

Report of  
**NORTH DAKOTA STATE WATER CONSERVATION COMMISSION**  
1301 State Capitol  
**BISMARCK, NORTH DAKOTA**

**BIG COULEE DAM AND RECREATION COMPLEX**  
**TOWNER COUNTY**

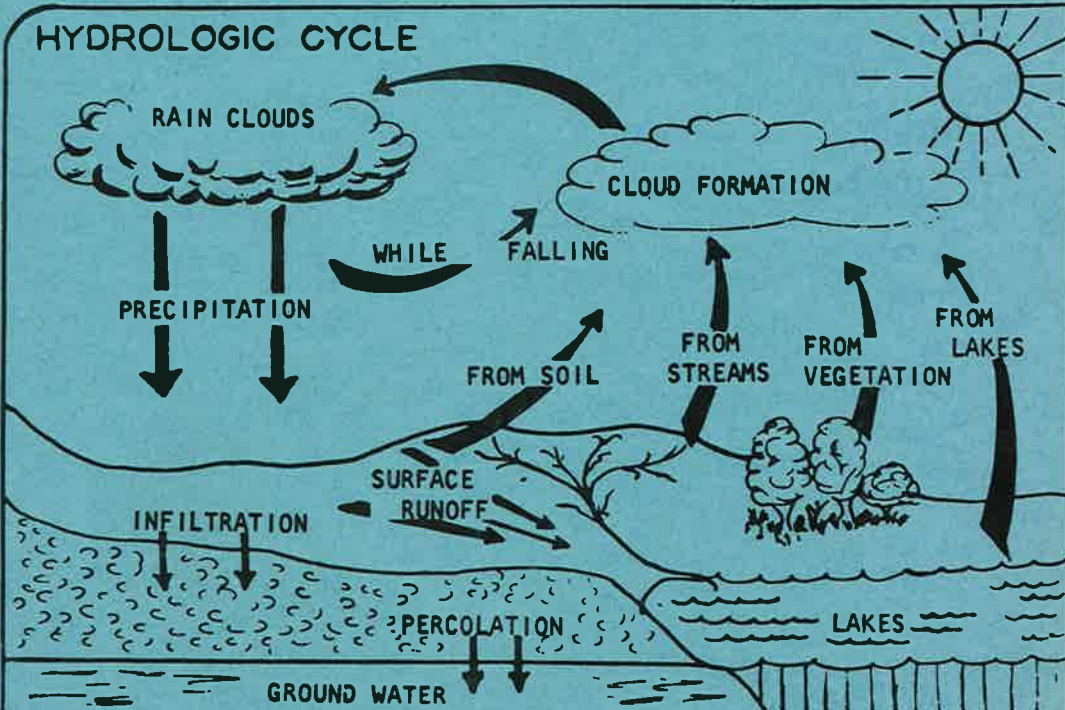
SWC Project #1418 - SORA Project #48-18

Prepared in cooperation with

City of Bisbee  
Towner County Park Board  
North Dakota State Outdoor Recreation Agency  
North Dakota State Water Commission

August 25, 1967

**HYDROLOGIC CYCLE**



NORTH DAKOTA STATE WATER COMMISSION

PROJECT REPORT

NAME: Big Coulee Dam and Recreation Complex, Towner County  
PROJECT: SWC #1418 - SORA #48-18  
DATE: August 25, 1967

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# North Dakota State Water Commission

1301 State Capitol

223-8000 Ext. 251

Bismarck, North Dakota 58501

August 25, 1967

John Greenslit  
State Liaison Officer  
State Outdoor Recreation Agency  
Bismarck, North Dakota 58501

RE: Big Coulee Dam and Recreation Complex,  
SWC Project #1418 - SORA Project #48-18

Dear Mr. Greenslit:

Enclosed are 7 copies of an acquisition and development proposal for the Big Coulee Dam and Recreation Complex in Towner County, prepared in our office in cooperation with the City of Bisbee, project sponsor, Towner County Park Board, and your office.

Copies of this report are being provided all project participants and an informational copy was sent to the State Game and Fish Department.

Please submit the proposal to the Bureau of Outdoor Recreation for a Federal grant from the Land and Water Conservation Fund. If further information is required, feel free to contact this office or the City of Bisbee at your convenience. We appreciate the cooperation of your staff and others who assisted in the preparation of this report.

Sincerely yours,



Milo W. Hoisveen  
Engineer-Secretary

MWH:JS:ka  
cc: Towner Co.Pk.Bd.  
Game & Fish  
Bisbee City Auditor

Governor William L. Guy  
Chairman  
Richard P. Gallagher  
Vice Chairman - Mandan

Harold Hanson  
New England  
Russell Dushinske  
Devils Lake

Henry J. Steinberger  
Donnybrook  
Gordon K. Gray  
Valley City

Arne Dahl, Ex-Officio Member  
Comm. of Agriculture & Labor  
Milo W. Hoisveen, Secretary  
Chief Engineer & State Engineer



DEPARTMENT OF THE INTERIOR BUREAU OF OUTDOOR RECREATION  PROJECT PROPOSAL - ACQUISITION	LEAVE BLANK FOR BOR USE ONLY		
	Date Received	Priority	Project Number
Project Officer			
Use this form for submission of individual projects for acquiring lands and waters or interests in lands and waters for public outdoor recreation purposes. If concurrent Development is being undertaken, check here <input checked="" type="checkbox"/>			

SECTION 1

1. State or Territory <b>North Dakota</b>	2. Name and address of agency responsible for project <b>City of Bisbee - c/o B. A. Hadler, Mayor - Bisbee, North Dakota 58317</b>
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3. Project Title  
**Big Coulee Dam and Recreation Complex, Towner County - SORA Project #48-18**

4. Brief description of project  
 Located in Section 36, Township 160 North, Range 68 West - Towner County, adjacent to the City of Bisbee (population 400) and State Highway #66, the project includes construction of a dam creating a 181 acre reservoir with a 1425 acre-foot capacity for outdoor recreation (78%) and municipal (22%) purposes. About 264.3 acres are to be acquired and public access will be provided. A picnicking and camping area are to be developed along with public use facilities for water-related outdoor recreation activities. Designed to meet Region IV needs for 1970, the project will also meet local unmet needs. Enhancement of the area's natural beauty is planned for the project.

**SWC Project #1418**

5. Duration of project from <b>1-1-68</b> to <b>12-1-70</b>	6. Federal assistance requested <b>10.79%</b>	7. Recommended priority <b>A</b>
--	--	-------------------------------------

8. Name, Organization, and Title of individual having day-to-day responsibility for direction of project <b>B. A. Hadler, Mayor Bisbee, North Dakota 58317</b>	9. Name and Address to appear on check <b>Milo W. Holvaasen, Fiscal Officer State Outdoor Recreation Agency 1301 State Capitol, Bismarck</b>
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10. TERMS AND CONDITIONS: In submitting this Project Proposal, the State hereby accepts the Terms and Conditions set forth in the BOR Grants-in-Aid Manual, which will be a part of the Project Agreement for any grant awarded under this proposal.

11. CERTIFICATION: As the official designated to represent the State and act for the State for purposes of the Land and Water Conservation Fund Act, I recommend that assistance be made available from the Fund, when monies are available, in accordance with the recommended priority. No financial assistance has been given or promised under any other Federal program or activity with regard to the proposed project. The State or public agency to be responsible for the proposed project has the ability and	intention to finance its share of the costs of this project. The Applicant will not discriminate against any person on the basis of race, color, or national origin in the use of any property or facility acquired or developed pursuant to this proposal, and shall comply with the terms and intent of Title VI of the Civil Rights Act of 1964, P. L. 88-354 (1964), and of the regulations promulgated pursuant to such Act by the Secretary of the Interior and contained in 43 CFR 17.
---	---

(Signature)	<b>John Greenlit</b> (Name)
(Date)	<b>State Liaison Officer</b> (Title)

12. For State use  
**7 SORA**  
**1 Bisbee**  
**1 Towner Co. (Rk. Bd.)**  
**1 Game & Fish**  
**10 SWC**

**August 25, 1967**

Big Coulee Dam and Recreation Complex  
 SORA Project #48-18 (SWC #1418)

Land Acquisition - BOR Form 8-90, Section 11 - Part 10

"Parcels to be Acquired"

PARCEL #	OWNER	LOCATION	ACRES	EST. VALUE
1	Jack Larson	Lot 1 - 31-160-67	34.75	\$
2	Jack Larson	NE $\frac{1}{4}$ NE $\frac{1}{4}$ - 36-160-68	13.75	
3	Jack Larson	SE $\frac{1}{4}$ NE $\frac{1}{4}$ - 36-160-68	<u>2.00</u>	
			50.5	\$5,050
4	Ole Lyster	NE $\frac{1}{4}$ SE $\frac{1}{4}$ - 36-160-68	30.0	
5	Ole Lyster	SE $\frac{1}{4}$ SE $\frac{1}{4}$ - 36-160-68	30.0	
6	Ole Lyster	Lot 2 - 31-160-67	<u>29.6</u>	
			89.6	\$8,960
7	Allen Christofferson	SE $\frac{1}{4}$ SW $\frac{1}{4}$ - 30-160-67	1.0	
8	Allen Christofferson	NE $\frac{1}{4}$ SW $\frac{1}{4}$ - 30-160-67	15.0	
9	Allen Christofferson	Lot 3 - 30-160-67	9.0	
10	Allen Christofferson	Lot 2 - 30-160-67	8.0	
11	Allen Christofferson	Lot 1 - 30-160-67	.6	
12	Allen Christofferson	SE $\frac{1}{4}$ NW $\frac{1}{4}$ - 30-160-67	12.0	
13	Allen Christofferson	NE $\frac{1}{4}$ NW $\frac{1}{4}$ - 30-160-67	14.0	
14	Allen Christofferson	SW $\frac{1}{4}$ NE $\frac{1}{4}$ - 30-160-67	8.0	
15	Allen Christofferson	NW $\frac{1}{4}$ NE $\frac{1}{4}$ - 30-160-67	<u>9.0</u>	
			76.6	\$7,660
16	Morris and Allen Christofferson	SW $\frac{1}{4}$ SE $\frac{1}{4}$ - 30-160-67	23.0	
17	Morris and Allen Christofferson	NW $\frac{1}{4}$ SE $\frac{1}{4}$ - 30-160-67	<u>23.1</u>	
			46.1	\$4,610

<u>PARCEL#</u>	<u>OWNER</u>	<u>LOCATION</u>	<u>ACRES</u>	<u>EST. VALUE</u>
18	Ernest and Phyllis Malmedal	NW $\frac{1}{4}$ NE $\frac{1}{4}$ - 31-160-67	<u>1.5</u>	<u>\$ 150</u>
		Sub-Totals	264.3	\$26,430
		Contingencies		<u>\$1,070</u>
		Total Estimated Land Costs		\$27,500

All lands are to be acquired in fee simple during the period January 1, 1968 - April 1, 1968.



DEPARTMENT OF THE INTERIOR  
BUREAU OF OUTDOOR RECREATION

PROJECT PROPOSAL - DEVELOPMENT

LEAVE BLANK FOR BOR USE ONLY

Date Received	Priority	Project Number
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Project Officer

Use this form for submission of individual projects which will develop lands and waters to facilitate their use by the public for outdoor recreation. If concurrent Acquisition is being undertaken, check here

SECTION 1

1. State or Territory **North Dakota**      2. Name and address of agency responsible for project **City of Bisbee - c/o B. A. Hadler, Mayor - Bisbee, North Dakota 58317**

3. Project Title **Big Coulee Dam and Recreation Area, Towner County, SORA Project #48-18**

4. Brief description of project  
**Located in Section 36, Township 160 North, Range 68 West, Towner County, adjacent to the City of Bisbee (population 400) and State Highway #66, the project includes construction of a dam creating a 181 acre reservoir with 1425 acre-feet capacity for outdoor recreation (78%) and municipal (22%) purposes. About 264.3 acres are to be acquired and public access will be provided. A picnicking and camping area are to be developed along with public use facilities for water-related outdoor recreation activities. Designed to meet Region IV needs for 1970, the project will also meet local unmet needs. Enhancement of the area's natural beauty is planned for the project.**

**SWC Project #1418**

5. Duration of project from **1-1-68 to 12-1-70**      6. Federal assistance requested ~~10,794~~ **\$39,932**      7. Recommended priority **A**

8. Name, Organization, and Title of individual having day-to-day responsibility for direction of project **B. A. Hadler, Mayor  
Bisbee, North Dakota 58317**      9. Name and Address to appear on check **Milo W. Hoisveen, Fiscal Officer  
State Outdoor Recreation Agency  
1301 State Capitol, Bismarck**

10. TERMS AND CONDITIONS: In submitting this Project Proposal, the State hereby accepts the Terms and Conditions set forth in the BOR Grants-in-Aid Manual, which will be a part of the Project Agreement for any grant awarded under this proposal.

11. CERTIFICATION: As the official designated to represent the State and act for the State for purposes of the Land and Water Conservation Fund Act, I recommend that assistance be made available from the Fund, when monies are available, in accordance with the recommended priority. No financial assistance has been given or promised under any other Federal program or activity with regard to the proposed project. The State or public agency to be responsible for the proposed project has the ability and intention to finance its share of the costs of this project. The Applicant will not discriminate against any person on the basis of race, color, or national origin in the use of any property or facility acquired or developed pursuant to this proposal, and shall comply with the terms and intent of Title VI of the Civil Rights Act of 1964, P. L. 88-354 (1964), and of the regulations promulgated pursuant to such Act by the Secretary of the Interior and contained in 43 CFR 17.

(Signature)

(Name)

**John Greenslit**

**State Liaison Officer**

(Date)

(Title)

12. For State use  
**7 SORA  
1 Bisbee  
1 Towner County Park Board  
1 Game & Fish  
10 SWC**

**August 25, 1967**

NORTH DAKOTA STATE WATER COMMISSION

ACQUISITION AND DEVELOPMENT PROJECT JUSTIFICATION REPORT  
BIG COULEE DAM AND RECREATION COMPLEX, TOWNER COUNTY  
SWC PROJECT #1418  
SORA PROJECT #48-18

August 25, 1967

A-D:660-1. PROJECT PLAN AND JUSTIFICATION:

A. State Plan Accord

Opportunities will be provided at the multi-purpose Big Coulee Dam and Recreation Complex for activities such as boating, swimming, camping, picnicking, fishing, hiking and playing outdoor games and sports.

The North Dakota State Comprehensive Outdoor Recreation Plan, as revised and up-dated, 1966, "Long Range Plan to 1980" indicates outdoor recreation needs on pages 60-62. In addition to assisting in meeting 1970 state needs, the project will serve local unmet needs as well.

Bureau of Outdoor Recreation priority designation "A" is accorded this project.

B. Summary of Area

Big Coulee Dam and Recreation Complex is located adjacent to the City of Bisbee (population 400) on State Highway #66 in Towner County - Economic Region IV, Devils Lake Basin.

Covered with natural grass, the area is presently utilized for agricultural purposes. Topography is ideal for installing a structure to retain water for outdoor recreation purposes over a 181 acre area. General layout of the project features are planned so as to enhance the area's appearance and add to its natural beauty.



C. Outline of Project Features

An \$85,000 dam is planned which will create a 181 acre reservoir with a capacity of 1425 acre-feet for outdoor recreation and municipal purposes. A cost estimate and site topography map are included with this proposal.

About 264 acres of agricultural land are to be acquired for the reservoir and public recreation area adjacent to the reservoir. The land is estimated to cost \$27,500.

Engineering services, estimated to cost \$4,000, are to be provided by the North Dakota State Water Commission.

Recreation facilities are to be installed for public use activities such as boating, swimming, camping, picnicking, playing games and hiking. Facilities and their costs are estimated as follows:

<u>Item</u>	<u>Number</u>	<u>Estimated Unit Cost</u>	<u>Estimated Total Cost</u>
1. Picnic and Camping Area			
a. Table	5	40	200
b. Shelter	1	500	500
c. Fireplace	2	50	100
d. Trash receptacle	5	20	100
e. Well and hand pump	1		600
f. Comfort station (pit type)	1 double		1,500
2. Boating and Swimming Area			
a. Loading ramp	1		1,000
b. Boat dock	1		1,000
c. Beach - sand	2000 CY	50	1,000
d. Bathhouse	1		1,200

<u>Item</u>	<u>Number</u>	<u>Estimated Unit Cost</u>	<u>Estimated Total Cost</u>
3. General Area Development			
a. Trees and shrubs			400
b. Signs			100
c. Parking lot			<u>900</u>
		Subtotal	8,600
		Contingencies	300
		Engineering	400
		Indirect	<u>700</u>
		TOTAL	\$ 10,000

In summary, the various project phases, their costs and cost allocations are as follows:

<u>PHASE</u>	<u>SORA</u>	<u>SWC</u>	<u>TOWNER CO. PK. BD.</u>	<u>BISBEE</u>	<u>BOR</u>	<u>TOTAL</u>
Engineering	\$ -	\$ 2,430	\$ -	\$ -	\$ 1,570	\$ 4,000
Land	-	-	8,353	8,353	10,794	27,500
Dam	-	35,000	8,319	8,319	33,362	85,000
Rec. Facilities	<u>5,000 (WC)</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>5,000</u>	<u>10,000</u>
TOTALS	\$5,000	\$37,430	\$16,672	\$16,672	\$50,726	\$126,500

Cost participation is only requested for that portion of the project costs allocated to recreation (\$101,452) and the balance is being borne by the State Water Commission, Towner County Park Board, and Bisbee. The water permit issued to the City of Bisbee by the State Engineer for this project, a copy of which is included herein, provides

that 21½% of the water is allocated for municipal use and 78½% for recreation purposes. Bisbee's foreseeable needs for municipal water are very adequately met through this formula.

D. Organizations and Coordination

All concerned state and local agencies and entities have reviewed the project proposal in draft form. Coordination of activities by project participants will be continued as each phase is developed.

Primary agencies and their responsibilities include:

1. Administration - State Outdoor Recreation Agency
2. Engineering - State Water Commission
3. Land Acquisition - Bisbee and Towner County Park Board
4. Dam Construction - State Water Commission, with contract forces and/or Towner County equipment
5. Recreation Facilities - Towner County Park Board
6. Financing - Bureau of Outdoor Recreation, State Outdoor Recreation Agency, State Water Commission, Bisbee, and Towner County Park Board

E. Economic Feasibility

The project will serve a 50 mile radius area with a population of 50,000. Anticipated annual visitation is 30,000 with an assumed value of \$1 per visitation. Annual operation and maintenance costs are estimated at \$1,800 and depreciation at \$3,380 for total annual costs of \$5,180. With estimated annual benefits of \$30,000 less \$5,180 annual costs, the average annual net benefits are \$24,820.

Assuming the \$101,452 total costs allocated to recreation were invested and compounded at 4% for 30 years, we would have a product of \$324,340. With net annual benefits of \$24,820 over the project's life



we would receive total benefits of \$744,600 indicating a benefit-cost ratio of 2.3:1. A project economic feasibility report is included with this project proposal.

F. Operation and Maintenance

The City of Bisbee and Towner County Park Board will operate and maintain the recreation complex with technical assistance from the State Water Commission for the structural maintenance which may be required. The area will be open to the public at all times. Funds for the operation and maintenance of the project will be obtained from taxes levied by the City and Towner County Park Board.

A-D:660-2. MAPS AND CHARTS

A. Included with this project proposal are the following maps and supporting data:

1. State map showing location of Big Coulee Project #48-18
2. SWC Map #6488-1418-1 "Reservoir Topography and Proposed Metes and Bounds"
3. SWC Map #6680-1418-3 "Log of Test Borings"
4. SWC Map #6718-1418-4 "Cross Sections"
5. SWC Map #6775-1418-5 "Enlarged Site Topography"
6. Design and Hydrologic Data (Office Engineer Report, dated October 31, 1966)
7. Area Capacity Curve
8. Soil Investigation Report (Investigation Engineer Report, dated October 18, 1966)
9. Water Permit and SWC Form #110 "Application for Dam Construction"

A-D:660-3. AGREEMENTS

A. The following are included with this proposal:

1. Towner County Board of Commissioners Approval - Resolution
2. Bisbee's Project Assurances
3. Construction Agreement between Towner County Park Board,  
Bisbee, State Outdoor Recreation Agency and State Water  
Commission

A-D:660-4. PLANS

- A. Construction plans for the project are in preparation and will be made available to all interested agencies and entities at a later date.

Prepared by:

  
Jim Schulz, Assistant Secretary  
North Dakota State Water Commission

JS:ka

Distribution:

7 SORA  
1 Bisbee City Auditor  
1 Towner Co.Pk.Bd.  
1 Game & Fish  
10 SWC

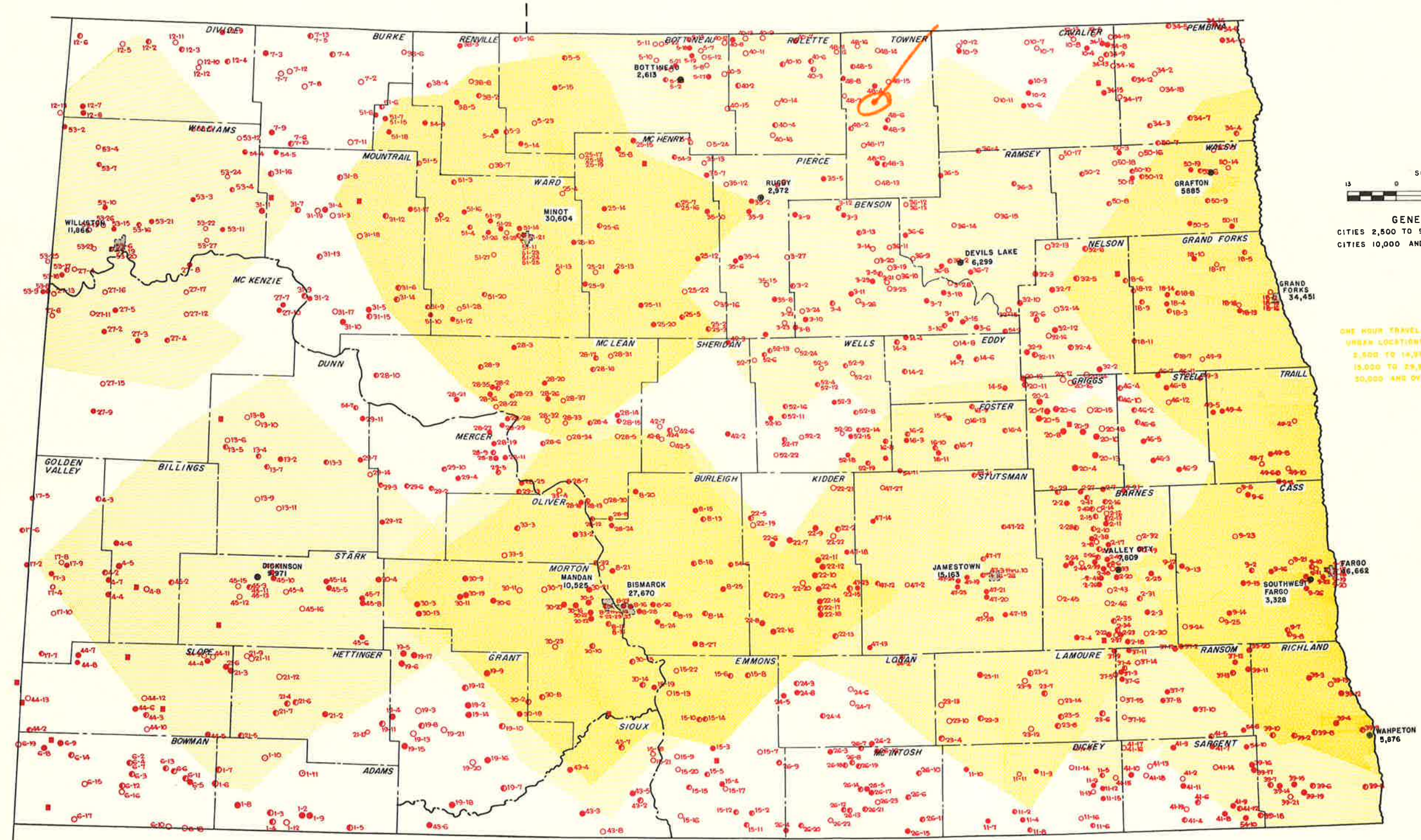
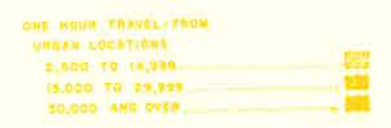


#48-18

# Map No. 3 - Generalized Extent of One Hour Travel from 1960 Urban Locations in North Dakota



**GENERAL LEGEND**  
CITIES 2,500 TO 9,999  
CITIES 10,000 AND OVER



**LEGEND**  
● EXISTING RECREATION AREAS  
○ POTENTIAL RECREATION AREAS  
◐ EXISTING & POTENTIAL RECREATION AREAS  
■ POINTS OF GEOLOGIC INTEREST





NORTH DAKOTA STATE WATER COMMISSION

COST ESTIMATE

BIG COULEE DAM  
SWC Project #1418  
August 25, 1967

Stripping - 8,000 yd. <sup>3</sup> @\$0.25	\$ 2,000.00
Core Trench Excavation - 5000 yd. <sup>3</sup> @\$0.60	3,000.00
Embankment - 70,000 yd. <sup>3</sup> @\$0.40	28,000.00
Seeding	300.00
Riprap - 1600 yd. <sup>3</sup> @\$4.00	6,400.00
Gravel - 400 yd. <sup>3</sup> @\$3.00	1,200.00
Concrete - 250 yd. <sup>3</sup> @\$90.00	22,500.00
Drawdown Pipe with Gate Valve	1,500.00
CSSP - 336 ft. <sup>2</sup> @\$5.00	<u>1,680.00</u>
Subtotal	\$66,580.00
Contingencies	7,000.00
Engineering	6,600.00
Indirect Costs	<u>4,820.00</u>
TOTAL	\$85,000.00

NORTH DAKOTA STATE OUTDOOR RECREATION AGENCY  
 Project Economic Feasibility Report  
 Benefit-Cost Ratio

Project BIG COULEE DAM AND RECREATION COMPLEX

Location (Co.) TOWNER SORA # 48-18  
 SWC # 1418

I. BASIC DATA

- A. Radius of anticipated use - 50 miles
- B. Population within use area - 50,000
- C. Anticipated annual visitation - 30,000
- D. Investment (include land) - Recreation Portion \$ 101,452
- E. Estimated life of facilities - 30 years

II. ANNUAL COSTS

- A.. Operation and Maintenance - \$ 1,800
- B. Depreciation (I.D ÷ I.E) - \$ 3,380
- C. Total annual costs - \$ 5,180

III. ANNUAL BENEFITS

- A. Assumed value per visitation - \$ 1
- B. Est. Annual Benefits (III.A x I.C) - \$ 30,000
- C. Average Annual Net Benefits - \$ 24,820  
 (III.B - II.C)

IV. BENEFIT-COST RATIO

- A. Factor for value of I. compounded  
 $\frac{\text{yrs. @ } \%}{(\text{Standard} - 30 \text{ yrs. @ } 4\% = 3.24339751)} =$  3.24339751
- B. Product of Investment (I.D) x factor (IV.A) - \$ 324,340
- C. Total benefits (III.C x I.E) - \$ 744,600
- D. Benefit-cost ratio (IV.C ÷ IV.B) - 2.3:1

Green Form - D-660-1.E

August 25, 1967



NORTH DAKOTA STATE WATER COMMISSION

OFFICE MEMO

MEMO TO: Milo W. Hoisveen, Chief Engineer  
FROM: Dale H. Glover, Office Engineer  
SUBJECT: Design Data for Big Coulee Dam, SWC Project #1418  
DATE: October 31, 1966

It has been proposed by local residents that a dam be built on Big Coulee near Bisbee, North Dakota, for the purpose of furnishing a municipal water supply to the City of Bisbee and for recreation purposes. The proposed location is in Section 36, Township 160 North, Range 68 West.

The reservoir will allow boating, fishing, and swimming. Picnicking and other recreational facilities will be installed in selected areas adjacent to the reservoir. This project will implement the outdoor recreational opportunities in Towner and adjacent counties.

The dam will consist of an earth embankment across the main coulee with a concrete chute service spillway. The chute will be 16 feet wide and under the design discharge of 1274 c.f.s., the flow depth will be 5.8 feet.

Records of runoff in the general area are meager, but it appears that, as an average, a yield of about 40 acre-feet per square mile can be anticipated. The annual total yield from the 93 square mile drainage area above the dam would be about 3720 acre-feet, or about  $2\frac{1}{2}$  times the reservoir capacity. The water surface area of the full pool will be 181 acres and the annual consumptive use due to evaporation is estimated as 540 acre-feet. This approximates the total annual water demand of the reservoir, and consequently indicates that the average supply is easily sufficient to maintain the reservoir at nearly full pool levels. The pool cannot be maintained at a constantly full level because of the variability of runoff in both volume and time; however, fluctuation of the water surface should be generally within a range of about  $1\frac{1}{2}$  feet.

Following are the physical data applicable to the design of this dam and reservoir.

### Hydrology

Drainage area	93 sq. mi.
Average annual yield	3720 acre-feet
50-year precipitation	4.5 inches in 5.0 hours
50-year frequency inflow flood	1396 c.f.s.
50-year frequency flood volume	2240 acre-feet

### Dam Embankment

Elevation of top of embankment	1581 ft., MSL
Length	1000 ft.
Maximum height	32 ft.

### Reservoir

Elevation of water surface at full pool	1571 ft., MSL
Maximum flood surcharge elevation of pool	1576 ft., MSL
Maximum depth at design full pool	22 ft.
Average depth at design full pool	7.9 ft.
Area of water surface at full pool	181 acres
Storage capacity below elevation 1571 ft., MSL	1425 acre-feet
Area of pool with depth 18 ft. or more	7.5 acres

### Spillway

Concrete chute, 16 ft. wide with drop inlet and stilling basin	
Capacity of chute at maximum flood surcharge	1274 c.f.s.
Volume of reinforced concrete in chute	200 c.y.

### Water Use

Municipal use for projected population of 500 in year 1980 at 150 g.p.c.d.	84 AF/yr.
Evaporation and seepage	540 AF/yr.

Total annual depletion	624 AF
Average annual yield	3720 AF

The reservoir will also have a riparian outlet consisting of a 12-inch steel pipe with gate-valve at the lower end, by means of which water may be released, if necessary, to downstream demands, or the reservoir drawn down for maintenance purposes.

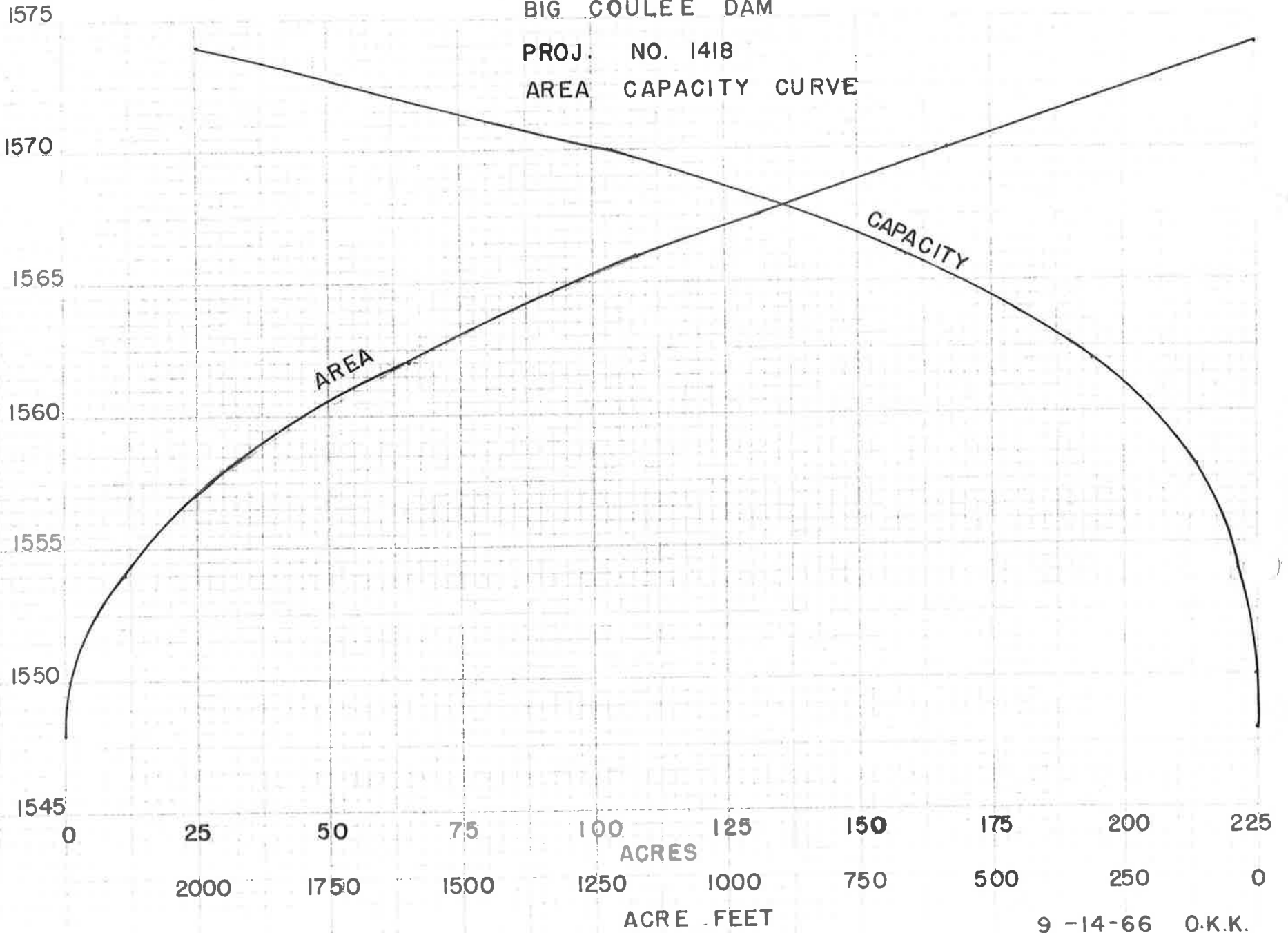
Dale H. Glover  
Office Engineer

DHG:ka

Dist.  
MWH  
DHG  
A1 G



BIG COULEE DAM  
 PROJ. NO. 1418  
 AREA CAPACITY CURVE



9 -14-66 O.K.K.

NORTH DAKOTA STATE WATER COMMISSION

OFFICE MEMO

MEMO TO: Milo W. Hoisveen, Chief Engineer  
FROM: Arland C. Grunseth, Investigation Engineer  
SUBJECT: Soil Investigation, Big Coulee Dam  
DATE: October 18, 1966

SOIL INVESTIGATION

Project No. 1418

County: Towner

Project Name: Big Coulee Dam

INTRODUCTION:

A preliminary investigation was initiated by the State Water Commission to determine the feasibility of an earth-fill dam at the proposed site on Big Coulee, northeast of Bisbee, North Dakota. A total of eleven test borings were drilled and tested by Lake Agassiz Testing Laboratories, Moorhead, Minnesota, during a period from July 18 to July 20, 1966.

The eleven test borings were drilled to depths varying from 12 to 30 feet. Borings 1 through 6 were drilled along the proposed centerline of the dam, boring 1A in the vicinity of the proposed chute spillway; the other test holes were drilled adjacent to the dam site for purposes of borrow exploration. The exact locations of the test borings and holes are shown on Drawing No. 6489-1418-2A.

Preliminary field boring logs furnished to the State Water Commission by Lake Agassiz Testing Laboratories are not a part of this report. Technical data and testing compiled herein were prepared by the staff of the State Water Commission.

GEOLOGY AND PHYSIOGRAPHY:

Big Coulee Dam Site, as described in this report, is located in Section 36, Township 160 North, Range 68 West, in the western part of

Towner County in north-central North Dakota. The surficial geology is primarily of glacial origin being situated in the Central Lowland Province (Fenneman, 1938, p. 559) and in the Drift Prairie as designated by Simpson (1929, p. 4). Surficial deposits in the dam site area consist entirely of glacial drift. Although the drift deposits are composed predominately of till and resemble each other in visual appearance, they differ somewhat in texture and composition. The bedrock in the area is the Pierre Shale of Cretaceous Age. The present creek occupying Big Coulee is a recent stream with an approximate drainage area of 93 square miles above the proposed impoundment.

#### SOIL CONDITIONS:

As explained in the introductory section, six borings were drilled along the proposed centerline of dam. Since different soil conditions exist along the coulee floor as compared to the coulee walls, the soil conditions will herein be discussed under two separate subheadings.

##### a. Coulee Walls:

The soil conditions indicated by Test Borings 1 and 3 appear to be near uniform, except for the upper twelve feet in boring number one.

Below approximate elevation 1572 the textural classification of the soil is predominantly a moderately plastic to plastic clay and clay loam within the CL soil group.

The soil is a lean textured clay (glacial till) with a fairly high silt content and occasional sand lenses. It is basically a cohesive-frictional type soil. The shear strength in Test Boring Number Three ranges from a low value of 1.00 tons per square foot to a high value of 1.83, or an average shear strength of approximately 1.41 tons per square foot. The consistency of the soil ranges from

stiff to very stiff.

The natural moisture content in boring number one ranges midway between the plastic limit and liquid limit within the upper 15 feet. However, below this depth, the natural moisture content drops below the plastic limit to denote relatively high stability. In boring number three within this same zone, the natural moisture content falls below the plastic limit throughout its entire thickness to produce a consistency index (Cr) of well above 100%.

b. Coulee Floor:

Four test borings drilled on the coulee floor indicate uniform soil conditions, consisting of gray sand in the upper levels and gray clay loam and sandy clay loam below. The gray sand was encountered in the upper levels of all but Test Boring Number Two.

Below approximate elevation 1551 the textural classification of the soil is predominantly a non-plastic sand, within the SW and SM soil group. This is the most critical soil layer in the soil foundation. It consists essentially of permeable and water bearing sands, with little or no binder material, in a loose to medium dense state. The coefficient of permeability is estimated at approximately,  $k=10^{-3}$ . It varies in thickness from approximately two feet in boring number six, to eight and eleven feet in boring number four and five, respectively. It attains its maximum thickness towards the east side of the coulee and pinches out rapidly to the west.

The lowermost portion of the foundation extends from the basal boundary of the gray sands to the final depth of each respective test boring. The soil within this zone is predominantly a gray glacial till. The textural quality of the soil is clay loam and sandy clay loam

of the CL soil group. The till is characterized by an unstratified mixture of clay, silt, sand, pebbles, and cobbles.

The till is a cohesive-frictional type soil. The cohesive strength in Test Boring Number Two ranges from a low value of 1.03 tons per square foot to a high value of 1.61, or an average cohesive strength of approximately 1.35 tons per square foot. The state of consistency of the soil within this zone varies from stiff to hard.

The natural moisture content within the basal zone lies about midway between the plastic limit and liquid limit in boring number two, whereas in boring number six the moisture content drops below the plastic limit. The result of the natural moisture content relative to the atterberg limits produces a consistency index (Cr) ranging from an average low value of approximately 50% to Cr values higher than 100%.

#### EMBANKMENT MATERIALS:

As previously mentioned, four test holes were drilled adjacent to the dam site for possible embankment material. The proposed borrow area and location of test holes are shown on Drawing No. 6489-1418-2A.

The soil encountered in the borrow area is predominantly a plastic clay within the CL soil group. Of the fine-grained soils, the CL soil group is best adapted for embankment construction. All material checked in the borrow area will be CL and suitable for fill, with the exception of some sand and gravel in the vicinity of Test Hole #3.

Information concerning textural classification, maximum dry density, and optimum moisture on material available for the dam embankment and clay core is attached at the end of this report.



RECOMMENDATIONS:


In view of the soils data encountered in the preliminary investigation and based on laboratory test results, the site is acceptable for an earth embankment with the following recommendations:

(1) A core trench should be cut into the coulee walls (abutments) and the coulee floor.

(2) The core trench shall be excavated with approximately a ten(10) foot bottom width along the main axis of the dam to the proposed depth as shown on Drawing No. 6680-1418-3 and in accordance with design specifications.

(3) Vertical excavation may vary depending upon subsurface conditions. However, the core trench shall be excavated to a minimum depth of two (2) feet into firm and impervious material.

(4) One area should be carefully checked when the trench is opened to be sure that the trench bottoms in glacial till (CL). This is in an area directly west and across the creek from Test Boring Number Six, where there is a break in slope (approximately elevation 1555).

  
Arland C. Grunseth  
Investigation Engineer

Permit No. 1444

Application for a Permit to Divert and Appropriate the Water of the State of North Dakota

Date received and filed in State Engineer's office March 23, 1967 9:00 a.m.

City of Bisbee (Name of Applicant), whose post office address is...

Bisbee, State of North Dakota, hereby applies for a permit to divert and appropriate water of the State of North Dakota as stated herein, subject to existing rights.

1. Source of proposed appropriation Big Coulee which is tributary to Mauvais Coulee and Lake Alice

2. A. Amount of water requested 1425 acre-feet storage plus 625 acre-feet annual use.

B. Proposed rate of withdrawal of water 1 cfs cubic feet per second or 450 gallons per minute.

3. Points of Diversion:

- A. (1) SE 1/4 SE 1/4 Sec. 36 Twp. 160 Rge. 68 (2) 1/4 1/4 Sec. Twp. Rge. (3) 1/4 1/4 Sec. Twp. Rge.

B. If water is to be delivered from storage reservoir complete the following: and file NDSWCC Form 110 or 111:

Location of dam SE 1/4 SE 1/4 Sec. 36 Twp. 160 Rge. 68 Height embankment above stream bed 32 Ft. Capacity of Reservoir 1425 acre-feet. Area of water surface 181 acres.

C. If water is to be obtained from well complete the following:

Proposed depth well Depth to top of Aquifer Proposed size well or well casing Depth to Bottom of Aquifer Has pump test been performed, if so, by whom Computed capacity of well

4. Purpose Municipal 21.5% - Recreation 78.5%

Sec. [vertical scale]

DO NOT COMPLETE THIS SIDE OF FORM — THIS SIDE FOR USE OF STATE ENGINEER

CONDITIONAL PERMIT

This is to certify that I have examined the foregoing application and hereby approve the same subject to prior water rights. The rate of withdrawal is not to exceed one cubic foot per second. ~~The acre-feet and rate of withdrawal are subject to modification by the State Engineer.~~ <sup>(If denied state reason, if approved state condition, if any, to approval)</sup> Failure to comply with any order of the State Engineer may result in forfeiture of water right.

The amount of water to be appropriated shall be limited to the amount that can be used beneficially, not to exceed 1425 acre feet ~~each year~~ storage plus 625 acre-feet annual use.

1. Date of priority March 23, 1967
2. Date of hearing on application June 19, 1967
3. Date of approval by State Water Conservation Commission June 30, 1967
4. Construction to be initiated on or before -
5. Construction to be completed on or before -
6. Water shall be beneficially used on or before December 31, 1972

WITNESS my hand and seal this 6th day of July, 19 67.

Thilo W. Housman  
State Engineer  
Secretary, State Water Conservation Commission

Permit No. \_\_\_\_\_

APPLICATION FOR PERMIT TO CONSTRUCT OR ENLARGE A DAM RESERVOIR

TO: Chief Engineer  
North Dakota State Water Conservation Commission  
Bismarck, North Dakota

I, Bernie Hadler, Mayor, City of Bisbee, the undersigned, do hereby apply for a permit to construct or enlarge a dam as indicated below and according to specifications shown on this and attached sheets:

1. Location: County Towner  
Legal description to nearest forty acre tract: SE 1/4 SE 1/4 Sec. 36 Twp. 160 N., Rge. 68 W.
2. Purpose: Municipal 21.5% - Recreation 78.5%
3. Data  
Drainage Area Above Dam 93 Square Miles  
Type of Dam Earth Embankment  
Type and Size of Spillway Concrete Chute Spillway 16' Wide  
Type and Size of Emergency Spillway to be added - grassed chute  
Type and Size of Gate Reservoir Control Structure \_\_\_\_\_  
Invert Height above Stream Bed of Control Structure \_\_\_\_\_  
Height of Spillway above Stream Bed 22 feet  
Surface Area of Reservoir at Spillway Crest 181 acres  
Computed Reservoir Capacity at Spillway Crest Elevation 1425 acre feet
4. Water course on which dam is to be located is a tributary to: Mauvais Coulee and Lake Alice
5. Will flows presently available to downstream riparian landowners be depleted? No If so, to what extent?  
12" Riparian Outlet Installed
6. Downstream landowners who might be deprived use of water by construction of the dam are \_\_\_\_\_
7. Is the dam and impounded water on the owners land? Yes  
(If the answer is no, proof of easement from other owner must be filed with application.)
8. For an enlargement of an existing dam, answer the following:  
Why is enlargement necessary? \_\_\_\_\_  
Year dam was constructed \_\_\_\_\_ By what agency \_\_\_\_\_  
Total yardage in existing dam \_\_\_\_\_
9. The dam will be built under the supervision of North Dakota State Water Commission and will conform to data and specifications given above and on the following attached sheets Plans on File  
(Name or Number of attached data sheet)
10. This dam will be operated in conformance to all state water laws and rules and regulations of the North Dakota State Water Conservation Commission.
11. Construction will begin on or before December 31, 1969  
and will be completed on or before December 31, 1970

Date Submitted:

Signed

*B. Hadler*

AFFIDAVIT OF DESIGNING AGENCY

The dam and reservoir described in this application and on attached sheets has been designed and approved by the North Dakota State Water Commission and, if the construction thereof is supervised by this agency, it will be built according to the specifications and data shown in this application and data sheets attached hereto.

Dated this 23rd day of March, 19 67

North Dakota State Water Commission  
(Name of Agency)

Bismarck, North Dakota  
(Address of Agency)

Designing Agency  
Signed North Dakota State Water Commission

By: Milo W. Horsween  
Title: State Engineer

For use of North Dakota State Water Conservation Commission  
**APPROVAL AND PERMIT**

This is to certify that I have examined the foregoing application and hereby approve the same subject to the rules and regulations of the North Dakota State Water Conservation Commission and the laws of the State of North Dakota subject the following conditions:

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WITNESS my hand and seal this 6th day of July, 19 67

Signed: Milo W. Horsween  
Chief Engineer  
North Dakota State Water Conservation Commission

**DISAPPROVAL**

This is to certify that I have examined the foregoing application and hereby reject and disapprove the same for the following reasons:

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from Towner County Commissioners  
minutes of May 2 1967

Commissioner Steele introduced the following Resolution and moved  
its adoption:

Whereas, requests have been made to the Towner County Commissioners for  
Towner County's approval of the contemplated proposal with regard to  
construction of Big Coulee Dam and Recreation Complex, SWC Project #1118,  
SORA Project #48-18;

And, Whereas the Towner County Commissioners have reviewed a  
proposal dated April 6 1967;

And

Whereas, the County Commissioners of Towner County are advised in the  
premises and to the extent of the proposal of April 6 1967;

Now, Therefore, be it Resolved the County Commissioners of Towner County  
hereby approve the said Big Coulee Dam and Recreation Complex tentatively  
contemplated for construction in Towner County provided never the less that  
this resolution shall in no way be interpreted as approval of the tentative  
cost allocation as proposed pursuant to the proposal dated and presented to  
said County Commissioners April 6 1967.

Commissioner Vesterso seconded the motion, and on call of roll all  
members voted "Aye".

Motion was declared duly carried and Resolution adopted.

E. M. Ellingson  
City Auditor  
Bisbee, N. Dakota

Dear Mr. Ellingson:

This is a copy of the "resolution" that  
was approved by the Board of County Commissioners yesterday  
May 2 1967.

Yours very truly

*Myrtle M. Aron*  
Towner County Auditor



SWC #1418

PART E - PROJECT ASSURANCES

(for use of SORA office only)

NORTH DAKOTA STATE OUTDOOR RECREATION AGENCY  
1301 STATE CAPITOL  
BISMARCK, NORTH DAKOTA

SORA PROJECT NO. 48-18

DATE RECEIVED \_\_\_\_\_

PRIORITY \_\_\_\_\_

APPLICANT

City of Bisbee

AGENCY

c/o B. A. Hadler, Mayor, Bisbee, North Dakota 58317

ADDRESS

PROJECT IS LOCATED IN \_\_\_\_\_

Towner

COUNTY

2. PROJECT IDENTIFICATION: TITLE Big Coulee Dam and Recreation Complex SORA NO. 48-18

LEGAL DESCRIPTION: \_\_\_\_\_ SEC. 36 TWP. 160 RGE. 68

SCOPE OF PROJECT: Construct a dam creating 181 acre reservoir with 1425 acre-feet capacity for recreation (78.5%) and municipal (21.5%) purposes costing \$85,000 acquiring 264.3 acres of land for \$27,500 and installing basic recreation facilities costing \$10,000.

TO BE STARTED January 1, 19 68 . TO BE COMPLETED December 1, 19 70

IN SUBMITTING THIS PROJECT PROPOSAL City of Bisbee

(Name of Applying Agency)

HEREBY CERTIFIES THAT:

- A. No financial assistance has been given or promised under any other Federal program or activity with regard to this proposed project.
- B. The Applicant responsible for the proposed project has the ability and the intention to finance its share of the project.
- C. The Applicant accepts the obligation to comply with applicable laws, rules and regulations in effect at the time of the award and to the further terms and conditions of the Bureau of Outdoor Recreation Manual in effect at the time of the award.
- D. Property acquired under this program will be placed in use as an outdoor recreation facility and will be retained for such use in perpetuity or otherwise as provided and agreed to in the project agreement. Prior approval of the North Dakota State Outdoor Recreation Agency will be obtained before any other disposal is made of such property.
- E. The Applicant has the intent and ability to finance the operation and maintenance of the facility being developed for so long as is required.
- F. No foreign uses of such property, other than those described in the proposal will be permitted unless approved in advance by the North Dakota State Outdoor Recreation Agency. In the event foreign use is made of such project the Applicant shall, within one year of such foreign use, reimburse the North Dakota State Outdoor Recreation Agency the cost of the project, less the amount of such cost paid by the Applicant.
- G. If for any reason it shall become necessary for any department or agency of the State of North Dakota to expend State funds in order to fulfill any obligations which the Applicant has agreed to perform in the construction and maintenance of this project, the Applicant shall, within a one year period, reimburse the State department or agency the amount of funds expended for such maintenance or operation.
- H. The Applicant understands that qualification of this project proposal by the North Dakota State Outdoor Recreation Agency does not in itself constitute an obligation or award of requested funds and does not guarantee that funds will necessarily be made available for the project.
- I. The Applicant will supply development specifications and detailed plans to the North Dakota State Outdoor Recreation Agency as requested to do so by the Executive Officer of the Agency.
- J. The Applicant shall, within thirty days after completion of the project, submit to the North Dakota State Outdoor Recreation Agency a certified and itemized statement of its expenditures made in connection with the project, and shall, upon request, make all financial records available to the North Dakota State Outdoor Recreation Agency at any time.

SUBMITTED BY CITY OF BISBEE APPLICANT

(Name of Applying Agency)

B.A. Hadler

(Authorized Representative)

TITLE MAYOR

DATE 8-15-67

(Authorized Representative)

TITLE \_\_\_\_\_

DATE \_\_\_\_\_

(Authorized Representative)

TITLE \_\_\_\_\_

DATE \_\_\_\_\_

Dist.  
SWC Proj. # 1418  
SWC Acct.  
Lea. Proj. Participant

SWC Proj. # 1418  
SORA Proj. # 48-18

A G R E E M E N T

CONSTRUCTION OF WORKS

THIS AGREEMENT is entered into by and between:

(1) The North Dakota State Water Commission, hereinafter referred to as the Commission, acting by and through, Milo W. Hoisveen, Secretary and Chief Engineer;

(2) The North Dakota State Outdoor Recreation Agency, hereinafter referred to as the Agency, acting by and through Milo W. Hoisveen (name) Executive Officer; (title)

(3) The City of Bisbee, hereinafter referred to as the City, acting by and through B. A. Hadler (name) Mayor; (title)

(4) The Towner County Park Board, hereinafter referred to as the Board, acting by and through \_\_\_\_\_ (name) Chairman. (title)

I. Project, Location and Purpose

WHEREAS, the parties to this Agreement propose to construct the following:

Big Coulee Dam and Recreation Complex

hereinafter referred to as the Project, located in Section 36, Township 160 North, Range 68 West Towner County, North Dakota, the purpose of which is to provide a water-based recreation complex (78½%) and water for municipal use (22½%).

NOW, THEREFORE, IT IS AGREED:

ii. Drawings and Specifications

That the Project shall be constructed in accordance with drawings

and specifications of the Commission, approved by  
the Board, Agency, and City,  
which drawings and specifications, to be prepared by the Commission  
(describe)

are by this reference made a part of this Agreement to the same force and  
effect as if they were incorporated into the body of this Agreement.

III. Costs and Allocations

That the estimated cost of the various Project elements and their  
allocation to the Project participants shall be as follows:

A. Preliminary Engineering and Investigations - Total Estimate \$ 4,000

- 1. North Dakota State Water Commission - \$ 2,430 or 60.8 %
- 2. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 3. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 4. Bureau of Outdoor Recreation \$ 1,570 or 39.2 %
- 5. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %

B. Land and/or Easement Acquisition - Total Estimate \$ 27,500

- 1. North Dakota State Water Commission - \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 2. Board \$ 8,353 or 30.4 %
- 3. Bisbee \$ 8,353 or 30.4 %
- 4. Bureau of Outdoor Recreation \$ 10,794 or 39.2 %
- 5. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %

C. Construction of Main Works - Total Estimate \$ 85,000

- 1. North Dakota State Water Commission - \$ 35,000 or 41.2 %
- 2. Board \$ 8,319 or 9.8 %
- 3. Bisbee \$ 8,319 or 9.8 %
- 4. Bureau of Outdoor Recreation \$ 33,362 or 39.2 %
- 5. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %

D. Construction of Appurtenant Works - Total Estimate \$ 10,000

- 1. North Dakota State Water Commission - \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 2. Agency (Water Commission Allocation) \$ 5,000 or 50 %
- 3. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 4. Bureau of Outdoor Recreation \$ 5,000 or 50 %
- 5. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %

E. Other Items - Total Estimate \$ 4,058 (State Outdoor Recreation Administrative charge)

- 1. North Dakota State Water Commission - \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 2. Agency \$ 2,029 or 50 %
- 3. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %
- 4. Bureau of Outdoor Recreation \$ 2,029 or 50 %
- 5. \_\_\_\_\_ \$ \_\_\_\_\_ or \_\_\_\_\_ %

F. Total Project Costs and Allocations - \$ 130,558

- 1. North Dakota State Water Commission - \$ 37,430 or 28.7 %
- 2. Agency \$ 7,029 or 5.4 %
- 3. Bisbee \$ 16,672 or 12.8 %
- 4. Bureau of Outdoor Recreation \$ 52,755 or 40.4 %
- 5. Board \$ 16,672 or ~~12.7~~ %

That all parties shall provide the others with cost statements within 30 days after the Project's completion and settlements shall be made within 30 days of receipt of said statements.

IV. Title to Lands and/or Easements

That title to all lands and/or easements for the Project shall be purchased in the name of The City of Bisbee by the City of Bisbee and recorded in the County Register of Deeds office wherein the Project is situated.

V. Operation and Maintenance

That the \_\_\_\_\_ City \_\_\_\_\_ shall operate and maintain the Project in accordance with rules and regulations prescribed by the Commission, Agency and Board \_\_\_\_\_.

VI. Indemnification

That the \_\_\_\_\_ City \_\_\_\_\_ does hereby accept responsibility for, and holds the Commission and the \_\_\_\_\_ Agency and Board \_\_\_\_\_ harmless from, all claims and damages to public or private properties, rights, or persons arising out of the construction, operation, and maintenance of the Project. In the event a suit is initiated or judgment entered against the Commission or Board and Agency \_\_\_\_\_ the \_\_\_\_\_ City \_\_\_\_\_ shall indemnify them for any settlement arrived at or judgment satisfied.

VI. Changes in Responsibilities

That changes in any responsibilities of the parties hereto or conditions herein stated will not be effective or binding unless such changes or conditions are made in writing, signed by the parties concerned and attached hereto.

VIII. Other Stipulations

1. Bureau of Outdoor Recreation participation is dependent upon approval by the Bureau and the availability of funds.

2. Towner County cost participation may be in the form of force account construction services, and shall be limited to an amount of \$16,672.00 only.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement the day and year indicated below.

WITNESS:

DATE:

NORTH DAKOTA STATE WATER COMMISSION  
By:

Jane Diedo

6/19/67

Melvin W. Horsman  
Secretary and Chief Engineer

Alan Schaber

8-4-67

North Dakota State Outdoor Recreation Agency

By: Jim Schuby <sup>asst</sup> Executive Officer

ATTEST:

City of Bisbee

Errol Bryson  
City Auditor

8-4-67

By: B. C. Hudler, Mayor  
Towner County Park Board

By: Maynard K. Blinn Chairman



NORTH DAKOTA STATE WATER COMMISSION

"Amendment"

January 8, 1968

BIG COULEE DAM AND RECREATION COMPLEX, TOWNER COUNTY  
 SORA Proj #48-18                      BOR #108                      SWC #1418

Land Acquisition - BOR Form 8-90, Section 11, Part 10

Subsequent to filing the Project Proposal and during the appraisal proceedings, it was determined that the land acquisition requirements for the Big Coulee Dam and Recreation Complex should be modified to reflect more accurate acreages to be acquired in fee and where permanent flooding and flowage easements should be attained.

The estimated values are based upon an appraisal report of Stanley Saugstad, Minot, dated December 1, 1967.

COST ESTIMATE AMENDMENT:

Revised Estimate for land and easements	\$36,500.00
Estimate Submitted with August, 1967 Proposal	<u>27,500.00</u>
Increase in land costs	9,000.00
78½% recreation use X \$36,500 =	28,652.50
21½% municipal use X \$36,500 =	<u>7,847.50</u>
	\$36,500.00

LAND COST ALLOCATION:

	<u>Proposed</u>	<u>Amended</u>	<u>Increase</u>
Towner County Park Board	\$8,353	\$8,353	-
Bisbee	8,353	13,819	5,466
Bureau of Outdoor Recreation	<u>10,794</u>	<u>14,328</u>	<u>3,534</u>
	\$ 27,500	\$36,500	\$9,000

PROJECT COST ALLOCATION REVISION:

With the land cost amended as noted above, the total project cost allocations could be modified as follows upon concurrence by all project participants.

	Engineering	Land	Dam	Facilities	Total
SORA (W.C.Allocation)	\$ -	\$ -	\$ -	\$ 5,000	\$ 5,000
State Water Commission	2,430	-	40,466	-	42,896
Towner County Park Board	-	8,353	8,319	-	16,672
Bisbee	-	13,819	2,853	-	16,672
Bureau of Outdoor Recreation	<u>1,570</u>	<u>14,328</u>	<u>33,362</u>	<u>5,000</u>	<u>54,260</u>
	\$ 4,000	\$36,500	\$85,000	\$10,000	\$135,500

LANDS AND EASEMENTS REQUIRED:

Landowners, locations, acreages and estimated value are shown as follows:

Owner	Location	Type of Purchase	Acre	Value
Allan & Morris Christopherson:	SE $\frac{1}{4}$ 30-160-67	Fee Simple	61.9	\$ 5,592.50
	SW $\frac{1}{4}$ 19-160-67	Flowage easement	1.1	60.50
		Severance		<u>1,200.00</u>
				<u>\$ 6,853.00</u>
Allan & Carman Christopherson:	NE $\frac{1}{4}$ 30-160-67	Fee simple	2.9	
	NW $\frac{1}{4}$ 30-160-67	Fee simple	2.8	
	SW $\frac{1}{4}$ 30-160-67	Fee simple	<u>64.1</u>	
			69.8	\$ 5,735.00
	NE $\frac{1}{4}$ 30-160-67	Flood easement	1.8	
	NW $\frac{1}{4}$ 30-160-67	Flood easement	<u>4.55</u>	
			6.35	476.25
	NE $\frac{1}{4}$ 30-160-67	Flowage easement	3.2	
	NW $\frac{1}{4}$ 30-160-67	Flowage easement	<u>8.2</u>	
			11.4	627.00
		Severance		<u>1,916.70</u>
				<u>\$ 8,754.95</u>
Olga Malmedal et al:	NE $\frac{1}{4}$ 31-160-67	Fee simple	.14	10.50
		Severance		<u>39.50</u>
				<u>\$ 50.00</u>
Ole Lyster:	NE $\frac{1}{4}$ NW $\frac{1}{4}$ 31-160-67	Fee simple	9.2	
	Lot 2, 31-160-67	Fee simple	30.7	
	Lot 3, 31-160-67	Fee simple	15.6	
	Lot 4, 31-160-67	Fee simple	13.7	
	SE $\frac{1}{4}$ 36-160-68	Fee simple	<u>71.3</u>	
			140.5	11,612.50
		Severance		<u>2,603.00</u>
				<u>\$14,215.50</u>

<u>Owner</u>	<u>Location</u>	<u>Type of Purchase</u>	<u>Acres</u>	<u>Value</u>
Jack R. Larson:	Lot 1,31-160-67	Fee simple	34.8	
	SE $\frac{1}{4}$ , NE $\frac{1}{4}$ 36-160-68	Fee simple	14.5	
			<u>49.3</u>	\$ 3,947.50
	NE $\frac{1}{4}$ , NE $\frac{1}{4}$ 36-160-68	Flood easement	1.2	90.00
	SE $\frac{1}{4}$ 25-160-68	Flowage easement	.33	
	NE $\frac{1}{4}$ 36-160-68	Flowage easement	4.5	
			<u>4.83</u>	265.65
		Severance		1,800.00
				<u>\$ 6,103.15</u>
		Total appraised value		\$35,976.60
		Contingencies		<u>523.40</u>
		Total estimated land value		<u>\$36,500.00</u>