Middle Republican NRD Board of Directors:

I appreciate the opportunity to submit this written testimony in regard to the management plan proposed for the Middle Republican Natural Resources district. I am a fifth generation farmer operating in Hayes County. I have a diversified dryland and irrigated operation. Over the years our family has integrated many conservation practices into our operation both on an irrigated and dryland basis. As an irrigated producer I feel the provisions in the present plan are much too restrictive and will cause serious economic damage in southwest Nebraska.

For the past couple years I have been monitoring a project at the University of Nebraska that has involved crop modeling. A crop model has been developed and recently released that simulates corn production under various management schemes. I have worked with Dr. Achim Doberman, one of the chief developers of the program, in my own operation to utilize data in making management decisions. Dr. Doberman has been featured in various publications and farm magazines for his work in the area of crop modeling and I'm sure would be glad to share any of his findings with this board.

Hybrid-Maize is a computer program that simulates the growth and yield of a corn crop (Zea mays L.) under non-limiting or water-limited (i.e. irrigated or rainfed) conditions based on daily weather data. The purpose of this simulation model is to allow corn producers, crop consultants, and researchers to hypothetically explore the impact of weather and management changes on crop performance so that they might better understand site yield potential, year-to-year variation in yield potential, and possible management options that affect yield and yield stability. As with all simulation models, it represents a simplification of the 'real-world' system and, as such, its predictions may differ from actual outcomes.

Hybrid-Maize allows users to:

- Assess the overall site yield potential and its variability based on historical weather data;

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- Evaluate changes in attainable yield using different combinations of planting date, hybrid maturity, and plant density;
- Analyze corn yield in relation to the timing of silking and maturity in specific years;
- Explore options for optimal irrigation management;
- Conduct in-season simulations to evaluate actual growth up to the current date based on real-time weather data, and to forecast final yield scenarios based on historical weather data for the remainder of the growing season.

Hybrid-Maize does not allow assessment of different options for nutrient management nor does it account for yield losses due to weeds, insects, diseases, lodging, and other stresses. Hybrid-Maize has been evaluated primarily in rainfed and irrigated corn systems in the U.S. Corn Belt.

I have purchased this computer program and I felt that inputting some data into the program from the plan being proposed by the MRNRD may prove valuable in your decision whether to go ahead and proceed with the present plan. The first scenario I have developed using this program is to analyze what amount of irrigation water is needed to produce the maximum attainable yield based on weather data recorded at Champion, NE for the past 20 years. I realize this data is not in the Middle Republican district, but it is the closest station with a full set of 20 year data. In generating the data I entered what I felt were normal hybrid maturities (108 day corn), normal planting date (April 25) and average irrigated plant population (30,000 plants per acre). As you can see (page 5) based on that input data the average amount of irrigation application required for optimal yields during that time frame was 12.1" This amount produced a simulated yield of 253.2 bushels per acre. The maxuimum requirement was in 1984 at 16.6" while the lowest was in 1997 at 6.4" per year. Dr. Dobermann's experience is that under top management programs about 85% of that yield will be achieved under field conditions. The remaining 15% will be lost in factors unrelated to environment or irrigation. It is also important to realize this data all reflects 20/20 hindsight and perfectly times irrigation to match environmental requirements.

In looking at a few other scenarios within the restrictions of the MRNRD plan you can see that when irrigation is limited to 13.0 inches the long term yield drops from 253.2 down to 234.3 bushels (page 6-7). This assumes that no more than 13.0" can be pumped in any given year. Since the average required during this time frame is 12.1", if producers were able to carry forward and bank water during the years of lower water use, long term averages would not be affected. By setting a 39" allocation over three years, no years would have been below optimal yields until 2002. You should seriously consider a longer period than three years in order to not affect optimal yields during drought years. I have also included an analysis of the impact this may have during "water short years" (page 8)

I think the data presented reveals several issues with the present groundwater management plan.

1. In order to achieve long term yield stability, water saved during above average rainfall periods must be allowed to be carried forward for years of below normal rainfall in order to maintain long term averages.
2. Any plan which limits water during years of below average rainfall will have a serious economic impact for irrigated producers in this area.
3. A three year allocation will reduce yields significantly during drought periods such as what was experienced from 2000-2003.

Based on the data presented and comments from the public hearing in McCook I personally feel that if this board would adopt the following recommendations the economy and structure of southwest Nebraska would not be significantly altered if the following proposals would be considered:

1. End conservation programs that inhibit runoff thereby reducing streamflow.
2. Develop a long term plan to reduce draws from streamflow caused by trees and other vegetation.

3. Continue the moratorium on new well drilling until drought conditions ease and other long term plans can be established.
4. Structure any allocation amount so long term banking of unused water is allowed.
5. Allow a greater allocation (at least 15") during the initial years of the plan to allow producers the opportunity to more effectively manage the drought conditions presently being experienced.
6. Work with state and federal funding sources to move land in alluvial areas from irrigated to dryland production with fair reimbursement for producers.

Thank you for your consideration of my views. I feel the present plan should be voted down until some of the above areas are addressed. I would also hope that any plan put forward would be analyzed using crop models to see the effect on producers in this area.

Sincerely,

Loran Wach

Loran Wach

Wauneta, NE

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Simulation Summaries 1982-2003
Champion, NE Weather Data

Year	Maximum Grain Yield	Average Minimum Temp.	Average Maximum Temp.	Average Mean Temp	Average Daily Crop Use	Av. Daily Sunlight Intensity	Growing Season Rainfall	Irrigation Requirement for Yield
1982	259.2	49.0	76.0	62.0	0.22	480	15.7	11.5
1983	244.6	58.0	84.0	70.0	0.28	501	5.6	14.0
1984	241.2	55.0	85.0	70.0	0.30	566	4.1	16.6
1985	257.6	54.0	84.0	69.0	0.29	550	7.9	14.0
1986	278.7	54.0	83.0	68.0	0.27	540	15.0	10.2
1987	258.1	54.0	84.0	69.0	0.29	552	13.9	12.8
1988	249.3	56.0	88.0	72.0	0.30	573	10.6	12.7
*1989	214.7	54.0	82.0	68.0	0.28	535	10.7	10.2
1990	230.8	56.0	88.0	72.0	0.32	576	6.7	14.0
1991	257.1	56.0	86.0	71.0	0.27	528	10.2	11.4
*1992	309.1	48.0	78.0	63.0	0.28	459	17.7	10.2
*1993	230.9	51.0	78.0	65.0	0.24	472	15.5	7.6
1994	258.3	56.0	87.0	71.0	0.31	554	8.4	12.7
*1995	197.0	54.0	83.0	69.0	0.26	499	12.0	10.2
*1996	321.0	50.0	77.0	64.0	0.21	456	20.5	6.4
1997	263.6	53.0	82.0	68.0	0.27	515	9.7	14.0
1998	242.7	56.0	86.0	71.0	0.29	551	9.6	8.9
1999	321.7	53.0	81.0	67.0	0.25	494	14.2	8.9
2000	217.4	55.0	87.0	71.0	0.32	525	3.9	16.6
2001	223.7	55.0	86.0	70.0	0.29	488	7.6	12.7
2002	248.6	56.0	88.0	72.0	0.34	548	5.5	15.1
2003	244.7	54.0	87.0	71.0	0.30	543	5.2	15.3
Average	253.2	53.9	83.6	68.8	0.28	523	10.5	12.1

*Yield affected by frost before phisological maturity

HYBRID-MAIZE MODEL
FULLY IRRIGATED

Simulations using long-term historical weather data from 1982 to 2003

Rank	Year	GrainYield	GrainDM	StoverDM	TotalDM	HI
Best yield	1996	322.0	7.63	5.27	12.9	0.59
75% perce	1991	261.9	6.2	5.88	12.08	0.51
Median yie	1984	248.6	5.89	6.62	12.51	0.47
25% perce	1998	242.7	5.75	6.26	12.01	0.48
Worst yield	1995	197.0	4.67	6.07	10.73	0.43
Long-term mean		253.7	6.01	6.35	12.36	0.48

Among the five years above, frost damage during grain filling occurred in:
1996
1995

Overall probability of frost occurrence during grain filling (%) : 27

User-specified inputs:
Weather file : Champion, NE.wth
Start from planting on (m/d) : 4/25 (DOY=115)
Total GDD50F : 2590
Plant population (*1000/acre) : 30.0
Planting depth (inch) : 1.4
Water regime : Optimal (fully irrigated)

HYBRID-MAIZE MODEL
IRRIGATION LIMITED TO 13"

Simulations using long-term historical weather data from 1982 to 2003

Rank	Year	GrainY	GrainDM	StoverDM	TotalDM	HI
Best yield	1996	322.0	7.63	5.27	12.9	0.59
75% perce	1985	251.8	5.96	4.96	10.92	0.55
Median yie	1987	236.1	5.59	5.72	11.31	0.49
25% perce	2003	214.4	5.08	4.35	9.43	0.54
Worst yield	1995	164.7	3.9	5.25	9.15	0.43
Long-term mean		234.3	5.55	5.25	10.8	0.51

Among the five years above, frost damage during grain filling occurred in:
1996
1985

Overall probability of frost occurrence during grain filling (%) : 27

User-specified inputs:
Weather file : Champion, NE.wth
Start from planting on (m/d) : 4/25 (DOY=115)
Total GDD50F : 2590
Plant population (*1000/acre) : 30.0
Planting depth (inch) : 1.4
Water regime : Irrigated
Soil moisture at start (w/w%) : 25
Texture of top-soil : Loam
Texture of sub-soil : Loam
Bulk density of top-soil : 1.3
Bulk density of sub-soil : 1.4
Max root depth (inch) : 39.4

Irrigation Applications

Date	Amount (inch)
5/1	0.50
5/15	0.60
5/29	0.60
6/6	0.60
6/13	0.70
6/20	0.70
6/27	0.70
7/4	0.90
7/11	0.90
7/18	1.00
7/25	1.00
8/1	1.00
8/8	0.70
8/15	0.70
8/22	0.60
8/29	0.60
9/5	0.60
9/12	0.60
Total	13.00

HYBRID-MAIZE MODEL

SUMMARY OF YEARS FOLLOWING BELOW NORMAL PRECIPITATION
(possible water short years)

Year	Grain Yield Optimal Irrigation	Rainfall (in.) Growing Season	Grain Yield Limited to 13"	Bushel Reduction from optimal	Percent Reduction from optimal	Grain Yield Limited to 11.7"	Bushel Reduction from optimal	Percent Reduction from optimal
1984	241.2	4.1	156.9	84.3	35.0	153.1	88.1	36.5
1985	257.6	7.9	251.6	6	2.3	251.0	6.6	2.6
1986	278.7	15.0	278.7	0	0.0	278.7	0.0	0.0
1991	257.1	10.2	251.0	6.1	2.4	238.9	18.2	7.1
1992	309.1	17.7	279.4	29.7	9.6	277.6	31.5	10.2
1995	197.0	12.0	164.7	32.3	16.4	157.0	40.0	20.3
1998	242.7	9.6	242.7	0	0.0	241.7	1.0	0.4
1999	321.7	14.2	315.5	6.2	1.9	310.7	11.0	3.4
2001	223.7	7.6	208.4	15.3	6.8	198.5	25.2	11.3
2002	248.6	5.5	213.5	35.1	14.1	205.9	42.7	17.2
2003	244.7	5.2	214.4	30.3	12.4	205.1	39.6	16.2
Average	258.6	9.9	234.3	22.3	9.2	228.9	27.6	11.4

Irrigation Applications	
Date	Amount (inch)
5/1	0.50
5/15	0.60
5/29	0.60
6/6	0.60
6/13	0.70
6/20	0.70
6/27	0.70
7/4	0.90
7/11	0.90
7/18	1.00
7/25	1.00
8/1	1.00
8/8	0.70
8/15	0.70
8/22	0.60
8/29	0.60
9/5	0.60
9/12	0.60
Total	13.00

Irrigation Applications	
Date	Amount (inch)
5/1	0.46
5/15	0.54
5/29	0.54
6/6	0.54
6/13	0.63
6/20	0.63
6/27	0.63
7/4	0.81
7/11	0.81
7/18	0.9
7/25	0.9
8/1	0.9
8/8	0.63
8/15	0.63
8/22	0.54
8/29	0.54
9/5	0.54
9/12	0.54
Total	11.7