

KS652.1005 State supplement - conservation management systems and irrigation planning

Planning irrigation systems

Tables [KS10-1](#), [KS10-2](#), and [KS10-3](#) should be used to determine if the flow rate of the water supply is adequate to meet peak crop consumptive use. This will help the landowner determine acreage that can be irrigated with the available water supplies. The landowner may want to alter their cropping pattern to more effectively utilize water supplies available. For instance, planting the entire acreage to corn would require a peak water use in July and August. Planting part of this acreage to winter wheat would move the peak use time on that acreage to the spring months. Normally, there would be a larger water supply available in the spring with a surface water source. In any case, the peak use in July and August would be reduced.

Another alternative would be to plant a crop (such as sorghum) with lower water requirements on part of the acreage.

Another alternative would be to use a limited irrigation approach. Using the information in this Kansas section for when to apply irrigation water when limited supplies are available will help to maximize production with a limited water supply.

These alternatives need to be evaluated in light of current market conditions. The objective is to maximize economic returns for the landowner--not necessarily to maximize crop production.

Planning computation - Use Tables [KS10-1](#), [KS10-2](#), and [KS10-3](#) to obtain values for peak consumptive use based on irrigation efficiency.

Example

A landowner has a well that produces 1000 gallons per minute (gpm). The peak consumptive use of the crop is 0.15 inch/day. How many acres can be irrigated with a 50 percent irrigation efficiency irrigating 12 hours per day? From the appropriate table ([Table KS10-1](#)), find 11.3 gpm/acre needed.

$$1000 \text{ gpm} / 11.3 \text{ gpm/acre} = 89 \text{ acres can be irrigated}$$

How many acres can be irrigated with 65 percent efficiency? From the appropriate table, find 8.7 gpm/acre.

$$1000 \text{ gpm} / 8.7 \text{ gpm/acre} = 115 \text{ acres can be irrigated}$$

To use a different number of hours irrigation time, the formula must be used.

Example

50 percent efficiency is desired for 15 hours operating time per day.

$$Q = \frac{(453) \times (d) \times (A)}{(t) \times (E)} = \frac{(453) \times (0.15\text{in.}) \times (1.0 \text{ ac.})}{(15\text{hr.}) \times (0.50)}$$

$$= 9.0 \text{ gpm/acre}$$

Where: d = Net application depth in inches
A = Acres
T = Time in hours
E = Irrigation efficiency of the system
= $\frac{\text{Net irrigation}}{\text{Gross application}}$

Table KS10-1 Requirements to Meet Peak Consumptive Use Irrigating 12 hours/day (gallons per minute [gpm]/acre)^{1/}

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27
30%	18.9	20.1	21.4	22.7	23.9	25.2	26.4	27.7	28.9	30.2	31.5	32.7	34.0
40%	14.2	15.1	16.0	17.0	17.9	18.9	19.8	20.8	21.7	22.7	23.6	24.5	25.5
50%	11.3	12.1	12.8	13.6	14.3	15.1	15.9	16.6	17.4	18.1	18.9	19.6	20.4
60%	9.4	10.1	10.7	11.3	12.0	12.6	13.2	13.8	14.5	15.1	15.7	16.4	17.0
65%	8.7	9.3	9.9	10.5	11.0	11.6	12.2	12.8	13.4	13.9	14.5	15.1	15.7
70%	8.1	8.6	9.2	9.7	10.2	10.8	11.3	11.9	12.4	12.9	13.5	14.0	14.6
75%	7.6	8.1	8.6	9.1	9.6	10.1	10.6	11.1	11.6	12.1	12.6	13.1	13.6
80%	7.1	7.6	8.0	8.5	9.0	9.4	9.9	10.4	10.9	11.3	11.8	12.3	12.7
85%	6.7	7.1	7.6	8.0	8.4	8.9	9.3	9.8	10.2	10.7	11.1	11.5	12.0
90%	6.3	6.7	7.1	7.6	8.0	8.4	8.8	9.2	9.6	10.1	10.5	10.9	11.3
95%	4.0	6.4	6.8	7.2	7.6	7.9	8.3	8.7	9.1	9.5	9.9	10.3	10.7

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40
30%	35.2	36.5	37.8	39.0	40.3	41.5	42.8	44.0	45.3	46.6	47.8	49.1	50.3
40%	26.4	27.4	28.3	29.3	30.2	31.1	32.1	33.0	34.0	34.9	35.9	36.8	37.8
50%	21.1	21.9	22.7	23.4	24.2	24.9	25.7	26.4	27.2	27.9	28.7	29.4	30.2
60%	17.6	18.2	18.9	19.5	20.1	20.8	21.4	22.0	22.7	23.3	23.9	24.5	25.2
65%	16.3	16.8	17.4	18.0	18.6	19.2	19.7	20.3	20.9	21.5	22.1	22.7	23.2
70%	15.1	15.6	16.2	16.7	17.3	17.8	18.3	18.9	19.4	20.0	20.5	21.0	21.6
75%	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1
80%	13.2	13.7	14.2	14.6	15.1	15.6	16.0	16.5	17.0	17.5	17.9	18.4	18.9
85%	12.4	12.9	13.3	13.8	14.2	14.7	15.1	15.5	16.0	16.4	16.9	17.3	17.8
90%	11.7	12.2	12.6	13.0	13.4	13.8	14.3	14.7	15.1	15.5	15.9	16.4	16.8
95%	11.1	11.5	11.9	12.3	12.7	13.1	13.5	13.9	14.3	14.7	15.1	15.5	15.9

^{1/}This table is based on the formula
$$Q = \frac{(453) \times (d) \times (A)}{(t) \times (E)}$$

Where: Q = Gallons per minute irrigation flow rate

453 = Conversion factor

d = Net application depth in inches

A = Acres

t = Time in hours

E = Irrigation efficiency of the system =
$$\frac{\text{net irrigation}}{\text{gross application}}$$

Table KS10-2 Requirements to Meet Peak Consumptive Use Irrigating 18 hours/day (gpm/acre) ^{1/}

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27
30%	12.6	13.4	14.3	15.1	15.9	16.8	17.6	18.5	19.3	20.1	21.0	21.8	22.7
40%	9.4	10.1	10.7	11.3	12.0	12.6	13.2	13.8	14.5	15.1	15.7	16.4	17.0
50%	7.6	8.1	8.6	9.1	9.6	10.1	10.6	11.1	11.6	12.1	12.6	13.1	13.6
60%	6.3	6.7	7.1	7.6	8.0	8.4	8.8	9.2	9.6	10.1	10.5	10.9	11.3
65%	5.8	6.2	6.6	7.0	7.4	7.7	8.1	8.5	8.9	9.3	9.7	10.1	10.5
70%	5.4	5.8	6.1	6.5	6.8	7.2	7.6	7.9	8.3	8.6	9.0	9.3	9.7
75%	5.0	5.4	5.7	6.0	6.4	6.7	7.0	7.4	7.7	8.1	8.4	8.7	9.1
80%	4.7	5.0	5.3	5.7	6.0	6.3	6.6	6.9	7.2	7.6	7.9	8.2	8.5
85%	4.4	4.7	5.0	5.3	5.6	5.9	6.2	6.5	6.8	7.1	7.4	7.7	8.0
90%	4.2	4.5	4.8	5.0	5.3	5.6	5.9	6.2	6.4	6.7	7.0	7.3	7.6
95%	4.0	4.2	4.5	4.8	5.0	5.3	5.6	5.8	6.1	6.4	6.6	6.9	7.2

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40
30%	23.5	24.3	25.2	26.0	26.8	27.7	28.5	29.4	30.2	31.0	31.9	32.7	33.6
40%	17.6	18.2	18.9	19.5	20.1	20.8	21.4	22.0	22.7	23.3	23.9	24.5	25.2
50%	14.1	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1
60%	11.7	12.2	12.6	13.0	13.4	13.8	14.3	14.7	15.1	15.5	15.9	16.4	16.8
65%	10.8	11.2	11.6	12.0	12.4	12.8	13.2	13.6	13.9	14.3	14.7	15.1	15.5
70%	10.1	10.4	10.8	11.1	11.5	11.9	12.2	12.6	12.9	13.3	13.7	14.0	14.4
75%	9.4	9.7	10.1	10.4	10.7	11.1	11.4	11.7	12.1	12.4	12.8	13.1	13.4
80%	8.8	9.1	9.4	9.8	10.1	10.4	10.7	11.0	11.3	11.6	12.0	12.3	12.6
85%	8.3	8.6	8.9	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.3	11.5	11.8
90%	7.8	8.1	8.4	8.7	8.9	9.2	9.5	9.8	10.1	10.3	10.6	10.9	11.2
95%	7.4	7.7	7.9	8.2	8.5	8.7	9.0	9.3	9.5	9.8	10.1	10.3	10.6

^{1/}This table is based on the formula
$$Q = \frac{(453) \times (d) \times (A)}{(t) \times (E)}$$

Where: Q = Gallons per minute irrigation flow rate

453 = Conversion factor

d = Net application depth in inches

A = Acres

t = Time in hours

E = Irrigation efficiency of the system = $\frac{\text{net irrigation}}{\text{gross application}}$

Table KS10-3 Requirements to Meet Peak Consumptive Use Irrigating 24 hours/day (gpm/acre)^{1/}

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27
30%	9.4	10.1	10.7	11.3	12.0	12.6	13.2	13.8	14.5	15.1	15.7	16.4	17.0
40%	7.1	7.6	8.0	8.5	9.0	9.4	9.9	10.4	10.9	11.3	11.8	12.3	12.7
50%	5.7	6.0	6.4	6.8	7.2	7.6	7.9	8.3	8.7	9.1	9.4	9.8	10.2
60%	4.7	5.0	5.3	5.7	6.0	6.3	6.6	6.9	7.2	7.6	7.9	8.2	8.5
65%	4.4	4.6	4.9	5.2	5.5	5.8	6.1	6.4	6.7	7.0	7.3	7.6	7.8
70%	4.0	4.3	4.6	4.9	5.1	5.4	5.7	5.9	6.2	6.5	6.7	7.0	7.3
75%	3.8	4.0	4.3	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.3	6.5	6.8
80%	3.5	3.8	4.0	4.2	4.5	4.7	5.0	5.2	5.4	5.7	5.9	6.1	6.4
85%	3.3	3.6	3.8	4.0	4.2	4.4	4.7	4.9	5.1	5.3	5.6	5.8	6.0
90%	3.1	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.5	5.7
95%	4.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4

Irrigation Efficiency	Consumptive Use (inches/day)												
	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40
30%	17.6	18.2	18.9	19.5	20.1	20.8	21.4	22.0	22.7	23.3	23.9	24.5	25.2
40%	13.2	13.7	14.2	14.6	15.1	15.6	16.0	16.5	17.0	17.5	17.9	18.4	18.9
50%	10.6	10.9	11.3	11.7	12.1	12.5	12.8	13.2	13.6	14.0	14.3	14.7	15.1
60%	8.8	9.1	9.4	9.8	10.1	10.4	10.7	11.0	11.3	11.6	12.0	12.3	12.6
65%	8.1	8.4	8.7	9.0	9.3	9.6	9.9	10.2	10.5	10.7	11.0	11.3	11.6
70%	7.6	7.8	8.1	8.4	8.6	8.9	9.2	9.4	9.7	10.0	10.2	10.5	10.8
75%	7.0	7.3	7.6	7.8	8.1	8.3	8.6	8.8	9.1	9.3	9.6	9.8	10.1
80%	6.6	6.8	7.1	7.3	7.6	7.8	8.0	8.3	8.5	8.7	9.0	9.2	9.4
85%	6.2	6.4	6.7	6.9	7.1	7.3	7.6	7.8	8.0	8.2	8.4	8.7	8.9
90%	5.9	6.1	6.3	6.5	6.7	6.9	7.1	7.3	7.6	7.8	8.0	8.2	8.4
95%	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.7	7.9

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