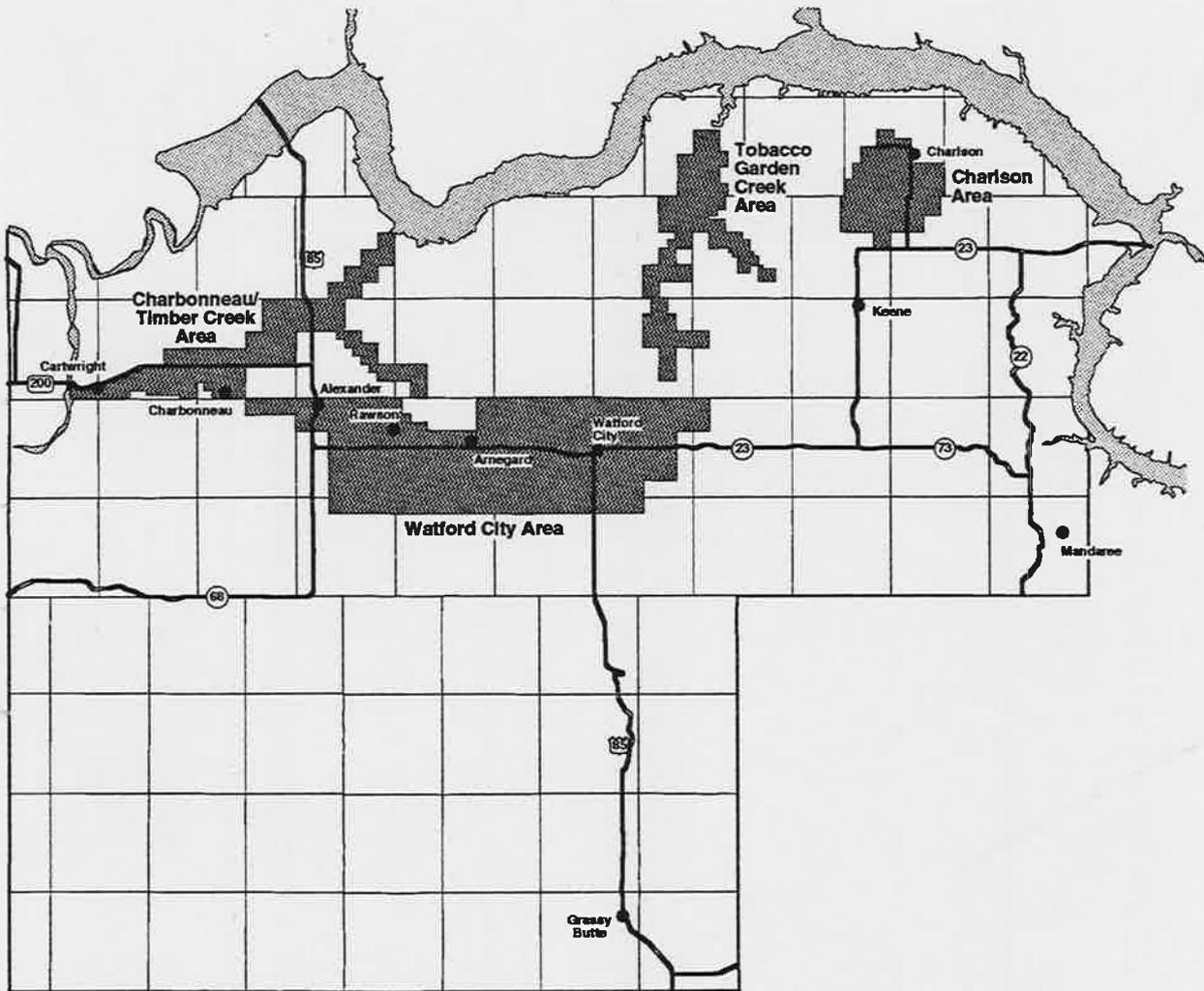


RECONNAISSANCE REPORT

McKENZIE COUNTY IRRIGATION
SWC PROJECT NO. 1857



NORTH DAKOTA
STATE WATER COMMISSION

June 1995

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McKenzie County Irrigation

SWC Project #1857

June 1995

North Dakota State Water Commission
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I. INTRODUCTION

The need for irrigation in North Dakota has been recognized since before statehood. During the North Dakota Constitutional Convention in 1889, Major John Wesley Powell, Director of the U.S. Geological Survey, stated that most of the state would require irrigation on at least a recurring cycle to sustain agricultural pursuits. By 1908, water was being provided to the Williston irrigation project. In the 1950s, the development of sprinkler systems, especially center pivot systems, increased the number of areas which could be irrigated. Sprinkler systems could irrigate rolling hills and land with much steeper slopes than flood irrigation. These systems, especially the center pivots, substitute capital investment for labor. Currently, approximately 80 percent of the state's irrigated acreage is under sprinklers. Most of the center pivot systems installed in McKenzie County and throughout the state were installed by individuals using ground water sources rather than surface water obtained through irrigation projects.

The Buford-Trenton irrigation project was constructed by the Bureau of Reclamation in 1940-43. At full development, the project irrigated approximately 10,000 acres of land near Williston. After the closure of the Garrison Dam in 1953, Lake Sakakawea began filling. The lake first reached its maximum normal operating elevation of 1850 feet msl in 1965. In 1958, the Corps of Engineers acquired the East Bottom of the Buford-Trenton project for the Garrison Dam-Lake Sakakawea project, reducing the irrigated area to approximately 7,100 acres. Currently, 9,876 acres are

being served with water. Continuing problems with the high water table caused by Lake Sakakawea are threatening the remaining area of the Buford-Trenton project.

The Upper Missouri Lake Sakakawea Planning Committee recognized the danger to the irrigation district and the potential impact it would have on the local economy. The committee has been working to prevent the loss of irrigation. The committee also approached the Williams and McKenzie County Water Resource Districts and proposed new irrigation districts to replace the Buford-Trenton District if necessary. They are also interested in enhancing the local economy and realize the potential irrigation holds for economic development.

In September 1991, the McKenzie County Commission requested that the State Water Commission conduct a study to determine the feasibility of creating new irrigation districts in McKenzie County. In November 1991, the State Water Commission entered into an agreement with the McKenzie County Water Resource Board to conduct a reconnaissance investigation of irrigation in McKenzie County. A copy of the agreement is included in Appendix A.

II. DESCRIPTION OF THE STUDY AREA

Location:

The study area consists of northern McKenzie County. McKenzie County covers an area of approximately 2,754 square miles in the northwestern part of North Dakota. The county is bordered on the west by Montana, on the north by the Missouri River, on the south by Golden Valley, Billings, and Dunn Counties, and on the east by Dunn County. The study area lies within the glaciated area of the Great Plains.

Climate:

The climate of McKenzie County is semi-arid. The average annual precipitation is 15.9 inches at Watford City. The average annual precipitation in McKenzie County is among the lowest in the state. Figure 1 shows the normal annual precipitation. About 70 percent of the precipitation falls during the growing season, which lasts from May into September. It is not uncommon for one part of the county to receive an inch (or more) of rain during a thunderstorm while another part receives very little or none. Over a period of many years, precipitation in one area of the county is probably similar to that of a nearby area, but within any one growing season there can be appreciable differences. The summers are usually warm, temperatures average 70 degrees Fahrenheit or more in July and August. However, temperatures exceeding 90 degrees Fahrenheit are not uncommon. The county is very cold in the winter, with recorded temperatures of below -40 degrees Fahrenheit.

Cropping Patterns:

Small grains, primarily wheat, and hay are the principal dry land crops. Cattle, and to a lesser extent sheep, are other important sources of farm income. The principal crops currently being irrigated are sugar beets, small grains, hay, and corn.

Water Source:

There are two possible sources of water for any irrigation project: ground water and surface water. Ground water was not considered as a water source for this study. Much of the ground water in the county is of marginal quality for irrigation, but the yield of the aquifers can exceed 500 gpm per well. A large number of wells would be required to supply an entire project, but ground water could possibly be a supplemental supply for a project.

The only reliable sources of surface water in the county are the Yellowstone River, the Missouri River and Lake Sakakawea. The main disadvantages of the Missouri River and Lake Sakakawea are the fluctuating levels and the meandering of the river channel which makes it difficult to locate pumping plants. Two types of pumping plants were considered: standard fixed plants and movable floating pumps. Some of the proposed areas do not have a suitable location for a fixed pumping plant. In these areas, only the floating pumps were considered.

III. STUDY DESCRIPTION

Soils and Topography:

The general soils map of the county was used to determine areas which have potential to be developed into irrigation districts. After a meeting in Watford City with interested parties, the decision was made to concentrate on the following areas shown in Figure 2: the Charlson area in the northeastern part of the county, the Tobacco Garden Creek area north of Watford City, the Charbonneau Creek - Timber Creek area along Highway 200, and the Watford City area south of Watford City.

Detailed soils maps of the selected areas were obtained from the Natural Resources Conservation Service (NRCS), formally the Soil Conservation Service, to determine the suitability of the soils for irrigation. The NRCS has divided the soils of the state into irrigation groups. These groups are divided into one of three classes based on the adaptability of the group to irrigation. The three classes are irrigable, conditional, and non-irrigable soils. Irrigable soils are those soils which have no restrictions to continued irrigation using the proper water application rates, amounts, timing, and water quality. Conditional soils are those soils which have restrictions due to water table, internal permeability, or salinity. The restrictions can be corrected with drainage or should be monitored and carefully managed. According to the North Dakota Irrigation Guide, these soils should be irrigated only as inclusions of less than 20 percent with irrigable soils. Non-irrigable soils have severe restrictions to irrigation and should only be irrigated as minor inclusions with other irrigable soils. Maps

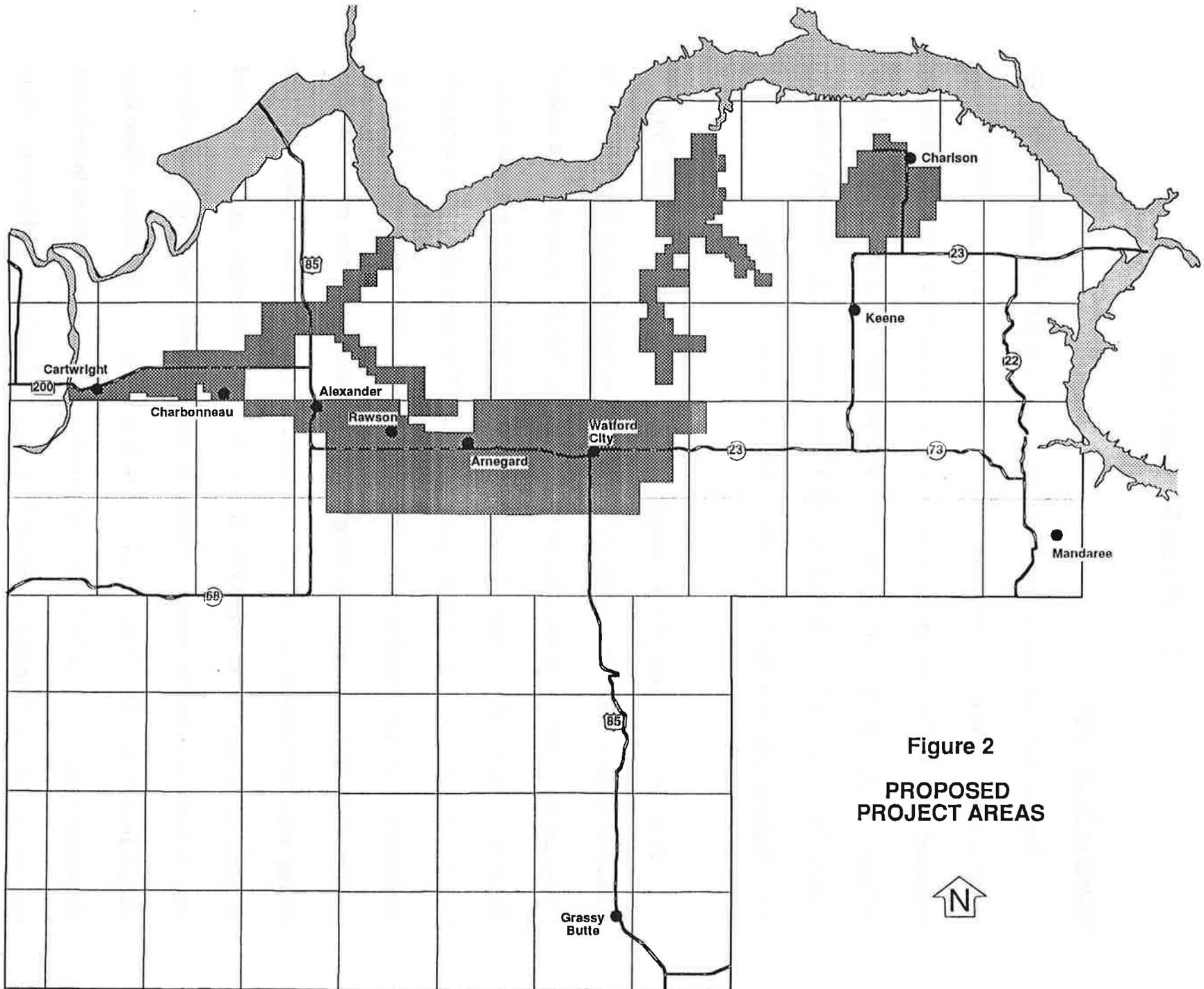


Figure 2
PROPOSED
PROJECT AREAS



showing the irrigation classes for each area are presented in the following sections.

The topography of the county was also considered in determining irrigation feasibility. The areas with rough topography were considered to be non-irrigable. The change in elevation from the water source to the irrigable lands is critical in determining the size of the pumping plants and conveyance works. The topography also limits potential intake sites and effects the layout of the conveyance works.

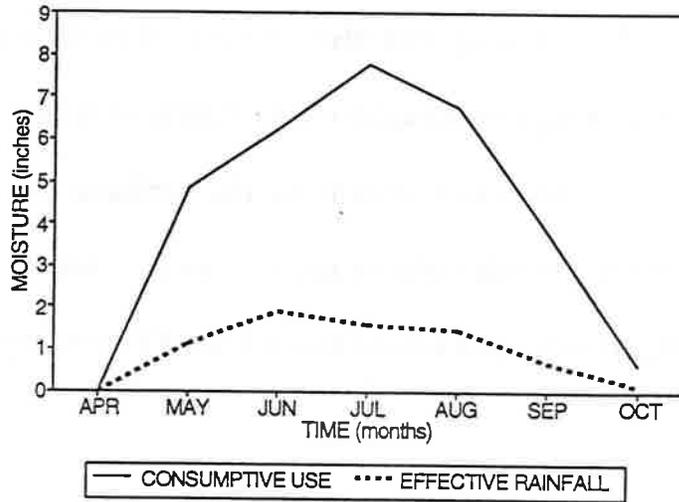
Crops:

The choice of crops to be irrigated depends on several factors including the growing season, crop water use, value of the crops, and access to markets. Due to the relatively short growing season in McKenzie County, the choice of crops is limited. The crops which may have potential to be irrigated include: alfalfa, corn, small grains, sugar beets, sunflowers, potatoes, field beans, grass, and some specialty crops such as vegetables, safflower, or canola.

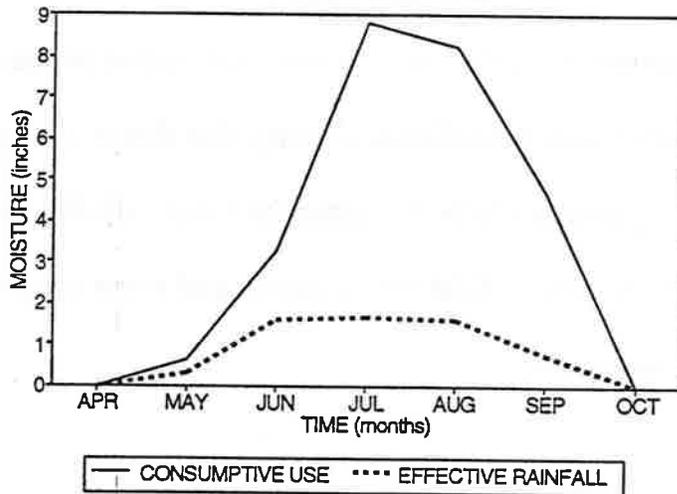
Irrigated crops should be chosen based on their response to additional water. Crop water use curves showing the depth in inches of effective rainfall and consumptive use for each month for alfalfa, corn, sugar beets, small grains, potatoes, and field beans are presented in Figures 3 and 4. Consumptive use, often called evapotranspiration, is the amount of water used by the plant and evaporated from adjacent soil or intercepted precipitation on plant foliage. Effective rainfall is the

FIGURE 3 CROP WATER USE CURVES

ALFALFA



SUGAR BEETS



CORN

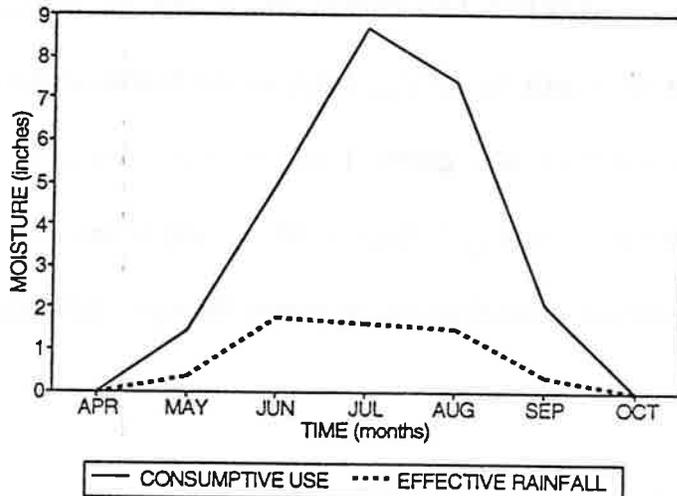
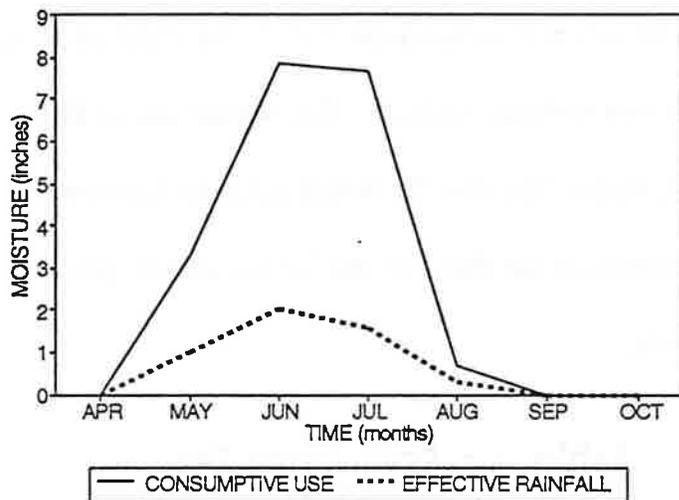
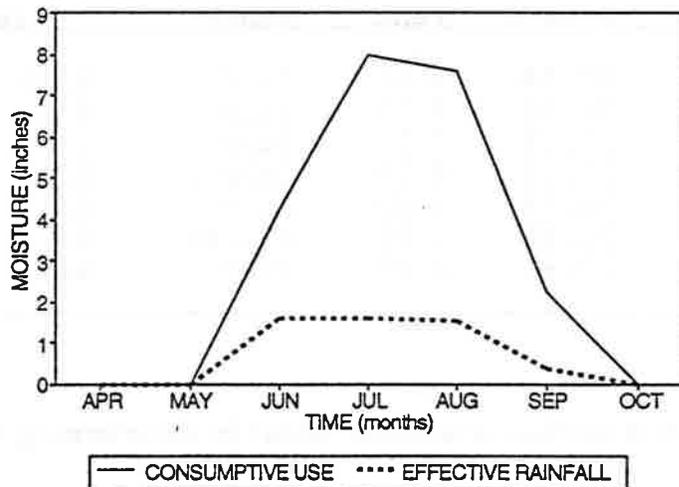


FIGURE 4 CROP WATER USE CURVES

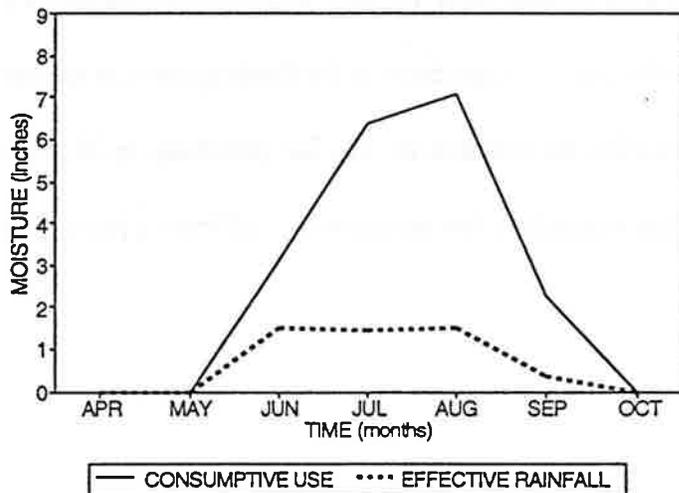
SMALL GRAIN



POTATOES



FIELD BEANS



portion of the total precipitation that is available to the crop in an average year. Alfalfa, corn, sugar beets, and potatoes use relatively large amounts of water over the entire growing season. Small grains use less water and their peak consumptive use is in June and July, the two wettest months. The water use of field beans is similar to small grains; however, beans require the water later in the season. Table 1 details the net irrigation requirements for these crops for the entire growing season and for the peak water use month.

**Table 1 - Crop Water Use
(Normal Year)**

Crop	Net Irrigation (Inches)			Growing Season
	Season	Monthly Peak	Month	
Alfalfa	20.58	6.21	July	5/10 - 10/ 8
Corn	16.46	7.03	July	5/18 - 9/16
Sugar Beets	17.23	7.17	July	5/20 - 10/ 1
Small Grains	11.94	6.13	July	5/ 1 - 8/ 8
Potatoes	14.74	6.43	July	6/ 2 - 9/15
Field Beans	11.68	5.59	August	6/ 2 - 9/15
Grass	17.91	5.97	July	5/ 1 - 10/ 8

The availability of a market is a major factor in determining the crops to be irrigated. Due to the number of cattle in the area there is an existing market for corn, both in the form of grain and silage, and alfalfa. Opportunities exist to expand these markets either by increasing cattle numbers or by feeding calves rather than shipping them out of state. Currently, no market exists for potatoes in McKenzie County. It may be possible to develop a market for potatoes if sufficient land is irrigated.

Sugar beets are currently being grown in the Lower Yellowstone Irrigation District. However, because of the necessity of having a contract with a processing plant to market sugar beets, it does not appear that the total sugar beet acreage in the county will increase. Although sugar beet acreage from the Lower Yellowstone area or the Buford-Trenton area, in Williams County, may be transferred to newly developed areas, it was assumed that sugar beets will not be grown in the proposed project areas. Currently, some beans are being raised in the area, and it may be possible to expand the acreage. There may also be opportunities to develop markets for specialty crops such as vegetables, safflower, canola, etc.

Efforts should be made to develop markets for high value crops. However, large scale production of specialty crops will require processing facilities. Irrigation must be developed to assure the supply of a product before processing facilities can be constructed for crops such as potatoes and sugar beets. Some specialty crops may be grown for local consumption. However, the area devoted to such crops will not be large enough to affect either the design or the economic justification of a project. Therefore, based on the crop water use and potential markets for the products, it appears that the main crops grown under irrigation, at least initially, will be corn, alfalfa, and a smaller amount of field beans. While the production of other crops is encouraged, it was assumed that the crops grown on the irrigated area will be split equally between corn and alfalfa.

Irrigation Systems:

Although there are many different systems available for irrigation, it was assumed that all of the systems would be center pivots. This assumption is not meant to restrict project development to solely center pivots. However, center pivots are currently the most popular method of irrigating and most of the new development will use center pivots. Although, smaller areas may be irrigated using other types of systems.

In addition to the irrigability of the soils, land ownership was also considered in determining the number, location, and size of the center pivots. Land ownership was determined using the 1975 Atlas of McKenzie County. The smallest tracts of land considered for irrigation were 40 acres.

Two sizes of center pivots were considered: a quarter section pivot and a 40-acre pivot. The quarter section pivot irrigates approximately 130 acres of the 160 acres in the quarter. The flow rate required for each quarter section pivot was assumed to be 800 gallons per minute (gpm). The 40-acre pivot irrigates approximately 32 acres. The flow rate required for each 40-acre pivot was assumed to be 200 gpm. The cost of a quarter section pivot was assumed to be \$35,000. The cost of the 40-acre pivot was assumed to be \$22,000.

In some instances, a towable pivot may be appropriate for 40-acre sites. A towable system reduces the equipment required and the cost to irrigate smaller fields; however, it will require more intense management. Eighty-acre fields were divided in half with a 40-acre pivot on each half. It may be more efficient to use one large pivot making only a half circle in these cases; however, the two smaller pivots were used to make the cost estimates more consistent. Some of the quarter section pivots will not be able to irrigate the full 130 acres due to obstructions. The irrigated area will be reduced in some areas due to these incomplete circles or smaller pivots. For design purposes and costs, it is assumed that these reduced size pivots will irrigate 130 acres.

The locations and size of the pivots shown in this report are only proposed for the purpose of determining the feasibility of developing irrigation. It may be possible to develop additional areas, particularly on land that was classified as conditional for irrigation. Also, some landowners may not be interested in developing irrigation in the proposed locations. A number of proposed pivot locations may currently be irrigated presently. In these cases, the landowners may not be interested in participating in the development of an irrigation project. Further study will be required to more accurately determine the irrigability of the land, and each landowner will have to be contacted during the design phase to determine their wishes. It is proposed that each irrigator will be responsible for the irrigation system, the pipe from the edge of the field, and any other equipment necessary in individual fields. The estimated cost for these items are included in this report to aid in determining the feasibility of a project. However,

each irrigator will determine the specifics of their system.

Design Flow:

The design flow was determined by assuming the irrigated crops will be evenly split between corn and alfalfa. Using information from the North Dakota Irrigation Guide for Climatic Area III for a normal year and assuming a carryover soil moisture of 2 inches and net irrigation depth of 1.5 inches per application, the average seasonal net irrigation would be 18.52 inches. During the peak month of July, a net application of 6.62 inches will be required. Assuming an application efficiency of 80 percent, the gross application for the growing season will be 23.2 inches, with 8.3 inches applied during the month of July. To apply the required amount of water, each pivot will have to run approximately 1700 hours during the irrigation season. During the peak month of July, each pivot will run approximately 610 hours, or 83 percent of the time. Therefore, to determine the design flow it was assumed that only 83 percent of the pivots will be running at any one time.

Most crops require much less water in May, June, September, and October than in July and August (Figures 3 and 4). There are two ways to reduce the water supplied: operate the pumps continuously at a lower flow rate or operate the pumps at the maximum flow for a shorter period of time. If the flow rate is reduced, the head loss in the pipes is also reduced. However, to take advantage of these reduced flow rates and head requirements separate low flow pumps are required. The extra pumps

increase the capital cost of the system, but reduce the pumping cost. If the flow rate is held constant but the pumping time is reduced, no additional pumps would be required. However, the system would have to be managed to coordinate irrigation and reduce wasted flows. Additional study will be required to determine the required flow rates, the savings possible by using low flow pumps, and the additional cost of the pumps. For this study, it was assumed the flow rate would be reduced but the head would remain constant during the months which require less irrigation water.

It may be possible to reduce the construction cost substantially by using ground water as a supplemental supply. By using ground water the size of the distribution system can be reduced. Depending on the distribution system and the possible location of wells, either the length of pipes needed or the diameter of the pipes could be reduced. The savings realized from reducing the size of the distribution system would be offset to some extent by the cost of the wells and pumps required to provide the ground water. The possibilities of using ground water as a supplemental supply should be evaluated during the feasibility phase.

Water Supply Systems:

The water supply systems discussed in this report include all the necessary pumps, pipes, canals, dams, reservoirs, and related works required to deliver irrigation water to the edge of all the irrigated fields. The distribution system component of the water supply system consists of pipelines delivering water from a common point to each field.

Pipelines were sized using the North Dakota Pipeline Design Program developed by the NRCS and modified for this project by Terry Carlson. This program calculates pressure pipe friction loss and resulting pressures along a pipeline based on elevations. The general Hazen-Williams formula is used for pipe hydraulic computations. The pipe diameter is calculated based on maximum velocity and friction loss values allowed. For this study, the maximum velocity in any pipe is limited to 5 feet per second, while the friction loss is not constrained. The pipes and pumps were sized to deliver the required flow to the most distant pivot at a pressure of 20 pounds per square inch (psi) when Lake Sakakawea is at its minimum elevation. Although 20 psi may not be sufficient pressure to operate the sprinklers, in many cases the normal level of Lake Sakakawea will increase this pressure. Pipes less than 24 inches in diameter are assumed to be PVC pipe with a Hazen-Williams C value of 150. Pipes with diameters of 24 inches and larger are assumed to be ductile iron with a C value of 100. The estimated installed costs per foot of pipe are shown in Table 2. These cost estimates are based on discussions in mid-1993 with the engineers for the Southwest Pipeline.

Table 2 - Pipe Costs

Pipe Diameter Inches	Cost Per Foot
PVC Pipe	
6	\$ 4.00
8	5.50
10	8.50
12	12.00
14	18.00
16	22.00
18	28.50
20	35.00

Table 2 - Pipe Costs (Cont.)

Pipe Diameter	Cost
Inches	Per Foot
Ductile Iron Pipe	
24	\$ 40.00
30	48.00
36	60.00
42	68.00
48	75.00
60	100.00
72	130.00

IV. ECONOMICS

The benefits of an irrigation project are difficult to determine. The direct benefits to the irrigator must outweigh the costs of developing, operating, and maintaining the system if the irrigator is to pay for the system. However, the majority of the benefits of an irrigation project accrue to people other than the irrigators. In a study of the economic impact of the Buford-Trenton Irrigation District, the NDSU Department of Agricultural Economics estimated that the economic on-farm impact of a switch from irrigated to dry cropland agriculture in 1990 would have been a decline of \$197 per acre in returns to unpaid labor and management. It was estimated that the switch would have reduced non-farm personal income by approximately \$449 per acre. Therefore, the benefit of the irrigation in the Buford-Trenton district accrued approximately 30 percent to the irrigators and 70 percent to others. These figures were developed assuming sugar beets had been planted on 46.7 percent of the irrigated land. It may not be possible to develop additional sugar beet acreage. Therefore, these figures may not accurately indicate the effect of additional irrigation on the economy. However, additional irrigation would certainly benefit many people in addition to the irrigators.

The estimated crop budgets for southwest North Dakota, as published by the NDSU Extension Service, were used to compare the possible returns under irrigated and dry-land conditions. These budgets are intended to be used as a guide; therefore, these numbers are an indication of the potential gains under irrigation. The southwest

region was used because irrigated crop budgets for the northwest region were not available, however, the parameters affecting crop budgets in the southwest are similar in the northwest. The crop budget was developed by subtracting all direct cash costs, an 8 percent return to machinery investment, machinery depreciation, and an 8 percent return to land investment from the returns for an individual crop assuming constant production practices, yields, and input prices. The remaining amount is the return to unpaid labor and management. Table 3 shows returns for various crops grown under dry land conditions and farm program participation.

**Table 3 - Per Acre Dry Land Crop Returns
To Unpaid Labor and Management**

Farm Program	Non Participation	95% of Base	80% of Base
Crop			
Spring Wheat (fallow)	-\$45.45	-\$25.78	-\$22.09
Spring Wheat (recrop)	- 39.97	- 13.30	- 9.62
Durum (fallow)	- 36.54	- 16.87	- 13.18
Durum (recrop)	- 27.69	- 8.03	- 4.34
Feed Barley	- 29.65	- 20.55	- 18.84
Corn Grain	- 49.51	- 35.63	- 33.02
Flax	- 43.74		
Oil Sunflowers	- 31.30		
Drybeans	- 22.12		
Millet	- 29.80		
Buckwheat	3.51		
Safflower	- 10.47		
Winter Wheat	- 17.09	2.58	6.26
Rye	- 35.01		

Irrigated crop returns are shown in the upcoming sections dealing with each proposed project. The returns are calculated assuming five different repayment plans. All the plans have a 20-year repayment schedule. The first three plans do not include

any cost-share, the irrigators would be responsible for the entire cost. A 10 percent interest rate is assumed for the first plan. The interest rate is based on the rate used by the Extension Service in developing the crop budgets. An interest rate of 5.5 percent is assumed for the second plan. The 5.5 percent interest is based on the current rates for 20-year bonds. Irrigation districts are eligible to use these bonds. However, the interest rate could change substantially by the time a project is ready for the bonds to be issued. The third plan is based on an assumed interest rate of 4 percent, with the State Water Commission providing the funds to lower the interest rate. Such a program is not currently available and would require authorization by the State Legislature. The fourth plan includes a 40 percent cost-share for the water supply system. The irrigators would be responsible for the equipment and pipe in each field and for the remaining 60 percent of the water supply system. A 10 percent interest rate is assumed for this plan. The fifth plan is identical to the fourth plan except for the interest rate. The interest rate for the fifth plan is assumed to be 5.5 percent based on 20-year bonds.

The pumping costs used in determining the returns are based on the estimated flow rates, size and number of pumps operating, and electricity cost information from McKenzie Electric Cooperative. These pumping costs are the only operation and maintenance costs included in this study. Additional O&M costs will occur. However, it is difficult to determine these costs. If more than one area is developed it may be possible to share equipment and personnel, reducing the costs. The level of automation will also impact the operating personnel and the O&M costs.

Further study will be needed to accurately determine the returns from irrigation. Any further study should include a composite economic model. This model would be based on the cost of developing irrigation, the possible crop rotations, the percentage of irrigated area on which each crop is grown, and the possible return from each crop. The result would be an estimate of the net returns per acre. Any additional study should also investigate the possibility of developing markets for specialty crops, particularly potatoes and sugar beets. The economic impact of potatoes and sugar beets can be substantial and may have a large effect on the feasibility of a project.

The State Water Commission often cost-shares on water development projects. Generally, on a large project the State Water Commission provides cost-share for each phase of the project. The phases may include feasibility, preliminary design, final design, and construction. The local sponsor requests funding for each phase. The Water Commission determines if a project will receive cost-share based on the feasibility of the project. Currently, the State Water Commission does not have any guidelines for cost-sharing on irrigation projects. Also the funds are not currently available for a project of this magnitude. An appropriation by the state legislature would be needed to provide the funds for either the cost-share or interest rate reduction. However, it certainly is in the interest of the state to assist in irrigation development as a means of economic development.

V. CHARLSON AREA

Description:

The Charlson area consists of 14 sections in Township 152 North, Range 96 West; Township 152 North, Range 95 West; and Township 153 North, Range 95 West. The irrigable land in this area is located on the uplands adjacent to Lake Sakakawea approximately 16 miles north and east of Watford City, Figure 5. Proposed pivot locations are shown in Figure 6. These proposed pivots are contingent upon more detailed land classification and landowner interest. A total of 2,446 acres could be irrigated if all the proposed pivots are developed.

Five water delivery systems were investigated. The intake for all five alternatives is located near the center of Section 33, Township 154 North, Range 95 West. The design flow at the intake for all the alternatives is 13,600 gpm. All of the alternatives will provide water to each pivot with sufficient pressure to operate the sprinklers.

Alternative 1:

The pipeline distribution system for Alternative 1 is shown in Figure 7. The distribution system contains 79,030 feet of pipe, Appendix B. The intake and pumping plant will be located near the shore of Lake Sakakawea in the center of Section 33, Township 154 North, Range 95 West. The design flow at the beginning of the distribution system is 13,600 gpm, the design pressure head is 690 feet.

FIGURE 5 CHARLSON AREA LAND IRRIGATION CLASSIFICATION

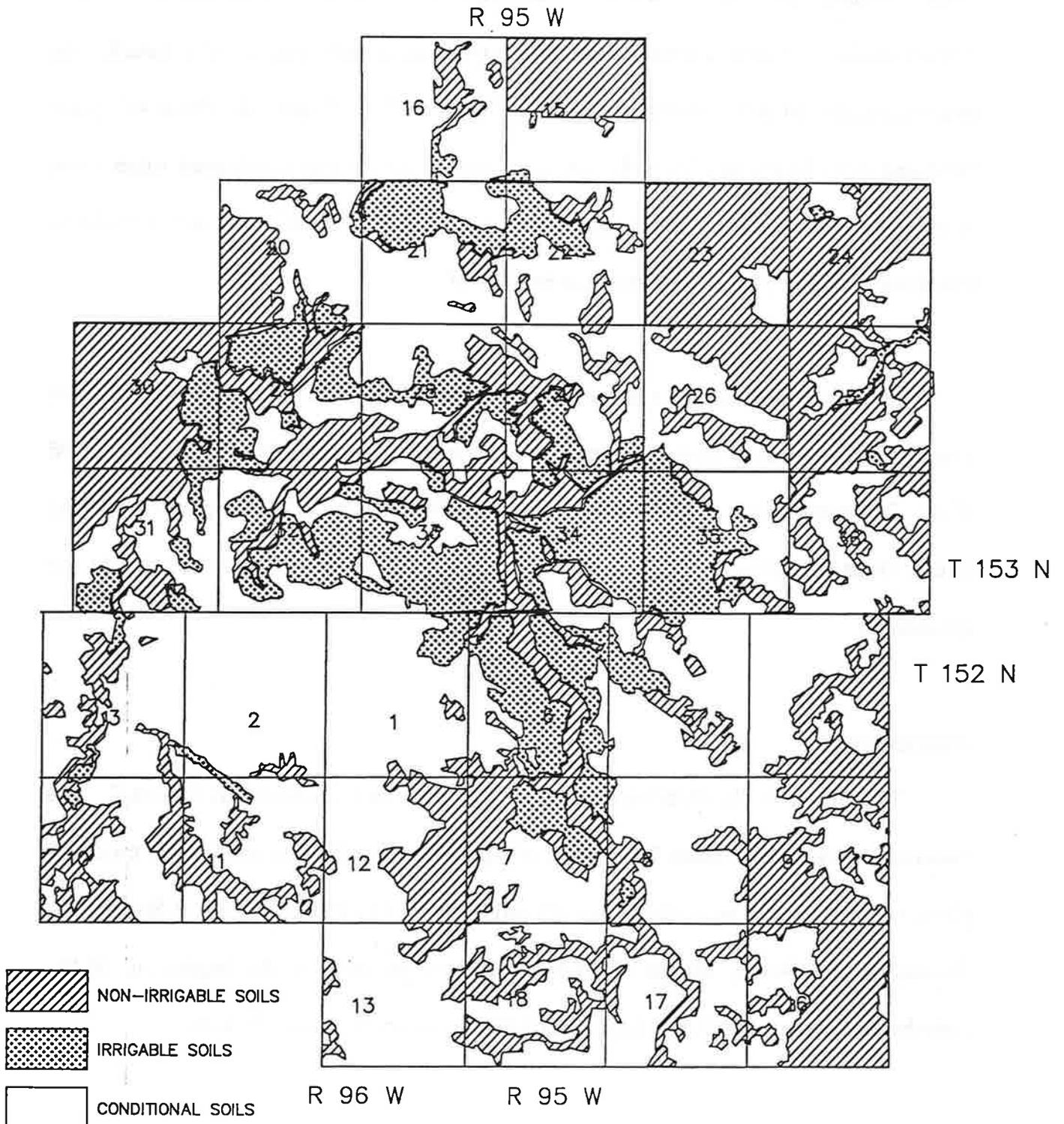


FIGURE 6 CHARLSON AREA PROPOSED PIVOT LOCATIONS

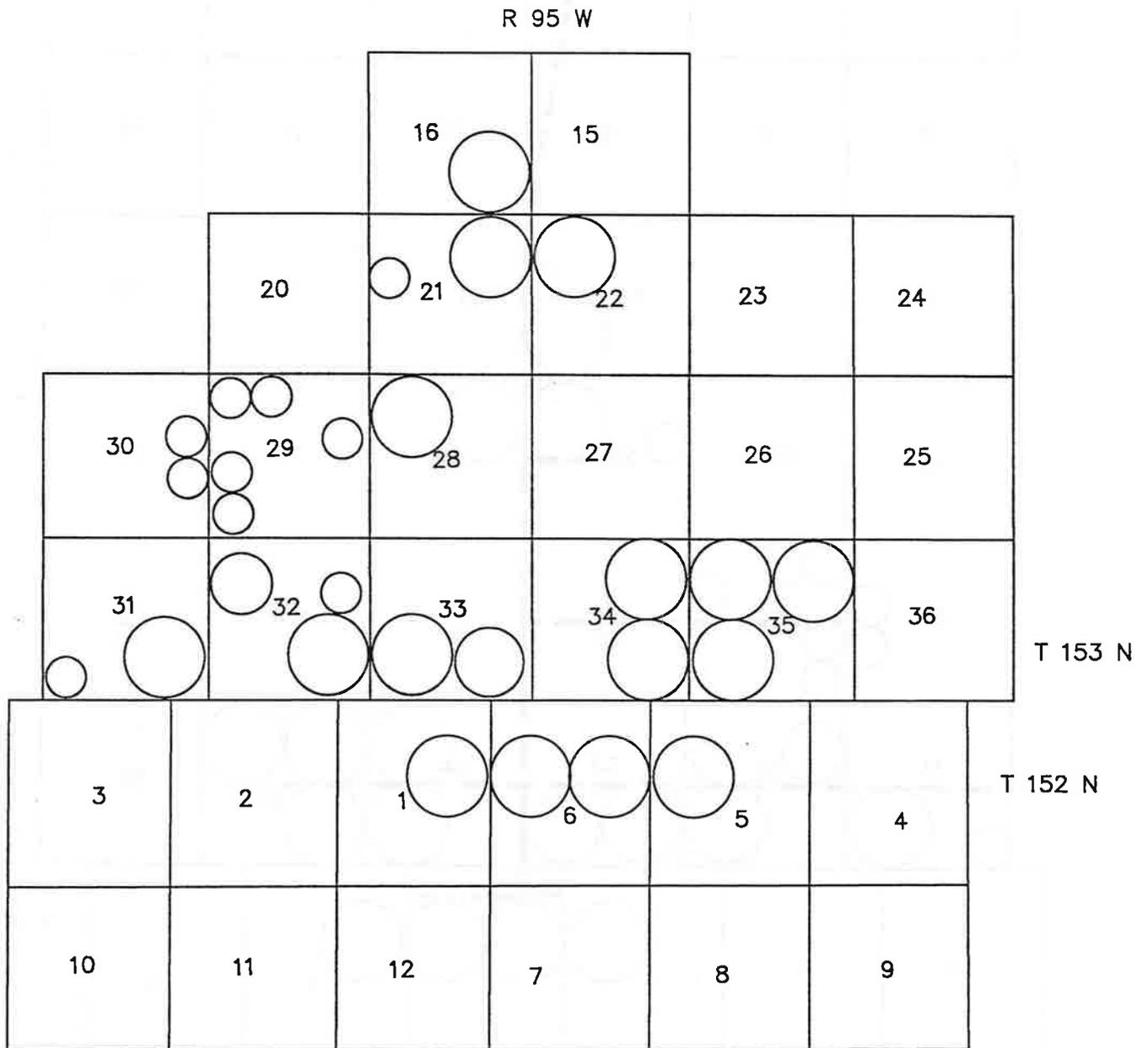
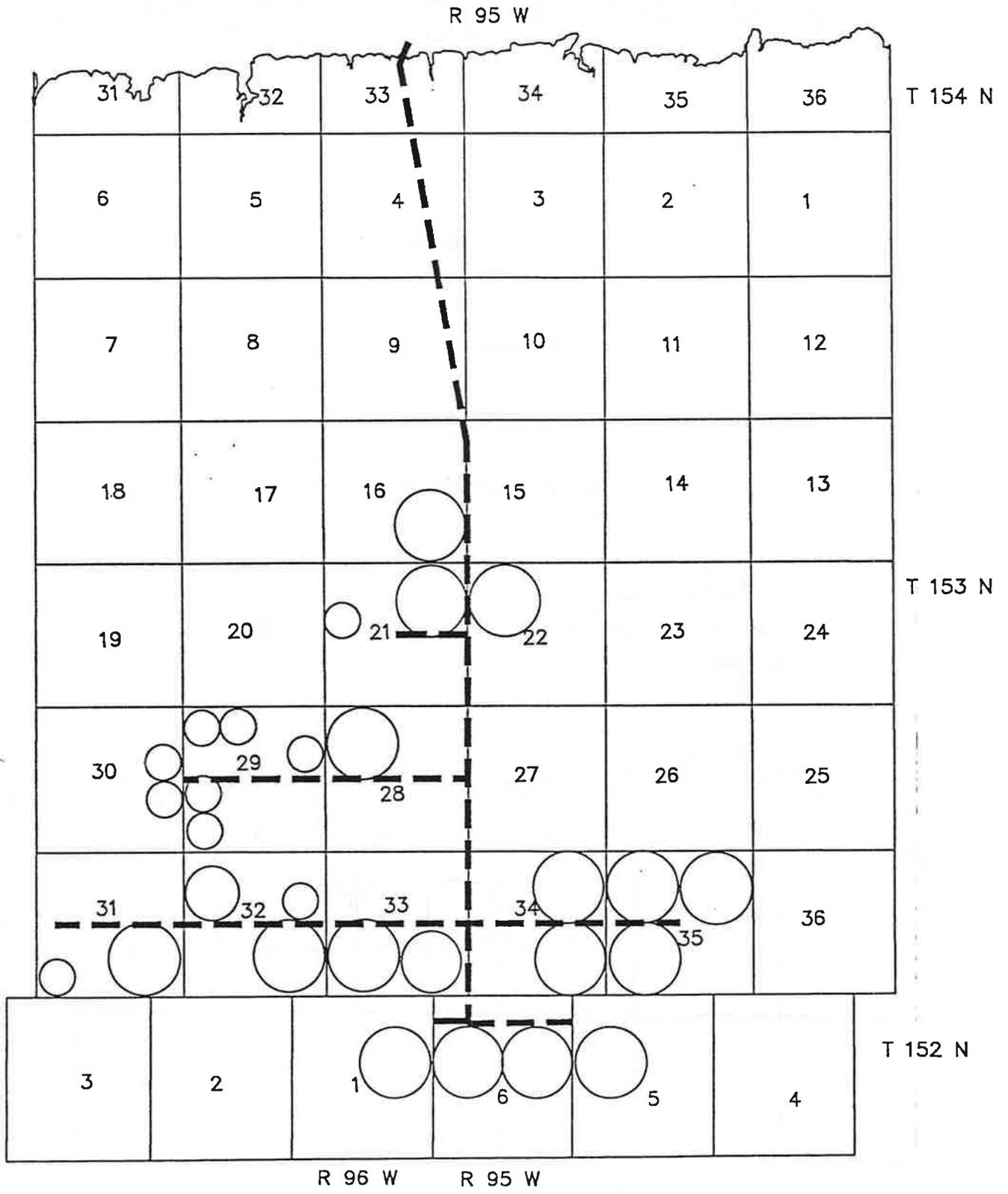


FIGURE 7 ALTERNATIVE 1 CHARLSON AREA



The estimated cost of this alternative is \$6,424,000. Distributed over the proposed irrigation area this results in a development cost of approximately \$2,600 per acre. The estimated annual pumping cost is \$150,000 or \$61 per acre.

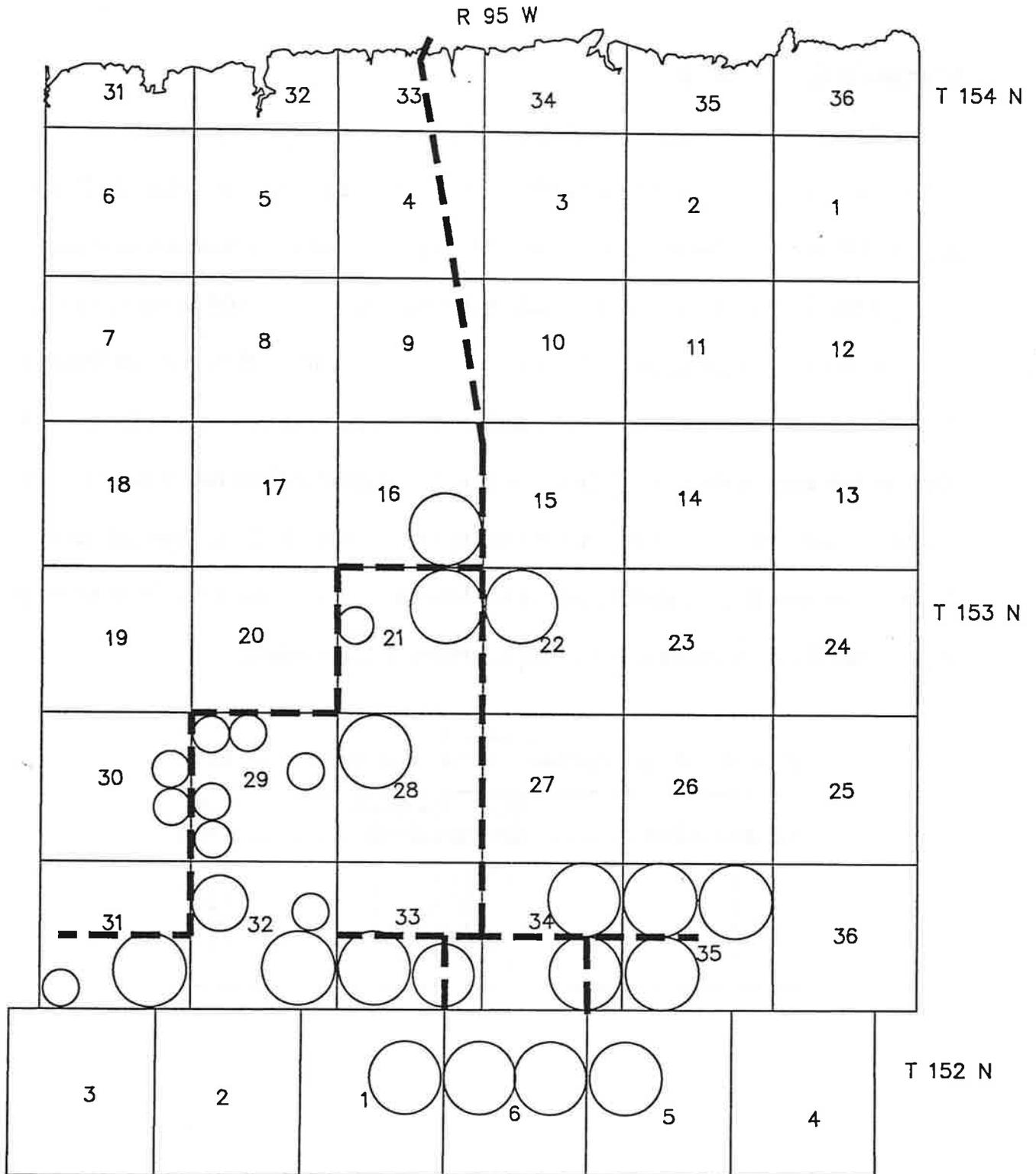
Alternatives 2, 3, and 4:

Alternatives 2, 3, and 4 are all similar to Alternative 1. The pumping plant for all three alternatives would be located in the center of Section 33, Township 154 North, Range 95 West. The distribution system for these alternatives are shown in Figures 8, 9, and 10. The pumping plant for each of these alternatives would be similar to the pumping plant for Alternative 1, the design flow is identical. However, all three of these alternatives require the pumps to deliver more head than Alternative 1. The cost of the distribution system for all these alternatives is greater than Alternative 1. The cost of the distribution system and the total dynamic head (TDH) are summarized in Table 4. The cost of the pumping plants for Alternatives 2, 3, and 4 would be slightly higher than for Alternative 1 due to the increased head required.

**Table 4
Distribution System Costs and Head Required**

Alternative	Distribution System Cost	TDH Feet
1	\$2,856,000	690
2	2,970,000	720
3	3,471,000	770
4	3,622,000	780

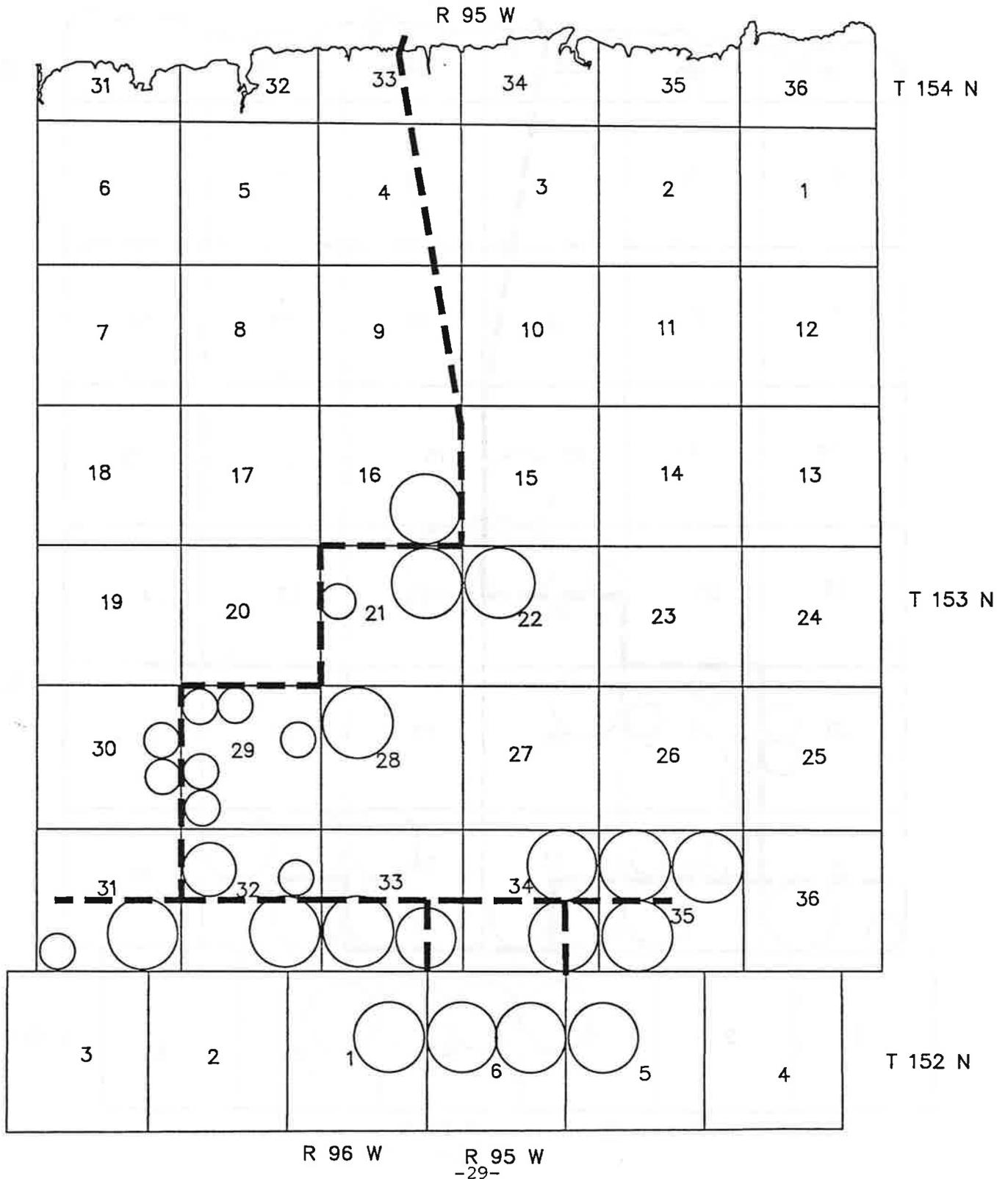
FIGURE 8 ALTERNATIVE 2 CHARLSON AREA



R 96 W

R 95 W

FIGURE 9 ALTERNATIVE 3 CHARLSON AREA



The cost for Alternatives 2, 3, and 4 are greater than the cost of Alternative 1. Due to the increased head required the pumping cost will also be greater. Because these alternative would be more costly and provide no increased benefits compared to Alternative 1, they were eliminated from further consideration.

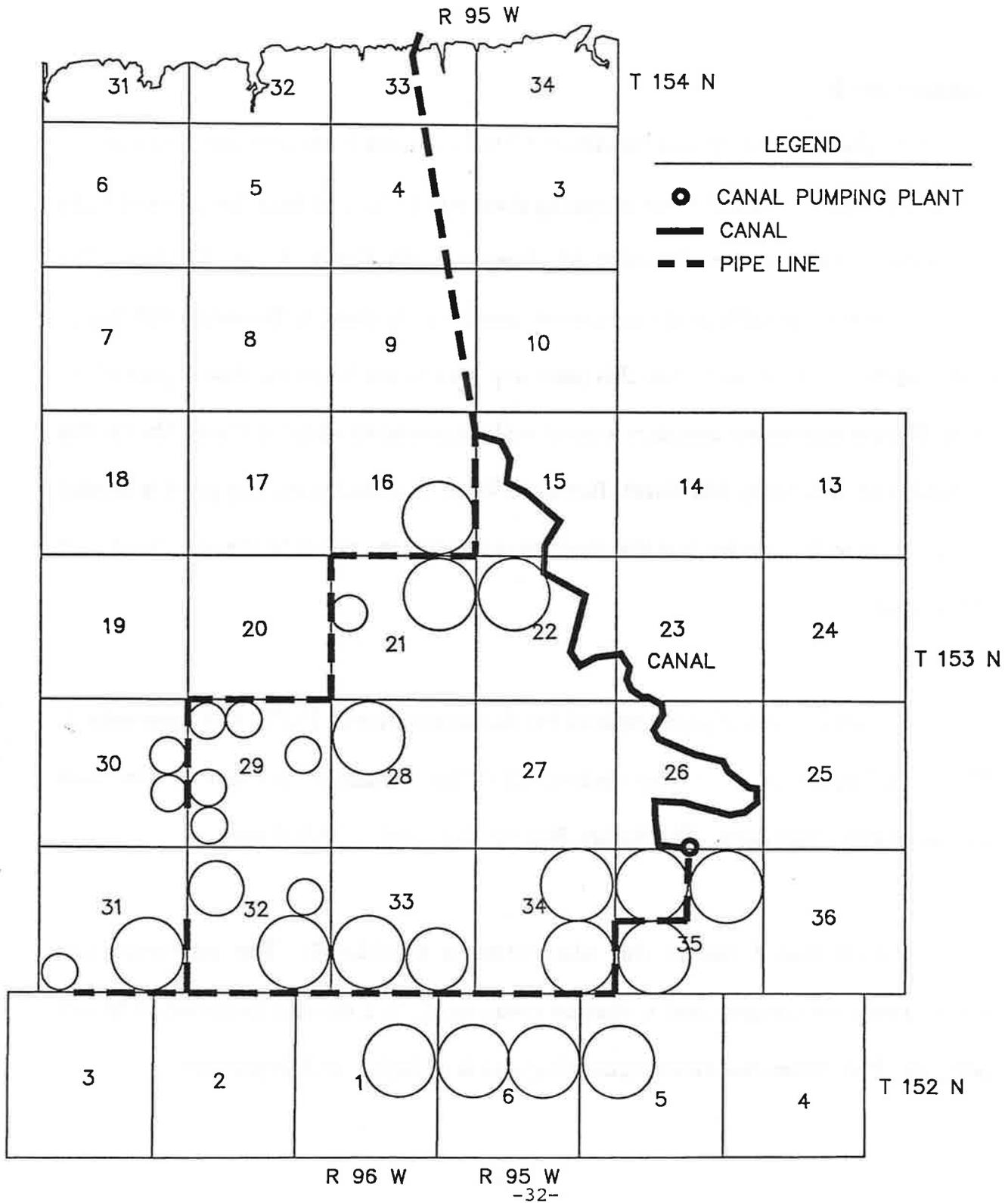
Alternative 5:

The distribution system for Alternative 5 contains both pipelines and a canal, Figure 11. The intake and main pumping plant will be located near the shore of Lake Sakakawea in the center of Section 33, Township 154 North, Range 95 West. The distribution system splits in the northwest quarter of Section 15, Township 153 North, Range 95 West. A pipeline from this point supplies pivots in the northwest part of the area. The remaining water enters a canal which transports water to the northern edge of Section 35, Township 153 North, Range 95 West. A second pumping plant is located at this point which pressurizes the pipeline supplying the pivots in the southeast part of the area.

The total length of pipe required for this alternative is 71,770 feet, Appendix B. The canal has a triangular cross section, 2:1 (2 feet horizontal to 1 foot vertical) side slopes, and is 3 feet deep. The design flow for the canal is 10,000 gpm.

The estimated cost of this alternative is \$6,122,000. The estimated cost distributed over the proposed irrigation area results in a development cost of \$2,500 per acre. The estimated annual pumping cost is \$172,000 or \$70 per acre.

FIGURE 11 ALTERNATIVE 5 CHARLSON AREA



Summary of Alternatives:

Five alternatives to develop irrigation in the Charlson area were investigated. Alternatives 2, 3, and 4 were eliminated from further consideration due to the cost of each of these alternatives. The estimated construction and pumping costs for Alternatives 1 and 5 are summarized in Table 5.

**Table 5
Cost of Alternatives**

Alternative	Construction Costs		Pumping Costs	
	Total	Per Acre	Total	Per Acre
1	\$6,424,000	\$2,600	\$150,000	\$61
5	6,122,000	2,500	172,000	70

Alternative 1 is the least costly alternative to operate. Alternatives 2, 3, and 4 are more costly both to construct and operate; therefore, they were eliminated. Alternative 5 is the least costly to construct. However, the operating costs for Alternative 5 are greater than the operating cost for Alternative 1.

Based on the above comparisons, Alternatives 1 and 5 were selected for economic analysis.

Economics:

The estimated irrigated crop budget was used to determine the economic return for Alternatives 1 and 5. The results of the budget for Alternative 1 are presented in Table 6. The results for Alternative 5 are shown in Table 7.

Based on the returns shown in Tables 6 and 7, it appears that this project is not feasible.

Table 6
Per Acre Returns to Unpaid Labor and Management
Alternative 1

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$325	-\$236	-\$210	-\$218	-\$160
Corn Grain	92.5% of Base	- 275	- 186	- 159	- 168	- 110
Corn Grain	77.5% of Base	- 265	- 176	- 150	- 158	- 100
Corn Silage	Non	- 250	- 162	- 135	- 143	- 85
Corn Silage	92.5% of Base	- 200	- 111	- 85	- 93	- 35
Corn Silage	77.5% of Base	- 190	- 101	- 75	- 83	- 25
Alfalfa Establishment Year		- 360	- 271	- 244	- 253	- 195
Alfalfa Established Stand		- 152	- 64	- 37	- 45	13
Drybeans		- 108	- 20	7	- 1	57

Table 7
Per Acre Returns to Unpaid Labor and Management
Alternative 5

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$318	-\$234	-\$209	-\$217	-\$162
Corn Grain	92.5% of Base	- 268	- 183	- 158	- 167	- 111
Corn Grain	77.5% of Base	- 258	- 174	- 148	- 157	- 102
Corn Silage	Non	- 244	- 159	- 134	- 143	- 87
Corn Silage	92.5% of Base	- 193	- 109	- 83	- 92	- 37
Corn Silage	77.5% of Base	- 183	- 99	- 74	- 82	- 27
Alfalfa Establishment Year		- 355	- 270	- 245	- 254	- 198
Alfalfa Established Stand		- 147	- 63	- 38	- 47	9
Drybeans		- 99	- 15	11	2	57

VI. TOBACCO GARDEN AREA

Description:

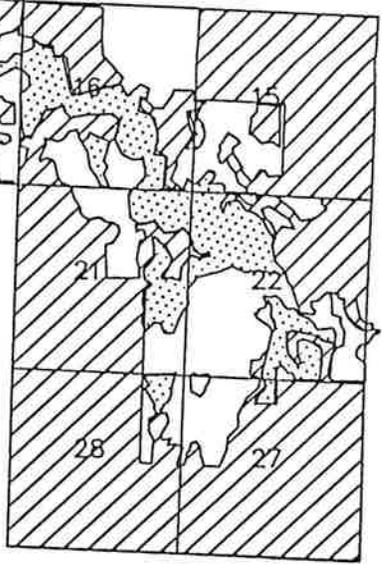
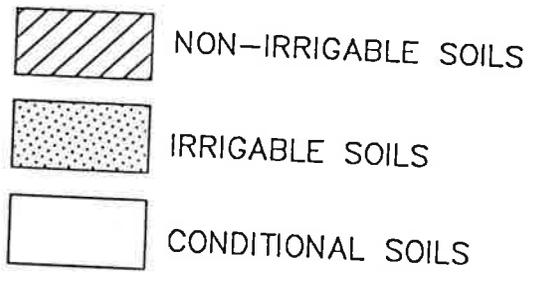
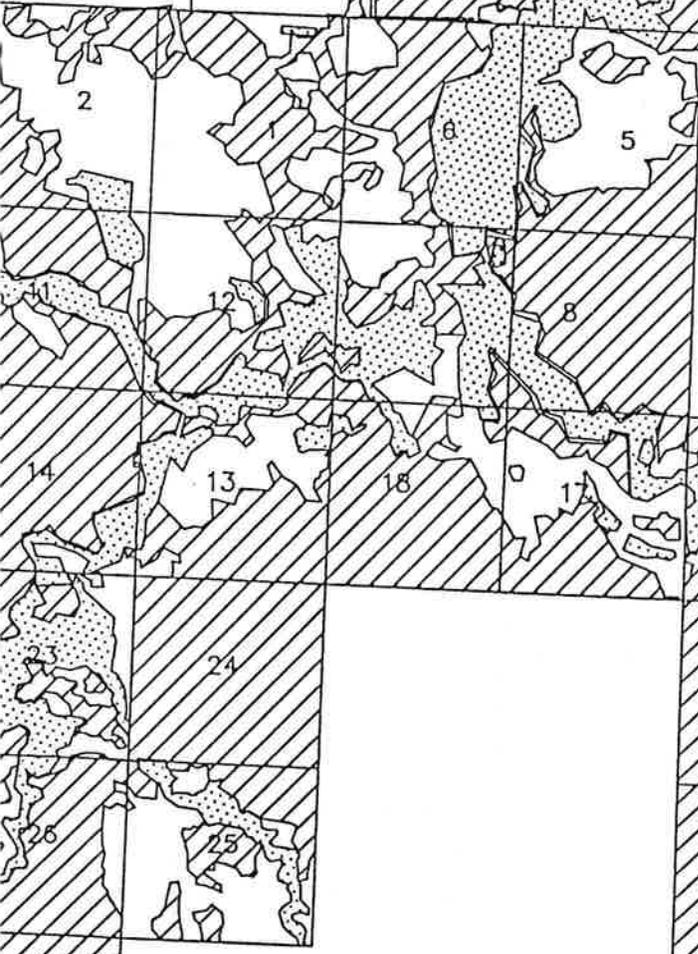
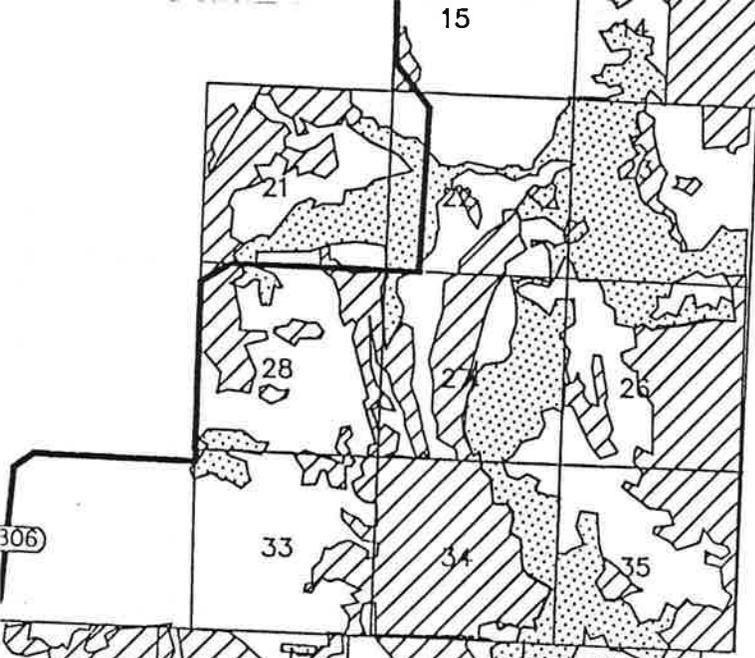
The Tobacco Garden area consists of 48 sections in Township 151 North, Range 98 West; Township 152 North, Range 97 West; Township 152 North, Range 98 West; and Township 153 North, Range 97 West. The irrigable land in this area extends approximately 15 miles north along Tobacco Garden Creek from a point 8 miles northeast of Watford City, Figure 12. Proposed pivot locations are shown in Figure 13. These proposed pivots are contingent upon more detailed land classification and landowner interest. A total of 1,646 acres could be irrigated if all the proposed pivots are developed. Alternatives 5, 6, and 7 considered only the northern six miles of the area. These alternatives would irrigate 1,052 acres.

Seven water delivery systems were investigated. The pumping system for all the alternatives consist of floating pumps on Lake Sakakawea and boosters pumps above the flood pool of the lake. All of the alternatives will provide water to each pivot with sufficient pressure to operate the sprinklers.

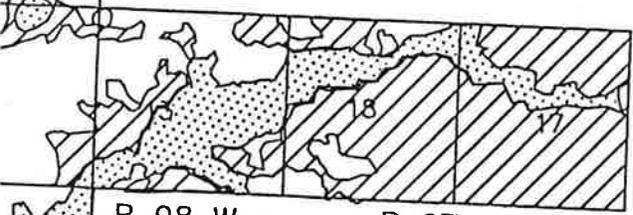
Alternative 1:

The pipeline distribution system for Alternative 1 is shown in Figure 14. The distribution system contains 167,110 feet of pipe, Appendix B. The intake and pumping plant will be located on the edge of Lake Sakakawea near the submerged river channel in the NW $\frac{1}{4}$ of Section 24, Township 153 North, Range 98 West. The design flow at the intake is 9,800 gpm, the design pressure head is 480 feet.

T 153 N



T 152 N



T 151 N

R 98 W

R 97 W

FIGURE 13
TOBACCO GARDEN AREA
PIVOT LOCATIONS

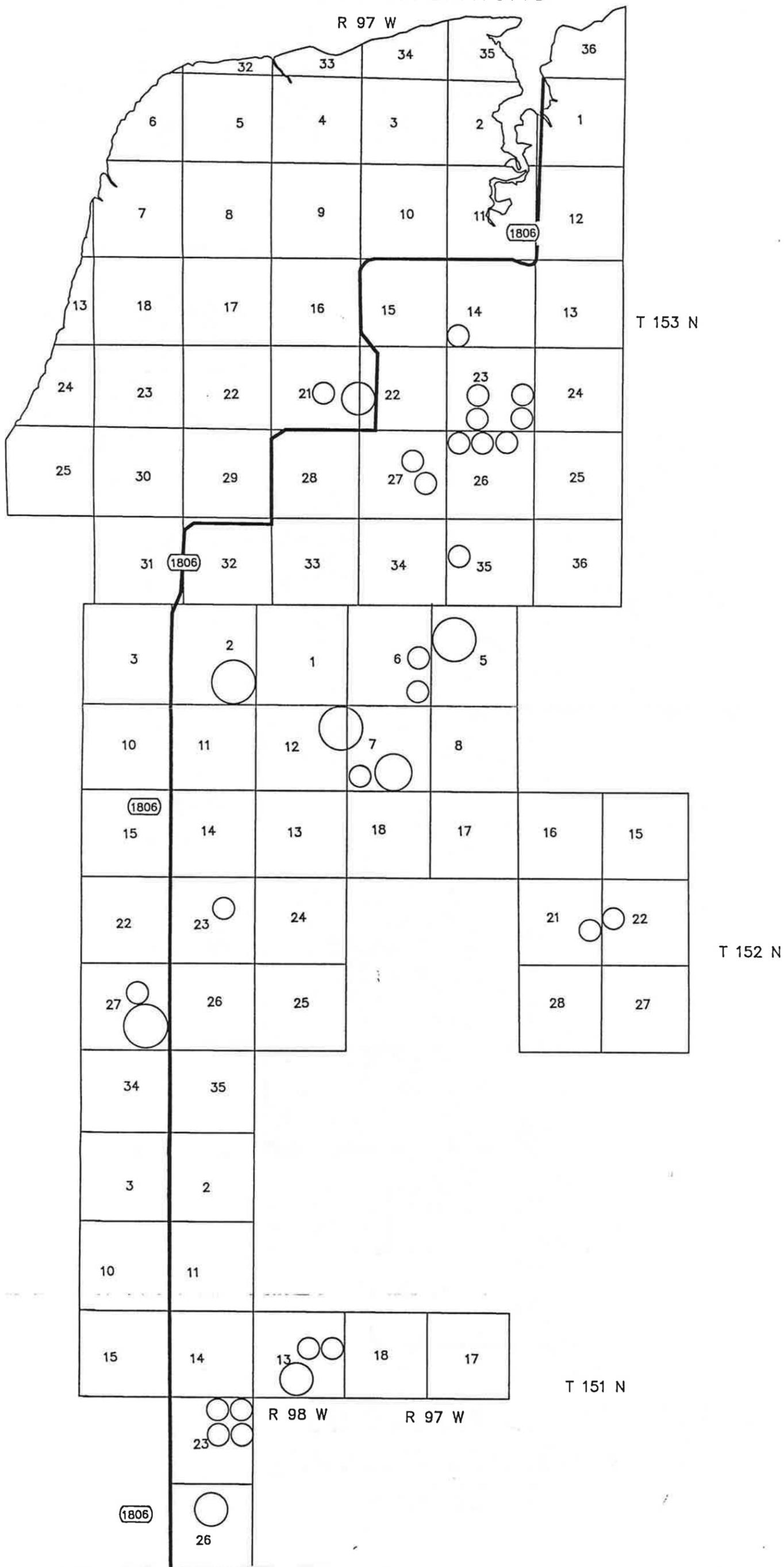


FIGURE 14
TOBACCO GARDEN AREA
ALTERNATIVE 1

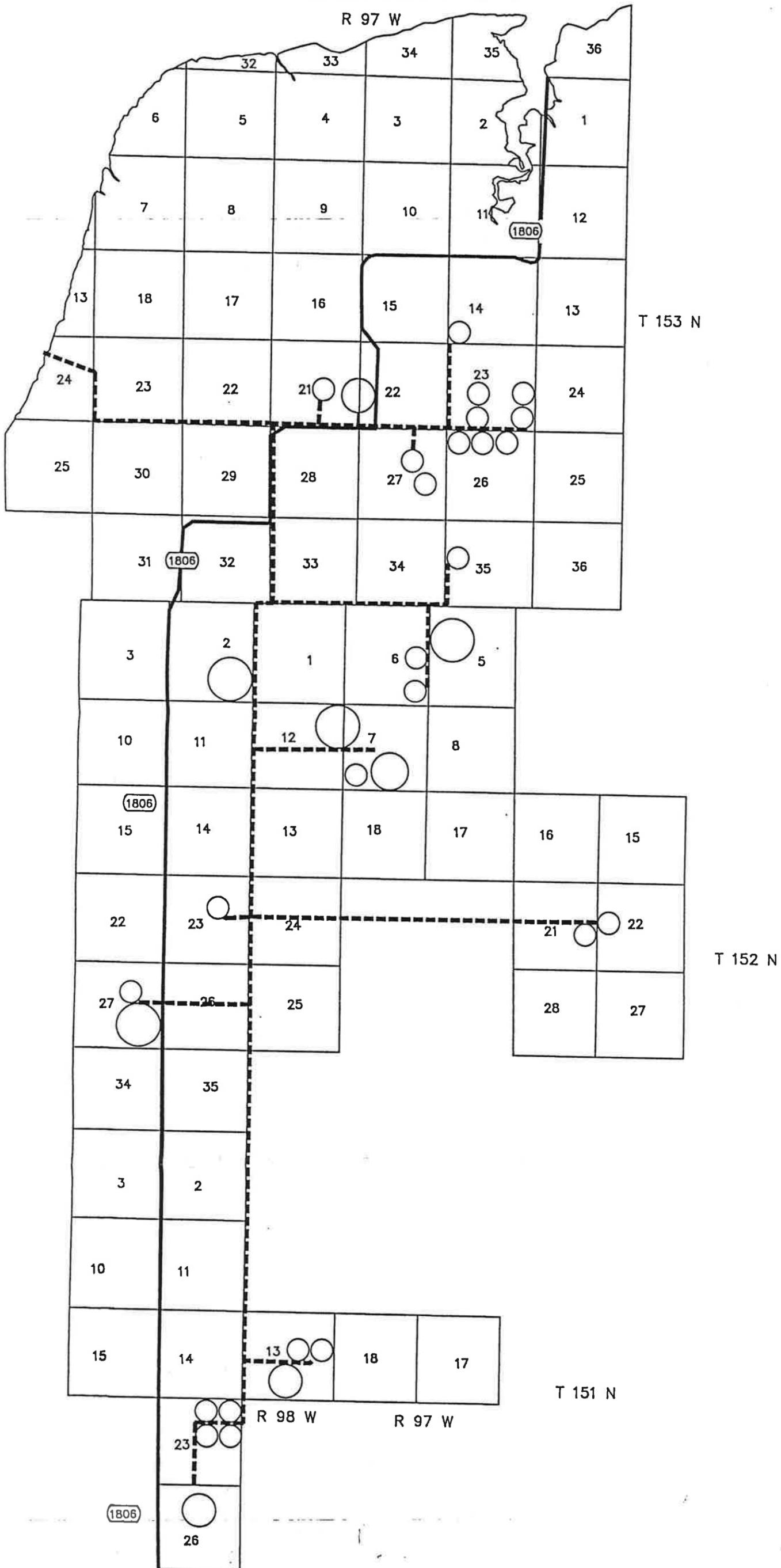


FIGURE 15
TOBACCO GARDEN AREA
ALTERNATIVE 2

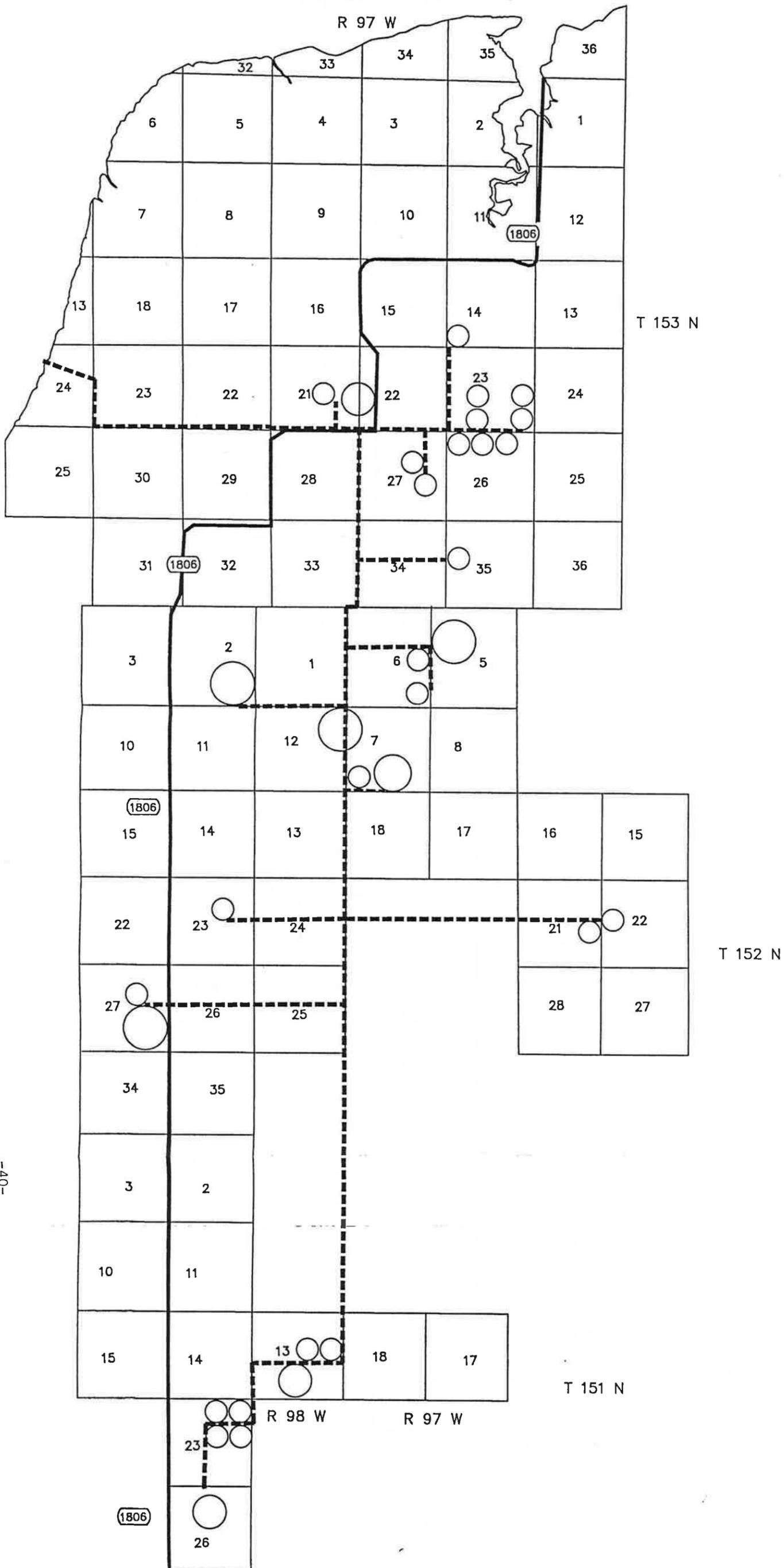
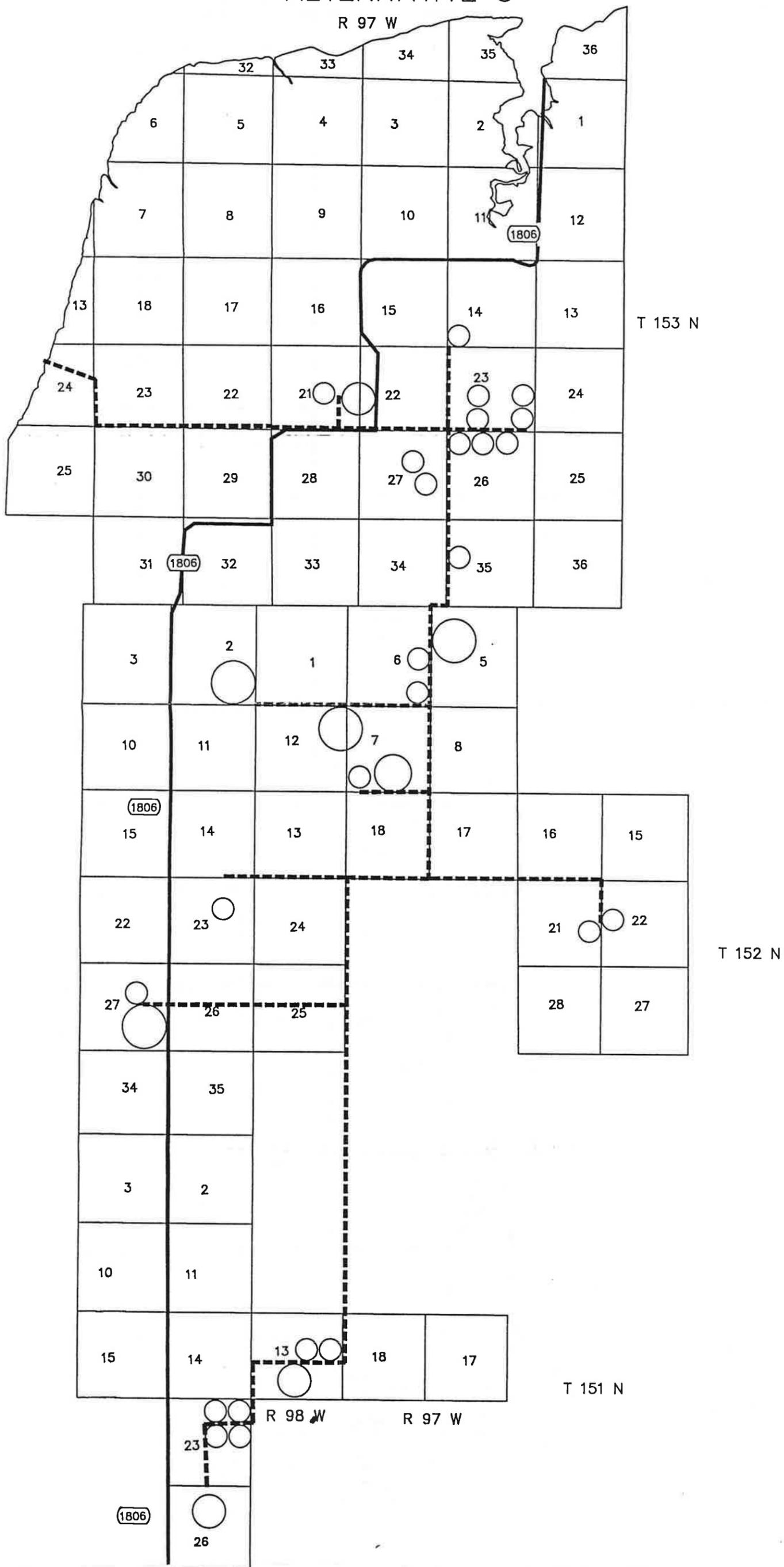


FIGURE 16
TOBACCO GARDEN AREA
ALTERNATIVE 3



Alternative 4:

Alternative 4 is shown in Figure 17. The distribution system contains 158,145 feet of pipe, Appendix B. The intake and pumping plant will be located near the shore of Lake Sakakawea in the NW¼ of Section 36, Township 154 North, Range 97 West. This intake location is not near the submerged river channel, when the reservoir is low there may be problems pumping from this location. The design flow at the intake is 9,800 gpm, the design pressure head is 550 feet.

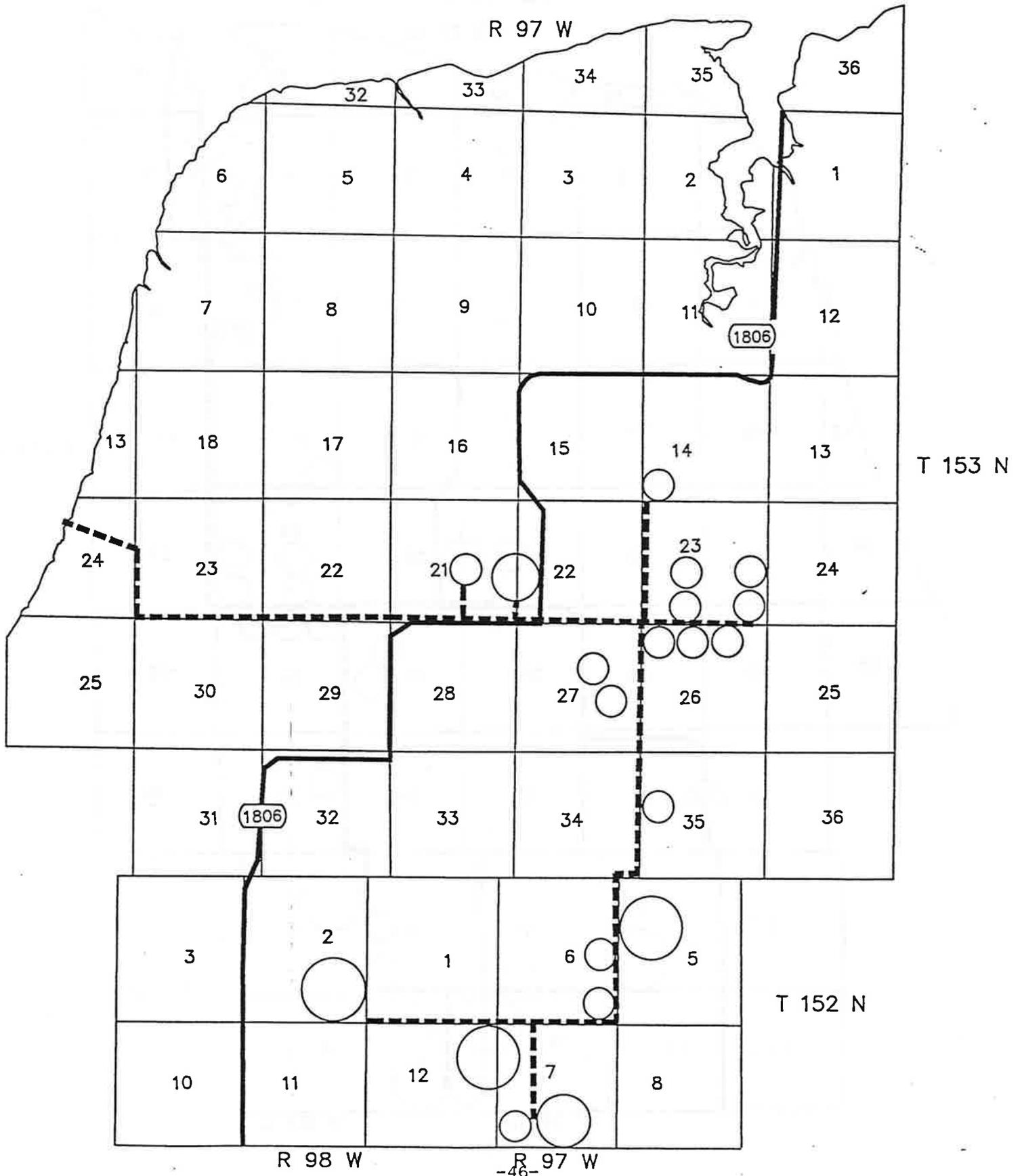
The cost estimate for Alternative 4 is \$8,170,000, or \$4960 per acre. This estimated cost is higher than the estimated cost for Alternative 1. Due to the increased head required the pumping cost for Alternative 4 will also be greater than the pumping cost for Alternative 1. Compared to Alternative 1, Alternative 4 will be more costly to construct and operate, will not provide any additional benefits, and has a less desirable intake location. Therefore, Alternative 4 was not considered further.

Alternative 5:

Alternative 5 provides water to the northern part of the area, the remaining pivots would not be served under this alternative. This reduces the irrigated area to 1,052 acres. The pivots served and the proposed pipeline are shown in Figure 18.

The distribution system contains 86,590 feet of pipe, Appendix B. The intake and pumping plant will be located near the shore of Lake Sakakawea in the NW¼ of

FIGURE 19 TOBACCO GARDEN AREA ALTERNATIVE 6



The estimated cost of Alternative 7 is \$4,200,000 or \$4,000 per acre. Because this cost and the design head are greater than for Alternative 5, this alternative was not investigated further.

Summary of Alternatives:

Seven alternatives to develop irrigation in the Tobacco Garden area were investigated. The construction cost, irrigated area, and total dynamic head (TDH) are summarized in Table 9.

**Table 9
Cost of Alternatives**

Alternative	Construction Costs		Irrigated	
	Total	Per Acre	Area	TDH
1	\$6,940,000	\$4,220	1,646	480
2	7,180,000	4,360	1,646	523
3	7,610,000	4,630	1,646	566
4	8,170,000	4,960	1,646	553
5	3,730,000	3,540	1,052	407
6	3,860,000	3,670	1,052	429
7	4,200,000	4,000	1,052	417

Alternatives 2, 3, 4, 6, and 7 are more costly both to construct and operate; therefore, they were eliminated. The estimated construction and pumping costs for Alternatives 1 and 5 are summarized in Table 10.

**Table 10
Comparison Alternatives 1 and 5**

Alternative	Construction Costs		Pumping Costs	
	Total	Per Acre	Total	Per Acre
1	\$6,940,000	\$4,220	\$110,000	\$67
5	3,730,000	3,540	67,100	64

VII. CHARBONNEAU/TIMBER CREEK AREA

Description:

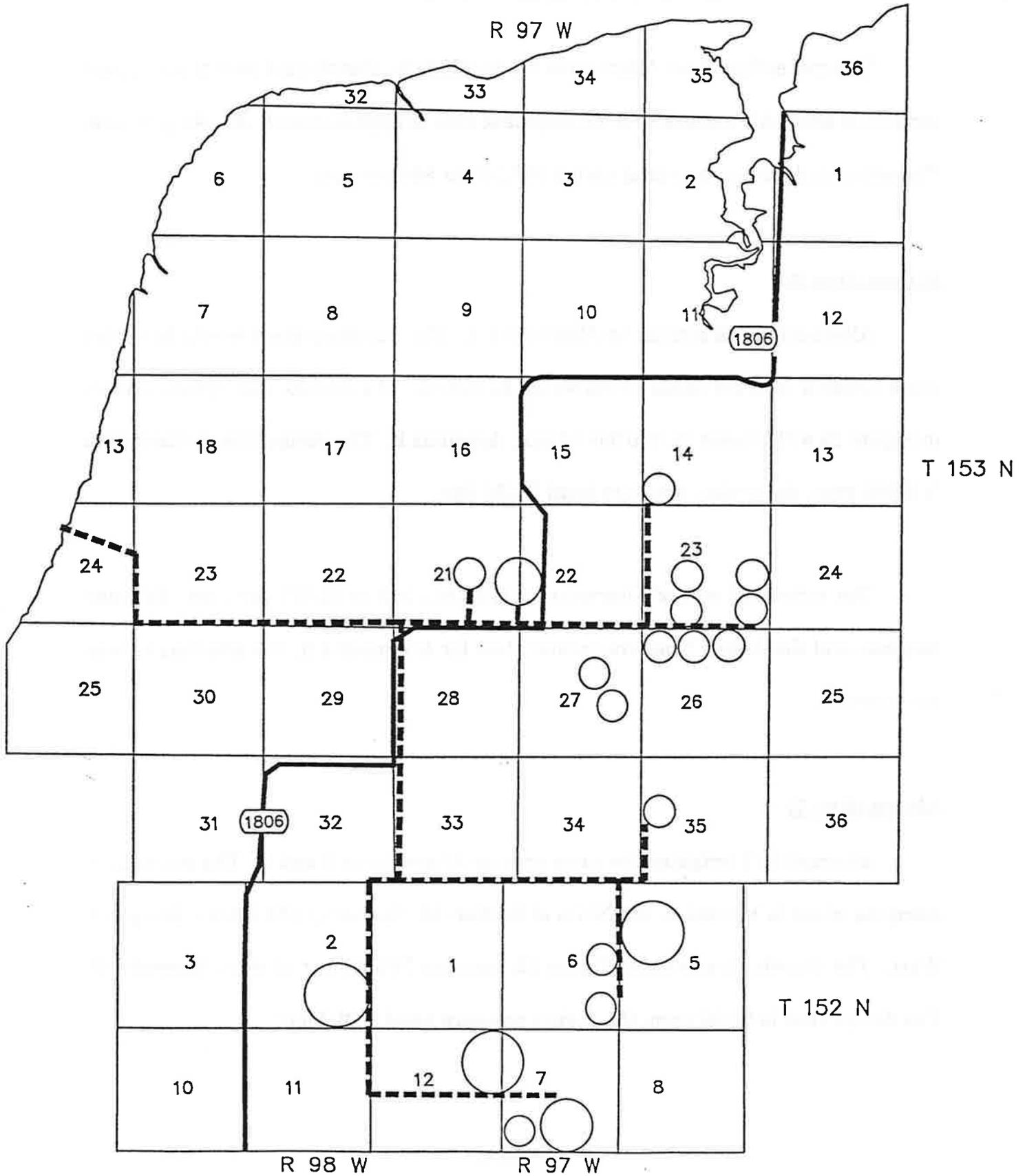
The Charbonneau/Timber Creek area consists of 57 sections in Township 151 North, Range 100 West; Township 151 North, Range 101 West; Township 151 North, Range 102 West; Township 151 North, Range 103 West; Township 151 North, Range 104 West; Township 152 North, Range 100 West; and Township 152 North, Range 101 West. The study area is along Charbonneau Creek and Timber Creek. The land irrigation classification and study area are shown in Figure 21. Proposed pivot locations are shown in Figure 22. These proposed pivots are contingent upon more detailed land classification and landowner interest. A total of 3,151 acres could be irrigated if all the proposed pivots are developed. Eight water delivery systems were investigated. Most of the alternatives consider only a portion of the total area.

Alternative 1:

The pipeline distribution system for Alternative 1 is shown in Figure 23. The distribution system contains 219,180 feet of pipe, Appendix B. The intake and pumping plant will be located on the Yellowstone River near the abandoned railroad bridge in the NW¼ of Section 35, Township 151 North, Range 104 West. The design flow at the intake is 18,200 gpm, the design pressure head is 740 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$13,810,000. Distributed over the proposed

FIGURE 18 TOBACCO GARDEN AREA ALTERNATIVE 5



Section 24, Township 153 North, Range 98 West near the submerged river channel. The design flow at the intake is 6,600 gpm, the design pressure head is 410 feet.

The cost estimate for Alternative 5 is \$3,730,000. Distributed over the proposed irrigation area this results in a development cost of approximately \$3,540 per acre. The estimated annual pumping cost is \$67,100 or \$64 per acre.

Alternative 6:

Alternative 6 is similar to Alternative 5. The pumping plant would be at the same location, and the same pivots would be served. The distribution system shown in Figure 19 will contain 71,850 feet of pipe, Appendix B. The design flow at the intake is 6,600 gpm, the design pressure head is 430 feet.

The estimated cost of Alternative 6 is \$3,860,000 or \$3,670 per acre. Because this cost and the design head are greater than for Alternative 5, this alternative was not pursued.

Alternative 7:

Alternative 7 irrigates the same area as Alternatives 5 and 6. The intake and pumping plant is located in the NW¼ of Section 36, Township 154 North, Range 97 West. The distribution system, Figure 20, contains 78,285 feet of pipe, Appendix B. The design flow is 6,600 gpm, the design pressure head is 420 feet.

FIGURE 19 TOBACCO GARDEN AREA ALTERNATIVE 6

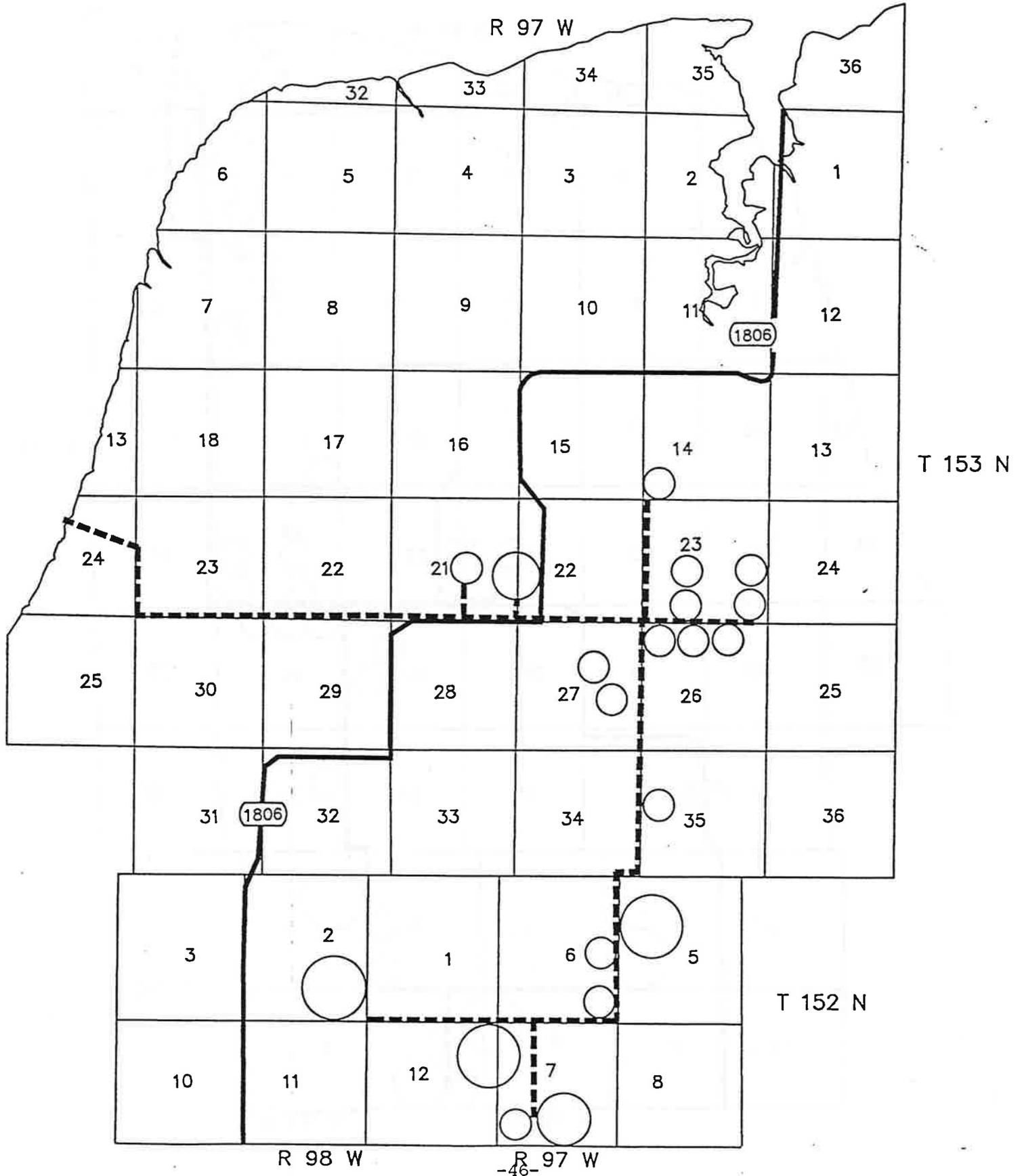
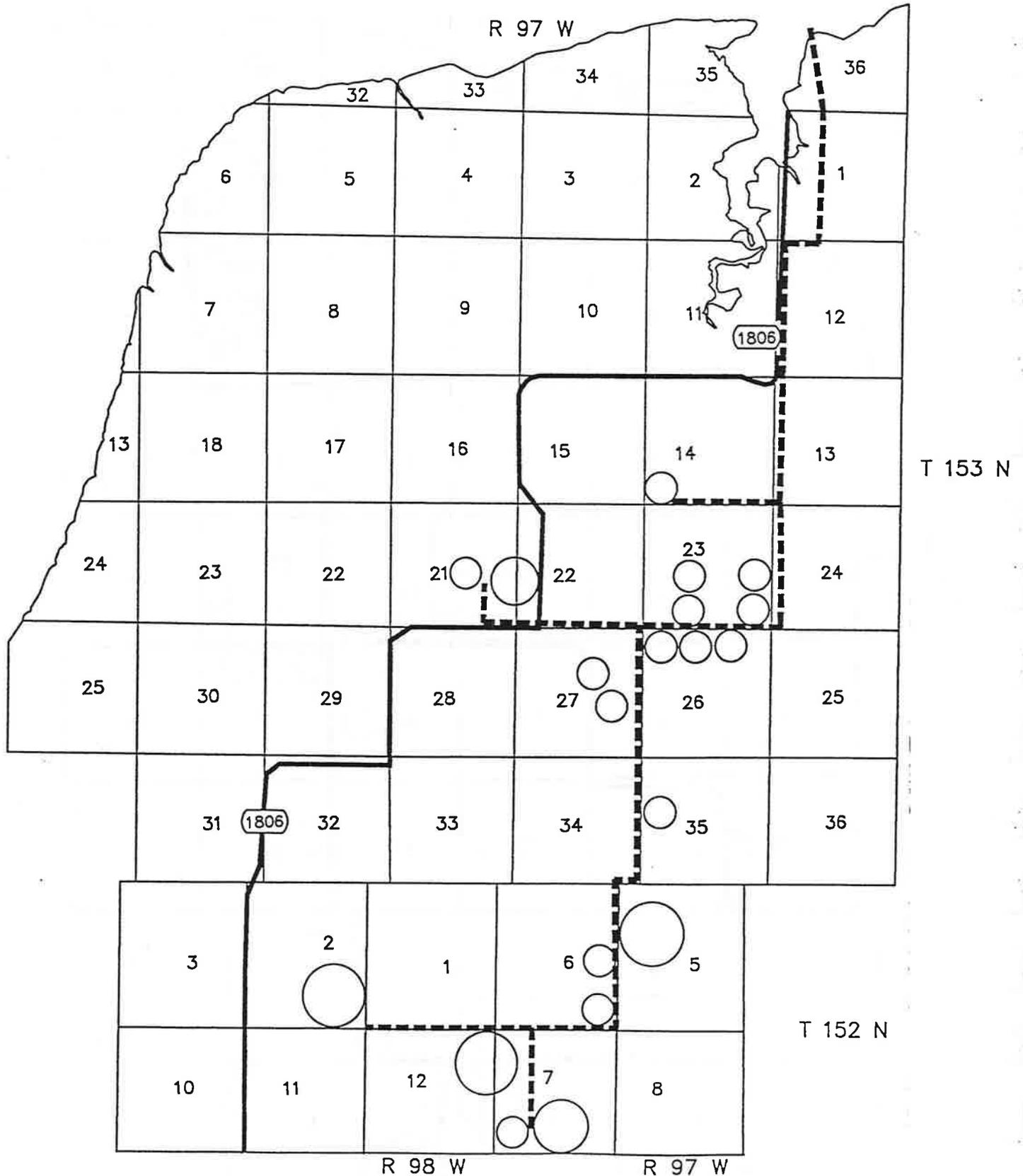


FIGURE 20 TOBACCO GARDEN AREA ALTERNATIVE 7



The estimated cost of Alternative 7 is \$4,200,000 or \$4,000 per acre. Because this cost and the design head are greater than for Alternative 5, this alternative was not investigated further.

Summary of Alternatives:

Seven alternatives to develop irrigation in the Tobacco Garden area were investigated. The construction cost, irrigated area, and total dynamic head (TDH) are summarized in Table 9.

**Table 9
Cost of Alternatives**

Alternative	Construction Costs		Irrigated Area	TDH
	Total	Per Acre		
1	\$6,940,000	\$4,220	1,646	480
2	7,180,000	4,360	1,646	523
3	7,610,000	4,630	1,646	566
4	8,170,000	4,960	1,646	553
5	3,730,000	3,540	1,052	407
6	3,860,000	3,670	1,052	429
7	4,200,000	4,000	1,052	417

Alternatives 2, 3, 4, 6, and 7 are more costly both to construct and operate; therefore, they were eliminated. The estimated construction and pumping costs for Alternatives 1 and 5 are summarized in Table 10.

**Table 10
Comparison Alternatives 1 and 5**

Alternative	Construction Costs		Pumping Costs	
	Total	Per Acre	Total	Per Acre
1	\$6,940,000	\$4,220	\$110,000	\$67
5	3,730,000	3,540	67,100	64

Alternative 5 is the least costly to construct and operate. However, Alternative 1 would irrigate more area. Based on the above comparisons, Alternative 5 was selected for economic analysis.

Economics:

The estimated irrigated crop budget was used to determine the economic return for Alternative 5. The results of the budget are presented in Table 11.

Based on the returns shown in Tables 11, it appears that this project is not feasible.

**Table 11
Per Acre Returns to Unpaid Labor and Management
Alternative 5**

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$435	-\$316	-\$280	-\$291	-\$213
Corn Grain	92.5% of Base	- 385	- 265	- 229	- 241	- 163
Corn Grain	77.5% of Base	- 375	- 255	- 219	- 231	- 153
Corn Silage	Non	- 361	- 241	- 205	- 217	- 138
Corn Silage	92.5% of Base	- 310	- 191	- 155	- 166	- 88
Corn Silage	77.5% of Base	- 301	- 181	- 145	- 156	- 78
Alfalfa						
Establishment Year		- 470	- 351	- 315	- 326	- 248
Alfalfa						
Established Stand		- 263	- 143	- 108	- 119	- 41
Drybeans		- 218	- 98	- 62	- 74	4

VII. CHARBONNEAU/TIMBER CREEK AREA

Description:

The Charbonneau/Timber Creek area consists of 57 sections in Township 151 North, Range 100 West; Township 151 North, Range 101 West; Township 151 North, Range 102 West; Township 151 North, Range 103 West; Township 151 North, Range 104 West; Township 152 North, Range 100 West; and Township 152 North, Range 101 West. The study area is along Charbonneau Creek and Timber Creek. The land irrigation classification and study area are shown in Figure 21. Proposed pivot locations are shown in Figure 22. These proposed pivots are contingent upon more detailed land classification and landowner interest. A total of 3,151 acres could be irrigated if all the proposed pivots are developed. Eight water delivery systems were investigated. Most of the alternatives consider only a portion of the total area.

Alternative 1:

The pipeline distribution system for Alternative 1 is shown in Figure 23. The distribution system contains 219,180 feet of pipe, Appendix B. The intake and pumping plant will be located on the Yellowstone River near the abandoned railroad bridge in the NW¼ of Section 35, Township 151 North, Range 104 West. The design flow at the intake is 18,200 gpm, the design pressure head is 740 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$13,810,000. Distributed over the proposed

FIGURE 21
CHARBONNEAU/TIMBER CREEK AREA
LAND IRRIGATION CLASSIFICATION AND STUDY AREA

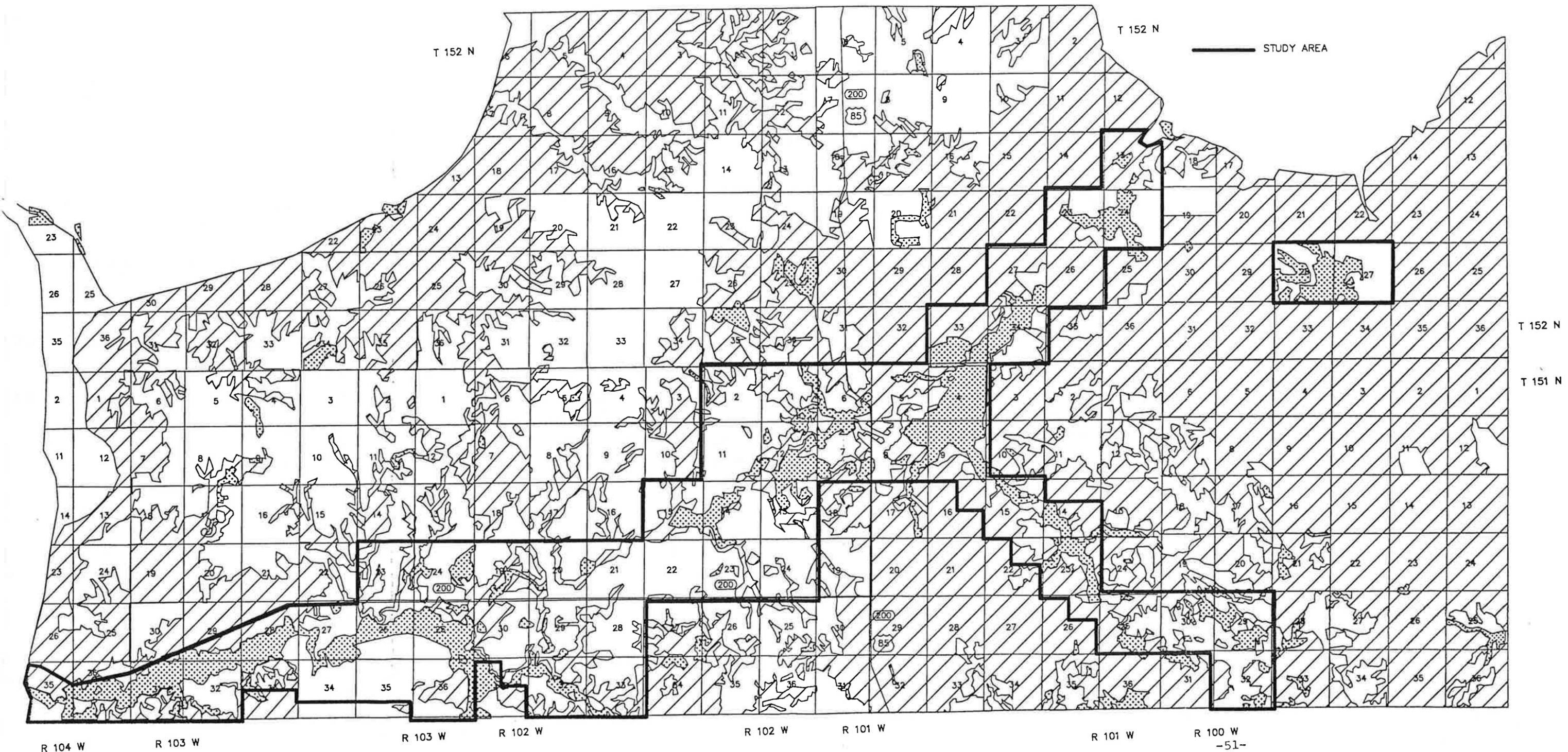


FIGURE 22
 CHARBONNEAU/TIMBER CREEK AREA
 PROPOSED PIVOT LOCATIONS

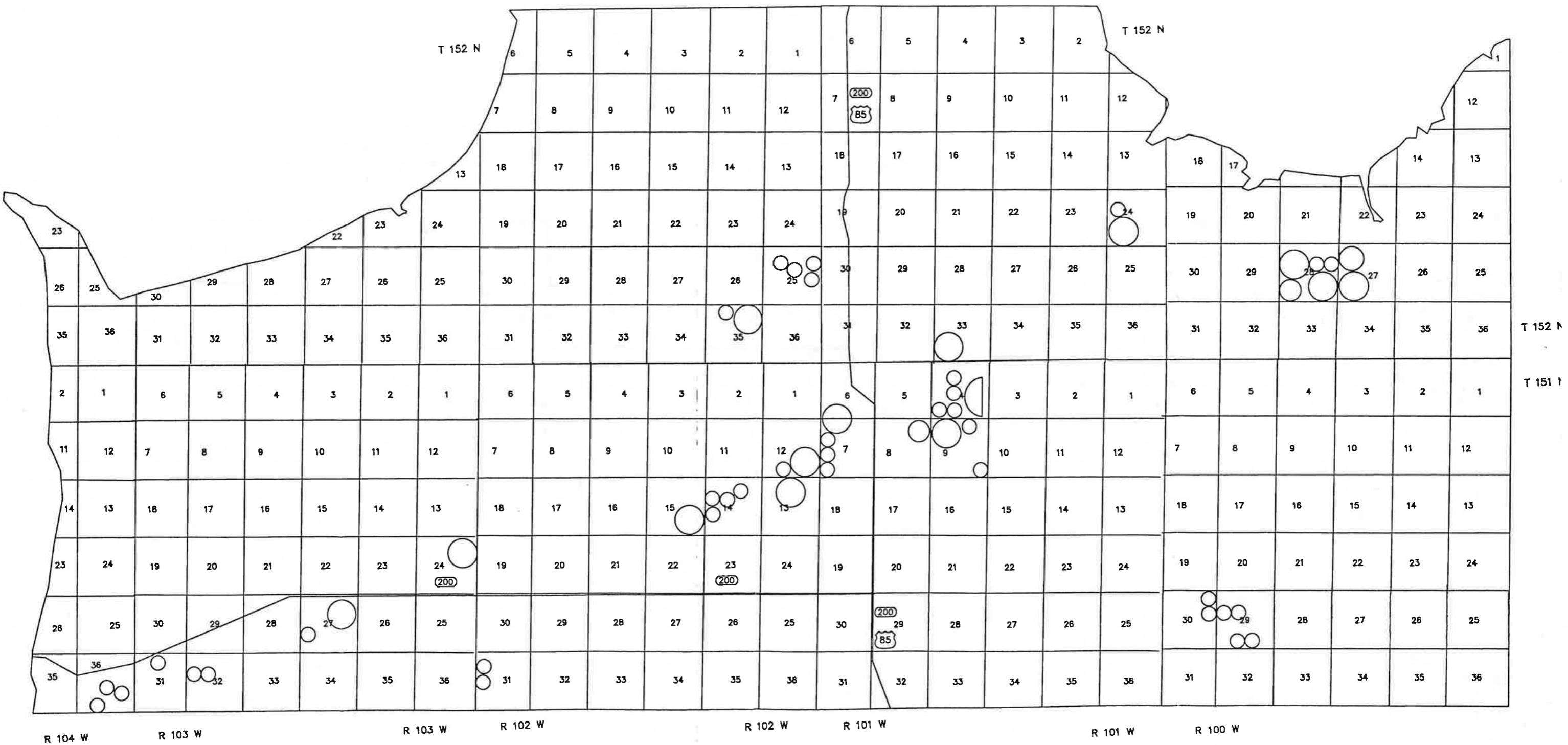
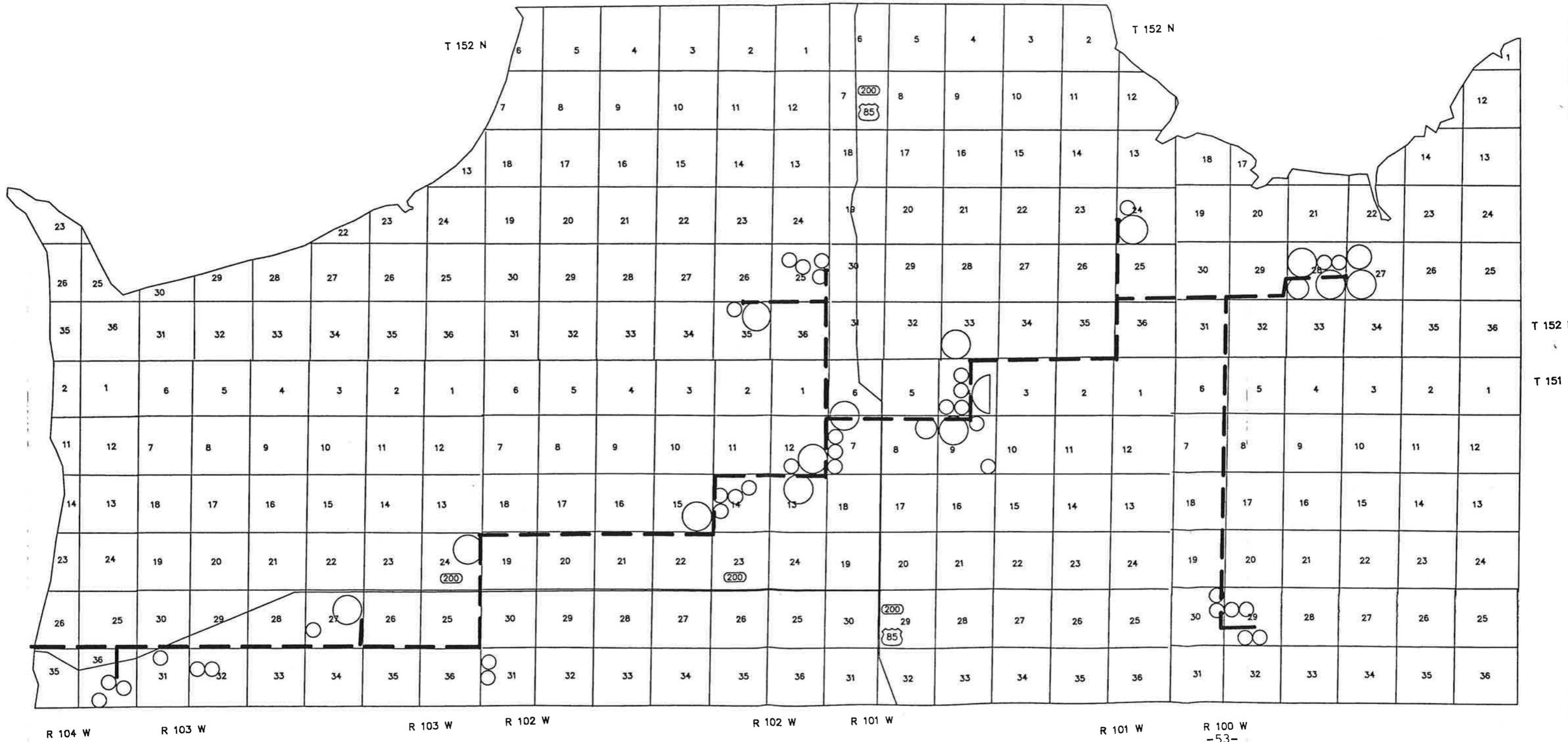


FIGURE 23
 CHARBONNEAU/TIMBER CREEK AREA
 ALTERNATIVE 1



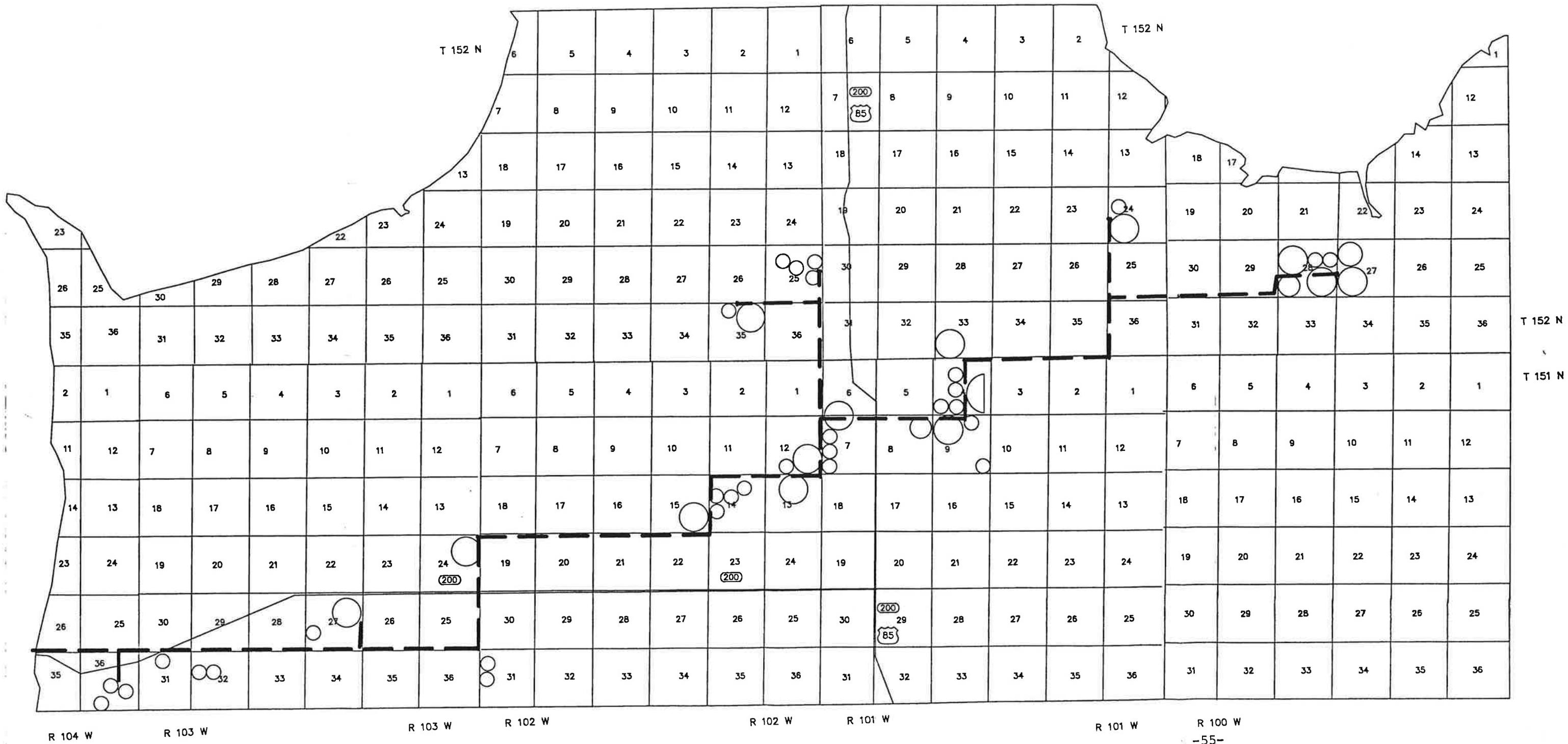
irrigation area this results in a cost of approximately \$4,380 per acre for the pipeline. The cost of the pumping plant and pivots are not included in this amount. The cost of the pumping plant and pivots were not calculated because the cost of \$4,380 per acre is not economically feasible.

Alternative 2:

The irrigable area in Sections 29 and 30, Township 151 North, Range 100 West is not served by Alternative 2. The irrigated area is reduced to 2,959 acres. The pipeline distribution system for Alternative 2 and the pivots served are shown in Figure 24. The distribution system contains 189,480 feet of pipe, Appendix B. The intake and pumping plant will be located on the Yellowstone River near the abandoned railroad bridge in the northwest quarter of Section 35, Township 151 North, Range 104 West. The design flow at the intake is 17,200 gpm, the design pressure head is 760 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$12,720,000. Distributed over the proposed irrigation area this results in a cost of approximately \$4,300 per acre for the pipeline. The cost of the pumping plant and pivots are not included in this amount. The cost of the pumping plant and pivots were not calculated because the cost of \$4,300 per acre is not economically feasible.

FIGURE 24
 CHARBONNEAU/TIMBER CREEK AREA
 ALTERNATIVE 2



Alternative 3:

Alternative 3 provides water to 2,219 acres. The pipeline distribution system and the pivots served by Alternative 3 are shown in Figure 25. The distribution system contains 139,320 feet of pipe, Appendix B. The intake and pumping plant will be located on the Yellowstone River near the abandoned railroad bridge in the NW¼ of Section 35, Township 151 North, Range 104 West. The design flow at the intake is 12,800 gpm, the design pressure head is 500 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$9,060,000. Distributed over the proposed irrigation area this results in a cost of approximately \$4,080 per acre for the pipeline. The cost of the pumping plant and pivots are not included in this amount. The cost of the pumping plant and pivots were not calculated because the cost of \$4,080 per acre is not economically feasible.

Alternative 4:

Alternative 4 provides water to 548 acres. The pivots used and the pipeline distribution system for Alternative 4 are shown in Figure 26. The distribution system contains 54,580 feet of pipe, Appendix B. The intake and pumping plant will be located on the Yellowstone River near the abandoned railroad bridge in the NW¼ of Section 35, Township 151 North, Range 104 West. The design flow at the intake is 3,200 gpm, the design pressure head is 470 feet.

FIGURE 25
 CHARBONNEAU/TIMBER CREEK AREA
 ALTERNATIVE 3

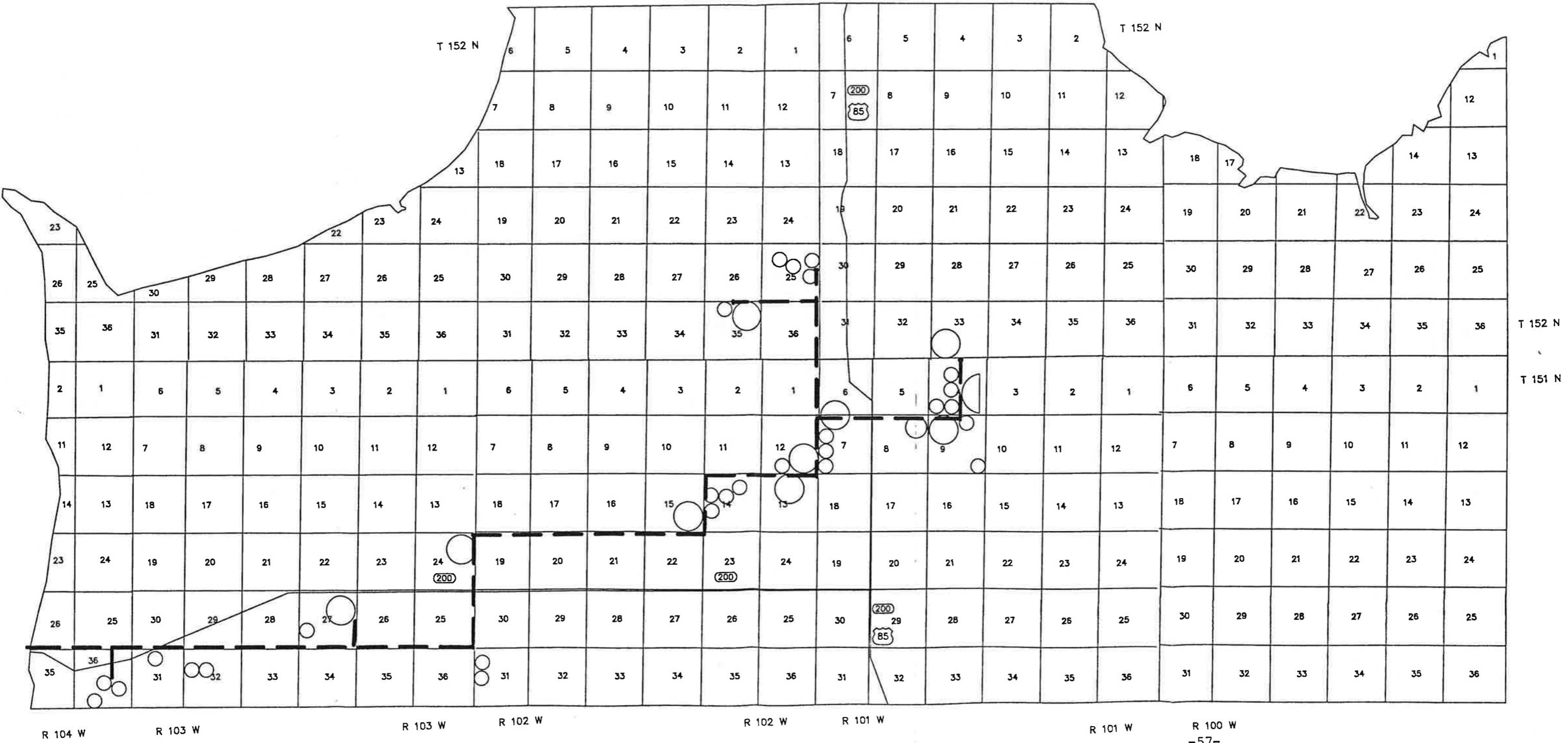
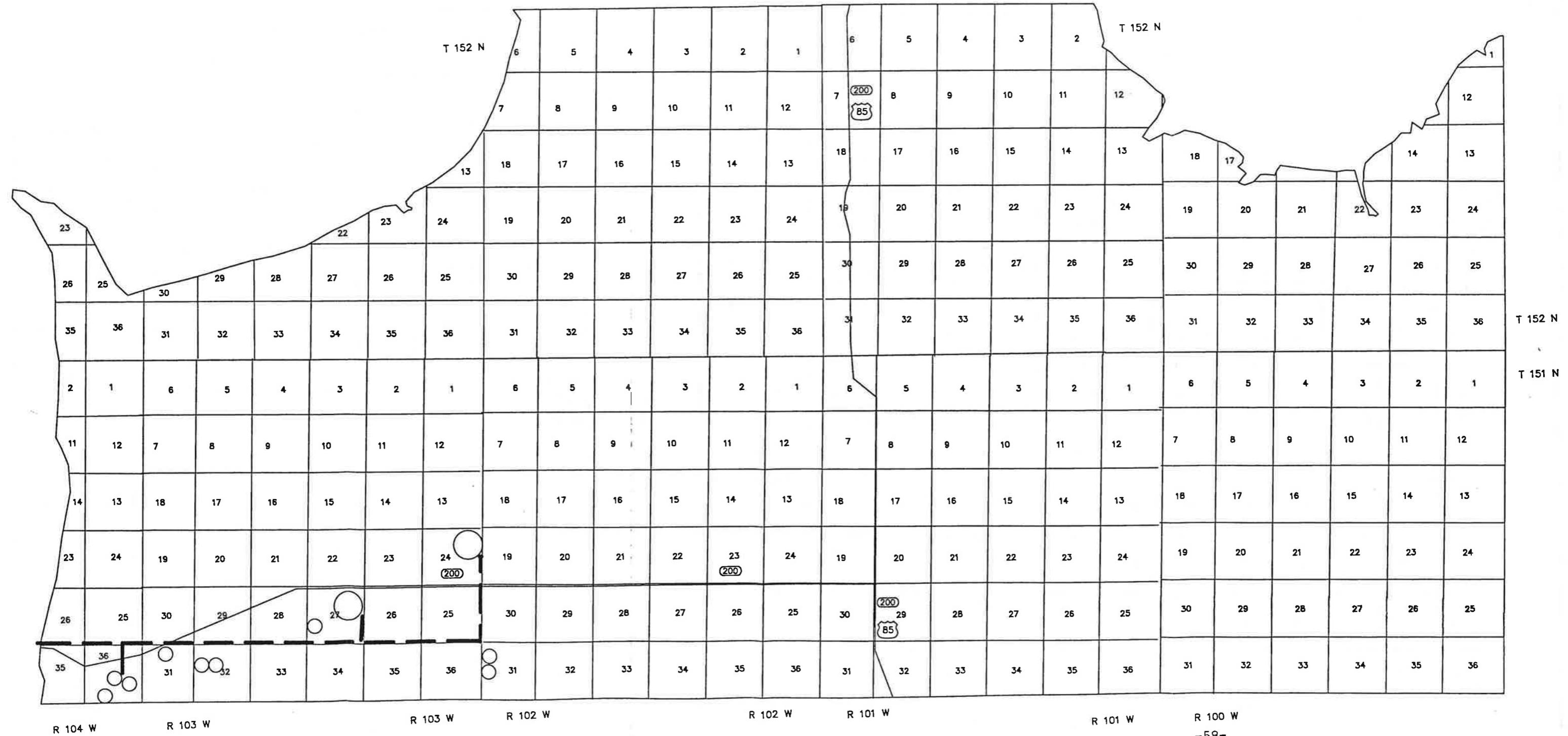


FIGURE 26
 CHARBONNEAU/TIMBER CREEK AREA
 ALTERNATIVE 4



The total estimated cost for Alternative 4 is \$1,950,000, Appendix C. This estimate does include the pumping plant and pivots. Distributed over the proposed irrigation area this results in a development cost of approximately \$3,560 per acre. The estimated annual pumping cost is \$41,300 or \$75 per acre.

Alternative 5:

Alternative 5 irrigates only 617 acres in Sections 27 and 28, Township 152 North, Range 100 West. The pipeline distribution system for Alternative 5 and the pivots served are shown in Figure 27. The distribution system contains 13,280 feet of pipe, Appendix B. The intake and pumping plant will be located on the edge of Lake Sakakawea on the Section line between Sections 15 and 16, Township 152 North, Range 100 West. The design flow at the intake is 4,400 gpm, the design pressure head is 430 feet.

The total estimated cost for Alternative 5 is \$1,240,000, Appendix C. This estimate includes cost of the pumping plant and pivots. Distributed over the proposed irrigation area this results in a development cost of approximately \$2,000 per acre. The estimated annual pumping cost is \$45,600 or \$74 per acre.

Alternative 6:

Alternative 6 irrigates 2,411 acres. The pipeline distribution system for Alternative 6 and the pivots served are shown in Figure 28. The distribution system

FIGURE 27 CHARBONNEAU/TIMBER CREEK AREA ALTERNATIVE 5

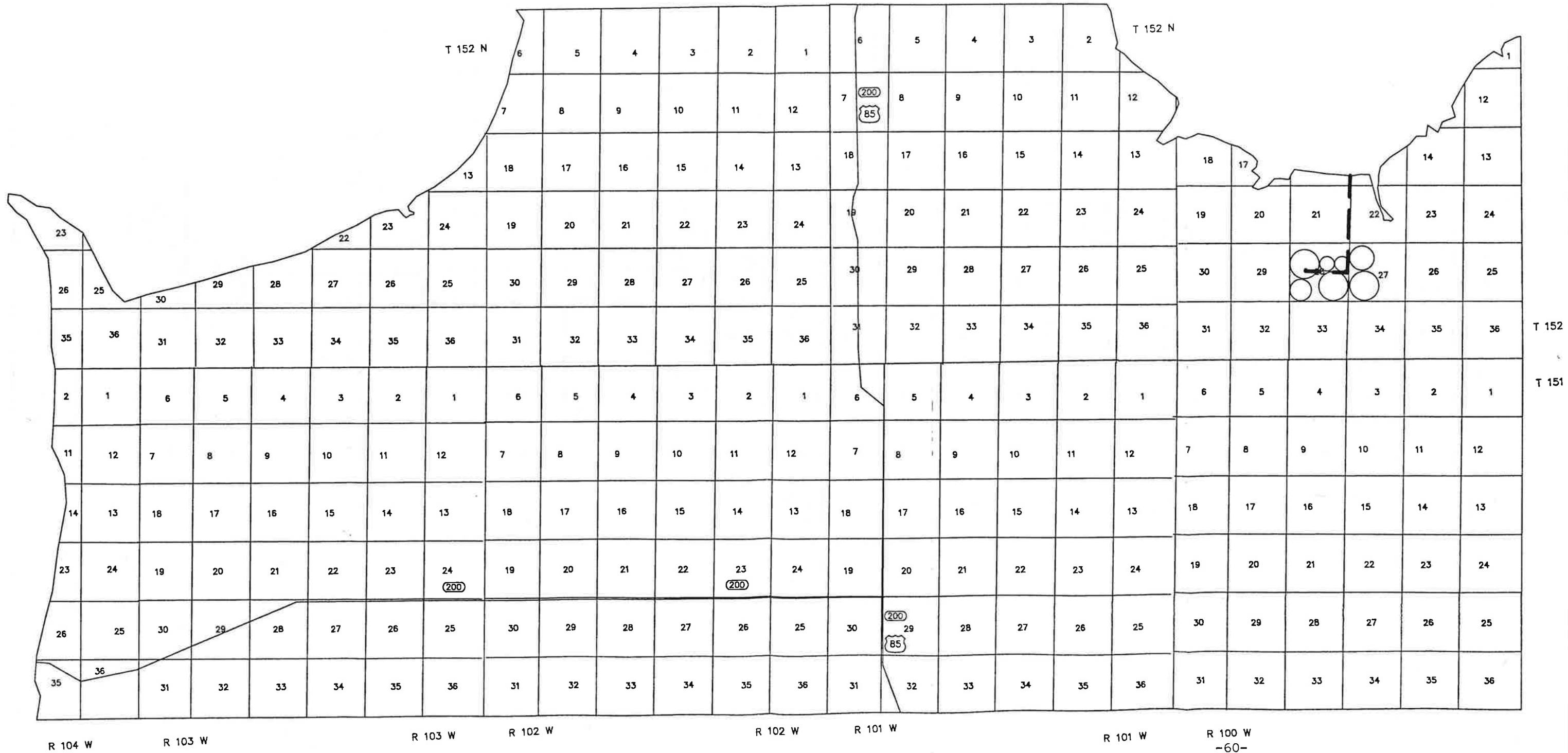
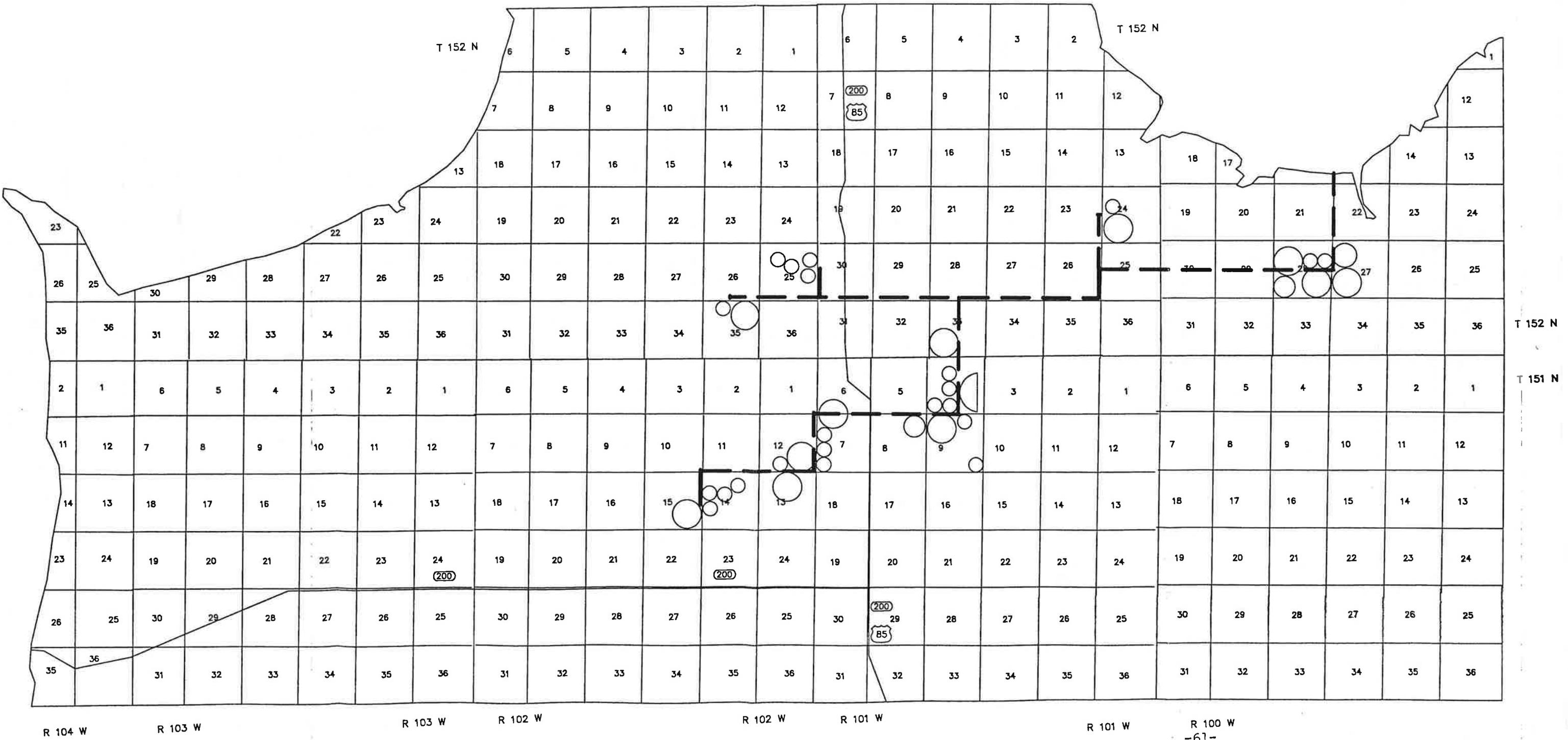


FIGURE 28 CHARBONNEAU/TIMBER CREEK AREA ALTERNATIVE 6



contains 120,460 feet of pipe, Appendix B. The intake and pumping plant will be located on the edge of Lake Sakakawea on the Section line between Sections 15 and 16, Township 152 North, Range 100 West. The design flow at the intake is 14,200 gpm, the design pressure head is 550 feet.

The total estimated cost for Alternative 6 is \$8,650,000, Appendix C. This estimate includes cost of the pumping plant and pivots. Distributed over the proposed irrigation area this results in a development cost of approximately \$3,590 per acre. The estimated annual pumping cost is \$153,500 or \$64 per acre.

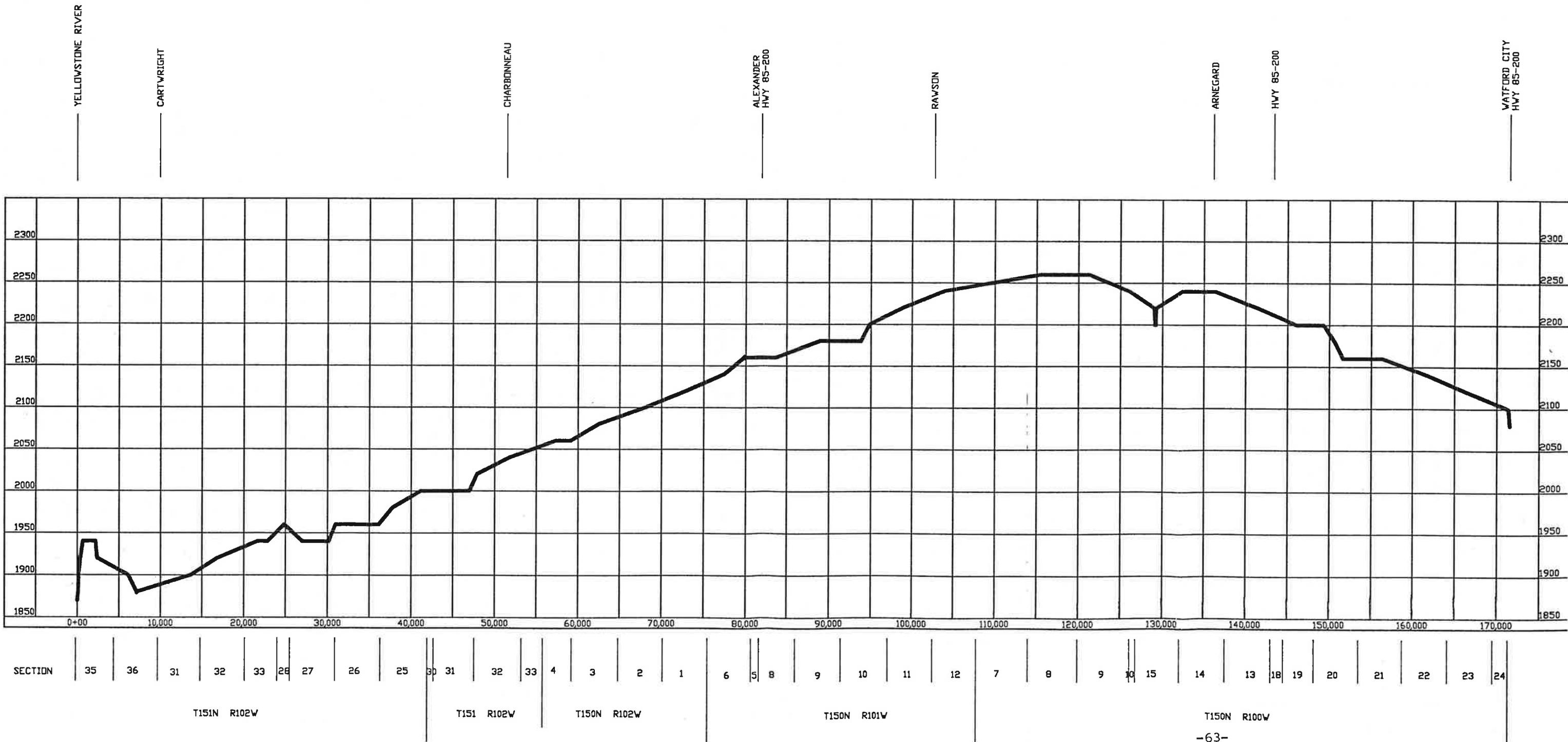
Alternative 7:

Alternative 7 consists of a canal following the abandoned Burlington Northern Railroad from the Yellowstone River in Section 35, Township 151 North, Range 104 West to Watford City. Figure 29 shows a profile of the railroad. The data for this profile was taken from USGS 7.5 minute quadrangle maps. There is 380 feet increase in elevation from near Cartwright to a point between Rawson and Arnegard. It would not be practical to build a canal along this route.

Alternative 8:

Alternative 8 irrigates 2,480 acres. The distribution system for Alternative 8 and the pivots served are shown in Figure 30. The distribution system contains 102,060 feet of pipe, Appendix B. Two canals are used in this alternative. The first

FIGURE 29 PROFILE OF ABANDONED RAILROAD



canal will be approximately 19,800 feet long. The estimated length of the second canal is 52,550 feet. Both canals will have a trapezoidal cross-section with a bottom width of 8 feet and 2:1 side slopes. The estimated volume of excavation for the canals is 173,500 cubic yards. The second canal will require 13 drop structures 6 feet high. The canals will also require 9 road crossings.

The intake and pumping plant will be located on the edge of Lake Sakakawea on the section line between Sections 15 and 16, Township 152 North, Range 100 West. The design flow at the intake is 14,200 gpm, the design pressure head is 520 feet. A relift pumping plant will be required at the end of the first canal in Section 13, Township 151 North, Range 100 West. The design flow for the canal relift pumps is 10,600 gpm, the design pressure head is 106 feet. A second relift pumping plant will be needed at the corner of Sections 1, 6, 7, and 12, Township 151 North, and Ranges 101 and 102 West. Two sets of pumps will be required at this site. One set will supply 3,800 gpm at 140 feet of head to the pivots south of this point. The other set will supply 1,800 gpm at 360 feet of head to the pivots to the north.

The total estimated cost for Alternative 8 is \$7,900,000, Appendix C. This estimate includes cost of the pumping plant and pivots. Distributed over the proposed irrigation area this results in a development cost of approximately \$3,780 per acre. The estimated annual pumping cost is \$224,400 or \$90 per acre.

Summary of Alternatives:

Eight alternatives to develop irrigation in the Charbonneau/Timber Creek area were investigated. Alternative 7 was eliminated without calculating the construction cost due to the topography of the proposed canal route. The construction cost, irrigated area, and total dynamic head (TDH) for Alternatives 1 through 6 and 8, are summarized in Table 12.

Table 12
Cost of Alternatives

Alternative	Construction Costs		Irrigated Area	TDH
	Total	Per Acre		
1	\$13,810,000*	\$4,380*	3,151	740
2	12,720,000*	4,300*	2,959	760
3	9,060,000*	4,080*	2,219	500
4	1,950,000	3,560	548	470
5	1,240,000	2,000	617	430
6	8,650,000	3,590	2,411	550
8	7,900,000	3,180	2,480	520

* Estimated cost of pumping plant and pivots not included.

The cost of the pipeline alone for Alternatives 1, 2, and 3 is over \$4,000 per acre; therefore, they were eliminated. The estimated construction and pumping costs for Alternatives 4, 5, 6, and 8, are summarized in Table 13.

Table 13
Alternatives 4 and 5

Alternative	Construction Costs		Pumping Costs	
	Total	Per Acre	Total	Per Acre
4	\$1,950,000	\$3,560	\$ 41,300	\$75
5	1,240,000	2,000	45,600	74
6	8,650,000	3,590	153,500	64
8	7,900,000	3,180	224,400	90

Each of these alternatives irrigate different areas. Therefore, a economic analysis was done for Alternative 4, 5, 6, and 8.

Economics:

The estimated irrigated crop budgets were used to determine the economic return for Alternatives 4, 5, 6, and 8. The results of the budgets are presented in Tables 14, 15, 16, and 17.

Table 14
Per Acre Returns to Unpaid Labor and Management
Alternative 4

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$448	-\$327	-\$291	-\$303	-\$225
Corn Grain	92.5% of Base	- 397	- 277	- 241	- 253	- 174
Corn Grain	77.5% of Base	- 388	- 267	- 231	- 243	- 164
Corn Silage	Non	- 373	- 253	- 217	- 229	- 150
Corn Silage	92.5% of Base	- 323	- 202	- 166	- 178	- 99
Corn Silage	77.5% of Base	- 313	- 193	- 157	- 168	- 90
Alfalfa						
Establishment Year		- 485	- 365	- 329	- 341	- 262
Alfalfa						
Established Stand		- 278	- 158	- 122	- 134	- 55
Drybeans		- 227	- 107	- 71	- 83	- 4

Table 15
Per Acre Returns to Unpaid Labor and Management
Alternative 5

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$263	-\$196	-\$175	-\$186	-\$140
Corn Grain	92.5% of Base	- 213	- 145	- 125	- 135	- 90
Corn Grain	77.5% of Base	- 203	- 135	- 115	- 126	- 80
Corn Silage	Non	- 189	- 121	- 101	- 111	- 66
Corn Silage	92.5% of Base	- 138	- 70	- 50	- 61	- 15
Corn Silage	77.5% of Base	- 128	- 61	- 40	- 51	- 6
Alfalfa Establishment Year		- 301	- 233	- 213	- 223	- 178
Alfalfa Established Stand		- 93	- 26	- 5	- 16	30
Drybeans		- 43	24	45	34	80

Table 16
Per Acre Returns to Unpaid Labor and Management
Alternative 6

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$440	-\$319	-\$283	-\$291	-\$213
Corn Grain	92.5% of Base	- 390	- 269	- 232	- 241	- 162
Corn Grain	77.5% of Base	- 380	- 259	- 223	- 231	- 153
Corn Silage	Non	- 366	- 244	- 208	- 217	- 138
Corn Silage	92.5% of Base	- 315	- 194	- 158	- 166	- 88
Corn Silage	77.5% of Base	- 305	- 184	- 148	- 156	- 78
Alfalfa Establishment Year		- 475	- 354	- 318	- 326	- 248
Alfalfa Established Stand		- 268	- 147	- 110	- 119	- 41
Drybeans		- 223	- 102	- 65	- 74	5

Table 17
Per Acre Returns to Unpaid Labor and Management
Alternative 8

Crop	Farm Program Participation	No Cost-Share Interest Rate			40% Cost-Share Interest Rate	
		10%	5.5%	4%	10%	5.5%
Corn Grain	Non	-\$417	-\$309	-\$277	-\$288	-\$217
Corn Grain	92.5% of Base	- 366	- 259	- 227	- 237	- 167
Corn Grain	77.5% of Base	- 357	- 249	- 217	- 228	- 157
Corn Silage	Non	- 342	- 235	- 202	- 213	- 143
Corn Silage	92.5% of Base	- 292	- 184	- 152	- 163	- 92
Corn Silage	77.5% of Base	- 282	- 174	- 142	- 153	- 82
Alfalfa Establishment Year		- 458	- 350	- 318	- 329	- 258
Alfalfa Established Stand		- 251	- 143	- 111	- 121	- 51
Drybeans		- 192	- 85	- 53	- 63	7

Based on the returns shown in Tables 14, 15, 16, and 17, it appears that Alternatives 4, 6, and 8 are not feasible. Alternative 5 may be feasible if cost-share and low interest rates are available.

VIII. WATFORD CITY AREA

Description:

The Watford City area consists of 53 sections in Township 150 North, Ranges 98 through 101 West. The study area extends from Alexander to a point 3 miles south and 4 miles east of Watford City. The land irrigation classification and study area are shown in Figures 31 through 35. Proposed pivot locations are shown in Figure 36. These proposed pivots are contingent upon more detailed land classification and landowner interest. Three water delivery systems were investigated. All three alternatives extend from either the Tobacco Garden area or the Charbonneau/Timber Creek area.

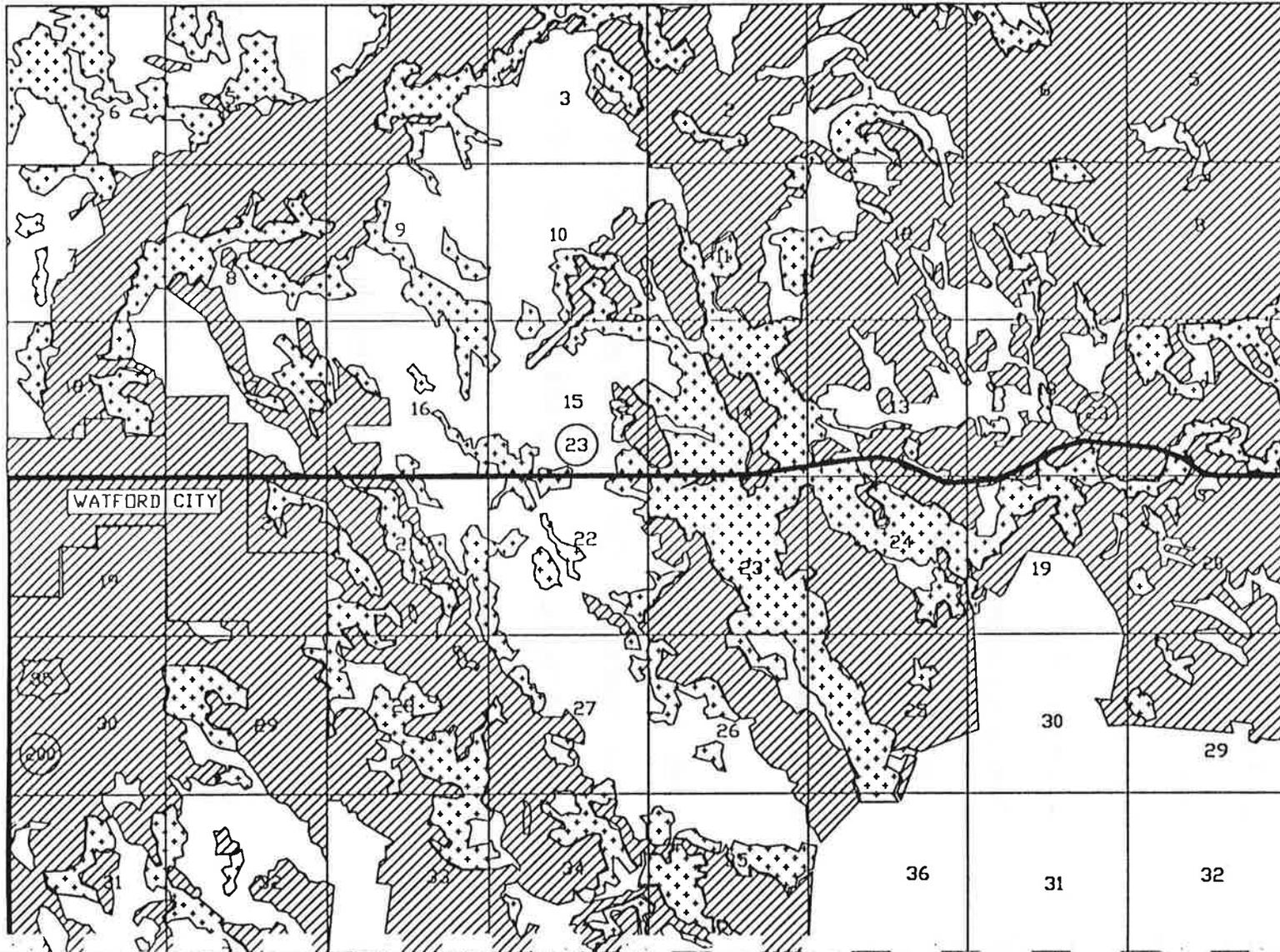
Alternative 1:

Alternative 1 irrigates 7,215 acres. The pipeline distribution system and the pivots served are shown in Figure 37. The distribution system contains 491,320 feet of pipe, Appendix B. The intake and pumping plant will be located in the northwest quarter of Section 24, Township 153 North, Range 98 West. The design flow at the intake is 42,400 gpm, the design pressure head is 970 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$29,850,000. Distributed over the proposed irrigation area this results in a cost of approximately \$4,140 per acre for the pipeline. The cost of the pumping plant and pivots are not included in this amount. The cost of

FIGURE 31
WATFORD CITY AREA
LAND IRRIGATION CLASSIFICATION

R 99 W R 98 W



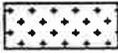
LEGEND

- NON-IRRIGABLE SOIL
- IRRIGABLE SOILS
- CONDITIONAL SOILS

T150N

FIGURE 32 WATFORD CITY AREA LAND IRRIGATION CLASSIFICATION

LEGEND

-  NON-IRRIGABLE SOILS
-  IRRIGABLE SOILS
-  CONDITIONAL SOILS

R 99 W

T150N

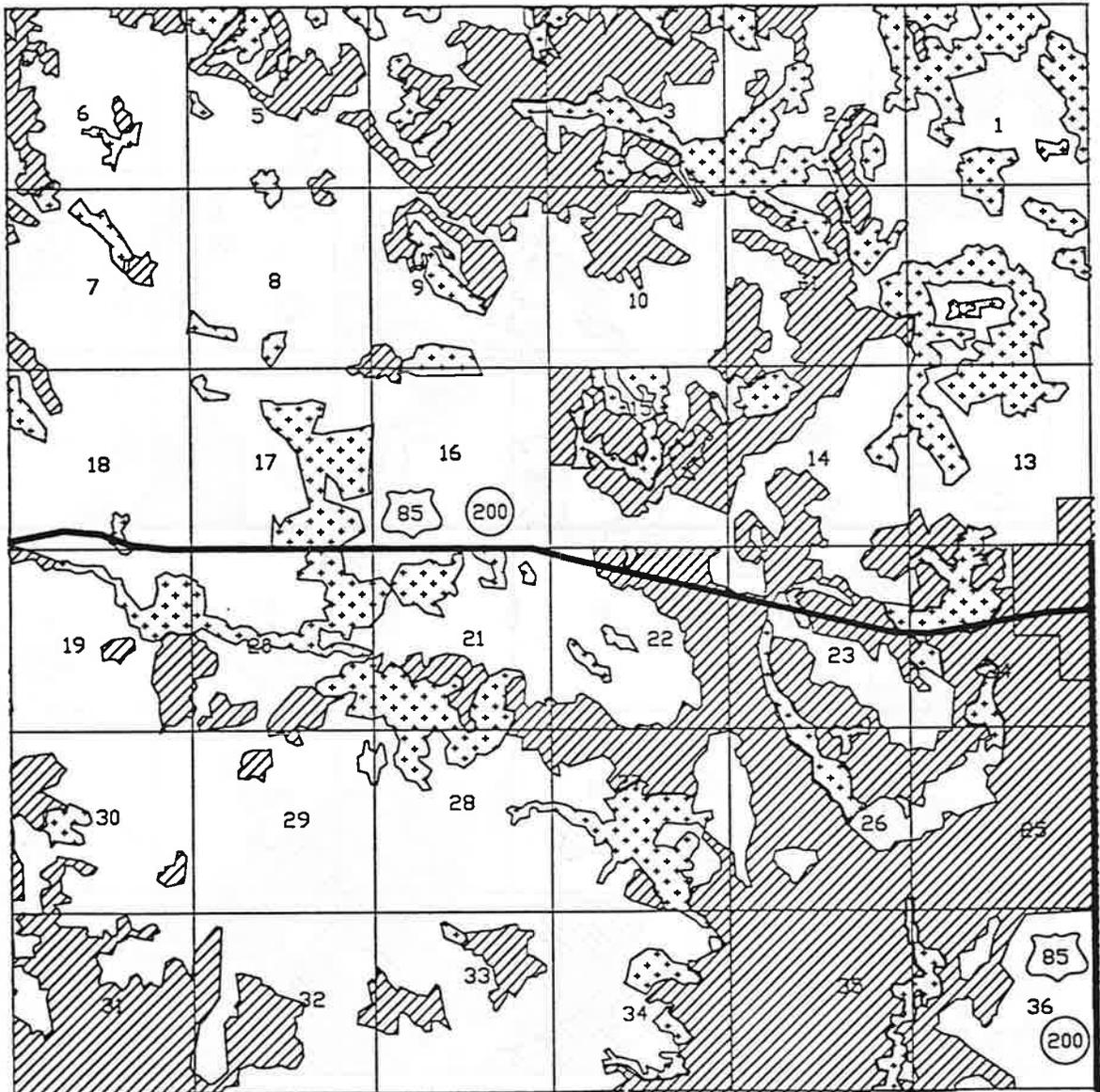


FIGURE 33 WATFORD CITY AREA LAND IRRIGATION CLASSIFICATION

LEGEND

-  NON-IRRIGABLE SOILS
-  IRRIGABLE SOILS
-  CONDITIONAL SOILS

R 100 W

T150N

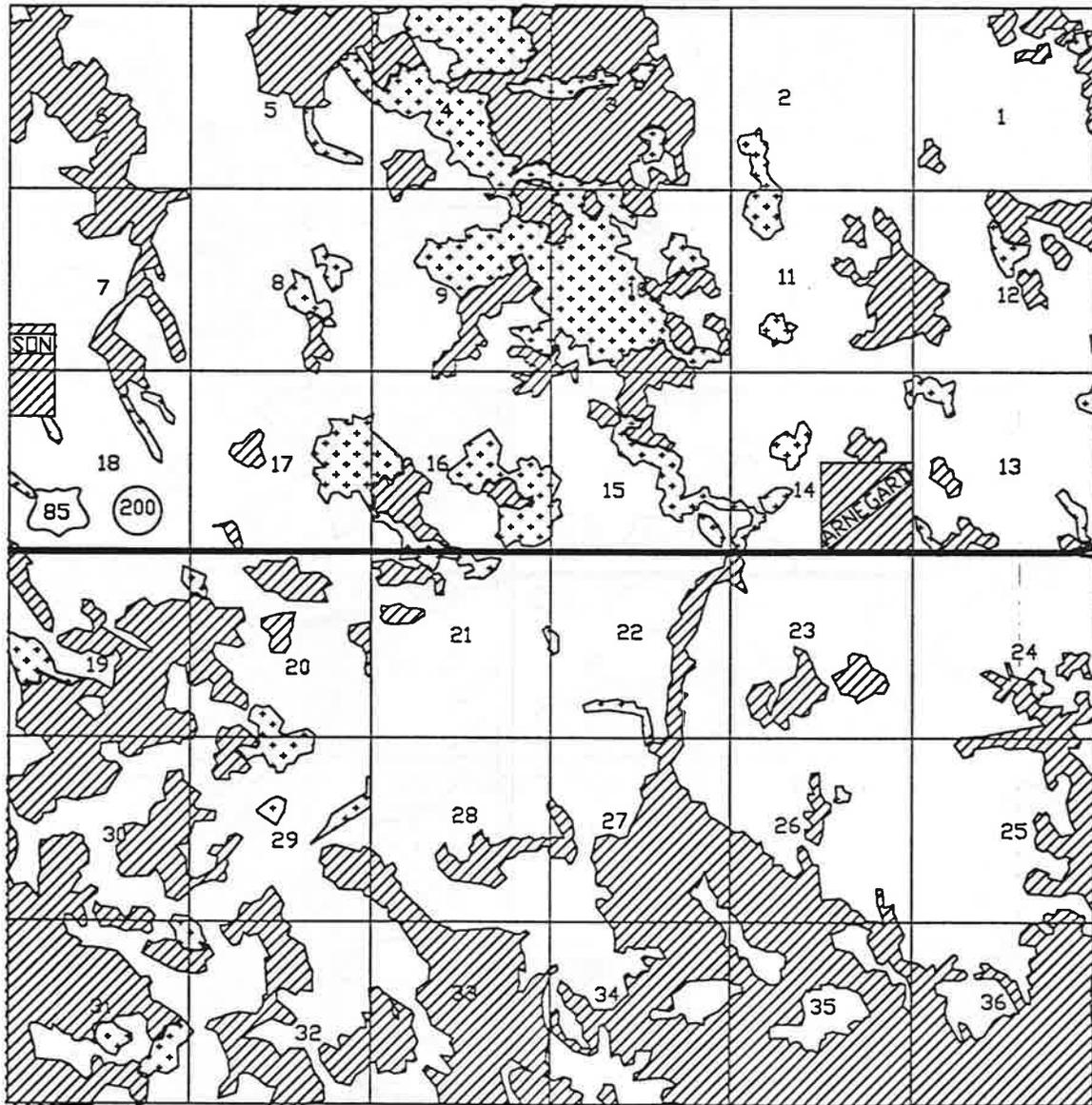


FIGURE 34 WATFORD CITY AREA LAND IRRIGATION CLASSIFICATION

LEGEND

-  NON-IRRIGABLE SOILS
-  IRRIGABLE SOILS
-  CONDITIONAL SOILS

R 101 W

T150N

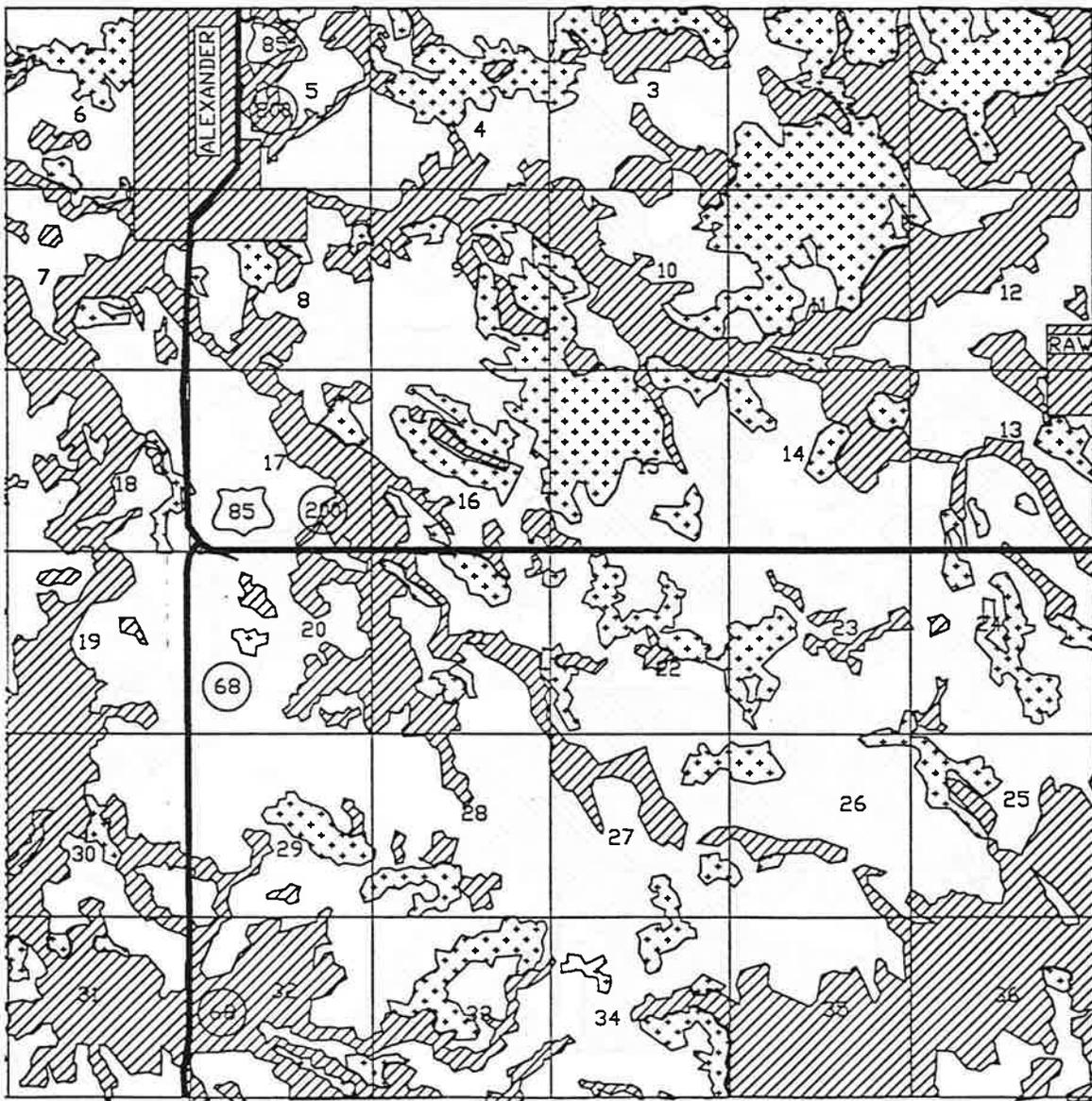
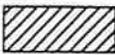
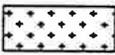
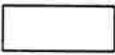


FIGURE 35 WATFORD CITY AREA LAND IRRIGATION CLASSIFICATION

LEGEND

-  NON-IRRIGABLE SOILS
-  IRRIGABLE SOILS
-  CONDITIONAL SOILS

R 103 W R 102 W

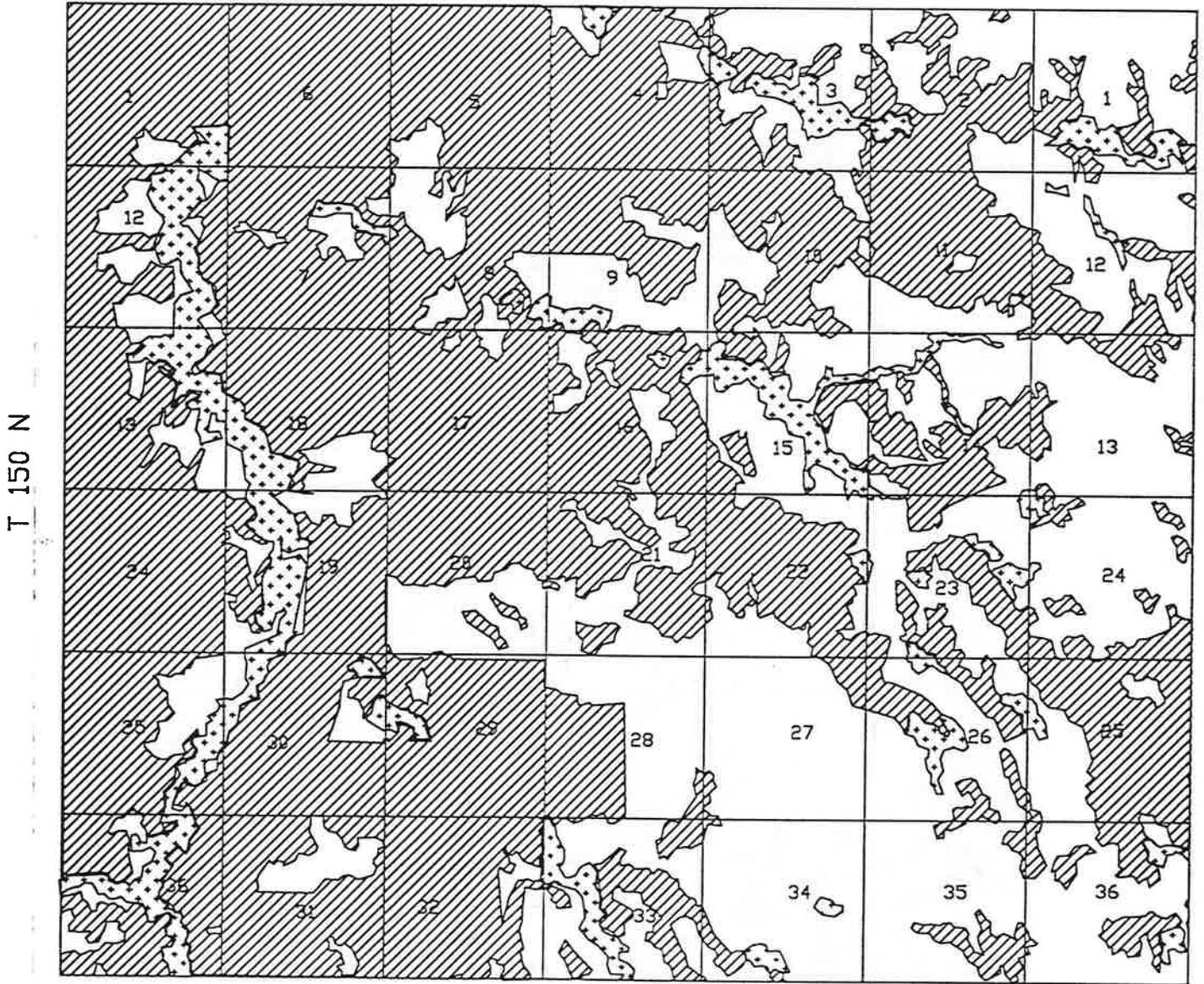


FIGURE 30
 CHARBONNEAU/TIMBER CREEK AREA
 ALTERNATIVE 8

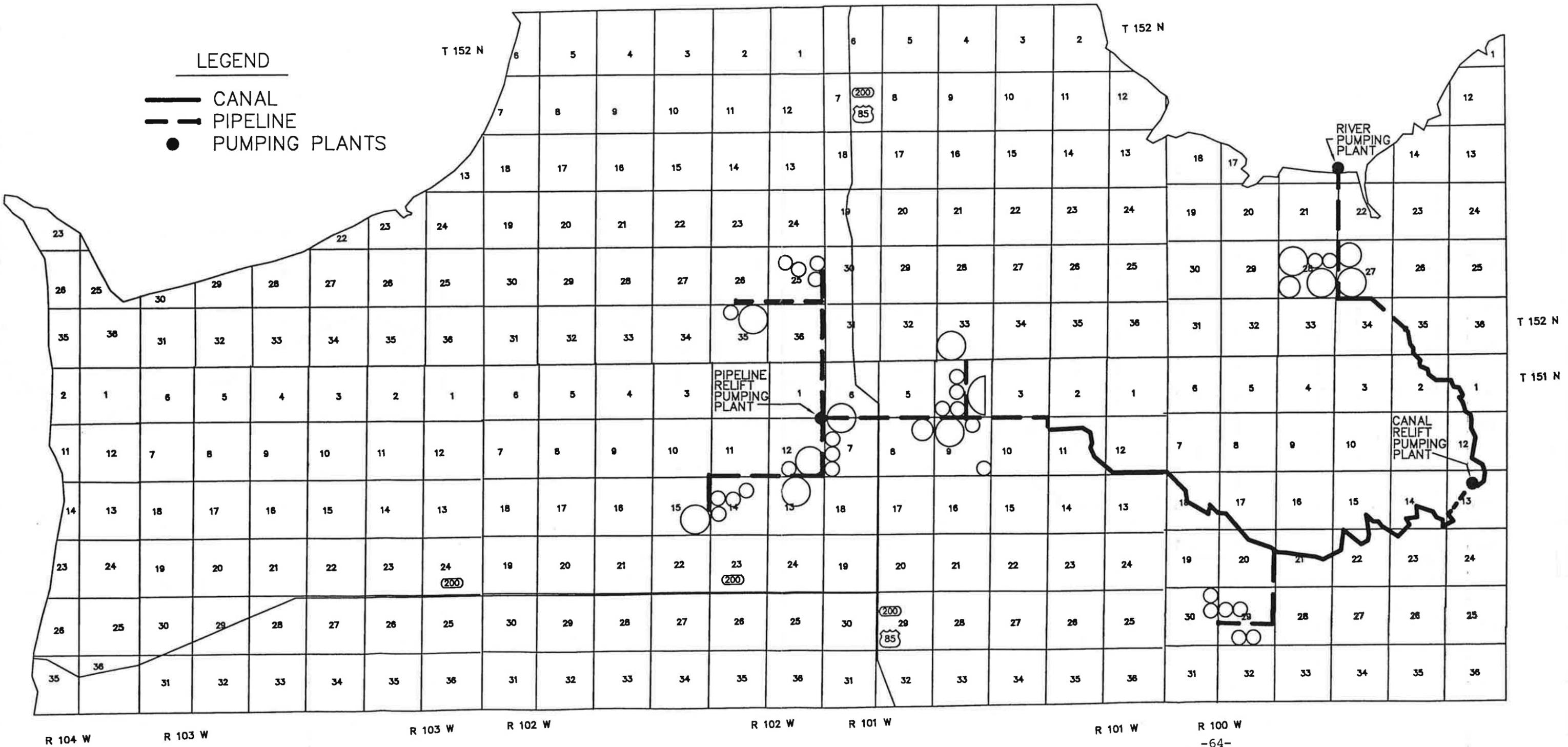


FIGURE 36 WATFORD CITY AREA PIVOT LOCATIONS

LEGEND
○ PIVOTS
— ROADWAYS

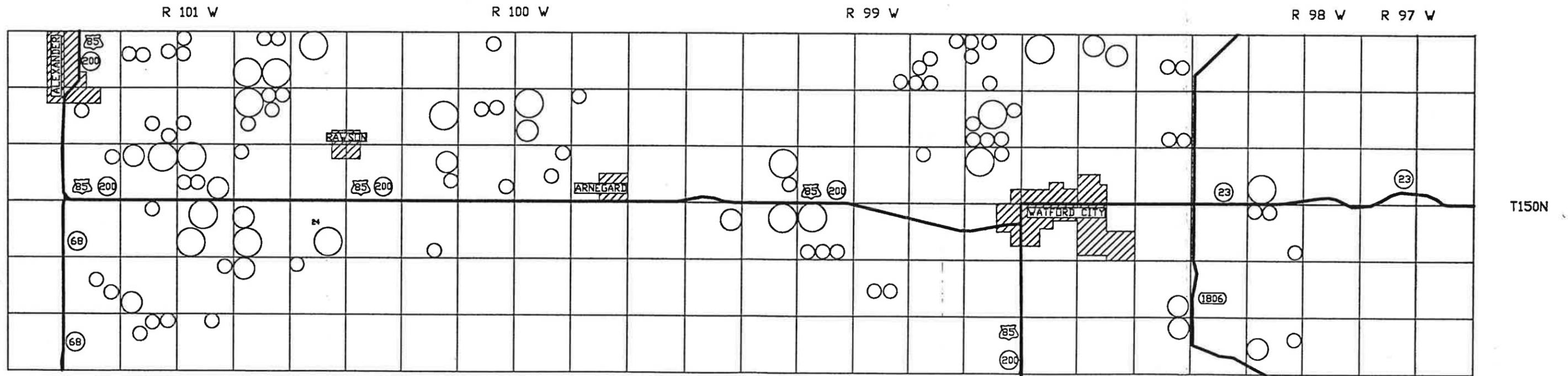
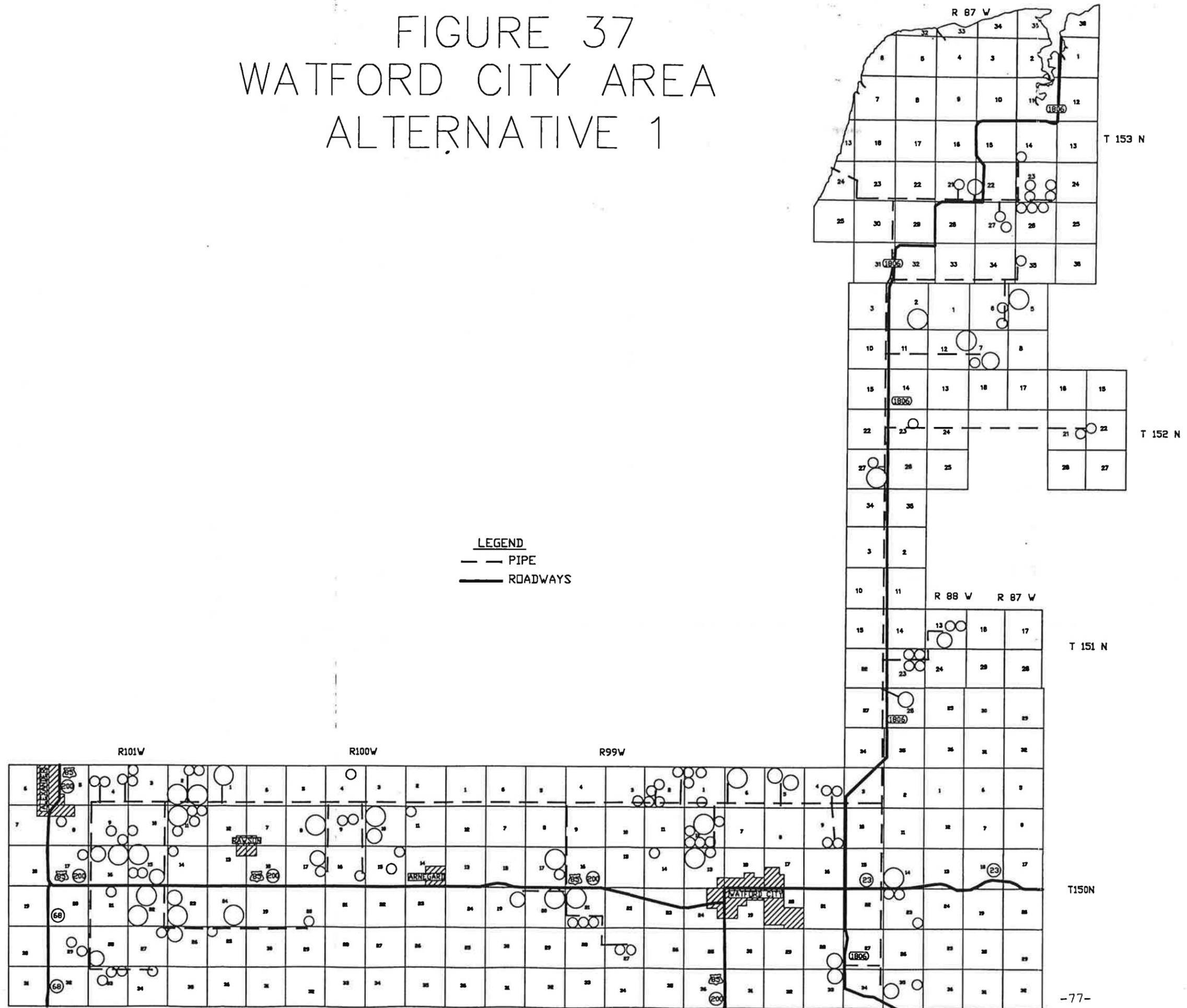


FIGURE 37 WATFORD CITY AREA ALTERNATIVE 1



the pumping plant and pivots were not calculated because the cost of \$4,140 per acre is not economically feasible.

Alternative 2:

Alternative 2 provides water to 7,916 acres. The pipeline distribution system and the pivots served by Alternative 2 are shown in Figure 38. The distribution system contains 433,960 feet of pipe, Appendix B. The intake and pumping plant will be located on the edge of Lake Sakakawea on the Section line between Sections 15 and 16, Township 152 North, Range 100 West. The design flow at the intake is 46,800 gpm, the design pressure head is 960 feet.

The estimated cost of the pipeline plus the unlisted items, contingencies, and engineering for this alternative is \$31,180,000. Distributed over the proposed irrigation area this results in a cost of approximately \$3,940 per acre for the pipeline. The cost of the pumping plant and pivots are not included in this amount. The cost of the pumping plant and pivots were not calculated because the cost of \$3,940 per acre is not economically feasible.

Alternative 3:

Alternative 3 irrigates 7,985 acres. The distribution system for Alternative 3 and the pivots served are shown in Figure 39. The distribution system contains 402,000 feet of pipe, Appendix B. Two canals are used in this alternative. The first

FIGURE 38
 WATFORD CITY AREA
 ALTERNATIVE 2

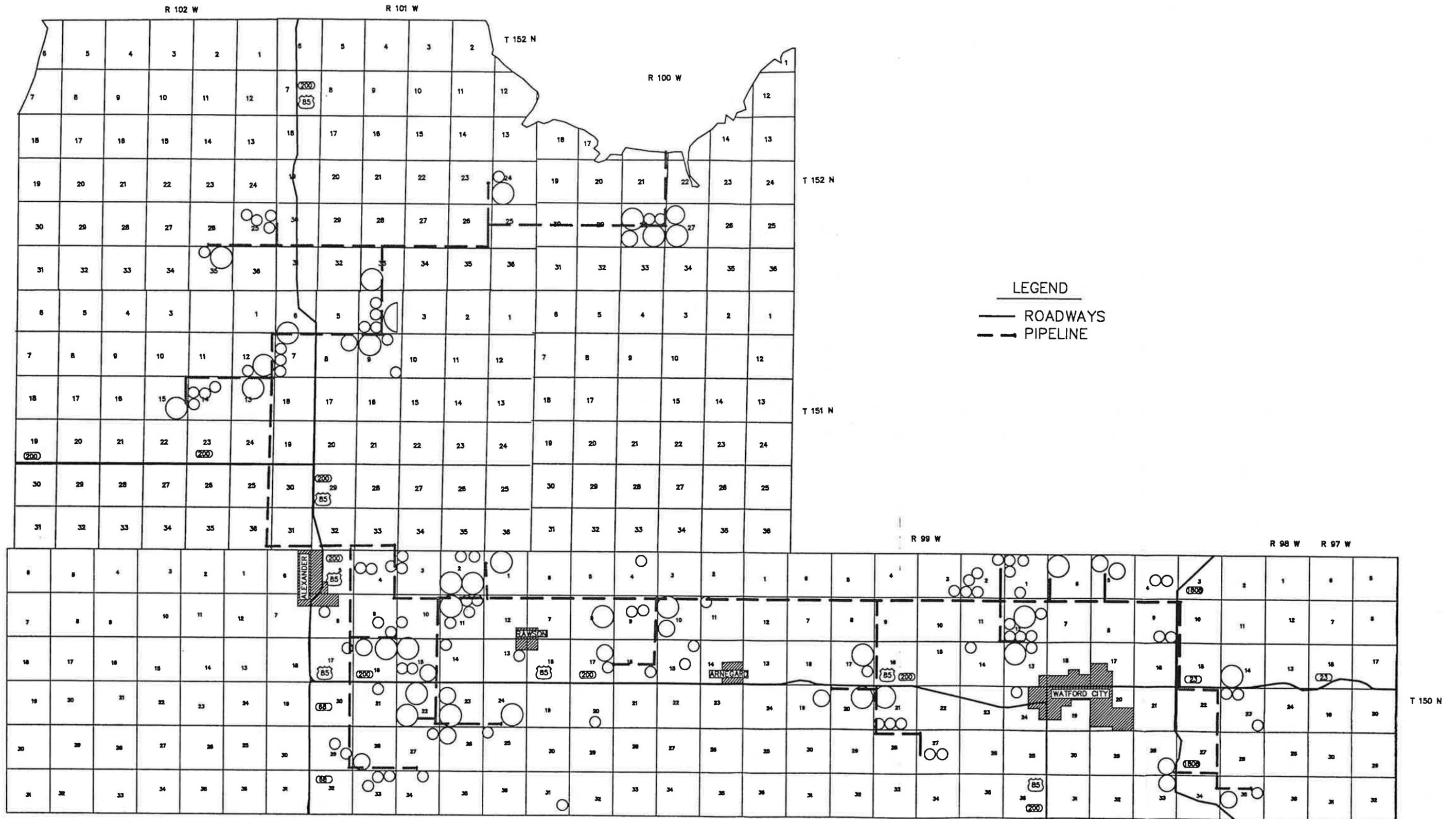
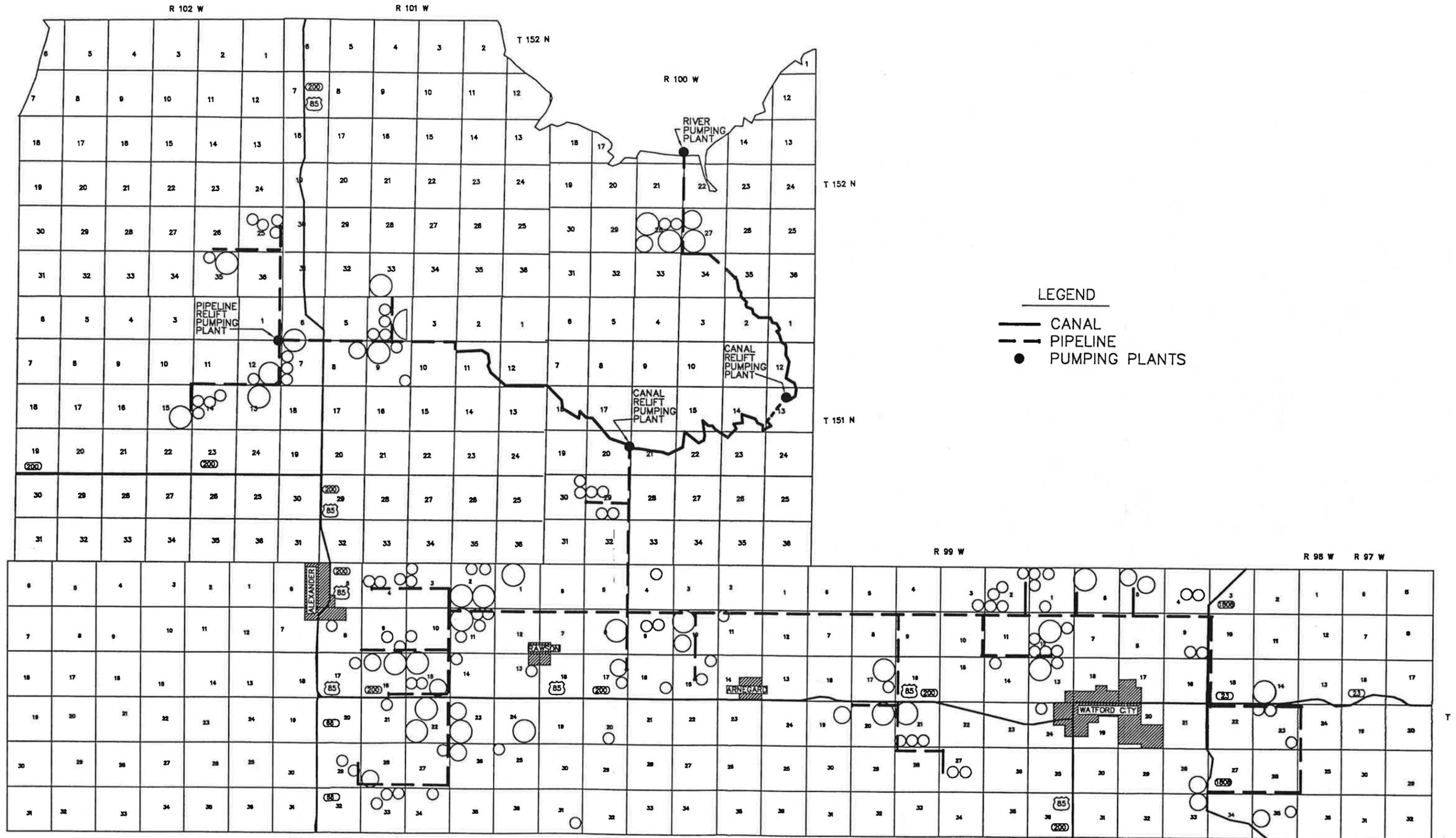


FIGURE 39
 WATFORD CITY AREA
 ALTERNATIVE 3



canal will be approximately 19,800 feet long. The estimated length of the second canal is 52,550 feet. Both canals will have a trapezoidal cross-section with a bottom width of 8 feet and 2:1 side slopes. The estimated volume of excavation for the canals is 246,500 cubic yards. The canals will require 14 drop structures 6 feet high, 1 drop structure 4 feet high, and 1 drop structure 3 feet high. The canals will also require 9 road crossings.

The intake and pumping plant will be located on the edge of Lake Sakakawea on the section line between Sections 15 and 16, Township 152 North, Range 100 West. The design flow at the intake is 46,800 gpm, the design pressure head is approximately 500 feet. A relift pumping plant will be required at the end of the first canal in Section 13, Township 151 North, Range 100 West. The design flow for the canal relift pumps is 43,200 gpm, the design pressure head is 107 feet. A second relift pumping plant will be needed on the section line between Sections 20 and 21, Township 151 North, Range 100 West. These pumps will supply the pivots south of this point. The design flow is 32,600 gpm, the design head is 315 feet. A third relift pumping plant will be needed at the corner of Sections 1, 6, 7, and 12, Township 151 North, Ranges 101 and 102 West. Two sets of pumps will be required at this site. One set will supply 3,800 gpm at 140 feet of head to the pivots south of this point. The other set will supply 1,800 gpm at 360 feet of head to the pivots to the north.

The total estimated cost for Alternative 3 is \$31,120,000, Appendix C. This estimate includes the cost of the pumping plants and pivots. Distributed over the proposed irrigation area this results in a development cost of approximately \$3,900 per acre.

Summary of Alternatives:

Three alternatives to develop irrigation in the Watford City area were investigated. The construction cost, irrigated area, and total dynamic head (TDH) for the alternatives are summarized in Table 18. Due to the estimated cost none of the alternatives are feasible.

**Table 18
Cost of Alternatives**

Alternative	Construction Costs		Irrigated	
	Total	Per Acre	Area	TDH
1	\$29,850,000*	\$4,110*	7,215	970
2	31,180,000*	3,940*	7,916	960
3	31,120,000	3,900	7,985	500

* Estimated cost of pumping plant and pivots not included.

IX. LEGAL REQUIREMENTS

Land Acquisition and Easements:

The pumping plant sites should be acquired in fee simple. However, many of the sites are located on property owned by the Corps of Engineers which they acquired for Lake Sakakawea. An easement from the Corps will be required to locate any facilities on their property.

Perpetual easements will be needed for the pipelines and canals used in the distribution systems. In addition, temporary construction easements will have to be purchased for construction. The majority of the proposed distribution systems are pipelines which would be located adjacent to existing roads, and on section lines and quarter lines. There will be a minimal disturbance of the land, most of which will occur during construction. In many cases the landowners from whom easements are needed will be irrigating from the project. If pipelines are constructed in highway right-of-ways, a permit from the North Dakota Department of Transportation will be needed.

Permits Required:

A water use permit is required for water appropriated from the Missouri River. This permit is issued by the North Dakota State Engineer. Currently, there is an ample supply of unappropriated water in the Missouri River.

The construction of the intakes and pumping plants will require excavation or placement of fill in a wetland. Therefore, a Section 404 permit must be obtained from the Corps of Engineers to meet the requirements of the Clean Water Act. In addition, construction will take place below the ordinary high watermark of the Missouri River, which is sovereign land. Consequently, a sovereign land permit, issued by the North Dakota State Engineer, will be required. A construction permit from the State Engineer will also be needed.

Irrigation Districts:

In areas where there is interest in proceeding with a project an irrigation district could be formed. The district could serve as the local sponsor for the project. To establish an irrigation district a petition describing the proposed district must be signed by landowners who own a majority of land within the proposed district and filed with the State Engineer. A feasibility report on the proposed plan of irrigation must be included with the petition. The feasibility report must include preliminary designs of all the proposed conveyance systems and other works, in sufficient detail to show the proposed method of construction. The feasibility report must also include an analysis of the soil and water compatibility of the irrigable land. This reconnaissance report will meet these requirements. The memorandum in Appendix E outlines in more detail the requirements for establishing an irrigation district.

X. FURTHER STUDY REQUIRED

Any project that is to be constructed will require further study. The next step in the process will be a feasibility study. This study should include:

- A soil survey of the land being proposed for irrigation, with emphasis on the conditional soils. The information from the soils survey would be critical in making the final determination of the land to be irrigated.
- Discussion with the landowners to establish the fields to be irrigated and the type of system to be used on each field.
- Preliminary detailed designs of the necessary pumping plants, reservoirs, conveyance systems and all other facilities of the project.
- Cost estimates and economic analysis of the project, including a composite economic model.
- Discussion of the environmental, economic, and social impacts of the project.
- Identification and location of existing pipelines, utilities, wildlife areas, archeological sites, and federally and state owned land. The impacts on these areas and procedures needed to accommodate them will be discussed.

XI. SUMMARY

The possibility of developing irrigation in four separate areas in McKenzie County was investigated. Table 19 summarizes the areas, the cost of construction, and the pumping cost for the selected alternative in each of these areas.

Table 19
Summary of Proposed Irrigation Areas

Area	Irrigated Area	Construction Costs		Pumping Costs	
		Total	Per Acre	Total	Per Acre
Charlson	2,446	\$6,420,000	\$2,600	\$150,000	\$61
Tobacco Garden	1,052	3,730,000	3,540	67,100	64
Charbonneau/ Timber Creek					
Alt. 5	617	1,240,000	2,000	45,600	74
Alt. 8	2,480	7,900,000	3,180	224,400	90
Watford City	7,985	31,120,000	3,900		

Unfortunately, the irrigable land in McKenzie County is not arranged to allow a project to serve the land at a reasonable cost. The irrigable land is distant from the river and is in small scattered parcels rather than a large contiguous area. A distribution system to serve these small parcels is very expensive. Also, the elevation of the land in the study area is relatively high. Lifting water from either the Yellowstone or the Missouri River is expensive, estimated pumping costs exceed \$60 per acre for all the alternatives considered. Because of the high costs it appears infeasible to develop a large scale irrigation project to serve several landowners in McKenzie County. This does not mean that it would not be possible for individuals to develop irrigation in the county.

XII. RECOMMENDATIONS

Based on the estimated cost of developing irrigation, \$2,000 per acre is the lowest estimate, and the estimated pumping costs which exceed \$60 per acre per year, it does not appear that development of any of the projects investigated in this study are feasible. Therefore, it is recommended that no further study of the areas investigated in this report be done.

APPENDIX A

Agreement

A G R E E M E N T

Reconnaissance Investigation
of Irrigation in
McKenzie County

I. PARTIES

THIS AGREEMENT is between the North Dakota State Water Commission, hereinafter Commission, through its Secretary, David A. Sprynczynatyk; and the McKenzie County Water Resource District, hereinafter District, through its Chairman, John Anderson.

II. PROJECT, LOCATION, AND PURPOSE

The District has requested the Commission to investigate the feasibility of developing irrigation within the county. Emphasis will be placed on areas in proximity to the Missouri and Yellowstone Rivers.

III. PRELIMINARY INVESTIGATION

The parties agree that further information is necessary concerning the feasibility of irrigation in McKenzie County. Therefore, the Commission agrees to:

1. Identify areas with irrigable soils using Soil Conservation Service soils maps.
2. Develop proposals for delivery of water to areas with irrigation potential.
3. Prepare preliminary cost estimates for the proposals.

4. Identify survey requirements for the possible irrigation areas.
5. Develop cost estimates for surveys and other field work necessary for preliminary design to be used as basis for cost-share for preliminary design.
6. Prepare a reconnaissance report containing the results of the investigation.

IV. PAYMENT AND TERM

The District agrees to pay the Commission a total of \$500.00 to partially defray the cost of the investigation. The payment must be made by the District prior to December 1, 1991. The parties agree that the project is to be completed by June 30, 1993.

V. RIGHTS-OF-ENTRY

The District agrees to obtain written permission from any affected landowners for field investigations by the Commission which are required for the reconnaissance investigation.

VI. INDEMNIFICATION

The District agrees to indemnify and hold harmless the State of North Dakota, the Commission, its Secretary, their employees and agents, from all claims, suits or actions of whatsoever nature resulting out of the design, construction, operation, or maintenance of the project. In the event a suit is initiated or judgement is entered against the State of North Dakota, the Commission, its Secretary, their employees or their agents, the District shall indemnify any or all of them for all costs and

expenses, including legal fees, and any judgment arrived at or satisfied or settlement entered.

VII. MERGER CLAUSE

This agreement constitutes the entire agreement between the parties. No waiver, consent, modification or change of terms of this agreement shall bind either party unless in writing, signed by the parties, and attached hereto. Such waiver, consent, modification or change, if made, shall be effective only in the specific instance and for the specific purpose given. There are no understandings, agreements, or representations, oral or written, not specified herein regarding this agreement.

NORTH DAKOTA STATE WATER COMMISSION

BY:

David A. Sprynczynatyk
DAVID A. SPRYNCZYNATYK
Secretary

MCKENZIE COUNTY WATER RESOURCE DISTRICT

By:

Arnold Ceynar
Arnold Ceynar
Vice Chairman

WITNESS:

Dele L. Frink

WITNESS:

Christ Edinger

DATE:

11/6/91

DATE:

11-26-91

APPENDIX B

Distribution System Pipe Requirements

**Table B-1 - Charlson Area
Alternative 1**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	6,600	\$ 4.00	\$ 26,400
10	12,320	8.50	104,720
12	2,540	12.00	30,480
14	3,960	18.00	71,280
16	5,600	22.00	123,200
18	7,740	28.50	220,590
20	5,460	35.00	191,100
36	<u>34,810</u>	60.00	<u>2,088,600</u>
Total	79,030		\$2,856,370

**Table B-2 - Charlson Area
Alternative 2**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	3,300	\$ 4.00	\$ 13,200
10	4,960	8.50	42,160
12	5,280	12.00	63,360
14	9,560	18.00	172,080
16	3,960	22.00	87,120
18	14,520	28.50	413,820
20	5,280	35.00	184,800
27	5,940	44.00	261,360
36	<u>28,870</u>	60.00	<u>1,732,200</u>
Total	81,670		2,970,100

**Table B-3 - Charlson Area
Alternative 3**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	3,300	\$ 4.00	\$ 13,200
10	2,640	8.50	22,440
12	5,280	12.00	63,360
16	2,580	22.00	56,760
20	5,340	35.00	186,900
27	9,240	44.00	406,560
36	<u>45,370</u>	60.00	<u>2,722,200</u>
Total	73,750		3,471,420

**Table B-4 - Charlson Area
Alternative 4**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	3,300	\$ 4.00	\$ 13,200
10	2,640	8.50	22,440
16	1,320	22.00	29,040
18	1,060	28.50	30,210
20	6,860	35.00	240,100
24	4,060	40.00	162,400
27	9,140	44.00	402,160
36	<u>45,370</u>	60.00	<u>2,722,200</u>
Total	73,750		3,621,750

**Table B-5 - Charlson Area
Alternative 5**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	3,960	\$ 4.00	\$ 15,840
8	6,600	5.50	36,300
10	5,280	8.50	44,880
14	7,260	18.00	130,680
16	5,940	22.00	130,680
18	6,600	28.50	188,100
20	8,480	35.00	296,800
24	5,380	40.00	215,200
27	1,320	44.00	58,080
36	<u>18,310</u>	60.00	<u>1,098,600</u>
Total	69,130		2,215,160

**Table B-6 - Tobacco Gardens Area
Alternative 1**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	20,790	\$ 4.00	\$ 83,160
8	28,380	5.50	156,090
10	14,180	8.50	120,530
12	21,540	12.00	258,480
14	3,300	18.00	59,400
16	23,232	22.00	511,104
18	8,448	28.50	240,768
20	10,560	35.00	369,600
24	9,620	40.00	384,800
27	10,560	44.00	464,640
36	<u>16,500</u>	60.00	<u>990,000</u>
Total	167,110		3,638,572

**Table B-7 - Tobacco Gardens Area
Alternative 2**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	23,900	\$ 4.00	\$ 95,600
8	19,140	5.50	105,270
10	32,300	8.50	274,550
12	12,540	12.00	150,480
16	23,760	22.00	522,720
18	5,280	28.50	150,480
20	8,580	35.00	300,300
24	14,980	40.00	599,200
27	8,580	44.00	377,520
36	<u>20,460</u>	60.00	<u>1,227,600</u>
Total	169,520		3,803,720

**Table B-8 - Tobacco Gardens Area
Alternative 3**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	15,840	\$ 4.00	\$ 63,360
8	19,800	5.50	108,900
10	24,900	8.50	211,650
12	12,540	12.00	150,480
16	23,760	22.00	522,720
18	13,200	28.50	376,200
20	5,280	35.00	184,800
24	15,880	40.00	635,200
27	13,860	44.00	609,840
36	<u>20,460</u>	60.00	<u>1,227,600</u>
Total	165,520		4,090,750

**Table B-9 - Tobacco Gardens Area
Alternative 4**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	9,240	\$ 4.00	\$ 36,960
8	9,900	5.50	54,450
10	29,700	8.50	252,450
12	9,900	12.00	118,800
16	21,120	22.00	464,640
18	15,840	28.50	451,440
20	7,920	35.00	277,200
24	15,880	40.00	635,200
27	9,240	44.00	406,560
36	<u>29,405</u>	60.00	<u>1,764,300</u>
Total	158,145		4,462,000

**Table B-10 - Tobacco Gardens Area
Alternative 5**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	17,490	\$ 4.00	\$ 69,960
8	1,320	5.50	7,260
10	5,600	8.50	47,600
12	11,640	12.00	139,680
14	12,540	18.00	225,720
16	7,772	22.00	170,984
18	3,168	28.50	90,288
20	10,560	35.00	369,600
24	<u>16,500</u>	40.00	<u>660,000</u>
Total	86,590		1,781,092

**Table B-11 - Tobacco Gardens Area
Alternative 6**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	8,580	\$ 4.00	\$ 34,320
8	1,320	5.50	7,260
10	12,410	8.50	105,485
12	1,320	12.00	15,840
16	3,960	22.00	87,120
18	9,940	28.50	283,290
20	7,260	35.00	254,100
24	<u>27,060</u>	40.00	<u>1,082,400</u>
Total	71,850		1,869,815

**Table B-12 - Tobacco Gardens Area
Alternative 7**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	3,960	\$ 4.00	\$ 15,840
10	16,500	8.50	140,250
12	5,280	12.00	63,360
16	3,960	22.00	87,120
18	9,940	28.50	283,290
20	7,260	35.00	254,100
24	<u>31,385</u>	40.00	<u>1,255,400</u>
Total	78,285		2,099,360

**Table B-13 - Charbonneau/Timber Creeks Area
Alternative 1**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	2,640	\$ 4.00	\$ 10,560
8	8,040	5.50	44,220
10	42,900	8.50	364,650
12	1,320	12.00	15,840
14	10,560	18.00	190,080
18	2,640	28.50	75,240
20	9,240	35.00	323,400
24	32,520	40.00	1,300,800
27	3,120	44.00	137,280
36	55,440	60.00	3,326,400
42	<u>50,760</u>	68.00	<u>3,451,680</u>
Total	219,180		9,240,150

**Table B-14 - Charbonneau/Timber Creeks Area
Alternative 2**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	1,320	\$ 4.00	\$ 5,280
8	8,040	5.50	44,220
10	14,520	8.50	123,420
12	1,320	12.00	15,840
14	10,560	18.00	190,080
18	2,640	28.50	75,240
20	38,280	35.00	1,339,800
24	6,600	40.00	264,000
27	10,560	44.00	464,640
36	64,680	60.00	3,880,800
42	<u>30,960</u>	68.00	<u>2,105,280</u>
Total	189,480		8,508,600

**Table B-15 - Charbonneau/Timber Creeks Area
Alternative 3**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	1,320	\$ 4.00	\$ 5,280
8	8,040	5.50	44,220
10	10,080	8.50	85,680
14	13,680	18.00	246,240
18	2,640	28.50	75,400
20	7,920	35.00	277,200
24	7,920	40.00	316,800
27	15,840	44.00	696,960
36	<u>71,880</u>	60.00	<u>4,312,800</u>
Total	139,320		6,060,580

**Table B-16 - Charbonneau/Timber Creeks Area
Alternative 4**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
8	5,140	\$ 5.50	\$ 28,270
10	18,480	8.50	157,080
14	14,520	18.00	261,360
16	9,240	22.00	203,280
18	<u>7,200</u>	28.50	<u>205,200</u>
Total	54,580		855,190

**Table B-17 - Charbonneau/Timber Creeks Area
Alternative 5**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
12	2,640	\$ 12.00	\$ 31,680
18	2,640	28.50	75,240
20	<u>8,000</u>	35.00	<u>280,000</u>
Total	13,280		386,920

**Table B-18 - Charbonneau/Timber Creeks Area
Alternative 6**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	1,320	\$ 4.00	\$ 5,280
10	22,700	8.50	192,950
12	5,280	12.00	63,360
14	13,200	18.00	237,600
16	3,960	22.00	87,120
18	5,280	28.50	150,480
20	7,920	35.00	277,200
24	6,760	40.00	270,400
27	7,760	44.00	341,440
36	<u>46,280</u>	60.00	<u>2,776,800</u>
Total	120,460		4,402,630

**Table B-19 - Charbonneau/Timber Creeks Area
Alternative 8**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	2,640	\$ 4.00	\$ 10,560
10	30,370	8.50	258,145
12	5,280	12.00	63,360
14	10,560	18.00	190,080
16	3,960	22.00	87,120
18	3,960	28.50	112,860
24	11,880	40.00	475,200
27	3,180	44.00	139,920
36	<u>30,230</u>	60.00	<u>1,813,800</u>
Total	102,060		3,151,045

**Table B-20 - Watford City Area
Alternative 1**

Pipe Diameter (inches)	Length (feet)	Cost (per foot)	Cost
6	64,920	\$ 4.00	\$ 259,680
8	36,300	5.50	199,650
10	50,720	8.50	431,120
12	44,640	12.00	535,680
14	28,380	18.00	510,840
16	11,352	22.00	249,744
18	23,908	28.50	681,378
20	18,860	35.00	660,100
24	25,080	40.00	1,003,200
36	21,120	60.00	1,267,200
42	31,680	68.00	2,154,240
48	29,040	75.00	2,178,000
54	58,080	88.00	5,111,040
60	<u>47,240</u>	100.00	<u>4,724,000</u>
Total	491,320		19,965,872

**Table B-21 - Watford City Area
Alternative 2**

Pipe Diameter (inches)	Length (feet)	Cost (per foot)	Cost
6	20,460	\$ 4.00	\$ 81,840
8	5,280	5.50	29,040
10	62,300	8.50	529,550
12	28,380	12.00	340,560
14	38,940	18.00	700,920
16	7,920	22.00	174,240
18	13,200	28.50	376,200
20	33,000	35.00	1,155,000
24	33,000	40.00	1,320,000
36	42,240	60.00	2,534,400
42	25,080	68.00	1,705,440
48	17,160	75.00	1,287,000
54	33,000	88.00	2,904,000
60	63,360	100.00	6,336,000
72	<u>10,640</u>	130.00	<u>1,383,200</u>
Total	433,960		20,857,390

**Table B-22 - Watford City Area
Alternative 3**

<u>Pipe Diameter</u> (inches)	<u>Length</u> (feet)	<u>Cost</u> (per foot)	<u>Cost</u>
6	29,700	\$ 4.00	\$ 118,800
8	2,640	5.50	14,520
10	75,500	8.50	641,750
12	19,800	12.00	237,600
14	44,220	18.00	795,960
16	15,180	22.00	333,960
18	21,120	28.50	601,920
20	33,000	35.00	1,155,000
24	25,080	40.00	1,003,200
27	17,700	44.00	778,800
36	69,340	60.00	4,160,400
42	6,600	68.00	448,800
54	19,190	88.00	1,688,720
60	12,290	100.00	1,229,000
72	<u>10,640</u>	130.00	<u>1,383,200</u>
Total	402,000		14,591,630

APPENDIX C

Cost Estimates

**Table C-1 - Charlson Area
Alternative 1**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumps		LS	\$	\$ 871,950
Distribution System		LS		<u>2,856,370</u>
Subtotal				\$ 3,728,320
15% Unlisted				<u>559,280</u>
Subtotal				\$ 4,287,600
30% Contingencies and Engineering				\$ 1,286,200
160 Acre Pivots	18	Ea.	35,000	\$ 630,000
40 Acre Pivots	10	Ea.	22,000	<u>\$ 220,000</u>
Total				\$ 6,423,800

**Table C-2 - Charlson Area
Alternative 5**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
River Pumping Plant		LS	\$	\$ 871,950
Pipelines:				
Intake to Distribution System		FT		1,019,400
Main Distribution		FT		441,540
Distribution After Canal		FT		912,620
Canal Pumping Plant		LS		<u>198,000</u>
Subtotal				\$ 3,443,510
15% Unlisted				516,530
Canal				<u>95,000</u>
Subtotal				\$ 4,055,540
30% Contingencies and Engineering				\$ 1,216,660
160 Acre Pivots	18	Ea.	35,000	\$ 630,000
40 Acre Pivots	10	Ea.	22,000	<u>\$ 220,000</u>
Total				\$ 6,122,200

**Table C-3 - Tobacco Garden Area
Alternative 1**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant		LS	\$	\$ 447,000
Distribution System		LS		<u>3,638,572</u>
Subtotal				\$ 4,085,572
15% Unlisted				<u>612,828</u>
Subtotal				\$ 4,698,400
30% Contingencies and Engineering				\$ 1,409,500
160 Acre Pivots	8	Ea.	35,000	\$ 280,000
40 Acre Pivots	25	Ea.	22,000	<u>550,000</u>
Total				\$ 6,937,900

**Table C-4 - Tobacco Garden Area
Alternative 2**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant			\$	\$ 442,000
Distribution System		LS		<u>3,803,720</u>
Subtotal				\$ 4,245,720
15% Unlisted				<u>636,860</u>
Subtotal				\$ 4,882,580
30% Contingencies and Engineering				\$ 1,464,720
160 Acre Pivots	8	Ea.	35,000	\$ 280,000
40 Acre Pivots	25	Ea.	22,000	<u>550,000</u>
Total				\$ 7,177,300

**Table C-5 - Tobacco Garden Area
Alternative 3**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant		LS	\$	\$ 447,500
Distribution System		LS		<u>4,090,750</u>
Subtotal				\$ 4,538,250
15% Unlisted				<u>680,750</u>
Subtotal				\$ 5,219,000
30% Contingencies and Engineering				\$ 1,565,700
160 Acre Pivots	8	Ea.	35,000	\$ 280,000
40 Acre Pivots	25	Ea.	22,000	<u>550,000</u>
Total				\$ 7,614,700

**Table C-6 - Tobacco Garden Area
Alternative 4**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant		LS	\$	\$ 447,000
Distribution System		LS		<u>4,462,000</u>
Subtotal				\$ 4,909,000
15% Unlisted				<u>736,400</u>
Subtotal				\$ 5,645,400
30% Contingencies and Engineering				\$ 1,693,600
160 Acre Pivots	8	Ea.	35,000	\$ 280,000
40 Acre Pivots	25	Ea.	25,000	<u>550,000</u>
Total				\$ 8,169,000

**Table C-7 - Tobacco Garden Area
Alternative 5**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumping Plant		LS	\$	\$ 374,916
Distribution System		LS		<u>1,781,092</u>
Subtotal				\$ 2,156,008
15% Unlisted				<u>323,392</u>
Subtotal				\$ 2,479,400
30% Contingencies and Engineering				\$ 743,800
160 Acre Pivots	5	Ea.	35,000	\$ 175,000
40 Acre Pivots	15	Ea.	22,000	<u>330,000</u>
Total				\$ 3,728,200

**Table C-8 - Tobacco Garden Area
Alternative 6**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumping Plant		LS	\$	\$ 374,916
Distribution System		LS		<u>1,869,815</u>
Subtotal				\$ 2,244,731
15% Unlisted				<u>336,709</u>
Subtotal				\$ 2,581,440
30% Contingencies and Engineering				\$ 774,460
160 Ac. Pivots	5	Ea.	35,000	\$ 175,000
40 Ac. Pivots	15	Ea.	22,000	<u>330,000</u>
Total				\$ 3,860,900

**Table C-9 - Tobacco Garden Area
Alternative 7**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumping Plant			\$	\$ 374,916
Distribution System		LS		<u>2,099,360</u>
Subtotal				\$ 2,474,276
15% Unlisted				<u>371,124</u>
Subtotal				\$ 2,845,400
30% Contingencies and Engineering				<u>\$ 853,600</u>
160 Ac. Pivots	5	Ea.	35,000	\$ 175,000
40 Ac. Pivots	15	Ea.	22,000	<u>330,000</u>
Total				<u>\$ 4,204,000</u>

**Table C-10 - Carbonneau/Timber Creek Area
Alternative 4**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant		LS		\$ 271,120
Distribution System		LS		<u>855,190</u>
Subtotal				\$ 1,126,310
15% Unlisted				<u>168,920</u>
Subtotal				\$ 1,295,230
30% Contingencies and Engineering				\$ <u>388,570</u>
160 Ac. Pivots	2	Ea.	35,000	\$ 70,000
40 Ac. Pivots	9	Ea.	22,000	<u>198,000</u>
Total				\$ 1,951,800

**Table C-11 - Charbonneau/Timber Creek Area
Alternative 5**

Project	Quantity	Unit	Unit Price	Total
Pumping Plant		LS	\$	\$ 293,784
Distribution System		LS		<u>386,920</u>
Subtotal				\$ 680,704
15% Unlisted				<u>102,106</u>
Subtotal				\$ 782,810
30% Contingencies and Engineering				\$ 234,890
160 Ac. Pivots	5	Ea.	35,000	\$ 175,000
40 Ac. Pivots	2	Ea.	22,000	<u>44,000</u>
Total				\$ 1,236,700

**Table C-12 - Charbonneau/Timber Creek Area
Alternative 6**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumping Plant		LS	\$	\$ 706,000
Distribution System		LS		<u>4,402,630</u>
Subtotal				\$ 5,108,630
15% Unlisted				<u>766,295</u>
Subtotal				\$ 5,874,925
30% Contingencies and Engineering				\$ 1,762,475
160 Ac. Pivots	15	Ea.	35,000	\$ 525,000
40 Ac. Pivots	22	Ea.	22,000	<u>484,000</u>
Total				\$ 8,646,400

**Table C-13 - Charbonneau/Timber Creek Area
Alternative 8**

<u>Project</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Pumping Plants:				
River Pumping Plant		LS	\$	\$ 716,000
Canal Relift				222,000
Pipeline Booster Pumps				183,500
Canal				285,302
Distribution System		LS		<u>3,151,045</u>
Subtotal				\$ 4,557,845
15% Unlisted				<u>683,675</u>
Subtotal				\$ 5,241,524
30% Contingencies and Engineering				\$ 1,572,480
160 Ac. Pivots	14	Ea.	35,000	\$ 490,000
40 Ac. Pivots	27	Ea.	22,000	<u>594,000</u>
Total				\$ 7,898,000

**Table C-14 - Watford City Area
Alternative 1**

Project	Quantity	Unit	Unit Price	Total
Distribution System		LS		\$ 8,372,782
Distribution System		LS		<u>11,593,090</u>
Subtotal				\$19,965,872
15% Unlisted				<u>2,994,888</u>
Subtotal				\$22,960,760
30% Contingencies and Engineering				<u>\$ 6,888,240</u>
Total				\$29,849,000

**Table C-15 - Watford City Area
Alternative 2**

Project	Quantity	Unit	Unit Price	Total
Distribution System		LS		8,366,230
Distribution System		LS		<u>12,491,160</u>
Subtotal				\$20,857,390
15% Unlisted				<u>3,128,610</u>
Subtotal				\$23,986,000
30% Contingencies and Engineering				<u>\$ 7,195,800</u>
Total				\$31,181,800

APPENDIX D

Irrigated Crop Budgets

**Table D-1 - Charlson Area
Alternative 1**

No Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.63 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	54.11	54.11	67.66	67.66	38.40
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$213.14	\$205.15	\$178.80	\$148.75	\$154.31
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	308.55	308.55	308.55	308.55	308.55
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$351.99	\$345.30	\$345.75	\$333.52	\$350.00
Sum of All Listed Costs	\$565.13	\$550.45	\$524.55	\$482.27	\$504.31
Return to Unpaid Labor and Management					
Non-participation	-\$325.13	-\$250.45	-\$359.55	-\$152.27	-\$108.31
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-274.65	-199.97			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-264.87	-190.19			

Table D-2 - Charlson Area
Alternative 1

No Cost Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.63 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	54.11	54.11	67.66	67.66	38.40
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$213.14	\$205.15	\$178.80	\$148.75	\$154.31
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	219.80	219.80	219.80	219.80	219.80
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$263.24	\$256.55	\$257.00	\$244.77	\$261.25
Sum of All Listed Costs	\$476.38	\$461.70	\$435.80	\$393.52	\$415.56
Return to Unpaid Labor and Management					
Non-participation	-\$236.38	-\$161.70	-\$270.80	-\$ 63.52	-\$ 19.56
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-185.90	-111.22			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-176.12	-101.44			

Table D-3 - Charlson Area
Alternative 1

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.63 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	54.11	54.11	67.66	67.66	38.40
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$213.14	\$205.15	\$178.80	\$148.75	\$154.31
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	193.27	193.27	193.27	193.27	193.27
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$236.71	\$230.02	\$230.47	\$218.24	\$234.72
Sum of All Listed Costs	\$449.85	\$435.17	\$409.27	\$366.99	\$389.03
Return to Unpaid Labor and Management					
Non-participation	-\$209.85	-\$135.17	-\$244.27	-\$ 36.99	\$ 6.97
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-159.37	-84.69			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-149.59	-74.91			

Table D-4 - Charlson Area
Alternative 1

40 Percent Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.63 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	54.11	54.11	67.66	67.66	38.40
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$213.14	\$205.15	\$178.80	\$148.75	\$154.31
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	201.51	201.51	201.51	201.51	201.51
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$244.95	\$238.26	\$238.71	\$226.48	\$242.96
Sum of All Listed Costs	\$458.09	\$443.41	\$417.51	\$375.23	\$397.27
Return to Unpaid Labor and Management					
Non-participation	-\$218.09	-\$143.41	-\$252.51	-\$ 45.23	-\$ 1.27
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-167.61	-92.93			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-157.83	-83.15			

**Table D-5 - Charlson Area
Alternative 1**

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.63 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	54.11	54.11	67.66	67.66	38.40
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$213.14	\$205.15	\$178.80	\$148.75	\$154.31
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	143.55	143.55	143.55	143.55	143.55
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$186.99	\$180.30	\$180.75	\$168.52	\$185.00
Sum of All Listed Costs	\$400.13	\$385.45	\$359.55	\$317.27	\$339.31
Return to Unpaid Labor and Management					
Non-participation	-\$160.13	-\$ 85.45	-\$194.55	\$ 12.73	\$ 56.69
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-109.65	-34.97			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-99.87	-25.19			

Table D-6 - Charlson Area
Alternative 5

No Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.02 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	62.14	62.14	77.69	77.69	44.09
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$221.17	\$213.18	\$188.83	\$158.78	\$160.00
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	293.75	293.75	293.75	293.75	293.75
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$337.19	\$330.50	\$330.95	\$318.72	\$335.20
Sum of All Listed Costs	\$558.36	\$543.68	\$519.78	\$477.50	\$495.20
Return to Unpaid Labor and Management					
Non-participation	-\$318.36	-\$243.68	-\$354.78	-\$147.50	-\$99.20
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-267.88	-193.20			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-258.10	-183.42			

Table D-7 - Charlson Area
Alternative 5

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.02 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	62.14	62.14	77.69	77.69	44.09
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$221.17	\$213.18	\$188.83	\$158.78	\$160.00
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	209.25	209.25	209.25	209.25	209.25
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$252.69	\$246.00	\$246.45	\$234.22	\$250.70
Sum of All Listed Costs	\$473.86	\$459.18	\$435.28	\$393.00	\$410.70
Return to Unpaid Labor and Management					
Non-participation	-\$233.86	-\$159.18	-\$270.28	-\$ 63.00	-\$ 14.70
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-183.38	-108.70			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-173.60	-98.92			

Table D-8 - Charlson Area
Alternative 5

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.02 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	62.14	62.14	77.69	77.69	44.09
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$221.17	\$213.18	\$188.83	\$158.78	\$160.00
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	184.00	184.00	184.00	184.00	184.00
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$227.44	\$220.75	\$221.20	\$208.97	\$225.45
Sum of All Listed Costs	\$448.61	\$433.93	\$410.03	\$367.75	\$385.45
Return to Unpaid Labor and Management					
Non-participation	-\$208.61	-\$133.93	-\$245.03	-\$ 37.75	\$ 10.53
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-158.13	-83.45			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-148.35	-73.67			

**Table D-9 - Charlson Area
Alternative 5**

40 Percent Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.02 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	62.14	62.14	77.69	77.69	44.09
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$221.17	\$213.18	\$188.83	\$158.78	\$160.00
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	192.82	192.82	192.82	192.82	192.82
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$236.26	\$229.57	\$230.02	\$217.79	\$234.27
Sum of All Listed Costs	\$457.43	\$442.75	\$418.85	\$376.57	\$394.27
Return to Unpaid Labor and Management					
Non-participation	-\$217.43	-\$142.75	-\$253.83	-\$ 46.57	\$ 1.73
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-166.95	-92.27			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-157.17	-82.49			

Table D-10 - Charlson Area
Alternative 5

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.02 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	62.14	62.14	77.69	77.69	44.09
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$221.17	\$213.18	\$188.83	\$158.78	\$160.00
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	137.35	137.35	137.35	137.35	137.35
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$180.79	\$174.10	\$174.55	\$162.32	\$178.80
Sum of All Listed Costs	\$401.96	\$387.28	\$363.38	\$321.10	\$338.80
Return to Unpaid Labor and Management					
Non-participation	-\$161.96	-\$ 87.28	-\$198.38	\$ 8.90	\$ 57.20
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-111.48	-36.80			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-101.70	-27.02			

**Table D-11 - Tobacco Garden
Alternative 5**

No Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.75 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.58	56.58	70.74	70.74	40.15
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.61	\$207.62	\$181.88	\$151.83	\$156.06
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	416.42	416.42	416.42	416.42	416.42
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$459.86	\$453.17	\$453.62	\$441.39	\$457.87
Sum of All Listed Costs	\$675.47	\$660.79	\$635.50	\$593.22	\$613.93
Return to Unpaid Labor and Management					
Non-participation	-\$435.47	-\$360.79	-\$470.50	-\$263.22	-\$217.93
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-384.99	-310.31			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-375.21	-300.53			

Table D-12 - Tobacco Garden
Alternative 5

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.75 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.58	56.58	70.74	70.74	40.15
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.61	\$207.62	\$181.88	\$151.83	\$156.06
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	296.63	296.63	296.63	296.63	296.63
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$340.07	\$333.38	\$333.83	\$321.60	\$338.08
Sum of All Listed Costs	\$555.68	\$541.00	\$515.71	\$473.43	\$494.14
Return to Unpaid Labor and Management					
Non-participation	-\$315.68	-\$241.00	-\$350.71	-\$143.43	-\$ 98.14
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-265.20	-190.52			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-255.42	-180.74			

Table D-13 - Tobacco Garden
Alternative 5

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.75 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.58	56.58	70.74	70.74	40.15
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.61	\$207.62	\$181.88	\$151.83	\$156.06
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	260.84	260.84	260.84	260.84	260.84
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$304.28	\$297.59	\$298.04	\$285.81	\$302.29
Sum of All Listed Costs	\$519.89	\$505.21	\$479.92	\$437.64	\$458.35
Return to Unpaid Labor and Management					
Non-participation	-\$279.89	-\$205.21	-\$314.92	-\$107.64	-\$ 62.35
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-229.41	-154.73			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-219.63	-144.95			

Table D-14 - Tobacco Garden
Alternative 5

40 Percent Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.75 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.58	56.58	70.74	70.74	40.15
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.61	\$207.62	\$181.88	\$151.83	\$156.06
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	272.37	272.37	272.37	272.37	272.37
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$315.81	\$309.12	\$309.57	\$297.34	\$313.82
Sum of All Listed Costs	\$531.42	\$516.74	\$491.45	\$449.17	\$469.88
Return to Unpaid Labor and Management					
Non-participation	-\$291.42	-\$216.74	-\$326.45	-\$119.17	-\$ 73.88
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-240.94	-166.26			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-231.16	-156.48			

Table D-15 - Tobacco Garden
Alternative 5

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.75 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.58	56.58	70.74	70.74	40.15
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.61	\$207.62	\$181.88	\$151.83	\$156.06
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	194.02	194.02	194.02	194.02	199.02
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$237.46	\$230.77	\$231.22	\$218.99	\$235.47
Sum of All Listed Costs	\$453.07	\$438.39	\$413.10	\$370.82	\$391.53
Return to Unpaid Labor and Management					
Non-participation	-\$213.07	-\$138.39	-\$248.10	-\$ 40.82	\$ 4.47
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-162.59	-87.91			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-152.81	-78.13			

Table D-16 - Charbonneau/Timber Creek Area
Alternative 4

No Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.25 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	66.87	66.87	83.61	83.61	47.45
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$225.90	\$217.91	\$194.75	\$164.70	\$163.36
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	418.50	418.50	418.50	418.50	418.50
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$461.94	\$455.25	\$455.70	\$443.47	\$459.95
Sum of All Listed Costs	\$687.84	\$673.16	\$650.45	\$608.17	\$623.31
Return to Unpaid Labor and Management					
Non-participation	-\$447.84	-\$373.16	-\$485.45	-\$278.17	-\$227.31
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-397.36	-322.68			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-387.58	-312.90			

**Table D-17 - Charbonneau/Timber Creek Area
Alternative 4**

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.25 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	66.87	66.87	83.61	83.61	47.45
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$225.90	\$217.91	\$194.75	\$164.70	\$163.36
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	298.12	298.12	298.12	298.12	298.12
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$341.56	\$334.87	\$335.32	\$323.09	\$339.57
Sum of All Listed Costs	\$567.46	\$552.78	\$530.07	\$487.79	\$502.93
Return to Unpaid Labor and Management					
Non-participation	-\$327.46	-\$252.78	-\$365.07	-\$157.79	-\$106.93
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-276.98	-202.30			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-267.20	-192.52			

**Table D-18 - Charbonneau/Timber Creek Area
Alternative 4**

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.25 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	66.87	66.87	83.61	83.61	47.45
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$225.90	\$217.91	\$194.75	\$164.70	\$163.36
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	262.14	262.14	262.14	262.14	262.14
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$305.58	\$298.89	\$229.34	\$287.11	\$303.59
Sum of All Listed Costs	\$531.48	\$516.80	\$494.09	\$451.81	\$466.95
Return to Unpaid Labor and Management					
Non-participation	-\$291.48	-\$216.80	-\$329.09	-\$121.81	-\$ 70.95
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-241.00	-166.32			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-231.22	-156.54			

Table D-19 - Charbonneau/Timber Creek Area
Alternative 4

40 Percent Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.25 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	66.87	66.87	83.61	83.61	47.45
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$225.90	\$217.91	\$194.75	\$164.70	\$163.36
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	274.09	274.09	274.09	274.09	274.09
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$317.53	\$310.84	\$311.29	\$299.06	\$315.54
Sum of All Listed Costs	\$543.43	\$528.75	\$506.04	\$463.76	\$478.90
Return to Unpaid Labor and Management					
Non-participation	-\$303.43	-\$228.75	-\$341.04	-\$133.76	-\$ 82.90
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-252.95	-178.27			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-243.17	-168.49			

**Table D-20 - Charbonneau/Timber Creek Area
Alternative 4**

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.25 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	66.87	66.87	83.61	83.61	47.45
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$225.90	\$217.91	\$194.75	\$164.70	\$163.36
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	195.24	195.24	195.24	195.24	195.24
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$238.68	\$231.99	\$232.44	\$220.21	\$236.69
Sum of All Listed Costs	\$464.58	\$449.90	\$427.19	\$384.91	\$400.05
Return to Unpaid Labor and Management					
Non-participation	-\$224.58	-\$149.90	-\$262.19	-\$ 54.91	-\$ 4.05
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-174.10	-99.42			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-164.32	-89.64			

**Table D-21 - Charbonneau/Timber Creek Area
Alternative 5**

No Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.18 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	65.43	65.43	81.81	81.81	46.43
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$224.46	\$216.47	\$192.95	\$162.90	\$162.34
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	235.51	235.51	235.51	235.51	235.51
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$278.95	\$272.26	\$272.71	\$260.48	\$276.96
Sum of All Listed Costs	\$503.41	\$488.73	\$465.66	\$423.38	\$439.30
Return to Unpaid Labor and Management					
Non-participation	-\$263.41	-\$188.73	-\$300.66	-\$ 93.38	-\$ 43.30
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-212.93	-138.25			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-203.15	-128.47			

Table D-22 - Charlson/Timber Creek Area
Alternative 5

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.18 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	65.43	65.43	81.81	81.81	46.93
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$224.46	\$216.47	\$192.95	\$162.90	\$162.34
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	167.76	167.76	167.76	167.67	167.67
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$211.20	\$204.51	\$204.96	\$192.73	\$209.21
Sum of All Listed Costs	\$435.66	\$420.98	\$397.91	\$355.63	\$371.55
Return to Unpaid Labor and Management					
Non-participation	-\$195.66	-\$120.98	-\$232.91	-\$ 25.63	\$ 24.45
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-145.18	-70.50			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-135.40	-60.72			

**Table D-23 - Charbonneau/Timber Creek Area
Alternative 5**

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.18 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	65.43	65.43	81.81	81.81	46.43
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$224.46	\$216.47	\$192.95	\$162.90	\$162.34
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	147.52	147.52	147.52	147.52	147.52
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$190.96	\$184.27	\$184.72	\$172.49	\$188.97
Sum of All Listed Costs	\$415.92	\$400.74	\$377.67	\$335.39	\$351.31
Return to Unpaid Labor and Management					
Non-participation	-\$175.42	-\$100.74	-\$212.67	-\$ 5.39	\$ 44.69
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-124.94	-50.26			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-115.16	-40.48			

**Table D-24 - Charbonneau/Timber Creek Area
Alternative 5**

40 Percent Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.18 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	65.43	65.43	81.81	81.81	46.43
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$224.46	\$216.47	\$192.95	\$162.90	\$162.34
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	157.99	157.99	157.99	157.99	157.99
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$201.43	\$194.74	\$195.19	\$182.96	\$199.44
Sum of All Listed Costs	\$425.89	\$411.21	\$388.14	\$345.86	\$361.78
Return to Unpaid Labor and Management					
Non-participation	-\$185.89	-\$111.21	-\$223.14	-\$ 15.86	\$ 34.22
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-135.41	-60.73			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-125.63	-50.95			

**Table D-25 - Charbonneau/Timber Creek Area
Alternative 5**

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.18 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	65.43	65.43	81.81	81.81	46.43
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$224.46	\$216.47	\$192.95	\$162.90	\$162.34
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	112.54	112.54	112.54	112.54	112.54
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$155.98	\$149.29	\$149.74	\$137.51	\$153.99
Sum of All Listed Costs	\$380.44	\$365.76	\$342.69	\$300.41	\$316.33
Return to Unpaid Labor and Management					
Non-participation	-\$140.44	-\$ 65.76	-\$177.69	\$ 29.59	\$ 79.67
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-89.96	-15.28			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-80.18	-5.50			

**Table D-26 - Charbonneau/Timber Creek Area
Alternative 6**

No Cost Share, 10 percent Interest

Pumping Cost (Irrigation Electricity) \$2.74 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.38	56.38	70.49	70.49	40.00
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.41	\$207.42	\$181.63	\$151.58	\$155.91
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	421.38	421.38	421.38	421.38	421.38
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$464.82	\$458.13	\$458.58	\$446.35	\$462.83
Sum of All Listed Costs	\$680.23	\$665.55	\$640.21	\$597.93	\$618.74
Return to Unpaid Labor and Management					
Non-participation	-\$440.23	-\$365.55	-\$475.21	-\$267.93	-\$222.74
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-389.75	-315.07			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-379.97	-305.29			

**Table D-27 - Charbonneau/Timber Creek Area
Alternative 6**

No Cost Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.74 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.38	56.38	70.49	70.49	40.00
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.41	\$207.42	\$181.63	\$151.58	\$155.91
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	300.17	300.17	300.17	300.17	300.17
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$343.61	\$336.92	\$337.37	\$325.14	\$341.62
Sum of All Listed Costs	\$559.02	\$544.34	\$519.00	\$476.72	\$497.53
Return to Unpaid Labor and Management					
Non-participation	-\$319.02	-\$244.34	-\$354.00	-\$146.72	-\$101.53
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-268.54	-193.86			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-258.76	-184.08			

**Table D-28 - Charbonneau/Timber Creek Area
Alternative 6**

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.74 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.38	56.38	70.49	70.49	40.00
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.41	\$207.42	\$181.63	\$151.58	\$155.91
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	263.95	263.95	263.95	263.95	263.95
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$307.39	\$300.70	\$301.15	\$288.92	\$305.40
Sum of All Listed Costs	\$522.80	\$508.12	\$482.78	\$440.50	\$461.31
Return to Unpaid Labor and Management					
Non-participation	-\$282.80	-\$208.12	-\$317.78	-\$110.50	-\$ 65.31
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-232.32	-157.64			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-222.54	-147.86			

**Table D-29 - Charbonneau/Timber Creek Area
Alternative 6**

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.74 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.38	56.38	70.49	70.49	40.00
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.41	\$207.42	\$181.63	\$151.58	\$155.91
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	272.50	272.50	272.50	272.50	272.50
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$315.94	\$309.25	\$309.70	\$297.47	\$313.95
Sum of All Listed Costs	\$531.35	\$516.67	\$491.33	\$449.05	\$469.86
Return to Unpaid Labor and Management					
Non-participation	-\$291.35	-\$216.67	-\$326.33	-\$119.05	-\$ 73.86
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-240.87	-166.19			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-231.09	-156.41			

**Table D-30 - Charbonneau/Timber Creek Area
Alternative 6**

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$2.74 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	56.38	56.38	70.49	70.49	40.00
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$215.41	\$207.42	\$181.63	\$151.58	\$155.91
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	194.11	194.11	194.11	194.11	194.11
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$237.55	\$230.86	\$231.31	\$219.08	\$235.56
Sum of All Listed Costs	\$452.96	\$438.28	\$412.94	\$370.66	\$391.47
Return to Unpaid Labor and Management					
Non-participation	-\$212.96	-\$138.28	-\$247.94	-\$ 40.66	\$ 4.53
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-162.48	-87.80			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-152.70	-78.02			

**Table D-31 - Charbonneau/Timber Creek Area
Alternative 8**

No Cost Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.90 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	80.24	80.24	100.33	100.33	56.94
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$239.27	\$231.28	\$211.47	\$181.42	\$172.85
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	374.20	374.20	374.20	374.20	374.20
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$417.64	\$410.95	\$411.40	\$399.17	\$415.65
Sum of All Listed Costs	\$656.91	\$642.23	\$622.87	\$580.59	\$588.50
Return to Unpaid Labor and Management					
Non-participation	-\$416.91	-\$342.23	-\$457.87	-\$250.59	-\$192.50
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-366.43	-291.75			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-356.65	-281.97			

**Table D-32 - Charbonneau/Timber Creek Area
Alternative 8**

No Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.90 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	80.24	80.24	100.33	100.33	56.94
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$239.27	\$231.28	\$211.47	\$181.42	\$172.85
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	266.56	266.56	266.56	266.56	266.56
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$310.00	\$303.31	\$303.76	\$291.53	\$308.01
Sum of All Listed Costs	\$549.27	\$534.59	\$515.23	\$472.95	\$480.86
Return to Unpaid Labor and Management					
Non-participation	-\$309.27	-\$234.59	-\$350.23	-\$142.95	-\$ 84.86
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-258.79	-184.11			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-249.01	-174.33			

**Table D-33 - Charbonneau/Timber Creek Area
Alternative 8**

No Cost-Share, 4 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.90 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	80.24	80.24	100.33	100.33	56.94
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$239.27	\$231.28	\$211.47	\$181.42	\$172.85
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	234.39	234.39	234.39	234.39	234.39
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$277.83	\$271.14	\$271.59	\$259.36	\$275.84
Sum of All Listed Costs	\$517.10	\$502.42	\$483.06	\$440.78	\$448.69
Return to Unpaid Labor and Management					
Non-participation	-\$277.10	-\$202.42	-\$318.06	-\$110.78	-\$ 52.69
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-226.62	-151.94			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-216.84	-142.16			

**Table D-34 - Charbonneau/Timber Creek Area
Alternative 8**

40 Percent Cost-Share, 10 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.90 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	80.24	80.24	100.33	100.33	56.94
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$239.27	\$231.28	\$211.47	\$181.42	\$172.85
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	245.06	245.06	245.06	245.06	245.06
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$288.50	\$281.81	\$282.26	\$270.03	\$286.51
Sum of All Listed Costs	\$527.77	\$513.09	\$493.73	\$451.45	\$459.36
Return to Unpaid Labor and Management					
Non-participation	-\$287.77	-\$213.09	-\$328.73	-\$121.45	-\$ 63.36
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-237.29	-162.61			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-227.51	-152.83			

**Table D-35 - Charbonneau/Timber Creek Area
Alternative 8**

40 Percent Cost-Share, 5.5 Percent Interest

Pumping Cost (Irrigation Electricity) \$3.90 per acre-inch

	Corn		Alfalfa		Drybeans
	Grain	Silage	Establishment Year	Established Year	
Market Income	\$240.00	\$300.00	\$165.00	\$330.00	\$396.00
Direct Costs					
Seed	\$ 28.00	\$ 19.50	\$ 41.25	\$ 0.00	\$ 27.00
Herbicides	22.53	22.53	6.82	0.00	18.90
Fungicides	0.00	0.00	0.00	0.00	0.00
Insecticides	14.09	14.09	0.00	0.00	0.00
Fertilizer	29.66	44.60	24.31	48.62	23.47
Crop Insurance	8.00	8.00	0.00	0.00	10.00
Fuel & Lubrication	7.11	15.87	12.11	7.83	9.72
Repairs	8.06	9.32	9.24	5.41	7.39
Drying	12.00	0.00	0.00	0.00	0.00
Hauling	12.00	0.00	0.00	0.00	4.40
Irrigation Electricity	80.24	80.24	100.33	100.33	56.94
Irrigation Repairs	6.00	6.00	6.00	6.00	6.00
Soil Testing, Other	1.05	1.05	3.85	6.60	1.20
Interest	10.53	10.08	7.56	6.63	7.83
Sum of Listed Direct Costs	\$239.27	\$231.28	\$211.47	\$181.42	\$172.85
Indirect (Fixed) Costs					
Land Taxes	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29	\$ 1.29
Mach. Investment	9.61	7.08	7.25	2.61	8.86
Irrigation Investment	174.57	174.57	174.57	174.57	174.57
Mach. Depreciation	15.74	11.58	11.86	4.27	14.50
Land Investment	16.80	16.80	16.80	16.80	16.80
Sum of Listed Direct Costs	\$218.01	\$211.32	\$211.77	\$199.54	\$216.02
Sum of All Listed Costs	\$457.28	\$442.60	\$423.24	\$380.96	\$388.87
Return to Unpaid Labor and Management					
Non-participation	-\$217.28	-\$142.60	-\$258.24	-\$ 50.96	\$ 7.13
Planting 92.5% of Base					
Deficiency Payment(+)	\$ 53.45	\$ 53.45			
Cost of Setaside(-)	2.97	2.97			
Return	-166.80	-92.12			
Planting 77.5% of Base					
Deficiency Payment(+)	\$ 63.80	\$ 63.80			
Cost of Setaside(-)	3.54	3.54			
Return	-157.02	-82.34			

APPENDIX E

Establishing an Irrigation District



MEMORANDUM

TO: *RS* Dave Sprynczynatyk, State Engineer
FROM: Patrick Stevens, Assistant Attorney General
RE: Irrigation Districts; *SWC* Project #1389
DATE: April 25, 1990

You asked me to provide you with an outline of what is necessary to form an irrigation district. The requirements for establishing an irrigation district are set forth below.

I. INTRODUCTION

Section 61-05-02 of the North Dakota Century Code provides that "[w]henever a majority of the electors within an area containing eighty acres . . . or more of land, susceptible of irrigation, desire to provide for the irrigation of such land, they may propose the organization of an irrigation district under the provisions of [chapter 61-05]." An "elector" is defined as "any landowner owning not less than five acres . . . of land whose land will be or is subject to assessments for construction or other costs, within a proposed or existing irrigation district, and who is a resident of this state." N.D. Cent. Code § 61-05-01(2) (1985).

II. THE PETITION AND OTHER DOCUMENTS

A petition for a proposed irrigation district must be filed with the State Engineer and must be signed by landowners who own a majority of land within the proposed district that will be subject to assessment. Id. § 61-05-07. The petition must describe the area to be included in the proposed district, and it must ask that the territory described be organized under the provisions of chapter 61-05. Id. Moreover, the petition must

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set forth the name and address of each petitioner and a description of his or her land, and the petition must have maps attached showing the boundary of the proposed district. Id. It should be noted that the proposed district may include lands which are not contiguous to any other lands in the district. Id.

The map included with the petition must show the location of the proposed conveyance systems and other works. Id. § 61-05-08. In addition, if the water supply is from a natural stream, the flow of the stream must be stated in cubic feet per second. Id. If the water supply is to be gathered by a storage reservoir, the map must show the location of the reservoir and must indicate the reservoir's capacity in acre-feet. Id. If the water supply is from ground water, the map must show the location of the wells and the proposed pumping rates. Id. Furthermore, unless otherwise authorized by the State Engineer, the maps must be drawn to a scale of not less than two inches to the mile. Id. Moreover, preliminary designs of all the proposed conveyance systems and other works must be prepared in sufficient detail to show the contemplated method of construction. Id.

In addition to the petition and the map, section 61-05-08 also requires a feasibility report on the proposed plan of irrigation. The feasibility report must include an analysis of the soil and water compatibility of the irrigable land of the proposed district. Id. It should also be noted that a

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registered professional engineer must prepare the map preliminary designs and feasibility report required by this section. Id.

Unless otherwise authorized by the State Engineer, the petition must also be accompanied by a bond. Id. § 61-05-09. The bond is to be for an amount double the probable cost of organizing the district, including the cost of the first election of the organization of the district. Id. The bond must be conditioned upon the surety's paying all costs in case the district shall not be approved by electors. Id. Moreover, within ten days after filing of a petition and the approval of the bond, the State Engineer must file a copy of the petition with the county auditor of each county in which the proposed irrigation district is situated. Id.

III. SUMMARY REPORT

Prior to the hearing described in Section IV below, the State Engineer must review the maps, preliminary designs, and feasibility study and must prepare a summary report showing the probable cost of the proposed irrigation works and the practicability and feasibility of the plan of irrigation suggested by the petitioners. Id. § 61-05-10. A copy of the report must be filed with the county auditor of each county where the proposed irrigation district is situated. Id. The State Engineer must also submit the report to the electors of the proposed district at the hearing on the petition. Id.

IV. THE HEARING

After examining the petition, the maps and papers pertaining to the proposed irrigation district, and after preparing a summary report, the State Engineer must fix a time and place for a hearing on the petition. Id. § 61-05-10. A notice stating that the petition will be heard and stating the time and place of the hearing must be filed with the county auditor of each county in which the proposed district is located. Id. The notice must also be published once a week for two consecutive weeks in the newspapers of general circulation in which the district is located and in the official newspaper of each county in which the district is located. Id. The date set for the hearing on the petition may not be less than twenty days after the first publication of notice. Id.

It should also be noted that at the hearing the State Engineer may amend the plan of irrigation proposed in the petition. Id. § 61-05-11. The State Engineer may adjourn the hearing and make changes in the proposed boundaries as he deems advisable. Id. The boundaries of the district, however, may not be extended until the electors who own a majority of the acres of land subject to assessment to be included in the extension have consented in writing. Id.

V. DECISION OF THE STATE ENGINEER

If the State Engineer determines the plan of irrigation is not practicable or that the plan is not economically sound, he

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must make an order denying the petition for the organization of the irrigation district. Id. § 61-05-12. He must also state his reasons for such action. Id. Also, a copy of the order must be filed with the county auditor in each county in which the proposed irrigation district is situated. Id.

If, however, the State Engineer finds that the establishment of the proposed irrigation district is advisable, and the plan proposed for irrigating the lands is practicable and economically sound, he must make an order establishing the irrigation district, subject to approval of the electors of the district at an election called by the State Engineer for that purpose. Id. § 61-05-13. If the district embraces more than 10,000 irrigable acres, the State Engineer by such order must divide the district into five or seven divisions as he deems necessary for the convenience of the electors of the district. Id. The order must also set forth the following:

1. The time and place of holding an election.
2. The boundaries of the district.
3. That a petition sufficient in form and substance was filed with the State Engineer.
4. That due and reasonable notice of the time and place of hearing on the petition was given to the qualified electors of the proposed district.

Id. A copy of the order must be filed with the county auditor of each county in which the irrigation district is situated. Id.

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VI. THE ELECTION

After making an order establishing the irrigation district, the State Engineer must give notice of an election to be held in the district for the purpose of determining whether or not the electors in the district approve the establishment of an irrigation district. § 61-05-14. The notice must state that an elector desiring to be a candidate for the office of the district director must file his or her name with the State Engineer not less than twenty days before the election. Id. The notice must also carry a reference to the maps previously filed with the county auditor describing the boundaries of the lands included in the district as established by the State Engineer, and must designate a name for the district. Id. The notice must be filed with the county auditor of each county in which the proposed district is situated and must be published once a week for two consecutive weeks in the newspapers of general circulation in which the district is located and in the official newspaper of each county in which the district is located. Id. The date set forth for the election must not be less than twenty-five nor more than thirty-five days after the first publication of the notice. Id. Section 61-05-15 sets forth a form for the notice of election.

Prior to the election, the State Engineer must appoint from the electors of the district one clerk and two judges, who constitute a board of election for the district. Id. § 61-05-16.

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If the district is divided into divisions, a board of election must be appointed for each division from the electors in the division. Id. If the members appointed do not attend the opening of the polls on the day of the election, the electors present at that hour may choose the members of the election board or fill the place of a absent member. Id.

An election upon the question of an organized irrigation district must be conducted in accordance with the general election laws of the state. Id. § 61-05-17. After the polls are closed, the election board must canvas the votes, and the clerk of the election board must certify to the State Engineer the results of the election. Id. The clerk of the board must then wrap the ballots cast at the election and mail them by registered or certified mail to the State Engineer who also must canvas the ballots and verify the results. Id. The State Engineer then files and retains in his office the ballots cast at the election. Id.

It should also be noted that the number of votes made by electors may vary. An elector owning twenty acres or less subject to assessment has one vote. Id. § 61-05-03. An elector owning more than twenty acres subject to assessment which will receive its water from a federal reclamation or irrigation project is entitled to one additional vote for each additional twenty acres owned or major fraction thereof. Id. The elector, however, may not have more than eight votes. Id. If an elector

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will not receive water from a federal reclamation or irrigation project, the voting works the same except instead of being limited to eight votes, an elector cannot cast more than thirty-five percent of the votes. Id.

If upon a canvas of the votes cast, it appears that a majority of all votes cast are in favor of the organization of the irrigation district, the State Engineer, by an order, declare the territory duly organized as an irrigation district under the name and style designated and declares the persons receiving the highest number of votes duly elected as directors. Id. § 61-05-18. The State Engineer must file a certified copy of the order immediately in the office of the register of deeds in each county in which any portion of the irrigation district is situated. Id. The State Engineer must also file a copy of the order with the county auditor of each such county. Id. The State Engineer must also immediately make out and mail by registered and certified mail to each person elected to the office as a director a certificate of election signed by him. Id.

The State Engineer must also file in the office of the secretary of state a duly certified copy of his order declaring the irrigation district duly organized. Id. § 61-05-19. The secretary of state must then issue to the State Engineer a certificate under the seal of the state of the due organization of the district. Id. The secretary must also file a copy of the certificate and the order of the State Engineer. Id.

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