

PRELIMINARY DESIGN
RICHLAND COUNTY
DRAIN #65
SWC #1207



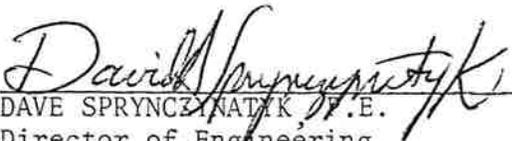
PREPARED BY
STATE WATER
COMMISSION
MARCH, 1981

PRELIMINARY DESIGN
RICHLAND COUNTY DRAIN #65

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I. INTRODUCTION

PURPOSE AND SCOPE

The following report contains the results of a study conducted by the State Water Commission to investigate and determine the feasibility of improving Richland County Drain #65. The Richland County Water Management Board intends to improve the drain to eliminate the problems that presently exist. Thus, the Richland County Water Management District requested the State Water Commission to investigate the feasibility of alleviating the problems presently experienced by Drain #65.

Included in this report is a brief history of the drain, a physical description of the watershed, an engineering analysis of the problems, and a short environmental assessment of the project's impact on the area. The engineering analysis includes an analysis of the drainage area, a construction cost estimate, a description of the project benefits, and a summary of the report. The best available technology was utilized to develop solutions that will sufficiently meet the needs of the watershed. The preliminary design complies with criteria established by the State Water Commission.

II. HISTORY

The purpose of Drain #65 is to relieve flood damage within the watershed and to prevent detriment to adjacent Drain #30 by overloading. The drain was originally petitioned in 1947, but was voted down. It was again petitioned, planned, and finally declared a legal drain on June 27, 1960. The Soil Conservation Service estimated the cost at \$61,400. State aid of \$20,000 was committed to the drain in October, 1960. The State Highway Department contributed an additional \$2,000 in recognition of benefits to North Dakota Highway Route #11.

During the construction of the drain in 1962, excessive rains prevented final completion and caused considerable erosion. The drain was repaired and finally completed in 1963, but heavy rains again caused considerable erosion upstream and overtopping toward the outfall end, requiring approximately \$11,500 to complete and repair the drain.

This drain has been beset by controversy, which has been largely based on arguable points of evaluation of direct and indirect benefits. Landowners within the assessment area of Drain #30 disagree to being assessed for costs of Drain #65.

Through the years, excessive erosion and inadequate capacity of the channel has plagued the landowners in the watershed. To investigate solutions to the problems being experienced, the Richland County Water Management District contacted the State Water Commission. On March 15, 1979, an investigation agreement was entered into between the State Water Commission and the Richland County Water Management District. The State Water Commission agreed to evaluate the condition of the existing drain, determine possible solutions to problems known to exist, recommend the most feasible improvement, and prepare a cost estimate for the improvement (see Appendix).

III. PHYSICAL DESCRIPTION

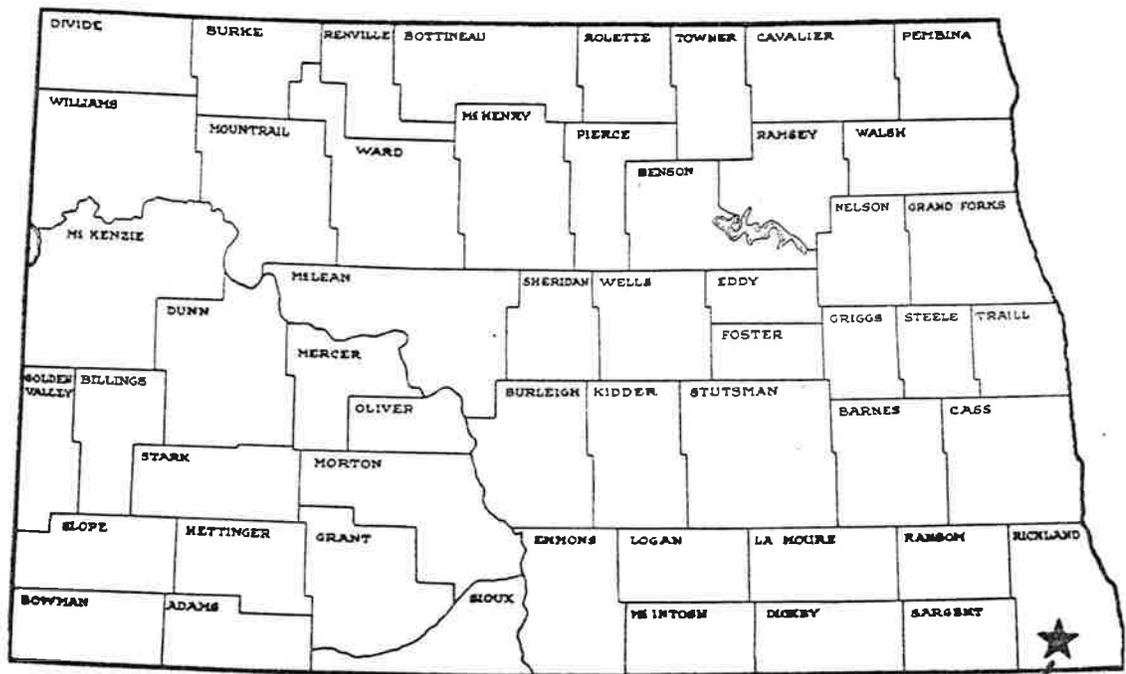
PHYSIOGRAPHY

The project area is located in central Richland County, approximately one mile east of the town of Hankinson, North Dakota (see Figure 1). Drain #65 is a tributary to the Wild Rice River which is part of the Red River Basin. Approximately 96 percent of the watershed contributes directly to the drain. This is due largely to agricultural drainage. The remainder of the drainage area consists of closed pockets of standing water.

The Red River Basin is classified as a sub-humid to humid continental climate with moderately warm summers and cold winters. Rapid changes in daily weather patterns are characteristic of this area. Frequent passage of weather fronts and high and low pressure systems result in a wide variety of weather. The annual mean temperature is 39^oF. with the warmest month being July and the coldest month being January. The annual mean precipitation is 16 inches.

The contributing drainage area to Drain #65 is approximately 37 square miles. It takes 22.9 hours for runoff to travel from the hydraulically most distant part of the watershed to the drain outlet into the Wild Rice River. Throughout the watershed, the average slope of the land is approximately 0.0025 ft/ft. The slope of Drain #65 varies from 0.0005 ft/ft to 0.0022 ft/ft.

Two major artificial barriers pass through the watershed of Drain #65, Interstate 29, and the Soo Line Railroad track. These barriers have some effect on runoff by concentrating the water to certain points, and altering the time of concentration. The majority of watershed is cropland, with some pasture land.



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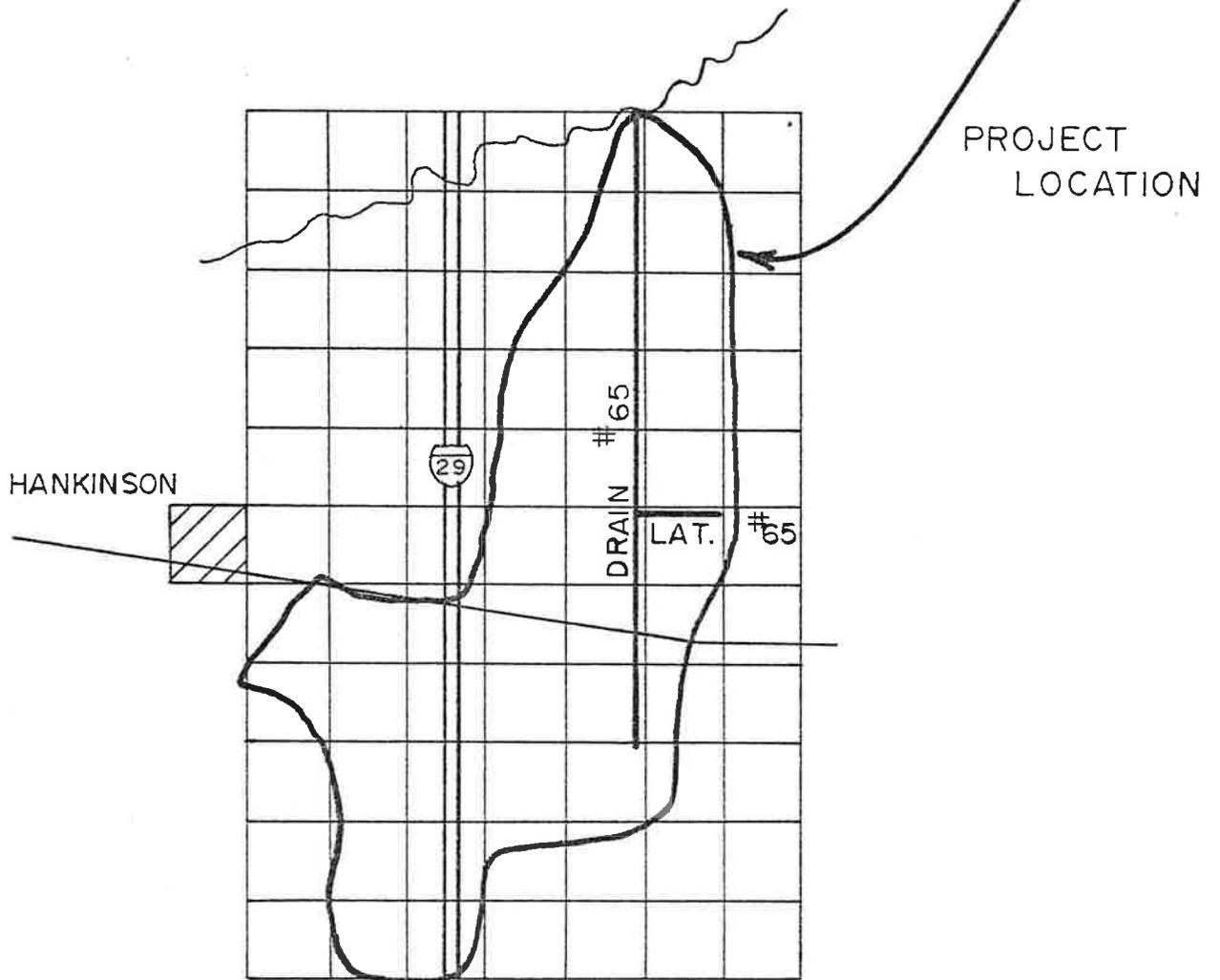


FIGURE 1

IV. ENGINEERING ANALYSIS

HYDROLOGIC INVESTIGATION

The TR-20 computer program developed by the U.S. Soil Conservation Service was used to determine the peak discharge and corresponding flow volume for various frequency storms. The program formulates a mathematical model of the watershed, based on the following input data: rainfall distribution, type of soil, soil moisture condition, land use, time of concentration, hydraulic characteristics of the channels, and the size of the drainage area. The hydrologist must make accurate estimates of the data to formulate an accurate model of the watershed. The program was used to generate peak discharges at the existing structures and critical points in the watershed.

Peak discharges were analyzed for both rainfall and snowmelt frequencies runoff. The 5, 10, and 25 year rainfall and snowmelt frequencies were evaluated. Because of its larger peak and higher volume, the snowmelt runoff was used for design data.

The 10 year frequency snowmelt on the watershed is approximately 2.8 inches of moisture. The following peaks were generated for the outflow of Drain #65 into the Wild Rice River.

TABLE 1

<u>Frequency</u> (years)	<u>Snowmelt</u> (cfs)
5	1284
10	1748
25	2243

Discharges for the 10 year flow at the existing structures are illustrated in Figure 2.

EXPECTED PEAK DISCHARGES 10 YEAR-10-DAY SNOWMELT RUNOFF

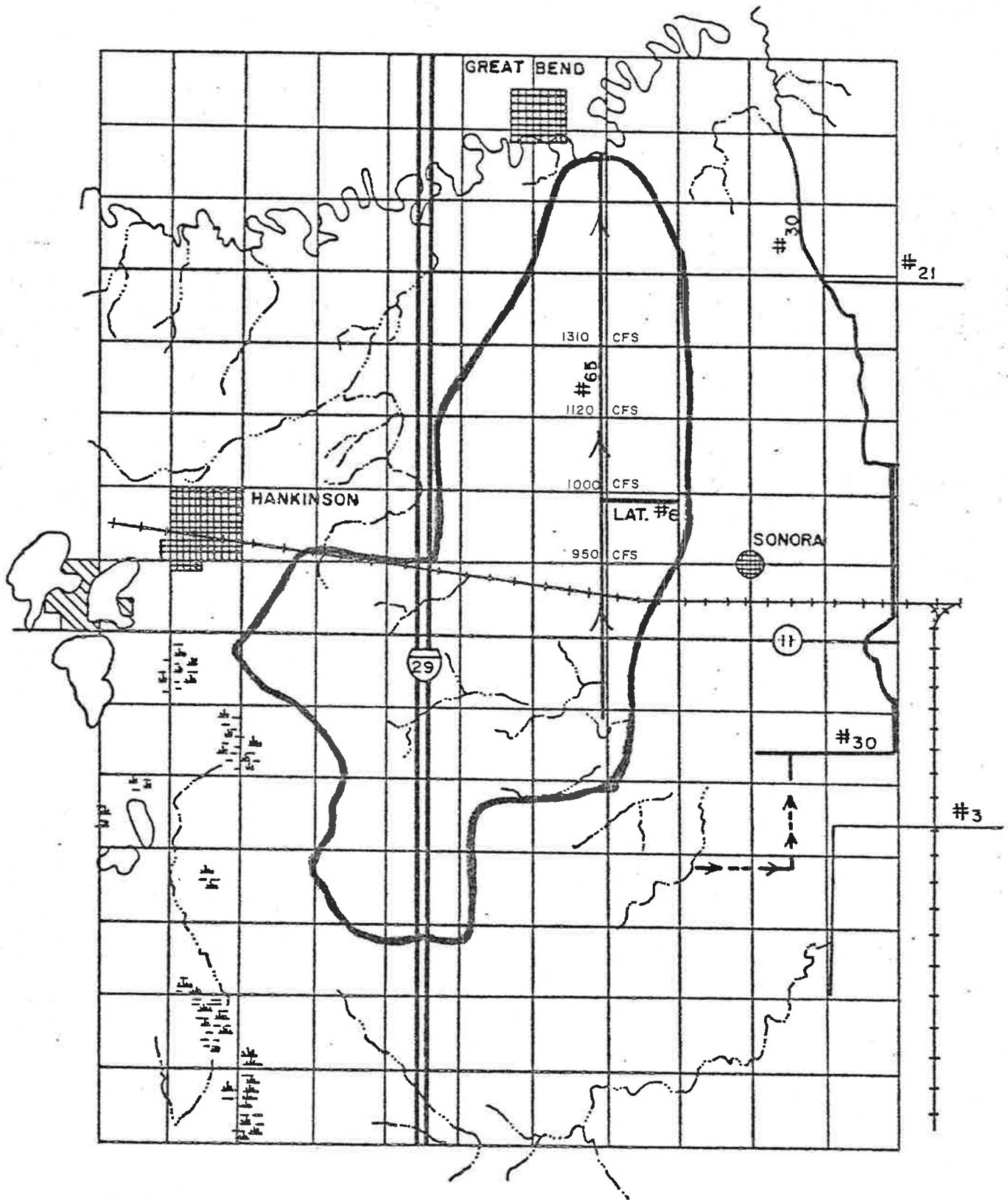


FIGURE 2

SOLUTION

During the engineering investigation, several trips were made to the watershed by engineers of the State Water Commission to determine the best solution to the problem. The following preliminary design reflects the recommendations of the engineers who inspected the watershed and observed the problems therein.

To relieve the landowners along Drain #65 from flood and backwater damage, an entire watershed plan was developed. The plan mainly focuses on the drain itself, with minor improvements planned for the upper reaches of the watershed. From the hydrologic analysis, it has been determined that the drain will require widening and deepening to adequately handle the design flow. Approximately 38,210 C.Y. of excavation will be needed to construct the channel to meet the design flow. This construction would almost physically double the size of the drain.

The engineering analysis also determined that three road crossings located within the drain were found to be inadequate (see Figures 3 and 4). Road crossings at the (1) midway point of Section 35; (2) between Sections 35 and 26; and (3) between Sections 26 and 23, were found to be inadequate to handle the design flow. The present capacity of the crossings is 933 cfs, 1192 cfs, and 1140 cfs, respectively. To be able to meet the design flow of 1310 cfs, an additional four foot diameter CMP is proposed for each crossing, 1 and 2. The 22 feet wide by 6 feet high bridge at the road crossing between Sections 26 and 23 (3) will be widened to 24 feet to increase the capacity to 1750 cfs. The remaining crossings along the drain were adequate to handle the design flow. Therefore, no modification work is needed.

DRAIN 65 EXISTING STRUCTURES

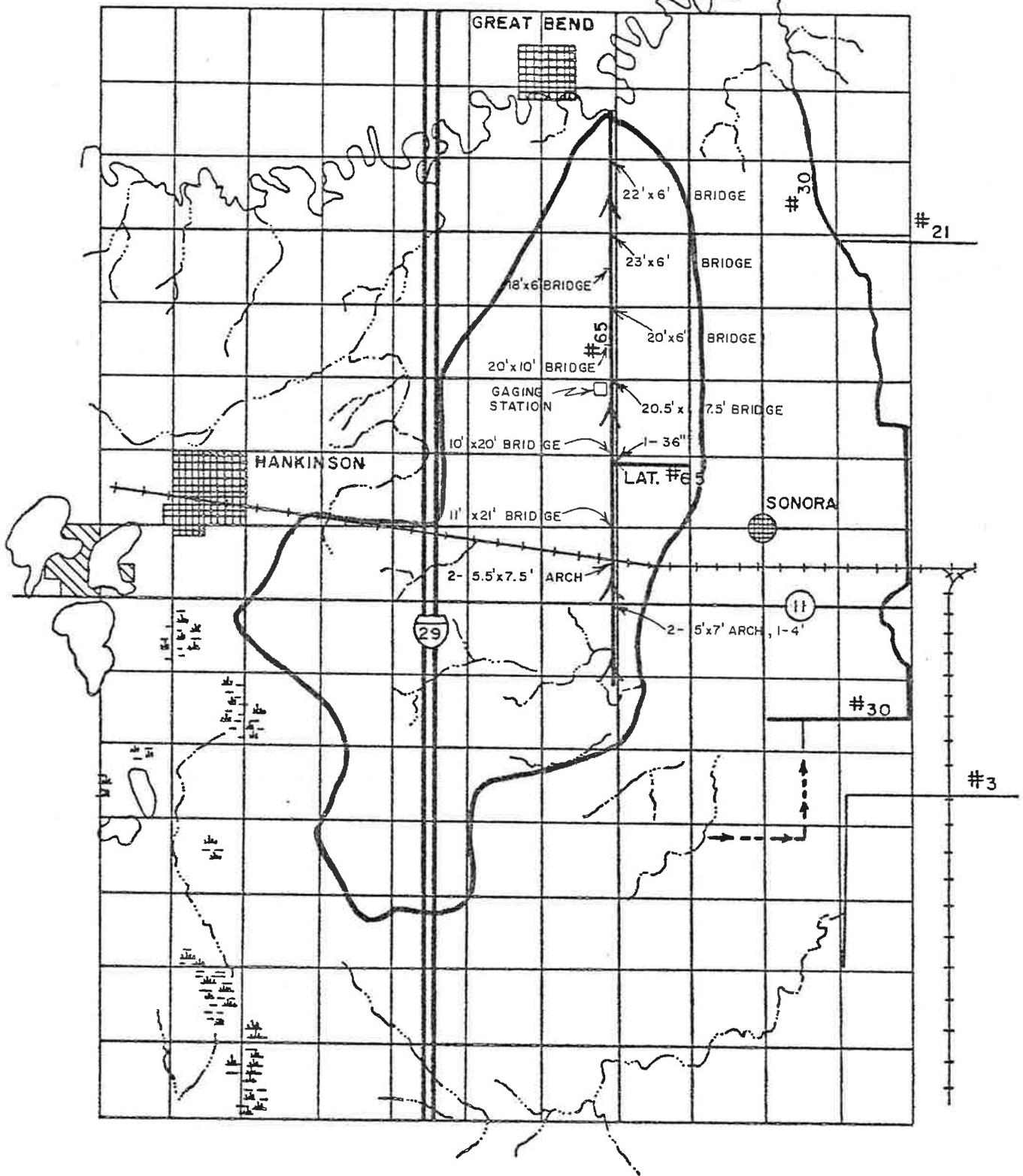


FIGURE 3

In previous years, the drain channel has experienced erosion problems due to the gradient in several sections of the drain. To check this erosion, two ditch blocks are proposed. The approximate location of the proposed ditch blocks is station 360+00 (Section 26, T130, R49) and station 100+00 (Section 35, T131, R49). Figure 5 shows an isometric view of a ditch block. The blocks are to be located in the steepest sections of the drain where the slopes are 0.22 percent and 0.08 percent. To relieve fields located next to the drain of standing water caused by the soil banks, approximately seven additional field drains will be needed. These, along with the existing field drains, should insure proper drainage of the adjacent fields if operated properly.

Past problems with washouts and inadequate capacity in a small ditch running parallel to the Soo Line Railroad track necessitate the need for minor cleanout and reconstruction. The majority of the watershed that this ditch drained has recently been routed north to the Wild Rice River along Interstate 29 by the North Dakota Highway Department. This should relieve the ditch along the tracks of at least 60 percent of the runoff volume previously experienced. Therefore, minor cleanout and reconstruction should be sufficient to restore the channel to the needed capacity.

The proposed modifications (see Figure 6) were preliminarily designed to be able to accommodate the 10 year 10 day snowmelt runoff. Beneficially, they will relieve only flood problems previously experienced for a storm frequency less than or equal to the design frequency. Total cost for the modifications is \$91,060. Table 2 contains a cost breakdown for the items recommended for the project.

DRAIN 65 STRUCTURE CAPACITY

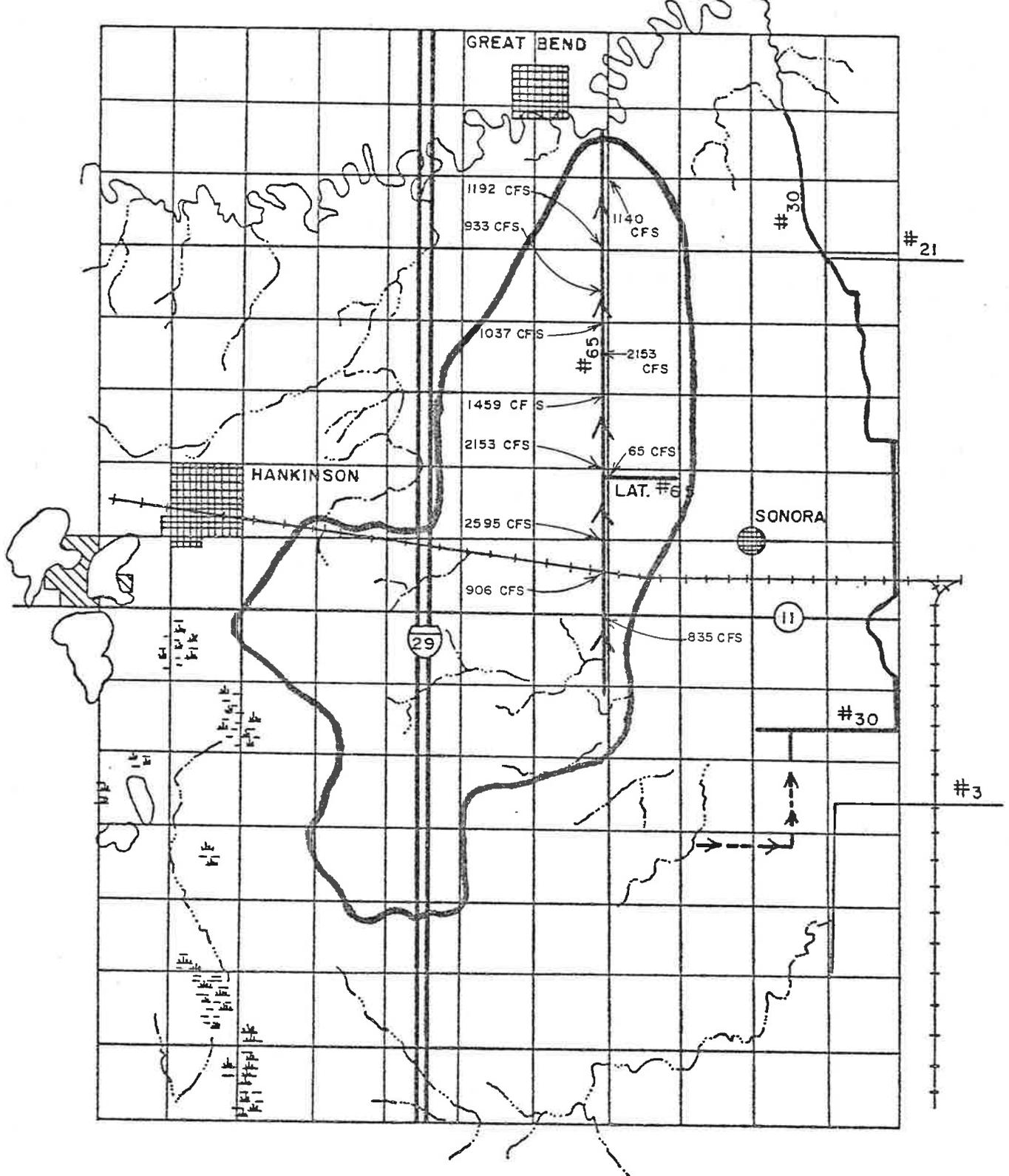


FIGURE 4

DITCH BLOCK

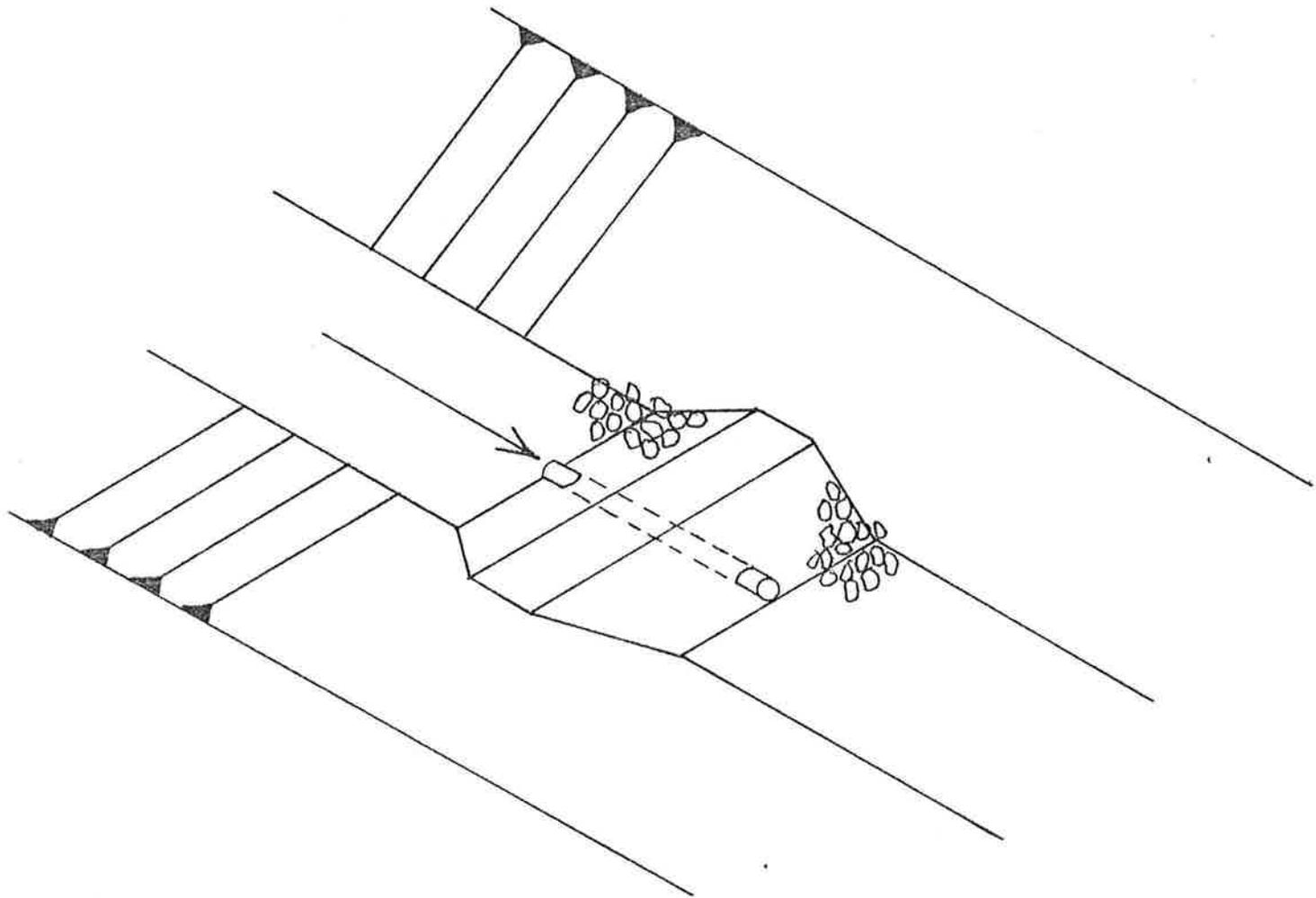


FIGURE 5

PROPOSED MODIFICATIONS

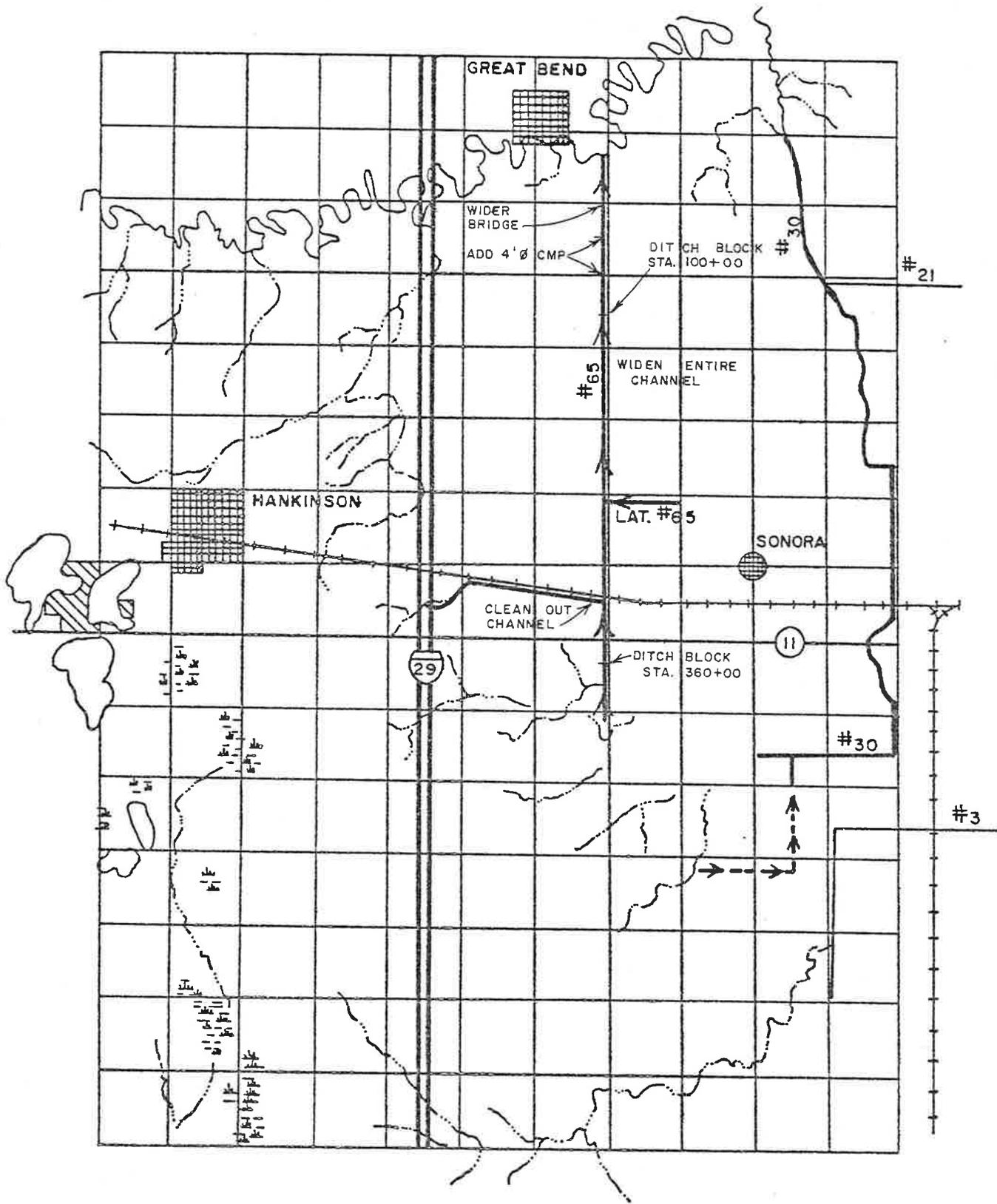


FIGURE 6

TYPICAL CROSS SECTION MODIFICATION

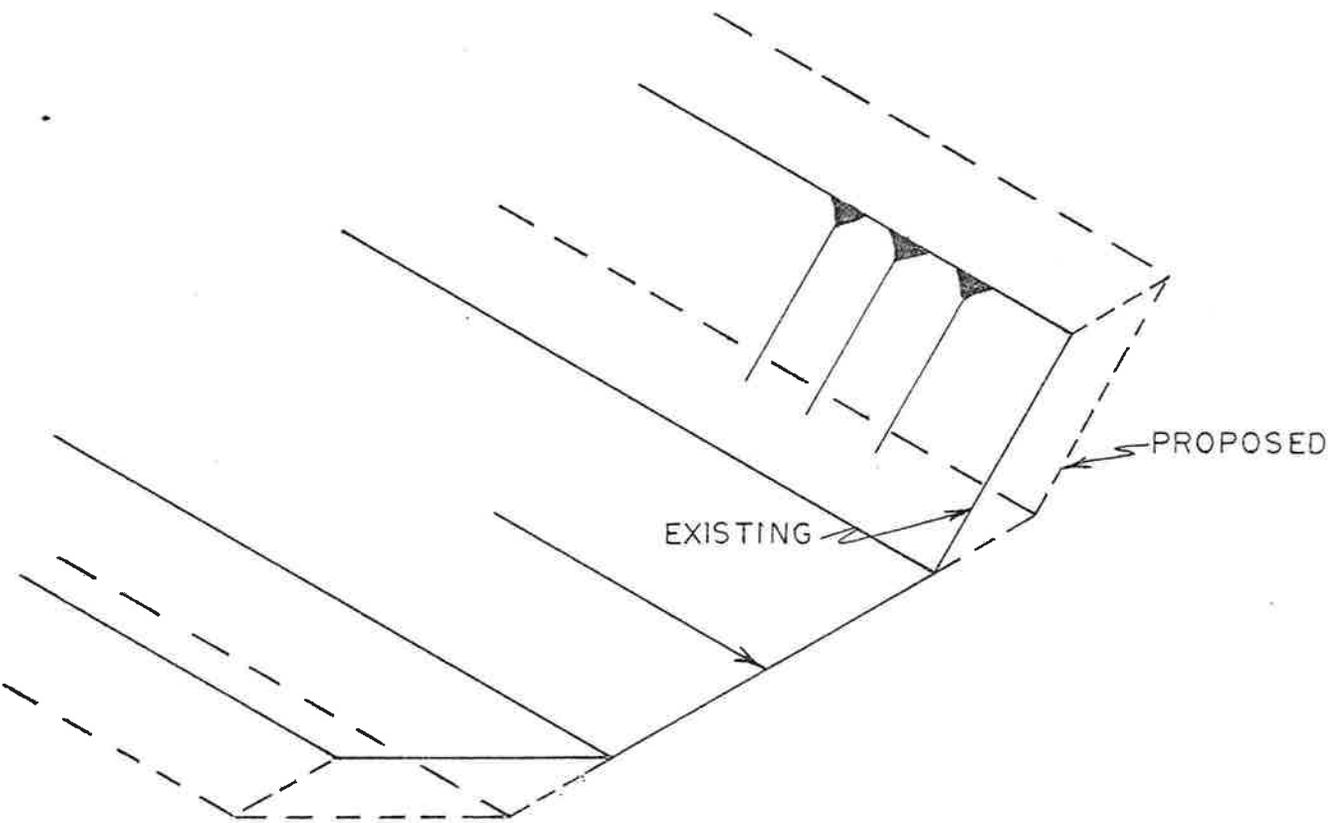
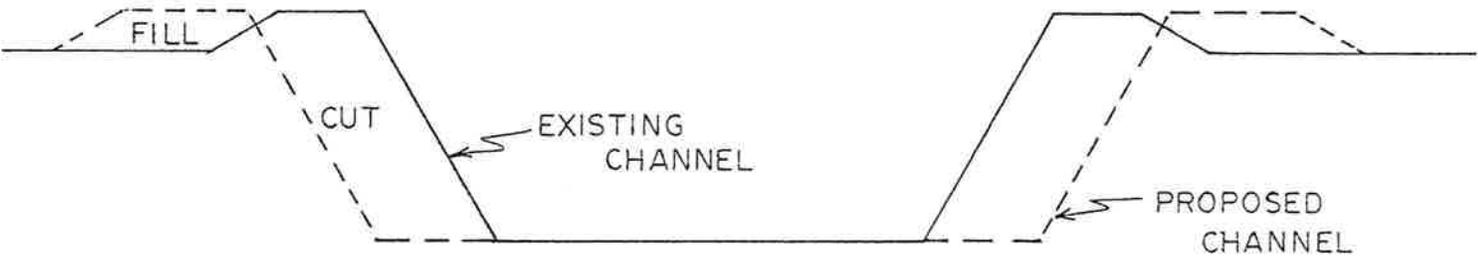


FIGURE 7

TABLE 2

COST BREAKDOWN

Excavation	38,210 CY @ \$1/CY	\$38,210
Ditch Blocks (2)		
Fill	400 CY @ \$1.50/CY	600
Riprap	120CY @ \$25/CY	3,000
2-12" dia. CMP	25' each @ \$20/LF	1,000
Road Crossings		
2 - 4' dia. CMP	25' each @ \$90/LF	\$ 2,250
Bridge Improvement	- LS	15,000
Channel Cleaning and Improvement	- LS	<u>\$10,000</u>
		\$70,060
	+30% Contingencies, Administration	<u>21,000</u>
	TOTAL	\$91,060

* Does not include land purchase

V. ENVIRONMENTAL SURVEY

The following environmental survey gives a brief overview of the positive and negative environmental impacts that would result from the implementation of this project. This is not intended to be a comprehensive environmental assessment, it will identify subjects that would be analyzed in detail in an environmental assessment. In the following paragraphs, several environmental categories are identified and discussed specifically for the watershed of Drain #65.

LAND USE

The watershed of Drain #65 currently has the following land use breakdown.

Small Grain Crops	65%
Pasture	5%
Row Crops	15%
Farmsteads	1%
Roads	2%
Fallow	12%

It should be noted that land will have to be obtained for the construction of the channel. The land use of the watershed will not be changed or affected by the project.

AESTHETICS

The aesthetics of the watershed will not be greatly affected by the construction done on the drain. The drain conforms to the natural environment and material, and does not alter the existing man-made structures already in place, such as road crossings. The structures shall contain some concrete and riprap which will be blended into the natural landscape along with the fill material. Also, once the construction

of the channel is completed, the entire excavation and fill areas will be seeded with native grasses.

WILDLIFE

The modifications proposed for the watershed should have very little affect on wildlife, due to the fact that the drain already exists. Some disruption will be experienced by the wildlife during the construction period, but this will be only temporary. Some channel cleanout will cause adverse effects on the wildlife which relies on the area for cover. There were no actual observations made pertaining to the wildlife population to the project area. Therefore, no conclusions can be made to determine the exact effects the project will have on the wildlife population.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Excavated land removed and used to construct the channel can be assumed to be partially altered. Fossil fuel and labor used during the construction of the project will be irretrievably committed.

SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate and determine the best solution for improvement of Richland County Drain #65. The drain presently experiences excessive erosion and lacks the capacity to handle most spring runoffs. To relieve erosion problems, the recommended plan included the construction of ditch blocks plus reducing the slope of the channel in critical areas. The capacity of three road crossings was determined to be inadequate to handle the design flow. Additional culverts

are proposed to increase the capacity of two of these road crossings, with some bridge widening planned for the third. It was also determined that the channel must be widened and deepened to be able to adequately handle the design flow. The ditch bottom will have to be increased approximately 10 feet to accomplish this. Several minor modifications, like snagging and clearing, will also be required in the upper reaches of the watershed. The total construction cost is estimated at \$91,060. The recommended modifications were designed to provide protection from the 10 year 10 day snowmelt with the proper maintenance and operation.

As stated before, land must be obtained to accomodate widening the drain. The local sponsors must determine whether the proposed solution of this project is feasible and practical.

APPENDIX

A G R E E M E N T
PRELIMINARY INVESTIGATION
BY THE
NORTH DAKOTA STATE WATER COMMISSION

Handwritten initials and date:
JF
9/21/79

I. PARTIES

THIS AGREEMENT is between the North Dakota State Water Commission, hereinafter referred to as the Commission, acting through the State Engineer, Vern Fahy, and the Board of Commissioners, Richland County Water Management District, hereinafter referred to as the Board, acting through its Chairman, Aaron Heglie.

II. PROJECT, LOCATION AND PURPOSE

The Board has requested the Commission to investigate and determine the feasibility of improving Richland County Drain #65 and its major laterals. Richland County Drain #65 is located 2.5 miles east of and parallel to Interstate 29 near Hankinson, North Dakota.

The purpose of this project is to evaluate the condition of the existing drain, determine possible solutions to problems known to exist, recommend the most feasible improvement, and prepare a cost estimate for the improvement.

III. PRELIMINARY INVESTIGATION

The parties agree that further information is necessary concerning the proposed project. Therefore, the Commission shall conduct a preliminary investigation consisting of the following:

1. Obtain field survey data necessary for the evaluation of the problem and the preliminary design.
2. Complete a hydrologic analysis to determine the design discharges.
3. Complete a preliminary design of the proposed alternative.
4. Prepare a detailed cost estimate.
5. Summarize the results and state conclusions and recommendations.

Subsurface exploration and design work for the final design and specification stage shall not be made under this agreement.

N. D. STATE WATER COMMISSION <small>STATE OFFICE BUILDING BISMARCK, NORTH DAKOTA 58505</small>	No 004587 Date <u>April 3 19 79</u>
Received of <u>Richland Co. W.M.D.</u>	
The Sum of <u>Seven hundred fifty dollars</u> \$ <u>750⁰⁰</u>	
For <u>preliminary inv - 1207</u>	
THANK YOU!	
By <u>K. Koch</u> <i>(Signature)</i>	

Cash Check M.O. 3-79

IV. DEPOSIT - REFUND

The Board shall deposit \$750.00 with the Commission to partially cover the cost of the investigation. Upon receipt of a request from the Board to terminate the investigation; or upon a breach of this agreement by any of the parties, the Commission shall provide the Board with a statement of all expenses incurred in the investigation and shall refund to the Board any unexpended funds.

V. RIGHTS OF ENTRY

The Board agrees to obtain written permission from any affected landowner to allow the Commission to enter upon his property to conduct field surveys which are required for the investigation.

VI. INDEMNIFICATION

The Board hereby accepts responsibility for and holds the Commission free from all claims and damages to public and private properties, rights or persons arising out of this investigation. In the event a suit is initiated or judgement rendered against the Commission, the Board shall indemnify it for any judgement arrived at or judgement satisfied.

VII. CHANGES TO AGREEMENT

Changes to any contractual provisions herein will not be effective or binding unless such changes are made in writing, signed by the parties and attached hereto.

BOARD OF COMMISSIONERS
RICHLAND COUNTY WATER MANAGEMENT
DISTRICT

NORTH DAKOTA STATE WATER COMMISSION

Aaron H. Heglie
Aaron Heglie
Chairman

Vernon Fahy
Vernon Fahy
State Engineer

Mar-27-1979
Date

March 20, 1979
Date

Distribution
Water Mgt. Board
SWC Project #1207
SWC Accountant
SWC Investigation Engineer

