# WATER QUALITY PLANNING GUIDES

## Rangeland Watershed Program

U.C. Cooperative Extension and USDA Natural Resources Conservation Service

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**PLANNING GUIDE** NO. 1

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# Identifying Your Goals

What are you trying to achieve through your use of time, effort, money, and management skills? Where are you going, how are you going to get there, and when will you arrive at your intended destination? The answers to these questions, and the nature of your intentions for the future, can be found in your choice of goals. Since management is a goal-directed activity (an activity directed toward goal attainment), your goals provide direction to all your management efforts.

Goals are a very personal aspect of life. While your goals may be similar to those identified by others, they will be unique to you (your family). They will reflect your values and beliefs, the resources you have to work with, and the opportunities and limitations that you face. Through their goals, each person, family, or business unit identifies its aspirations for the future.

If goals really are this personal, you may wonder why we start a discussion of ranch management by focusing on goals and priorities. We do so because individuals and families seem much more likely to achieve the things they want in life if they know what they are trying to accomplish, how they want to carry out their actions or decisions, and when their efforts are to be completed.

## Goal Identification Considerations

All of us have goals that we work toward over many years — goals such as the debt-free ownership of a farm or ranch or "burning" the mortgage on the family home. Some goals will require a lifetime to achieve. Others can be attained in a year, a few years, or a decade. Goals that will be achieved over many years are called long-term goals. Those that can be attained in relatively short periods of time are usually called short-term goals or objectives. In farming/ranching, short-term goals focus on hoped-for achievements or production targets such as renting additional pasture for this year or increasing stocker average daily gains by 10 percent.

To the extent possible, one seeks to have short-term goals that directly support attainment of long-term goals. When this is true, the stage is set for more effective financial and business management. But, it's rare for all short-term and long-term goals to be mutually supporting. Production goals for farming/ ranching may be somewhat in opposition to important short-term quality of life goals. If you find inconsistencies in your set goals, don't be surprised. Priority setting provides a means of examining conflict or competition between goals and identifying the ones that you believe are most important or most urgent.

## Goal Writing Guidelines

Here are some ideas about writing goal statements that can serve as guidelines as you complete the goal setting exercise:

- Goals are written action statements. "To complete..." or "To earn..." or other action statement introduces a typical goals.
- Long-term goals usually specify the time by which the goal is to be attained. "To pay off the real estate mortgage by..."

- When long-term goals do not specify a time, they usually refer to qualitative aspects of life. "To make it possible for each of our children to secure a college or university degree by providing..."

- Long-term goals should be believable in that they should describe situations or conditions that you think you can achieve over the years. Avoid "pie-in-the-sky" long-term goals that you neither believe in nor will find possible to achieve.

- Short-term goals indicate the time by which the goal is to be attained. "To replace our present tractor with a 125 horsepower model by the end of 1999."

- Short-term goals should be attainable in that they should describe situations that you believe are possible to achieve in the designated time. Avoid "impossible" short-term goals that you know cannot be attained, as they cause great discouragement.

As you write goal statements you are expressing your hopes and dreams and ambitions for the future by identifying what you want to achieve, how you intend to achieve, and when you intend to achieve each desired outcome.

The following worksheets will help you develop three kinds of long- and short-term goals: production, quality of life, and natural resource goals. You will want to review and update these goals throughout the planning process and at least annually thereafter.

Prepared by Melvin R. George, Extension Range and Pasture Specialist, University of California, Davis, CA

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# Legal Descriptions of Property

In all states created out of the Territory Northwest of the Ohio River, states south and west of Georgia, and all states west of the Mississippi River except Texas, the U.S. System of Rectangular Surveys was used exclusively or nearly so. However, even in these states, metes-and-bounds descriptions have been resorted to in describing land tracts for which title was obtained prior to being officially surveyed by the U.S. government. Special attention should be directed to the states of Texas and Ohio. When the state of Texas came into the Union in 1845, it retained all lands within its present boundary. Most of eastern and southern Texas is comprised of unregulated land divisions and includes, in part, lands granted to individuals and groups of settlers by the Spanish and Mexican governments and later by the Republic of Texas. However, most of the lands in northern and western Texas were divided under a rectangular system patterned after the U.S. System of Rectangular Surveys.

## U.S. System of Rectangular Surveys[1]

This system, also referred to as the Survey of the Public Domain or the Congressional Survey System, is based on the Land Ordinance of 1785. After being modified in 1787 and again in 1796, it became the official land survey system for the public domain, i.e., those lands to which the federal government gained title through cession, purchase, and conquest before they were allotted to private individuals. The original public domain consisted of the westerly lands east of the Mississippi River that were relinquished by the original 13 states between 1781 and 1802. Subsequent additions were made to the public domain between 1803 and 1867, comprising nearly all of the present land areas of the U.S. west of the Mississippi River excluding Texas.

The U.S. System of Rectangular Surveys is based on arbitrarily selected pairs of east/west and north/south lines intersecting at an **initial point** (also referred to as the point of origin). The north/south line passing through the initial point is referred to as the **principle meridian**, and the perpendicularly intersecting east/west line is referred to as the **base line**. Both lines are run on true cardinal directions. The survey of the public domain has utilized 15 initial points and accompanying intersecting lines east of the Mississippi River, 19 points west of the Mississippi River, and three points in Alaska. Figure 1 shows the survey area controlled by each principal meridian and base line.

Figure 1 shows the subsequent division of each survey area into rectangular land tracts. This process follows distinct sequential steps. First, the four quadrants formed by the principal meridian

[1]The Public Lands Survey is carried out under direction of the Bureau of Land Management, formerly the General Land Office. Further details on the U.S. System of Rectangular Surveys can be found in the Manual of Instructions for the Survey of the Public Lands of the United States (Washington, DC; U.S. Government Printing Office, 1947.

and base line are divided into 24-mile blocks (not diagramed in Figure 2). Second, each 24-mile block is divided into sixteen, 6-mile square **townships**. The secondary north/south lines delineating the townships are referred to as **range lines** and the secondary east/west lines as **township lines**. Third, each township is divided by north/south and east/west **section lines** into 36 one-mile square **sections** of approximately 640 acres each. Fourth, each section is divided into half-mile square **quarter sections** of approximately 160 acres each. Further subdivision may take place after the land is transferred into private ownerships.

Within this land division system, only one tract of land can have a given description. Each township is designated numerically by the number of the **tier** (row) north or south of the base line and by the number of the **range** (column) east or west of the principal meridian. The sections within each township since 1796 have been numbered 1 through 36 beginning in the upper right hand corner as shown in Figure 2 (lower left). The complete legal description of the tract of land lying in the lower right corner of the section diagram of Figure 2 is (assuming location in the Salt Lake Principal Meridian survey area):

> East half of the Southeast Quarter of Section 14, Township 2 South, Range 3 West of the Salt Lake Principal Meridian (abbreviated to E1/2SE1/4, Sec. 14, T2S R3W, Salt Lake P.M.)

Range lines and township lines are respectively true meridians and true parallels. Theoretically, the sides and base (east, west, and south boundaries) of each township will be of full distance. Section lines, on the other hand, are surveyed parallel to the eastern and southern boundaries of the township. This results in putting the deficiencies or excess area in sections along the northern and western edges of the townships. These area discrepancies are allowed for by establishing irregular size lots along the outward edges of the affected sections. These lots, as well as those resulting from irregularities caused by such things as lake boundaries and survey area boundaries, are numbered within the section in a counter-clockwise direction.

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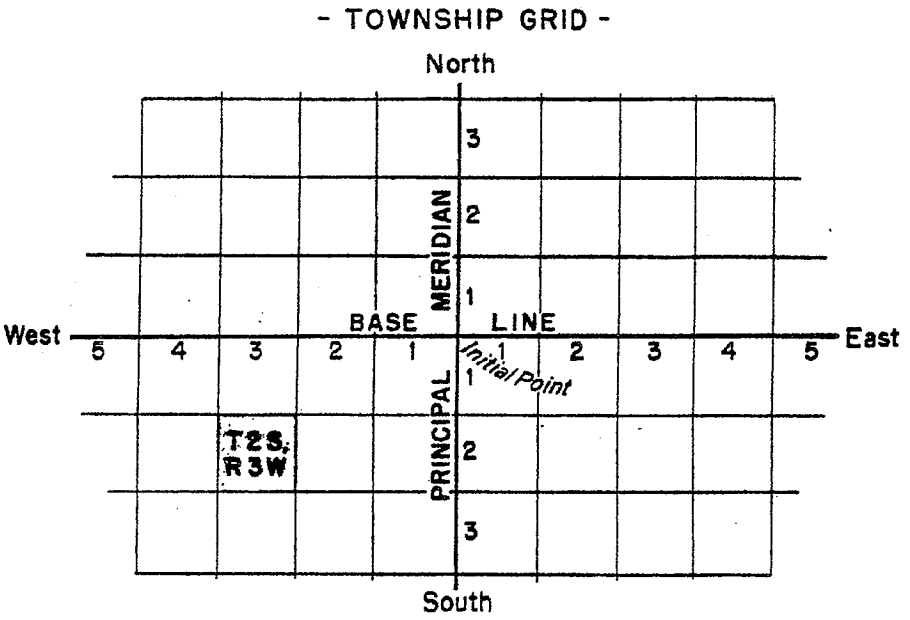
# GENERALIZED DIAGRAM OF THE RECTANGULAR SYSTEM OF SURVEYS




TOWNSHIP 2 SOUTH, RANGE 3 WEST

| | | | | | |
|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | Section 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

SECTION 14

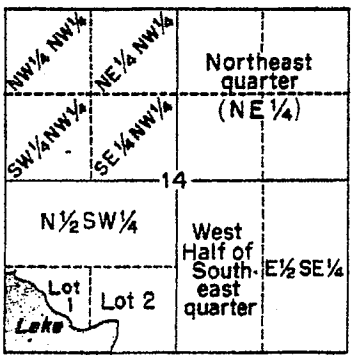



Figure 1. Generalized diagram of land division within the U.S. System of Rectangular Surveys.

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# Developing a Ranch Map

Maps play a useful role in the development and presentation of a ranch plan. Much of the ranch inventory can be shown on maps. Maps can graphically show the natural and cultural features present on the ranch and their spatial relationships.

To develop a ranch map begin with a base map. The base map is often an aerial photo acquired from USDA or from private sources. Topographic maps can serve as a base map. Sometimes hand drawn maps are used as a base map. Information is usually added to base maps by adding transparent layers showing additional features not shown on the base map.

Following is a list of ranch inventory information that can be included in various maps and overlays:

Base Maps:

- Begin by including an information block showing the name and location of the ranch, name of the owner or manager, name of persons who developed the map, date of map preparation, and map scale.
- A map legend should be included to explain symbols and color schemes used on the map. Conventional mapping symbols used by USDA NRCS are shown in Figure 1.
- Property, field, and pasture boundaries may be shown on the base map or as an overlay.

Overlays:

- The Boundary Overlay shows property lines and fence lines, roads, and other features at the digression of the map maker.
- The Hydrology and Natural Feature Overlay shows streams, rivers, lakes, marshes, estuaries, and other water bodies on or adjacent to your ranch. This overlay may also include important natural features such as ridge tops, cliffs, valleys, and other natural features.
- A Cultural Features Overlay may include roads, trails, stock water sites, fences, corrals, railroads, ranch headquarters, windbreaks, irrigation and drainage structures, your house, barn, and any other desired feature.
- A Field or Pasture Overlay with unit names or numbers and acreages should be developed or incorporated in the Boundary Layer.
- A Planning Overlay may be developed to show the location of planned developments and treatments. This information may be included on other overlays.
- Sometimes a Soils Overlay can be useful, but more commonly the maps from local soil surveys are reference or included with the plan.

## Developing Overlays

Overlays are easy to develop. Sheets of acetate or other transparent material are placed over the base map. Tick marks are placed on the overlay, marking the corners or other locations on the base map so that the overlay can always be returned to its proper geographic location. It is helpful to tape the base map and overlay to your work surface. Be sure to use tape that is easy to remove without damaging the overlay or map. Once the overlay sheet is "geo-located," you are ready to start drawing features on the overlay. Initially, you should use erasable ink pens so that you can remove your geographic and artistic errors. Once you are satisfied with the overlay, you could redo the map with permanent ink. Don't forget to label the overlay down in one of the corners. Some day you will use a computer to do this. Geographic information system software is widely used by agencies and universities, but it is expensive and takes a great deal of effort to learn. So, for now, develop your ranch maps by hand.

## Estimating Area

You may need to estimate the area in a pasture or for the entire ranch. A common means of estimating area is by using an acreage calculating dot grid. To use a dot grid, you determine the number of dots in a known area (i.e., 25 dots = 5 acres). Then you count the dots in an unknown area and calculate the number of acres. If you know the scale of your map, you can use the tables that often accompany dot grids.

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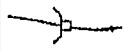
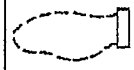
# CONSERVATION PLAN MAP SYMBOLS

| | | |
|---|---|---|
| Farm or ranch operations boundary | Railroad | Spring |
| Ownership boundary | Power transmission line (Label BURIED if underground) | Marsh |
| Field or land use boundary | Intermittent streams | Inclusion tie |
| Land use capability class, range or woodland site boundary | Gully | Building |
| Range condition boundary | Perennial streams | Rock outcrop |
| Range condition EC, GC, FC, PC | Natural barrier or escarpment | Corral |
| Good motor road | Important ridge top | Stack yard |
| Poor motor or private road | Cattle guard | Farmstead H |
| Trail or jeep road (Label) TRAIL | Wet spot | Field or pasture unit number (2) |
| | Pond or lake Pond | Field or pasture acreage 320 A. |

| | EXISTING | PLANNED | | EXISTING | PLANNED |
|---|---|---|---|---|---|
| Fence | | | Direction of irrigation | | |
| Electric fence | | | Pickup ditch | P | P |
| Shelterbelt | | | Diversion ditch | D | D |
| Stream bank protection | | | Drainage Ditch (open drain) | | |
| Dike or levee | | | Closed drain | | |
| Pipe line or sprinkler main | | | Terrace | T | T |
| Permanent sprinkler lateral | | | Tide or flood gate | | |
| Portable sprinkler lateral | | | Division box or turnout | | |
| Flume | | | Pipe riser | | |
| Canal | CANAL / CANAL | CANAL / CANAL | Diversion or spreader dam | | |
| Irrigation ditch | | | Check dam or gully plug | | |

| | EXISTING | PLANNED | | EXISTING | PLANNED |
|---|---|---|---|---|---|
| Drop or overfall |  |  | Windmill |  |  |
| Dam and reservoir |  |  | Windmill and trough |  |  |
| Stock pond, tank or charco |  |  | Water tank |  |  |
| Spring development |  |  | Pump |  |  |
| Spring and trough |  |  | Salt ground |  |  |
| Trough |  |  | Small reservoir |  |  |
| Well |  |  | | | |

*Notes:* *When existing fences are combined with other symbols, they may be shown as follows:*

 = Fence along both sides of good motor road, etc.

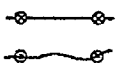
 = Fence along one side of ditch, etc.

*When planned fences are combined with other symbols, they may be shown as follows:*

 = Planned fence along both sides of good motor road, etc.

 = Planned fence along one side of ditch, etc.

*When fences or ditches, etc., are to be removed, they may be shown as follows:*



## SPECIAL SYMBOLS

Blowout ..... 

Moderate wind erosion ..... 

Severe wind erosion ..... 

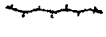
Severely eroded or gullied area .. 

Wind hummocks ..... 

Overblown soil ..... 

Saline spot ..... 

Gully ..... 

Unstable channel .. ..... 

Rock outcrop ..... 

Stoniness

Stony ..... 

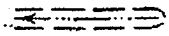
Very stony ..... 

Gravel ..... 

Chert fragments ..... 

Clay spot ..... 

Clay butte ..... 

Vegetative waterway..... 

Special purpose plantings. .. ..... 


(label)

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# Animal Units

The term "animal unit" is something that all ranchers, extension personnel, and rangeland managers use and presumably understand. But do we really understand what an "animal unit" is?

Over 60 years ago the term animal unit was defined as "1 cow-unit and that was the equivalent to 5 sheep and 5 goats." The "cow unit," however, wasn't fully defined. About 20 years later the animal unit was defined as "the amount of forage grazed by a mature cow in 1 year" (whatever that is) and that 5 sheep, 5 goats, or 1 horse were "considered" equal to 1 cow for range grazing.

Over the years our ability and our need to define animal unit more precisely has increased. Today their are three approaches to defining an animal unit: a cow-calf unit, 1,000 lbs. of live weight of any species, and on an energy basis.

## Cow-Calf Unit

The following table has become the "bible" of animal units based on the original cow-calve unit.

| Cattle | Animal Unit |
|---|---|
| Weaned calf to yearling | .6 |
| Steers and heifers (1-2 years) | 1.0 |
| Mature cows with or without calf | 1.0 |
| Mature bulls | 1.3 |
| **Sheep** | |
| 5 weaned lambs to yearlings | .6 |
| 5 muttons or ewes | 1.0 |
| 5 mature ewes with or without lambs | 1.0 |
| 5 mature rams | 1.3 |
| **Goats and Deer** | |
| 6 weaned kids to yearlings | .6 |
| 6 muttons or does | 1.0 |
| 6 does with or without kids | 1.0 |
| 6 mature bucks | 1.3 |
| 6 deer | 1.0 |

The "Bible Standards" were based upon research data that is over 32 years old. Certainly, we have obtained more knowledge to answer the question, "What is an animal unit?" Listed below are two major problems that the animal unit concept doesn't address.

1. Growing livestock (post-weaned growth). As an animal grows his nutrition and forage intake changes. A 600 lb. calf can certainly eat more forage and require a lower quality diet (percent level) than a 400 lb. calf. If you correctly stock a pasture with 400 lb. calves, those calves should certainly grow and develop. As they get larger their forage intake requirement increases, and if a stocking rate adjustment isn't made, then the pasture becomes "overgrazed." This change in forage demand for a growing animal must be considered in order to obtain desired animal performance.

2. Cow with or without a calf. There is no question that when a cow delivers a calf and starts to lactate, the nutrient requirement and forage intake greatly increase. Therefore, to say that a cow with or without a calf is an animal unit is misleading. Over the coarse of a year, however, the animal unit of a producing cow may in fact average out to be 1 animal unit. However, the variation within that year of production is tremendous. The forage requirement does fluctuate within any production year. If this is not accounted for at certain times of the year, the pasture will be overgrazed. To make matters worse, these overgrazed periods are the most economically important periods of the production year.

## 1000 lbs. Liveweight

In the 1950s, animal unit was defined as "1000 lbs. liveweight, or roughly equivalent to the weight of a cow and a calf." However, it is common during part of the year for a cow and calf to total 1400 lbs. liveweight. Further work in the 1950s led some researchers to adopt a liveweight approach to defining an animal unit. Under this approach a 1,000 lb. (454 kg) animal of any species was equivalent to 1 animal unit. This method will

account for changes in growing animals if it is recalculated every month or two, such as in a monthly stock flow chart.

## Metabolizable Energy

Dr. Larry D. White of the Texas A & M Extension Service has developed the concept of using the daily metabolizable energy requirement of an animal to account for changing nutrient requirements. He has developed comparisons using a 1000 lb. dry cow during the last third of pregnancy as a standard (17.3 Mcal).

All metabolizable energy requirements are then compared to 17.3 Mcal of metabolizable energy for the 1000 lb. dry cow. The result of this comparison is referred to as a "stock unit." For example:

| Type of Animal | Metabolizable Energy | Standard Animal Unit |
|---|---|---|
| 1,100 lb. lactating cow | 19.9 | 17.3 Mcal = 1.15 |
| 800 lb. lactating cow | 16.6 | 17.3 Mcal = .96 |
| 500 lb. steer (gaining 1#/day) | 11.8 | 17.3 Mcal = .68 |
| 700 lb. steer (gaining 0.5#/day) | 13.1 | 17.3 Mcal = .76 |
| 2,000 lb. bull | 24.9 | 17.3 Mcal = 1.44 |
| 132 lb. ewes (dry) | 4.8 | 17.3 Mcal = .28 |
| 88 lb. Angora does (dry) | 3.9 | 17.3 Mcal = .23 |

The stock unit equivalent measure is similar to the animal unit in purpose. It compares the daily metabolizable energy requirements (17.3 Mcal equal) for a mature 1000 lb. cow at the last third of pregnancy (standard SUE) to the energy requirements at different weights, physiological conditions, and between animals. The SUE allows estimation of forage quantity needs by multiplying SUE by 19.6 lbs. dry matter (50% digestibility) for the animal in question. By using a conversion based on energy, we can correct intake for digestibility and more appropriately estimate daily forage demand.

The stock unit equivalent guides (development for a 50% digestible forage) allow us to adjust daily intake based on research relative to different feed digestibilities. Also, they allow comparison among species of animals that eat different diets but can be compared on metabolizable energy requirements. This procedure and use of SUE is used in determining forage grown. Also, ratios among species are expressed on the primary nutrient selected for energy and can be adjusted with diet analysis for different forage intakes.

## Forage and Feed Equivalents

An AUM is the amount of feed required by an animal unit for one month. It is approximately equivalent to the following forages and feeds:

| | |
|---|---|
| 400 lbs. | of total digestible nutrients (TDN) |
| 400 lbs. | of total digestible nutrients (TDN) |
| 800 lbs. | (.4 ton) of hay |
| 1,333 lbs. | (.67 ton) silage |
| 2,400 lbs. | (1.25 tons) green feed |
| 533 lbs. | (.27 ton) concentrate |

More precise AUM conversions can be calculated for specific feeds using data in the NRC nutritional requirements for beef or sheep.

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Prepared by Melvin R. George, Extension Range and Pasture Specialist, University of California, Davis. Adapted from White, Larry, 1987, Total Ranch Management, Cooperative Extension, Texas A&M University.