PRAIRIE FARM REHABILITATION ADMINISTRATION SERVING THE PRAIRIE PROVINCES

Soil and Water
Conservation Branch

Dugouts For Farm Water Supplies



Canada

Introduction

In many parts of Western Canada, dugouts provide the main source of farm water supply. On most farms the basic conservation measure of trapping and holding melting snow can provide all the livestock and farmstead water needs. Many farm dugouts, in the past, were constructed solely as an emergency water supply for drought conditions. Today dugouts are generally relied upon to provide a continuing water supply and thus must be large enough to provide this supply on a regular annual basis through dry years in a drought-prone region.

This pamphlet provides the following main points to consider before constructing a dugout:

1. Farm water requirements determine the size of dugout needed to provide a reliable water supply through a drought period.
2. The dugout site must be located to provide an adequate supply of contamination-free water.
3. Construction must be planned so the dugout will yield a lasting water supply with minimum erosion and maintenance.

Page 6 and 7 of this pamphlet present a graph, a consumption table and an evaporation zone map to assist in determining appropriate dugout sizes for individuals.

The dugout sizes derived from the graph provide a reliable annual water supply allowing for a one year drought. The annual supply is the amount consumed each year. A one year drought is simulated by providing the water supply through a year of no spring runoff. Evaporation, silting and ice formation are also accounted for in simulating the supply capability shown in the dugout sizing graph.

PRFA is a federal government agency, established in 1935 to deal with soil and water conservation problems in the three Prairie provinces. **Before** starting any on-farm water project contact your local PFRA office with respect to technical advice and financial assistance. PFRA policy statements and applications are available from your local district office.

PFRA Office Locations

Alberta	**Saskatchewan**		**Manitoba**
Hanna	Gravelbourg	Rosetown	Brandon
Lethbridge	Maple Creek	Shaunavon	Dauphin
Medicine Hat	Melfort	Swift Current	Morden
Peace River	Melville	Watrous	
Red Deer	Moose Jaw	Weyburn	
Vegreville	North Battleford		
Westlock			

Points to consider before dugout construction

Size

Use the consumption table on page 6 to determine the amount of water required.
Having calculated the water supply required, the dugout sizing graph on page 6 can be used to determine the dugout size and depth best suited to your needs. The water supply shown on the graph covers a one-year drought situation. A larger dugout should be constructed for expansion of your needs or to cover a more extended drought period.

No allowance has been made for seepage as dugouts should only be excavated in impervious (nonporous) materials. A dugout excavated in pervious material is unlikely to be effective as a water reservoir.

The water table should be considered. An aquifer that loses water and does not maintain its level will drain whatever water is in a dugout. If a water-bearing aquifer exists, water supply from a well would help avoid pollution problems. For livestock watering from a shallow aquifer a scoopout much smaller than a dugout will serve the purpose at less expense.

Consult your local PFRA office for advice concerning waterproof linings when there is no alternative to constructing a reservoir in pervious materials.

Long and narrow dugouts are effective in reducing evaporation losses when constructed across prevailing winds. They are also easy to clean, using a dragline, when this becomes necessary.

Note that a deeper dugout with a smaller surface area can provide a more effective water supply using the same excavation volume. See dugout sizing graph, page 6.

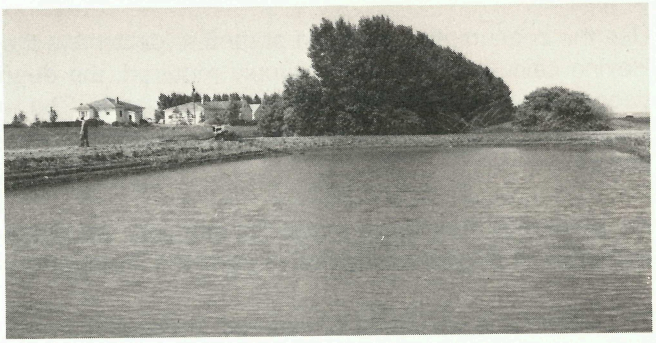


Dugout lifespan is increased and water quality enhanced by fencing out livestock and delivering water to water troughs.

Site

The drainage area should be large enough to fill the dugout with water from snowmelt most years.





Small drainage areas can be enhanced by skillfully placed tree plantings or other snow-trapping measures.

Although the water supply location should be convenient to the farmhouse and yard, drainage from the farmyard and livestock must not be allowed to contaminate the water.

Shelter from winds reduces evaporation loss but trees should be kept back from dugouts to avoid contamination from leaves and debris and to allow access for maintenance.

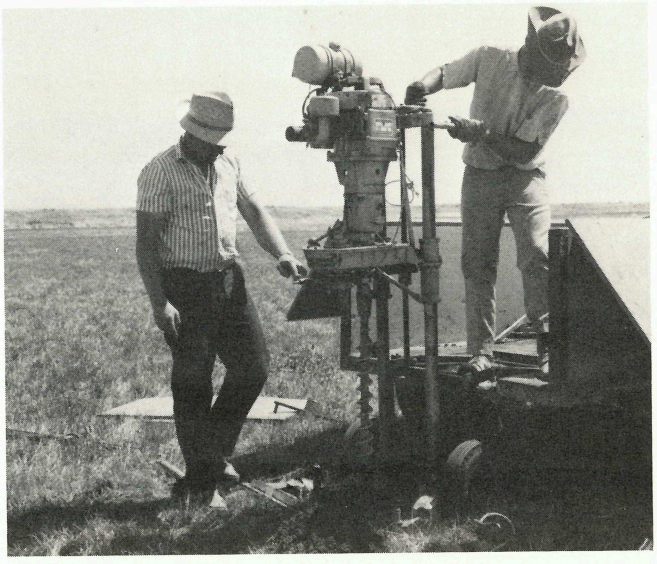
Soil conditions should be investigated by drilling the site one metre deeper than the proposed dugout. The existence of a pervious layer of soil may indicate an unsuitable area or soft wet ground may warn of difficult construction conditions.

It is very difficult to maintain good quality water in dugouts located in sloughs or marshy areas. Water diverted from a snowmelt watercourse is a more satisfactory way of assuring a water supply of good quality water.

The watershed area, or at least the drainage course, should be grassed rather than cultivated. Runoff from cultivated areas silts the dugout and can lead to turbidity and algae problems.

See your local provincial agency for technical guidance in farm water treatment.





Test holes may be made by hand auger or boring machine to determine subsoil conditions.

Construction

The dugout sizing graph on page 6 is based on the maximum recommended slopes of 4:1 end slopes and 1½:1 side slopes. In erodible and unstable soil, flatter side slopes (2:1) should be used and the top width made correspondingly wider.

Dugouts are constructed using various types of earthmoving equipment such as motorized scrapers or draglines. A dragline can work in wet or soft ground whereas a scraper can more easily level spoil piles and place topsoil as required.

Spoil banks from dugout excavations should be leveled and, if possible, the area should be restored to productive use. Spoil banks left near a dugout tend to erode back into the excavation, causing silting. A minimum of five metres should be left between spoil banks and the edge of the dugout. The preferred treatment is to strip topsoil before excavation and replace it over the subsoil after construction, to allow successful regrassing.

Water intakes should be installed at construction time. Gravel filters are not recommended as they contribute to water quality problems. A floating intake, with provisions to adjust the level from which it draws water is most suitable. The water intake should be equipped with a valve at the pumpwell and a second valved pipe should also be installed from near the bottom of the dugout as an emergency supply in case of freeze-up or damage to the floating intake.

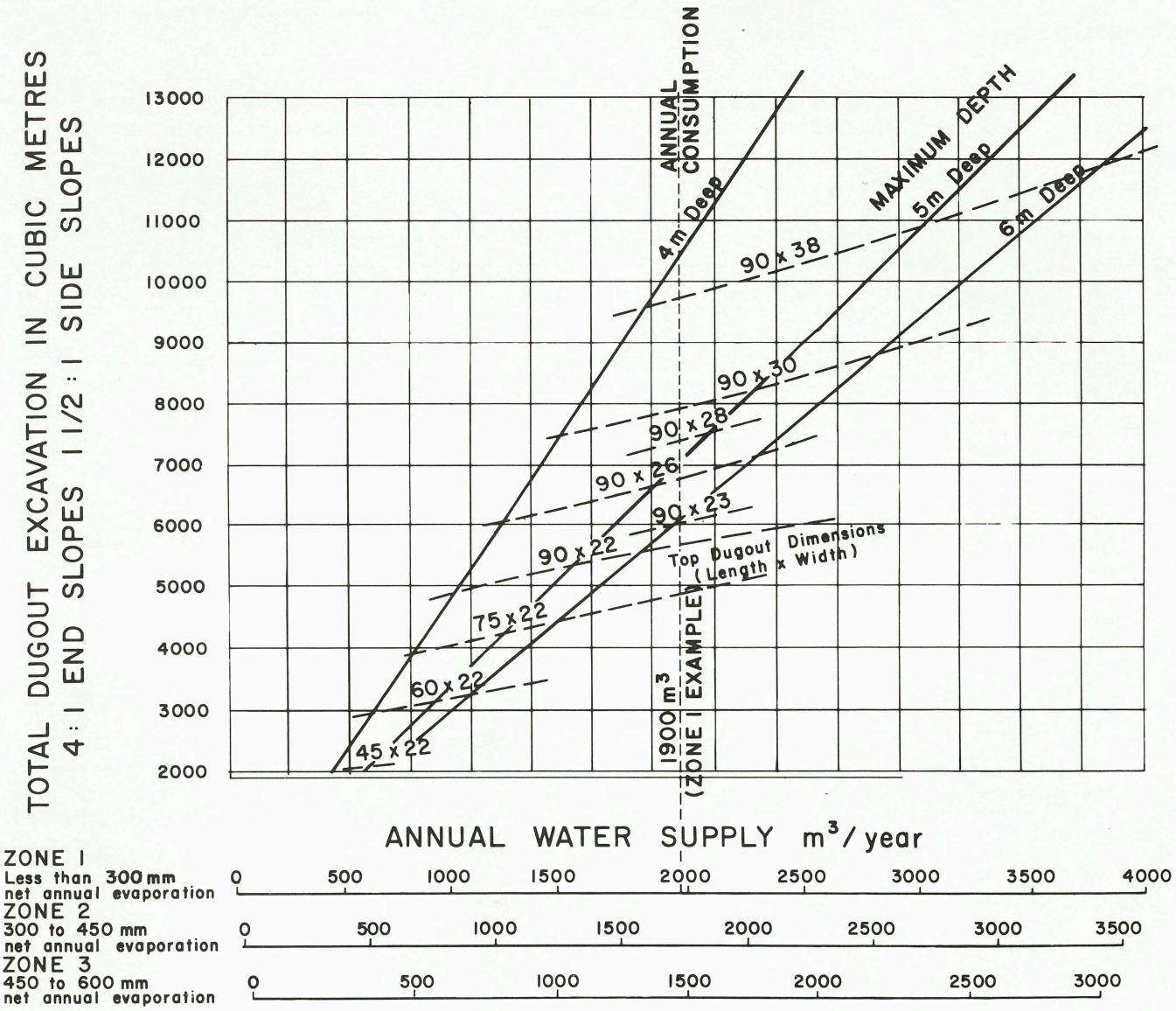


Cat and scraper stripping topsoil prior to excavating dugout.



Dugout nearing completion spoil dirt leveled and covered with topsoil to be returned to productive use.

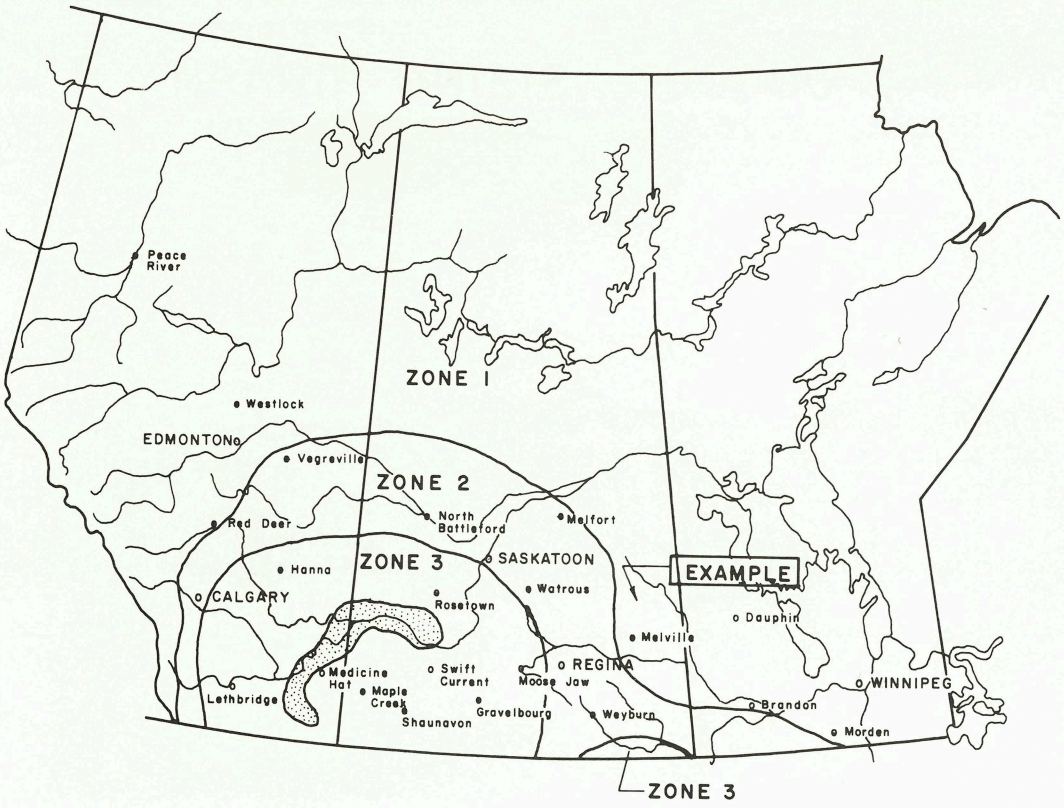
DUGOUT SIZING GRAPH



Annual Water Consumption Table in Cubic Metres (m³)

Unit	Consumption Per Year
Human (60 gal./day)	— 100 m³/person
Dairy Cattle (36 gal./day)	— 60 m³/head
Beef Cattle (15 gal./day)	— 25 m³/head
Dairy Cattle — winter only	— 35 m³/head
Beef Cattle — winter only	— 15 m³/head
Horse (15 gal./day)	— 25 m³/head
Hog (4 gal./day)	— 6 m³/head
Sheep (2.4 gal./day)	— 4 m³/head
100 Chickens (7 gal./day)	— 11 m³/100
100 Turkeys (10 gal./day)	— 17 m³/100
4 500 * Crop Spraying Tank (1,000 gal. tank)	— 4.5 m³/tank
Small Garden Plot 30 m x 35 x m (100 ft. x 115 ft.)	— 300 m³/1000 m² (0.25 acre)
Lawn or Ornamental Garden	
Applying 200 mm/year (8 inches of water/year)	— 200 m³/1000 m² (0.25 acre)

When calculating the required annual water supply based on the above consumption rates, allowance should be made for the **maximum** expected units of use. Should a large number of any one unit be contemplated, consult your PFRA representative for a more accurate estimate of water requirement.



Evaporation Zones

For Use with the Dugout Sizing Graph

Zone 1 — Less than 300 mm net annual evaporation
Zone 2 — 300 mm to 450 mm net annual evaporation
Zone 3 — 450 mm to 600 mm net annual evaporation
— 600 mm to 750 mm net annual evaporation*

* This area of high evaporation also has low runoff potential and needs special consideration. For size and location of dugouts see your local PFRA office.

Example

A dugout is required near Melville, Saskatchewan to supply water for the following:

5 people	2 horses
3 to 5 milk cows	50 to 100 chickens
30 to 40 beef cattle	

The farmyard has a garden plot 20 m x 30 m (65 ft. x 100 ft.) and would water a slightly larger area of lawn if water was available.

Crop spraying uses approximately 10 water tanks (1,000 gallons each) each year.

The annual water consumption is calculated as follows:

	Unit Quantity		Rate Required	Consumption
5 people	5	x	100 -	500 m^3
5 dairy cattle	5	x	60 -	300
40 beef cattle (winter only)	40	x	15 -	600
2 horses	2	x	25 -	50
100 chickens	1	x	11 -	11
Garden	0.6	x	300 -	180
Lawn	0.8	x	200 -	160
Crop spraying	10	x	4.5 -	45
			Total	1,846 m^3

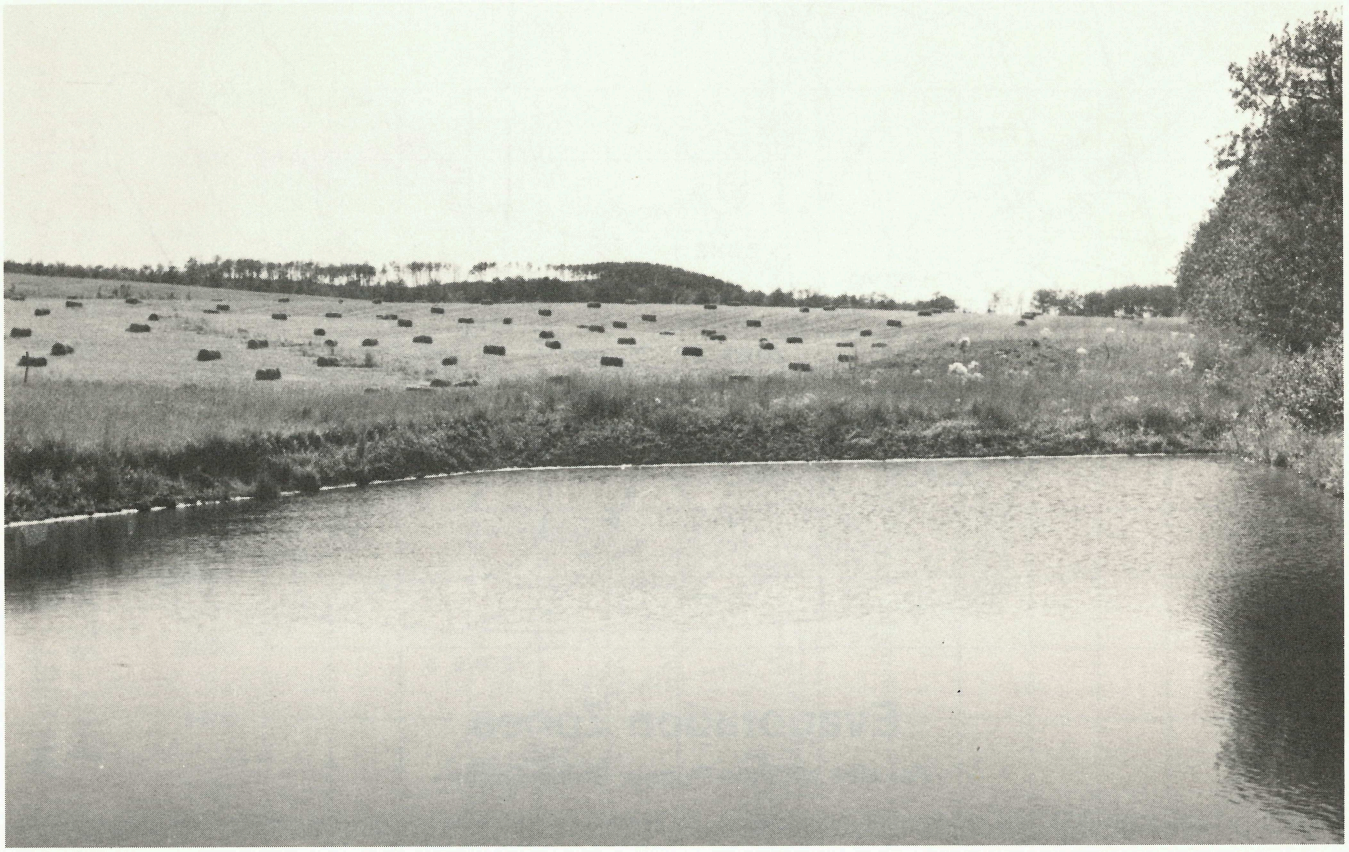
The effective water supply required is 1900 m^3/year.

From the Evaporation Zone Chart above Melville is seen to be in Zone 1.

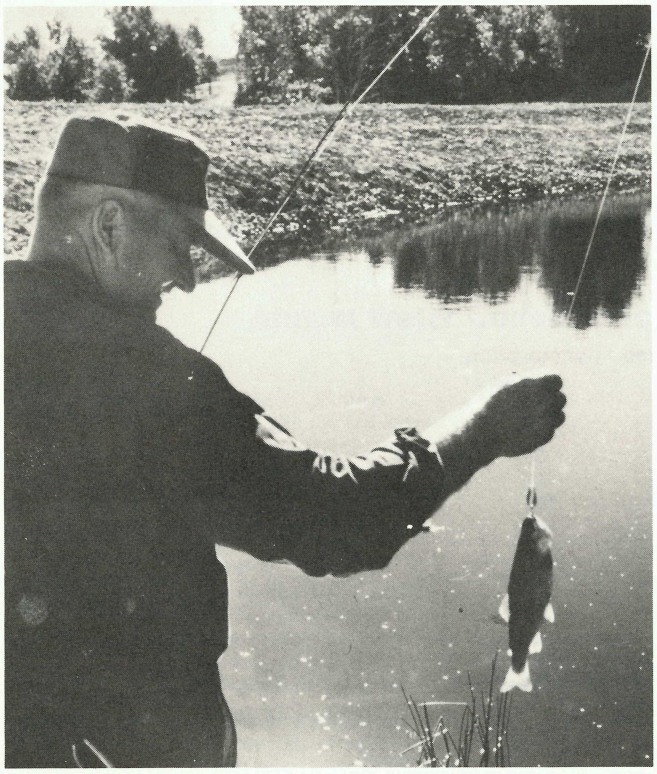
On the Dugout Sizing Graph on page 6 a vertical line is drawn upward from 1900 m^3/year on the Zone 1 water supply line.

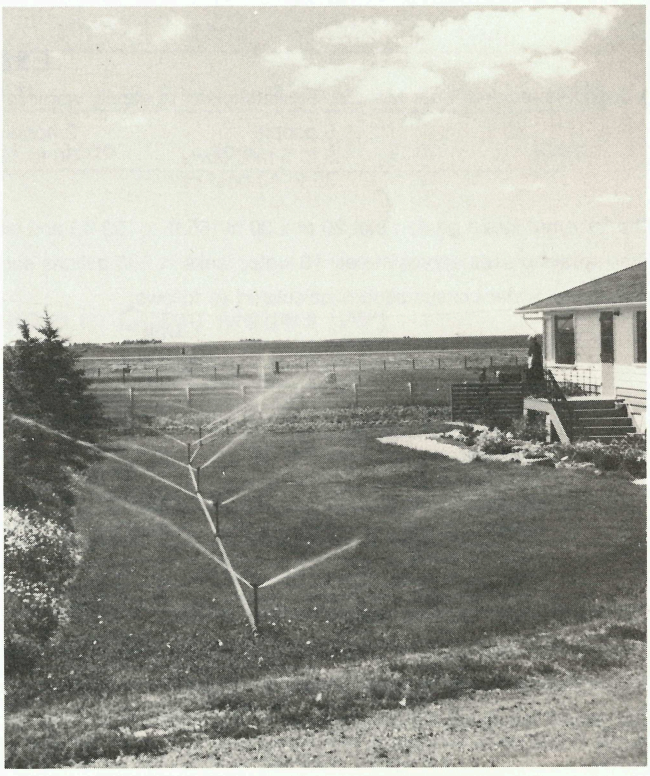
The vertical line shows the size and depth combinations that will provide sufficient water. A dugout 90 m x 23 m x 6 m deep would be economical at only 6 000 m^3 of excavation but drilling finds a layer of soft wet clay at about this depth, so it is decided to start with a top size of 90 X 28 meters.

Reaching a depth of 5 m will provide a secure water supply of 2100 m^3 per year with an excavation of 7 425 m^3.



A grass drainage basin helps enhance the quality of runoff water.





Additional Benefits of an Adequate Water Supply.

Agriculture
Canada

Prairie Farm
Rehabilitation
Administration

Administration du
Rétablissement Agricole
des Prairies

Disponible en Francais