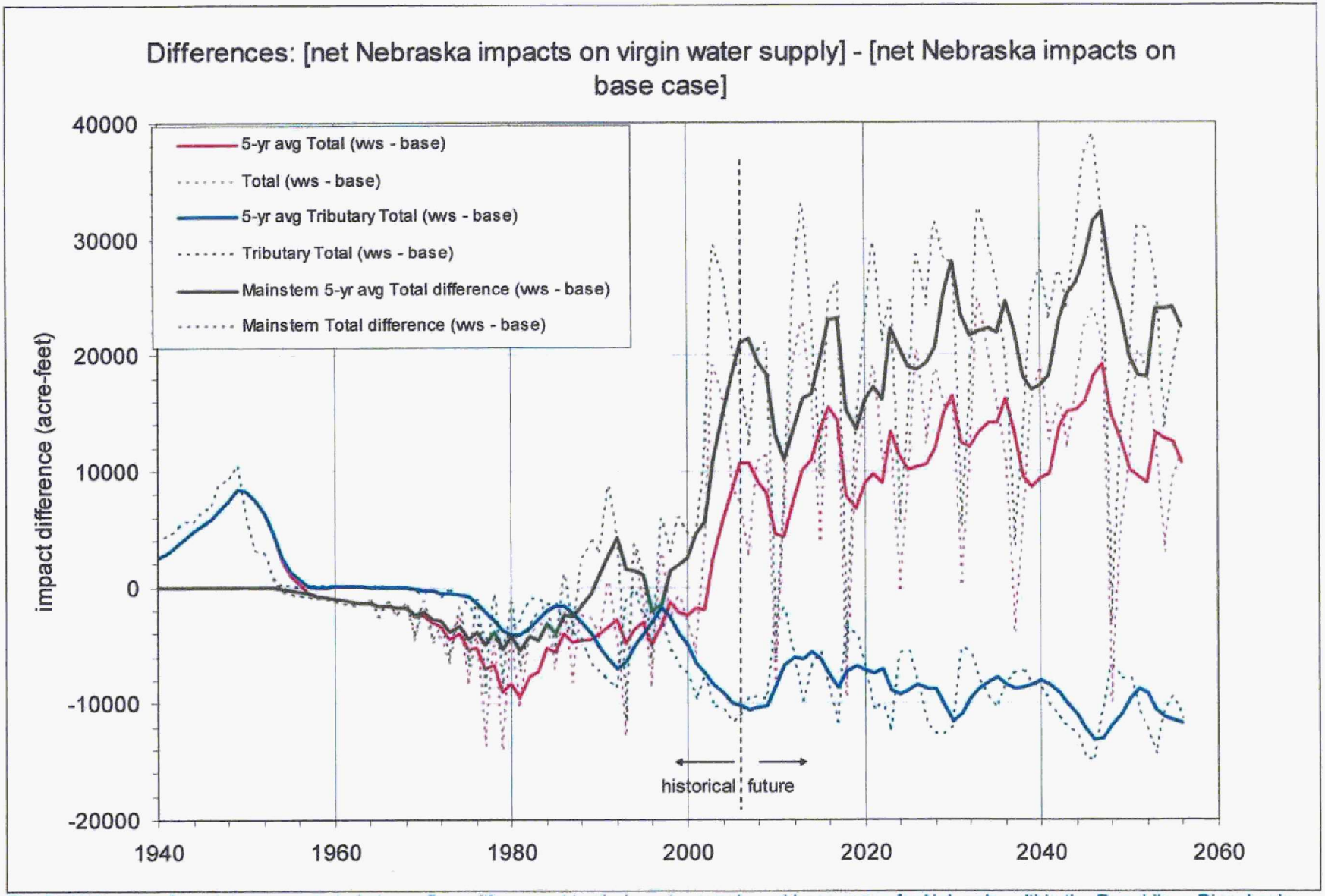


Fig. 2. Net sums of impacts on computed streamflow with respect to virgin water supply and base cases for Nebraska within the Republican River basin. [ChNE_Net_impact_differences in vws_impacts_vs_base_impacts.xls]

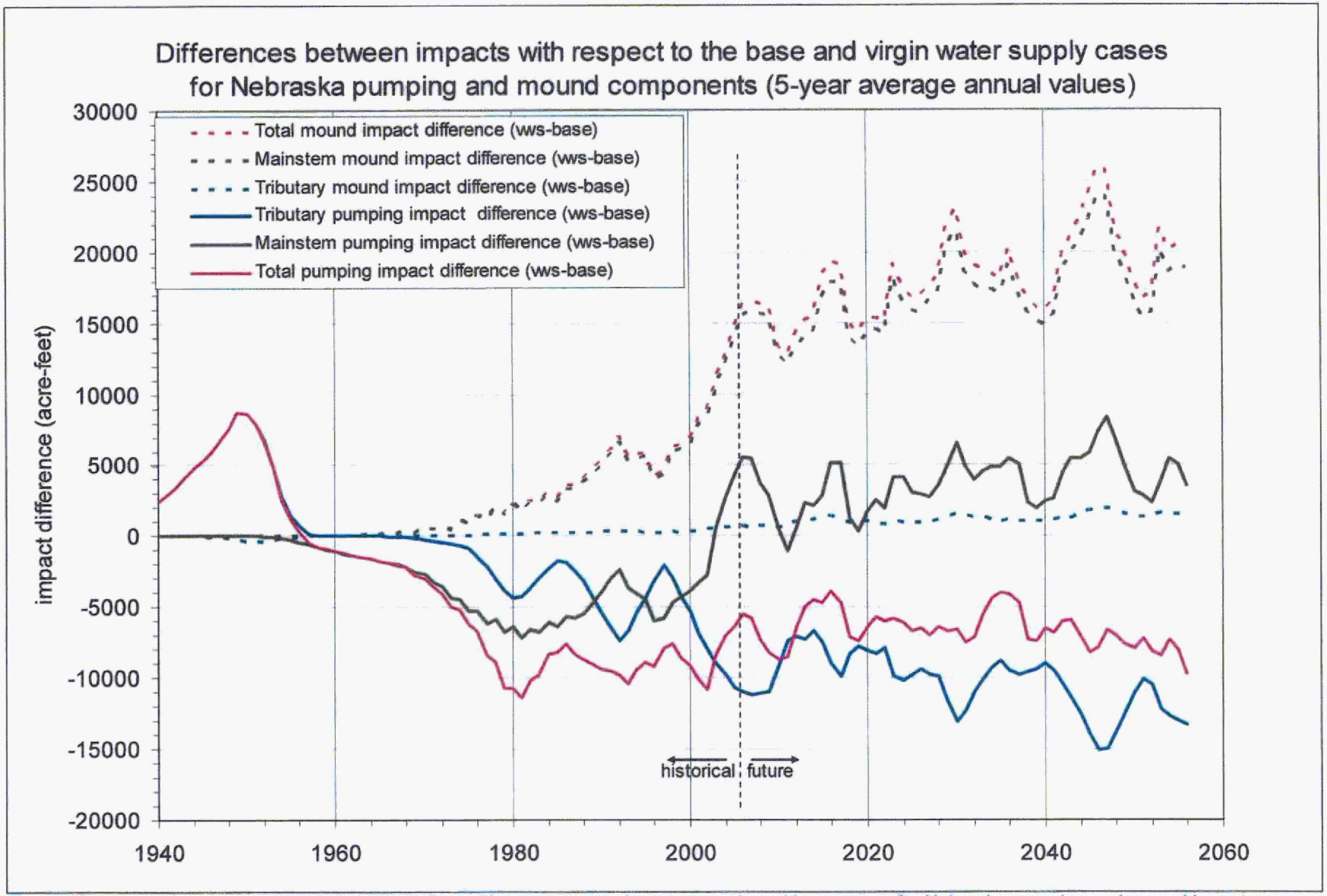


Fig. 3. Net sums of impacts on computed streamflow with respect to virgin water supply and base cases for Nebraska pumping and mound import components within the Republican River basin. Dashed lines: mound impact differences; solid lines: pumping impact differences. After 1956, impacts with respect to virgin water supply case are greater for both pumping and mound components. [ChNE_impact_differences in vws_impacts_vs_base_impacts.xls]

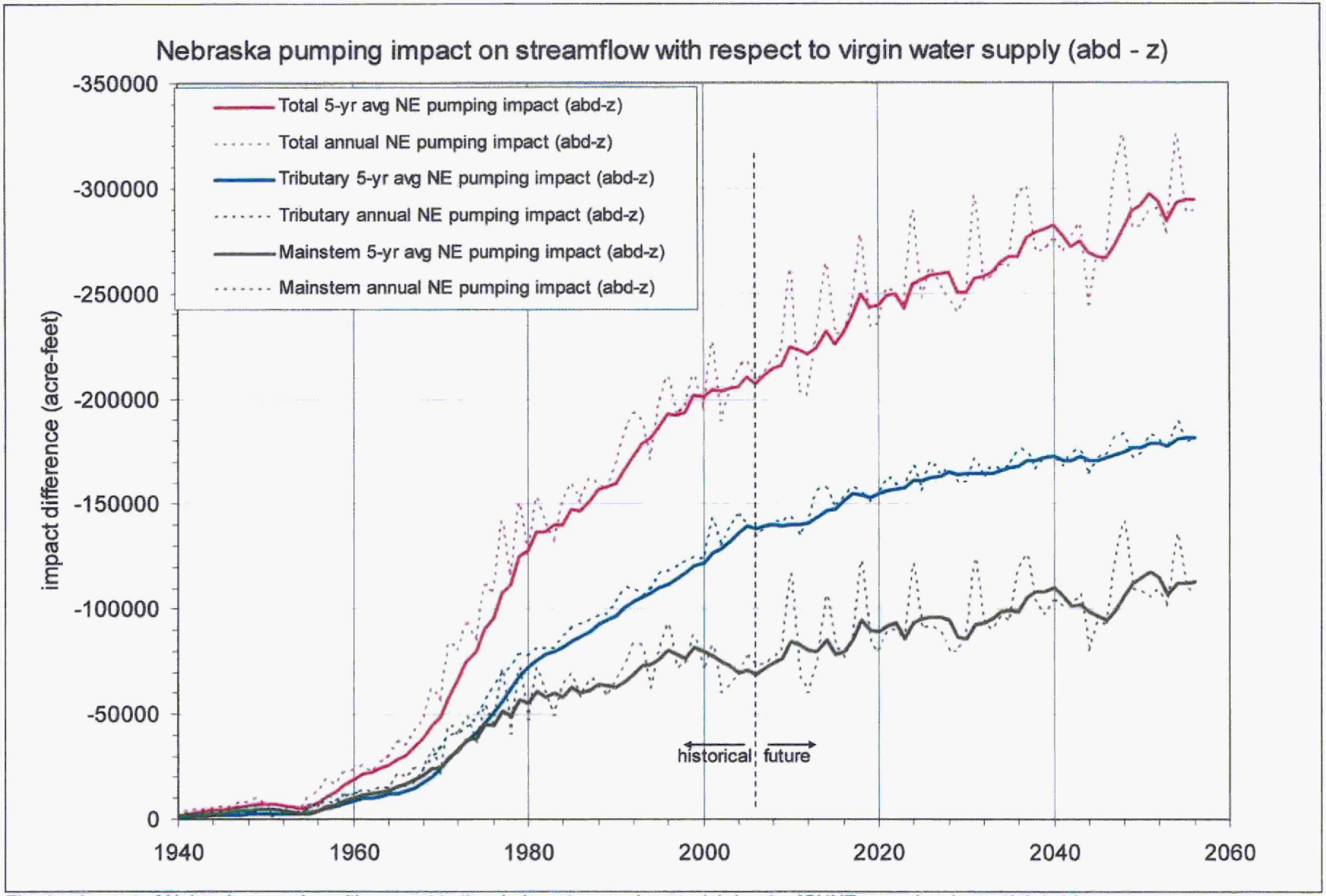


Fig. 4a. Impact of Nebraska pumping with respect to the virgin water supply case (abd – z).. [CHNE_pumping_impact(abd-z) in vws_impacts_vs_base_impacts.xls]

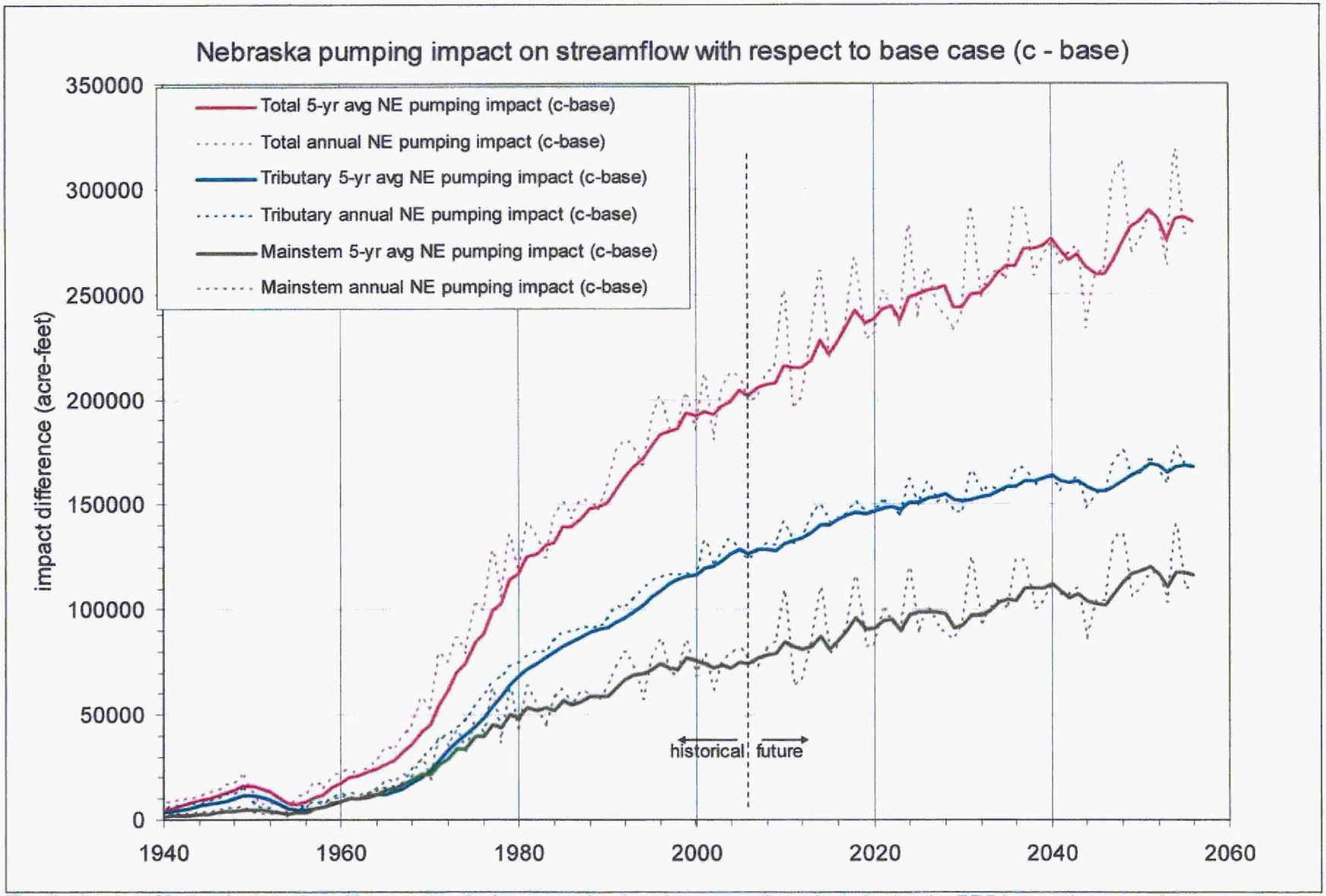


Fig. 4b. Impact of Nebraska pumping with respect to the base case (c – base), as currently evaluated using the RRCA groundwater model. [CHNE_pumping_impact(c-base) in vws_impacts_vs_base_impacts.xls]

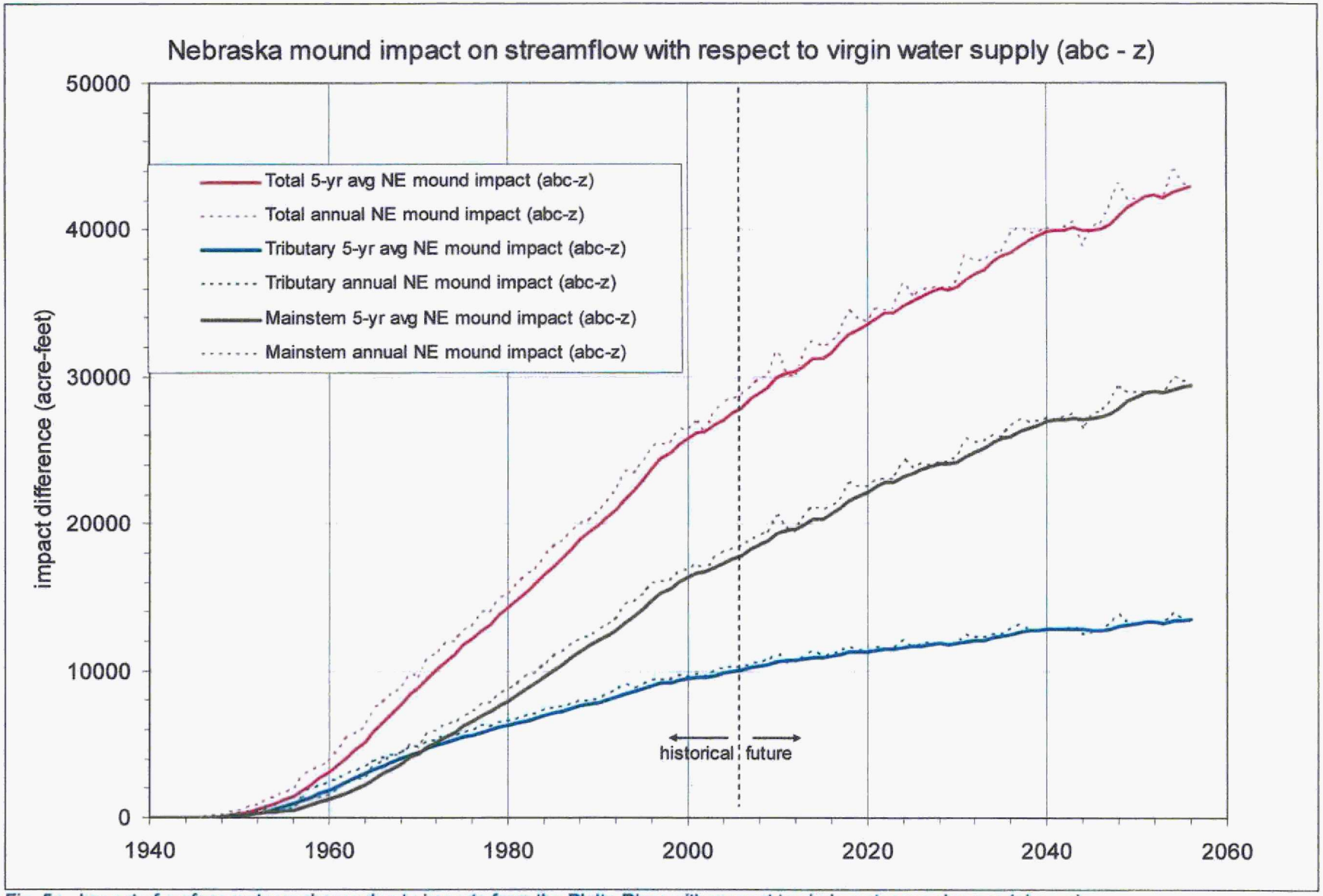


Fig. 5a. Impact of surface water recharge due to imports from the Platte River with respect to virgin water supply case (abc – z).
[CHNE_mound_impact(abc-z) in vws_impacts_vs_base_impacts.xls]

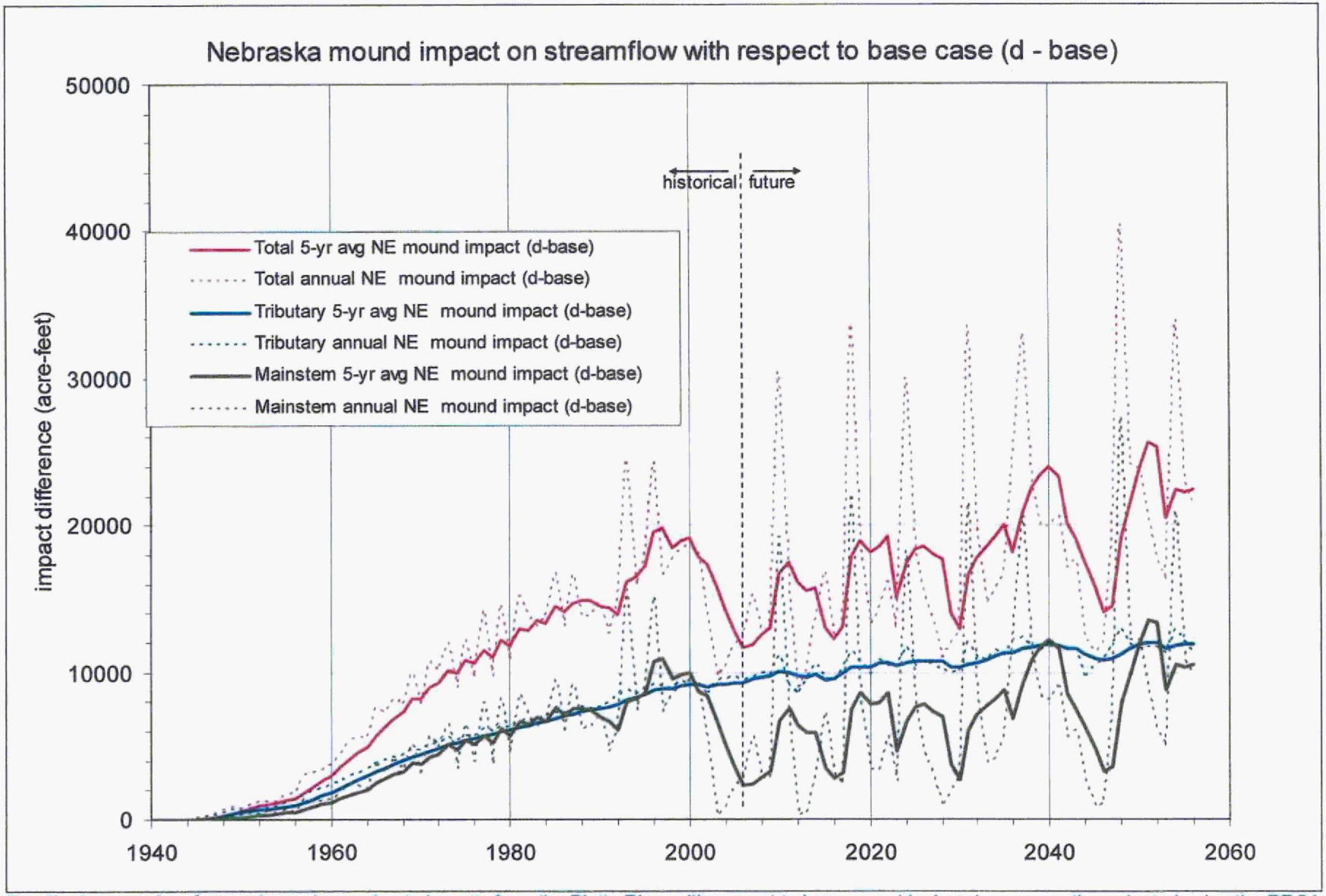


Fig. 5b. Impact of surface water recharge due to imports from the Platte River with respect to base case (d – base), as currently evaluated using the RRCA groundwater model. [CHNE_mound_impact(d-base) in baseflow_seq50.xls]

Appendix. Batch files used to run additional cases and evaluate impacts.

Batch file runmf2k_bcd.bat listing: set up and run additional historical runs (12p model 1918-2000 and 12s model 2001-2006)

```
rem batch file runmf2k_bcd.bat usage: begin in L:\gw\rrca\2000\ to run mf2k for additional cases bcd and acd, and
to change folders as needed.
rem
@echo on
rem run rrppf from L:\gw\rrca\2000s\ to write RCH and WEL package input files for additional impact cases acd and
bcd:
cd ..\2000s
..\bin\rrppf rrpp\12s_thru_2000bcd.par 50 >rrpp\12s_thru_2000bcd.log
..\bin\rrppf rrpp\12s_thru_2000acd.par 50 >rrpp\12s_thru_2000acd.log
rem
rem run mf2k from L:\gw\rrca\2000\ for impact cases acd and bcd (to be compared with virgin water supply case z):
cd ..\2000
..\bin\mf2k nam\12p234.nam
..\bin\mf2k nam\12p134.nam
rem
rem run acct_mo to calculate impacts on streamflow of case abd vs. case z:
..\bin\acct_mo impacts\12p_separate_impacts_on_vws_1918-2000.par >impacts\12p_separate_impacts_on_vws_1918-2000.log
rem
rem run readHeads from folder L:\gw\rrca\2000\out\ to extract ending heads in 2000 at end of simulation for input
to 2001-2006 run:
cd out
..\..\bin\readheads <..\heads\readHeads_12p234_Dec2000.par >..\heads\readHeads_12p234_Dec2000.log
..\..\bin\readheads <..\heads\readHeads_12p134_Dec2000.par >..\heads\readHeads_12p134_Dec2000.log
rem
rem run rrppf from L:\gw\rrca\bgn2001\ to write RCH and WEL package input files for additional impact cases acd and
bcd:
cd ..\..\bgn2001
..\bin\rrppf rrpp\bgn2001bcd.par 50 >rrpp\bgn2001bcd.log
..\bin\rrppf rrpp\bgn2001acd.par 50 >rrpp\bgn2001acd.log
rem
rem run mf2k from L:\gw\rrca\bgn2001\ for impact cases bcd and acd (to be compared with virgin water supply case
z):
..\bin\mf2k nam\bgn2001bcd.nam
..\bin\mf2k nam\bgn2001acd.nam
rem
rem run acct_mo to calculate impacts on streamflow of case abd vs. case z:
..\bin\acct_mo impacts\separate_impacts_on_vws_2001-2006.par >impacts\separate_impacts_on_vws_2001-2006.log
```

Batch file runmf2k_bcd.bat listing: set up and run additional future run (12s model 2007-2056 using historical year sequence 50)

```
rem batch file runmf2k_bcd_futures.bat usage: begin in L:\gw\rrca\futures\ to run mf2k for additional cases bcd and
acd, and to change folders as needed.
rem
@echo on
rem
rem run readHeads from folder L:\gw\rrca\bgn2001\out\ to extract ending heads in 2006 at end of simulation for
input to 2007-2056 runs:
cd ..\bgn2001\out
..\..\bin\readheads <..\heads\readHeads_bcd_Dec2006.par >..\heads\readHeads_bcd_Dec2006.log
..\..\bin\readheads <..\heads\readHeads_acd_Dec2006.par >..\heads\readHeads_acd_Dec2006.log
..\..\bin\readheads <..\heads\readHeads_abd_Dec2006.par >..\heads\readHeads_abd_Dec2006.log
rem
rem run rrppf from L:\gw\rrca\futures\ to write RCH and WEL package input files for additional impact cases bcd,
acd and abd:
cd ..\..\futures
..\bin\rrppf rrpp\2007-2056bcd.par 50 >rrpp\2007-2056bcd.log
..\bin\rrppf rrpp\2007-2056acd.par 50 >rrpp\2007-2056acd.log
..\bin\rrppf rrpp\2007-2056abd.par 50 >rrpp\2007-2056abd.log
rem
rem run mf2k from L:\gw\rrca\futures\ for impact cases bcd, acd and abd (to be compared with virgin water supply
case z):
..\bin\mf2k nam\2007-2056bcd.nam
..\bin\mf2k nam\2007-2056acd.nam
..\bin\mf2k nam\2007-2056abd.nam
rem
rem run acct_mo to calculate impacts on streamflow of cases bcd, acd, abd and abc vs. case z:
..\bin\acct_mo impacts\separate_impacts_on_vws_2007-2056.par >impacts\separate_impacts_on_vws_2007-2056.log
```

Parameter files for input to accounting program acct_mo for simulations of years 2001-2006

Evaluate separate impacts of cases a-d with respect to base case: file separate_impacts_2001-2006.par

```
separate_impacts_2001-2006.par  usage: from L:\gw\rrca\bgn2001\> ..\bin\acct_pc2 impacts\separate_impacts_2001-
2006.par
12s
..\data0\acct.12s
out\bgn2001.sfi
out\bgn2001a.sfi
out\bgn2001b.sfi
out\bgn2001c.sfi
out\bgn2001d.sfi
impacts\separate_impacts_2001-2006.htm
y
bgn2001
a: no CO pumping (+)
b: no KS pumping (+)
c: no NE pumping (+)
d: no mound (-)
3*'+','-'
0,2001,2001,2006, nss,bgnsim,iyr0,iyr1
```

Evaluate separate impacts of cases with respect to virgin water supply case: file separate_impacts_on_vws_2001-2006.par

```
separate_impacts_on_vws_2001-2006.par  usage: from L:\gw\rrca\bgn2001\> ..\bin\acct_mo
impacts\separate_impacts_on_vws_2001-2006.par
12s
..\data0\acct.12s
out\bgn2001z.sfi
out\bgn2001bcd.sfi
out\bgn2001acd.sfi
out\bgn2001abd.sfi
out\bgn2001abc.sfi
impacts\separate_impacts_on_vws_2001-2006.htm
y
z: no development (+)
bcd: CO pumping only; no (KS NE) pumping, no mound and no commingled irrigated area (+)
acd: KS pumping only; no (CO NE) pumping, no mound and no commingled irrigated area (+)
abd: NE pumping only; no (CO KS) pumping and no mound (+)
abc: mound only; no (CO KS NE) pumping (+)
4*'+'
0,2001,2001,2006,0,0, nss,bgnsim,iyr0,iyr1,optBase,optMon
```