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## KS651.1080 Dead animal composting facilities

### (a) General

This section was developed to facilitate technical assistance for dead animal (mortality) composting facilities. Anyone composting livestock in Kansas shall meet the requirements of Kansas Regulation 28-29-25d, Livestock Composting. Composting facilities  $\frac{1}{2}$  acre or less shall be registered with the Kansas Department of Health and Environment (KDHE), and facilities larger than  $\frac{1}{2}$  acre shall have a permit issued by KDHE. However, if the composting facility is located on a KDHE-permitted animal feeding operation, then a separate registration or permit is not required.

Information on the composting process and sizing the facilities for composting dead animals can be found in [Chapter 2 in National Engineering Handbook Part 637 \(NEH 637\)](#), [Environmental Engineering](#), and in [Section 651.1007\(f\)](#). Composting facilities usually have a primary and secondary stage. The primary stage may be implemented using static bins/piles or windrows or with a manufactured mechanical in-vessel composting device. The secondary stage is usually implemented using bins/piles or windrows.

The design volume for each stage should be based on peak disposal requirements for the animal operation. The peak disposal period normally occurs when the animals are close to their market weight. If information on mortality is not available from the producer, the design mortality rate and carcass design weight values from [Section 651.1007\(f\)](#) should be used.

### (b) Bin system composting

The available capacity of the primary composting bins shall be at least the volume determined by multiplying the weight of dead animals at maturity by a volume factor. In

general, the designer should use a volume factor of 20 cubic feet for larger animals such as cows and smaller numbers as the carcass size decreases. A table in [Section 651.1007](#) has different volume factors. This will yield enough space for the feeding cycle of the animals in a well-managed composting system.

Calculation of the available bin capacity should account for the angle of repose of the material in the bin. In the absence of actual data, use an angle of repose of 1 horizontal to 1 vertical (1:1) (45 degrees.) Note that a narrower bin width will mean less volume lost to the angle of repose.

The minimum number of primary and secondary bins required for a bin-only system is:

- Primary bins = Volume needed for composting / volume of bins (rounded up to whole number)
- Secondary bins = Number of primary bins
- Total bins = Primary + Secondary
- Minimum system design = 4 bins total

Additional bins may also be provided for storage of carbon source materials.

#### (1) Composting sequence

**Step 1**—The primary bin will be filled and allowed to compost for 90 days after the last carcass is placed or until the temperature in the area of the last carcass placed falls below 130°F after a period of temperatures in the range of 130° to 160°F. If the temperature does not reach at least 130°F after 7 days of composting, the pile should be turned and more water or carbon source should be added to achieve a moisture content that will allow the composting process to proceed.

**Step 2**—The material finished with primary composting is moved to a secondary bin. More carbon source is added as necessary to maintain desired moisture content.

**Step 3**—The material will be allowed to reheat through a second composting cycle in the secondary bin for 90 days. More carbon source and/or water shall be added as necessary to maintain desired moisture content over the secondary composting period.

### (2) Filling the primary stage bins

A minimum layer of 12 inches of carbon source should be placed on the floor of the bin prior to loading the first carcasses and on the sides and on top of the carcasses. This thickness shall also be maintained on the sides and top during the composting process.

The time to completely fill a primary bin will depend on the bin size and amount of mortalities being produced. In addition, the scheduling of bin use and degree of inactivity in a bin will depend on the number of days' worth of mortality volume that each bin will hold. A bin that holds a larger number of days' worth of mortalities results in more inactivity.

### (3) Operation and maintenance of a bin composter

The operation and maintenance instructions are very important for composting systems. The instructions should include both the primary and secondary bins. Some general considerations include the following:

- Typically, coarse sawmill sawdust, shredded cornstalks, coarse-ground corn cobs, and other materials possessing like properties and having similar particle size are recommended for the carbon source due to their high bulk, ease of handling, absorbency, and high carbon content. Straw and very fine sawdust are recommended with reservation because the fine texture of these materials restricts proper air movement, and straw will flatten out.
- Do not use oak, cedar, or redwood material because of their tannin content. Do not use treated wood material because the treatment will kill the aerobic bacteria that are needed to accomplish the composting.

- Provide a recommendation for a startup recipe and operation. Determining the best recipe for the operation will require some initial experimentation. The initial compost mix shall result in a carbon to nitrogen ratio between 25:1 and 40:1. A suggested startup mix for composting of swine mortalities is 3.7 cubic yards of carbon source for each 1,000 pounds of carcass.
- Provide a recommendation for monitoring of moisture in the bins. The moisture content of the compost mix must be maintained at 40-65% by weight (wet basis) to enable the aerobic bacteria to work effectively. Too much moisture in the mix prevents adequate oxygen content and inhibits the composting activity. Add bulking material to create a more porous mix whenever moisture content begins to approach the upper limit and monitor more frequently until moisture content is successfully brought back down to the desired range.
- Measurement of moisture content may be done by visual observation if the producer has experience with silage production. Proper silage moisture content is approximately 65%, so the operator would need to make sure that the mix does not get quite that wet. Another method is to take some compost material in your hand and squeeze it. Compost at proper moisture content should stick together in a ball. If it falls apart, it is too dry; if it expands or moisture squeezes out, it is too wet.
- Provide a recommendation for monitoring of temperature. Many references recommend that the compost temperature must reach 130° to 160°F during the composting cycle and should be above 130°F for at least 5 days.
- For the secondary stage bins, compost temperature should again reach at least 130°F and then cool to a temperature lower than 100°F.

### (c) Mechanical in-vessel composting

The in-vessel composter may be selected from the list of approved products. The selected product shall have a capacity adequate to handle the design daily mortality rate determined above, using manufacturer's recommendations.

#### (1) Sizing the secondary bins

For the selected in-vessel composter product, design the capacity of the secondary bins to handle the output of the in-vessel composter when running at full capacity (which may be higher than the design daily mortality rate) to account for instances when higher-than-average mortalities are experienced.

Use the manufacturer's predicted rate for output volume of primary stage compost per day. This will be less than the theoretical output of the device—if calculated based strictly on available volume and cycle time—because during proper operation, there will be significant air space in the vessel to allow for proper moisture control and aerobic bacteria composting activity. Also, a volumetric reduction takes place during the primary composting phase in the vessel.

Plan for a percentage of the primary stage compost to be recycled back into the in-vessel composter along with any bones that have not been fully processed, to be used as part of the carbon source for new mortalities. Use manufacturer's recommendation for this percentage.

Sizing of the secondary bins may be done as follows:

**Step 1**—Determine the daily production volume (cubic feet per day) of primary stage compost to be moved into secondary processing by applying the manufacturer's recommended percentages and rates as described above.

**Step 2**—Select a bin size that will work for the producer, taking into account available equipment and management style.

**Step 3**—For the selected bin size, calculate the available volume of each bin. In the absence of actual data, use an angle of repose of 1:1 (45 degrees.) Note that a narrower bin width will mean less volume lost to the angle of repose.

**Step 4**—Determine the number of days' worth of storage each bin represents by dividing the available bin volume by the daily production volume.

**Step 5**—Determine process and storage time. Plan for the secondary treatment to take 90 days. This is conservative. If appropriate for the planned management of the system, add up to 60 days' worth of storage capacity for each batch of compost. This is to accommodate scheduling of land application for a total of up to 150 days that a batch of compost will occupy the secondary bin after the bin is completely filled.

**Step 6**—Calculate total cycle time by summing the number of days to fill the bin with the process and storage time determined above. This cycle time represents the amount of time until each bin can be emptied and used again.

**Step 7**—Calculate minimum number of secondary bins needed by dividing the total cycle time by the number of days to fill the bin. Add an extra bin if desired for storage of carbon source.

**Step 8**—The recommended minimum number of secondary bins is 2.

#### (2) Operation and maintenance of a mechanical in-vessel composter

The operation and maintenance instructions are very important for the in-vessel composting system and should rely heavily on the manufacturer's recommendations. The instructions should include both the primary device and the secondary bins. Some general considerations include the following:

- Typically, wood chips or shavings are ideal carbon sources due to their high bulk, ease of handling, absorbency, and high carbon content. Straw or sawdust are not recommended because these materials are too fine and do not allow proper air

- movement, and straw will flatten out. However, use the manufacturer's recommendations for carbon source.
- Do not use oak, cedar, or redwood material because of their tannin content. Do not use treated wood material because the treatment will kill the aerobic bacteria that are needed to accomplish the composting.
  - Provide a recommendation for a startup recipe and operation. The initial compost mix shall result in a carbon to nitrogen ratio between 25:1 and 40:1. Use manufacturer's instructions. Determining the best recipe for the operation will require some initial experimentation.
  - Provide a recommendation for monitoring of moisture in the in-vessel unit. The moisture content of the compost mix must be maintained at 40-65% by weight (wet basis) to enable the aerobic bacteria to work effectively. Manufacturer's recommendations may vary; the resulting instructions should meet both Natural Resources Conservation Service (NRCS) standards and manufacturer's recommendations. Too much moisture in the mix prevents adequate oxygen content and inhibits the composting activity. Add bulking material to create a more porous mix whenever moisture content begins to approach the upper limit and monitor more frequently until moisture content is successfully brought back down to the desired range.
  - Measurement of moisture content may be done by visual observation if the producer has experience with silage production. Proper silage moisture content is approximately 65%, so the operator would

need to make sure that the mix does not get quite that wet.

- Provide a recommendation for monitoring of temperature. Some in-vessel composters contain built-in thermometers for this purpose. The compost temperature must reach 130° to 160°F during the composting cycle with at least 5 days above 130°F.
- For the secondary stage bins, compost temperature should again reach at least 130°F and then cool to a temperature lower than 100°F.
- Adjustment of the basic recipe is done by observation of the color of the completed primary stage compost, as instructed by the manufacturer. In general:
  - Chocolate color is desirable
  - Tan color means add more recycle materials
  - Coffee color means add more fresh carbon source

#### (d) Windrow and static pile composting

Composting using windrows or static piles will be similar to bin composting. The footprint will be larger as there would be no walls to hold back the compost materials.

#### (e) References

NRCS National Engineering Handbook Part 637 (NEH 637), *Environmental Engineering*, Chapter 2, Composting.

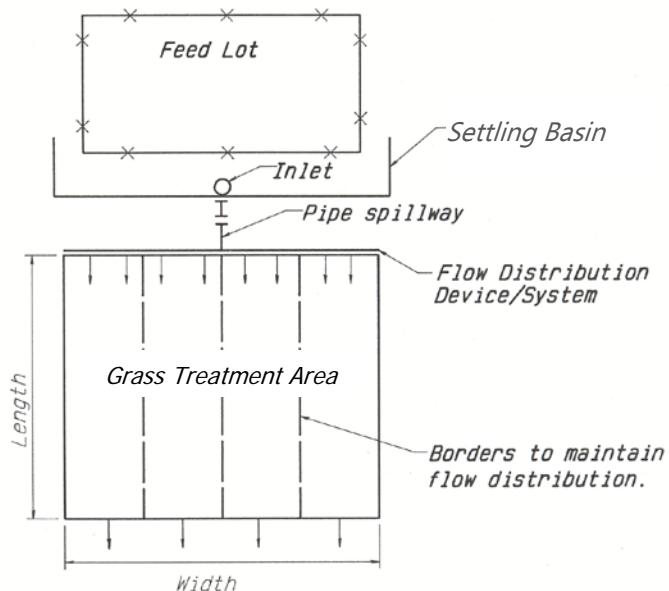
NRCS National Engineering Handbook Part 651 (NEH 651), *Agricultural Waste Management Field Handbook*, Section 651.1007.

## **KS651.1081 Vegetated treatment area (wastewater treatment strip or vegetative filter)**

### **(a) General information**

This section was developed to aid in the design of a vegetated treatment area (VTA) using the infiltration and treatment method. This practice uses a settling basin and an area of perennial grass to treat and remove sediment, organic waste, nutrients, and other pollutants from stormwater runoff discharged from livestock confinement areas. A VTA is planned and designed according to [Conservation Practice Standard \(CPS\) 635, Vegetated Treatment Area](#), and the procedure in this section. Additional information can be found in Sections [651.0605\(c\)](#) and [651.1005\(b\)\(7\)](#).

**Figure KS10-1** Typical VTA system



*Note: Discharge occurs when rainfall exceeds the design storm or soil is saturated.*

A VTA system consists of the following components: settling basins, flow distribution devices, and grass treatment areas as shown in Figure KS10-1. The performance objectives of each component are as follows:

#### **(1) Settling basin**

- Have the capacity to store the average annual sediment yield.
- Detain lot runoff to induce the settling or deposition of solids and nutrients.
- Provide controlled outflow to the grass treatment area.
- Control the 25-year, 24-hour rainfall event without overtopping or uncontrolled discharge.
- Facilitate maintenance—especially solids removal.

**(2) Flow distribution system**

- Control and uniformly distribute settling basin discharge into the grass treatment area.
- Provide the inflow capacity, velocity, and flow depth to the grass treatment area required to meet hydraulic performance criteria.

**(3) Grass treatment area**

- Infiltrate the settling basin discharge resulting from a 2-year, 24-hour rainfall event.
- Control the settling basin discharge resulting from a 25-year, 24-hour rainfall event such that all flow is controlled within the treatment area, flow depth does not exceed 6 inches, average velocity does not exceed 1.5 foot/second, and contact time (for example, travel time) through the treatment area is at least 1 hour.
- Nitrogen loading is adequately distributed and does not exceed the average annual agronomic requirement of the vegetation, based upon average yield.
- The outlet of the grass treatment area is stable (for example, not subject to significant erosion).

**(b) System process concepts**

The conceptual processes and assumptions used to develop these design procedures are listed in the following steps:

**Step 1**—Rainfall begins and is deposited simultaneously on the lot (open confinement area) and the grass treatment area.

**Step 2**—The initial portion of the rainfall is infiltrated. Lot runoff begins after approximately 0.5 inch of rainfall (assuming a bare earth lot, runoff curve number [CN] = 90). Grass treatment area runoff begins after the initial abstraction of the soil-grass cover is satisfied. For typical conditions, the initial abstraction ranges from 0.5 to 1.3 inches.

**Step 3**—Runoff from the lot is routed into the settling basin and is detained there. Initial outflows are relatively small (typically 10% to 20% of the design discharge for an orifice-controlled pipe spillway). Detention time in the settling basin is much greater than the time of concentration of the grass treatment area.

**Step 4**—Runoff resulting from direct rainfall onto the grass treatment area occurs unimpeded. Using the NRCS Type II 24-hour rainfall distribution as a model, most of the runoff will occur between hours 10 and 15 in the 24-hour period for typical conditions. Therefore, the settling basin should have a detention time of greater than 15 hours to minimize outflow during the time when runoff from direct rainfall is occurring on the grass treatment area.

**Step 5**—Direct rainfall onto the grass treatment area has satisfied the initial abstraction and used a portion of the storage available in the soil profile. Runoff detained in the settling basin must be released and distributed such that the application rate does not exceed the soil intake rate and the application volume does not exceed the remaining soil moisture storage volume. Border irrigation theory and practice is used to design a system that infiltrates the discharge from the settling basin resulting from a 2-year, 24-hour rainfall.

**Step 6**—Only a portion of the soil moisture storage volume that is available in the grass treatment area after direct rainfall is used to store the settling basin discharge. This reduces the risk of the soil becoming saturated by a single design rainfall event, minimizes deep percolation and leaching, and leaves some soil moisture storage available for subsequent rainfall events. Evapotranspiration subsequently depletes stored soil moisture, and nutrient uptake by the grass depletes nutrient concentrations. Eventually, the required soil moisture storage is again available.

**Step 7**—Risk of polluted discharge from the grass treatment area is influenced primarily by design rainfall frequency and allocation of soil moisture storage. Although the 2-year, 24-hour

rainfall event is of lesser magnitude than the 25-year, 24-hour rainfall event used for containment system design, the level of protection is still relatively high since 80% to 90% of all rainfall events are less than the 2-year, 24-hour rainfall. Only 50% of the available soil moisture storage volume (for example, available water capacity [AWC]) in the grass treatment area is used to store direct rainfall and settling basin discharge. This assumes that the average soil moisture storage prior to a 2-year, 24-hour rainfall is less than 50% of available capacity.

### (c) Considerations and limitations

- Any extraneous (foreign) drainage, including unpolluted surface runoff and roof runoff, must be diverted to the greatest extent practicable.
- Generally, the drainage area, including lots and any undiverted extraneous drainage, must be less than 5 acres in order for a system to be feasible.
- VTA systems are most applicable to operations confining 500 animal units or less.
- Adequate area must be available to construct the system components. As a general rule, the grass treatment area will be approximately equal to the lot or open confinement area.
- A soil depth and usable root zone of at least 2 feet under the grass treatment area is necessary for acceptable performance. The maximum soil depth considered to be an effective root zone is 5 feet. Shallow soils with limited water-holding capacity will require relatively large treatment areas. Porous or sandy soils (intake family 1.5 or greater) are not suitable for grass treatment systems.

- The effectiveness of VTA systems will be reduced during chronic wet periods due to insufficient soil moisture storage. Periods of prolonged drought or excessive rainfall may damage vegetation and also reduce effectiveness.
- Nutrient uptake and "mechanical" filtering or treatment by vegetation will be greatly reduced during the dormant season.
- Grass treatment areas are best suited to areas of uniform slope ranging from 0.3% to 4% except for 0.1 and 0.3 inch per hour intake families where the slope range is 0.5% to 4%. A minimum of 1% is required for the entrance slope to move the runoff water away from the flow distribution system.
- Adequate maintenance is required to keep the settling basin and flow distribution system functional, maintain a vigorous stand of vegetation, and prevent excessive nutrient accumulation. Vegetation should be managed so that height is always 4 inches or greater.

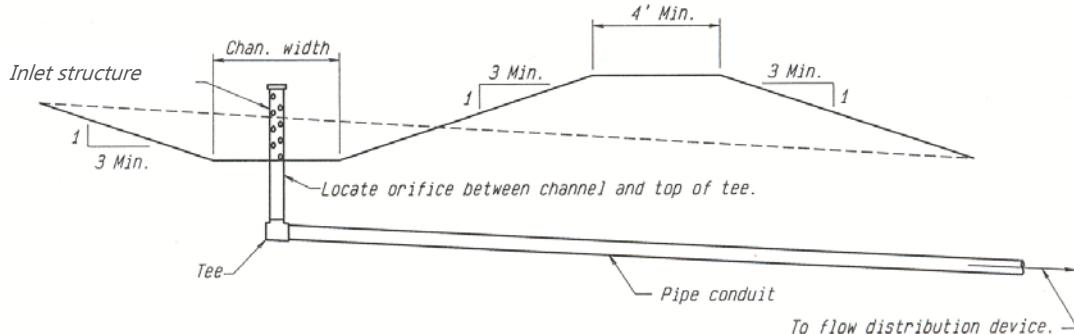
### (d) Design criteria

#### (1) Extraneous (foreign) drainage

Extraneous drainage consisting of unpolluted surface runoff and roof runoff shall be diverted away from lots, open confinement areas, and components of VTA systems to the greatest extent possible.

#### (2) Settling basin

Settling basins shall be used to collect and detain runoff from open lots and confinement areas and to provide controlled discharge of runoff to distribution systems and grass treatment areas as shown in Figure KS10-2. Where necessary, additional practices such as gradient diversions, grassed waterways, and gutters may be used as part of the runoff collection system.

**Figure KS10-2** Typical settling basin layout

Settling basins shall have the capacity to store the average annual sediment yield from the drainage area or 0.5 acre-inch/acre—whichever is greater. Unless more accurate information is available, the average annual sediment yield may be estimated using the procedure in [Section KS651.1082](#).

Settling basins shall be designed to control the runoff from the 25-year, 24-hour storm event without overtopping or overflowing. NRCS procedures shall be used to calculate runoff volumes. A runoff CN of 90 shall be used to calculate runoff from a bare-earth lot while a CN of 97 shall be used for paved (concrete) surfaces. CNs for other runoff areas will have to be determined. A minimum detention time of 15 hours will be provided for the design storm. Refer to [Section KS651.1081\(g\)\(3\)](#) for suggested time-storage-discharge relationships.

A pipe spillway will be used as the primary outlet device. The pipe spillway shall consist of an inlet structure, an orifice, and a main conduit. The inlet shall consist of a perforated riser or other device such as a picket structure that is designed to preclude entry of debris into the pipe spillway. Risers shall be made from rigid, relatively smooth materials. Perforations may consist of round holes (a minimum of 1 inch in diameter) or rectangular slots. The minimum diameter or side dimension of any riser shall be 6 inches. The hydraulic capacity shall be 1.2 times the required design discharge.

An orifice will be used to control discharge and will be designed to provide the required design discharge as nearly as possible. An orifice is typically fabricated from a perforated plate fixed within the riser between the settling basin channel and the main conduit. A single smooth circular hole centered in the plate provides the flow control. The holes are generally fabricated in  $\frac{1}{4}$ -inch increments. The orifice may be omitted when the required diameter is 90% or more of the riser pipe diameter.

The main conduit shall consist of non-perforated pipe with a minimum diameter of 6 inches. Design hydraulic capacity shall be greater than or equal to design orifice discharge.

All pipe spillway components shall be designed to withstand dead loads from earthfill and adjacent structures and live loads due to animal and vehicle traffic. Components and fittings shall be hydraulically smooth, watertight, and corrosion-resistant. Where applicable, pipe spillway components shall also be protected from damages resulting from fire and maintenance operations.

A natural or excavated auxiliary spillway should be provided whenever possible. The crest of the auxiliary spillway will be at or above the maximum detention storage elevation. The settling basin shall provide a minimum of 0.5 foot of freeboard above the auxiliary spillway crest elevation.

Settling basins formed by earth embankments should have side slopes of 3:1 or flatter and minimum top widths of 4 feet.

The designed dimensions, cross sections, and clearance distances shall facilitate maintenance operations—especially solids removal. The riser and orifice shall be accessible for solids removal and repair.

### (3) Flow distribution device

The flow distribution device shall be designed to convey the discharge from the settling basin pipe spillway to the upper end of the grass treatment area. Flow shall be uniformly distributed and provide the inflow depth, velocity, and capacity required for treatment area performance. Head loss within the flow distribution device should be minimized. Gated irrigation pipe, concrete and timber weirs, and similar devices may be used as distribution devices. Closed conduits shall have a minimum diameter of 6 inches. The flow distribution device shall be designed to facilitate maintenance—especially sediment and debris removal.

## (e) Grass treatment area

### (1) Infiltration design element

The grass treatment area shall be designed to infiltrate the settling basin discharge resulting from the 2-year, 24-hour rainfall. Border irrigation principles are used to complete the infiltration element of the design. The following relationship shall be used to allocate soil moisture storage:

$$I_f + I_{lr} \leq 50\% \text{ (AWC)}$$

Where:

$I_f$  = Portion of 2-year, 24-hour rainfall that falls directly onto the grass treatment area and is infiltrated (inches)

$I_{lr}$  = Volume of runoff from the open lot, extraneous area, and sediment basin expressed as an equivalent depth over

the grass treatment area, which is discharged through the settling basin and is infiltrated into the treatment area (inches)

AWC = Available water capacity of the soil root zone

NRCS procedures may be used to determine runoff depths. AWC refers to the amount of moisture that can be stored in the soil root zone and extracted by the plant. Refer to [Section KS652.0204 in National Engineering Handbook Part 652 \(NEH 652\), Irrigation Guide](#), for listings of AWC by soil name. The soil must have a minimum depth of 2 feet. Soil depth shall be based upon the planned condition of the treatment area after grading.

NRCS intake family curves will be used to determine opportunity and application times. The minimum required application time is given by the relationship:

$$T_{lr} = T_t - T_f$$

Where:

$T_{lr}$  = Minimum required application time for infiltration of  $I_{lr}$  into the grass treatment area (minutes)

$T_t$  = Total opportunity time required for infiltration of  $I_f + I_{lr}$  (minutes)

$T_f$  = Opportunity time required for infiltration of  $I_f$  (minutes)

To meet this requirement, the detention time of the settling basin must equal or exceed the application time. Use of 24-hour detention time will generally meet this requirement.

The actual peak discharge (from the 25-year, 24-hour storm) from the settling basin pipe spillway design will be used to determine the size of the grass treatment area. The peak discharge rate resulting from a 2-year, 24-hour rainfall will generally be 85% of that resulting

from a 25-year, 24-hour rainfall when an orifice-controlled pipe spillway is used so that a small factor of safety will result from this procedure.

The following relationships will be used to determine grass treatment area dimensions:

$$\text{Volume of lot and other runoff} = \text{Volume of runoff infiltrated into grass treatment area}$$

Using runoff and area quantities and the relationship Volume = Area x Depth implies that:

$$(R_{lr}) (A_{lr}) = (A_f)(I_{lr})$$

OR

$$A_f = (R_{lr}) (A_{lr}) / (I_{lr})$$

Where:

$A_f$  = The required size of the grass treatment area (acres)

$R_{lr}$  = The depth of runoff from the lot, extraneous area, and settling basin that results from a 2-year, 24-hour rainfall (inches)

$A_{lr}$  = The drainage area from the lot or confinement area plus any extraneous drainage area that cannot be diverted plus the settling basin (acres)

$I_{lr}$  is as previously defined

The dimensions of the treatment area may be determined by selecting a desired length or width dimension and then solving for the remaining dimension:

$$L = (A_f) (43,560 \text{ sq. ft./ac.}) / W$$

OR

$$W = (A_f) (43,560 \text{ sq. ft./ac.}) / L$$

Where:

$L$  and  $W$  are the length and width dimensions, respectively, of the treatment area (feet)

The actual peak unit discharge,  $q$  (cfs/foot), of the grass treatment area is determined using the relationship:

$$q = Q / W$$

Where:

$$Q = \text{Actual peak discharge from the settling basin pipe spillway (cfs)}$$

Also,  $q$  must be less than or equal to the unit discharge required for an application rate which does not exceed the soil intake rate as follows:

$$Q_u = (L) (I_{lr}) / (720) (T_{lr})$$

Where:

$$Q_u = \text{Application rate peak discharge per unit width (cfs/ft.)}$$

Infiltration is assumed to be 100% for the 2-year, 24-hour rainfall in this equation. This implies that there is no runoff of the settling basin discharge out of the grass treatment area.

The parameters  $L$ ,  $I_{lr}$ , and  $T_{lr}$  are as previously defined, and 720 is a unit conversion factor.

If necessary, adjust treatment area dimensions until  $q \leq Q_u$ .

The grass treatment area will be subdivided into border segments according to the following guideline:

Flow Direction Slope (%)	Maximum Border Width (feet)
0.3 - 1	50
1.1 - 2	40
2.1 - 4	30

Slopes of less than 0.3% or greater than 4% are not applicable to this design. Uniform slopes in the direction of flow are strongly recommended; however, actual slope may vary from the design slope by  $\pm 50\%$  as long as the slope limits are not exceeded. If site conditions allow, have the steepest slope at the gated pipe and gradually flatten the slope until it is level at the bottom of

the strip. A minimum of 1% is required for the entrance slope of the grass treatment area. Each border is to be level in the direction perpendicular to the flow (zero cross slope). The maximum border length is 1,000 feet; flow redistribution devices are recommended to be provided for each border length increment of 400 feet. Flow distances of 400 feet or less are more conducive to uniform flow and infiltration. The minimum border ridge height shall be 0.5 foot. Another option for border ridges are furrows 4 inches deep and 12 inches apart installed for the length of the VTA. The requirements for contact time, flow depth, and velocity mentioned below still have to be met.

Grass treatment area and border dimensions may be adjusted slightly to facilitate maintenance and equipment operation.

### (2) Flow design element

The flow through the grass treatment area shall conform to the following limits:

- Flow depth less than 6 inches.
- Flow velocity less than or equal to 1.5 feet/second in any reach.
- Contact time (for example, travel time through the treatment area) greater than or equal to 1 hour.

The actual peak unit discharge,  $q$ , determined for the infiltration design element will be used to analyze the flow design. Grass treatment area design charts in Table KS10-4 may be used for this analysis.

The outlet of the grass treatment area shall be stable, and the treatment area shall not discharge into an actively eroding area such as a gully.

### (3) Nitrogen loading design element

An estimate of the average annual nitrogen load delivered to the grass treatment area shall be made. Use the Nitrogen Loading Analysis procedure shown on page 3 of the Vegetated Treatment Area Design Worksheet (Figure KS10-3) or from the report by Koelsch et al.

(2006) that is referenced to in Section KS651.1081(h)(4) to estimate the amount of nitrogen in the feedlot runoff. The nitrogen load shall not exceed the average annual uptake by the vegetation, based upon a realistic yield goal. Nitrogen uptake or consumption by crop or type of vegetation may be taken from [Section 651.0606](#), Kansas State Research and Extension publications, or Midwest Plan Service (MWPS) publications.

### (4) Vegetation design element

The vegetation used in the grass treatment area should be a perennial grass adapted to the site. It is recommended that the vegetation be established prior to any discharge from the settling basin. The vegetation must be managed to maintain a minimum height of 4 inches. Recommendations for grass species may be found in [CPS 342, Critical Area Planting](#). The grass treatment area shall be fenced to exclude livestock and unauthorized vehicular traffic.

## (f) Design documentation

All documentation related to the design of the VTA will be submitted to the state regulatory agency for review and approval. This includes resource data, calculations, citation of assumptions and references used, and any other supporting data or standardized design material. Use of the Vegetated Treatment Area Design Worksheet (Figure KS10-3) will satisfy most of the design documentation requirements.

### (1) Plans and specifications

A complete set of plans and specifications will be developed for each system design. This package will generally consist of narrative plans, construction drawings, and specifications covering materials and construction operations.

### (2) Narrative plan

Each narrative plan should contain the following information:

- A description of the system operation (including the number, average weight, and

confinement time of the livestock). Production and waste management operations will also be briefly described.

- Waste management system operation and maintenance requirements. This includes maintenance of the settling basin (for example, clean-out level or elevation and debris removal from the pipe spillway), distribution system, and grass treatment area (for example, maintenance of vegetation and border grade). Other components such as diversions, fences, and any safety measures will also be addressed. Vegetation will be removed at least annually by haying. Annual soil testing will be used to monitor nitrate, phosphate, potassium, pH, and salinity levels in the treatment area soils. Maximum accumulation limits should be recommended. Unless other information is available, recommendations should be obtained from Kansas State Research and Extension.

A comprehensive nutrient management plan (CNMP) will be developed that addresses solid waste removed from the confinement area, solids removed from the settling basin, and any other wastes produced by the system. For each type of waste, the plan will indicate the method of application; the location, land use, and size of application area; the frequency of application; and the recommended application rate and its estimated nutrient content. Recommendations for determination of site-specific application rates based upon lab analysis will be included. Statements prohibiting application of waste on frozen, saturated, snow-covered, or highly erodible ground will also be included.

### (3) Construction drawings

Construction drawings will contain the following details:

- Location map—A map shall be submitted which shows the location of the confined livestock feeding facilities and of the waste management facilities. Use a scale of 1 inch = 2,000 feet (1:24,000) or larger.

Photocopies or tracings of U.S. Geological Survey (USGS) topographic maps are recommended for this purpose.

In addition to the confinement and waste management facilities, features subject to separation distance requirements shall also be shown on the map. These include the following:

- Property lines and facility boundaries
- Residences and habitable structures within 1 mile plus the names and addresses of the owners
- Water resources (wells, public water supply pipelines, streams, ponds, wetlands, etc.)
- Flood plain boundaries
- Utilities

Where feasible, the property lines, water resources, and utilities may be shown on the plan view of the waste management facilities.

The location of the areas and acres available for waste utilization shall also be shown on the location map.

- Plan view—This consists of a detailed topographic map with the location of all waste management facility components (diversions, settling basins, distribution devices, treatment areas, fences, etc.) plotted to scale on it. The dimensions of the treatment area shall be shown. The locations of soil boring test holes shall also be plotted and labeled on this drawing.

The recommended (vertical) contour interval is 1 foot for slopes of 1% or less or 2 feet for slopes of 1% to 4%. A drawing scale of 1 inch = 50 feet or 100 feet is also recommended. The scale and a north arrow shall be shown on the drawing. Any benchmarks used for design or construction shall also be shown and described on this sheet or another appropriate sheet. The legal description of the facilities shall be shown on this drawing, and at least one component

of the waste management system shall be referenced to a section corner or other legal reference point.

- Settling basin—Dimensions, channel grades, cuts and fills, and other information related to earthwork shall be shown. Pipe spillway materials, dimensions, inlet and outlet elevations, orifice and riser details, pipe trench elevations, and grades will also be included. Plotted profiles and cross sections should be used to portray this information.
- Flow distribution device—Show dimensions, materials, elevations, and locations of device components.
- Grass treatment area—Show grading requirements (including cuts, fills, and finished slopes) and dimensions of border areas and berms. Grid maps or topographic maps showing finished contours are typically used to portray grading plans. Logs of soil boring test holes in the treatment area shall be shown on this drawing or another appropriate drawing.
- Drawings of other pertinent components such as diversions or gutters.
- Seeding plan—Indicate the area to be seeded, the species to be seeded, the seeding rate (pounds per acre), and any fertilizer or soil amendments required. The seeding plan shall also indicate the method of seeding (drilled, broadcast, etc.) and any special operations or preparations required.
- Table of quantities—This item is recommended but not required for plan approval. Typical items include excavation, embankment, pipe and appurtenances, lumber, concrete, seed, etc. Due to the numerous types of plastic pipe available, it is recommended that the pipe diameter, materials, and quality be listed in the table of quantities. An example of such a listing is as follows: "6-inch diameter PVC pipe, SDR 26, ASTM D 2241."

#### **(4) Specifications**

Specifications will be developed for each design that address materials and construction processes. Excavation, embankment, grading tolerances, seed quality, and material and installation requirements for pipe, concrete, lumber, and fences (as applicable) are to be included in the specifications.

### **(g) Design tools**

#### **(1) Hydrology**

Runoff from rainfall may be determined using NRCS methods. Runoff will be based on CNs corresponding to Antecedent Runoff Condition (ARC) II. CNs applicable to the grass treatment area design are given below:

Soil-Cover Complex and Condition	Hydrologic Soil Group	CN (ARC II)
Lot or confinement area:		
—Bare earth surface	All	90
—Concrete surface	All	97
Grass, good condition	B	61
Grass, good condition	C	74
Grass, good condition	D	80

#### **(2) 24-hour duration rainfall**

Table KS10-1 lists the runoff for the 2-year, 24-hour and 25-year, 24-hour rainfalls. This information is tabulated for each county in the state. This table generally provides all the data required to determine runoff from confinement areas and grass treatment areas.

**(3) Detention storage and release factors**

The following factors may be used to determine detention storage and discharge requirements for settling basins:

Detention Time (hours)	Storage Factor	Release Factor
15	0.56	1.75
18	0.58	1.50
24	0.63	1.00
36	0.67	0.75
48	0.75	0.50

Refer to Figure KS10-4 for an example of a VTA design worksheet in the use of these factors. Other factors or procedures will be considered on a case-by-case basis if submitted with adequate supporting documentation.

**(4) Riser orifices**

Table KS10-2 is for the design of orifices used to control flow in pipe spillways and is based upon a discharge coefficient equal to 0.6. When determining head, the depth of water in the settling basin should be multiplied by 0.7 to estimate effective head inside a perforated riser:

$$\text{Head} = (0.7) \times (\text{Water depth in settling basin}) + (\text{Vertical distance from settling basin channel to orifice})$$

Orifice diameters less than 3 inches are not recommended due to potential plugging problems.

**(5) Soil intake family curves**

Most soils mapped in Kansas have been assigned to Intake Family groups. These are listed in [Section KS652.0204 in NEH 652](#). The intake family curves (accumulated intake vs. time) were developed from the following equation:

$$F = a (T_o)^b + c$$

OR

$$T_o = ((F - c) / a)^{1/b}$$

Where:

F = Accumulated water intake (inches)

T<sub>o</sub> = Intake opportunity time (minutes)

a, b, and c are curve parameters whose values are given below

Intake Family	Parameter Values		
	a	b	c
0.1	0.0244	0.661	.0275
0.3	0.0368	0.721	0.275
0.5	0.0467	0.756	0.275
1.0	0.0701	0.785	0.275

Plotted curves of this equation are also contained in Table KS10-3.

**(6) Grass treatment area design charts**

Grass treatment area design charts for selected slopes are included in Table KS10-4 to aid in completion of the "Flow Design" portion of the worksheet (Figure KS10-3). The charts were created using a procedure developed by Darrel Temple, Hydraulic Engineer, Agricultural Research Service, and taken from the reference Design of Grass Lined Channels, D. M. Temple, January 1982.

**Table KS10-1** 24-Hour Duration Rainfall-Runoff

County	Rainfall Frequency	Rainfall, inches	RCN-8 Runoff, in inches				
			61	74	80	90	97
ALLEN	2 year	3.8	0.69	1.42	1.85	2.69	3.41
	25 year	6.9	2.61	3.93	4.57	5.70	6.51
ANDERSON	2 year	3.7	0.66	1.37	1.79	2.63	3.34
	25 year	6.7	2.45	3.74	4.37	5.48	6.29
ATCHISON	2 year	3.5	0.55	1.21	1.60	2.40	3.10
	25 year	6.3	2.18	3.40	4.02	5.10	5.90
BARBER	2 year	3.1	0.40	0.97	1.33	2.08	2.76
	25 year	5.6	1.77	2.88	3.46	4.50	5.29
BARTON	2 year	2.9	0.32	0.84	1.17	1.88	2.55
	25 year	5.2	1.50	2.54	3.09	4.09	4.87
BOURBON	2 year	3.8	0.69	1.42	1.85	2.69	3.41
	25 year	6.8	2.56	3.87	4.51	5.63	6.44
BROWN	2 year	3.4	0.52	1.15	1.53	2.33	3.03
	25 year	6.1	2.08	3.28	3.88	4.95	5.75
BUTLER	2 year	3.6	0.61	1.30	1.71	2.53	3.24
	25 year	6.6	2.40	3.67	4.30	5.40	6.21
CHASE	2 year	3.6	0.60	1.27	1.68	2.49	3.20
	25 year	6.3	2.24	3.47	4.09	5.18	5.98
CHAUTAUQUA	2 year	3.9	0.75	1.50	1.93	2.80	3.52
	25 year	7.3	2.89	4.27	4.93	6.08	6.90
CHEROKEE	2 year	4.0	0.79	1.57	2.01	2.88	3.61
	25 year	7.1	2.75	4.09	4.75	5.88	6.70
CHEYENNE	2 year	2.3	0.14	0.49	0.75	1.35	1.96
	25 year	4.1	0.88	1.70	2.16	3.05	3.79
CLARK	2 year	2.7	0.27	0.75	1.06	1.75	2.40
	25 year	4.9	1.28	2.25	2.76	3.73	4.50
CLAY	2 year	3.2	0.46	1.06	1.43	2.20	2.89
	25 year	5.8	1.89	3.03	3.62	4.67	5.46
CLOUD	2 year	3.0	0.37	0.91	1.26	1.99	2.67
	25 year	5.5	1.65	2.73	3.29	4.31	5.10
COFFEY	2 year	3.7	0.67	1.38	1.80	2.64	3.35
	25 year	6.7	2.48	3.77	4.41	5.52	6.33
COMANCHE	2 year	3.0	0.35	0.88	1.21	1.94	2.61
	25 year	5.3	1.53	2.57	3.12	4.13	4.91
COWLEY	2 year	3.7	0.65	1.35	1.76	2.60	3.31
	25 year	6.7	2.47	3.76	4.40	5.51	6.32
CRAWFORD	2 year	3.9	0.76	1.52	1.96	2.82	3.55
	25 year	7.1	2.75	4.10	4.76	5.89	6.71
DECATUR	2 year	2.6	0.22	0.66	0.95	1.61	2.25
	25 year	4.5	1.08	1.97	2.46	3.40	4.15

County	Rainfall Frequency	Rainfall, inches	RCN-8 Runoff, in inches				
			61	74	80	90	97
DICKINSON	2 year	3.3	0.49	1.12	1.49	2.28	2.98
	25 year	5.9	1.96	3.13	3.72	4.78	5.57
DONIPHAN	2 year	3.4	0.53	1.17	1.56	2.35	3.06
	25 year	6.1	2.10	3.30	3.91	4.98	5.78
DOUGLAS	2 year	3.5	0.58	1.25	1.65	2.47	3.17
	25 year	6.3	2.19	3.41	4.03	5.11	5.91
EDWARDS	2 year	2.8	0.29	0.78	1.09	1.79	2.45
	25 year	5.1	1.40	2.40	2.94	3.92	4.70
ELK	2 year	3.7	0.68	1.40	1.82	2.66	3.38
	25 year	7.0	2.69	4.03	4.69	5.81	6.63
ELLIS	2 year	2.7	0.26	0.72	1.02	1.70	2.35
	25 year	4.8	1.26	2.21	2.73	3.69	4.46
ELLSWORTH	2 year	3.0	0.36	0.90	1.24	1.97	2.65
	25 year	5.4	1.63	2.71	3.27	4.29	5.08
FINNEY	2 year	2.4	0.17	0.55	0.82	1.44	2.06
	25 year	4.3	0.99	1.84	2.32	3.23	3.98
FORD	2 year	2.6	0.24	0.69	0.99	1.66	2.30
	25 year	4.7	1.17	2.10	2.60	3.55	4.31
FRANKLIN	2 year	3.6	0.61	1.30	1.70	2.52	3.23
	25 year	6.4	2.28	3.52	4.14	5.24	6.04
GEARY	2 year	3.4	0.54	1.19	1.58	2.38	3.08
	25 year	6.0	2.03	3.22	3.82	4.88	5.68
GOVE	2 year	2.6	0.21	0.64	0.92	1.58	2.21
	25 year	4.7	1.16	2.09	2.59	3.54	4.30
GRAHAM	2 year	2.6	0.23	0.67	0.96	1.62	2.26
	25 year	4.7	1.22	2.16	2.67	3.63	4.39
GRANT	2 year	2.3	0.15	0.52	0.77	1.38	2.00
	25 year	4.4	1.03	1.91	2.39	3.32	4.07
GRAY	2 year	2.6	0.22	0.66	0.94	1.59	2.23
	25 year	4.5	1.09	1.99	2.48	3.41	4.17
GREELEY	2 year	2.3	0.13	0.47	0.72	1.31	1.92
	25 year	4.3	0.99	1.85	2.33	3.24	3.99
GREENWOOD	2 year	3.6	0.63	1.33	1.74	2.57	3.28
	25 year	6.7	2.48	3.77	4.41	5.52	6.33
HAMILTON	2 year	2.3	0.14	0.50	0.76	1.36	1.98
	25 year	4.5	1.09	1.99	2.48	3.41	4.17
HARPER	2 year	3.4	0.51	1.14	1.52	2.31	3.01
	25 year	6.0	2.01	3.19	3.79	4.86	5.65
HARVEY	2 year	3.4	0.51	1.14	1.53	2.32	3.02
	25 year	6.0	2.03	3.22	3.82	4.88	5.68

**Table KS10-1** 24-Hour Duration Rainfall-Runoff (Continued)

County	Rainfall Frequency	Rainfall, inches	RCN & Runoff, in inches				
			61	74	80	90	97
HASKELL	2 year	2.4	0.18	0.57	0.85	1.48	2.10
	25 year	4.4	1.05	1.93	2.41	3.34	4.09
HODGEMAN	2 year	2.6	0.22	0.65	0.94	1.60	2.24
	25 year	4.6	1.12	2.03	2.53	3.47	4.23
JACKSON	2 year	3.4	0.53	1.17	1.56	2.35	3.06
	25 year	6.1	2.09	3.29	3.90	4.97	5.77
JEFFERSON	2 year	3.5	0.58	1.25	1.65	2.47	3.17
	25 year	6.3	2.22	3.45	4.06	5.15	5.95
JEWELL	2 year	2.9	0.31	0.81	1.14	1.85	2.51
	25 year	5.1	1.45	2.47	3.01	4.00	4.78
JOHNSON	2 year	3.6	0.64	1.34	1.75	2.58	3.29
	25 year	6.7	2.45	3.74	4.37	5.48	6.29
KEARNY	2 year	2.4	0.16	0.54	0.80	1.42	2.04
	25 year	4.4	1.03	1.91	2.39	3.32	4.07
KINGMAN	2 year	3.2	0.46	1.06	1.43	2.20	2.89
	25 year	5.8	1.84	2.98	3.56	4.60	5.39
KIOWA	2 year	2.9	0.31	0.81	1.14	1.85	2.51
	25 year	5.1	1.42	2.44	2.97	3.96	4.74
LABETTE	2 year	4.0	0.81	1.60	2.04	2.92	3.65
	25 year	7.3	2.88	4.26	4.93	6.07	6.89
LANE	2 year	2.5	0.20	0.61	0.89	1.53	2.16
	25 year	4.5	1.06	1.95	2.44	3.37	4.12
LEAVENWORTH	2 year	3.5	0.59	1.26	1.66	2.48	3.18
	25 year	6.4	2.28	3.53	4.15	5.25	6.05
LINCOLN	2 year	2.9	0.34	0.86	1.19	1.91	2.58
	25 year	5.3	1.55	2.61	3.16	4.17	4.95
LINN	2 year	3.6	0.64	1.34	1.75	2.58	3.29
	25 year	6.5	2.33	3.59	4.22	5.31	6.12
LOGAN	2 year	2.4	0.16	0.54	0.81	1.42	2.05
	25 year	4.3	0.99	1.85	2.33	3.24	3.99
LYON	2 year	3.6	0.61	1.30	1.71	2.53	3.24
	25 year	6.4	2.30	3.55	4.17	5.27	6.07
MARION	2 year	3.4	0.54	1.19	1.57	2.37	3.07
	25 year	6.1	2.09	3.29	3.90	4.97	5.77
MARSHALL	2 year	3.2	0.46	1.06	1.43	2.21	2.90
	25 year	5.7	1.82	2.95	3.53	4.57	5.36
MCPHERSON	2 year	3.2	0.44	1.04	1.40	2.17	2.86
	25 year	5.7	1.80	2.93	3.50	4.54	5.33
MEADE	2 year	2.6	0.23	0.67	0.96	1.62	2.26
	25 year	4.6	1.14	2.06	2.56	3.50	4.26

County	Rainfall Frequency	Rainfall, inches	RCN & Runoff, in inches				
			61	74	80	90	97
MIAMI	2 year	3.6	0.63	1.32	1.73	2.56	3.27
	25 year	6.6	2.38	3.65	4.28	5.38	6.19
MITCHELL	2 year	2.9	0.32	0.84	1.17	1.88	2.55
	25 year	5.2	1.47	2.49	3.03	4.03	4.81
MONTGOMERY	2 year	3.9	0.77	1.54	1.98	2.84	3.57
	25 year	7.2	2.85	4.22	4.88	6.02	6.84
MORRIS	2 year	3.5	0.58	1.25	1.64	2.46	3.16
	25 year	6.2	2.11	3.32	3.93	5.00	5.80
MORTON	2 year	2.4	0.16	0.54	0.80	1.42	2.04
	25 year	4.5	1.08	1.98	2.47	3.41	4.16
NEMaha	2 year	3.3	0.48	1.10	1.47	2.25	2.95
	25 year	6.0	1.97	3.14	3.74	4.80	5.59
NEOSHO	2 year	3.9	0.75	1.50	1.93	2.80	3.52
	25 year	7.1	2.78	4.14	4.80	5.93	6.75
NESS	2 year	2.6	0.21	0.64	0.93	1.58	2.22
	25 year	4.5	1.10	2.00	2.49	3.42	4.18
NORTON	2 year	2.7	0.24	0.69	0.99	1.67	2.31
	25 year	4.7	1.20	2.14	2.64	3.60	4.36
OSAGE	2 year	3.5	0.59	1.26	1.66	2.48	3.18
	25 year	6.3	2.21	3.44	4.05	5.14	5.94
OSBORNE	2 year	2.8	0.30	0.80	1.12	1.82	2.48
	25 year	5.0	1.36	2.35	2.88	3.86	4.63
OTTAWA	2 year	3.1	0.40	0.97	1.32	2.07	2.75
	25 year	5.6	1.72	2.83	3.40	4.43	5.22
PAWNEE	2 year	2.8	0.28	0.77	1.08	1.77	2.43
	25 year	5.0	1.38	2.38	2.91	3.90	4.67
PHILLIPS	2 year	2.7	0.26	0.72	1.02	1.70	2.35
	25 year	4.9	1.29	2.25	2.77	3.74	4.51
POTTAWATOMIE	2 year	3.4	0.51	1.14	1.52	2.31	3.01
	25 year	5.9	1.95	3.11	3.70	4.76	5.55
PRATT	2 year	3.0	0.36	0.90	1.24	1.97	2.64
	25 year	5.4	1.63	2.71	3.27	4.29	5.08
RAWLINS	2 year	2.5	0.18	0.59	0.86	1.50	2.12
	25 year	4.3	0.99	1.85	2.33	3.24	3.99
RENO	2 year	3.2	0.44	1.03	1.39	2.16	2.85
	25 year	5.7	1.81	2.93	3.51	4.55	5.34
REPUBLIC	2 year	3.0	0.36	0.90	1.24	1.97	2.65
	25 year	5.5	1.70	2.79	3.36	4.39	5.18
RICE	2 year	3.0	0.38	0.93	1.28	2.02	2.70
	25 year	5.4	1.63	2.71	3.27	4.29	5.08

**Table KS10-1** 24-Hour Duration Rainfall-Runoff (Continued)

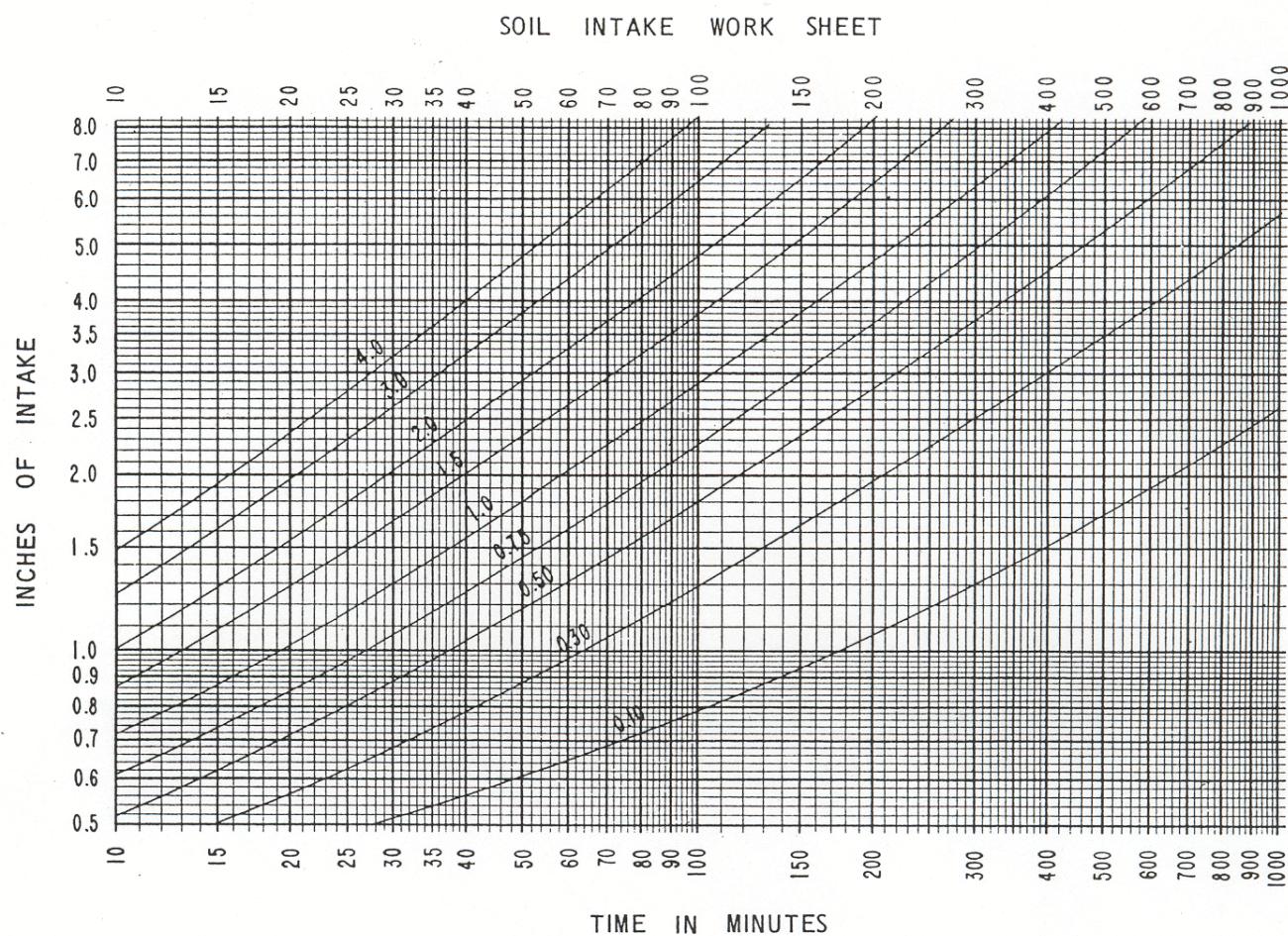
County	Rainfall Frequency	Rainfall inches	RCN & Runoff, in inches				
			61	74	80	90	97
RILEY	2 year	3.3	0.50	1.12	1.50	2.29	2.99
	25 year	5.9	1.97	3.13	3.73	4.79	5.58
ROOKS	2 year	2.7	0.26	0.72	1.03	1.71	2.36
	25 year	4.9	1.30	2.28	2.80	3.77	4.54
RUSH	2 year	2.7	0.26	0.72	1.03	1.71	2.36
	25 year	4.8	1.26	2.22	2.74	3.70	4.47
RUSSELL	2 year	2.9	0.32	0.84	1.17	1.88	2.55
	25 year	5.2	1.47	2.49	3.03	4.03	4.81
SALINE	2 year	3.1	0.42	1.00	1.36	2.11	2.80
	25 year	5.6	1.75	2.86	3.43	4.47	5.26
SCOTT	2 year	2.5	0.19	0.60	0.88	1.51	2.14
	25 year	4.5	1.07	1.96	2.44	3.38	4.13
SEDWICK	2 year	3.4	0.52	1.16	1.54	2.34	3.04
	25 year	6.1	2.05	3.24	3.84	4.90	5.70
SEWARD	2 year	2.5	0.20	0.61	0.90	1.54	2.17
	25 year	4.6	1.12	2.03	2.52	3.46	4.22
SHAWNEE	2 year	3.5	0.56	1.22	1.61	2.42	3.12
	25 year	6.1	2.09	3.29	3.90	4.97	5.77
SHERIDAN	2 year	2.5	0.20	0.63	0.91	1.56	2.19
	25 year	4.6	1.11	2.01	2.50	3.44	4.20
SHERMAN	2 year	2.3	0.14	0.50	0.76	1.36	1.98
	25 year	4.1	0.87	1.68	2.14	3.03	3.77
SMITH	2 year	2.7	0.26	0.73	1.04	1.72	2.37
	25 year	4.9	1.29	2.26	2.78	3.75	4.52
STAFFORD	2 year	2.9	0.33	0.86	1.18	1.89	2.56
	25 year	5.3	1.52	2.57	3.11	4.12	4.90

County	Rainfall Frequency	Rainfall inches	RCN & Runoff, in inches				
			61	74	80	90	97
STANTON	2 year	2.3	0.14	0.50	0.76	1.36	1.98
	25 year	4.5	1.08	1.97	2.46	3.40	4.15
STEVENS	2 year	2.4	0.17	0.56	0.83	1.45	2.07
	25 year	4.5	1.06	1.95	2.44	3.37	4.12
SUMNER	2 year	3.5	0.56	1.22	1.61	2.42	3.12
	25 year	6.2	2.12	3.33	3.93	5.01	5.81
THOMAS	2 year	2.4	0.18	0.57	0.85	1.48	2.10
	25 year	4.3	0.97	1.82	2.29	3.20	3.95
TREGO	2 year	2.6	0.22	0.65	0.94	1.60	2.24
	25 year	4.7	1.17	2.10	2.60	3.55	4.31
WABAUNSEE	2 year	3.5	0.56	1.23	1.62	2.43	3.13
	25 year	6.1	2.10	3.30	3.91	4.98	5.78
WALLACE	2 year	2.3	0.15	0.52	0.77	1.38	2.00
	25 year	4.3	0.96	1.81	2.28	3.20	3.94
WASHINGTON	2 year	3.1	0.42	1.00	1.36	2.11	2.80
	25 year	5.7	1.78	2.89	3.47	4.51	5.30
WICHITA	2 year	2.4	0.15	0.53	0.79	1.40	2.02
	25 year	4.4	1.03	1.91	2.39	3.32	4.07
WILSON	2 year	3.8	0.69	1.42	1.85	2.69	3.41
	25 year	7.0	2.67	4.00	4.65	5.77	6.59
WOODSON	2 year	3.7	0.68	1.41	1.83	2.67	3.39
	25 year	6.9	2.66	3.99	4.64	5.76	6.58
WYANDOTTE	2 year	3.6	0.62	1.32	1.72	2.55	3.26
	25 year	6.6	2.43	3.71	4.35	5.45	6.26

**Table KS10-2** Riser Orifices

Orifice Diameter (inches)	Flow Area (sq. ft.)	Head (feet)										
		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
1	0.006	0.027	0.033	0.038	0.042	0.046	0.05	0.053	0.056	0.059	0.062	0.065
1.25	0.009	0.042	0.051	0.059	0.066	0.072	0.078	0.083	0.088	0.093	0.097	0.102
1.5	0.012	0.059	0.073	0.084	0.094	0.103	0.111	0.119	0.126	0.133	0.139	0.146
1.75	0.017	0.081	0.099	0.114	0.128	0.14	0.151	0.162	0.172	0.181	0.19	0.198
2	0.022	0.105	0.129	0.149	0.166	0.182	0.197	0.21	0.223	0.235	0.247	0.258
2.25	0.028	0.133	0.163	0.188	0.21	0.231	0.249	0.266	0.282	0.298	0.312	0.326
2.5	0.034	0.164	0.201	0.232	0.259	0.284	0.307	0.328	0.348	0.367	0.385	0.402
2.75	0.041	0.199	0.243	0.281	0.314	0.344	0.371	0.397	0.421	0.444	0.466	0.486
3	0.049	0.236	0.289	0.333	0.373	0.408	0.441	0.472	0.5	0.527	0.553	0.578
3.25	0.058	0.277	0.339	0.391	0.438	0.479	0.518	0.554	0.587	0.619	0.649	0.678
3.5	0.067	0.321	0.393	0.454	0.508	0.556	0.6	0.642	0.681	0.718	0.753	0.786
3.75	0.077	0.369	0.451	0.521	0.583	0.638	0.689	0.737	0.782	0.824	0.864	0.903
4.00	0.087	0.419	0.513	0.592	0.662	0.725	0.783	0.837	0.888	0.936	0.982	1.03
4.25	0.099	0.473	0.579	0.668	0.747	0.818	0.884	0.945	1	1.06	1.11	1.16
4.5	0.11	0.53	0.649	0.749	0.838	0.917	0.991	1.06	1.12	1.18	1.24	1.3
4.75	0.123	0.59	0.723	0.835	0.933	1.02	1.1	1.18	1.25	1.32	1.38	1.45
5	0.136	0.654	0.801	0.925	1.03	1.13	1.22	1.31	1.39	1.46	1.53	1.6
5.25	0.15	0.721	0.883	1.02	1.14	1.24	1.35	1.44	1.53	1.61	1.69	1.77
5.5	0.165	0.79	0.968	1.12	1.25	1.37	1.48	1.58	1.68	1.77	1.85	1.94
5.75	0.18	0.863	1.06	1.22	1.37	1.5	1.62	1.72	1.83	1.93	2.02	2.11
6.00	0.196	0.94	1.15	1.33	1.49	1.63	1.76	1.88	1.99	2.1	2.2	2.3

Discharge rate of circular orifices in cubic feet per second (cfs)

**Table KS10-3** Soil Intake Family Curves

**Table KS10-4** Grass Treatment Area Design Charts

Slope = 0.3%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0011	0.5	0.026
0.0015	0.6	0.03
0.0033	1	0.04
0.0045	1.2	0.045
0.0065	1.5	0.052

Slope = 0.5%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0018	0.5	0.042
0.0024	0.6	0.048
0.0055	1	0.067
0.0075	1.2	0.075
0.0109	1.5	0.088

Slope = 1.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0025	0.5	0.06
0.0034	0.6	0.067
0.0078	1	0.094
0.0107	1.2	0.107
0.0155	1.5	0.124

Slope = 1.5%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0031	0.5	0.073
0.0041	0.6	0.082
0.0096	1	0.115
0.0131	1.2	0.131
0.019	1.5	0.152

Slope = 2.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0036	0.5	0.085
0.0048	0.6	0.095
0.0111	1	0.133
0.0151	1.2	0.151
0.0219	1.5	0.175

Slope = 3.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0044	0.5	0.104
0.0058	0.6	0.116
0.0135	1	0.163
0.0185	1.2	0.185
0.0268	1.5	0.214

Slope = 4.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.005	0.5	0.12
0.0067	0.6	0.134
0.0156	1	0.189
0.0213	1.2	0.213
0.031	1.5	0.248

## (h) Technical references

Technical references containing resource data, design procedures, and/or design aids that are applicable to grass treatment systems are listed below. Please contact the publishing agency or organization to obtain copies of these publications.

### (1) Hydrology and hydraulics

USDA Natural Resources Conservation Service, National Engineering Handbook, Part 650, *Engineering Field Handbook*, Chapter 2, contains hydrologic data including rainfall amounts, CNs, and runoff tables. Chapter 3 contains hydraulic design aids and procedures.

USDA Natural Resources Conservation Service, electronic Field Office Technical Guide (eFOTG) at <http://www.nrcs.usda.gov/technical/efotg/>, Section II, “Climatic Data” tab

USDA Natural Resources Conservation Service. 1986, second edition. Urban Hydrology for Small Watersheds, Technical Release No. 55. Complete treatment of synthetic hydrologic procedures for urban and rural areas. Chapter 6 covers storage volume for detention basins.

### (2) Soils

USDA Natural Resources Conservation Service. Various dates. Soil Surveys of Counties. Includes soil maps, names and symbols, physical descriptions, and interpretive tables.

USDA Natural Resources Conservation Service. 1997, National Engineering Handbook, Part 652, *Irrigation Guide*, Section KS652.0204 lists available water-holding capacity by soil texture.

### (3) Irrigation

USDA Natural Resources Conservation Service. 1974. National Engineering Handbook, Part 623, *Irrigation*, or Section 15, *Irrigation*, Chapter 4, Border Irrigation. Covers theory and practice of border irrigation.

### (4) Agricultural waste management

Midwest Plan Service (MWPS). 1993, third edition. MWPS-18, Livestock Waste Facilities Handbook. All phases of waste management are covered in this publication, including waste utilization and nitrogen consumption by vegetation.

USDA Natural Resources Conservation Service, 1992, National Engineering Handbook, Part 651, *Agricultural Waste Management Field Handbook*. All phases of waste management are covered in this publication, including waste utilization and nitrogen consumption by vegetation.

USDA Natural Resources Conservation Service. Kansas Conservation Practice Standard 635, Vegetated Treatment Area.

Koelsch, R., B. Kintzer, and D. Meyer. (ed.) 2006. Vegetated Treatment Systems for Open Lot Runoff - A Collaborative Report. USDA, NRCS.

<http://www.heartlandwq.iastate.edu/ManureManagement/AlternativeTech/Avtsguidance/>

### (5) Vegetation

Cooperative Extension Service, Kansas State University. 1993. MF-1064, Grass Waterway Maintenance. Much of the maintenance information in this publication is also applicable to grass treatment areas.

Cooperative Extension Service, Kansas State University. 1980. C-613, Bermuda Establishment and Management. Covers establishment, production, and maintenance of this grass.

Cooperative Extension Service, Kansas State University. 1992. C-402, Smooth Brome Production and Utilization. Covers establishment, production, and maintenance of this grass.

Cooperative Extension Service, Kansas State University. 1984. L-703, Selecting Native Grasses for Erosion Control. Many of the recommendations in this publication will also be applicable to grass treatment areas.

**Figure KS10-3** Vegetated Treatment Area Design Worksheet - Blank Copy**Vegetated Treatment Area Design Worksheet - Page 1**

Name \_\_\_\_\_ Ident. No. \_\_\_\_\_

Legal Description \_\_\_\_\_ County \_\_\_\_\_

Designed by \_\_\_\_\_ Date \_\_\_\_\_

**Resource Data**Lot/Confinement Area

Confinement time (dates and no. of days): \_\_\_\_\_

Livestock type: \_\_\_\_\_ Number of head: \_\_\_\_\_ Average weight: \_\_\_\_\_ pounds

Extraneous or foreign drainage (circle one):

1. Does not exist
2. Is included in the design drainage area
3. Is diverted (attach design documentation)

Lot/confinement area surface:

Bare earth, Curve Number (CN) = 90 Area = \_\_\_\_\_ acres

Concrete or paved, CN = 97 Area = \_\_\_\_\_ acres

Extraneous drainage, CN = \_\_\_\_\_, Area = \_\_\_\_\_ acres

Settling basin, CN = \_\_\_\_\_, Area = \_\_\_\_\_ acres

Weighted CN for runoff area = \_\_\_\_\_

**Grass Treatment Area**

Soils - Soil name and symbol (from soil survey): \_\_\_\_\_

NRCS hydrologic soil group \_\_\_\_\_ → CN = \_\_\_\_\_ for grass, good condition

Intake family \_\_\_\_\_ Root zone depth = \_\_\_\_\_ feet

Available waterholding capacity (AWC) = \_\_\_\_\_ inches

Land slope \_\_\_\_\_ % Available length = \_\_\_\_\_ feet Available width = \_\_\_\_\_ feet

**Rainfall**

2-year, 24-hour rainfall = \_\_\_\_\_ inches

25-year, 24-hour rainfall = \_\_\_\_\_ inches

Average annual rainfall = \_\_\_\_\_ inches

**Settling Basin**Sediment Storage: Use average annual sediment yield or 0.5 acre-inch/acre from lot area, whichever is greater.  
Show calculations below or attach documentation.

**Figure KS10-3** (continued)**Vegetated Treatment Area Design Worksheet - Page 2**

For detention storage and release rate factors, refer to charts in Table KS10-4.

Design release time = \_\_\_\_\_ hours (must be greater than 15 hours)

Lot runoff: 25-year, 24-hour rainfall = \_\_\_\_\_ inches @ weighted CN = \_\_\_\_\_ → Runoff = \_\_\_\_\_ inches

Required detention storage = (25-year, 24-hour runoff) x (storage factor)

$$= (\text{_____ inches}) \times (\text{_____}) = \text{_____ inches}$$

Total required storage = sediment storage + detention storage

$$= (\text{_____ inches}) + (\text{_____ inches}) = \text{_____ inches}$$

Required release rate =  $0.042 \times (\text{drainage area in acres}) \times (\text{runoff in inches}) \times (\text{release factor})$

$$= (0.042 \times \text{_____ acres}) \times (\text{_____ inches}) \times (\text{_____}) = \text{_____ cfs}$$

Attach calculations documenting storage design and hydraulic design of the pipe spillway (inlet device, orifice, and conduit). The Storage Terrace Spreadsheet can be used to calculate storage. **Use the actual discharge to design the distribution device and the grass treatment area.**

**Flow Distribution Device**

Devices such as gated irrigation pipe and timber and concrete weirs may be used. Attach design documentation.

**Grass Treatment Area**Infiltration Design

Lot/confinement area:

2-year, 24-hour rainfall = \_\_\_\_\_ inches @ weighted CN = \_\_\_\_\_ → Runoff  $R_{lr} = \text{_____ inches}$

Runoff from direct rainfall on grass treatment area:

2-year, 24-hour rainfall = \_\_\_\_\_ inches @ CN = \_\_\_\_\_ → Runoff  $R_f = \text{_____ inches}$

Initial infiltration on grass treatment area,  $I_f = 2\text{-year, 24-hour direct rainfall} - \text{runoff } R_f$

$$I_f = (\text{_____ inches}) - (\text{_____ inches}) = \text{_____ inches}$$

Determine required intake opportunity time for  $I_f$  using intake family and intake vs. time graph in [NEH 623, Irrigation; Figure 4-1 in Chapter 4 of NEH 15, Irrigation](#); or equations found in charts in Table KS10-4.

$$T_f = \text{_____ minutes}$$

Determine total required intake opportunity time to infiltrate 50% AWC using intake family and intake vs. time graph or equations found in charts in Table KS10-4:

$$50\% \text{ AWC} = (0.5) \times (\text{_____ inches}) = \text{_____ inches}, \rightarrow T_t = \text{_____ minutes}$$

Depth of lot/confinement area runoff to be infiltrated into the grass treatment area:

$$I_{lr} = 50\% \text{ AWC} - I_f = (\text{_____ inches}) - (\text{_____ inches}) = \text{_____ inches}$$

Minimum required application time of settling basin discharge:

$$T_{lr} = T_t - T_f = (\text{_____ minutes}) - (\text{_____ minutes}) = \text{_____ minutes} = \text{_____ hours}$$

NOTE: Settling basin release time must be greater than or equal to  $T_{lr}$ .

**Figure KS10-3** (continued)**Vegetated Treatment Area Design Worksheet - Page 3**

Determine grass treatment area required for infiltration:

$$A_f = (R_{lr}) \times (A_{lr}) / (I_{lr}) = (\text{_____ inches}) \times (\text{_____ acres}) / (\text{_____ inches}) = \text{_____ acres}$$

Determine grass treatment area dimensions by selecting a desired length or width and solving for the remaining dimension:

$$L, W = \text{_____ feet} \text{ (circle dimension chosen)}$$

$$L = (A_f) \times (43,560 \text{ square foot/acre}) / W \text{ or } W = (A_f) \times (43,560 \text{ square foot/acre}) / L$$

$$\rightarrow \text{_____} = (\text{_____ acres}) \times (43,560 \text{ square foot/acre}) / (\text{_____ feet}) = \text{_____ feet} \rightarrow \text{Use } \text{_____ feet}$$

Calculate actual unit discharge:

$$q = Q / W = (\text{_____ cfs}) / (\text{_____ feet}) \text{ _____ cfs/foot}$$

Where Q is the actual peak discharge of the pipe spillway, taken from the settling basin design

Determine the limiting unit discharge for an application rate, which does not exceed the soil intake rate using the following equation:

$$Qu = (L) (I_{lr}) / (720 T_{lr}) = (\text{_____ feet}) \times (\text{_____ inches}) / (720 \times \text{_____ minutes}) = \text{_____ cfs/foot}$$

$$\rightarrow q = \text{_____ cfs/foot} \text{ must be } \leq Qu \text{ _____ cfs/foot; if not, select new L and W dimensions and redesign}$$

**Flow Design**

Flow design is based on actual unit discharge:  $q = \text{_____ cfs/foot}$  Attach calculations or use charts in Table KS10-4.

Estimated flow depth at upper end of grass treatment area:  $d = \text{_____ inches}$  (must be < 6 inches)

Design flow velocity:  $V = \text{_____ feet/second}$  (must be < 1.5 feet/second in any reach)

$$\text{Contact time: } T_{con} = L / 3600V$$

$$= (\text{_____ feet}) / (3600) \times (\text{_____ feet/second}) = \text{_____ hour} \text{ (must be } \geq 1 \text{ hour)}$$

**Nitrogen Loading Analysis**

Select the most appropriate of the procedures indicated below for estimating average annual (net) nitrogen yield to the grass treatment area. (If another method is used, provide the documentation)

Beef feedlot runoff procedure:

Net N yield = (unit yield in pounds N/acre-inch) x (lot drainage area in acres) x (confinement period runoff in inches)

Backgrounding operations (confinement between \_\_\_\_\_ and \_\_\_\_\_)\* (Period must be 6 months or less)

Net N yield = (30 pounds N/acre-inch) x (\_\_\_\_\_ acres) x (\_\_\_\_\_ inches) = \_\_\_\_\_ pounds N

Continuous (year-round) operations\*:

Net N yield = (22.5 pounds N/acre-inch) x (\_\_\_\_\_ acres) x (\_\_\_\_\_ inches) = \_\_\_\_\_ pounds N

\*Attach calculations documenting runoff determination

General procedure:

1. Determine total "as excreted" nitrogen production for the confinement period. Show calculations below and list production reference.

**Figure KS10-3** (continued)**Vegetated Treatment Area Design Worksheet - Page 4**

2. Net N yield =  $(0.045) \times (\text{gross production in pounds N})$   
 $= (0.045) \times (\text{_____ pounds N}) = \text{_____ pounds N}$

Nitrogen loading analysis:

1. List type of treatment area vegetation, average annual yield or production, and corresponding nitrogen uptake or consumption. Also, list nitrogen consumption reference. [Table 6-6](#) lists consumption rates.

2. Analyze adequacy of treatment area:

Treatment area =  $L \times W / 43560 = (\text{_____ feet}) \times (\text{_____ feet}) / 43560 = \text{_____ acre}$   
 (Net N yield in lbs. N) / (treatment area in acres)  $\leq 100\%$  (average annual N consumption in pounds N/acre)  
 $(\text{_____ pounds N}) / (\text{_____ acres}) = \text{_____ pounds N/acre} \leq (\text{_____ pounds N/acre})$

3. If treatment area is not adequate, determine minimum area required for nitrogen loading:

Minimum area, acre =  $(\text{net N yield in pounds N}) / (\text{average annual N consumption in pounds N/acre})$   
 $= (\text{_____ pounds N}) / (\text{_____ pounds N/acre}) = \text{_____ acres}$

**Grass Treatment Area Summary**

Indicate the final design dimensions and details below. Dimensions may be adjusted slightly to facilitate equipment operation for haying and maintenance. Refer to the table in KS651.1081(e) to determine border widths.

**Settling Basin**

Design release time = \_\_\_\_\_ hours

Total required storage = \_\_\_\_\_ inches

Actual storage = \_\_\_\_\_ inches or \_\_\_\_\_ cubic feet

Required release rate = \_\_\_\_\_ cfs Actual release rate \_\_\_\_\_ cfs

Riser or inlet size and type \_\_\_\_\_

Pipe spillway diameter = \_\_\_\_\_ inches Orifice diameter \_\_\_\_\_ inches

**Flow Distribution Device**

Type and size of device used:

**Grass Treatment Area**

Length used = \_\_\_\_\_ feet Width used = \_\_\_\_\_ feet Treatment area = \_\_\_\_\_ acres

Area is subdivided into \_\_\_\_\_ borders, each \_\_\_\_\_ feet wide

**Figure KS10-4** Example of Vegetated Treatment Area Design Worksheet**Vegetated Treatment Area Design Worksheet - Page 1**Name I. M. Trying Ident. No. \_\_\_\_\_Legal Description NW 37-17S-10W County CenterDesigned by M. N. Engineer Date 9/15/09**Resource Data**Lot/Confinement AreaConfinement time (dates and no. of days): October 1 - March 31 (180 days)Livestock type: beef Number of head: 300 Average weight: 800 pounds

Extraneous or foreign drainage (circle one):

- Does not exist  
 Is included in the design drainage area  
 3. Is diverted (attach design documentation)

Lot/confinement area surface:

Bare earth, Curve Number (CN) = 90 Area = 3 acresConcrete or paved, CN = 97 Area = 0 acresExtraneous drainage, CN =       , Area = 0 acresSettling basin, CN = 80, Area = 0.2 acresWeighted CN for runoff area = 89.4**Grass Treatment Area**Soils - Soil name and symbol (from soil survey): Farnum, FnNRCS hydrologic soil group B → CN = 61 for grass, good conditionIntake family 0.5 Root zone depth = 5 feetAvailable waterholding capacity (AWC) = 11.7 inchesLand slope 1 % Available length = 420 feet Available width = 600 feet**Rainfall**2-year, 24-hour rainfall = 3 inches25-year, 24-hour rainfall = 5.6 inchesAverage annual rainfall = 25.97 inches**Settling Basin**

Sediment Storage: Use average annual sediment yield or 0.5 acre-inch/acre from lot area, whichever is greater. Show calculations below or attach documentation.

Use monthly precipitation charts and monthly percentage tables from [Chapter 10 in NEH 651](#).

Pratt County: Mean annual runoff 6 inches

Annual sediment yield =  $(.015) \times (6 \text{ inches/year}) = 0.09 \text{ inch/year}$ . Use minimum of 0.5 acre-inch/year

**Figure KS10-4** (continued)**Vegetated Treatment Area Design Worksheet - Page 2**

For detention storage and release rate factors, refer to charts in Table KS10-4.

Design release time = 24 hours (must be greater than 15 hours)

Lot runoff: 25-year, 24-hour rainfall = 5.6 inches @ weighted CN = 89.4 → Runoff = 4.39 inches

$$\begin{aligned} \text{Required detention storage} &= (\text{25-year, 24-hour runoff}) \times (\text{storage factor}) \\ &= (\underline{4.39} \text{ inches}) \times (\underline{0.63}) = \underline{2.77} \text{ inches} \end{aligned}$$

$$\begin{aligned} \text{Total required storage} &= \text{sediment storage} + \text{detention storage} \\ &= (\underline{0.5} \text{ inches}) + (\underline{2.77} \text{ inches}) = \underline{3.27} \text{ inches} \end{aligned}$$

$$\begin{aligned} \text{Required release rate} &= 0.042 \times (\text{drainage area in acres}) \times (\text{runoff in inches}) \times (\text{release factor}) \\ &= (0.042 \times \underline{3.2} \text{ acres}) \times (\underline{4.39} \text{ inches}) \times (\underline{1}) = \underline{0.59} \text{ cfs} \end{aligned}$$

Attach calculations documenting storage design and hydraulic design of the pipe spillway (inlet device, orifice, and conduit). The Storage Terrace Spreadsheet can be used to calculate storage. **Use the actual discharge to design the distribution device and the grass treatment area.** Example is as shown in Figure KS10-5.

**Flow Distribution Device**

Devices such as gated irrigation pipe and timber and concrete weirs may be used. Attach design documentation.

**Grass Treatment Area**Infiltration Design

Lot/confinement area:

2-year, 24-hour rainfall = 3 inches @ weighted CN = 89.4 → Runoff R<sub>lr</sub> = 1.93 inches

Runoff from direct rainfall on grass treatment area:

2-year, 24-hour rainfall = 3 inches @ CN = 61 → Runoff R<sub>f</sub> = 0.37 inches

Initial infiltration on grass treatment area, I<sub>f</sub> = 2-year, 24-hour direct rainfall - runoff

$$I_f = (\underline{3} \text{ inches}) - (\underline{0.37} \text{ inches}) = \underline{2.63} \text{ inches}$$

Determine required intake opportunity time for I<sub>f</sub> using intake family and intake vs. time graph in [NEH 623, Irrigation](#); [Figure 4-1 in Chapter 4 of NEH 15, Irrigation](#); or equations found in charts in Table KS10-4.

$$T_f = \underline{179} \text{ minutes}$$

Determine total required intake opportunity time to infiltrate 50% AWC using intake family and intake vs. time graph or equations found in charts in Table KS10-4:

$$50\% \text{ AWC} = (0.5) \times (\underline{11.7} \text{ inches}) = \underline{5.85} \text{ inches}, \rightarrow T_t = \underline{559} \text{ minutes}$$

Depth of lot/confinement area runoff to be infiltrated into the grass treatment area:

$$I_{lr} = 50\% \text{ AWC} - I_f = (\underline{5.85} \text{ inches}) - (\underline{2.63} \text{ inches}) = \underline{3.22} \text{ inches}$$

Minimum required application time of settling basin discharge:

$$T_a = T_t - T_f = (\underline{559} \text{ minutes}) - (\underline{179} \text{ minutes}) = \underline{380} \text{ minutes} = \underline{6.3} \text{ hours}$$

NOTE: Settling basin release time must be greater than or equal to T<sub>a</sub>.

**Figure KS10-4** (continued)**Vegetated Treatment Area Design Worksheet - Page 3**

Determine grass treatment area required for infiltration:

$$A_f = (R_{lr}) \times (A_{lr}) / (I_{lr}) = (\underline{1.93} \text{ inches}) \times (\underline{3.2} \text{ acres}) / (\underline{3.22} \text{ inches}) = \underline{1.92} \text{ acres}$$

Determine grass treatment area dimensions by selecting a desired length or width and solving for the remaining dimension:

( W = 420 feet (circle dimension chosen)

$$L = (A_f) \times (43,560 \text{ square feet/acre}) / W \text{ or } W = (A_f) \times (43,560 \text{ square feet/acre}) / L$$

$$\rightarrow \underline{W} = (\underline{1.92} \text{ acres}) \times (43,560 \text{ square feet/acre}) / (\underline{420} \text{ feet}) = \underline{199} \text{ feet} \rightarrow \text{Use } \underline{200} \text{ feet}$$

Calculate actual unit discharge:

$$q = Q / W = (\underline{0.59} \text{ cfs}) / (\underline{200} \text{ feet}) = \underline{0.00295} \text{ cfs/foot}$$

Where Q is the actual discharge of the pipe spillway, taken from the settling basin design

Determine the limiting unit discharge for an application rate, which does not exceed the soil intake rate using the following equation:

$$Qu = (L) (I_{lr}) / (720 Ta) = (\underline{420} \text{ feet}) \times (\underline{3.22} \text{ inches}) / (720 \times \underline{380} \text{ minutes}) = \underline{0.00494} \text{ cfs/foot}$$

$\rightarrow q = \underline{0.00295} \text{ cfs/foot}$  must be  $\leq Qu$   $\underline{0.00494} \text{ cfs/foot}$ ; if not, select new L and W dimensions and redesign

**Flow Design**

Flow design is based on actual unit discharge:  $q = \underline{0.00295} \text{ cfs/foot}$  Attach calculations or use charts in Table KS10-4.

Estimated flow depth at upper end of grass treatment area:  $d = \underline{0.55} \text{ inches}$  (must be  $< 6$  inches)

Design flow velocity:  $V = \underline{0.063} \text{ feet/second}$  (must be  $< 1.5$  feet/second in any reach)

*Estimated flow depth and design velocity are interpolated from Figure KS10-6.*

Contact time:  $T_{con} = L / 3600V$

$$= (\underline{420} \text{ feet}) / (3600) \times (\underline{0.063} \text{ feet/second}) = \underline{1.85} \text{ hour} \text{ (must be } \geq 1 \text{ hour)}$$

**Nitrogen Loading Analysis**

Select the most appropriate of the procedures indicated below for estimating average annual (net) nitrogen yield to the grass treatment area.

Beef feedlot runoff procedure:

Net N yield = (unit yield in pounds N/acre-inch) x (drainage area in acres) x (confinement period runoff in inches)

Backgrounding operations (confinement between October 1 and April 1)\* (Period must be 6 months or less)

$$\text{Net N yield} = (30 \text{ pounds N/acre-inch}) \times (\underline{3} \text{ acres}) \times (\underline{1.29} \text{ inches}) = \underline{116} \text{ pounds N}$$

Continuous (year-round) operations\*: *N/A*

$$\text{Net N yield} = (22.5 \text{ pounds N/acre-inch}) \times (\underline{\quad} \text{ acres}) \times (\underline{\quad} \text{ inches}) = \underline{\quad} \text{ pounds N}$$

\*Attach calculations documenting runoff determination

*Runoff calculation with CN = 90: Oct = 0.66, Nov = 0.09, Dec = 0.07, Jan = 0, Feb = 0.07, Mar = 0.40.*

*Total runoff for confinement period - 1.29 inches.*

General procedure:

1. Determine total "as excreted" nitrogen production for the confinement period. Show calculations below and list production reference.

*N/A*

**Figure KS10-4** (continued)**Vegetated Treatment Area Design Worksheet - Page 4**

2. Net N yield =  $(0.045) \times (\text{gross production in pounds N})$   
 $= (0.045) \times (\underline{\hspace{2cm}} \text{pounds N}) = \underline{\hspace{2cm}} \text{pounds N}$

Nitrogen loading analysis:

1. List type of treatment area vegetation, average annual yield or production, and corresponding nitrogen uptake or consumption. Also, list nitrogen consumption reference. [Table 6-6](#) lists consumption rates.

*NEH 651 Table 6-6: Bromegrass, 3 tons/acre/year average yield, N = 1.87%*  
*→ Nitrogen consumption =  $(0.0187) \times (3 \text{ tons/acre/year}) \times (2,000 \text{ pounds./ton}) = 112 \text{ pounds./acre/year}$*

2. Analyze adequacy of treatment area:

Treatment area =  $L \times W / 43560 = (\underline{420} \text{ feet}) \times (\underline{200} \text{ feet}) / 43560 = \underline{1.93} \text{ acre}$   
 $(\text{Net N yield in lbs. N}) / (\text{treatment area in acres}) \leq 100\% \text{ (average annual N consumption in pounds N/acre)}$   
 $(\underline{116} \text{ pounds N}) / (\underline{1.93} \text{ acres}) = \underline{60} \text{ pounds N/acre} \leq (\underline{112} \text{ pounds N/acre})$

3. If treatment area is not adequate, determine minimum area required for nitrogen loading:

Minimum area, acre =  $(\text{net N yield in pounds N}) / (\text{average annual N consumption in pounds N/acre})$   
*N/A*       $= (\underline{\hspace{2cm}} \text{pounds N}) / (\underline{\hspace{2cm}} \text{pounds N/acre}) = \underline{\hspace{2cm}} \text{acres}$

**Grass Treatment Area Summary**

Indicate the final design dimensions and details below. Dimensions may be adjusted slightly to facilitate equipment operation for haying and maintenance. Refer to Design Tools in KS651.1081(g) in NEH 651 to determine border widths.

**Settling Basin**

Design release time = 24 hours

Total required storage = 3.27 inches

Actual storage = 3.30 inches or 38,375 cubic feet

Required release rate = 0.59 cfs Actual release rate 0.59 cfs

Riser or inlet size and type 6-inch diameter perforated riser with 40 holes/foot

Pipe spillway diameter = 6 inches Orifice diameter 4.05 inches

**Flow Distribution Device**

Type and size of device used: *Alternatives*

Weir of treated lumber - level crest length = 210 feet  $Q = CLH^{3/2}$ ,  $H = (Q/CL)^{2/3}$

$Q = 0.59 \text{ cfs}$ ,  $C = 3.1$ ,  $L = 200$

$H = (0.59 / (3.1 \times 200))^{2/3} = 0.0097 \text{ foot or } 0.12 \text{ inch}$

*Use three 2 x 6 treated lumber for horizontal weir and nailed to a 2 x 6 vertical support every 4 feet. Install top of weir level and approximately 5 inches above ground line to pond and still the approach flow.*

*6-inch PVC gated pipe with pipe from settling basin with outlet in one end of gated pipe. Flow length of 200 feet,  $Q = 0.59 \text{ cfs}$  or  $265 \text{ gpm}$ ,  $di = 5.76 \text{ inches}$ ,  $C = 150$  friction loss using Hazen-Williams equation  $Q/C = 0.0006273 di^{2.03} s^{0.54}$  (Reference Eq. 3-11 on page 3-21 in NEH 650) is approximately 1.19 feet x 0.36 multiple outlet factor = 0.43 foot. Add 0.5 foot freeboard. Minimum pipe grade needs to be 0.46 percent or drop of 0.93 foot in the 200 length of pipe to overcome friction loss from pipe flow and provide the necessary pressure flow.*

**Grass Treatment Area**

Length used = 420 feet Width used = 200 feet Treatment area = 1.93 acres

Area is subdivided into 4 borders, each 50 feet wide

**Figure KS10-5** Settling Basin Design - Example of Results from Storage Terrace Spreadsheet (eFOTG Job Sheet in Terrace [600])

Name	I.M. Tryng	Drainage Area	3.2 acres	Riser Diameter	6 inches								
Legal Desc.	NW4 37-17S-10W	Soil Loss	7.2 t/acr/yr	No. of Holes/ft	recommend 40 number								
County	Center	Curve Number	89.4	Size of Holes	1 inches								
Sediment Basin	Settling Basin	25 yr, 24 hr Rainfall	5.6 inches	Orifice Below Ground	0 feet								
Line No.		Flood Duration	24 hours	Riser Discharge	1.30 cfs								
Designed by	MNE			Minimum Orifice Dia.	4.04 inches								
Date	9/29/2009	Soil Loss	0.50 inches	Design Orifice Dia.	4.05 inches								
Comments:		Runoff	4.39 inches	Pipe Flow Above	0.00 cfs								
		Required Storage	3.25 inches	Pipe Diameter	6 inches								
		Req'd Storage Volume	37763.4 cu ft	Pipe Slope	100 %								
		Required Release Rate	0.59 cfs	"n" & Pipe Material	0.009 Smooth Wall PVC								
		Before any investigation or construction activity, the excavator is responsible for calling Kansas One-Call at 800-344-7233 (800-DIG-SAFE)			Pipe Discharge								
					Actual Discharge								
					0.59 cfs								
					Flow Type								
					Non-Pressure								
<b>Sediment Basin Cross Section</b>													
Top Width	10 feet	Minimum Height	1.5 feet	Cut Volume	26625.4 986.1 cu.yd.								
Ratio or Length	Ratio	Freeboard	1 feet	Fill Volume	21277.6 788.1 cu.yd.								
Cut Slope	3 : 1	Riser Station	3+00	Cut/Fill Ratio	1.25								
Front Slope	3 : 1	Overfill at Riser	0.5 feet	Storage Volume	38375.0								
Back Slope	3 : 1	Water Depth at Riser	2.7 feet	Storage Ratio	1.02								
Stake Method	1	Riser Height	3.0 feet										
Hl Elevation	96.50	Block as Needed at Sta 0+00 Block as Needed at Sta 6+00		Max Water Surface Grade Rod	5.7								
				Channel Elevation at Riser	88.1								
Station (feet)	Land Slope (%)	B/w (feet)	Stake Rod	Channel Rod	Ridge Rod	Cut (feet)	Fill (feet)	Water Depth	Height (feet)	Cut/Fill Ratio	Cut Length	Front Length	Back Length
0+00	c 2.0	c 20	6.0	7.9	4.7	1.9	1.3	2.2	3.2	2.35	7.3	9.6	5.4
1+00	2.0	20	6.4	7.9	4.7	1.5	1.7	2.2	3.2	1.34	6.1	9.6	6.7
2+00	2.0	20	6.7	7.9	4.7	1.2	2.0	2.2	3.2	0.88	5.1	9.6	7.6
3+00	2.0	20	6.7	8.4	4.2	1.7	2.5	2.7	4.2	0.92	6.7	12.6	9.4
4+00	2.0	20	6.6	7.9	4.7	1.3	1.9	2.2	3.2	1.01	5.4	9.6	7.3
5+00	2.0	20	6.2	7.9	4.7	1.7	1.5	2.2	3.2	1.77	6.7	9.6	6.0
6+00	2.0	20	6.1	7.9	4.7	1.8	1.4	2.2	3.2	2.04	7.0	9.6	5.7

**Figure KS10-6** Example of Grass Treatment Area Design Chart

Slope = 0.3%			Slope = 0.5%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)	Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0011	0.5	0.026	0.0018	0.5	0.042
0.0015	0.6	0.03	0.0024	0.6	0.048
0.0033	1	0.04	0.0055	1	0.067
0.0045	1.2	0.045	0.0075	1.2	0.075
0.0065	1.5	0.052	0.0109	1.5	0.088

Slope = 1.0%			Slope = 1.5%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)	Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0025	0.5	0.06	0.0031	0.5	0.073
0.0034	0.6	0.067	0.0041	0.6	0.082
0.0078	1	0.094	0.0096	1	0.115
0.0107	1.2	0.107	0.0131	1.2	0.131
0.0155	1.5	0.124	0.019	1.5	0.152

Slope = 2.0%			Slope = 3.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)	Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.0036	0.5	0.085	0.0044	0.5	0.104
0.0048	0.6	0.095	0.0058	0.6	0.116
0.0111	1	0.133	0.0135	1	0.163
0.0151	1.2	0.151	0.0185	1.2	0.185
0.0219	1.5	0.175	0.0268	1.5	0.214

Slope = 4.0%		
Capacity per Foot of Bottom Width (cfs)	Depth of Flow (in.)	Velocity of Flow (fps)
0.005	0.5	0.12
0.0067	0.6	0.134
0.0156	1	0.189
0.0213	1.2	0.213
0.031	1.5	0.248

## KS651.1082 Suggested procedures for sediment volume estimation

### (a) Sediment transported by runoff from open lots

This procedure applies only where sediment is deposited in a structure as a result of runoff from open lots. This procedure is applicable to the design of runoff detention and storage structures such as settling basins and storage ponds.

Estimated sediment yield (acre-inches):

$$(\% \text{ SC}) \times (\text{MAR}) \times (\text{DA}) \times (\text{SP})$$

Where:

% SC = Percent solids content of runoff, typically ranging from 0.75% to 3%—Use a minimum value of 1.5% for design purposes.

MAR = Mean annual runoff (in inches)—Mean annual runoff may be determined from Table KS10-6.

DA = Contributing drainage area (in acres)

SP = Sediment storage period (in years)

When a settling basin precedes a waste storage structure, it may be assumed that a portion of the sediment yield will be captured in the basin and prevented from entering the storage structure. Use the following factors for sediment yield distribution:

Settling Basin Detention Storage % of the 25-Year, 24-Hour Runoff	Sediment Retention Factor
0% detention	0
> 0% ≤ 35%	0.15
> 35% < 45%	0.33
45% or more	0.67

#### Example:

A beef feedlot has a contributing drainage area of 10 acres. The feedlot surface is bare earth. The mean annual runoff for the area is 7 inches per year. The waste management facilities consist of an earthen storage structure preceded by a settling basin. The settling basin provides detention storage for 63% of the 25-year, 24-hour storm runoff. The structure is to include storage for the estimated 15-year sediment yield. The settling basin is to be designed to store at least twice the estimated annual sediment yield. Determine the sediment volumes required for design purposes.

Estimated annual sediment yield:

$$(1.5\%) \times (7 \text{ inches/year}) \times (10 \text{ acres}) \\ = 1.05 \text{ acre-inches/year}$$

Volume retained by settling basin:

$$(0.67) \times (1.05 \text{ acre-inches/year}) \times (2 \text{ years}) \\ = 1.41 \text{ acre-inches}$$

Therefore, the settling basin design must provide at least 1.41 acre-inches allocated to storage of sediment.

Annual volume retained by earthen storage structure:

$$\text{Total volume} - \text{settling basin volume} \\ = 1.05 - (0.67)(1.05) \\ = 1.05 - 0.70 = 0.35 \text{ acre-inch/year}$$

Sediment storage for structure design =  
 $(0.35 \text{ acre-inch/year}) \times (15 \text{ years}) = 5.25 \text{ acre-inches}$

Therefore, allocate at least 5.25 acre-inches of storage in the pond design to sediment accumulation to meet the requirement for 15 years of sediment storage capacity.

### **(b) Sediment resulting from direct deposition in a storage structure**

This procedure is applicable to systems where all waste (solid and liquid) is directly deposited into a storage structure. An example of such a system is an enclosed swine facility where all waste is flushed directly into an earthen storage structure. The procedure is based upon the daily production of solids.

Estimated sediment yield:

$$(FS + (R)(VS)) \times (N) \times (D) \times (Y)$$

Where:

FS = Fixed solids, pounds/day

VS = Volatile solids, pounds/day

R = Fraction of volatile solids retained

N = Average number of animals confined in the system

D = Days per year animals are confined

Y = Number of years required for sediment storage

Note that this procedure deals only with livestock waste. If other wastes (such as bedding material, soil, or spilled feed) are also deposited in the storage structure, then they must be accounted for separately. These sources may be disregarded if they account for 5% or less of the total waste.

Values for total and volatile solids are in [Section 651.0403](#) and in MWPS-18, Section 1, Manure Characteristics (Midwest Plan Service 2000). The fixed solids fraction may be derived by applying the relationship: TS = FS + VS, where TS = total solids.

The fraction of volatile solids retained (R) is a function of storage time, biological activity, and dilution. Suggested factors are:

- Long-term storage (storage capacity > 365 days), dilution greater than 50%, good anaerobic condition: R = 0.3
- Intermittent storage or confinement, dilution less than 50%, highly variable levels in storage structure: R = 0.8

#### **Example:**

Swine operation, continuous confinement, earthen storage structure capacity greater than 365 days—The system confines 500 grower pigs with an average weight of 150 pounds. All waste is flushed into the storage structure twice daily. Dilution factor is 2:1 (greater than 50%). The structure is to include storage corresponding to the estimated sediment yield for 10 years.

Values for FS and VS may be determined from MWPS-18, Section 1 or [Section 651.0403](#). In this case, use MWPS-18, Section 1, Table 6:

$$TS = 1.0 \text{ pound/day/animal}$$

$$VS = 0.8 \text{ pound/day/animal}$$

$$FS = TS - VS = 1.0 - 0.8 = 0.2 \text{ pound/day/animal}$$

$$\text{Assume } R = 0.3$$

Estimated sediment yield:

$$(0.2 + (0.3 \times 0.8)) \text{ pound/day/animal} \times (500 \text{ animals}) \times (365 \text{ days/year}) \times (10 \text{ years}) = 803,000 \text{ pounds}$$

Weight may be converted to volume using a wet density. From MWPS-18, Section 1, Table 6, density = 62 pounds/cubic foot:

$$(803,000 \text{ pounds}) / (62 \text{ pounds/cubic foot}) = 12,952 \text{ cubic feet}$$

Therefore, allocate at least 12,952 cubic feet of storage in the structure design to sediment accumulation to meet the requirement for 10 years of sediment storage capacity.

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## KS651.1083 Precipitation, evaporation and runoff tables

This section provides data regarding the mean monthly and annual precipitation and evaporation values and mean monthly and annual runoff values for each county in Kansas. This data can be used to size storage facilities, settling basins, and VTAs used in agricultural waste management systems. Information for the sources of the data and how the data is to be used is shown below.

### (a) Mean monthly and annual precipitation and free water surface (lake) evaporation values (Table KS10-5)

Precipitation data was obtained from the National Oceanic and Atmospheric Administration (NOAA) and is the average of 30 years of daily precipitation records (1961 to 1990) from NOAA reporting stations in Kansas. Current average values may be different but not significantly.

Evaporation data is from the NOAA Technical Report National Weather Service (NWS) 33, "Evaporation Atlas for the Contiguous 48 United States," June 1982 and NOAA Technical Report NWS 34, "Mean Monthly, Seasonal and Annual Pan Evaporation for the United States," December 1982.

### (b) Mean monthly and annual runoff values (Table KS10-6)

Mean monthly and mean annual runoff values have been determined by analyzing 30 years of daily precipitation records (1961 to 1990) from NOAA reporting stations in Kansas. The

computer model used for the analyses updates the ARCs on a daily basis, and the NRCS runoff CN is used to calculate daily runoff depths. These values are then summed by month and year, and long-term (30-year) mean values are statistically determined. Runoff values have been tabulated by runoff CN to represent a variety of land cover and soil conditions. The "Non-Feedlot Areas" columns apply only to runoff originating from extraneous drainage areas that do not contain confined livestock feeding areas. The "Feedlots" columns apply to runoff originating from feedlot surfaces. **Do not use composite (weighted) CNs to determine runoff from areas of differing land use—determine runoff volumes separately for each CN.** For example, do not use a composite number to determine runoff from a feedlot area and a pasture area with a CN of 74. Calculate the runoff volumes separately and sum them together (if needed) for the design of a storage structure.

The "Feedlots" columns give two choices for lot surfaces: "Earth" and "Conc." "Earth applies to lots with a bare earth surface while "Conc." applies to lots with a concrete or similar paved surface. It is assumed that there is some manure pack on each surface. When both surfaces contribute runoff to a waste control structure, the runoff volume for each surface area should be determined and the sum of the two used for design purposes.

Runoff CNs have been associated with bare earth and concrete lots. Research has shown that the standard definition of ARC does not strictly apply to these surfaces since runoff is initiated earlier in the rainfall event. To prevent confusion and lessen the possibility of errors, these CNs are not listed in the tables.

**Table KS10-5** Mean Monthly and Annual Precipitation and Free Water Surface (Lake) Evaporation Values

County		Mean Values in inches												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
ALLEN	Precipitation	1.20	1.22	3.13	3.38	4.82	5.44	3.90	4.17	4.81	3.79	2.58	1.48	39.91
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
ANDERSON	Precipitation	1.42	1.19	3.01	3.53	4.67	5.71	3.37	4.62	4.35	4.02	2.56	1.74	40.18
	Evaporation	1.38	1.38	2.76	4.14	5.52	6.44	6.90	6.44	4.60	3.22	1.84	1.38	46
ATCHISON	Precipitation	0.99	0.93	2.42	3.08	4.92	4.86	3.98	4.14	4.83	3.18	1.93	1.39	36.64
	Evaporation	1.32	1.32	2.64	3.96	5.28	6.16	6.60	6.16	4.40	3.08	1.76	1.32	44
BARBER	Precipitation	0.49	0.85	1.92	2.42	3.43	3.86	2.57	3.25	2.57	2.22	1.34	0.80	25.72
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
BARTON	Precipitation	0.57	0.80	1.84	2.24	3.41	4.28	3.30	3.09	2.34	2.10	1.12	0.90	25.98
	Evaporation	1.71	1.71	3.42	5.13	6.84	7.98	8.55	7.98	5.70	3.99	2.28	1.71	57
BOURBON	Precipitation	1.54	1.58	3.26	3.68	4.80	5.67	3.52	3.83	4.74	4.14	2.85	1.89	41.50
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
BROWN	Precipitation	0.94	1.01	2.37	3.18	4.84	5.62	3.67	4.13	4.50	2.99	1.82	1.28	36.33
	Evaporation	1.32	1.32	2.64	3.96	5.28	6.16	6.60	6.16	4.40	3.08	1.76	1.32	44
BUTLER	Precipitation	0.86	1.11	2.60	2.86	4.39	5.58	3.60	3.69	3.86	2.89	2.08	1.37	34.90
	Evaporation	1.53	1.53	3.06	4.59	6.12	7.14	7.65	7.14	5.10	3.57	2.04	1.53	51
CHASE	Precipitation	0.89	0.94	2.49	2.95	4.61	5.27	3.49	3.38	4.00	2.85	1.90	1.22	33.99
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50
CHAUTAUQUA	Precipitation	1.24	1.43	3.14	3.32	5.83	4.63	2.83	3.31	4.81	3.76	2.80	1.62	38.72
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50
CHEROKEE	Precipitation	1.56	1.78	3.42	3.67	5.31	5.04	3.02	3.82	5.13	3.81	3.45	2.06	42.06
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
CHEYENNE	Precipitation	0.47	0.45	1.28	1.61	3.14	2.78	2.70	1.82	1.35	1.02	0.69	0.45	17.75
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
CLARK	Precipitation	0.37	0.57	1.51	1.71	3.40	3.35	2.66	2.67	2.48	1.54	0.97	0.71	21.93
	Evaporation	1.95	1.95	3.90	5.85	7.80	9.10	9.75	9.10	6.50	4.55	2.60	1.95	65
CLAY	Precipitation	0.68	0.82	2.28	2.57	4.28	4.30	3.62	3.50	3.45	2.58	1.42	0.98	30.47
	Evaporation	1.47	1.47	2.94	4.41	5.88	6.86	7.35	6.86	4.90	3.43	1.96	1.47	49
CLOUD	Precipitation	0.58	0.75	2.17	2.38	4.15	4.46	3.70	3.55	2.86	1.92	1.11	0.84	28.47
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50
COFFEY	Precipitation	0.87	0.85	2.48	3.06	4.26	5.41	3.77	3.53	4.06	3.01	1.89	1.18	34.36
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48
COMANCHE	Precipitation	0.55	0.87	1.66	1.85	3.37	3.99	2.76	3.43	2.46	2.01	1.21	0.88	25.04
	Evaporation	1.86	1.86	3.72	5.58	7.44	8.68	9.30	8.68	6.20	4.34	2.48	1.86	62
COWLEY	Precipitation	1.03	1.37	2.37	2.72	4.69	4.41	3.26	3.50	3.78	2.90	2.33	1.49	33.87
	Evaporation	1.53	1.53	3.06	4.59	6.12	7.14	7.65	7.14	5.10	3.57	2.04	1.53	51
CRAWFORD	Precipitation	1.42	1.74	3.62	3.90	5.33	5.82	3.40	4.02	4.75	4.29	3.12	2.00	43.41
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
DECATUR	Precipitation	0.45	0.48	1.59	1.98	3.78	3.77	3.47	2.20	2.03	1.18	0.83	0.52	22.28
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
DICKINSON	Precipitation	0.66	0.82	2.13	2.65	3.76	5.02	3.38	3.47	3.18	2.68	1.57	0.87	30.20
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50

**Table KS10-5** Mean Monthly and Annual Precipitation and Evaporation Free Water Surface (Lake) Values (Continued)

County		Mean Values in inches												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
DONIPHAN	Precipitation	0.87	0.96	2.43	3.06	5.01	5.15	4.02	4.44	4.81	3.02	1.81	1.25	36.83
	Evaporation	1.29	1.29	2.58	3.87	5.16	6.02	6.45	6.02	4.30	3.01	1.72	1.29	43
DOUGLAS	Precipitation	1.22	1.12	2.73	3.46	4.96	5.82	3.97	3.98	4.52	3.32	2.24	1.74	39.09
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
EDWARDS	Precipitation	0.48	0.76	1.94	2.16	3.39	3.58	3.16	3.27	2.10	1.72	1.04	0.91	24.50
	Evaporation	1.86	1.86	3.72	5.58	7.44	8.68	9.30	8.68	6.20	4.34	2.48	1.86	62
ELK	Precipitation	1.11	1.17	2.74	3.24	5.27	4.69	3.60	3.60	4.31	3.32	2.48	1.45	36.98
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50
ELLIS	Precipitation	0.35	0.54	1.77	1.95	2.71	3.46	3.46	2.63	2.19	1.43	0.93	0.54	21.97
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
ELLSWORTH	Precipitation	0.60	0.78	2.23	2.39	4.10	4.03	3.22	3.31	3.11	2.21	1.09	0.78	27.84
	Evaporation	1.62	1.62	3.24	4.86	6.48	7.56	8.10	7.56	5.40	3.78	2.16	1.62	54
FINNEY	Precipitation	0.33	0.46	1.15	1.56	3.17	2.87	2.60	2.16	1.59	1.00	0.76	0.36	17.99
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
FORD	Precipitation	0.49	0.62	1.56	2.05	3.03	3.10	3.24	2.73	1.91	1.28	0.83	0.65	21.48
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66
FRANKLIN	Precipitation	1.32	1.20	3.08	3.42	4.75	5.65	3.55	3.80	4.59	3.44	2.38	1.61	38.78
	Evaporation	1.38	1.38	2.76	4.14	5.52	6.44	6.90	6.44	4.60	3.22	1.84	1.38	46
GEARY	Precipitation	0.70	0.81	2.36	2.73	4.31	4.33	3.75	3.45	3.86	2.76	1.57	1.05	31.68
	Evaporation	1.47	1.47	2.94	4.41	5.88	6.86	7.35	6.86	4.90	3.43	1.96	1.47	49
GOVE	Precipitation	0.49	0.67	1.57	2.02	3.89	3.32	3.44	3.00	2.13	1.36	0.97	0.62	23.47
	Evaporation	1.86	1.86	3.72	5.58	7.44	8.68	9.30	8.68	6.20	4.34	2.48	1.86	62
GRAHAM	Precipitation	0.52	0.64	1.71	1.98	3.42	2.91	3.12	2.85	2.16	1.31	1.03	0.62	22.27
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
GRANT	Precipitation	0.36	0.42	0.86	1.28	2.69	2.92	2.03	2.34	1.81	0.83	0.73	0.37	16.63
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
GRAY	Precipitation	0.49	0.62	1.64	1.93	3.52	3.66	3.58	2.66	1.95	1.32	0.93	0.53	22.84
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
GREELEY	Precipitation	0.37	0.41	1.00	1.13	2.69	2.71	2.60	1.98	1.54	0.74	0.50	0.33	16.01
	Evaporation	1.89	1.89	3.78	5.67	7.56	8.82	9.45	8.82	6.30	4.41	2.52	1.89	63
GREENWOOD	Precipitation	1.16	1.34	2.71	3.32	4.77	5.56	3.30	4.29	4.43	3.23	2.52	1.61	38.25
	Evaporation	1.50	1.50	3.00	4.50	6.00	7.00	7.50	7.00	5.00	3.50	2.00	1.50	50
HAMILTON	Precipitation	0.35	0.42	0.90	1.22	2.34	2.41	2.39	2.01	1.72	0.90	0.59	0.37	15.62
	Evaporation	1.92	1.92	3.84	5.76	7.68	8.96	9.60	8.96	6.40	4.48	2.56	1.92	64
HARPER	Precipitation	0.84	0.87	2.40	2.96	3.82	4.56	3.06	2.85	3.12	1.86	1.78	0.92	29.04
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
HARVEY	Precipitation	0.67	0.87	2.42	2.71	4.41	4.67	3.09	3.11	3.63	2.55	1.80	1.17	31.10
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
HASSELL	Precipitation	0.35	0.48	1.23	1.44	3.21	3.22	2.59	2.35	2.10	1.11	0.81	0.39	19.26
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
HODGEMAN	Precipitation	0.58	0.71	1.89	2.01	3.01	3.40	2.66	2.41	1.47	1.50	1.00	0.70	21.35
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66

**Table KS10-5** Mean Monthly and Annual Precipitation and Evaporation Free Water Surface (Lake) Values (Continued)

County		Mean Values in inches												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
JACKSON	Precipitation	0.92	0.90	2.37	3.18	4.60	6.00	3.61	4.31	4.84	3.18	1.92	1.36	37.18
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
JEFFERSON	Precipitation	1.04	0.99	2.55	3.33	5.35	5.65	4.28	3.95	4.93	3.50	2.06	1.42	39.04
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
JEWELL	Precipitation	0.49	0.72	1.97	2.47	4.00	3.80	3.51	3.55	3.55	1.99	1.09	0.71	27.85
	Evaporation	1.56	1.56	3.12	4.68	6.24	7.28	7.80	7.28	5.20	3.64	2.08	1.56	52
JOHNSON	Precipitation	1.14	1.04	2.75	3.53	5.12	5.83	3.75	3.70	5.05	3.59	2.50	1.53	39.53
	Evaporation	1.32	1.32	2.64	3.96	5.28	6.16	6.60	6.16	4.40	3.08	1.76	1.32	44
KEARNY	Precipitation	0.24	0.36	0.92	1.45	2.77	2.59	2.71	2.38	1.87	0.77	0.68	0.30	17.03
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66
KINGMAN	Precipitation	0.59	0.93	2.23	2.44	3.92	4.12	3.06	3.23	3.32	2.46	1.63	0.91	28.84
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
KIOWA	Precipitation	0.46	0.70	1.60	1.89	3.32	4.11	2.73	2.76	2.49	1.73	1.04	0.75	23.59
	Evaporation	1.86	1.86	3.72	5.58	7.44	8.68	9.30	8.68	6.20	4.34	2.48	1.86	62
LABETTE	Precipitation	1.52	1.52	3.60	3.87	5.46	5.42	3.35	4.13	5.24	4.06	3.08	1.90	43.14
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
LANE	Precipitation	0.47	0.60	1.41	1.77	3.01	3.00	2.81	2.46	2.12	1.18	0.94	0.51	20.29
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66
LEAVENWORTH	Precipitation	1.11	1.07	2.45	3.71	5.30	5.02	4.62	4.31	5.09	3.82	2.21	1.48	40.17
	Evaporation	1.32	1.32	2.64	3.96	5.28	6.16	6.60	6.16	4.40	3.08	1.76	1.32	44
LINCOLN	Precipitation	0.65	0.81	2.18	2.33	4.15	3.38	3.47	3.36	2.83	2.14	1.30	0.79	27.37
	Evaporation	1.62	1.62	3.24	4.86	6.48	7.56	8.10	7.56	5.40	3.78	2.16	1.62	54
LINN	Precipitation	1.39	1.41	3.37	3.72	4.96	5.31	3.35	4.46	4.89	3.83	2.69	1.66	41.01
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
LOGAN	Precipitation	0.39	0.35	1.22	1.43	3.10	2.96	2.66	2.20	1.78	1.03	0.72	0.39	18.23
	Evaporation	1.86	1.86	3.72	5.58	7.44	8.68	9.30	8.68	6.20	4.34	2.48	1.86	62
LYON	Precipitation	0.96	0.96	2.70	3.14	4.86	5.55	3.62	3.82	4.07	3.16	2.04	1.32	36.20
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48
MARION	Precipitation	0.76	0.86	2.32	2.92	4.66	5.05	3.53	3.06	3.88	2.74	1.86	1.04	32.69
	Evaporation	1.53	1.53	3.06	4.59	6.12	7.14	7.65	7.14	5.10	3.57	2.04	1.53	51
MARSHALL	Precipitation	0.61	0.73	2.14	2.57	4.23	4.79	3.56	4.04	3.60	2.54	1.35	0.95	31.12
	Evaporation	1.38	1.38	2.76	4.14	5.52	6.44	6.90	6.44	4.60	3.22	1.84	1.38	46
MCPHERSON	Precipitation	0.56	0.85	2.34	2.79	4.00	4.68	3.28	3.36	3.43	2.32	1.36	0.93	29.89
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
MEADE	Precipitation	0.50	0.70	1.62	1.65	3.45	3.12	2.98	2.47	2.42	1.31	0.91	0.67	21.79
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
MIAMI	Precipitation	1.45	1.21	2.83	3.72	4.82	6.43	3.53	3.97	4.84	3.82	2.47	1.55	40.65
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
MITCHELL	Precipitation	0.63	0.71	2.12	2.32	4.02	4.23	2.90	3.07	2.89	2.04	1.03	0.72	26.69
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
MONTGOMERY	Precipitation	1.30	1.52	3.55	3.60	5.53	5.33	3.14	3.80	4.61	3.71	2.85	1.70	40.64
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48

**Table KS10-5** Mean Monthly and Annual Precipitation and Evaporation Free Water Surface (Lake) Values (Continued)

County		Mean Values in inches												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
MORRIS	Precipitation	0.73	0.90	2.44	3.27	4.42	4.62	3.32	3.41	3.42	2.65	1.81	1.21	32.20
	Evaporation	1.47	1.47	2.94	4.41	5.88	6.86	7.35	6.86	4.90	3.43	1.96	1.47	49
MORTON	Precipitation	0.46	0.58	1.16	1.58	2.57	2.42	2.83	2.24	1.93	0.79	0.82	0.39	17.78
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66
NEMAHA	Precipitation	0.85	0.88	2.37	2.97	4.67	5.32	3.79	4.21	4.16	2.77	1.80	1.07	34.86
	Evaporation	1.35	1.35	2.70	4.05	5.40	6.30	6.75	6.30	4.50	3.15	1.80	1.35	45
NEOSHO	Precipitation	1.33	1.58	3.32	3.73	5.53	5.13	3.79	4.36	4.57	4.02	2.82	1.72	41.91
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
NESS	Precipitation	0.41	0.57	1.66	1.93	2.90	3.35	2.95	2.46	2.12	1.21	0.91	0.52	20.98
	Evaporation	1.92	1.92	3.84	5.76	7.68	8.96	9.60	8.96	6.40	4.48	2.56	1.92	64
NORTON	Precipitation	0.45	0.53	1.58	2.10	3.60	3.18	3.11	2.57	2.06	1.43	0.88	0.51	21.99
	Evaporation	1.65	1.65	3.30	4.95	6.60	7.70	8.25	7.70	5.50	3.85	2.20	1.65	55
OSAGE	Precipitation	1.02	0.91	2.60	3.51	4.59	5.46	2.83	3.58	4.09	2.72	2.11	1.34	34.75
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
OSBORNE	Precipitation	0.52	0.70	2.06	2.35	3.96	3.39	3.33	2.73	2.92	1.51	1.09	0.67	25.23
	Evaporation	1.62	1.62	3.24	4.86	6.48	7.56	8.10	7.56	5.40	3.78	2.16	1.62	54
OTTAWA	Precipitation	0.61	0.76	2.08	1.93	4.30	4.10	3.70	2.99	3.06	2.07	1.27	0.78	27.64
	Evaporation	1.56	1.56	3.12	4.68	6.24	7.28	7.80	7.28	5.20	3.64	2.08	1.56	52
PAWNEE	Precipitation	0.43	0.64	1.59	2.05	2.96	3.87	3.21	3.05	2.47	1.60	1.04	0.77	23.67
	Evaporation	1.80	1.80	3.60	5.40	7.20	8.40	9.00	8.40	6.00	4.20	2.40	1.80	60
PHILLIPS	Precipitation	0.39	0.51	1.87	2.21	3.85	3.51	3.19	2.92	2.44	1.46	0.93	0.48	23.75
	Evaporation	1.62	1.62	3.24	4.86	6.48	7.56	8.10	7.56	5.40	3.78	2.16	1.62	54
POTTAWATOMIE	Precipitation	0.85	0.92	2.39	2.75	4.47	5.37	3.74	3.56	4.01	2.85	1.83	1.19	33.90
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
PRATT	Precipitation	0.53	0.89	2.01	2.29	3.52	3.76	3.04	2.93	2.66	2.23	1.18	0.94	25.97
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
RAWLINS	Precipitation	0.55	0.52	1.59	1.92	3.79	3.33	3.23	2.26	1.92	1.19	0.87	0.58	21.73
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
RENO	Precipitation	0.59	0.91	2.16	2.65	3.89	4.29	3.35	3.15	3.40	2.44	1.37	0.93	29.11
	Evaporation	1.65	1.65	3.30	4.95	6.60	7.70	8.25	7.70	5.50	3.85	2.20	1.65	55
REPUBLIC	Precipitation	0.61	0.79	2.37	2.62	4.29	4.58	3.87	3.94	3.67	2.09	1.23	0.95	31.00
	Evaporation	1.47	1.47	2.94	4.41	5.88	6.86	7.35	6.86	4.90	3.43	1.96	1.47	49
RICE	Precipitation	0.60	0.98	2.28	2.38	3.74	4.14	3.35	3.04	2.69	2.39	1.37	0.97	27.93
	Evaporation	1.65	1.65	3.30	4.95	6.60	7.70	8.25	7.70	5.50	3.85	2.20	1.65	55
RILEY	Precipitation	0.82	0.93	2.36	2.95	4.56	5.48	3.39	3.32	4.13	3.07	1.77	1.09	33.87
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48
ROOKS	Precipitation	0.38	0.58	1.99	1.94	3.67	3.15	3.55	2.75	2.63	1.36	0.99	0.50	23.47
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56
RUSH	Precipitation	0.50	0.68	1.81	2.17	3.36	3.75	3.08	2.67	2.24	1.56	1.04	0.67	23.53
	Evaporation	1.80	1.80	3.60	5.40	7.20	8.40	9.00	8.40	6.00	4.20	2.40	1.80	60
RUSSELL	Precipitation	0.56	0.71	2.07	2.69	3.51	3.42	3.38	3.72	2.93	1.67	1.09	0.76	26.49
	Evaporation	1.68	1.68	3.36	5.04	6.72	7.84	8.40	7.84	5.60	3.92	2.24	1.68	56

**Table KS10-5** Mean Monthly and Annual Precipitation and Evaporation Free Water Surface (Lake) Values (Continued)

County		Mean Values in Inches												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
SALINE	Precipitation	0.69	0.90	2.36	2.81	4.23	4.27	3.37	3.31	3.09	2.48	1.42	0.89	29.82
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
SCOTT	Precipitation	0.60	0.63	1.39	1.69	3.09	3.04	2.96	2.28	2.01	1.04	0.96	0.62	20.31
	Evaporation	1.98	1.98	3.96	5.94	7.92	9.24	9.90	9.24	6.60	4.62	2.64	1.98	66
SEDWICK	Precipitation	0.79	0.96	2.43	2.38	3.82	4.31	3.13	3.02	3.49	2.22	1.59	1.20	29.34
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
SEWARD	Precipitation	0.46	0.65	1.34	1.40	2.98	2.77	2.92	2.22	1.88	1.06	0.85	0.50	19.03
	Evaporation	2.07	2.07	4.14	6.21	8.28	9.66	10.35	9.66	6.90	4.83	2.76	2.07	69
SHAWNEE	Precipitation	0.95	1.04	2.47	3.08	4.45	5.54	3.59	3.89	3.81	3.06	1.93	1.43	35.22
	Evaporation	1.38	1.38	2.76	4.14	5.52	6.44	6.90	6.44	4.60	3.22	1.84	1.38	46
SHERIDAN	Precipitation	0.40	0.48	1.46	1.89	3.49	2.95	3.01	2.54	1.70	1.18	0.81	0.48	20.39
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
SHERMAN	Precipitation	0.41	0.39	1.18	1.30	3.49	3.19	2.87	1.80	1.57	0.90	0.69	0.41	18.23
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
SMITH	Precipitation	0.37	0.48	1.85	2.26	3.72	3.56	2.76	3.09	2.72	1.63	0.88	0.55	23.86
	Evaporation	1.59	1.59	3.18	4.77	6.36	7.42	7.95	7.42	5.30	3.71	2.12	1.59	53
STAFFORD	Precipitation	0.47	0.78	1.78	2.39	3.54	3.67	2.76	2.56	2.50	2.08	1.05	0.88	24.47
	Evaporation	1.74	1.74	3.48	5.22	6.96	8.12	8.70	8.12	5.80	4.06	2.32	1.74	58
STANTON	Precipitation	0.36	0.44	0.96	1.36	2.68	2.54	2.54	2.16	1.73	0.81	0.69	0.35	16.62
	Evaporation	1.95	1.95	3.90	5.85	7.80	9.10	9.75	9.10	6.50	4.55	2.60	1.95	65
STEVENS	Precipitation	0.32	0.45	0.99	1.55	3.24	3.03	2.58	2.32	1.85	0.94	0.85	0.34	18.46
	Evaporation	2.04	2.04	4.08	6.12	8.16	9.52	10.20	9.52	6.80	4.76	2.72	2.04	68
SUMNER	Precipitation	0.90	1.09	2.51	3.01	4.42	4.60	3.26	3.50	3.47	2.30	2.05	1.18	32.28
	Evaporation	1.62	1.62	3.24	4.86	6.48	7.56	8.10	7.56	5.40	3.78	2.16	1.62	54
THOMAS	Precipitation	0.31	0.34	1.17	1.56	3.66	3.19	3.16	2.04	1.70	1.04	0.62	0.36	19.14
	Evaporation	1.77	1.77	3.54	5.31	7.08	8.26	8.85	8.26	5.90	4.13	2.36	1.77	59
TREGO	Precipitation	0.52	0.64	1.71	1.98	3.42	2.91	3.12	2.85	2.16	1.31	1.03	0.62	22.27
	Evaporation	1.80	1.80	3.60	5.40	7.20	8.40	9.00	8.40	6.00	4.20	2.40	1.80	60
WABAUNSEE	Precipitation	0.92	0.96	2.57	3.38	4.72	5.18	3.41	3.89	4.38	2.87	2.05	1.32	35.62
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
WALLACE	Precipitation	0.41	0.50	1.40	1.34	3.51	3.22	2.85	1.89	1.72	1.06	0.73	0.49	19.12
	Evaporation	1.80	1.80	3.60	5.40	7.20	8.40	9.00	8.40	6.00	4.20	2.40	1.80	60
WASHINGTON	Precipitation	0.64	0.80	2.32	2.74	4.53	4.77	3.51	3.83	4.03	2.26	1.42	0.99	31.84
	Evaporation	1.41	1.41	2.82	4.23	5.64	6.58	7.05	6.58	4.70	3.29	1.88	1.41	47
WICHITA	Precipitation	0.35	0.40	1.09	1.29	2.84	2.54	2.61	2.27	1.80	0.93	0.63	0.34	17.08
	Evaporation	1.95	1.95	3.90	5.85	7.80	9.10	9.75	9.10	6.50	4.55	2.60	1.95	65
WILSON	Precipitation	1.10	1.20	2.83	3.06	5.10	5.21	3.82	3.72	4.15	3.75	2.84	1.68	38.45
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48
WOODSON	Precipitation	1.22	1.33	3.17	3.77	4.67	5.76	4.19	4.33	5.11	3.77	2.76	1.65	41.73
	Evaporation	1.44	1.44	2.88	4.32	5.76	6.72	7.20	6.72	4.80	3.36	1.92	1.44	48
WYANDOTTE	Precipitation	1.19	1.07	2.50	3.22	4.66	5.23	3.63	3.77	5.20	3.49	2.06	1.44	37.47
	Evaporation	1.32	1.32	2.64	3.96	5.28	6.16	6.60	6.16	4.40	3.08	1.76	1.32	44













**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
CRAWFORD	January	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.17	0.21	0.24	0.56
	February	0.05	0.05	0.06	0.06	0.08	0.08	0.09	0.11	0.12	0.14	0.15	0.18	0.20	0.23	0.27	0.32	0.36	0.74
	March	0.15	0.16	0.19	0.21	0.24	0.27	0.29	0.35	0.39	0.43	0.48	0.55	0.61	0.71	0.81	0.95	1.03	1.88
	April	0.11	0.12	0.15	0.17	0.21	0.24	0.27	0.33	0.38	0.43	0.49	0.57	0.65	0.77	0.89	1.05	1.22	2.18
	May	0.20	0.22	0.26	0.29	0.34	0.37	0.41	0.49	0.55	0.61	0.69	0.79	0.88	1.04	1.20	1.40	1.85	3.18
	June	0.20	0.22	0.26	0.29	0.33	0.38	0.43	0.49	0.57	0.64	0.73	0.84	0.94	1.11	1.29	1.50	2.22	3.61
	July	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.18	0.22	0.27	0.31	0.40	0.49	0.60	1.00	1.81
	August	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.19	0.23	0.27	0.33	0.41	0.47	0.60	0.73	0.88	1.32	2.38
	September	0.24	0.27	0.31	0.34	0.39	0.43	0.47	0.54	0.61	0.67	0.75	0.84	0.94	1.08	1.23	1.41	1.87	2.98
	October	0.31	0.32	0.36	0.38	0.43	0.46	0.50	0.56	0.61	0.66	0.73	0.81	0.89	1.02	1.15	1.30	1.68	2.64
	November	0.16	0.17	0.20	0.22	0.26	0.29	0.32	0.37	0.41	0.46	0.51	0.57	0.64	0.73	0.83	0.95	0.97	1.72
	December	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.17	0.20	0.23	0.28	0.34	0.40	0.85
	Annual	1.53	1.69	1.97	2.19	2.54	2.83	3.15	3.70	4.18	4.67	5.31	6.08	6.84	8.06	9.35	10.91	14.15	24.53
DECATUR	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.05
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.07
	March	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.14	0.17	0.21	0.24	0.58
	April	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.17	0.22	0.28	0.34	0.83
	May	0.04	0.04	0.05	0.06	0.08	0.10	0.11	0.15	0.17	0.20	0.24	0.29	0.35	0.44	0.54	0.67	0.93	1.88
	June	0.10	0.10	0.12	0.14	0.15	0.17	0.19	0.22	0.26	0.29	0.34	0.39	0.44	0.54	0.63	0.75	1.19	2.12
	July	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.24	0.31	0.38	0.46	0.76	1.62
	August	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.05	0.07	0.08	0.12	0.16	0.21	0.42	0.91
	September	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.21	0.26	0.37	0.83
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.14	0.37
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.07	0.21
	December	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.09
	Annual	0.21	0.24	0.29	0.34	0.41	0.48	0.55	0.68	0.80	0.93	1.12	1.35	1.57	1.99	2.45	3.03	4.50	9.58
DICKINSON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.17
	March	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.21	0.27	0.34	0.41	0.94
	April	0.04	0.04	0.06	0.06	0.08	0.09	0.10	0.13	0.14	0.16	0.19	0.22	0.25	0.30	0.36	0.43	0.45	1.02
	May	0.06	0.07	0.08	0.09	0.11	0.13	0.14	0.17	0.20	0.23	0.27	0.32	0.37	0.46	0.56	0.68	0.92	1.88
	June	0.10	0.12	0.15	0.17	0.20	0.23	0.27	0.32	0.37	0.42	0.49	0.57	0.66	0.79	0.93	1.11	1.66	2.88
	July	0.22	0.23	0.25	0.26	0.28	0.30	0.33	0.36	0.40	0.43	0.48	0.54	0.59	0.70	0.79	0.91	1.27	2.08
	August	0.03	0.04	0.05	0.07	0.08	0.10	0.11	0.14	0.17	0.19	0.24	0.29	0.33	0.43	0.51	0.62	0.88	1.76
	September	0.06	0.07	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26	0.31	0.36	0.40	0.48	0.56	0.66	0.92	1.61
	October	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.24	0.29	0.35	0.42	0.51	0.74	1.40
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.21	0.25	0.61
	December	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.06	0.20
	Annual	0.58	0.64	0.76	0.86	1.01	1.15	1.30	1.55	1.79	2.03	2.37	2.78	3.19	3.90	4.64	5.57	7.61	14.64

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone.
DONIPHAN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.16
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.05	0.19	
	March	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.27	0.32	0.40	0.46	1.05
	April	0.03	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.21	0.25	0.30	0.36	0.45	0.60	1.32
	May	0.14	0.15	0.19	0.22	0.27	0.31	0.35	0.42	0.48	0.55	0.63	0.72	0.83	0.98	1.14	1.34	1.74	2.99
	June	0.14	0.16	0.19	0.22	0.26	0.29	0.33	0.39	0.45	0.51	0.59	0.69	0.78	0.94	1.10	1.30	1.83	3.19
	July	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.22	0.25	0.30	0.36	0.42	0.52	0.63	0.76	0.99	1.98
	August	0.16	0.17	0.20	0.22	0.25	0.28	0.31	0.37	0.41	0.46	0.53	0.61	0.69	0.81	0.95	1.10	1.60	2.65
	September	0.21	0.23	0.27	0.30	0.35	0.40	0.44	0.51	0.58	0.65	0.73	0.83	0.92	1.07	1.23	1.40	1.92	3.05
	October	0.07	0.08	0.09	0.11	0.13	0.14	0.16	0.19	0.22	0.25	0.29	0.35	0.39	0.48	0.57	0.67	0.79	1.58
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.24	0.62
	December	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.11	0.32
	Annual	0.84	0.94	1.13	1.28	1.52	1.73	1.95	2.33	2.68	3.04	3.51	4.09	4.66	5.61	6.61	7.83	10.36	19.10
DOUGLAS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.06	0.08	0.10	0.30	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.07	0.25	
	March	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.16	0.18	0.22	0.26	0.30	0.36	0.43	0.52	0.55	1.23
	April	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.14	0.17	0.21	0.25	0.30	0.37	0.46	0.57	0.77	1.57
	May	0.13	0.14	0.18	0.20	0.24	0.27	0.30	0.37	0.42	0.47	0.55	0.63	0.72	0.85	1.00	1.19	1.60	2.90
	June	0.26	0.28	0.33	0.36	0.41	0.46	0.51	0.59	0.67	0.74	0.85	0.96	1.07	1.26	1.44	1.66	2.51	3.94
	July	0.07	0.09	0.11	0.13	0.15	0.18	0.20	0.25	0.29	0.33	0.39	0.46	0.52	0.64	0.76	0.90	1.28	2.31
	August	0.09	0.09	0.11	0.12	0.13	0.15	0.17	0.20	0.24	0.28	0.33	0.40	0.46	0.57	0.69	0.83	1.21	2.28
	September	0.30	0.32	0.37	0.40	0.45	0.49	0.53	0.60	0.66	0.71	0.78	0.86	0.95	1.06	1.19	1.34	1.66	2.58
	October	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.16	0.20	0.24	0.29	0.38	0.47	0.59	0.88	1.77
	November	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.20	0.23	0.28	0.34	0.41	0.44	0.95
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.20	0.25	0.59
	Annual	0.97	1.08	1.28	1.43	1.68	1.90	2.13	2.54	2.90	3.27	3.79	4.39	5.01	6.00	7.06	8.37	11.32	20.69
EDWARDS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.16
	March	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.08	0.09	0.10	0.12	0.14	0.17	0.21	0.26	0.32	0.37	0.84
	April	0.07	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.15	0.16	0.18	0.21	0.24	0.28	0.33	0.39	0.38	0.92
	May	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.18	0.20	0.23	0.26	0.30	0.34	0.40	0.47	0.57	0.81	1.66
	June	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.17	0.21	0.27	0.35	0.45	0.90	1.81
	July	0.10	0.11	0.12	0.14	0.16	0.18	0.20	0.23	0.26	0.28	0.32	0.36	0.40	0.47	0.55	0.64	1.00	1.73
	August	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	0.24	0.32	0.41	0.51	0.97	1.78
	September	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.17	0.21	0.25	0.43	0.85
	October	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	0.26	0.35	0.80
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.06	0.08	0.09	0.08	0.25
	December	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.27
	Annual	0.31	0.35	0.43	0.49	0.58	0.67	0.76	0.92	1.07	1.22	1.43	1.70	1.96	2.43	2.96	3.61	5.46	11.10

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
ELK	January	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.12	0.33
	February	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.36
	March	0.05	0.05	0.07	0.08	0.10	0.11	0.12	0.16	0.18	0.20	0.24	0.27	0.32	0.38	0.45	0.54	0.60	1.26
	April	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.23	0.26	0.29	0.34	0.38	0.46	0.54	0.64	0.84	1.57
	May	0.35	0.37	0.42	0.45	0.51	0.55	0.59	0.68	0.74	0.81	0.89	0.99	1.09	1.24	1.40	1.60	1.88	3.13
	June	0.21	0.22	0.25	0.27	0.29	0.32	0.35	0.39	0.43	0.47	0.52	0.58	0.65	0.75	0.87	1.01	1.76	2.90
	July	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.13	0.16	0.20	0.24	0.29	0.37	0.46	0.57	0.94	1.73
	August	0.04	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.17	0.19	0.24	0.29	0.34	0.44	0.54	0.65	0.96	1.90
	September	0.17	0.19	0.23	0.26	0.30	0.34	0.38	0.44	0.49	0.55	0.62	0.70	0.78	0.91	1.04	1.19	1.57	2.61
	October	0.20	0.21	0.23	0.24	0.26	0.28	0.30	0.33	0.36	0.38	0.42	0.47	0.52	0.60	0.69	0.79	1.06	1.87
	November	0.11	0.12	0.13	0.14	0.16	0.18	0.20	0.23	0.25	0.28	0.31	0.35	0.39	0.45	0.52	0.61	0.63	1.22
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.08	0.10	0.13	0.16	0.46
	Annual	1.22	1.33	1.52	1.67	1.91	2.11	2.33	2.70	3.03	3.36	3.81	4.35	4.90	5.80	6.77	7.95	10.63	19.35
ELLIS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.09
	March	0.05	0.05	0.06	0.06	0.08	0.09	0.09	0.11	0.13	0.14	0.16	0.18	0.21	0.25	0.29	0.34	0.35	0.76
	April	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.13	0.16	0.20	0.34	0.77
	May	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.12	0.17	0.39	1.01
	June	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.21	0.25	0.32	0.39	0.49	0.84	1.66
	July	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.09	0.12	0.15	0.19	0.23	0.31	0.39	0.49	0.90	1.71
	August	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.12	0.14	0.19	0.25	0.32	0.62	1.27
	September	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.13	0.17	0.22	0.35	0.84
	October	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.14	0.20	0.50
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.04	0.05	0.07	0.10	0.29
	December	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.07
	Annual	0.10	0.12	0.15	0.18	0.23	0.28	0.33	0.42	0.52	0.63	0.78	0.98	1.18	1.55	1.95	2.48	4.12	8.99
ELLSWORTH	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.07	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.17
	March	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.07	0.09	0.10	0.13	0.15	0.19	0.24	0.30	0.37	0.43	0.99
	April	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.12	0.14	0.18	0.22	0.28	0.33	0.87
	May	0.07	0.08	0.11	0.13	0.15	0.18	0.20	0.25	0.29	0.33	0.39	0.45	0.52	0.63	0.74	0.89	1.13	2.20
	June	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.16	0.19	0.22	0.26	0.31	0.37	0.46	0.56	0.68	1.15	2.20
	July	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.21	0.25	0.30	0.38	0.46	0.57	0.99	1.79
	August	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.13	0.17	0.22	0.27	0.36	0.45	0.56	0.93	1.76
	September	0.17	0.18	0.21	0.23	0.25	0.27	0.30	0.33	0.36	0.39	0.43	0.47	0.51	0.58	0.65	0.73	0.97	1.59
	October	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.24	0.29	0.35	0.41	0.45	0.98
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.07	0.08	0.08	0.33
	December	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.17
	Annual	0.39	0.45	0.54	0.64	0.75	0.87	1.00	1.20	1.41	1.61	1.90	2.25	2.60	3.20	3.85	4.65	6.58	13.10

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots			
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
FINNEY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
	March	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.10	0.37
	April	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.18	0.22	0.24	0.59
	May	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.10	0.13	0.18	0.24	0.32	0.58	1.29
	June	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.08	0.13	0.17	0.24	0.61	1.36	
	July	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.19	0.24	0.31	0.48	1.09
	August	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.10	0.14	0.18	0.23	0.49	0.93
	September	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.18	0.52	
	October	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.10	0.30
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.09	0.23
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	Annual	0.03	0.04	0.06	0.08	0.10	0.13	0.17	0.22	0.29	0.36	0.46	0.60	0.74	1.01	1.31	1.70	2.91	6.80
FORD	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.08
	March	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.18	0.23	0.24	0.60
	April	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.15	0.17	0.21	0.26	0.32	0.36	0.86
	May	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.17	0.22	0.29	0.59	1.31
	June	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.11	0.14	0.17	0.23	0.30	0.39	0.79	1.57
	July	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.19	0.26	0.33	0.42	0.67	1.50
	August	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.18	0.24	0.30	0.38	0.57	1.20
	September	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.08	0.10	0.14	0.29	0.74	
	October	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.25	0.51
	November	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.19
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04	0.10	
	Annual	0.09	0.11	0.14	0.17	0.22	0.27	0.32	0.41	0.52	0.62	0.77	0.96	1.16	1.52	1.91	2.42	3.89	8.69
FRANKLIN	January	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.08	0.10	0.13	0.35	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.07	0.07	0.30	
	March	0.03	0.04	0.05	0.06	0.08	0.10	0.11	0.14	0.17	0.19	0.23	0.28	0.33	0.40	0.49	0.61	0.70	1.50
	April	0.03	0.03	0.05	0.05	0.07	0.08	0.09	0.12	0.14	0.16	0.19	0.23	0.27	0.34	0.43	0.53	0.76	1.60
	May	0.12	0.13	0.16	0.18	0.22	0.25	0.28	0.34	0.38	0.43	0.50	0.58	0.66	0.79	0.92	1.09	1.48	2.63
	June	0.19	0.20	0.24	0.27	0.32	0.36	0.40	0.47	0.54	0.60	0.69	0.79	0.89	1.05	1.23	1.43	2.14	3.57
	July	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.17	0.21	0.26	0.30	0.40	0.49	0.60	0.99	1.87
	August	0.07	0.07	0.09	0.10	0.12	0.14	0.16	0.19	0.22	0.26	0.31	0.37	0.43	0.53	0.65	0.78	1.15	2.17
	September	0.20	0.22	0.26	0.29	0.34	0.38	0.42	0.48	0.54	0.60	0.68	0.77	0.86	1.00	1.14	1.31	1.51	2.66
	October	0.04	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.18	0.22	0.26	0.31	0.38	0.47	0.57	0.95	1.78
	November	0.06	0.07	0.09	0.10	0.11	0.13	0.14	0.17	0.19	0.21	0.25	0.28	0.32	0.38	0.45	0.53	0.59	1.14
	December	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.17	0.47
	Annual	0.77	0.87	1.05	1.20	1.42	1.63	1.84	2.21	2.56	2.89	3.36	3.94	4.51	5.47	6.50	7.77	10.64	20.05

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots			
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
GEARY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.15
	March	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.22	0.25	0.29	0.34	0.41	0.48	0.58	0.61	1.24
	April	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.29	0.35	0.43	0.45	1.05
	May	0.05	0.05	0.06	0.08	0.10	0.11	0.13	0.16	0.20	0.23	0.28	0.34	0.40	0.51	0.62	0.77	1.13	2.24
	June	0.04	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.21	0.26	0.32	0.37	0.48	0.59	0.73	1.39	2.51
	July	0.06	0.07	0.09	0.10	0.12	0.13	0.15	0.18	0.22	0.25	0.30	0.36	0.42	0.52	0.63	0.76	1.16	2.09
	August	0.05	0.06	0.06	0.08	0.09	0.10	0.12	0.14	0.17	0.20	0.24	0.29	0.34	0.43	0.53	0.64	0.99	1.90
	September	0.16	0.17	0.20	0.22	0.25	0.28	0.30	0.35	0.39	0.44	0.49	0.55	0.62	0.72	0.83	0.96	1.17	2.06
	October	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.22	0.26	0.32	0.40	0.49	0.69	1.37
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.13	0.15	0.43
	December	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.30
	Annual	0.47	0.53	0.64	0.74	0.89	1.02	1.17	1.42	1.67	1.91	2.26	2.69	3.11	3.86	4.65	5.63	7.92	15.42
GOVE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.05	0.14
	March	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.14	0.17	0.20	0.24	0.27	0.59
	April	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.13	0.17	0.21	0.27	0.32	0.76
	May	0.06	0.07	0.08	0.09	0.11	0.13	0.14	0.17	0.20	0.23	0.27	0.32	0.37	0.46	0.56	0.68	0.96	1.90
	June	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.17	0.20	0.25	0.31	0.39	0.85	1.63
	July	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.17	0.21	0.26	0.30	0.39	0.48	0.58	0.96	1.83
	August	0.08	0.09	0.10	0.12	0.13	0.15	0.17	0.19	0.22	0.24	0.27	0.31	0.35	0.42	0.49	0.57	0.77	1.45
	September	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.23	0.26	0.30	0.45	0.90
	October	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.24	0.50
	November	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.31
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.09	
	Annual	0.32	0.36	0.42	0.48	0.56	0.65	0.73	0.87	1.01	1.15	1.35	1.59	1.83	2.26	2.74	3.33	5.02	10.15
GRAHAM	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.09
	March	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.13	0.16	0.19	0.23	0.24	0.59
	April	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.06	0.08	0.10	0.14	0.19	0.24	0.35	0.80
	May	0.08	0.08	0.10	0.11	0.13	0.14	0.16	0.19	0.21	0.24	0.28	0.33	0.37	0.46	0.55	0.66	0.89	1.81
	June	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.13	0.16	0.20	0.23	0.30	0.37	0.45	0.71	1.42
	July	0.03	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.10	0.12	0.15	0.18	0.21	0.28	0.35	0.44	0.73	1.52
	August	0.05	0.06	0.08	0.09	0.10	0.12	0.14	0.16	0.19	0.22	0.25	0.30	0.34	0.42	0.50	0.59	0.78	1.57
	September	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.14	0.18	0.22	0.28	0.40	0.87
	October	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.10	0.12	0.15	0.23	0.55
	November	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.28	
	December	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.17	
	Annual	0.20	0.23	0.29	0.34	0.41	0.49	0.57	0.70	0.84	0.98	1.19	1.45	1.69	2.15	2.63	3.23	4.52	9.70

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
GRANT	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	
	March	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.09	0.23
	April	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.14	0.42
	May	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.15	0.18	0.20	0.26	0.31	0.38	0.53	1.12
	June	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.18	0.23	0.29	0.57	1.15
	July	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.17	0.29	0.71
	August	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.17	0.21	0.25	0.30	0.51	0.99
	September	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.10	0.12	0.15	0.22	0.56
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.07	0.23
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.10	0.22
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	Annual	0.12	0.14	0.17	0.20	0.24	0.28	0.32	0.38	0.44	0.51	0.60	0.71	0.83	1.05	1.29	1.59	2.52	5.72
GRAY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.08
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.12
	March	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14	0.16	0.18	0.20	0.23	0.26	0.31	0.37	0.70
	April	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.15	0.18	0.23	0.28	0.34	0.39	0.88
	May	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.20	0.24	0.32	0.39	0.49	0.74	1.58
	June	0.04	0.05	0.06	0.08	0.10	0.12	0.14	0.18	0.21	0.25	0.30	0.35	0.41	0.51	0.61	0.72	1.15	1.99
	July	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.23	0.26	0.31	0.37	0.42	0.52	0.61	0.73	1.15	2.04
	August	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.17	0.21	0.25	0.28	0.35	0.42	0.51	0.69	1.32
	September	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.15	0.31	0.76
	October	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.13	0.23	0.53
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.08	0.27
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.07
	Annual	0.23	0.27	0.33	0.39	0.47	0.56	0.66	0.80	0.96	1.12	1.34	1.61	1.88	2.36	2.86	3.49	5.16	10.34
GREELEY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.04
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.05
	March	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.29
	April	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.16	0.39
	May	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.18	0.21	0.24	0.27	0.33	0.39	0.46	0.54	1.11
	June	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.12	0.17	0.22	0.29	0.58	1.22
	July	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.10	0.12	0.17	0.22	0.28	0.50	1.15
	August	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.20	0.30	0.73
	September	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.11	0.14	0.18	0.22	0.54
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.08	0.19
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.06
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.04
	Annual	0.06	0.07	0.09	0.12	0.15	0.18	0.22	0.28	0.35	0.41	0.52	0.66	0.79	1.05	1.32	1.68	2.53	5.82

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots			
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	
GREENWOOD	January	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.09	0.09	0.32
	February	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.36
	March	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.19	0.23	0.29	0.35	0.44	1.21
	April	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.17	0.19	0.22	0.26	0.30	0.36	0.44	0.53	0.64	1.56
	May	0.17	0.20	0.23	0.27	0.31	0.35	0.40	0.47	0.52	0.59	0.67	0.76	0.86	1.01	1.16	1.35	2.88
	June	0.23	0.25	0.29	0.32	0.36	0.40	0.43	0.50	0.56	0.62	0.69	0.79	0.87	1.02	1.18	1.38	3.54
	July	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.20	0.25	0.29	0.36	0.44	0.54	1.76
	August	0.03	0.04	0.06	0.07	0.09	0.11	0.14	0.17	0.21	0.25	0.31	0.38	0.44	0.56	0.69	0.84	2.48
	September	0.19	0.21	0.25	0.29	0.33	0.37	0.41	0.47	0.53	0.58	0.65	0.74	0.82	0.95	1.08	1.23	2.62
	October	0.08	0.09	0.11	0.12	0.14	0.17	0.19	0.22	0.25	0.29	0.33	0.39	0.44	0.53	0.63	0.75	1.81
	November	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.22	0.25	0.27	0.30	0.33	0.37	0.43	0.49	0.57	1.18
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.15	0.19	0.57
	Annual	0.95	1.06	1.26	1.42	1.67	1.89	2.11	2.50	2.85	3.21	3.69	4.27	4.85	5.81	6.84	8.11	20.28
HAMILTON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.06	
	March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.16	
	April	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.44	
	May	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.09	0.11	0.13	0.17	0.22	0.27	0.81
	June	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.11	0.15	0.20	0.40	0.98
	July	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.08	0.09	0.13	0.17	0.22	0.40	0.97
	August	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.06	0.08	0.25	0.67
	September	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.15	0.29	0.69
	October	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.11	0.13	0.32
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.11	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	
	Annual	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.24	0.28	0.35	0.44	0.53	0.72	0.93	1.22	5.26
HARPER	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.25
	February	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.24
	March	0.10	0.11	0.13	0.14	0.17	0.19	0.21	0.25	0.27	0.31	0.34	0.38	0.43	0.49	0.56	0.64	1.23
	April	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.15	0.18	0.20	0.24	0.28	0.32	0.39	0.47	0.56	1.32
	May	0.14	0.16	0.19	0.22	0.25	0.28	0.31	0.36	0.41	0.46	0.51	0.58	0.65	0.75	0.86	0.98	2.10
	June	0.07	0.09	0.11	0.13	0.15	0.17	0.20	0.24	0.28	0.32	0.37	0.44	0.50	0.61	0.73	0.86	2.38
	July	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.09	0.12	0.15	0.21	0.28	0.36	0.66	1.42
	August	0.03	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.09	0.11	0.14	0.17	0.20	0.27	0.33	0.42	1.53
	September	0.06	0.07	0.08	0.10	0.12	0.13	0.15	0.19	0.22	0.25	0.29	0.34	0.39	0.46	0.54	0.64	1.54
	October	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.23	0.28	0.33	0.91
	November	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.26	0.67
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.21	
	Annual	0.49	0.55	0.67	0.78	0.92	1.07	1.22	1.46	1.70	1.94	2.27	2.67	3.04	3.71	4.41	5.28	13.80

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone
HARVEY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.11	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.06	0.21	
	March	0.11	0.11	0.13	0.14	0.16	0.17	0.18	0.21	0.23	0.25	0.28	0.31	0.34	0.39	0.45	0.53	0.59	1.15
	April	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.15	0.17	0.19	0.21	0.24	0.28	0.33	0.39	0.48	0.60	1.23
	May	0.10	0.11	0.14	0.16	0.19	0.22	0.25	0.31	0.36	0.41	0.47	0.55	0.62	0.74	0.88	1.04	1.35	2.51
	June	0.17	0.18	0.21	0.23	0.26	0.29	0.32	0.36	0.40	0.44	0.50	0.57	0.63	0.74	0.86	1.01	1.68	2.77
	July	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.18	0.21	0.24	0.31	0.38	0.46	0.84	1.52
	August	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.17	0.21	0.28	0.36	0.46	0.78	1.64
	September	0.11	0.12	0.14	0.16	0.18	0.21	0.23	0.26	0.30	0.33	0.37	0.42	0.47	0.56	0.65	0.75	1.10	1.94
	October	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.18	0.21	0.26	0.30	0.38	0.45	0.54	0.71	1.38
	November	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.18	0.23	0.24	0.64
	December	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.33	
	Annual	0.62	0.70	0.83	0.94	1.10	1.25	1.40	1.65	1.89	2.13	2.46	2.87	3.27	3.97	4.72	5.64	8.09	15.44
HASKELL	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.04
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.07
	March	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.21	0.25	0.47
	April	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.15	0.19	0.50
	May	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.23	0.29	0.36	0.45	0.65	1.47
	June	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.15	0.18	0.25	0.32	0.41	0.71	1.53
	July	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.11	0.14	0.16	0.21	0.26	0.33	0.57	1.21
	August	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.08	0.12	0.16	0.22	0.48	1.04
	September	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.08	0.11	0.14	0.18	0.29	0.77
	October	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.08	0.10	0.13	0.39	
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.11	0.25	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	
	Annual	0.12	0.14	0.17	0.19	0.23	0.26	0.31	0.38	0.46	0.55	0.67	0.84	1.01	1.32	1.67	2.12	3.40	7.75
HODGEMAN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.08
	February	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.19	
	March	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.16	0.18	0.21	0.25	0.30	0.36	0.43	0.88
	April	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.19	0.23	0.29	0.37	0.87
	May	0.02	0.02	0.03	0.04	0.05	0.06	0.06	0.08	0.10	0.11	0.13	0.16	0.18	0.22	0.27	0.34	0.52	1.22
	June	0.02	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.13	0.15	0.19	0.23	0.27	0.35	0.43	0.54	1.06	1.89
	July	0.02	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.09	0.11	0.13	0.16	0.19	0.25	0.31	0.39	0.64	1.29
	August	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.06	0.08	0.11	0.15	0.20	0.26	0.33	0.53	1.08
	September	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.07	0.10	0.17	0.50	
	October	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.17	0.21	0.26	0.62
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.06	0.08	0.10	0.13	0.23	0.44	0.90
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.04		
	Annual	0.12	0.14	0.18	0.22	0.28	0.34	0.40	0.51	0.62	0.74	0.90	1.11	1.32	1.71	2.13	2.67	4.22	9.09

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots			
		.60	.62	.64	.66	.68	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88	.90	Earth	Conc.
JACKSON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.13
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.20
	March	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.13	0.16	0.18	0.23	0.28	0.34	0.41	0.94
	April	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.10	0.12	0.14	0.17	0.20	0.27	0.34	0.43	0.61	1.38
	May	0.05	0.06	0.08	0.09	0.12	0.14	0.16	0.21	0.25	0.30	0.36	0.44	0.52	0.65	0.79	0.96	1.30	2.49
	June	0.21	0.23	0.28	0.31	0.36	0.40	0.45	0.52	0.59	0.65	0.74	0.84	0.94	1.10	1.28	1.48	2.26	3.59
	July	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.20	0.24	0.29	0.34	0.42	0.51	0.63	0.98	1.89
	August	0.22	0.24	0.28	0.31	0.35	0.38	0.42	0.48	0.53	0.58	0.65	0.73	0.81	0.94	1.07	1.23	1.60	2.68
	September	0.34	0.37	0.42	0.46	0.52	0.57	0.62	0.70	0.77	0.84	0.93	1.03	1.12	1.27	1.41	1.58	1.76	2.80
	October	0.11	0.12	0.14	0.17	0.19	0.22	0.24	0.28	0.32	0.35	0.40	0.46	0.51	0.60	0.69	0.81	0.98	1.76
	November	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.14	0.18	0.23	0.29	0.32	0.78
	December	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.09	0.11	0.12	0.13	0.15	0.18	0.19	0.41
	Annual	1.06	1.18	1.39	1.56	1.80	2.02	2.24	2.63	2.98	3.33	3.80	4.36	4.92	5.84	6.81	8.00	10.49	19.04
JEFFERSON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.21
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.04	0.04	0.20
	March	0.02	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.12	0.15	0.17	0.21	0.25	0.30	0.37	0.45	0.52	1.15
	April	0.04	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.14	0.17	0.20	0.24	0.28	0.35	0.43	0.53	0.79	1.60
	May	0.21	0.23	0.27	0.30	0.36	0.40	0.44	0.52	0.58	0.65	0.73	0.83	0.94	1.09	1.26	1.47	1.81	3.19
	June	0.25	0.27	0.31	0.34	0.40	0.44	0.48	0.56	0.62	0.69	0.77	0.86	0.96	1.11	1.27	1.47	2.21	3.67
	July	0.07	0.08	0.10	0.13	0.15	0.18	0.21	0.25	0.30	0.34	0.41	0.49	0.56	0.69	0.82	0.97	1.40	2.46
	August	0.03	0.03	0.04	0.06	0.07	0.09	0.11	0.15	0.18	0.22	0.27	0.33	0.39	0.50	0.61	0.75	1.26	2.33
	September	0.31	0.34	0.38	0.42	0.47	0.51	0.56	0.64	0.71	0.77	0.86	0.96	1.06	1.21	1.36	1.54	1.77	2.92
	October	0.13	0.13	0.15	0.16	0.18	0.21	0.23	0.26	0.30	0.33	0.38	0.44	0.49	0.59	0.69	0.80	1.03	1.92
	November	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.14	0.16	0.19	0.22	0.25	0.29	0.34	0.40	0.42	0.90
	December	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.14	0.16	0.42	
	Annual	1.11	1.22	1.43	1.60	1.86	2.10	2.34	2.76	3.13	3.51	4.02	4.64	5.25	6.24	7.30	8.60	11.45	20.96
JEWELL	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.06	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.16	
	March	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.26	0.32	0.34	0.78
	April	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.10	0.13	0.16	0.20	0.25	0.31	0.40	0.97
	May	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.14	0.17	0.21	0.26	0.31	0.40	0.49	0.62	0.98	1.93
	June	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.16	0.19	0.23	0.28	0.35	0.44	0.54	1.11	2.04
	July	0.05	0.05	0.06	0.07	0.09	0.10	0.11	0.14	0.16	0.19	0.22	0.27	0.32	0.41	0.50	0.61	0.86	1.74
	August	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.07	0.09	0.10	0.13	0.17	0.20	0.27	0.35	0.45	0.92	1.82
	September	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.21	0.24	0.28	0.34	0.39	0.48	0.57	0.68	0.87	1.75
	October	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.18	0.20	0.24	0.28	0.33	0.40	0.83
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.08	0.10	0.34	
	December	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.15	
	Annual	0.24	0.28	0.35	0.42	0.51	0.60	0.70	0.86	1.04	1.21	1.46	1.77	2.08	2.64	3.26	4.03	6.10	12.57



**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone
KIOWA	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.20
	March	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.08	0.09	0.11	0.14	0.18	0.22	0.23	0.58
	April	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.16	0.19	0.24	0.26	0.69
	May	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.21	0.24	0.26	0.30	0.34	0.39	0.46	0.54	0.65	0.86	1.68
	June	0.05	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.21	0.25	0.29	0.35	0.40	0.50	0.61	0.74	1.23	2.25
	July	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.23	0.29	0.36	0.62	1.26
	August	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.10	0.12	0.15	0.20	0.26	0.33	0.58	1.28
	September	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.15	0.17	0.20	0.22	0.26	0.31	0.36	0.61	1.07
	October	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.17	0.21	0.25	0.33	0.75
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.26	0.08
	December	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.06	0.17	
	Annual	0.26	0.30	0.37	0.43	0.51	0.59	0.68	0.82	0.97	1.11	1.31	1.56	1.81	2.26	2.74	3.35	4.93	10.22
LABETTE	January	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.19	0.20	0.56
	February	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.08	0.09	0.11	0.12	0.14	0.17	0.20	0.23	0.53
	March	0.14	0.15	0.18	0.20	0.23	0.26	0.28	0.33	0.37	0.41	0.47	0.53	0.60	0.70	0.81	0.95	1.03	1.94
	April	0.15	0.17	0.20	0.22	0.25	0.28	0.31	0.36	0.41	0.46	0.52	0.59	0.67	0.78	0.91	1.06	1.22	2.18
	May	0.24	0.26	0.31	0.34	0.40	0.44	0.48	0.57	0.63	0.70	0.79	0.89	0.99	1.15	1.32	1.51	1.88	3.18
	June	0.29	0.32	0.36	0.39	0.44	0.48	0.52	0.59	0.65	0.72	0.81	0.91	1.01	1.18	1.35	1.55	2.17	3.46
	July	0.30	0.31	0.33	0.35	0.37	0.39	0.41	0.44	0.47	0.50	0.54	0.59	0.63	0.72	0.80	0.90	1.15	1.91
	August	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.28	0.36	0.43	0.57	0.71	0.88	1.26	2.46
	September	0.25	0.28	0.33	0.37	0.42	0.48	0.53	0.62	0.70	0.78	0.88	1.00	1.11	1.28	1.46	1.67	2.25	3.42
	October	0.20	0.21	0.24	0.27	0.30	0.33	0.37	0.42	0.47	0.52	0.58	0.66	0.73	0.85	0.97	1.12	1.40	2.36
	November	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.32	0.36	0.41	0.46	0.52	0.58	0.68	0.78	0.90	0.95	1.73
	December	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.13	0.15	0.19	0.23	0.28	0.35	0.76
	Annual	1.78	1.93	2.22	2.44	2.79	3.09	3.40	3.94	4.43	4.92	5.57	6.35	7.12	8.36	9.66	11.23	14.10	24.50
LANE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.06
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.09
	March	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.49
	April	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.26	0.26	0.68
	May	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.19	0.25	0.31	0.39	0.56	1.27
	June	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.12	0.18	0.25	0.33	0.73	1.47	
	July	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.14	0.19	0.25	0.32	0.63	1.31
	August	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.23	0.28	0.35	0.48	1.05
	September	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22	0.25	0.30	0.35	0.42	0.50	0.99
	October	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.07	0.09	0.11	0.20	0.20	0.42
	November	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.11	0.29
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04
	Annual	0.10	0.12	0.16	0.19	0.24	0.29	0.35	0.45	0.55	0.65	0.80	1.00	1.19	1.55	1.95	2.45	3.68	8.17

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots				
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90		
LEAVENWORTH	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.08		
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06		
	March	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.14	0.17	0.20	0.23	0.29	0.35	0.42		
	April	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.20	0.23	0.27	0.31	0.36	0.44	0.52	0.62		
	May	0.27	0.30	0.34	0.38	0.43	0.48	0.52	0.60	0.66	0.73	0.81	0.91	1.00	1.15	1.31	1.51		
	June	0.07	0.08	0.09	0.11	0.13	0.16	0.18	0.22	0.26	0.30	0.36	0.43	0.50	0.63	0.76	0.92		
	July	0.22	0.24	0.27	0.29	0.33	0.37	0.41	0.47	0.52	0.58	0.65	0.74	0.82	0.96	1.10	1.25		
	August	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.23	0.27	0.31	0.37	0.44	0.51	0.63	0.76	0.91		
	September	0.29	0.32	0.38	0.43	0.49	0.55	0.60	0.70	0.78	0.85	0.95	1.06	1.17	1.34	1.50	1.69		
	October	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.29	0.33	0.37	0.42	0.49	0.55	0.66	0.78	0.92		
	November	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.22	0.27	0.32	0.39		
	December	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.13	0.16	0.17		
	Annual	1.15	1.28	1.51	1.69	1.97	2.22	2.47	2.92	3.32	3.72	4.25	4.89	5.51	6.55	7.63	8.94		
															12.17	21.22			
LINCOLN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.11	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.20
	March	0.02	0.02	0.03	0.03	0.05	0.05	0.07	0.09	0.10	0.12	0.15	0.18	0.21	0.26	0.32	0.40	0.48	1.01
	April	0.05	0.05	0.06	0.07	0.08	0.09	0.09	0.11	0.12	0.13	0.15	0.17	0.19	0.23	0.27	0.32	0.41	0.89
	May	0.15	0.16	0.18	0.20	0.22	0.24	0.26	0.30	0.33	0.37	0.42	0.47	0.53	0.63	0.74	0.88	1.12	2.18
	June	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.29	0.37	0.48	0.95	1.80
	July	0.03	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.13	0.15	0.19	0.23	0.28	0.36	0.44	0.55	0.98	1.80
	August	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.10	0.12	0.15	0.19	0.23	0.32	0.40	0.51	0.96	1.79
	September	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.28	0.33	0.40	0.51	1.14
	October	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.19	0.25	0.30	0.36	0.55	1.07
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.12	0.13	0.41
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.19	
	Annual	0.32	0.37	0.44	0.51	0.60	0.70	0.81	0.97	1.15	1.33	1.59	1.91	2.22	2.78	3.39	4.16	6.27	12.59
LINN	January	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.17	0.44	
	February	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16	0.19	0.50
	March	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.20	0.23	0.26	0.31	0.36	0.41	0.50	0.60	0.72	0.85	1.69
	April	0.05	0.06	0.08	0.09	0.12	0.14	0.16	0.20	0.24	0.28	0.33	0.40	0.46	0.56	0.67	0.81	1.00	1.94
	May	0.23	0.25	0.29	0.31	0.36	0.39	0.43	0.50	0.56	0.62	0.69	0.78	0.87	1.02	1.17	1.36	1.80	3.05
	June	0.12	0.13	0.15	0.17	0.20	0.23	0.26	0.31	0.35	0.40	0.47	0.56	0.64	0.79	0.94	1.14	1.90	3.29
	July	0.04	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.15	0.17	0.21	0.25	0.29	0.37	0.46	0.55	0.83	1.68
	August	0.12	0.13	0.16	0.18	0.22	0.25	0.28	0.34	0.39	0.45	0.52	0.60	0.68	0.83	0.97	1.14	1.56	2.74
	September	0.30	0.32	0.37	0.41	0.46	0.51	0.55	0.64	0.70	0.77	0.86	0.96	1.05	1.20	1.36	1.54	1.74	2.90
	October	0.15	0.16	0.19	0.20	0.24	0.26	0.28	0.33	0.37	0.41	0.45	0.52	0.58	0.68	0.78	0.91	1.16	2.06
	November	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.21	0.23	0.26	0.29	0.33	0.37	0.42	0.49	0.57	0.67	1.27
	December	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.08	0.10	0.12	0.14	0.18	0.22	0.25	0.60
	Annual	1.20	1.31	1.55	1.72	2.01	2.26	2.51	2.98	3.37	3.78	4.32	4.98	5.64	6.71	7.86	9.27	12.12	22.15

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots				
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
LOGAN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	March	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.38
	April	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10	0.13	0.42	
	May	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.13	0.15	0.18	0.22	0.26	0.33	0.41	0.51	0.70	1.51
	June	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.22	0.28	0.35	0.68	1.46
	July	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.19	0.24	0.29	0.48	1.08
	August	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.06	0.08	0.09	0.13	0.17	0.22	0.38	0.86
	September	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.13	0.17	0.31	0.70	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.12	0.29
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.06	0.18
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	Annual	0.09	0.10	0.13	0.15	0.18	0.22	0.26	0.33	0.40	0.48	0.60	0.75	0.90	1.19	1.50	1.91	3.03	6.95
LYON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.05	0.20
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.28
	March	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22	0.26	0.32	0.38	0.46	0.53	1.18
	April	0.06	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.18	0.20	0.23	0.27	0.31	0.38	0.46	0.55	0.68	1.44
	May	0.12	0.13	0.16	0.19	0.23	0.26	0.30	0.36	0.41	0.47	0.55	0.63	0.72	0.85	1.00	1.17	1.44	2.63
	June	0.15	0.17	0.20	0.22	0.26	0.29	0.32	0.38	0.43	0.48	0.55	0.65	0.73	0.88	1.03	1.22	1.94	3.25
	July	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.16	0.19	0.22	0.27	0.31	0.40	0.48	0.54	0.93	1.75
	August	0.04	0.04	0.06	0.07	0.08	0.10	0.12	0.14	0.18	0.20	0.25	0.31	0.36	0.46	0.57	0.70	1.13	2.11
	September	0.17	0.19	0.23	0.25	0.29	0.33	0.36	0.41	0.46	0.51	0.57	0.64	0.71	0.81	0.93	1.06	1.34	2.26
	October	0.07	0.07	0.09	0.10	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.30	0.34	0.41	0.49	0.59	0.79	1.51
	November	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.20	0.23	0.28	0.33	0.39	0.43	0.90
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.15	0.17	0.45	
	Annual	0.74	0.82	0.99	1.12	1.32	1.51	1.70	2.03	2.33	2.64	3.06	3.57	4.08	4.94	5.85	6.98	9.50	17.94
MARION	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.16
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.09	0.25
	March	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.24	0.30	0.37	0.41	1.02
	April	0.07	0.07	0.09	0.10	0.12	0.13	0.14	0.16	0.18	0.20	0.23	0.26	0.29	0.35	0.42	0.51	0.62	1.35
	May	0.10	0.11	0.14	0.16	0.19	0.22	0.26	0.31	0.36	0.41	0.48	0.56	0.65	0.79	0.94	1.11	1.46	2.71
	June	0.29	0.31	0.34	0.37	0.41	0.45	0.49	0.54	0.60	0.65	0.72	0.80	0.87	1.00	1.13	1.29	1.93	3.10
	July	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.24	0.29	0.35	0.41	0.51	0.61	0.74	1.04	1.90
	August	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.14	0.21	0.28	0.36	0.46	0.74	1.61
	September	0.09	0.10	0.12	0.14	0.17	0.19	0.22	0.26	0.30	0.34	0.40	0.47	0.53	0.64	0.75	0.89	1.22	2.18
	October	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.19	0.24	0.29	0.34	0.43	0.52	0.62	0.74	1.49
	November	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.17	0.21	0.26	0.31	0.72
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.10	0.30		
	Annual	0.65	0.72	0.86	0.98	1.14	1.31	1.47	1.75	2.03	2.30	2.69	3.15	3.61	4.42	5.27	6.33	8.68	16.79

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
MARSHALL	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.15	
	March	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.20	0.26	0.30	0.81
	April	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.21	0.28	0.37	0.93
	May	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.21	0.25	0.29	0.35	0.41	0.48	0.59	0.71	0.86	1.12	2.23
	June	0.09	0.11	0.13	0.16	0.19	0.22	0.24	0.30	0.34	0.39	0.44	0.51	0.59	0.70	0.83	0.98	1.68	2.88
	July	0.08	0.09	0.11	0.13	0.14	0.16	0.18	0.21	0.24	0.27	0.32	0.37	0.42	0.51	0.60	0.71	1.03	1.91
	August	0.07	0.08	0.09	0.11	0.13	0.14	0.16	0.20	0.23	0.26	0.30	0.35	0.40	0.49	0.58	0.70	1.15	2.12
	September	0.10	0.11	0.12	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.32	0.37	0.42	0.51	0.60	0.71	1.02	1.88
	October	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.18	0.23	0.28	0.35	0.59	1.21
	November	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.13	0.44
	December	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.21	
	Annual	0.44	0.50	0.61	0.70	0.84	0.97	1.11	1.34	1.56	1.78	2.09	2.46	2.84	3.48	4.18	5.07	7.51	14.83
MCPHERSON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.07	
	February	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.23
	March	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.14	0.16	0.18	0.21	0.25	0.29	0.35	0.42	0.50	0.54	1.11
	April	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.23	0.29	0.37	0.49	1.17
	May	0.12	0.13	0.16	0.18	0.21	0.24	0.27	0.32	0.36	0.40	0.46	0.52	0.59	0.69	0.80	0.94	1.19	2.14
	June	0.12	0.13	0.15	0.17	0.21	0.23	0.26	0.30	0.35	0.39	0.44	0.51	0.58	0.70	0.83	0.99	1.60	2.82
	July	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	0.25	0.33	0.42	0.52	0.89	1.71
	August	0.04	0.04	0.06	0.07	0.08	0.10	0.11	0.14	0.17	0.19	0.23	0.29	0.34	0.43	0.52	0.64	1.09	1.93
	September	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.26	0.30	0.33	0.38	0.43	0.49	0.57	0.66	0.77	1.00	1.77
	October	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.34	0.40	0.47	0.61	1.17
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.44
	December	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.06	0.08	0.20	
	Annual	0.52	0.58	0.71	0.81	0.96	1.10	1.24	1.49	1.73	1.97	2.30	2.71	3.11	3.81	4.54	5.46	7.71	14.75
MEADE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.07	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.17
	March	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.19	0.23	0.28	0.33	0.35	0.74
	April	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.11	0.15	0.22	0.59
	May	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.18	0.21	0.24	0.28	0.33	0.41	0.50	0.61	0.85	1.73
	June	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.25	0.32	0.39	0.49	0.79	1.56
	July	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.19	0.23	0.30	0.38	0.47	0.80	1.48
	August	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.11	0.13	0.18	0.23	0.30	0.63	1.18
	September	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.08	0.10	0.14	0.19	0.26	0.36	0.95
	October	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.20	0.49
	November	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.26	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.11	
	Annual	0.13	0.16	0.20	0.24	0.30	0.37	0.43	0.54	0.66	0.78	0.96	1.18	1.42	1.83	2.29	2.88	4.39	9.33

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots				
		60	62	.64	66	68	.70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
MIAMI	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.12	0.38
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.06	0.07	0.27
	March	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.20	0.25	0.32	0.40	0.49	1.16
	April	0.05	0.06	0.08	0.09	0.12	0.13	0.16	0.20	0.23	0.27	0.31	0.37	0.43	0.52	0.63	0.76	0.93	1.84
	May	0.14	0.15	0.18	0.20	0.24	0.27	0.30	0.36	0.41	0.47	0.54	0.62	0.71	0.85	1.00	1.18	1.63	2.82
	June	0.21	0.24	0.29	0.33	0.38	0.44	0.49	0.58	0.67	0.75	0.86	0.99	1.10	1.31	1.51	1.76	2.63	4.19
	July	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.20	0.25	0.29	0.38	0.46	0.57	0.90	1.77
	August	0.06	0.06	0.08	0.09	0.10	0.12	0.14	0.17	0.21	0.24	0.29	0.35	0.41	0.52	0.64	0.79	1.29	2.39
	September	0.23	0.26	0.31	0.36	0.41	0.47	0.52	0.60	0.68	0.75	0.84	0.95	1.04	1.20	1.35	1.53	1.89	2.92
	October	0.10	0.11	0.13	0.15	0.18	0.20	0.22	0.27	0.31	0.34	0.40	0.46	0.52	0.62	0.73	0.86	1.13	2.07
	November	0.05	0.06	0.08	0.09	0.10	0.12	0.13	0.16	0.18	0.20	0.23	0.27	0.31	0.37	0.43	0.51	0.56	1.13
	December	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.15	0.21	0.50	
	Annual	0.87	0.99	1.20	1.38	1.63	1.88	2.13	2.55	2.94	3.33	3.87	4.50	5.14	6.19	7.30	8.65	11.83	21.43
MITCHELL	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.09
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.17
	March	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.15	0.17	0.20	0.25	0.30	0.36	0.39	0.89
	April	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.19	0.23	0.28	0.35	0.86
	May	0.08	0.09	0.10	0.12	0.15	0.17	0.19	0.23	0.26	0.30	0.35	0.41	0.47	0.57	0.68	0.82	1.12	2.17
	June	0.12	0.13	0.15	0.17	0.20	0.23	0.25	0.30	0.34	0.38	0.44	0.51	0.58	0.69	0.80	0.94	1.44	2.48
	July	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.07	0.08	0.09	0.11	0.14	0.17	0.21	0.27	0.34	0.69	1.40
	August	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.11	0.17	0.23	0.32	0.64	1.43	
	September	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.22	0.28	0.34	0.58	1.22
	October	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.17	0.21	0.27	0.45	0.92
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06	0.08	0.08	0.08	0.28
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.04	0.14
	Annual	0.29	0.33	0.41	0.47	0.57	0.66	0.76	0.92	1.08	1.24	1.48	1.76	2.05	2.56	3.12	3.84	5.84	12.05
MONTGOMERY	January	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.17	0.42
	February	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.17	0.20	0.49
	March	0.19	0.21	0.23	0.25	0.29	0.31	0.34	0.38	0.42	0.46	0.51	0.57	0.64	0.74	0.85	0.98	1.09	1.97
	April	0.09	0.10	0.12	0.13	0.16	0.18	0.20	0.25	0.29	0.32	0.38	0.44	0.50	0.60	0.71	0.84	0.88	1.79
	May	0.20	0.23	0.28	0.31	0.37	0.42	0.47	0.55	0.63	0.70	0.79	0.90	1.02	1.18	1.36	1.58	1.93	3.34
	June	0.21	0.24	0.27	0.30	0.33	0.38	0.42	0.48	0.54	0.60	0.69	0.79	0.88	1.04	1.21	1.40	2.14	3.49
	July	0.05	0.06	0.07	0.09	0.10	0.11	0.13	0.15	0.18	0.20	0.23	0.28	0.31	0.39	0.46	0.55	0.93	1.64
	August	0.11	0.12	0.13	0.14	0.16	0.18	0.19	0.22	0.25	0.28	0.32	0.37	0.42	0.51	0.61	0.73	0.98	1.97
	September	0.20	0.22	0.26	0.29	0.34	0.38	0.42	0.49	0.55	0.61	0.69	0.78	0.88	1.02	1.16	1.34	1.73	2.79
	October	0.34	0.36	0.39	0.42	0.45	0.48	0.51	0.56	0.60	0.63	0.69	0.74	0.80	0.90	1.00	1.12	1.40	2.26
	November	0.11	0.12	0.15	0.17	0.19	0.22	0.24	0.28	0.32	0.35	0.39	0.45	0.50	0.59	0.67	0.78	0.80	1.52
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.15	0.19	0.22	0.55
	Annual	1.53	1.68	1.93	2.14	2.44	2.72	2.99	3.46	3.88	4.30	4.86	5.53	6.20	7.28	8.43	9.83	12.46	22.23

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
MORRIS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.25
	March	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.24	0.30	0.36	0.43	0.50	1.09
	April	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.14	0.15	0.17	0.20	0.24	0.27	0.34	0.41	0.50	0.57	1.29
	May	0.05	0.06	0.08	0.10	0.13	0.16	0.19	0.23	0.27	0.32	0.38	0.45	0.52	0.63	0.76	0.91	1.13	2.20
	June	0.07	0.09	0.10	0.12	0.15	0.17	0.19	0.23	0.27	0.31	0.37	0.44	0.51	0.64	0.77	0.93	1.59	2.78
	July	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.08	0.11	0.14	0.18	0.22	0.30	0.39	0.49	0.96	1.74
	August	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.11	0.14	0.18	0.22	0.29	0.37	0.48	0.87	1.82
	September	0.09	0.10	0.12	0.13	0.16	0.18	0.20	0.24	0.27	0.30	0.34	0.38	0.43	0.50	0.58	0.67	0.87	1.61
	October	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.14	0.16	0.20	0.23	0.29	0.36	0.43	0.61	1.28
	November	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.24	0.27	0.64
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.06	0.08	0.11	0.14	0.37
	Annual	0.36	0.42	0.52	0.61	0.74	0.88	1.02	1.24	1.48	1.71	2.04	2.44	2.84	3.55	4.31	5.26	7.60	15.16
MORTON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	
	March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.12	0.32
	April	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.09	0.10	0.13	0.15	0.18	0.21	0.26	0.29	0.62
	May	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.17	0.22	0.28	0.44	1.04
	June	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.12	0.16	0.21	0.38	0.96	
	July	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	0.26	0.54	1.18
	August	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.21	0.23	0.27	0.31	0.36	0.44	0.91
	September	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.13	0.17	0.29	0.67	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.18	
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.20	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	
	Annual	0.11	0.12	0.15	0.18	0.21	0.26	0.30	0.36	0.43	0.50	0.60	0.73	0.86	1.11	1.38	1.73	2.64	6.26
NEMAHA	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.22		
	March	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.20	0.25	0.31	0.38	0.43	1.00
	April	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.23	0.27	0.33	0.40	0.49	0.53	1.22
	May	0.07	0.08	0.10	0.12	0.15	0.18	0.21	0.26	0.31	0.36	0.42	0.50	0.58	0.70	0.84	1.01	1.46	2.67
	June	0.12	0.14	0.17	0.20	0.24	0.28	0.32	0.38	0.45	0.51	0.59	0.69	0.78	0.93	1.09	1.28	2.09	3.34
	July	0.03	0.04	0.06	0.07	0.09	0.11	0.13	0.16	0.20	0.23	0.28	0.34	0.39	0.49	0.59	0.71	1.08	2.05
	August	0.04	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.20	0.24	0.30	0.35	0.45	0.56	0.69	1.26	2.28
	September	0.15	0.17	0.20	0.22	0.26	0.29	0.32	0.37	0.42	0.47	0.53	0.60	0.67	0.79	0.91	1.05	1.46	2.41
	October	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.14	0.17	0.21	0.25	0.31	0.38	0.47	0.76	1.41
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.16	0.20	0.24	0.65	
	December	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.07	0.09	0.09	0.26	
	Annual	0.48	0.56	0.70	0.83	1.01	1.18	1.36	1.66	1.95	2.25	2.65	3.14	3.62	4.43	5.32	6.40	9.47	17.62

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
NEOSHO	January	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.12	0.38
	February	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.19	0.23	0.23	0.57
	March	0.12	0.13	0.15	0.17	0.20	0.22	0.24	0.29	0.32	0.36	0.41	0.47	0.53	0.61	0.72	0.84	0.95	1.77
	April	0.10	0.11	0.13	0.15	0.18	0.20	0.22	0.27	0.31	0.34	0.39	0.45	0.52	0.61	0.72	0.85	0.87	1.76
	May	0.39	0.42	0.48	0.52	0.59	0.64	0.70	0.80	0.87	0.95	1.04	1.15	1.27	1.43	1.61	1.82	2.32	3.66
	June	0.13	0.15	0.18	0.20	0.23	0.26	0.29	0.34	0.39	0.44	0.50	0.58	0.66	0.80	0.94	1.12	1.74	3.06
	July	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.18	0.22	0.25	0.30	0.36	0.42	0.52	0.63	0.76	1.24	2.18
	August	0.03	0.04	0.06	0.07	0.09	0.11	0.13	0.17	0.21	0.25	0.30	0.37	0.43	0.55	0.68	0.83	1.33	2.48
	September	0.12	0.13	0.17	0.19	0.23	0.27	0.30	0.37	0.43	0.48	0.56	0.66	0.75	0.89	1.04	1.22	1.59	2.70
	October	0.20	0.21	0.24	0.27	0.29	0.32	0.35	0.39	0.44	0.48	0.54	0.61	0.68	0.80	0.92	1.07	1.41	2.35
	November	0.11	0.12	0.14	0.16	0.19	0.21	0.23	0.27	0.30	0.33	0.38	0.43	0.48	0.56	0.64	0.74	0.81	1.46
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.20	0.26	0.63
	Annual	1.27	1.40	1.65	1.85	2.16	2.42	2.69	3.18	3.60	4.03	4.62	5.31	6.00	7.13	8.34	9.81	12.89	23.01
NESS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.11
	March	0.04	0.04	0.05	0.05	0.07	0.07	0.08	0.09	0.11	0.12	0.13	0.15	0.18	0.21	0.24	0.29	0.32	0.68
	April	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.12	0.16	0.22	0.28	0.28	0.73
	May	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.22	0.29	0.48	1.17
	June	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.14	0.16	0.19	0.23	0.26	0.33	0.41	0.49	0.94	1.73
	July	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.10	0.14	0.17	0.23	0.30	0.39	0.72	1.50
	August	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10	0.15	0.21	0.46	1.06	
	September	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.08	0.10	0.14	0.17	0.22	0.35	0.86	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.14	0.41		
	November	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.10	0.30	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.07	
	Annual	0.10	0.12	0.15	0.17	0.22	0.27	0.31	0.40	0.49	0.59	0.73	0.91	1.09	1.45	1.84	2.35	3.85	8.64
NORTON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.09
	March	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.22	0.25	0.58
	April	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.10	0.14	0.18	0.29	0.71
	May	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.12	0.14	0.16	0.19	0.22	0.27	0.34	0.42	0.53	0.83	1.72
	June	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.17	0.21	0.27	0.34	0.43	0.74	1.53
	July	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.13	0.15	0.21	0.27	0.34	0.64	1.34
	August	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06	0.07	0.08	0.11	0.13	0.17	0.22	0.28	0.47	1.14
	September	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.14	0.33	0.72
	October	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.08	0.10	0.23	0.50		
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.09	0.27	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	
	Annual	0.08	0.10	0.13	0.16	0.20	0.25	0.30	0.38	0.47	0.56	0.70	0.88	1.07	1.41	1.80	2.32	3.91	8.71

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone
OSAGE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.19
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.21
	March	0.03	0.04	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.14	0.17	0.20	0.23	0.28	0.34	0.42	0.48	1.06
	April	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.16	0.18	0.21	0.25	0.29	0.33	0.40	0.48	0.58	0.77	1.50
	May	0.08	0.09	0.12	0.14	0.17	0.20	0.23	0.29	0.34	0.39	0.46	0.54	0.63	0.76	0.90	1.07	1.31	2.49
	June	0.19	0.21	0.25	0.29	0.34	0.38	0.42	0.49	0.56	0.62	0.71	0.81	0.90	1.06	1.23	1.42	2.02	3.40
	July	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.09	0.11	0.15	0.17	0.24	0.30	0.38	0.50	1.22
	August	0.04	0.04	0.06	0.07	0.08	0.10	0.12	0.15	0.19	0.22	0.27	0.33	0.39	0.50	0.61	0.74	1.06	2.00
	September	0.21	0.22	0.25	0.27	0.30	0.33	0.35	0.41	0.44	0.48	0.53	0.59	0.65	0.74	0.85	0.97	1.29	2.16
	October	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.23	0.31	0.54	1.20
	November	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.15	0.17	0.20	0.24	0.29	0.35	0.39	0.85
	December	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.14	0.40
	Annual	0.63	0.70	0.85	0.97	1.16	1.33	1.50	1.81	2.09	2.38	2.77	3.24	3.71	4.52	5.38	6.44	8.59	16.68
OSBORNE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.06
	February	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.14	
	March	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.20	0.25	0.30	0.37	0.40	0.88
	April	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.09	0.11	0.15	0.19	0.25	0.30	0.82
	May	0.17	0.18	0.20	0.22	0.24	0.26	0.28	0.32	0.35	0.38	0.42	0.46	0.52	0.59	0.68	0.79	1.08	1.92
	June	0.05	0.05	0.06	0.07	0.09	0.10	0.11	0.14	0.16	0.18	0.22	0.26	0.30	0.37	0.44	0.54	0.85	1.67
	July	0.03	0.03	0.04	0.05	0.06	0.07	0.07	0.09	0.11	0.12	0.15	0.18	0.21	0.28	0.34	0.43	0.71	1.46
	August	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.07	0.10	0.13	0.15	0.21	0.27	0.35	0.54	1.18
	September	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22	0.25	0.31	0.38	0.45	0.67	1.27
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.13	0.22	0.54
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.39
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.11
	Annual	0.33	0.36	0.43	0.48	0.56	0.65	0.73	0.88	1.02	1.17	1.37	1.64	1.89	2.37	2.87	3.52	5.01	10.44
OTTAWA	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.11	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.19	
	March	0.03	0.03	0.05	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.20	0.23	0.27	0.33	0.40	0.48	0.54	1.11
	April	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.21	0.25	0.31	0.38	0.46	0.49	1.13
	May	0.06	0.07	0.10	0.11	0.14	0.17	0.20	0.24	0.29	0.33	0.40	0.47	0.54	0.66	0.79	0.94	1.18	2.28
	June	0.05	0.05	0.07	0.09	0.10	0.12	0.14	0.17	0.21	0.24	0.28	0.34	0.39	0.49	0.60	0.74	1.28	2.40
	July	0.05	0.06	0.08	0.09	0.11	0.14	0.16	0.20	0.23	0.27	0.32	0.38	0.43	0.53	0.62	0.74	1.22	1.98
	August	0.12	0.13	0.14	0.15	0.17	0.19	0.20	0.23	0.26	0.29	0.32	0.37	0.41	0.49	0.57	0.67	0.99	1.80
	September	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26	0.30	0.35	0.39	0.47	0.55	0.64	0.83	1.55
	October	0.04	0.04	0.06	0.07	0.08	0.09	0.10	0.13	0.15	0.17	0.20	0.24	0.27	0.34	0.40	0.48	0.67	1.27
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.13	0.16	0.44	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.21	
	Annual	0.43	0.49	0.61	0.72	0.87	1.02	1.16	1.42	1.66	1.91	2.25	2.66	3.06	3.75	4.48	5.38	7.52	14.48

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots			
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone
PAWNEE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.11
	March	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.22	0.58
	April	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16	0.19	0.23	0.28	0.32	0.79
	May	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.19	0.25	0.31	0.39	0.54	1.28
	June	0.06	0.07	0.09	0.11	0.12	0.14	0.16	0.18	0.22	0.25	0.29	0.35	0.40	0.50	0.60	0.72	1.35	2.37
	July	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.14	0.17	0.23	0.30	0.38	0.72	1.41
	August	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.17	0.20	0.24	0.28	0.32	0.40	0.48	0.57	0.83	1.59
	September	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.14	0.16	0.19	0.23	0.27	0.33	0.47	0.97
	October	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.15	0.19	0.23	0.31	0.68
	November	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06	0.07	0.10	0.10	0.30
	December	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.17
	Annual	0.20	0.24	0.30	0.36	0.43	0.52	0.60	0.73	0.88	1.02	1.22	1.47	1.72	2.17	2.66	3.27	4.95	10.29
PHILLIPS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.10	
	March	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14	0.16	0.18	0.20	0.23	0.27	0.31	0.36	0.39	0.78
	April	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.14	0.18	0.26	0.78
	May	0.08	0.08	0.10	0.11	0.13	0.15	0.17	0.20	0.24	0.27	0.32	0.38	0.44	0.53	0.64	0.77	1.08	2.05
	June	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.16	0.19	0.24	0.31	0.38	0.73	1.55
	July	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.14	0.16	0.20	0.25	0.31	0.55	1.18
	August	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.18	0.23	0.29	0.67	1.35
	September	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.13	0.16	0.20	0.25	0.32	0.45	1.02
	October	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.12	0.15	0.19	0.33	0.66
	November	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.25	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.05	
	Annual	0.20	0.23	0.28	0.33	0.39	0.45	0.52	0.63	0.76	0.88	1.05	1.27	1.49	1.90	2.34	2.91	4.57	9.78
POTAWATOMIE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.12	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.23
	March	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.16	0.19	0.22	0.27	0.32	0.39	0.45	1.02
	April	0.04	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.14	0.15	0.18	0.20	0.23	0.28	0.34	0.41	0.50	1.11
	May	0.11	0.12	0.15	0.16	0.20	0.23	0.25	0.31	0.35	0.40	0.47	0.54	0.62	0.75	0.88	1.05	1.34	2.54
	June	0.15	0.18	0.21	0.24	0.28	0.32	0.36	0.42	0.49	0.55	0.63	0.73	0.82	0.97	1.14	1.33	2.00	3.29
	July	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.26	0.30	0.35	0.41	0.46	0.56	0.65	0.77	1.23	2.14
	August	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.15	0.20	0.24	0.32	0.41	0.51	0.98	1.92
	September	0.25	0.27	0.30	0.33	0.37	0.40	0.44	0.50	0.54	0.59	0.66	0.73	0.80	0.91	1.03	1.16	1.41	2.30
	October	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.19	0.23	0.27	0.34	0.42	0.51	0.76	1.47
	November	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.18	0.23	0.25	0.66
	December	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.34
	Annual	0.69	0.78	0.92	1.05	1.24	1.42	1.60	1.90	2.20	2.49	2.89	3.36	3.83	4.63	5.48	6.53	9.10	17.15

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots					
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
PRATT	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.07	0.22
	March	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.18	0.20	0.25	0.30	0.36	0.40	0.85
	April	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.18	0.20	0.23	0.27	0.30	0.35	0.41	0.48	0.49	0.99
	May	0.10	0.11	0.13	0.14	0.17	0.19	0.21	0.25	0.28	0.31	0.36	0.41	0.47	0.55	0.64	0.76	1.00	1.75
	June	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.13	0.17	0.21	0.25	0.34	0.42	0.54	1.13	2.07
	July	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.18	0.21	0.28	0.35	0.44	0.70	1.44
	August	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.21	0.28	0.34	0.43	0.75	1.50
	September	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.18	0.21	0.26	0.32	0.40	0.64	1.24
	October	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.19	0.22	0.26	0.30	0.37	0.43	0.51	0.66	1.25
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.09	0.33
	December	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.07	0.21
	Annual	0.29	0.34	0.42	0.49	0.59	0.70	0.81	0.98	1.17	1.35	1.61	1.93	2.23	2.79	3.37	4.11	6.00	11.91
RAWLINS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.05
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.06
	March	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.24	0.52
	April	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.15	0.18	0.22	0.59
	May	0.13	0.15	0.17	0.18	0.21	0.23	0.26	0.30	0.33	0.37	0.42	0.48	0.54	0.63	0.74	0.87	1.20	2.15
	June	0.12	0.13	0.15	0.17	0.19	0.21	0.23	0.26	0.28	0.31	0.35	0.39	0.43	0.50	0.58	0.67	1.04	1.81
	July	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.12	0.14	0.15	0.18	0.21	0.24	0.29	0.35	0.43	0.80	1.59
	August	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.08	0.11	0.25	0.70
	September	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.09	0.12	0.15	0.30	0.67	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.04	0.06	0.12	0.35	
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.09	0.19
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.07	0.07
	Annual	0.32	0.35	0.41	0.46	0.53	0.60	0.67	0.78	0.89	1.01	1.16	1.36	1.56	1.90	2.28	2.76	4.26	8.75
RENO	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.07
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.26	
	March	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.14	0.16	0.19	0.23	0.27	0.33	0.41	0.46	1.04
	April	0.14	0.15	0.17	0.18	0.20	0.22	0.24	0.27	0.30	0.32	0.35	0.39	0.43	0.48	0.54	0.61	0.63	1.20
	May	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.20	0.23	0.27	0.32	0.37	0.43	0.52	0.62	0.75	0.96	1.90
	June	0.06	0.07	0.09	0.11	0.13	0.15	0.18	0.22	0.26	0.29	0.35	0.41	0.48	0.59	0.71	0.85	1.39	2.52
	July	0.05	0.05	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.25	0.30	0.35	0.43	0.52	0.64	0.94	1.74
	August	0.07	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.18	0.20	0.24	0.29	0.33	0.42	0.51	0.62	0.96	1.83
	September	0.09	0.10	0.12	0.14	0.16	0.19	0.21	0.25	0.29	0.32	0.37	0.43	0.49	0.58	0.67	0.79	0.95	1.72
	October	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.25	0.28	0.32	0.37	0.41	0.49	0.56	0.64	0.81	1.35
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10	0.11	0.41		
	December	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.20		
	Annual	0.57	0.64	0.77	0.88	1.04	1.19	1.34	1.60	1.84	2.08	2.42	2.83	3.23	3.92	4.65	5.55	7.38	14.24

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
REPUBLIC	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.08
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.22
	March	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.16	0.18	0.20	0.23	0.26	0.29	0.35	0.40	0.48	0.52	1.07
	April	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.19	0.24	0.30	0.37	0.51	1.12
	May	0.07	0.08	0.10	0.12	0.15	0.17	0.20	0.24	0.28	0.32	0.37	0.44	0.51	0.62	0.74	0.89	1.20	2.28
	June	0.05	0.06	0.08	0.09	0.12	0.14	0.16	0.21	0.24	0.29	0.35	0.42	0.50	0.61	0.75	0.92	1.59	2.81
	July	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.20	0.24	0.30	0.35	0.45	0.55	0.68	1.25	2.18
	August	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.20	0.25	0.30	0.41	0.51	0.64	1.14	2.15
	September	0.06	0.07	0.09	0.11	0.13	0.15	0.18	0.21	0.25	0.28	0.33	0.38	0.44	0.53	0.63	0.74	1.16	2.00
	October	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.20	0.25	0.30	0.50	0.95
	November	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.18	0.46	
	December	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.06	0.07	0.10	0.24		
	Annual	0.34	0.40	0.51	0.60	0.74	0.87	1.01	1.25	1.48	1.72	2.06	2.47	2.89	3.60	4.37	5.32	8.25	15.56
RICE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.27
	March	0.02	0.02	0.03	0.03	0.05	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.20	0.25	0.31	0.37	0.42	0.96
	April	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.23	0.28	0.34	0.44	0.96
	May	0.07	0.08	0.10	0.12	0.14	0.16	0.18	0.23	0.26	0.30	0.34	0.40	0.46	0.54	0.65	0.77	0.92	1.86
	June	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.17	0.20	0.24	0.29	0.34	0.41	0.51	0.62	0.76	1.29	2.43
	July	0.04	0.04	0.06	0.07	0.08	0.09	0.11	0.14	0.16	0.19	0.22	0.27	0.31	0.39	0.47	0.57	1.04	1.81
	August	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.17	0.24	0.31	0.40	0.70	1.47
	September	0.09	0.10	0.11	0.12	0.14	0.15	0.17	0.19	0.21	0.23	0.26	0.30	0.33	0.39	0.45	0.52	0.79	1.38
	October	0.13	0.14	0.16	0.17	0.19	0.21	0.23	0.26	0.28	0.31	0.34	0.38	0.41	0.47	0.53	0.60	0.71	1.29
	November	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.18	0.46
	December	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.25	
	Annual	0.45	0.50	0.61	0.69	0.83	0.95	1.07	1.29	1.49	1.70	1.97	2.31	2.65	3.23	3.87	4.66	6.66	13.17
RILEY	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.08	0.22
	March	0.02	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22	0.27	0.33	0.40	0.45	1.05
	April	0.03	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.24	0.30	0.36	0.44	0.53	1.16
	May	0.10	0.12	0.15	0.17	0.21	0.24	0.28	0.33	0.38	0.44	0.51	0.59	0.67	0.80	0.93	1.10	1.35	2.51
	June	0.18	0.20	0.23	0.26	0.30	0.34	0.37	0.44	0.50	0.56	0.64	0.74	0.83	0.99	1.15	1.33	1.95	3.29
	July	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.25	0.33	0.40	0.50	0.81	1.60
	August	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.15	0.19	0.24	0.32	0.41	0.52	0.81	1.70
	September	0.16	0.17	0.20	0.22	0.26	0.29	0.32	0.37	0.42	0.46	0.52	0.60	0.66	0.78	0.90	1.05	1.34	2.31
	October	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.18	0.21	0.26	0.30	0.38	0.46	0.56	0.87	1.61
	November	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.09	0.10	0.13	0.16	0.19	0.21	0.21	0.56
	December	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.28		
	Annual	0.58	0.66	0.80	0.92	1.09	1.26	1.44	1.72	2.00	2.28	2.66	3.13	3.59	4.38	5.21	6.24	8.49	16.40

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots			
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone
ROOKS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.08
	February	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.15
	March	0.07	0.07	0.08	0.09	0.11	0.11	0.13	0.15	0.16	0.18	0.20	0.22	0.25	0.29	0.34	0.39	0.43	0.84
	April	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.13	0.17	0.22	0.33	0.81
	May	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.22	0.25	0.32	0.40	0.50	0.76	1.63
	June	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.05	0.07	0.09	0.12	0.15	0.19	0.26	0.34	0.44	0.79	1.63
	July	0.03	0.04	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.19	0.23	0.26	0.34	0.41	0.51	0.91	1.75
	August	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.10	0.13	0.16	0.19	0.25	0.31	0.38	0.52	1.17
	September	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.23	0.28	0.48	0.98
	October	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.09	0.11	0.14	0.22	0.52	0.22
	November	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.15	0.38
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.09	0.09
	Annual	0.19	0.21	0.26	0.31	0.38	0.44	0.51	0.64	0.77	0.90	1.09	1.34	1.57	2.02	2.50	3.11	4.71	10.04
RUSH	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.16
	March	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.20	0.24	0.29	0.33	0.74
	April	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.21	0.26	0.32	0.43	0.94
	May	0.02	0.03	0.04	0.04	0.06	0.07	0.08	0.10	0.13	0.15	0.18	0.22	0.26	0.32	0.40	0.49	0.62	1.45
	June	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.08	0.10	0.13	0.16	0.21	0.25	0.33	0.43	0.54	1.10	2.07
	July	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.14	0.18	0.21	0.27	0.33	0.41	0.83	1.59
	August	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.11	0.14	0.17	0.21	0.27	0.33	0.40	0.69	1.30
	September	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.19	0.24	0.29	0.38	0.89
	October	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.12	0.15	0.19	0.27	0.67
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.29	0.29
	December	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.14	0.06	0.14
	Annual	0.14	0.17	0.22	0.27	0.34	0.40	0.47	0.61	0.74	0.88	1.08	1.33	1.58	2.02	2.51	3.12	4.86	10.27
RUSSELL	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.06
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.13
	March	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.19	0.21	0.24	0.26	0.30	0.35	0.41	0.43	0.87
	April	0.06	0.07	0.08	0.09	0.11	0.12	0.13	0.16	0.18	0.20	0.23	0.27	0.31	0.37	0.44	0.53	0.65	1.27
	May	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.20	0.24	0.32	0.40	0.50	0.73	1.61
	June	0.08	0.08	0.10	0.11	0.12	0.14	0.15	0.18	0.20	0.23	0.26	0.29	0.33	0.40	0.47	0.56	0.98	1.78
	July	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.17	0.19	0.22	0.26	0.30	0.37	0.45	0.55	0.94	1.78
	August	0.02	0.02	0.03	0.05	0.05	0.08	0.09	0.11	0.15	0.18	0.22	0.27	0.32	0.42	0.51	0.63	0.94	1.90
	September	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.18	0.21	0.24	0.27	0.32	0.35	0.42	0.49	0.58	0.84	1.45
	October	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.09	0.12	0.16	0.27	0.67	0.67
	November	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.08	0.09	0.08	0.29
	December	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.15
	Annual	0.36	0.41	0.50	0.58	0.69	0.79	0.90	1.08	1.25	1.42	1.66	1.96	2.25	2.78	3.35	4.06	5.96	11.96

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots				
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
SALINE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.11
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.19
	March	0.03	0.03	0.05	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.20	0.23	0.27	0.33	0.40	0.48	0.54	1.11
	April	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.21	0.25	0.31	0.38	0.46	0.49	1.13
	May	0.06	0.07	0.10	0.11	0.14	0.17	0.20	0.24	0.29	0.33	0.40	0.47	0.54	0.66	0.79	0.94	1.18	2.28
	June	0.05	0.05	0.07	0.09	0.10	0.12	0.14	0.17	0.21	0.24	0.28	0.34	0.39	0.49	0.60	0.74	1.28	2.40
	July	0.05	0.06	0.08	0.09	0.11	0.14	0.16	0.20	0.23	0.27	0.32	0.38	0.43	0.53	0.62	0.74	1.22	1.98
	August	0.12	0.13	0.14	0.15	0.17	0.19	0.20	0.23	0.26	0.29	0.32	0.37	0.41	0.49	0.57	0.67	0.99	1.80
	September	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26	0.30	0.35	0.39	0.47	0.55	0.64	0.83	1.55
	October	0.04	0.04	0.06	0.07	0.08	0.09	0.10	0.13	0.15	0.17	0.20	0.24	0.27	0.34	0.40	0.48	0.67	1.27
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.10	0.13	0.16	0.44
	December	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.21		
	Annual	0.43	0.49	0.61	0.72	0.87	1.02	1.16	1.42	1.66	1.91	2.25	2.66	3.06	3.75	4.48	5.38	7.52	14.48
SCOTT	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.09
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.11
	March	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.08	0.09	0.12	0.15	0.19	0.49
	April	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.11	0.15	0.19	0.21	0.62
	May	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22	0.28	0.34	0.41	0.56	1.26
	June	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.10	0.13	0.16	0.22	0.29	0.37	0.73	1.52
	July	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.09	0.12	0.15	0.21	0.28	0.36	0.57	1.34	
	August	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.16	0.21	0.41	0.94	
	September	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.14	0.18	0.23	0.36	0.84
	October	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.20	0.36
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.13	0.32
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.05
	Annual	0.06	0.07	0.10	0.12	0.16	0.20	0.25	0.32	0.41	0.50	0.63	0.80	0.98	1.32	1.69	2.18	3.42	7.95
SEDGWICK	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.15
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.08	0.24	
	March	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.15	0.17	0.19	0.22	0.25	0.28	0.34	0.40	0.48	0.55	1.10
	April	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.11	0.14	0.16	0.20	0.24	0.30	0.42	0.98
	May	0.09	0.10	0.13	0.14	0.18	0.20	0.23	0.28	0.33	0.37	0.42	0.49	0.56	0.66	0.77	0.91	1.13	2.05
	June	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.19	0.24	0.30	0.39	0.50	0.63	1.32	2.44
	July	0.04	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.14	0.17	0.20	0.24	0.28	0.35	0.43	0.53	0.93	1.72
	August	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.08	0.11	0.14	0.17	0.24	0.31	0.39	0.81	1.57
	September	0.11	0.12	0.14	0.16	0.19	0.21	0.23	0.28	0.31	0.35	0.40	0.46	0.52	0.61	0.71	0.83	1.06	1.89
	October	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.16	0.19	0.21	0.26	0.32	0.38	0.52	1.05
	November	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.16	0.20	0.21	0.57
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.11	0.31
	Annual	0.37	0.42	0.53	0.61	0.75	0.86	0.99	1.22	1.42	1.64	1.94	2.30	2.67	3.30	3.99	4.84	7.17	14.07

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas												Feedlots										
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone					
SEWARD	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.06				
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.16	0.25	0.55			
	March	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.18	0.22	0.20	0.51	0.72	1.50			
	April	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.10	0.13	0.20	0.41	0.61	1.28			
	May	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.21	0.26	0.32	0.41	0.72	1.50	0.61	1.34			
	June	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.11	0.13	0.18	0.23	0.30	0.61	1.28	0.21	0.63			
	July	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.16	0.19	0.25	0.31	0.40	0.61	1.34	0.18	0.39			
	August	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.08	0.11	0.15	0.20	0.41	0.90	0.06	0.21			
	September	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.12	0.16	0.21	0.63	0.18	0.39			
	October	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.18	0.39	0.06	0.21			
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.10	0.21	0.01	0.06			
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06			
	Annual	0.09	0.10	0.13	0.16	0.19	0.23	0.27	0.34	0.42	0.51	0.63	0.78	0.94	1.24	1.58	2.02	3.32	7.60					
SHAWNEE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.16	0.24	0.53	1.14		
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.07	0.24	0.51	1.22	2.38		
	March	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.13	0.15	0.17	0.20	0.23	0.27	0.33	0.39	0.47	0.53	1.14	2.15	3.62	9.99	1.89	
	April	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16	0.19	0.23	0.29	0.35	0.43	0.51	1.22	1.23	2.17	5.51	1.08	
	May	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.20	0.23	0.28	0.33	0.40	0.46	0.58	0.70	0.86	1.01	1.19	1.41	2.15	3.62	9.31	17.71
	June	0.14	0.16	0.19	0.22	0.26	0.30	0.33	0.40	0.47	0.53	0.62	0.73	0.83	1.01	1.19	1.41	2.15	3.62	1.23	2.38			
	July	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.21	0.23	0.26	0.30	0.34	0.39	0.47	0.56	0.66	0.99	1.89					
	August	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.19	0.23	0.26	0.31	0.37	0.43	0.54	0.65	0.78	1.23	2.17					
	September	0.19	0.20	0.24	0.26	0.30	0.33	0.36	0.42	0.46	0.51	0.56	0.63	0.69	0.80	0.90	1.03	1.25	2.12					
	October	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.22	0.26	0.31	0.36	0.45	0.53	0.64	0.86	1.67					
	November	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.22	0.26	0.30	0.70					
	December	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.08	0.09	0.11	0.14	0.18	0.41					
	Annual	0.65	0.74	0.90	1.02	1.22	1.39	1.57	1.89	2.18	2.49	2.90	3.40	3.91	4.75	5.66	6.78	9.31	17.71					
SHERIDAN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04					
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05					
	March	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.11	0.14	0.16	0.46					
	April	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.12	0.15	0.19	0.23	0.28	0.69					
	May	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.15	0.18	0.22	0.27	0.31	0.39	0.48	0.59	0.88	1.70					
	June	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.18	0.22	0.27	0.33	0.67	1.35					
	July	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.08	0.11	0.14	0.20	0.26	0.35	0.77	1.54					
	August	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.11	0.14	0.16	0.22	0.28	0.35	0.51	1.08					
	September	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.11	0.23	0.59					
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.05	0.07	0.15	0.40					
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.07	0.21					
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.05					
	Annual	0.06	0.08	0.11	0.15	0.19	0.24	0.30	0.39	0.48	0.58	0.72	0.90	1.08	1.41	1.77	2.24	3.74	8.18					

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Conc.
SHERMAN	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04
	March	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.31	
	April	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.08	0.10	0.14	0.41	
	May	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.16	0.19	0.26	0.33	0.42	0.77	1.59
	June	0.07	0.07	0.09	0.10	0.11	0.13	0.15	0.17	0.20	0.22	0.26	0.30	0.34	0.41	0.48	0.56	0.86	1.59
	July	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.18	0.23	0.28	0.35	0.55	1.21
	August	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.05	0.07	0.10	0.20	0.57
	September	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.06	0.07	0.09	0.12	0.16	0.28	0.63	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.08	0.26	
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.09	
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	
	Annual	0.10	0.12	0.14	0.17	0.21	0.25	0.30	0.37	0.44	0.52	0.63	0.77	0.92	1.18	1.47	1.84	3.02	6.77
SMITH	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	
	March	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.21	0.26	0.31	0.33	0.74
	April	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.14	0.18	0.24	0.32	0.88
	May	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.13	0.15	0.19	0.23	0.28	0.36	0.45	0.56	0.88	1.81
	June	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.16	0.19	0.23	0.27	0.34	0.43	0.53	0.94	1.83
	July	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.08	0.13	0.17	0.23	0.53	1.19	
	August	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.10	0.15	0.21	0.29	0.62	1.43
	September	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.11	0.14	0.17	0.22	0.28	0.35	0.58	1.17
	October	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.25	0.60
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.04	0.07	0.24
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.06	
	Annual	0.09	0.11	0.15	0.18	0.23	0.28	0.34	0.43	0.54	0.65	0.83	1.04	1.27	1.69	2.15	2.75	4.55	10.04
STAFFORD	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.17	
	March	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.22	0.27	0.31	0.75
	April	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.15	0.18	0.21	0.24	0.28	0.34	0.41	0.49	1.03
	May	0.07	0.07	0.09	0.10	0.12	0.13	0.15	0.18	0.20	0.23	0.27	0.31	0.36	0.44	0.52	0.64	0.81	1.70
	June	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.11	0.14	0.18	0.25	0.33	0.44	0.94	1.95
	July	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.18	0.23	0.29	0.36	0.71	1.34
	August	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.13	0.16	0.21	0.27	0.34	0.52	1.18
	September	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.21	0.23	0.26	0.29	0.31	0.36	0.41	0.47	0.66	1.16
	October	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.11	0.14	0.17	0.19	0.25	0.30	0.37	0.51	1.05
	November	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.09	0.08	0.26
	December	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.11	0.11	0.24		
	Annual	0.33	0.36	0.43	0.49	0.57	0.65	0.73	0.87	1.01	1.16	1.36	1.62	1.88	2.36	2.87	3.51	5.19	10.85

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas													Feedlots				
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth.	Conc.
STANTON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.23
	March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.45
	April	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.45
	May	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.16	0.18	0.21	0.26	0.32	0.38	0.51	1.10
	June	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.13	0.17	0.22	0.27	0.49	1.09
	July	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.17	0.22	0.45	1.04
	August	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.07	0.08	0.09	0.11	0.13	0.17	0.20	0.25	0.41	0.90
	September	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.09	0.11	0.14	0.24	0.61
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.08	0.22
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.17
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	Annual	0.09	0.11	0.13	0.15	0.18	0.22	0.26	0.31	0.38	0.44	0.53	0.65	0.77	1.01	1.26	1.60	2.52	5.94
STEVENS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.08	0.27	
	April	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.08	0.09	0.11	0.14	0.17	0.23	0.57
	May	0.07	0.08	0.10	0.11	0.13	0.15	0.17	0.20	0.23	0.26	0.29	0.34	0.38	0.46	0.54	0.64	0.85	1.64
	June	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.21	0.24	0.30	0.37	0.46	0.70	1.48
	July	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.08	0.12	0.16	0.42	1.02
	August	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.14	0.17	0.19	0.22	0.26	0.29	0.35	0.40	0.47	0.59	1.13
	September	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.08	0.10	0.13	0.24	0.63	
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.08	0.27		
	November	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.15	0.31
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
	Annual	0.18	0.21	0.25	0.29	0.34	0.40	0.46	0.55	0.66	0.75	0.89	1.06	1.23	1.55	1.89	2.32	3.34	7.43
SUMNER	January	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.06	0.23		
	February	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.09	0.31		
	March	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.18	0.21	0.24	0.29	0.34	0.42	0.50	0.60	0.67	1.33
	April	0.05	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.20	0.23	0.27	0.32	0.39	0.46	0.56	0.57	1.30
	May	0.16	0.18	0.21	0.24	0.27	0.31	0.34	0.40	0.46	0.51	0.58	0.66	0.75	0.88	1.02	1.18	1.45	2.58
	June	0.08	0.10	0.12	0.14	0.16	0.19	0.21	0.25	0.30	0.34	0.40	0.47	0.53	0.65	0.78	0.92	1.52	2.71
	July	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.11	0.13	0.16	0.20	0.24	0.31	0.39	0.48	0.77	1.57
	August	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.18	0.22	0.25	0.29	0.34	0.39	0.48	0.57	0.68	1.06	1.88
	September	0.14	0.15	0.17	0.19	0.21	0.23	0.25	0.30	0.33	0.36	0.40	0.46	0.51	0.59	0.68	0.79	1.07	1.88
	October	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.19	0.22	0.25	0.31	0.37	0.43	0.60	1.16
	November	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.17	0.19	0.22	0.25	0.28	0.32	0.37	0.43	0.47	0.91
	December	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.10	0.33
	Annual	0.65	0.73	0.87	1.00	1.18	1.36	1.53	1.83	2.11	2.39	2.78	3.25	3.70	4.49	5.31	6.32	8.42	16.18

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas														Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	
THOMAS	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.07
	April	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.18
	May	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.18	0.21	0.24	0.29	0.34	0.42	0.51	0.62	0.88
	June	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.21	0.24	0.31	0.37	0.45	0.85
	July	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.13	0.15	0.21	0.27	0.35	0.68
	August	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.09	0.12	0.16	0.28
	September	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.10	0.27
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.06	0.11	0.30
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.11
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	Annual	0.09	0.10	0.13	0.16	0.20	0.24	0.29	0.36	0.43	0.51	0.63	0.78	0.93	1.22	1.53	1.95	3.33
TREGO	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08
	March	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.17	0.20	0.25	0.26
	April	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.11	0.15	0.19	0.28
	May	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.22	0.28	0.42
	June	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.13	0.16	0.19	0.26	0.33	0.42	0.78
	July	0.10	0.11	0.12	0.14	0.16	0.18	0.19	0.22	0.25	0.28	0.32	0.37	0.41	0.49	0.57	0.67	0.95
	August	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.20	0.26	0.34	0.61
	September	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.06	0.07	0.10	0.14	0.18	0.29
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.06	0.09	0.13
	November	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.28
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.06
	Annual	0.16	0.18	0.22	0.26	0.31	0.36	0.42	0.52	0.62	0.72	0.87	1.07	1.26	1.62	2.01	2.52	3.85
WABAUNSEE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.15
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.21
	March	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.19	0.23	0.27	0.33	0.41	0.50	0.54
	April	0.08	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.19	0.21	0.24	0.27	0.31	0.38	0.45	0.55	0.66
	May	0.11	0.12	0.15	0.17	0.21	0.24	0.28	0.34	0.39	0.45	0.52	0.60	0.69	0.82	0.97	1.14	1.47
	June	0.11	0.12	0.15	0.17	0.21	0.24	0.27	0.33	0.38	0.44	0.52	0.62	0.72	0.88	1.05	1.26	2.02
	July	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.15	0.18	0.21	0.26	0.31	0.36	0.46	0.55	0.67	0.99
	August	0.06	0.06	0.08	0.09	0.10	0.12	0.13	0.16	0.19	0.22	0.26	0.32	0.37	0.46	0.56	0.69	1.20
	September	0.21	0.23	0.27	0.30	0.35	0.39	0.42	0.49	0.55	0.60	0.67	0.75	0.82	0.93	1.05	1.19	1.47
	October	0.06	0.07	0.08	0.10	0.11	0.13	0.15	0.17	0.20	0.22	0.26	0.30	0.34	0.41	0.48	0.57	0.77
	November	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.05	0.06	0.08	0.10	0.12	0.17	0.21	0.27	0.32
	December	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.13	0.16	0.17
	Annual	0.70	0.78	0.95	1.08	1.29	1.47	1.66	2.01	2.32	2.64	3.07	3.59	4.12	4.99	5.93	7.07	9.70
																	18.20	

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth.	Conc.
WALLACE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.06
	March	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.18	0.44
	April	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.43
	May	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.21	0.25	0.30	0.34	0.42	0.50	0.61	0.79	1.59
	June	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.15	0.17	0.19	0.22	0.25	0.29	0.36	0.43	0.52	0.89	1.70
	July	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.16	0.21	0.27	0.57	1.28
	August	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.08	0.11	0.14	0.30	0.71
	September	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.09	0.11	0.14	0.17	0.20	0.33	0.72
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.09	0.27	0.09
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.16	0.03
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.07	0.07
	Annual	0.14	0.16	0.20	0.23	0.27	0.32	0.37	0.45	0.54	0.62	0.75	0.91	1.06	1.36	1.69	2.11	3.36	7.47
WASHINGTON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.16
	March	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.15	0.17	0.19	0.21	0.25	0.28	0.33	0.40	0.47	0.51	1.07
	April	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.20	0.26	0.32	0.48	1.08
	May	0.10	0.11	0.13	0.14	0.17	0.19	0.22	0.26	0.30	0.35	0.41	0.48	0.55	0.67	0.80	0.96	1.24	2.43
	June	0.09	0.10	0.12	0.13	0.15	0.17	0.20	0.24	0.27	0.31	0.37	0.44	0.51	0.64	0.78	0.94	1.62	2.89
	July	0.03	0.04	0.04	0.05	0.06	0.08	0.09	0.12	0.14	0.17	0.21	0.26	0.31	0.40	0.49	0.60	1.06	1.92
	August	0.08	0.09	0.10	0.12	0.14	0.16	0.18	0.21	0.24	0.27	0.31	0.36	0.41	0.50	0.60	0.72	1.21	2.17
	September	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.22	0.26	0.29	0.35	0.41	0.47	0.58	0.69	0.83	1.20	2.14
	October	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.18	0.23	0.29	0.51	1.03
	November	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.15	0.18	0.49
	December	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.07	0.08	0.09	0.23
	Annual	0.46	0.52	0.63	0.73	0.87	1.00	1.14	1.38	1.61	1.84	2.17	2.57	2.98	3.67	4.44	5.40	8.15	15.67
WICHITA	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	March	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.08	0.28
	April	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.10	0.15	0.39
	May	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12	0.15	0.18	0.23	0.29	0.36	0.52	1.15
	June	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.16	0.41	0.97
	July	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.07	0.09	0.12	0.17	0.42	0.99
	August	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.15	0.19	0.24	0.40	0.90
	September	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.12	0.15	0.19	0.27	0.65
	October	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.12	0.27	0.27
	November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.13	0.13
	December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	Annual	0.04	0.05	0.07	0.08	0.11	0.13	0.16	0.21	0.26	0.32	0.40	0.51	0.62	0.83	1.07	1.39	2.42	5.79

**Table KS10-6** Mean Monthly and Annual Runoff Values (Continued)  
Runoff Curve Number and Corresponding Runoff (in inches)

County	Month	Non-Feedlot Areas															Feedlots		
		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	Earth	Cone.
WILSON	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.10	0.11	0.32
	February	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.11	0.13	0.16	0.38
	March	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.18	0.21	0.23	0.27	0.31	0.36	0.43	0.51	0.61	0.67	1.43
	April	0.01	0.02	0.02	0.03	0.04	0.06	0.07	0.10	0.12	0.15	0.18	0.23	0.27	0.35	0.43	0.53	0.61	1.39
	May	0.24	0.26	0.30	0.33	0.37	0.41	0.44	0.51	0.56	0.62	0.69	0.77	0.86	1.00	1.14	1.32	1.59	2.84
	June	0.19	0.20	0.24	0.26	0.30	0.33	0.37	0.44	0.50	0.56	0.64	0.73	0.83	0.98	1.14	1.34	2.02	3.37
	July	0.24	0.25	0.28	0.29	0.32	0.34	0.36	0.39	0.42	0.45	0.50	0.55	0.60	0.69	0.79	0.91	1.37	2.25
	August	0.02	0.02	0.03	0.05	0.06	0.08	0.10	0.13	0.17	0.21	0.27	0.33	0.39	0.51	0.62	0.76	1.20	2.16
	September	0.15	0.17	0.20	0.23	0.26	0.29	0.33	0.38	0.43	0.48	0.54	0.62	0.70	0.82	0.95	1.10	1.33	2.36
	October	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.25	0.28	0.32	0.37	0.43	0.51	0.61	0.72	0.90	1.74
	November	0.19	0.20	0.23	0.25	0.29	0.31	0.34	0.39	0.42	0.46	0.51	0.56	0.61	0.69	0.77	0.86	0.89	1.49
	December	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.10	0.14	0.18	0.18	0.54	
	Annual	1.20	1.30	1.51	1.67	1.93	2.15	2.38	2.79	3.16	3.53	4.03	4.63	5.23	6.22	7.27	8.55	11.02	20.27
WOODSON	January	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.08	0.1	0.13	0.14	0.38
	February	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.09	0.11	0.14	0.18	0.42
	March	0.03	0.04	0.05	0.06	0.08	0.1	0.12	0.15	0.18	0.21	0.25	0.3	0.35	0.43	0.52	0.63	0.74	1.49
	April	0.11	0.12	0.14	0.16	0.18	0.2	0.22	0.26	0.29	0.33	0.37	0.43	0.49	0.58	0.68	0.8	0.9	1.82
	May	0.2	0.22	0.25	0.27	0.31	0.34	0.38	0.43	0.48	0.53	0.6	0.67	0.75	0.88	1.01	1.17	1.49	2.64
	June	0.09	0.11	0.14	0.17	0.21	0.25	0.29	0.36	0.43	0.49	0.59	0.7	0.81	0.99	1.18	1.4	2.11	3.58
	July	0.14	0.15	0.18	0.2	0.23	0.26	0.29	0.33	0.37	0.41	0.47	0.53	0.6	0.7	0.82	0.95	1.42	2.4
	August	0.05	0.06	0.08	0.09	0.11	0.14	0.17	0.2	0.25	0.29	0.36	0.44	0.51	0.66	0.8	0.97	1.53	2.68
	September	0.22	0.24	0.29	0.32	0.37	0.42	0.46	0.54	0.61	0.68	0.76	0.87	0.96	1.12	1.28	1.47	1.89	3.05
	October	0.21	0.22	0.25	0.26	0.29	0.31	0.34	0.38	0.42	0.46	0.51	0.57	0.63	0.72	0.82	0.95	1.21	2.09
	November	0.17	0.18	0.2	0.21	0.23	0.25	0.27	0.3	0.32	0.34	0.37	0.41	0.45	0.51	0.58	0.66	0.68	1.32
	December	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.06	0.07	0.09	0.12	0.16	0.18	0.55	
	Annual	1.24	1.36	1.6	1.79	2.07	2.33	2.59	3.04	3.45	3.86	4.42	5.09	5.74	6.84	8.01	9.43	12.45	22.41
WYANDOTTE	January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.08	0.10	0.28	
	February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.24	
	March	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.11	0.12	0.14	0.17	0.20	0.23	0.29	0.35	0.42	0.46	1.06
	April	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.17	0.20	0.23	0.27	0.31	0.36	0.44	0.52	0.62	0.77	1.52
	May	0.27	0.30	0.34	0.38	0.43	0.48	0.52	0.60	0.66	0.73	0.81	0.91	1.00	1.15	1.31	1.51	1.82	3.12
	June	0.07	0.08	0.09	0.11	0.13	0.16	0.18	0.22	0.26	0.30	0.36	0.43	0.50	0.63	0.76	0.92	1.68	2.86
	July	0.22	0.24	0.27	0.29	0.33	0.37	0.41	0.47	0.52	0.58	0.65	0.74	0.82	0.96	1.10	1.25	1.90	2.91
	August	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.23	0.27	0.31	0.37	0.44	0.51	0.63	0.76	0.91	1.44	2.51
	September	0.29	0.32	0.38	0.43	0.49	0.55	0.60	0.70	0.78	0.85	0.95	1.06	1.17	1.34	1.50	1.69	1.96	3.07
	October	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.29	0.33	0.37	0.42	0.49	0.55	0.66	0.78	0.92	1.35	2.26
	November	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.16	0.19	0.22	0.27	0.32	0.39	0.46	0.95
	December	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.11	0.13	0.16	0.17	0.44
	Annual	1.15	1.28	1.51	1.69	1.97	2.22	2.47	2.92	3.32	3.72	4.25	4.89	5.51	6.55	7.63	8.94	12.17	21.22

## **KS651.1084 Liners for waste storage ponds and lagoons**

The following is a condensed version of the [Documentation Requirements for Pond Sealing or Lining for Conservation Practices 521A, 521B, 521C, and 521D](#). It is for the investigation, design, and construction of soil or flexible membrane liners.

### **(a) Geologic investigation**

All sites for animal waste storage ponds and waste treatment lagoons shall be investigated to determine geologic conditions. These investigations shall be conducted by geologists, soil scientists, or others with training and experience in geologic investigations. These investigations should include the following:

- Perform soil borings or equivalent excavations in the pond and borrow areas (if needed).
- Describe the material found during the borings.
- Determine the depth to water table(s) (if encountered).
- Obtain disturbed and/or undisturbed soil samples as needed for testing.

### **(b) Soil testing**

The soil samples obtained during the geologic investigations shall be tested by one of the following methods:

- Soil mechanics tests per testing procedures stated in Section KS651.1085 for permeability, Standard Proctor density, optimum moisture, and Atterberg limits.
- Perform field soil tests to log the soil using the Unified Soil Classification System (USCS) and determine other soil properties.

### **(c) Design**

Depending on the method of soil testing, the designer can design the liner by one of the following two methods:

- Use the results from the soil mechanics tests to determine if a liner is required. If a liner is required, then does the liner require a soil amendment and, if so, how much? Also, calculate a liner thickness.
- Use the results from the field soil tests and, based on documented experience using similar soils and with similar design conditions and using information from [Appendix 10D](#) and the appropriate standard, calculate liner thickness and soil amendment amount (if needed).

### **(d) Construction**

Construction specifications can be written one of the following two ways:

- Specify the soil density, soil moisture, liner thickness, and amendment amount (if needed) that are required for construction of the liner. This is based on the soil mechanics tests results. Soil density and moisture are documented using standard procedures as described in Section KS651.1085.
- Specify a compaction method (equipment and passes), soil moisture by feel or other method, liner thickness, and amendment amount (if needed) required for construction of the liner. This information is based on past soil density and soil moisture tests or on seepage or permeability tests that document that the method specification was adequate to meet standard requirements. A folder or file shall be maintained to document this information. During construction, document the equipment used and the number of passes it made and that the specified soil moisture level was obtained.

## (e) Liner Certification

After construction of the liner, certification is needed to show that the liner was constructed to meet the requirements of NRCS standards. This certification can be shown by one of the following methods:

- The soil density and soil moisture met or exceeded the construction specification requirements and were verified by standard testing methods, and the liner thickness and soil amendment amount were verified.
- The soil density and soil moisture were within a specified range of soil density and moisture, they were measured by standard testing methods, and the liner thickness and soil amendment amount were verified.
- One or more in-place samples of the liner were taken and sent to a soil mechanics lab for permeability testing, and the test results met the permeability requirements.
- A “whole pond” seepage test was conducted, documentation was obtained that the test followed the established procedure, and the seepage was equal to or less than the seepage requirement.

## KS651.1085 Guidance for design and testing of compacted clay liners for waste holding ponds

The requirements for a liner should be determined during the soil investigation phase of the proposed site. The design of the liner is based on the properties of the soil—especially permeability. The amount and type of testing should be based on the four permeability group categories of the soils as defined in [Appendix 10D](#) or previous tests or experience. Some soils in Kansas are more permeable than indicated by permeability groups. There are several factors that may cause this increase in permeability. One of them is high calcium content. These soils should require laboratory analysis and may require use of soil amendments to meet low permeability requirements.

### (a) Laboratory testing of liner materials

It is preferable to test the liner materials at the beginning of the design process. Since turnaround time for lab testing can be quite lengthy, it should be done early to ensure the results are available for the design.

- Collect a disturbed sample (large bag sample) of each material to be used to construct the liner. Approximately 50 pounds will be needed of each liner material. Seal each large sample in a plastic bag to prevent drying.
- An undisturbed sample (3- or 5-inch Shelby tube) of the in-situ material may be collected to determine its natural permeability.
- Deliver the sample(s) to the testing laboratory as soon as possible. Include instructions to the laboratory as to the type of tests to run and the test parameters. The undisturbed sample should be extruded from

the Shelby tube or other sampling device within 48 hours of the time it was sampled.

- Undisturbed samples, if taken, should be tested before large bag samples. The sample(s) should be tested to determine dry density, moisture content, Atterberg limits, and permeability. If the in-situ material(s) represented by the undisturbed sample(s) is sufficiently impermeable and the in-situ soil profile is sufficiently thick to meet design requirements and is homogeneous, testing of the large bag sample(s) may not be needed. Standard test methods are listed in Section KS651.1085(e).
- Large bag samples should be tested as follows—using the methods in Section KS651.1085(e):

**Step 1**—Determine the Standard Proctor density, optimum moisture, and Atterberg limits. If the material being tested has a low percentage of fines (15% or less passing the #200 sieve) and a plasticity index less than 7 (for example, relatively clean sand), go directly to Step 4.

**Step 2**—Prepare a test specimen from the material compacted to a minimum 90% of Standard Proctor density at soil moisture 2 to 4% above optimum moisture content. Test the specimen to determine if it is sufficiently impermeable.

- If the specimen is sufficiently impermeable, further tests in Step 3 and/or Step 4 may not be needed.
- If the specimen is **not** sufficiently impermeable, the laboratory needs instructions to either continue with Step 3 or to go directly to Step 4.

**Step 3**—Increase the compaction of the material (for example, 95% of Standard Proctor density) and prepare another test specimen from the material at 2 to 4% above optimum moisture content. Test the specimen to determine if it is sufficiently impermeable.

— If the specimen is sufficiently impermeable, further tests in Step 4 may not be needed. The laboratory needs instructions to stop or to continue with Step 4.

— If the specimen is **not** sufficiently impermeable, continue with Step 4.

**Step 4**—If the specimen is not sufficiently impermeable, a soil amendment will be needed.

— For material with a low percentage of fines (15% or less passing the #200 sieve) and a plasticity index less than 7, sodium bentonite should be mixed with the sample material and tested as stated in Step 2. At least 2 or 3 tests may be required to determine the minimum amount of bentonite (suggest starting with 1.0 pound/square foot/4-inch thick lift) needed to achieve an acceptable permeability rate. This handbook and [CPS 521C, Pond Sealing or Lining - Bentonite Treatment](#), contain additional information on the use of bentonite as a sealant. For permeability testing, the liner thickness should be known before determining a target permeability (k value).

— For material with a significant percentage of fines (30% or more passing the #200 sieve) and a plasticity index of 7 or greater, a soil dispersant such as soda ash should be mixed with the sample material and tested as stated in Step 2. At least 2 or 3 tests may be required to determine the minimum amount of dispersant needed to achieve an acceptable permeability rate. This handbook and [CPS 521B, Pond Sealing or Lining - Soil Dispersant Treatment](#), contain additional information on the use of soil dispersants.

— For material with between 15 and 30% passing the #200 sieve, laboratory testing as outlined in the above 2 items in Step 4 will be needed to determine

whether bentonite or soda ash is more cost-effective.

### (b) Local testing of materials

Local testing of liner materials is applicable for soils in Groups III and IV from [Appendix 10D](#). Field identification of these soils can be done by any specialist trained in soil identification. Table KS10-7 can be used to determine Atterberg limits from percent clay.

- Collect a disturbed sample (large bag sample) of each material to be used to construct the liner. Approximately 50 pounds will be needed of each liner material. Seal each large sample in a plastic bag to prevent drying.
- Determine the Standard Proctor density and optimum moisture using American Society for Testing and Materials (ASTM) D698 as shown in Section KS651.1085(e). Record data from the test on an appropriate form or chart. (Forms [NRCS-ENG-359, Work Sheet for Compaction and Penetration Resistance Data](#), and [NRCS-ENG-352, Material Testing Report: Compaction and Penetration Resistance](#), can be used to aid in the completion of the standard test.)
- For both the upper and lower limit densities of 90% and 100% of Standard Proctor dry density ( $y_d$ ), compute the values for the theoretical saturated water content ( $w_{sat}(\%)$ ) using the following equation:

$$w_{sat}(\%) = \left[ \frac{y_{water}}{y_d} - \frac{1}{G_s} \right] \times 100$$

These calculated points can be plotted on the compaction curve on [Form NRCS-ENG-352](#). These points will make up the zero voids curve. Use a specific gravity ( $G_s$ ) = 2.70 for clay soils.

- Compute water contents equal to 80% and 90% of theoretical saturation water content for each of the upper and lower densities. Plot both the 80% and 90% moisture curves.

These curves will plot parallel to each other and to the zero air void (saturation) curve. The liner should be designed with a moisture and density combination within the boundaries of the area defined by the 80% and 90% of saturation curves between 90% and 100% of Standard Proctor dry density.

- Plot the natural water content of the soils to be used in constructing the liner on the graph to assist the designer with selecting the most appropriate compactive effort.
- The soil amendment amount may be specified following the standards in the eFOTG or from previous experience with similar soils.

### (c) Construction specifications and testing

Construction specifications for liners are specific instructions to the contractor giving directions on installing the liner. Testing of the completed liner will be required to determine if the moisture and/or specified minimum densities have been achieved.

- Write construction specifications for installation of the liner based on the information from the laboratory or local tests. The specifications need to state the following:
  - The minimum and maximum soil moisture contents and incorporation methods

#### **Example:**

From optimum to 3% over optimum or 19.5% to 22.5% at the time of compaction. Additional water shall be added in the borrow area when possible. Water added in the storage pond just prior to compaction will be thoroughly mixed using a disc, tiller, or other suitable equipment. This may be done concurrently with incorporation of amendments if required.

- The amount and type of amendments to be used (if any). For example, soda ash will be incorporated into the soil at the rate of 0.1 pound/square foot of liner per compacted layer. Apply amendments with a minimum of 2 passes in perpendicular directions. Be cautious when applied during windy conditions. Preferable moisture of subgrade when additive is applied (for example, dispersant) needs to be near the recommended water content range, but bentonite will ball up if subgrade is too wet.
- How the amendment (if required) is to be mixed into the soil

**Example:**

The soda ash will be incorporated into the liner material outside of the storage pond area. It shall be thoroughly mixed using a disc, tiller, or other suitable equipment. This may be done concurrently with incorporation of water if needed.

- How the soil will be compacted (for example, either the minimum acceptable density or minimum amount of compactive effort to be applied).

**Example:**

The minimum dry density of the compacted liner will be 94.5 pounds/cubic foot or the liner shall be constructed in 2 nearly equal lifts or layers. Each lift shall be compacted with at least 4 passes of a tamping roller weighing a minimum of 10,000 pounds. Each pass shall consist of at least 1 passage of the roller drum over the entire surface of the layer. The preceding layer of compacted fill or foundation material shall be moisture conditioned prior to placement of additional fill to permit suitable bond of the liner layers.

- Perform adequate tests and inspection to ensure the liner is installed according to the

construction specifications. Inspection of the incorporation of soil amendments and compaction by a specified number of passes will need to be documented. ([Form KS-ENG-16, Waste Management System Inspection Report](#), can be used for this.) Describe how the contractor is performing the work and the type of equipment being used. Photographic documentation of the work progress is suggested.

- A minimum of 1 moisture test is required. Additional tests are recommended for larger sites. The moisture test should be conducted in accordance with ASTM D2216 or ASTM D4643 as described in Section KS651.1085(e) for sites with a specified construction soil moisture percent. ([Form KS-ENG-63, Moisture-Density Determination](#), can be used as documentation of test results.) Sites using method specifications will be tested for the proper “feel.”
- At least 1 density test is suggested for all constructed liners and is required if the construction specifications require a minimum density. Density tests should be conducted in accordance with ASTM D2937 or ASTM D2922 as described in Section KS651.1085(e). ([Form KS-ENG-63](#) can also be used as documentation of density tests.) Plot the test results on the Proctor curve from the lab tests or local tests to determine if the installed liner meets the minimum requirements for moisture and density for acceptable permeability rates.
- Perform adequate surveys to verify that the liner thickness and finished slopes meet the intent of the construction drawings. Keep all survey notes neat and organized. Note any approved changes on as-built plans.
- Backfill any test holes with compacted “hole plug” or similar bentonite chip materials to maintain liner integrity. Clay used to construct the liner may be used but must have sufficient soil moisture and compaction.

**(d) Post testing of the constructed waste holding pond**

This may be done by either laboratory testing, construction oversight, or whole pond test. Laboratory testing is recommended. The constructed waste holding pond should be tested at a rate of not less than 1 test per surface acre measured at the maximum water surface elevation (bottom of freeboard).

Backfill any test holes with compacted “hole plug” or similar bentonite chip materials to maintain liner integrity. Clay used to construct the liner may be used but must have sufficient soil moisture and compaction.

**(1) Laboratory testing**

Collect an undisturbed sample(s) (3- or 5-inch Shelby tube) of the in-situ material(s). The sample(s) should be the full depth of the liner. Test the sample(s) to determine the dry density, moisture content, and permeability using the appropriate methods listed in Section KS651.1085(e).

**(2) Construction oversight**

If the soils at the site are similar to soils at another site that was designed and constructed with the laboratory testing method, then correct construction methods along with soil density and soil moisture measurements can be used to approve the liner.

**(3) Whole-pond test**

This test requires that the pond be filled with water to the pump-out level. The procedure can be obtained from Kansas State Research and Extension.

**(e) Standard tests****(1) Standard test methods for laboratory or local testing**

ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN·m/m<sup>3</sup>)

ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D5084, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D4643, Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

**(2) Standard test methods for construction testing**

ASTM D2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method

ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D4643, Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

**Table KS10-7** Atterberg limits correlation

Estimating Liquid Limit (LL) and Plasticity Index (PI) from Percent and Type of Clay (Note: Use percent of minus #40 sieve for evaluation)						
Percent 2 microns	Montmorillonitic Class		Mixed Class with Considerable 2:1 Clays		Mixed Class with Considerable 1:1 Clays	
	LL	PI	LL	PI	LL	PI
10	26	9	21	4	16	3
12	28	11	23	6	18	4
14	30	12	25	7	20	5
16	32	14	26	8	21	6
18	34	15	28	9	23	7
20	36	17	30	11	25	8
22	38	19	32	13	27	9
24	40	20	34	14	29	10
26	42	22	35	15	30	11
28	44	23	37	16	32	12
30	46	25	39	18	34	13
32	48	27	41	20	36	14
34	50	28	43	21	38	15
36	52	30	44	22	39	16
38	54	31	46	23	41	17
40	56	33	48	25	43	18
42	58	35	50	27	45	19
44	60	36	52	28	47	20
46	62	38	53	29	78	21
48	64	39	55	30	50	22
50	66	41	57	32	52	23
52	68	43	59	34	54	24
54	70	44	61	35	56	25
56	72	46	62	36	57	26
58	74	47	64	37	59	27
60	76	49	66	39	61	28

These correlations were developed in the 1960s by NRCS soil scientists from regression analyses.

The scientists suggest not using the correlations for kaolinitic-type clays.