

Small Domestic Household Water Right Exceptions: Recommendations for the CSKT Water Compact Negotiation

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Prepared in support of the CSKT Water Compact Negotiation

The Water Resources Division encourages the ratification of water right exceptions for small domestic household-use as part of the Confederated Salish and Kootenai Tribe's (CSKT) water right compact. In support of this proposed exception, I define household and itemize the primary functions that a well should serve, offering quantifications of the minimum volume and flow rate needed to supply those primary functions. My calculations are designed to ensure an adequate supply and recommend maximum values and thus err on the side of over-estimating water requirements and under-estimating efficiency. I also describe and recommend terminology associated with the proposed exception in efforts to restrict the exemption to small household domestic wells and exclude ponds, pits, reservoirs, and other unintended appropriations.

Exceptions refer to water appropriations that are formally recognized as water rights, but attainable under expedited means in relation to standard permitting processes. In areas governed by the Montana Water Use Act, appropriators seeking groundwater developments with flow rates and total volumes less than 35 gallons per minute (GPM) and 10 acre-feet (AF) per year are allowed to file a *Notice of Completion of Groundwater Development* by filing form 602 (Appendix A) and paying a fee. The form requires information that allows the DNRC to approximate diverted volumes and flow rates and ensure the appropriation meets the permit exception criteria. The requisite rigor and detail of information required through the standard water right permitting process is substantially more than that required by a 602 exception. Public notice is not required for 602 exceptions and there is no allowance for objections. Non excepted authorizations must be obtained before putting water to use. The 602 exception allows the user to put the water to use before obtaining the water right, thereby dramatically reducing timing complications.

Volume and Flow Rate Methods:

Household wells have many functions and uses, but two elements are paramount to establishing the annual flow rate and volume required: domestic-use and lawn and garden. Each element has an associated diverted volume and flow rate. The total annual *diverted volume* is the sum of consumed and return-flow volumes. *Consumed volume* is the annual amount of water used for a beneficial purpose, such as water transpired by growing vegetation, evaporated from soils or water surfaces, or incorporated into products that

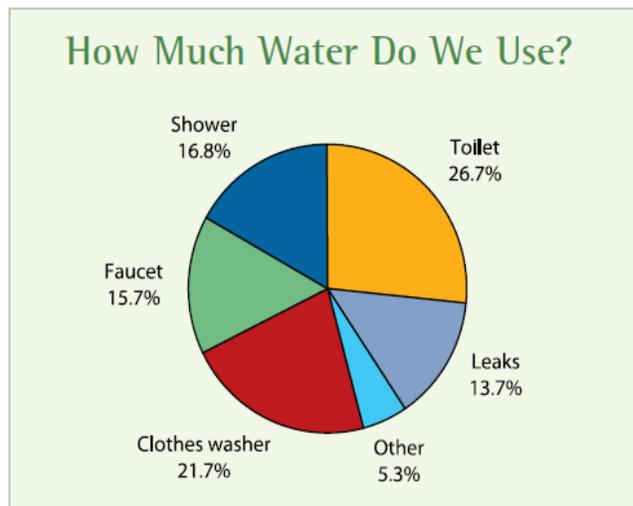


Figure 1: in-house water use (EPA, 2008; AWWARF, 2009)

does not return to ground or surface water, while *return-flow* is water that is diverted but not consumed to the source and instead does eventually return to ground or surface water.

Domestic uses (in-house) include but are not limited to the use of showers, toilets, faucets, clothes washers, and other; leaks make up a significant portion of the average use (Figure 1). On average, in-house use is 187.5 gallons per house per day (Kimsey and Flood, 1987), which is 684,375 gallons or 0.21 AF per year (Levens et al., 2008); the calculation is based on the U.S. average of 2.5 people per household. More specifically, the average person uses 59.8 gallons per day (AWWARF, 1999), which equates to 21,827 gallons or 0.067 AF per year.

I used census information for Lake and Sanders Counties (Figure 2) to estimate an appropriate number of people per household for purposes of quantifying total in-house use (Table 1). The average household size is approximately 2.4 people per household, but I choose to use volumes necessary for a five-person household as 97% of all households contain five people or less. Accordingly, a five-person household uses approximately 0.33 AF (5 x 0.067) of water per year and by applying a 33 percent overage for purposes of addressing non-typical home uses, I estimate that 0.5 AF per year is more than sufficient for supplying the vast majority of individual households (Table 4).

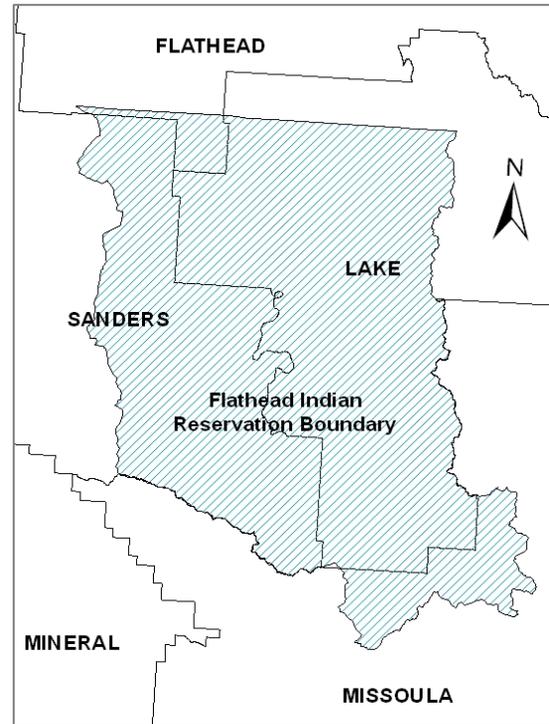


Figure 2: Flathead Indian Reservation/county boundaries

Table 1: Number of People Per Household Sanders and Lake Counties, Montana								
Persons Per House	1	2	3	4	5	6	>7	Total Households
Sanders Co	1,176	1,768	527	450	248	70	37	4,276
Lake Co	2,952	5,944	1,921	1,269	668	245	186	13,185
Combined	4,128	7,712	2,448	1,719	916	315	223	17,461
Total Houses with five people or less per house							16,923	97%
Total Houses with six people or more per house							538	3%

(U.S. Census Bureau, 2010)

Of the total domestic water use, only a fraction is consumed to the system; the rest returns to aquifers and surface water through water treatment systems as return flow. Municipal systems

typically consume 2 percent of the total diverted domestic volume (Kinsey and Flood, 1987), while septic system typically consume 12 percent of the total diverted household volume (Vanslyke and Simpson, 1974). For this quantification, I chose to use the 12 percent consumption value based on the septic systems so as to prevent underestimation of the total consumptive volumes associated with domestic use. Applying the 12 percent consumption rate equates to an annual consumption of 0.06 AF per year (Table 4).

Flow rate maximums are typically established by a combination of pump size and the distance and elevation change between the source and the place of use; an efficient system uses the smallest pump required to simultaneously overcome conveyance resistance while still providing the maximum flow rate required for the use. For maximum domestic flow rate requirements I reference a seven-minute peak demand (Table 2). Most of the houses in Lake and Sanders Counties have 2.5 or less bathrooms. Accordingly, I choose to use 14 GPM as this amount accommodates the seven-minute peak demand for a 2 to 2.5 bathroom house.

Table 2: Seven-minute In-house Peak Demand Period

OUTLETS	FLOW RATE GPM	TOTAL USAGE GALLONS	BATHROOMS IN HOME			
			1	1 1/2	2 - 2 1/2	3 - 4
Shower or Bath Tub	5	35	35	35	53	70
Lavatory	4	2	2	4	6	8
Toilet	4	5	5	10	15	20
Kitchen Sink	5	3	3	3	3	3
Automatic Washer	5	35	—	18	18	18
Dishwasher	2	14	—	—	3	3
Normal seven-minute *peak demand (gallons)			45	70	98	122
Minimum sized pump required to meet peak demand without supplemental supply			7 GPM (420 GPH)	10 GPM (600 GPH)	14 GPM (840 GPH)	17 GPM (1020 GPH)

Note: Values given are average and do not include higher or lower extremes
*Peak demand can occur several times during morning and evening hours.

(WSC, 2003)

Lawn and Garden typically represents the largest volume of water used by a household. Of particular difficulty in making a recommendation, is the highly subjective determination of an adequate or appropriate lawn size. Advocates of water conservation often urge xeriscaped lawns, while a lawn enthusiast may desire four acres of mowed and irrigated grass surrounding their home.

To determine a reasonable maximum yard size, I looked to recommendations from wildland fire prevention experts. A review of wildland fire urban-interface case studies reveals a 90 percent structure survival during wildfire for homes with nonflammable roofs when a 66-foot vegetation clearance is present (Cohen, 2000). While a 66-foot buffer sized lawn is not the only way to increase home structure survival during wildfire, it is perhaps the most common method employed in the U.S. Accordingly, I applied the 66-foot buffer for irrigable yard area calculations, affording the option of a lawn size that accommodates this *firewise* zone recommendation. Yards larger than this standard are not as practicably justified as essential to a household, and should instead rely on non-excepted water right acquisitions.

To integrate the buffer recommendation I first determined the average square footage of a U.S. home to be approximately 2,350 square feet and assumed that half of that number (first floor) in addition to a two car garage would constitute a reasonable average home footprint. I then generated a three dimensional model of said house and applied a 66-foot buffer to the home for means of calculating the associated firewise lawn around the home, thus giving an area of 0.7 acres (Figure 3).



Figure 3: Firewise yard 66-foot boundary equates to 0.7 acres for a typical home.

I based annual lawn and garden volume estimates on irrigation water requirements of alfalfa during dry years. I used 1.75 AF/acre (21 inches) as a net irrigation rate for alfalfa as predicted by the NRCS Irrigation Water Requirements software using weather data from the Polson Weather Station (Appendix B). The consumption rate, when applied to a 0.7-acre firewise yard, rounds up to an annual 1.30 AF total. Typical lawn and garden application efficiency likely lies somewhere between periodic move gun type sprinklers and fixed laterals; which range between 50 to 75 percent in efficiency (Table 3). I applied a 65 percent efficiency standard, ten

Table 3: Sprinkler Application Efficiency Values by Type	
Type	Ea (%)
Periodic move lateral	60 – 75
Periodic move gun type or boom sprinklers	50 – 60
Fixed laterals (solid set)	60 – 75
Traveling sprinklers (gun type or boom)	55 – 65
Center pivot - standard	75 – 85
Linear (lateral) move	80 – 87
LEPA - center pivot and linear move	90 – 95

(NRCS, 1997)

percent of which is lost to evaporation (consumptive) and 25 percent of which bypasses the root system and eventually becomes return flow (diverted but not consumed). Factoring in the efficiency yields a total diverted annual volume of approximately 1.9 AF and a total consumed annual volume of 1.4 AF for a 0.7-acre firewise yard (Table 4).

Volume and Flow Rate Results:

I combined in-house and lawn and garden diverted and consumed annual volumes (Table 4). These values are assumed to include all typical purposes required for a household. The total diverted 2.4 AF maximum volume threshold constitutes a 76% reduction from the current State of Montana 602 standard of 10 AF. Although not specifically listed in the table, the amount is intended to include purposes in addition to domestic and lawn and garden, so long as the total annual consumed volume does not exceed 2.40.

Table 4: Annual Diverted and Consumed Water Volume Estimates		AF Per Year		
		Household	Irrigation	Total
Five-person household with 0.7-acre firewise lawn	Diversions	0.50	1.9	2.4
	Consumption	0.06	1.4	1.5

An adequate max flow rate should include peak simultaneous uses of all requisite diverted volumes per unit time, inclusive of overage for situations where oversized pumps are utilized. It needs to be noted, that maximum flow rates are the exception rather than the norm. Max flow rates are not consistent, and only at maximum withdraw, will a small household system achieve this value.

My max flow rate calculations showed a clear need for irrigation zoning, should an applicant decide to develop the entire 0.7-acre lawn. In fact, when combined with total maximum in-house flow rate requirements, my calculations exceed the current State of Montana standard of 35 GPM. As a result, I recommend that the exception not provide for all possible simultaneous uses, but instead apply the expectation that when running one of the four-hour irrigation sets, in-house flow rates be limited, therefore, I recommend using 35 GPM as a maximum flow rate for this exception.

Table 5: Maximum Flow Rate Calculations for 0.7 Acre Firewise Lawn and Five-person Household with Three Zones								
IWR Rate (AF/Acre)	Irrigated Acres	IWR + Efficiency Total (AF)	IWR + Efficiency Total (gal)	Hours	Zones	Flow Rate Irrigation (GPM)	Flow Rate In-House (GPM)	Flow Rate Total (GPM)
0.083	0.7	0.058	18932	4	1	78.88	14	92.88
0.083	0.35	0.029	9466	4	2	39.44	14	53.44
0.083	0.24	0.020	6491	4	3	27.05	14	41.05

Terminology and design:

Household, in this case, means the dwelling, house, or other domestic facilities where an individual, family or social unit lives. I recommend this exception excludes commercial facilities and other buildings that are not dwellings. I recommend this exception require a connection to a household and allows for one and only one connection.

Flow Rate is a measurement of the rate at which water flows or is diverted, impounded, or withdrawn from the source of supply for beneficial use, and commonly measured in cubic feet per second (CFS) or gallons per minute (GPM). *Diverted volume* is total amount of diverted volume, including both the consumptive volume and return flow. Volumes are expressed as either gallons (gal) or acre-feed (AF). I recommend using the diverted volume and flow rates as the maximum volume for this type of exception (2.4 AF and 35 GPM).

MCA 85-2-102(29) defines *well* to mean any artificial opening or excavation in the ground, however made, by which ground water is sought or can be obtained or through which it flows under natural pressures or is artificially withdrawn. This broad definition is the one used when implementing MCA 85-2-306(3) *Notice of Completion of Groundwater Development* exceptions. The exception statute, in conjunction with the well definition allows for ponds, pits, excavations, and reservoirs to be developed so long as they meet the other criteria requirements.

In Montana, licensed well drillers operate under a separate definition of the term *water well* as per MCA 37-43-102(7):

(a) "Water well" means an excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed and intended for the location, diversion, artificial recharge, or acquisition of ground water.

(b) The term does not include:

(i) spring development or excavations, by backhoe or otherwise, for recovery and use of surface waters or for the purpose of stock watering or irrigation when the depth is 25 feet or less; or

(ii) an excavation made for the purpose of obtaining or prospecting for oil, natural gas, minerals, or products of mining or quarrying or for inserting media to repressure oil- or natural-gas-bearing formations or for storing petroleum, natural gas, or other product

The MCA 37-43-102(7) definition is narrower than MCA 85-2-102(29) used for the *Notice of Completion of Groundwater Development* and specifically excludes excavations. I recommend using this definition, or one similar, which will limit the exception to household use.

Well casings are steel or plastic pipes which serve as the lining of a well, preventing it from caving in and protecting groundwater from contamination by surface water. *Well casing head* is a heavy, flanged steel fitting connected to the first string of casing. I suggest adding both requirements to exemptions, as it will further restrict exemptions to households and add the benefit of protecting groundwater resources from contaminants.

Summary Recommendations:

Establishing a limited household exception on the Flathead Indian Reservation will allow small water users to legally develop water systems that enable basic living functions without having to undergo the expense and time restriction of applying for and obtaining a standard water right authorization. To mandate standard water right acquisitions for these small domestic uses puts a disproportionately large burden on the applicant for what amounts to a relatively small volume of water as compared to other uses. Allocating water management staff to process standard water right acquisition requests for these small domestic uses will detract time which should be spent on more substantial resource management issues.

The exception should allow for up to but not exceeding 2.4 AF diverted volume per year and a 35 GPM flow rate. These values are maximums. The limitation greatly reduces the likelihood of adversely affecting senior water right holders. The flow rate, in particular, will only reach 35 gpm at maximum-use and cannot be sustained long-term as the volume maximum is limiting.

To achieve maximum build-out of a 0.7-acre firewise lawn, an appropriator will need to zone lawn irrigation and stagger application and in-home use. I recommend that the exception include limited stock, fish, wildlife, and other uses associated with household domestic, so long as the maximum flow rate and volumes are not exceeded.

The definition of the term well should approximate MCA 37-43-102(7), thereby limiting the exception and excluding ponds, pits, excavations, and reservoirs. The exception should mandate well shaft casings and well head casings, but allow developed springs. The exception should mandate the well be connected to one and only one household. The exceptions should accommodate controlled groundwater area management restrictions as they exist at the time of the compact agreement and allow for future changes, by the Unitary Management Board or otherwise named governing entity, as controlled groundwater area boundaries and specific regulations change to reflect future conditions.

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Appendix A:

<p>Form No. 602 R 4/21/2009</p> <h2 style="text-align: center;">NOTICE OF COMPLETION OF GROUNDWATER DEVELOPMENT</h2> <p style="text-align: center;">Use this form for completed groundwater developments where the water <u>has been put to use</u> for the purposes identified with a maximum use of 35 GPM not to exceed 10 AC-FT per year.</p> <p style="text-align: center;">Incomplete forms will be returned.</p> <p style="text-align: center;">Filing Fee \$125.00</p>	<p style="text-align: center;">FOR DEPARTMENT USE ONLY</p> <p>Notice No. _____ Basin _____ Priority Date _____ Time _____ AM - PM Rec'd By _____ Fee Rec'd \$ _____ Check No. _____ Deposit Receipt # _____ Payor (if different from name(s) listed in item 1 below) _____</p> <p>Refund \$ _____ Date _____ Deficiency Letter Sent _____</p>
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⇒ Your priority is determined by the date of filing. If it is determined this form was improperly filed, your priority date may be changed.
 ⇒ If your development is within a Controlled Ground Water Area, the regional office will contact you to explain the correct filing requirements.

1. NAME _____
 MAILING ADDRESS _____
 CITY _____ STATE _____ ZIP _____
 WORK PHONE _____ HOME PHONE _____ CELL PHONE _____

2. DIVERSION USED TO OBTAIN GROUNDWATER

Well - Attach well log, if available Water Well Contractor Name: _____
 Developed Spring (Excavation performed at the spring location.)
 Pit/Pond - Surface Area _____ Acres _____ Depth _____

3. FLOW RATE USED _____ GPM

4. COMBINATION OR SHARED DEVELOPMENT

a. Will this development be used in combination with another well or spring? Yes No
 b. Will this development be shared by other users? Yes No
 If yes for either question, list the water right numbers and explain how the development is used. _____

5. PURPOSE AND PERIOD OF USE

Domestic	Number of homes supplied _____ Year round use? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, from _____ to _____, inclusive of each year.
Lawn & Garden	Total Size of lawn and/or garden - length x width _____ April 1 - October 31 <input type="checkbox"/> Yes <input type="checkbox"/> No If no, from _____ to _____, inclusive of each year.
Irrigation	Type of crop _____ Total Crop Acres Irrigated _____ April 1 - October 31 <input type="checkbox"/> Yes <input type="checkbox"/> No If no, from _____ to _____, inclusive of each year.
Stock (Example: 100 Cows & 1 Horse)	Number and type _____ Year round use? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, from _____ to _____, inclusive of each year.
Other	Describe the purpose of the use _____ Amount of water used _____ gallons per day Number of days used _____ Year round use? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, from _____ to _____, inclusive of each year.

6. POINT OF DIVERSION - Location of Ground water Development

_____ 1/4 _____ 1/4 _____ 1/4 Section _____ Twp _____ N / S Rge _____ E / W County _____
 Lot _____ Block _____ Tract No. _____ Subdivision Name _____
 Government Lot No. _____ COS No. _____
 Street or Road Address, including City, State & Zip Code of the Development _____

7. PLACE OF USE - Enter the 17 digit geocode applicable to the place of use legal land description. _____ If there are multiple places of use, attach additional sheets and list the geocode for each legal land description. The geocodes can be found in county records.

Is the place where water is used the same as the point of diversion? Yes No
 If no, enter the place of use land description below. Attach additional sheets if necessary.
 Domestic Stock Irrigation Other
 _____ 1/4 _____ 1/4 _____ 1/4 Section _____ Twp _____ N / S Rge _____ E / W County _____
 Lot _____ Block _____ Tract No. _____ Subdivision Name _____
 Government Lot No. _____ COS No. _____
 Street or Road Address, including City, State & Zip Code of the Place of Use _____

8. AFFIDAVIT OF OWNERSHIP OR WRITTEN CONSENT

I have possessory interest in the property where the water has been put to beneficial use and I have the exclusive property rights in the ground water development works OR I have attached written consent of the person owning the ground water development works and/or written notification to the land owner pursuant to MCA 85-2-306(1).

The statements appearing here are to the best of my knowledge true and correct.

Appropriator's Signature _____ Date: _____
 _____ Date: _____

Go to web site <http://www.dnrc.mt.gov/wrd/> to learn additional information about the use of this form.



**FORM 602, NOTICE OF COMPLETION OF GROUNDWATER DEVELOPMENT
EXCEPTIONS FOR A SMALL GROUND WATER DEVELOPMENT
INSTRUCTIONS**

To use this form, the following must apply to your water use.

- ✘ The ground water must have been put to use for the purpose(s) identified.
- ✘ The development is not located within the boundaries of a Controlled Ground Water Area.
- ✘ The source is ground water, meaning any water located beneath the ground surface. The water is typically diverted from the ground via a well, developed spring, or a collection of water in a ground water pit or pond.
- ✘ The flow rate used is 35 gallons per minute or less. This is the rate you are taking water from the source.
- ✘ The total volume used from the development does not exceed 10 acre-feet per year. If you share a well with others, the total volume used by all of the users cannot exceed 10 acre-feet per year. When the water use exceeds that amount, then you must file an Application for Beneficial Water Use Permit.

If a map is included with your filing, it must include the following information - North Arrow, Section, Township, Range and mark an X where the development is located. If the required information is included on the map, DNRC will confirm the written land description matches the map. If it does not, DNRC will change the written description to match the map.

Complete items 1 through 8 ONLY if you have determined this is the correct form to file.

All of the required information must be entered for your application to be considered correct and complete as required under 85-2-306, MCA.

Item 1. Enter the complete name of the person to be listed as the water right owner(s), their mailing address, and phone numbers.

Item 2. Check the type of ground water development used to obtain the ground water. If the source is a well, provide the well driller's name. If the source is a ground water pit or pond, provide the surface area and depth of the pond. This information will be used to determine the evaporation that will occur from the pond.

Item 3. Enter the flow rate used. To determine the actual flow rate you are pumping, turn the water on until the pump comes on and stays on. Time how many seconds it takes to fill a 5-gallon bucket. Use the following formula to calculate the flow rate. $300/\# \text{ of seconds} = \text{flow rate in GPM}$. You can also turn on the bathtub faucet and time (in minutes) how long it takes to fill a 1 or 5 gallon bucket.

Item 4. Check yes if the development is connected with another well or spring. Check yes if the development is shared by other users. For example, two homes on well. If you answer yes to either question, provide the water right number and document how the development is used. If a shared well agreement exists, provide a copy of that agreement.

Item 5. Check the purposes for which the water is used. If the water is used during the months specified, check 'yes'. If not, check 'no' and enter the month and day water is used each year.

Item 6. Enter the land description for the location of the development. Describe the location to the nearest 10 acres if possible. Legal land descriptions, subdivisions, geocodes, and certificate of survey information may be obtained from the well log; the county records; or from the Montana Cadastral system at: <http://gis.mt.gov/>.

- Subdivisions – In addition to the above description, enter the lot and block or tract number, subdivision name.
- Government Lots – In addition to the land description, enter the government lot number.
- Certificate of Survey - In addition to the land description, enter the survey number.
- Street or Road Address – Enter the physical address of the development including city, state, and zip code.

Item 7. Enter the land description for where the water is used. Describe the location to the nearest 10 acres if possible. Legal land descriptions, subdivisions, geocodes, and certificate of survey information may be obtained from the well log; the county records; or from the Montana Cadastral system at: <http://gis.mt.gov/>.

- Subdivisions – In addition to the above description, enter the lot and block or tract number, subdivision name.
- Geocode(s) - Enter the geocode(s) for the land description entered.
- Government Lots – In addition to the land description, enter the government lot number.
- Certificate of Survey - In addition to the land description, enter the survey number.
- Street or Road Address – Enter the physical address of the development including city, state, and zip code.

Item 8. If the statements are correct, sign the form.

Appendix B:

Irrigation Water Requirements
Crop Data Summary

Job: Exempt Wells	Crop: Alfalfa Hay
Location: MRO	County: Lake, MT
By: Mace	Date: 05/13/08
Weather Station: POLSON	Sta No: MT6635
Latitude: 4741 Longitude: 11410	Elevation: 2990 feet above sea level
Computation Method: Blaney Criddle (TR21)	Net irrigation application: 1 inches
Crop Curve: Blaney Criddle Perennial Crop	Estimated carryover moisture used at season:
Begin Growth: 5/10 End Growth: 9/22	Begin: 0.5 inches End: 0.5 inches

Month	Total Monthly ET (3) inches	Dry Year 80% Chance (1)		Normal Year 50% Chance (1)		Average Daily ETc inches	Peak Daily ETPk inches
		Effective Precipitation inches	Net Irrigation Requirements inches (2)	Effective Precipitation inches	Net Irrigation Requirements inches (2)		
January	0.00	0.00	0.00	0.00	0.00	0.00	
February	0.00	0.00	0.00	0.00	0.00	0.00	
March	0.00	0.00	0.00	0.00	0.00	0.00	
April	0.00	0.00	0.00	0.00	0.00	0.00	
May	2.49	0.60	1.39	0.78	1.21	0.11	
June	5.93	0.97	4.96	1.26	4.67	0.20	0.24
July	7.53	0.62	6.91	0.81	6.73	0.24	0.31
August	6.55	0.64	5.91	0.83	5.72	0.21	0.26
September	2.72	0.41	1.81	0.53	1.69	0.12	
October	0.00	0.00	0.00	0.00	0.00	0.00	
November	0.00	0.00	0.00	0.00	0.00	0.00	
December	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	25.23	3.24	20.99	4.21	20.02		

(1) For 80 percent occurrence, growing season effective precipitation will be equaled or exceeded 8 out of 10 years. For 50 percent chance occurrence, effective precipitation will be equaled or exceeded 1 out of 2 years.

(2) Net irrigation requirements is adjusted for carryover moisture used at the beginning of the season and carryover moisture used at the end of the growing season.

(3) ET (Evapotranspiration) is adjusted upwards 10% per 1000 meters above sea level.

Date: 5/14/2008