

Limited Irrigation Crop Insurance/Water Conservation Area Calculator

Kansas Water Office- Contract 17-104

The image shows a center pivot irrigation system in a field. Overlaid on the right is a screenshot of a web-based calculator. The calculator has several input fields at the top: 10. Insured Crop (Corn), 11. System Type (Pivot System), 12. FSN, 13. Tract, 14. Unit, and 15. Field. Below these is a table with columns for Year, Reported Crop, Reported Water Diverted (Acre-Feet), Reported Acres, Yield (After trend substitution, exclusions, or applicable), and Water Applied (Acre-Inches). The table lists data from 1995 to 2015. At the bottom of the table, it says 'Average based on checked years:'. Below the table are three rows of proposed water application scenarios, with columns for Proposed Water Applied (Inch per Acre), Proposed Irrigated Acres, Proposed Water Use (Acre-Feet), Percent Reduction in Average Use, RMA Estimated Reduction in Bushel Per Acre, Expected Yield (Average Yield - Estimated Reduction), and Expected Percent Reduction in Yield.

16. Year (uncheck box to exclude)	17. Reported Crop	18. Reported Water Diverted (Acre-Feet)	19. Reported Acres	20. Yield (After trend substitution, exclusions, or applicable)	21. Water Applied (Acre-Inches)
<input type="checkbox"/> 2015	Wheat	12.69	125		N/A
<input checked="" type="checkbox"/> 2014	Corn	175.94	238	185	6.83
<input checked="" type="checkbox"/> 2013	Corn	188.35	177	174	23.09
<input type="checkbox"/> 2012	Wheat	216.82	128		N/A
<input type="checkbox"/> 2011	Grain Sorghum and Wheat	114.09	125		N/A
<input type="checkbox"/> 2010	Soybeans and wheat	163.94	122		N/A
<input checked="" type="checkbox"/> 2009	Corn	118.09	146	204	19.12
<input type="checkbox"/> 2008	Wheat and Other	145.51	149		N/A
<input checked="" type="checkbox"/> 2007	Corn	195.78	135		17.45
<input checked="" type="checkbox"/> 2006	Corn	152.68	120	200	14.95
<input type="checkbox"/> 2005	Wheat	85.71	125	180	N/A
<input type="checkbox"/> 2004	More than one type of crop	170.61	122		N/A
<input type="checkbox"/> 2003	Wheat	24.88	141		N/A
<input checked="" type="checkbox"/> 2002	Corn	252.62	141		21.50
<input checked="" type="checkbox"/> 2001	Corn	7.38	138	188	0.85
<input type="checkbox"/> 2000	Corn and Wheat	0.00	149	170	N/A
<input type="checkbox"/> 1999	Corn and Soybeans	130.40	238		N/A
<input type="checkbox"/> 1998	Corn and Wheat	159.62	140		N/A
<input type="checkbox"/> 1997	Corn and Wheat	180.81	141		N/A
<input type="checkbox"/> 1996	Corn and Wheat	309.68	140		N/A
Average based on checked years:		187.26	148.6	184	12.78

22. Proposed Water Applied (Inch per Acre)	23. Proposed Irrigated Acres	24. Proposed Water Use (Acre-Feet)	25. Percent Reduction in Average Use	26. RMA Estimated Reduction in Bushel Per Acre	27. Expected Yield (Average Yield - Estimated Reduction)	28. Expected Percent Reduction in Yield
10	140	116.67	25.96%	-30	154	15.51%
12	140	145.00	11.03%	-13	190	6.87%
8		0.00	100.00%			

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Kansas Geological Survey Open-File Report 2017-48

GEOHYDROLOGY

KANSAS GEOLOGICAL SURVEY
OPEN-FILE REPORT 2017-48

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Introduction

In 2016, the Risk Management Agency (RMA) of the U.S. Department of Agriculture funded the Kansas Water Office (KWO) to develop resources that support activities in the RMA's Topeka Regional office while also increasing the awareness of expanded limited crop insurance opportunities across Kansas. Through this effort, the KWO sub-contracted with the Kansas Geological Survey (KGS) to develop an online tool to facilitate the review of limited irrigation crop insurance applications by providing real-time access to historic water use information in combination with RMA calculations of crop yield reductions under limited irrigation practices. This online tool can also be used to explore possible water use reductions and potential effects on crop yields under proposed Water Conservation Areas or Local Enhanced Management Area plans.

The RMA tool is a stand-alone, data-driven website, developed using Adobe ColdFusion web authoring software. The site provides real-time access to reported water use information from the Water Information Management and Analysis System (WIMAS) and RMA yield tables for limited irrigation applications. WIMAS is a separate online resource, hosted by the KGS, that allows access to Kansas water right data maintained by the Kansas Department of Agriculture, Division of Water Resources (KDA-DWR). WIMAS data are updated daily. Potential yield reductions resulting from reduced water applications are taken from county-based, deficit irrigation tables provided by the RMA.

Accessing the RMA Tool

The RMA Documentation Tool for Limited Irrigation is a data-driven, stand-alone website that displays information based on a unique identification number provided for a specified Kansas water right. This ID can be passed from other applications, entered manually, or, for this project, looked up using the Water Right Selection web page:

http://hercules.kgs.ku.edu/geohydro/rma/wr_lookup.cfm

Kansas water rights are referred to in a variety of ways with the most common being the "file number." A file number consists of combinations of a water right's type, vested county code, water right number, and water right qualifier.

The majority of water rights in Kansas are appropriated water rights and can be looked up simply by entering the water right number. For example, to retrieve information about file number/water right 29884, enter its number in the Water Right Number field while leaving all the other fields blank (fig. 1). Because every file number has a water right number, this is a required field.

Water Right Selection	
Please enter a water right file number for the RMA Tool. Bolded indicates a required field.	
Right Type:	<input type="text" value=""/>
Vested County Code:	<input type="text" value=""/>
Water Right Number:	<input type="text" value="29884"/>
Water Right Qualifier:	<input type="text" value=""/>
<input type="button" value="Select Water Rights"/>	

Figure 1. Appropriated water right query example.

Sometimes, individual water rights are divided for administrative reasons. When this is the case, the Water Right Qualifier field must be used to find the water right’s unique identification number. For example, file number 5245-D2 is composed of water right number “5245” and water right qualifier “D2” (fig. 2). By default, water rights without water right qualifiers are left blank or specified as “00.”

Water Right Selection	
Please enter a water right file number for the RMA Tool. Bolded indicates a required field.	
Right Type:	<input type="text" value=""/>
Vested County Code:	<input type="text" value=""/>
Water Right Number:	<input type="text" value="5245"/>
Water Right Qualifier:	<input type="text" value="D2"/>
<input type="button" value="Select Water Rights"/>	

Figure 2. Split water right qualifier query example.

If the file number represents a vested water right (those that pre-date the 1945 Kansas Water Appropriation Act), the abbreviation for the county in which the water right is located must be selected from the Vested County Code drop-down list. An example of a vested water right is FI-183, where FI is the vested county code and 183 is the water right number. Both need to be specified (fig. 3). Because the water right qualifier isn’t needed in this example, the Water Right Qualifier field can be left blank.

Water Right Selection	
Please enter a water right file number for the RMA Tool. Bolded indicates a required field.	
Right Type:	<input type="text"/>
Vested County Code:	<input type="text" value="FI"/>
Water Right Number:	<input type="text" value="183"/>
Water Right Qualifier:	<input type="text"/>
<input type="button" value="Select Water Rights"/>	

Figure 3. Vested water right query example.

Finally, in rare circumstances, the right type for a file number may be needed. These cases involve term (T), temporary (P), basin term (B), or some domestic (D) water rights. If appropriated (A) or vested (V) rights are specified, this drop-down list can remain blank.

Once all the necessary fields have been specified, the Water Right Selection Page queries the WIMAS database to retrieve the WR_ID value for that water right. The WR_ID is an internal number that uniquely identifies a water right. Unlike the components that make up a water right file number, in which the values have meaning relative to each other (e.g., right type, vested county code, water right number, and water right qualifier), the WR_ID is used primarily to facilitate application and database development. It is an arbitrary number that never changes once assigned and is not used to reference a water right on public forms or certificates. Instead, it is used primarily by programmers.

If the query parameters are successful, the WR_ID for the specified water right will be passed to the RMA Documentation Tool website as a URL variable. If no matching water right record is found, all the components that make up the specified file number will be listed and the user will be prompted to adjust the query.

RMA Documentation Tool for Limited Irrigation

The RMA Documentation Tool for Limited Irrigation provides access to past years of reported water use for a water right in combination with RMA-based, calculated crop yields under proposed limited irrigation applications. To open the page, an individual water right must be specified in the URL string by its WR_ID number, which is a unique internal ID assigned by the KDA-DWR to represent a single water right. Without the WR_ID reference, the website will return an error message to the user.

For example, the following URL string lists the RMA tool's web address with the WR_ID value for vested right FI-183 shown in figure 3:

http://hercules.kgs.ku.edu/geohydro/rma/yield_tool.cfm?wr_id=49909

The URL variable, called "WR_ID," is listed immediately after the question mark in the URL string and its value, 49909, follows the equal sign. The use of URL variables allows the RMA tool to be accessed from a variety of web- and desktop-based applications. It can also be opened by manually typing or cutting/pasting the URL string directly into the address bar of a web browser.

At the top of the page, the RMA tool displays the water right's file number, the types of use made of water, and the points of diversion associated with the right (fig. 4). The water right file number is composed of the vested county code (if applicable), the water right number, and the water right's qualifier. The water right file number is hyperlinked to the WIMAS website, which provides additional information, such as the priority date, authorized annual quantities and rates, and any associated records from driller's logs and depth-to-water measurements.

RMA Documentation Tool for Limited Irrigation

Water Right [FI 183 - 00](#)
1 Type(s) of Use: 2 Point of Diversion(s):

Figure 4. Example of a listed water right and its type of water use and points of water diversion.

When the page is opened, the RMA tool queries the WIMAS database for the last 10 years of reported water use along with contact information for the water use correspondent on record with the KDA-DWR. Reported water use is stored in WIMAS by a water right, its specific use made of water, and a specific point of water diversion. If the values in the use made of water or point of diversion dropdown boxes on the RMA tool change (fig. 4), the website re-populates with new water use information from WIMAS.

The user will be notified if the water right, the selected use made of water, or the selected point of diversion is dismissed or inactive.

Overview of Data Fields

The RMA Documentation Tool has several numbered data fields, some unique to the RMA and others to the reported water use. Yellow shading indicates the field's values can be edited and will be applied to other tools used within the page once the user clicks the Update Form button, located at the bottom of the web page. Light blue shading indicates the field's values are computed based on other data values on the page and cannot be edited. The RMA Documentation Tool does not save any of the information entered or changed on this page. If the water right information displayed is incorrect, the user must contact the KDA-DWR to properly update the water right record.

Fields 1 to 9

Data fields in this part of the form identify the county in which the selected point of diversion is located (a key parameter for RMA's yield calculations) along with contact information for the water use correspondent (fig. 5). Yellow-shaded fields can be edited.

1. Crop Year:	2018	4. Producer Name:	John Doe	7. Phone:	785-228-5512
2. State:	Kansas	5. Address:	1234 Kansas Drive	8. Tax ID:	xxx-xxx-xxxx
3. County:	Wallace	6. City, ST, Zip:	Rmaville, KS, 64323-3232	9. Policy Number:	xxx-xxx-xxx

Figure 5. Example of data fields 1 to 9.

- 1. Crop Year:** The year irrigation is intended to take place. By default, it will be the current year plus one.
- 2. State:** Although the RMA is active in other states, this tool is developed specific to Kansas-based water right data. This field cannot be edited.
- 3. County:** The name of the county in which the selected point of diversion is located. This value is retrieved from WIMAS and cannot be changed.
- 4. Producer Name:** Name of the current water use correspondent on record with the KDA-DWR. The initial value in this field is retrieved from WIMAS.
- 5 and 6. Address and City, ST, ZIP:** Address of the current water use correspondent on record with the KDA-DWR. The initial value in this field is retrieved from WIMAS but can be changed to reflect the owner, tenant, or another type of contact person.
- 7. Phone:** Phone number of the water use correspondent. By default, this field is blank. The user may enter a phone number for reference.
- 8. Tax ID:** The tax ID number of the water use correspondent. By default, this field is blank. The user may enter a tax ID number for reference.
- 9. Policy Number:** The policy number of the written agreement assigned by the RMA and must be entered manually.

Fields 10 to 15

These fields specify the crop to be grown, the type of irrigation system to be used, and various designations representing the irrigated acres (fig. 6). The values provided in Field 10 (insured crop) and Field 11 (system type) are critical and are used to estimate reductions in yields based on RMA deficit irrigation tables.

10. Insured Crop:	Corn	12. FSN:	9999	14. Unit:	XXX
11. System Type:	Pivot System	13. Tract:	XXX	15. Field:	XXX

Figure 6. Example of data fields 10 to 15.

10. Insured Crop: The type of crop—corn or soybeans—to be planted during the crop year specified in Field 1. The RMA tool matches the value entered in this field to crops listed in Field 17 (reported crop) and in the RMA yield estimates calculated in Fields 26 (estimated reduction in bushels per acre), 27 (expected yield), and 28 (expected percent reduction in yield).

11. System Type: The type of irrigation system to be deployed during the crop year specified in Field 1. The RMA tool uses the value entered in this field when calculating estimates displayed in Fields 26 (estimated reduction in bushels per acre), 27 (expected yield), and 28 (expected percent reduction in yield).

12. FSN: Farm Service Agency farm serial number associated with each unit.

13. Tract: The applicable tract of land under the listed unit from Field 14.

14. Unit: The units of measure for the tract.

15. Field: The applicable field under the listed tract.

Fields 16 to 21

This section of the form displays reported water use along with user specified yield information for the purpose of identifying average acre-foot per acre water usage and average yield conditions for a given crop type (fig. 7). Users can include or exclude years of water use years that are used to establish average conditions from which estimates of proposed future water use reductions and any RMA's computed reductions in yield for a given crop type and irrigation system are compared against.

By default, the RMA Tool provides the last ten years of reported water use, queried from WIMAS for the listed water right and its specified use made of water and point of diversion. Water use reports are required to be submitted each year by March 1st. At which time, they

undergo a six to nine month quality control review before being approved for public use. Water use for the 2017 calendar year, for example, should be available in late summer to early fall of 2018.

16. Year (uncheck box to exclude)	17. Reported Crop	18. Reported Water Diverted (Acre-Feet)	19. Reported Acres	20. Yield (After trend, substitution, exclusion, as applicable)	21. Water Applied (Acre-Inch)
<input checked="" type="checkbox"/> 2016	Corn	127.52	125	185	12.24
<input checked="" type="checkbox"/> 2015	Wheat	12.68	125	57	1.22
<input checked="" type="checkbox"/> 2014	Corn	175.94	239	190	8.83
<input checked="" type="checkbox"/> 2013	Corn	198.16	103	180	23.09
<input checked="" type="checkbox"/> 2012	Corn	216.82	125	97	20.81
<input type="checkbox"/> 2011	Grain Sorghum and Whea	114.09	125		N/A
<input checked="" type="checkbox"/> 2010	Soybeans and Wheat	193.84	123	50	18.91
<input type="checkbox"/> 2009	Corn and Wheat	118.09	140		N/A
<input type="checkbox"/> 2008	Corn	145.51	140	172	N/A
<input checked="" type="checkbox"/> 2007	Corn	196.38	135	192	17.46
<input type="checkbox"/> 2006	Corn and Wheat	152.68	125		N/A
<input type="checkbox"/> 2005	Wheat	80.31	125		N/A
<input type="checkbox"/> 2004	More than one type of cr	170.61	123		N/A
<input type="checkbox"/> 2003	Wheat	24.85	141		N/A
<input type="checkbox"/> 2002	Corn and Wheat	252.82	141		N/A
<input type="checkbox"/> 2001	Corn and Wheat	7.38	136		N/A
<input type="checkbox"/> 2000	Corn and Wheat	0.00	140		N/A
<input type="checkbox"/> 1999	Corn and Soybeans	130.60	139		N/A
<input type="checkbox"/> 1998	Corn and Wheat	159.83	140		N/A
<input type="checkbox"/> 1997	Corn and Wheat	180.81	141		N/A
Average based on checked years of water use:		160.19	139.3	136	14.65

Figure 7. Example of data fields 16 to 21.

16. Year: The calendar year of reported water use. If the check box is marked, then that year's reported diverted amount of water (Field 18), reported acres irrigated (Field 19), user-specified, bushels per acre yield (Field 20), and computed water applied (Field 21) are used to compute the average conditions, which are listed at the bottom of each column. Unchecking the box removes that year's water use from consideration.

When the page is loaded or undergoes a hard refresh caused by changing the use made of water or point of diversion values at the top of the page, the water use years are automatically checked if the reported crop type in Field 17 matches the insured crop in Field 10. Years in which Field 17 and Field 10 do not match are unchecked. If a user manually checks or unchecks boxes in Field 16, those selections are maintained when the user clicks the Update Form button at the bottom of the screen.

Shading patterns:

- Light yellow indicates the box is checked and the reported crop type (Field 17) matches the insured crop type (Field 10). This year's water use information is likely being used properly in calculations of average water use.
- Dark yellow or greenish indicates the box is not checked but the reported crop type (Field 17) matches the insured crop type (Field 10). This year's water use

information is *not* being used to compute average water use, but the box probably should be checked.

- Light red/pink indicates the box is not checked and the reported crop type (Field 17) does not match the insured crop type (Field 10). This year's water use information is *not* being used to compute average water use and likely should remain unchecked.
- Dark red indicates the box is checked but the reported crop type (Field 17) does not match the insured crop type (Field 10). This year's water use information is being used to compute average water use, but the box likely should be unchecked.

17. Reported Crop: The type of crop reported irrigated during the calendar year. When the RMA tool opens, the values are retrieved from WIMAS for the given water right, use made of water, point of diversion, and year of water use. The listed crop type can be changed manually. Pressing enter/return or clicking the Update Form button at the bottom of the page will refresh the page and update all calculated fields.

Shading patterns:

- Light yellow indicates the reported crop type (Field 17) matches the insured crop type (Field 10).
- Light red/pink indicates the reported crop type (Field 17) does *not* match the insured crop type (Field 10).

18. Reported Water Diverted: The total acre-feet of water reported used during the year. When the RMA tool opens, the values are retrieved from WIMAS for the given water right, use made of water, point of diversion, and year of water use. The total amount of water reported diverted can be changed manually. Pressing enter/return or clicking the Update Form button at the bottom of the page will refresh the page and update all calculated fields.

19. Reported Acres: The total number of acres irrigated during the year. When the RMA tool opens, the values are retrieved from WIMAS for the given water right, use made of water, point of diversion, and year of water use. The total acres reported irrigated can be change manually. Pressing enter/return or clicking the Update Form button at the bottom of the page will refresh the page and update all calculated fields.

20. Yield: The yield in bushels per acre harvested during the water use. The user provides this information; it is not saved. Pressing enter/return or clicking the Update Form button at the bottom of the page will refresh the page and update all calculated fields.

21. Water Applied: This field is calculated from the total amount of water reported diverted (Field 18) divided by the total acres reported irrigated (Field 19) for the year. The light blue shading indicates the field is computed and cannot be changed.

Fields 22 to 29

Fields 22 to 29 (fig. 8) are designed to evaluate proposed water use applications for limited irrigation agreements or possible inclusion in other management activities, such as enrolling in a Water Conservation Area. Proposed water use applications are compared to the established average conditions displayed in the last row of Fields 18 through 21 and to any reductions in bushels per acre computed from RMA’s deficit irrigation cropping templates based on the selected crop type—corn or soybeans—and irrigation system. Users can specify up to five different water use proposals at once.

22. Proposed Water Applied (Inch per Acre)	23. Proposed Irrigated Acres	24. Proposed Water Use (Acre-Feet)	25. Percent Reduction in Average Water Use	26. RMA Estimated Reduction in Bushel Per Acre	27. Expected Yield (Average Yield - Estimated Reduction)	28. Expected Percent Reduction in Yield
8	125	83.33	47.98%	-54	82	39.92%
10	125	104.17	34.97%	-36	100	26.59%
12	125	125.00	21.97%	-19	116	14.27%
15	200	250.00	0.00%			
10	100	83.33	47.98%	-36	100	26.59%

Figure 8. Examples of data fields 22 to 28.

22. Proposed Water Applied: The proposed number of inches of water per acre to be applied entered by the user.

23. Proposed Irrigated Acres: The total number of acres proposed to be irrigated entered by the user.

24. Proposed Water Use: The total annual water usage, in acre-feet, calculated by multiplying the proposed water applied (Field 22) and the total proposed acres to be irrigated (Field 23). This field is calculated based on the values in Fields 22 and 23 and cannot be edited.

25. Percent Reduction in Average Use: The percent reduction in average use, calculated by dividing the established average reported water diverted (Field 18) by the proposed water usage (Field 24). This field is calculated based on the values in Fields 18 and 24 and cannot be edited.

26. RMA Estimated Reduction in Bushel per Acre: The estimated reduction in yield (in bushels per acre) from the average user-specified crop yields (Field 20) based on RMA’s deficit irrigation template for the county of application (Field 3), insured crop type (Field 10), and type of irrigation system (Field 11). A “No Match Found” message indicates the reductions in bushels per acre for the selected crop type has not yet been established by the RMA or is in a county not currently eligible for deficit irrigation agreements. This field cannot be edited.

27. Expected Yield. The expected yield based on the average user-specified yields (Field 20) minus the estimated reduction in bushels per acre (Field 26). This field cannot be edited.

28. Expected Percent Reduction in Yield. The expected percent reduction in yield, calculated by dividing the computed expected yield (Field 27) from the average user-specified yields (Field 20). This field cannot be edited.

29. Notes. Any additional notes or remarks can be entered here.

The RMA Documentation Tool serves primarily as a planning tool and does not save any of the information entered or changed on the page. Once the pertinent information is entered, users can to save the page as a stand-alone web page or print to a hard copy format. Future developments may include more robust printing options or the option to export to a spreadsheet.

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