

1. Considered: 12-2, 1981 FUTURE USE
Water Right No. 4831-3

2. Name of Applicant CENDAK WATER SUPPLY SYSTEM, INC.

3. Post Office Address BOX 69-MILLER 57362

4. Amount of Water Claimed 1,500,000 ACFT/ANN ~~maximum acre feet~~

5. Source of Water Supply MISSOURI RIVER (Oahe Reservoir)

6. Water to be used for MULTIPLE acres to be irrigated 396,000

7. County HUGHES about 6 miles NORTH of PIERRE

8. PROOF OF PUBLICATION: Received 12-1-81 Not Received _____

APPLICATION: Approved ✓ Subject to Forward to State Legislature

Not Approved _____ Action Deferred without recommendation By WMB

for Legislature's consideration

Dated Received 11/18/81 Application complete yes no _____ FEE N/A

Remarks _____

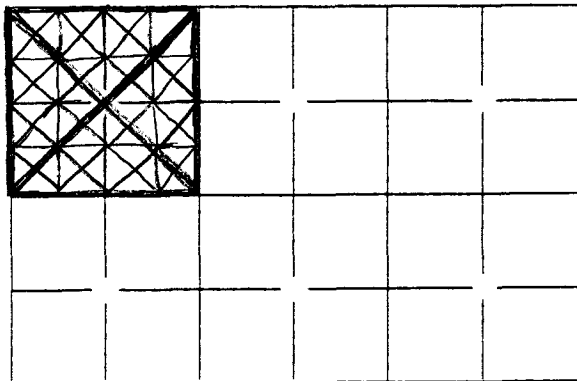
Corrected Application received _____ Period of Annual Use CONTINUOUSLY

FOR OTHER USES

Received yes _____ no _____ APPROVED/CONDITIONAL (Circle one) MAR/OCT For IR

WI-1 Description same as application - yes _____ no _____ Remarks _____

Disapproved _____ Returned _____



Diversion Point _____

NW⁴, SEC. 6-T11N-R79W

~~Land to be irrigated~~ _____

PRIORITY
11/18/81

WATER
QUALITY
N/A

WELL LOG Driller N/A Licensed - yes _____ no _____

Depth _____

Remarks _____

MAP Map No. 4039-3 Map located in Water Right X Map file _____
Type of Map DRAWN Prepared by PE - Oehlberg

+++++

REVIEWED This Application was received within 30 days of the date received, accepted as complete, Number assigned and written up for advertisement before the Board on:

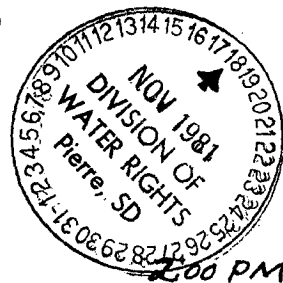
11/20/81
given to newspaper on 20th,

Petty Westlund
(Signed)

+++++

PROTESTS Letters/Petitions in File - yes _____ no _____ Remarks _____

REMARKS Date
F.F. & C. Final Decision, including F.F. & C. of Law were adopted _____
OF LAW, Date
FINAL Final Decision mailed to parties and/or parties notified that Final Decision was
DECISIONS adopted _____
ETC. Remarks _____

No. 4831-3Map No. 4039-3 Water Division No. 3 MISSOURI RIVER District
Above for Office Use 10140101

APPLICATION FOR PERMIT To Appropriate Water within the State of South Dakota

Check one of the following:

New _____ Vested Right _____ Future Use XX

Change in Diversion _____ Additional Diversion _____

Change in Acreage _____ Additional Acreage _____

1. Name of Applicant CENDAK Water Supply System, Inc. Phone No. 853-2705
Box 69 Miller SD 57362
 Post Office Address (Street, RR, or Box) (Town) State (Zip Code)
 If a corporation show date and place of incorporation 11-18-81 Pierre SD

2. Method of accomplishing work (contract, employment of others, or by direct labor) contract3. Name of diversion work CENDAK Water Supply System4. Amount of water claimed (cubic feet per second) 1,500,000 acre feet annually5. Source of water supply Missouri River (Oahe Reservoir) storage6. Location of point of diversion NW $\frac{1}{4}$ Section 6, 111, 79County Hughes7. Annual period or periods during which water is to be used March through October for irrigation8. Use to be made of water, (irrigation, industrial, municipal, commercial, recreation, etc.) other uses year around multipurpose9. For irrigation use, Total number of acres to be irrigated 396,000 POTENTIAL

List below each forty acre subdivision, or lot, or fraction thereof and show number of acres to be irrigated in each.

Land Description	No. Acres Irr.	Land Description	No. Acres Irr.

Attach sheet if more space is needed

10. Time required to complete construction of water supply system NA years. Additional time required to complete application of water to the proposed beneficial use NA years.

11. Choice of county newspaper for publication of Notice of Intent to Appropriate Water DAILY CAPITAL JOURNAL

12. Principal Features of the Proposed Water Supply System.

A. Works proposed to divert water from its natural source.

Pumping station on Missouri River

B. Works proposed to transport water to place of use.

Canal and Reservoir System

C. Works proposed to apply water to beneficial use.

Secondary lateralsPipelinesEstimated Total Cost \$ NA

Attachments: Attach Form 2A if diversion from a well or dugout, or if storage of water, is proposed. Attach map.
 (see instructions concerning preparation.)

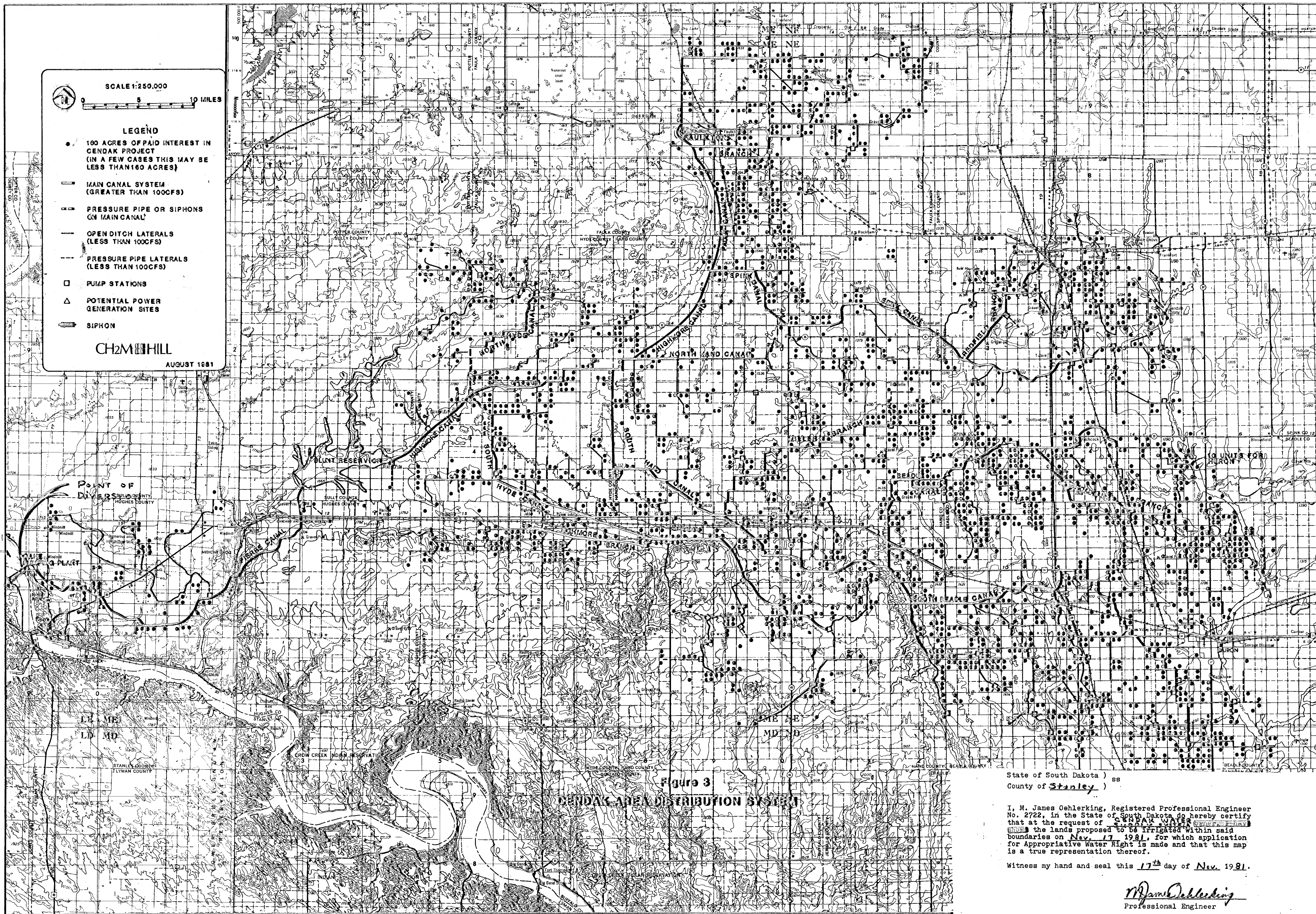
STATE OF SOUTH DAKOTA)
 County of Hughes) ss.

I, _____ the applicant, certify that I have read the foregoing application and have examined the attached map and that the matters therein stated are true and that I intend, and am able to complete the necessary construction.

Signed David H. Hauschild ChairmanSubscribed and sworn to before me this 17th day of November, 1981Karen Schlaak

Notary Public (or other qualified officer)

KAREN SCHLAACK, Ad. Sec.
 Water Rights Division



SCALE 1:250,000
0 5 10 MILES

LEGEND

- 100 ACRES OF PAID INTEREST IN CENDAK PROJECT (IN A FEW CASES THIS MAY BE LESS THAN 160 ACRES)
- MAIN CANAL SYSTEM (GREATER THAN 100CFS)
- PRESSURE PIPE OR SIPHONS ON MAIN CANAL
- OPEN DITCH LATERALS (LESS THAN 100CFS)
- PRESSURE PIPE LATERALS (LESS THAN 100CFS)
- PUMP STATIONS
- △ POTENTIAL POWER GENERATION SITES
- SIPHON

CH2M HILL

AUGUST 1981

Figure 3
CENDAK AREA DISTRIBUTION SYSTEM

State of South Dakota) ss
County of Stanley)

I, M. James Oehlerking, Registered Professional Engineer No. 2722, in the State of South Dakota do hereby certify that at the request of CENDAK WATER CONVEYANCE DISTRICT the lands proposed to be irrigated within said boundaries on Nov. 17, 1981, for which application for Appropriative Water Right is made and that this map is a true representation thereof.

Witness my hand and seal this 17th day of Nov. 1981.

M. James Oehlerking
Professional Engineer

MA.

MAP#
4039-3

APPL.
4831-3

WATER RIGHT APPLICATION APPROVAL

The Water Management Board hereby approves Water Right Application No.

4831-3

CENDAK WATER SUPPLY SYSTEM, INC. - BOX 69 MILLER

(Applicant)

(Post Office Address)

SOUTH DAKOTA 57362

(State)

With the following qualifications.

Date of first receipt of application _____, 19____

Date of return to applicant for correction, amendments or changes required _____, 19____

Date of receipt of corrected application _____, 19____

Approved _____, 19____, Recorded in Book _____ Page _____

WATER RIGHT PERMIT NO. _____

The Water Management Board hereby grants and issues this Water Right Permit No. _____ authorizing the construction of the water use system and the putting of water to beneficial use as stated in the Application and as qualified in the Water Right Application approval, subject, however, to the following limitations and conditions:

1. The date from which applicant may claim right is _____, 19____
2. The equivalent of at least one-fifth of the work above specified is to be completed on or before _____, 19____
3. The whole of said work is to be completed on or before _____, 19____
4. The limit of time from proof of beneficial use of water appropriated in accordance herewith is _____, 19____
5. The water appropriated shall be used for the purpose of _____

6. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be injuriously affected by this appropriation.

7. The amount of the appropriation herein granted shall not exceed _____ cubic feet per second; neither shall it exceed the capacity of the above described water supply system, nor shall it exceed the amount of water needed for beneficial uses served, and if for irrigation purposes said appropriation must be limited to not more than 2 acre feet per acre per year and be limited to not more than one-seventieth (1/70) of one cubic foot of water per second of time for each acre of land to which water is actually and beneficially applied

for irrigation on or before _____, 19____; said water to be used during the following described annual period: _____

Witness my hand this _____ day of _____, 19____

THE WATER MANAGEMENT BOARD

By: _____
Chief Engineer, Water Rights

Certificate of Construction Issued _____, 19____

Water License Issued _____, 19____

STATE OF SOUTH DAKOTA
OFFICE OF
THE SECRETARY OF STATE

Certificate Of Incorporation
Non - Profit

I, ALICE KUNDERT, Secretary of State of the State of South Dakota, hereby
certify that duplicate originals of the Articles of Incorporation of

.... **CINDAK WATER SUPPLY SYSTEM, INC.**
duly signed and verified, pursuant to the provisions of the South Dakota Nonprofit
Corporation Act, have been received in this office and are found to conform to law.

ACCORDINGLY and by virtue of the authority vested in me by law, I hereby issue this
Certificate of Incorporation of

.... **CINDAK WATER SUPPLY SYSTEM, INC.**
and attach hereto a duplicate original of the Articles of Incorporation.

IN TESTIMONY WHEREOF, I have hereunto
set my hand and affixed the Great Seal of the
State of South Dakota, at Pierre, the Capital,
this **18th** day of

..... **November** .. A.D. 19 **81** ..

Alice Kundert
.....
Secretary of State

.....
Deputy

and this 18th day of
Nov. 1981

Alvin Linder
SECRETARY OF STATE

NOV 18 1981

ARTICLES OF INCORPORATION
OF
CENDAK WATER SUPPLY SYSTEM, INC.

Executed by the undersigned for the purpose of forming a
South Dakota corporation under the provisions of SDCL 47-22,
the South Dakota Non-Profit Corporation Act.

ARTICLE I

The name of the corporation is Cendak Water Supply System,
Inc.

ARTICLE II

The period of existence is perpetual.

ARTICLE III

The purpose or purposes for which the corporation is organized
are as follows:

- (a) To foster, promote, and advocate the orderly development
of water, soil and recreational resources in Hughes,
Beadle, Spink, Hand, Hyde and Faulk Counties;
- (b) To encourage, promote and assist in the coordination
of federal, state, and local plans and activities
relating to development of such resources;
- (c) To advise, confer and negotiate with government agencies,
political subdivisions, non-profit organizations and
private interests with respect to the development of
such resources;
- (d) To render all practicable services in obtaining, main-
taining, and preserving favorable state and local
legislation for, and opposing legislation being hostile
to, the development of such resources;
- (e) To accept and use donations of money, property, personal
services, or facilities to affect the purposes for which
this organization is established;
- (f) To acquire, hold, own, maintain, and control water and
water rights from the Missouri River or other sources
of supply;

- (g) To educate and disseminate information to members and general public pertaining to the needs and possibilities of development of such resources;
- (h) To do all and everything necessary, suitable and proper for the accomplishment of any of the purposes or the furtherance of any of the powers or objectives herein set forth, either alone or in association with other corporation, individuals, governmental organizations, and to do every other act or thing incidental or pertinent to or drawing out of or connected with the aforesaid purposes or powers or any part or parts thereof, provided the same be not inconsistent with the laws under which this corporation is organized.
- (i) In addition to the foregoing powers, this corporation shall have and possess all the powers set forth according to the South Dakota Non-Profit Corporation Act.

ARTICLE IV

The corporation shall have one class of members which shall consist of individuals, associations, firms, corporations, and partnerships engaged in or interested in the development of irrigation, and the development of water, soil, and recreational resources, and whose objectives and purposes are in keeping with the objectives and purposes of the corporation as above described, upon payment of the annual dues as provided in the By-Laws.

ARTICLE V

The address of its registered office is Box 69, Miller, South Dakota, 57362, and the name of its registered agent at such address is James Lewis. 405 E J 15 register-office DRL

ARTICLE VI

The number of directors constituting the Board of Directors is 18 and the names and addresses of the directors are as follows:

NAME	ADDRESS
Galen Theobald	P. O. Box 884 Pierre, SD 57501
Lyle Stewart	Rural Route Blunt, SD 57522
Dave Hauschild	212 North Fir Pierre, SD 57501
Gary Haiwick	Route 2, Box 170 Highmore, SD 57345
James Schuette	P. O. Box 266

Don Faulstich	Highmore, SD 57345
	Route 1, Box 39
	Highmore, SD 57345
Harvey Faulstich	Rural Route
	Orient, SD 57467
Jerry Poindexter	Route 4
	Miller, SD 57362
Ron Jennings	<i>St Lawrence</i> 57173 <i>ack</i>
	South Dakota
Curtis Bauman	Rural Route 2
	Huron, SD 57350
Dennis Slepekas	Rural Route 2
	Huron, SD 57350
Gerald Bischoff	Rural Route 2
	Huron, SD 57350
Roger Masot	Rural Route 2, Box 50
	Redfield, SD 57469
Greg Bixler	Rural Route 1
	Hitchcock, SD 57348
Doyle Harms	Rural Route 2, Box 56
	Redfield, SD 57469
Doug Dieter	<i>R.R.</i> Faulkton, <i>SD</i>
	South Dakota 57438
Stanley McCloud	Rural Route
	Cresbard, SD 57435
Dennis Biedenfeld	<i>R.R.</i> Faulkton, <i>SD</i>
	South Dakota 57438

ARTICLES VII

The names and addresses of the incorporators are as follows:

<u>NAME</u>	<u>ADDRESS</u>
David L. Hauschild	212 N. Fir, Pierre, SD 57501
Donlan Faulstich	Route 1, Box 39 Highmore, SD 57345

Jerry Poindexter

Route 4,
Miller, SD 57362

ARTICLE VIII

Assets of the corporation shall include gifts, bequests and any lawful charges made for services rendered and also dues collected in accordance with the By-Laws.

ARTICLE IX

By-Laws of the corporation for the management of its affairs shall be adopted by the Board of Directors and may be amended or repealed by means of a majority vote of the voting members present at any regular or special meeting of the membership.

ARTICLE X

In the event of the liquidation or dissolution of the corporation, the assets of the corporation, after payment of all debts and obligations, shall be disposed of by the then existing Board of Directors as a gift to some organization, society, institution of higher learning, or a corporation actively engaged in the enhancement of irrigated agriculture, that is approved as a non-profit organization exempt from income tax by the Internal Revenue Service.

ARTICLE XI

These Articles may be amended in the manner authorized by law at the time of amendment.

Executed in duplicate this 18th day of November, 1981.

David L. Hauschild
Donlan Faulstich
Jerry Poindexter

State of South Dakota)
County of Hyde) ss

On this 18th day of November, 1981, before me, the undersigned, personally appeared David L. Hauschild, Donlan Faulstich, and Jerry Poindexter, known to me or satisfactorily proven to be the persons whose names are subscribed to the within instrument,

and acknowledged that they executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(SEAL)

D. G. Matre
Notary Public
D. G. MATRE
Notary Public — South Dakota
HYDE COUNTY
My Commission Expires 2-1-84

State of South Dakota)
County of Hyde) ss

David L. Hauschild, Donlan Faulstich and Jerry Poindexter, being first duly sworn, each for himself deposes and says: that he is one of the persons described in who signed to foregoing Articles of Incorporation as an incorporator therein; that he has read said Articles and knows the contents thereof; that the incorporators intend in good faith to form a corporation for the purposes of the promotion of a lawful business set forth in said Articles, and not for the purpose of enabling any corporation or corporations to avoid the provisions of SDCL Chapter 37-1 relating to unlawful trusts and combinations and laws amendatory thereto.

David L. Hauschild
Donlan Faulstich
Jerry Poindexter

Subscribed and sworn to before me this 18th day of November, 1981.

(SEAL)

D. G. Matre
Notary Public
D. G. MATRE
Notary Public — South Dakota
HYDE COUNTY
My Commission Expires 2-1-84

Receipt No. C21499

File No. NS-7287

ARTICLES OF INCORPORATION OF

CENDAK WATER SUPPLY SYSTEM, INC.

Filed at Request of

Dave Hauschild
212 North Fir
Pierre, SD 57501

State of South Dakota

Office of Secretary of State

Filed in the office of the Secretary of State on

the 18th day of Nov 19 81

Alice Lunder
Secretary of State

By _____
Deputy

Fee Received \$20

CENDAK
IRRIGATION PROJECT

MASTER PLAN

CH₂M  HILL

SEPTEMBER 1981



engineers
planners
economists
scientists

September 2, 1981

D14992.A0

Mr. David Hauschild
Chairman
CENDAK Steering Committee
212 North Fin
Pierre, South Dakota 57501

Dear Mr. Hauschild:

Transmitted herewith is the Master Plan report for the
CENDAK Irrigation Project.

This report has been prepared in accordance with instructions from the CENDAK Steering Committee's Executive Board. It is organized essentially in accordance with the Appraisal Report outline provided by the Bureau of Reclamation dated March 9, 1981. Under separate cover, we are also transmitting a brief report providing cost curves and procedures to estimate costs for smaller laterals of less than 100 cfs and on-farm facilities, both open-ditch and pipe systems.

CH2M HILL appreciates the opportunity to work on a new and exciting concept in irrigation development. If we can be of further assistance, please let us know.

Sincerely,

A handwritten signature in cursive script that reads "Michael R. Stansbury".

Michael R. Stansbury, P.E.
Manager, Water Resources Division

jle
Enclosures

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Chapter I

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The CENDAK Irrigation Project is an outgrowth of several attempts over many years to bring irrigation to Central South Dakota. The project will serve an area of approximately 400,000 acres in six South Dakota counties through a series of canals and pumping stations. The project would utilize a portion of the uncompleted Oahe Unit facilities, plus approximately 390 miles of additional main canals of over 100 cubic feet per second. This report presents a master plan for development of the area; the estimated costs, financing, and operating options; and the steps for conducting a feasibility study.

PROJECT DESCRIPTION

A preliminary plan has been developed that will provide irrigation water to 396,000 acres through a series of pumping stations, canals, laterals, and pipelines. The project will utilize water pumped from Oahe Reservoir on the Missouri River near Pierre, and will extend eastward to the vicinity of the City of Huron. Figures 1, 2, and 3 present maps showing the general location of the project, the lands to be served, and the preliminary alignment of the main project features.

The main features of the plan include the 3,200-cfs capacity Oahe Pumping Plant and Pierre Canal; the 381,000-acre-foot (active storage) Blunt Reservoir; the 7,300-cfs Highmore Canal; and numerous other canals, laterals, and pumping plants. The Oahe Pumping Plant, Pierre Canal, and Blunt Reservoir were all part of the partially constructed Oahe project.

Potential low head hydroelectric power sites have been identified on some of the main canals. These sites should be fully evaluated in future studies.

PUBLIC INVOLVEMENT

The CENDAK project is being sponsored by the steering committees established in each of the six counties and by an executive committee comprised of three members from each county committee. These groups have been actively generating local support for the project and have collected contributions totaling over \$100,000 from landowners who are interested in receiving water from the project. These monies have been used to pay expenses related to investigating the project and preparation of this Master Plan Report.

ALTERNATIVES CONSIDERED

A number of different canal alignments for the distribution system were considered in developing the irrigation system. Wherever possible, an attempt has been made to follow section lines for the canal alignment and stay away from wetlands and potential environmentally sensitive areas. The proposed system configuration is intended to be representative of the type of system that could be built to serve the lands identified for irrigation. It is likely that substantial changes could occur during feasibility and final design studies.

The cost of the major facilities for the CENDAK project is estimated at approximately \$375 million. This cost includes all major pumping plants, canals, canal branches, and appurtenant structures.

Based on the total area served, 396,000 acres, the unit cost of the main delivery system is \$950 per acre. Based on acres irrigated by the center pivots, 335,000 acres, the unit cost of the main delivery system is \$1,120 per acre.

In addition to the main delivery system, costs for laterals less than 100 cfs and on-farm facilities can be estimated by procedures outlined in a separate report on determining costs for the lateral distribution system. Two primary types of lateral distributions were considered; one with open gravity fed ditches to on-farm pumps and the other, pressure pipes served by pumping stations on the main canals. Typical cost of the open ditch lateral system would be \$1,070 per acre at 50-percent density. Typical cost of the pressure pipe lateral system would range from \$600 per acre for a pivot adjacent to a main canal to \$1,820 per acre for a single pivot 2 miles from the main canal.

Annual operation cost of the main delivery is estimated to be \$8.35 per acre for general O&M and \$1.01 per acre for basic pumping power cost. In addition, those areas requiring multiple pumping lifts, such as the Highmore Branch, could reach \$15.50 per acre based on the assumptions used.

FEDERAL INVOLVEMENT

The Oahe Unit of the Missouri Basin Pick-Sloan Project was authorized by Congress as part of the irrigation function of the overall basin plan and to replace lands flooded along the Missouri River when Oahe Dam was constructed. However, several groups voiced such strong opposition that the project was placed in a "deferred" status. Although the CENDAK project is not directly related to the Oahe Unit, the project sponsors would like to substitute proposed Oahe funding for the major facilities of the CENDAK project. The Federal

government would then be relieved of its responsibility to replace the original Oahe project lands. As part of the commitment of the Federal government to develop and improve living conditions in the Great Plains Region, provisions were enacted to utilize excess power revenues for water resources development. Fulfillment of that commitment, even 40 years later, would greatly enhance the CENDAK project.

PROBLEMS AND NEEDS

The project is designed to accomplish two main goals:

1. To bring high-quality water to nearly 400,000 acres of fertile lands in central South Dakota, and;
2. To develop sufficient irrigated land so that the economic trends in the area can be reversed and economic growth can be promoted.
3. To provide an assured supply of high quality water for multiple use in the project area.

The proposed CENDAK project is one of the most promising ways of accomplishing these goals.

INSTITUTIONAL ARRANGEMENTS

Three major areas requiring appropriate institutional arrangements are discussed. These are sponsoring entity, water rights, and financial arrangements. A unique project of the type envisioned will require an appropriate sponsoring entity. The entity must be legally strong, yet flexible to meet the changing needs of the project. It must also be acceptable to local members and local, state, and Federal governmental agencies. Five options were considered: a nonprofit corporation, an irrigation district, a water user district, a separate conservancy subdistrict, and the Oahe Conservancy Sub-District. It is recommended that a water user district be formed which covers only those lands to be irrigated.

Upon acceptance of a Master Plan concept and the establishment of a water user district, it is further recommended that a future use water application be prepared and filed with the state. This future use permit will require legislative approval. Upon completion of the preliminary plans and feasibility studies, the future use permit should be converted into a regular water right permit. This may be done in stages.

The final and most difficult institutional arrangement is to plan for financing of the project. Financing of the preliminary design and feasibility study could require up to 1 or

2 percent of the anticipated construction cost. Raising \$4 million to \$8 million, or \$10 to \$20 per acre, could be difficult. Initially a more limited feasibility could be undertaken with the preliminary design of a definite plan delayed to a later date. Options include a per-acre assessment, subdistrict or county financial assistance, state financial assistance, Federal government appropriations, and/or a combination of these methods. Considering the economic conditions of the project area with its recurring disaster designations due to drought conditions and its potential for a viable economy based on irrigated agriculture, it would be appropriate for Federal assistance in conducting the feasibility and preliminary design studies.

Financing of capital cost will again require innovative combinations of private and public assistance. Operational and maintenance costs, along with a portion of the amortized capital costs, should be covered by water service contract revenues.

Chapter II INTRODUCTION

PURPOSE AND SCOPE

The CENDAK Irrigation Project Master Plan has been prepared at the request of people in the project area to investigate the potential of transporting and developing water from the Missouri River for use in central South Dakota. The primary purpose of the water development project is irrigation. Additionally, water would be supplied for municipal and industrial use, rural water systems, livestock supplies, recreation, fish and wildlife, and stream flow augmentation.

Over the past few months, residents of Hughes, Hyde, Hand, Faulk, Spink, and Beadle Counties who desired a reliable water supply system for irrigation and other uses have worked hard to assess the overall interest; they now want to proceed with project development. This Master Plan, financed fully from local assessments, is a further step in assessing the developmental potential.

The scope of the Master Plan is broad. It attempts to briefly describe the project area, report the degree of public involvement to date, describe the resource problems and needs of the area, evaluate the resource capabilities, and make an appraisal formulation and evaluation of a potential project. The institutional constraints and requirements are also discussed, along with a proposed plan of study to carry the project through its next step toward completion. Major emphasis will be upon project formulation and evaluation to meet the expressed desires of the local sponsoring organization.

The physical plan and facilities proposed herein are based upon limited field investigations and data. The project formulation is at appraisal level, which means that many alternatives have not been fully formulated and evaluated. Preliminary cost estimates are provided; however, it must be recognized that these could change drastically, depending upon which alternatives are ultimately selected and developed.

PREVIOUS INVESTIGATIONS

The utilization of Missouri River water to irrigate the broad, fertile lands of east central South Dakota has been desired by South Dakotans since before the turn of the century. The development of more efficient construction machinery and methods, efficient pumps and water control systems, and circular sprinkler systems over the past few

decades makes it physically possible to transport and utilize water for irrigation over large areas heretofore restricted from such development. The control and regulation of Missouri River stream flows by the system of mainstem dams developed under the Pick-Sloan Missouri Basin program and the availability of low-cost hydropower developed at these same mainstem dams further provide an opportunity to utilize Missouri River water.

There have been numerous studies and investigations of water resources capabilities and potential developments in central South Dakota. None, however, has dealt specifically with the CENDAK water supply system concept. Some of the more significant reports dealing with portions of the project area include:

- o House Document 475 (78th Congress, Second Session), Missouri River Basin Plan of the Corps of Engineers, 1944.
- o Senate Document 191 (78th Congress, Second Session), Missouri Basin Plan of the Bureau of Reclamation, 1944.
- o Senate Document 247 (78th Congress, Second Session), Missouri River Basin Project, 1944.
- o "Water and Related Land Resources, James River Basin and Designated Missouri River Sub-Basins, South Dakota," Department of Agriculture, May, 1966.
- o "Information on Past Studies and Alternative Considerations for James River Basin, North and South Dakota," Department of the Army, Missouri River Division, Corps of Engineers, Omaha, Nebraska, January, 1971.
- o "Report on Oahe Unit, MRBP," Department of the Interior, Bureau of Reclamation, May, 1965.
- o "Supplemental Report on Oahe Unit, MRBP," Department of the Interior, Bureau of Reclamation, June, 1965.
- o "Oahe Unit, MRBP-South Dakota," House Document No. 163 (90th Congress, First Session), August 31, 1967.
- o "Definite Plan Report on Initial Stage: Oahe Unit, MRBP," Department of the Interior, Bureau of Reclamation, January, 1971.

- o "Status of Investigations, Municipal and Industrial Water, Oahe Unit, P-SMBP," Department of the Interior, Bureau of Reclamation, September, 1972.
- o "Final Environmental Impact Statement, Oahe Unit, P-SMBP," Department of the Interior, Bureau of Reclamation, December 17, 1973.
- o "Appraisal Report on Eastern South Dakota Basins," Department of the Interior, Bureau of Reclamation, August, 1975.
- o "Resource Inventory of the James River Basin," Volume II-B, Section 10, South Dakota Water Plan, South Dakota Department of Natural Resources Development, December, 1978.
- o "Resources Inventory of the Missouri Coteau," Volume II-B, Section 14, South Dakota Water Plan, South Dakota Department of Natural Resources Development.
- o "Resources Inventory of the Missouri Mainstem River Basin, Lake Oahe, and Lake Sharpe Subbasins," Volume II-B, Section 15A, South Dakota Water Plan, Dakota Department of Natural Resources Development, November, 1976.
- o "Report on Oahe Unit Termination Study, Initial Stage, Oahe Unit, P-SMBP," Department of the Interior, Water and Power Resources Service, May, 1980.
- o "Riverside Appraisal Study, Economic/Demographic and Social Assessment," ABT Associates, Inc., January 9, 1981.

In addition to these reports, the Bureau of Reclamation has completed construction plans for the Oahe Pumping Plant, Pierre Canal, Medicine Creek Siphon, and Blunt Reservoir of the Oahe Unit, Pick-Sloan Missouri Basin Program. The design criteria for the Highmore Canal have been approved and much of the layout is completed. These plans and designs can be incorporated into the CENDAK water delivery system as well as those facilities partially constructed.

Chapter III SETTING

LOCATION OF PROJECT AREA

The CENDAK irrigation project area is located in central South Dakota. It is bordered on the west by Lake Oahe and Lake Sharpe; on the south by the southern boundaries of Hughes, Hyde, Hand, and Beadle Counties; on the east by the James River; and on the north by Highway 212 in Spink County, by Highway 20 in Faulk County, and the northern boundaries of Hyde, part of Sully, and Hughes Counties. Total area is 5,034 square miles, or 3,221,000 acres. Figure 1 presents an outline of the project area.

SOCIAL AND ECONOMIC CHARACTERISTICS

The economic base of the project area consists primarily of dryland farming and ranching. With the exception of Hughes County, all counties are heavily dependent upon the agricultural economy. Hughes County, with the state capitol in Pierre, is dominated by state government activities.

History and Settlement

All of South Dakota was part of the Louisiana Purchase secured from France in 1803. The American Indians were natives of the area, with the Sioux tribe dominating at the time of the coming of the white man. The Lewis and Clark Expedition passed through the area on its way up the Missouri River in 1804, although other explorers and fur traders were in the area prior to that time. In 1861, the Dakota Territory was created by Congress, but it was not until 1889 that North and South Dakota were admitted to the Union as states.

The advent of the railroads in the late 1870s and early 1880s really established the "Great Dakota Boom." Land within the project area was opened for settlement and many immigrants from European countries settled in the area. Towns such as Huron, Miller, Highmore, Blunt, and Pierre became "railhead boomtowns" for a few short months.

Population

The total population of the CENDAK project area has been declining since the 1930s. The only area showing significant population increases has been Hughes County; this is due to the impact of state government growth in the City of Pierre. Also, the construction of Oahe Dam and Big Bend Dam in the 1950s and early 1960s contributed to an anomaly in population trends for communities adjacent to the Missouri River. The

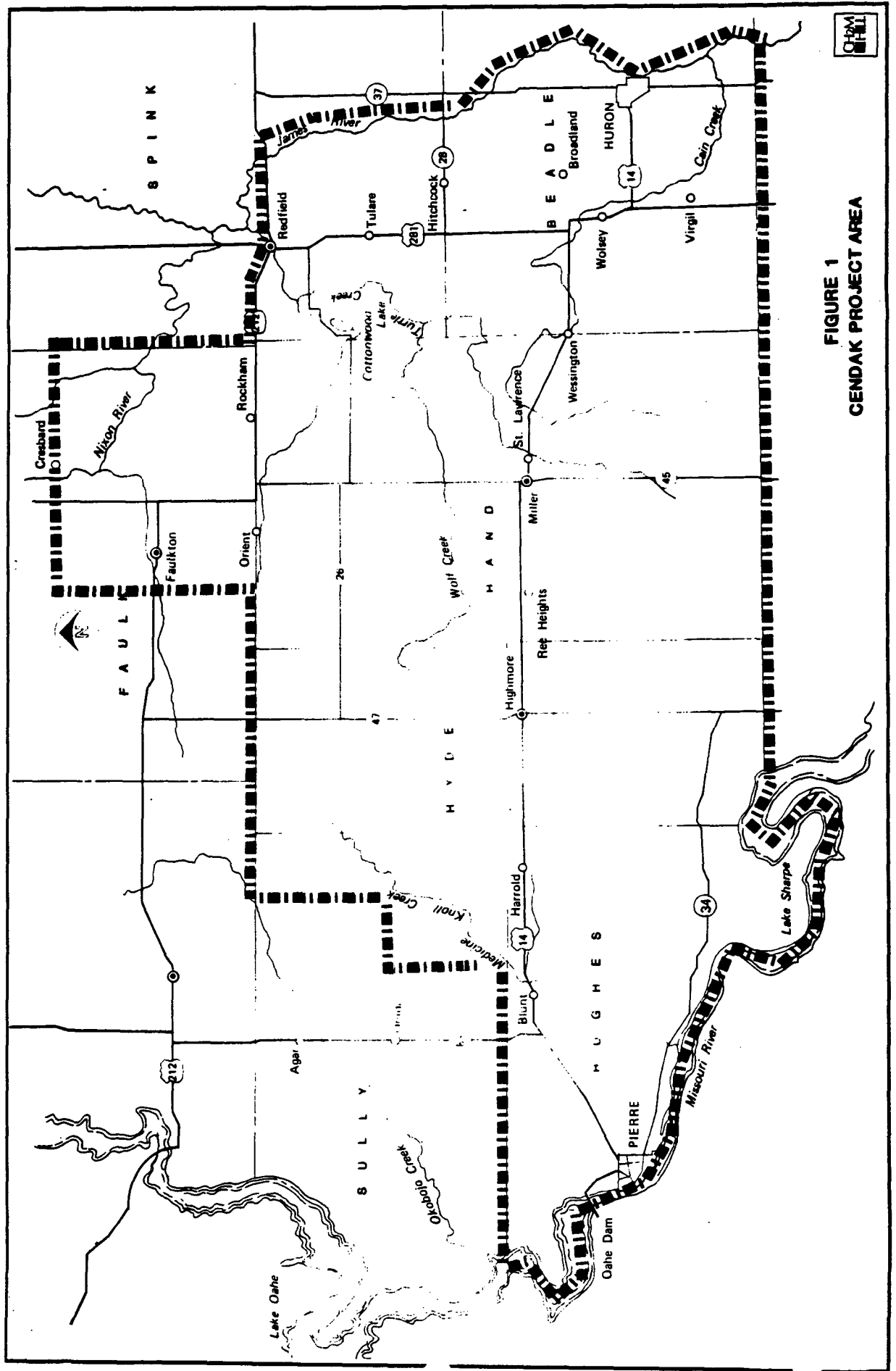


FIGURE 1
GENDAK PROJECT AREA

other large town in the project area, Huron, has shown a small but steady decline since the 1930s. Its population loss in recent years has been even larger from a percentage standpoint.

Table 1 shows both rural and municipal population for the project. "Municipal" is defined as any incorporated city, whereas "rural" includes all unincorporated places and farm populations. Only one of the seven counties, Hughes, has shown a population increase between 1970 and 1980. The other six counties have experienced the following losses: Hyde, 17.7 percent; Hand, 15.9 percent; Sully, 36.0 percent; Faulk, 12.5 percent; Spink, 13.4 percent; and Beadle, 7.2 percent. With the exceptions of Pierre, which grew by 23.4 percent between 1970 and 1980, and Redfield, which grew by 2.9 percent, each of the other towns in the project area lost population. Huron was down 9.1 percent; Miller, 10.1 percent; and Highmore, 10.1 percent.

During the 1930s, severe drought conditions and the general economic collapse drove many people from the land. During World War II, many people left for military service or to work in war-related industries. During the post-war period, increased farm mechanization, rural electrification, and better transportation led to increased farm sizes and reduced demand for farm labor. In the 1970s, depressed farm prices and another severe drought, 1974-1976, caused many people to leave the project area. Drought again hit parts of the project area in 1980-1981, and several of the counties have again asked for Federal disaster aid.

Economy

Agriculture dominates the economy of the project area. Dryland farming for small grains and some corn is the principal type. Ranching on the grasslands of Sully, Hyde, and Hand Counties is a major factor. Most farms and ranches rely upon livestock sales as the principal income source which provides as much as two-thirds to three-fourths of the total income. Farm sizes have increased significantly in the last 30 years, yet income fluctuates greatly depending upon livestock prices and weather conditions. Irrigation along the Missouri River and that from limited ground water sources are assisting in feedstock stabilization.

The City of Huron is the only major wholesale and retail outlet for the area. The other county seat towns of Redfield, Miller, Highmore, and Faulkton also serve as local supply centers. Pierre is unique, due to state governmental influence. The City of Pierre economy is influenced somewhat from recreational use of the mainstem reservoirs. Industries are generally small; however, the meat packing industry in

Table 1
POPULATION
CENDAK PROJECT AREA

County	Rural		Municipal		Total		Percent Change
	1970	1980	1970	1980	1970	1980	
Hughes	1,304	1,626	10,328	12,594	11,632	14,220	22.2
Hyde	1,342	1,014	1,173	1,055	2,515	2,069	-17.7
Hand	3,268	2,683	2,615	2,265	5,883	4,948	-15.9
Sully (part)	375	240	0	0	375	240	-36.0
Faulk (part)	1,077	825	1,146	1,120	2,223	1,945	-12.5
Spink (part)	2,803	1,892	3,154	3,265	5,957	5,157	-13.4
Beadle (part)	3,704	3,684	15,318	13,959	19,022	17,643	- 7.2
Total	13,873	11,964	33,734	34,258	47,607	46,222	- 2.9

SOURCE: "Advance Reports, 1980 Census of Population and Housing," Bureau of Census,
U.S. Department of Commerce, February, 1981.

the City of Huron has a significant impact on the local economy.

The 1980 per capita income, as reported in the United States News and World Report of May 25, 1981, is \$7,452 for South Dakota. Only two states rank lower. The United States average is \$9,458 or 27-percent higher. Annual per capita income by county is shown in Table 2. This does show that per capita income varies greatly from year to year, especially in the farm sector.

NATURAL ENVIRONMENTAL CHARACTERISTICS

Climate

The climate of the project area can be described as mid-continental and semiarid. Average annual temperatures average approximately 45 degrees F, with extremes of over 100 degrees F to -40 degrees F. Strong winds and snow often create blizzard conditions.

Average annual precipitation ranges from approximately 18 inches in Beadle and southern Hand Counties to 16 inches in the Pierre area. Yearly fluctuations in precipitation are common, creating severe drought conditions.

The average frost-free periods (minimum temperature above 32 degrees F) are approximately 140 days in the Pierre area and 130 days near Huron.

Topography

The topography of the project area ranges from gently rolling or undulating to very rolling. The more significant features affecting the CENDAK project are the Missouri Trench, with Lake Oahe at a normal elevation of 1608; the Missouri benchlands through Hughes and Sully Counties at an elevation of approximately 1700 to 1800 feet; the Highmore Pass in Hyde County at an elevation of 1700; and the James River lowlands, with an elevation from approximately 1400 to 1270 at Huron.

Geology

The surficial geology of the area is a glacial-derived till and outwash laid over Pierre shale of the Upper Cretaceous period. The glacial drift varies from location to location, both in depth and composition. In some areas it is predominantly a till, while in other areas, outwash sands and gravels dominate.

Table 2
PER CAPITA INCOME BY COUNTY
CENDAK PROJECT AREA

<u>County</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Hughes	5,951	6,352	7,283	7,888	---
Hyde	4,570	5,668	6,054	7,125	---
Hand	4,572	6,157	6,431	6,860	---
Sully	5,334	7,423	10,340	6,957	---
Faulk	3,974	7,033	6,611	7,283	---
Spink	4,251	6,375	6,126	6,176	---
Beadle	5,467	6,253	6,682	7,372	---
South Dakota	5,120	5,953	6,335	6,992	7,452
United States	6,395	7,026	7,846	8,757	9,458

Source: Bureau of Economic Analysis, Department of Commerce.

Wetlands

Since the area is of glacial-derived topography, numerous sloughs, potholes, and natural lakes are found in the project area. These sloughs and lakes are generally shallow and frequently go dry during the summer period. Some of the larger, deeper sloughs may last through a normal rainfall year but go dry during extended drought periods; however, the sloughs and potholes provide important wildlife habitats and provisions will be necessary to maintain and enhance these areas. Efforts would be made to enhance the canal right-of-ways and Blunt Reservoir to offset wetland losses.

PRESENT WATER RESOURCES DEVELOPMENT

Present water uses within the project area are irrigation, municipal and industrial, rural domestic, livestock, fish and wildlife, and recreation. Hydropower is produced at Oahe Dam and at Big Bend Dam. Both ground water and surface water provide for existing uses.

Irrigation

Irrigation development within the project area has increased in recent years. Ten years ago, little or no irrigation was taking place within the project area. The availability of water from Lake Oahe and Lake Sharpe on the Missouri River has spurred development adjacent to these areas. Limited ground water availability, especially in southwestern Spink and western Beadle Counties, has also contributed to the increase in irrigation. A limited amount of water is also pumped from the James River.

All irrigation development has been through private individual projects, with the exception of the Grey Goose Irrigation District in northwestern Hughes County. The Grey Goose project was developed in 1979 through funding from the Farmers Home Administration; the project area covers approximately 3,100 acres of irrigation. Water is pumped from Lake Oahe and delivered through a pipe system under pressure to pivot systems on the project.

Table 3 shows the 1981 irrigation water right permits by area. Of the approximately 140,000 acres under permit, only 40 percent are actually irrigated in any 1 year, based upon statewide trends. On that basis, only 56,000 acres are actually irrigated. The low percentage of actual irrigation is due to lack of adequate water in most years, changes in cropping patterns, and the fact that some systems are still being developed, even though a water right permit has been granted.

Table 3
1981 IRRIGATION WATER RIGHT PERMITS
CENDAK PROJECT AREA

<u>County</u>	<u>Ground Water Acreage</u>	<u>Surface Water Acreage</u>			<u>Total Acreage</u>
		<u>Missouri River</u>	<u>James River</u>	<u>Other</u>	
Hughes	5,578	44,313		922	50,813
SE Sully	4,858			480	5,338
Hyde	3,587			702	4,289
Hand	10,344			3,579	13,923
SE Faulk	320			62	382
SW Spink	20,720		4,658	1,292	26,670
W Beadle	<u>32,810</u>	<u> </u>	<u>4,705</u>	<u>785</u>	<u>38,300</u>
Total	78,217	44,313	9,363	7,822	139,715

SOURCE: Division of Water Rights, Department of Water and
Natural Resources.

Municipal and Industrial Water

Table 4 shows the municipalities within the project area and their current water supply sources and uses. The Cities of Huron and Pierre dominate the usage. Huron relies partially upon storage provided by the James River Diversion Dam, an advanced unit of the Oahe Unit.

Except for Pierre, the quality of water is generally unsatisfactory. High minerals, especially in the Dakota sandstone wells, create considerable problems. Huron's water supply quality varies from time to time, creating added treatment expenses and problems.

In view of the potential to provide an assured supply of high quality water for municipal and industrial use, the cities of Huron, Miller, and Highmore have made financial contributions to CENDAK to assist with the preliminary studies.

Rural Domestic and Livestock Use

There are no centralized rural water systems in the area. The WEB Water Development Project proposes to pipe water from the Missouri River in the Mobridge area to Aberdeen and places east and south. The northeastern portion of the project area could be served from this system.

Current rural domestic and livestock uses are dependent upon wells and stock ponds. Most domestic use is from wells, generally from the Dakota sandstone. Again, water quality is a major problem.

Recreation/Fish and Wildlife Uses

Recreational areas along Lake Oahe and Lake Sharpe serve the project area. In addition, there are state parks and recreation areas at Lake Louise northwest of Miller, at Lake Faulkton west of Faulkton, and at the James River Diversion Dam north of Huron. Numerous other small local parks and recreation areas are maintained by the surrounding communities.

Fish and wildlife areas are located at the above-mentioned recreational areas, and also at a number of natural lakes and sloughs throughout the area. Both Federal and state Game, Fish, and Park Department wildlife production areas are located in the project area. In addition, long-term easements have been provided on private lands to protect wildlife habitats. However, the private lands of the project area support and feed the majority of the wildlife found in the area.

Table 4
MUNICIPAL AND INDUSTRIAL WATER SUPPLY AND USAGE
CENDAK PROJECT AREA

County	Municipality	1980 Population	Source of Water Supply	Number of Wells	Well Depths	Major Ground Water Aquifer Source	System Storage (1,000 gal.)	Million Gallons Pumped (1977)	Maximum Daily Use (1977 gal.)
Hughes	Blunt	424	Ground water	2	68'-90'	Alluvium/glacial outwash	63	12.2	N/A
	Harrold	196	Ground water	2	45'-45'	Alluvium/glacial outwash	45	5.0	N/A
	Pierre	11,973	Ground water	10	60'-64'	Alluvium/glacial outwash	7,110	723.1	N/A
Hyde	Higmore	1,055	Ground water	2	135'-138'	Alluvium/glacial outwash	50	78.2	570,000
Hand	Miller	1,931	Ground water	4	1,175'-1,200'	Dakota sandstone	535	98	429,600
	Ree Heights	88	Ground water	2	40'-60'	Alluvium/glacial outwash	17	5	36,600
	St. Lawrence	223	Ground water	2	162'-162'	Alluvium/glacial outwash	80	6.8	49,800
SE Faulk	Faulton	981	Ground water	3	270'-270'	Glacial drift	130	45	191,000
	Orient	87	Ground water	1	1,560'	Dakota sandstone	None	3.6	12,000
	Rockham	52	Ground water	1	1,100'	Dakota sandstone	50	1.6	N/A
	Zell	NA	Ground water	1	1,100'	Dakota sandstone	7.5	1.9	N/A
SW Spink	Redfield	3,027	Ground water	2	1,080'-1,080'	Dakota sandstone	650	134	588,600
	Tulare	238	Ground water	1	950'	Dakota sandstone	100	5.8	42,200
W Beadle	Broadland	49	Ground water	1	990'	Dakota sandstone	None	1.2	9,000
	Hitchcock	132	Ground water	1	1,040'	Dakota sandstone	135	4.1	30,000
	Huron	13,000	James River	--	--	--	4,710	689	4,800,000
	Virgil	37	Ground water	1	1,130'	Dakota sandstone	125	1.2	8,600
	Wessington	327	Ground water	2	24'-1,100'	Glacial outwash and Dakota sandstone	50	10.4	76,000

Chapter IV PUBLIC INVOLVEMENT

GENERAL

The CENDAK water supply system concept is a grassroots concept deriving from the wants and desires of people living within the project area. For many years, people within the project area were involved in the planning and development of the Oahe Unit, even though the bulk of the benefits from the Oahe development would be in areas to the north and east of CENDAK. Various community groups were organized and operated to promote or oppose the Oahe Unit project. Out of these groups came the desire to provide a reliable water supply for "our" area; thus, the concept of CENDAK was developed.

COUNTY STEERING COMMITTEES

In late 1980 and early 1981, each of the six county areas in the project area created a water resources steering committee. They were organized as nonprofit associations or corporations for the purposes of promoting and developing water supplies in their areas. Some of the associations were derived from earlier county-wide water user associations.

The county steering committees are composed of interested farmers and residents of a given area. The committees receive funds from contributions and services, have a board of directors, and have a set of officers. Anyone within the designated area and who supports the goals and objectives of the organization can join.

CENDAK STEERING COMMITTEE

In May, 1981, the county steering committees banded together through mutual Articles of Agreement to form the CENDAK Steering Committee. The CENDAK Steering Committee has three representatives from each county and a set of officers. Its primary purpose is to guide the development of the project through an interim period of study and determine if further development is feasible. If so, the Steering Committee must then face the problem of organizing into a more permanent workable entity.

LANDOWNER INTEREST

From response to the establishment of the county steering committees and to meetings held by others, primarily the Oahe Conservancy Subdistrict, it became apparent that a

sizable percentage of landowners in the project area desired investigating the CENDAK concept. Initially, a concerted effort was made by each county committee to determine the level of interest. Landowners were asked about their interests and willingness to "sign up" tracts of land for irrigation. Landowners with approximately 594,000 acres indicated that interest through a sign-up procedure. At that time, no fees were asked.

Later, upon creation of the CENDAK Steering Committee and the decision to proceed with investigations, it became apparent that funding would be necessary. The Steering Committee decided to go back to those indicating interests in irrigation and ask for a contribution toward the investigation and other expenses. A fee structure of \$0.25 to \$0.50 per acre, depending upon the county and area involved, was requested. Within a 2-month period, over 396,000 acres were on the sign-up list.

Many of the farmers and ranchers that had earlier indicated irrigation interest for the entire farm now signed in only those quarters to actually be irrigated. This cut the number of acres but, at the same time, other operators asked to be included. While the acreage submitting good intention fees did decrease, the number of farm units increased.

Figure 2 (pocket) shows the acreage contributing funds to the investigations. This becomes the service area to be provided project water.

Public involvement is being continued through periodic meetings of the Steering Committee and through distribution to the local news media of activities of CENDAK. Eventually, the landowners involved will be asked to support or not support the continuation of predesign and feasibility investigation and the organizing of a permanent entity to sponsor the studies and project.

Chapter V PROBLEMS AND NEEDS

LOCAL

Low per-capita income, declining population, declining community services and facilities, limited opportunities, lack of satisfactory water supply, and other amenities associated with a quality lifestyle are all problems common to the CENDAK project area. The overriding consideration is the limited and widely fluctuating income to most farmers and small businessmen in the area. (See Table 2, Chapter III.) Varying weather conditions from year to year greatly influence the level of agriculture production in the area. Low precipitation causes reduced livestock feed production, which in turn means reduction in livestock numbers. Usually, this reduction takes place on falling markets, thereby further reducing the incomes of farmers and ranchers. Since the overriding majority of business activity is dependent upon agriculture in the project area, the small-town merchant and businessman also suffer during the drought years.

A stabilized feed base produced by irrigation would reduce the fluctuations in livestock numbers, allowing the farmers and ranchers to overcome drought periods. A stabilized feed base would also allow for the finishing or feeding out of more livestock in the area. Therefore, income could be raised by bringing livestock closer to the finished product and ready for retail sale.

Other local problems include the furnishing of satisfactory water for municipal and industrial use. Providing adequate water for rural domestic and livestock use would also be beneficial. With a satisfactory source of water supply, consideration could be given to developing rural water systems. Water-based recreation and enhancement of fish and wildlife resources would also be of help to the local area. Finally, a movement of Missouri River water to the James River for downstream flow augmentation would help provide an adequate water supply to downstream irrigators and to the City of Mitchell.

NATIONAL

For the past 30 years, agriculture production in the nation has exceeded demands. Worldwide demand for food has continued to grow. In recent years, improved sales and distribution methods have allowed agriculture products of the United States to be marketed worldwide. This has not only improved the national balance of trade, but has also benefitted developing countries worldwide.

Increased agriculture production in those areas most suited for such production would seem to make sense. Central South Dakota is certainly one of those areas.

A recent Commerce Department study of agriculture production in the six-state High Plains area indicates that the extensive irrigation in this area will be reduced over the next 20 to 40 years. As this area reverts back to dryland farming because of the lack of ground water, production will decrease. To the people of South Dakota and to the nation as a whole, it appears desirable to shift this agriculture production to the northern Great Plains; irrigation in the Dakotas would fulfill this requirement. The land and the water are available, and it is only a matter of bringing these resources together.

ENVIRONMENTAL

Environmental problems associated with irrigation in the Dakotas have been emphasized over the past decade. Many studies have been conducted regarding specific problem areas, but the overall beneficial and detrimental impacts of a given project are never adequately described and evaluated. Certain tradeoffs are required, and depending upon the viewpoint, these tradeoffs can be good or bad.

The major environmental potentials of the CENDAK project are the ability to provide water supplies for lakes and sloughs which now dry up during most years, the ability to maintain flowing streams in much of the project area from return flows and wastewaters, and the ability to convert land use from dryland farming to irrigated farming. With proper design and operation, these potentials could greatly enhance the natural environment.

Conversely, the CENDAK project will require certain lands for reservoir and canal rights-of-way. Some wetlands will be destroyed by canal and reservoir construction; other wildlife habitats will be affected through removal of grasslands and tree plantings.

SPECIAL

The CENDAK people and others throughout South Dakota believe that they have special needs for major irrigation development. The Pick-Sloan Missouri Basin Program was developed and authorized by Congress as a four-function program: flood control, hydropower, navigation, and irrigation. The construction of six mainstem dams and reservoirs in the Upper Missouri River Basin adversely impacted the States of South Dakota, North Dakota, and Montana. South Dakota lost over 500,000 acres of Missouri River bottomlands to the mainstem dams and reservoirs. Over the past 20 years, the downstream states have received full flood-control and

navigation benefits. The hydropower function has benefitted the Upper Missouri River Basin, but at the same time has also benefitted the Lower Missouri River Basin and the areas outside the Missouri Basin, such as Minnesota and Iowa.

The 1980 Annual Operating Plan for the Mainstem Missouri River Reservoirs prepared by the Corps of Engineers lists accumulated project benefits. This report shows the mainstem reservoir system has prevented \$1.5 billion of flood damages, developed \$1.1 billion of power revenues, and provided for navigation reaching 3.0 million tons in 1980. The 1980 power revenues alone were \$93 million. Total cost of the mainstem system at the time of construction was \$1.46 billion.

While flood-control, navigation, and hydropower benefits have been received over the past 20 to 30 years, the fourth function, irrigation, has not been developed. Many people within the CENDAK project area believe that the Federal government should fulfill its commitment and assist in the development of an irrigation projected desired by the local population.

Chapter VI

EVALUATION OF RESOURCE CAPABILITIES

As described earlier in Chapter III, the economy of the CENDAK service area depends nearly exclusively upon dryland farming. Although the economy has remained relatively stable over many years, the population continues to dwindle. Statewide per-capita income is one of the lowest in the nation, ranking 47th in the states in 1980 or about \$2,000 less than the national average.

LANDS

The lands are fertile, and adequate water is available in the Missouri River. Given sufficient water at a reasonable cost, several hundreds of thousands of acres of land could be irrigated within the six counties which comprise the CENDAK region. Although the proposed Oahe project traversed the area, very few lands were actually planned for irrigation.

One of the major goals of the project is to stabilize dryland operations on as many units as possible in the project area. For this reason efforts were made to incorporate one or two quarters per unit rather than conversion of the total farming/ranching unit to irrigation.

WATER

The CENDAK project is envisioned as one way to stimulate the local economy by combining the fertile soils and available water supplies into a project that would potentially serve approximately 400,000 acres.

OBJECTIVES AND CRITERIA

The specific objectives of this Master Plan are to:

1. Develop a conceptual plan and cost estimates so that a preliminary determination of feasibility can be made.
2. Evaluate alternatives to organize and finance the proposed project.
3. Review the available soils information to determine the need for additional study and classification.
4. Outline the necessary steps to conduct a full feasibility study of the project.

With these objectives in mind, the following criteria were used:

1. Systems will be developed to serve all lands where owner interest has been shown by providing a contribution to the county steering committee.
2. The existing or planned Oahe facilities, including the pumping plant, Pierre Canal, and Blunt Reservoir, will be used to the maximum extent possible.
3. For planning purposes, it is assumed that most lands will be irrigated using sprinkler systems.
4. Multiple purpose water use will be considered in sizing main conveyance facilities, although no specific distribution or storage facilities are included.

Chapter VII SOILS CAPABILITY

INTRODUCTION

One of the more important aspects in determining the feasibility of irrigating the CENDAK project area is the suitability and capability of the soils. Though portions of the area have been studied to varying degrees, additional work is still required and is necessary before the project can be constructed. This chapter presents a summary of the information gathered for the CENDAK Master Plan. Included is a description of the geology, soils, topography, drainage and relief, and climatic conditions of the study area. These factors are briefly discussed as they affect the proposed project. Estimated costs to develop additional information required for the proposed project is also presented.

GEOLOGY

The study area is located within the glaciated area of eastern South Dakota. The latest glacial epoch is known as the Wisconsin Stage and consists of four substages. At least two of these substages along with wind blown silt deposits (loess) played a major role in shaping the landscape. At the same time, these geologic events provided the parent material for the soils as well as modifying the drainage of the land surface and subsurface.

SOILS

A majority of the soils have formed in glacial till, made up of weathered ground-up rock fragments, including clay-rich shale from the underlying marine sediments. These soils commonly have a loam surface texture over a fine-textured, less permeable subsoil of clay loam, clay, or clay pan. At greater depths, these soils often grade into a less permeable glacial till or interbedded, buried soil material.

A lesser but substantial number of soils have formed on glacial outwash material or stratified glacial drift. These soils range from fine sandy loams to loams on the surface, but are often underlain by less permeable till material.

Other soils of lesser extent have formed in silty loess that mantles the glacial drift in some areas, or have formed in alluvium along the drainageways.

Bedrock consists of marine sediments typified by the Pierre shales exposed in steep bluffs near the Missouri River. Where the bedrock is shallow, these saline sediments may adversely affect the overlying soil by salt deposition.

TOPOGRAPHY

The topography of the glaciated area comprising most of the study area ranges from gently to very rolling. To a much lesser extent, areas of relatively uniform topography occur on glacial lakebed deposits or on stringers of recent alluvium along streams.

DRAINAGE AND RELIEF

Practically all of the study area drains to the Missouri River system or included resevoirs. The exceptions are small drainageways superimposed on the rolling topography that end in closed depressions, creating a basin relief.

CLIMATE

The study area has a continental climate characterized by long cold winters with fairly warm summers. Most of the precipitation occurs in late spring or early summer and varies from about 16 inches to 18 inches, increasing from west to east. However, the rainfall is variable and often does not meet crop requirements.

DISCUSSION

One of the most important factors in a successful long-term irrigation project is adequate drainage. The ground water must be maintained at the desired depth for successful crop production. The removal of excess water occurs naturally in some soils while other soils must be drained artificially, if they can be drained at all. Some soils can be well drained under the existing moisture regime and yet be poorly drained and require artificial drainage when irrigated. Other soils may show evidence of poor drainage only when overirrigated and may respond favorably to good management practices without the need for artifical drainage.

Most of the arable land within the study are is adequately drained under existing dryland farming practices. Under irrigation, however, many of these soils could be susceptible to drainage problems because of the basin relief, restrictive soil horizons, and the limited permeability of underlying glacial till deposits. An on-going program at South Dakota State University is investigating this situation.

Although valuable for land planning purposes, the level of detail required for Soil Conservation Service (SCS) county soil survey maps is not sufficient to define specific drainage needs within the study area. There is, however, a limited amount of more detailed soils information available from the SCS that will be helpful in evaluating potential drainage problems under sustained irrigation.

The United States Bureau of Reclamation (USBR) has conducted a number of land classification surveys within the study area. In addition to 5-foot borings, these surveys involve a minimum of two to four deep (10-feet) borings per township, depending on the level of detail. However, many of these surveys considered irrigation only by gravity and did not evaluate lands that by reason of position or topography must be irrigated by sprinkler. Most of the study area lands will be irrigated by sprinkler.

Other information pertinent to drainage conditions within a part of the study area includes investigative reports prepared by the United States Geological Service in cooperation with the South Dakota Geological Survey.

The results of these investigations by the various agencies will be of great assistance when drainage of the proposed project lands are considered. However, since drainage is often the factor that limits successful long-term irrigation, we feel that direct measurement of the conditions affecting drainage is absolutely necessary. For this reason, we strongly support the investigative program being undertaken by the South Dakota University at Brookings as described in their paper entitled "Preliminary Determination of Irrigability of CENDAK Project Soils."

According to Title 12, Department of Agricultural, State of South Dakota, the state permit requirements for soils information can be met using up-to-date SCS soils survey data and reports. Published soil surveys are available for Hand, Hughes, and Beadle Counties. A completed but unpublished survey is available for Faulk County. The Spink County survey is an older publication and may require field updating to meet state permit requirements. The Hyde County survey was started recently and the fieldwork may not be completed by the SCS for a year or more. The needed information could be made available at an earlier date if that portion of Hyde County within the study area was mapped during the beginning of the SCS fieldwork.

The high cost of development of irrigated land requires that only those lands most economically suitable be selected for implementation. The selection of these lands requires a knowledge of the soils within the study area. Much usable soils information is available to us from the SCS and the USBR.

The design of the irrigation scheme itself is dependent upon a detailed knowledge of the soils and drainage conditions within the irrigable area. Although there is a considerable collection of general soils information available, there appears to be a limited amount of detailed soils and drainage data for those lands within the study area.

INVESTIGATIONS

Therefore, it is proposed to stage the soil investigation in order to use available soils information and to develop new detailed soils information most economically. This can be done as follows:

Phase 1

Phase 1 would be a preliminary soil and drainage survey of the study area and would be done during the project feasibility studies.

The purpose of this survey would be to identify those areas with specific development possibilities. This preliminary survey would include neighboring lands within the proposed service area as well as those lands owned by farmers that have expressed interest in irrigation. The survey of the larger contiguous area is necessary to adequately assess soil and drainage conditions in order to better predict the effects of long-term irrigation on specific lands.

During this preliminary investigation existing state, USBR, and SCS information would be supplemented with a minimum number of field borings. The final product would be a map represented on an aerial photobase at a scale of about 1:50000 and a report describing the soils and drainage conditions in sufficient detail to separate irrigable from nonirrigable land. This phase assumes:

- o Availability of good quality aerial photography of the study area.
- o SCS soils survey information is available for the counties involved in the study area.
- o The state has collected and developed the pertinent drainage information envisioned by the South Dakota State University for the proposed CENDAK Project.

It is expected that the cost of this preliminary drainage and soil survey would range from about \$60,000 to \$100,000, depending on weather conditions and the availability of yet uncompleted soil and drainage information.

Phase 2

Phase 2 or the second stage of the classification scheme would be a systematic survey of the project area lands identified as irrigable during Phase 1. This phase of the soils work would probably only be required if Federal funds

for the project construction are made available through the Bureau of Reclamation. Federal procedures require that land classifications be completed so that repayment of project funds is guaranteed. This information would be presented on aerial photobase maps at a suitable scale for detailed irrigation planning. Depending upon conditions, a suitable scale might range from 1:20000 to 1:5000. The field survey and collection of information would be done in accordance with the methods used by the Bureau of Reclamation. The resulting product would be a land classification map delineating land into classes that reflect the economic capacity of the land under irrigation.

The cost of land classification is tied to several factors that will not be known until the preliminary soil and drainage survey has been completed. One of the major factors affecting the time involved in fieldwork is the continuity of the irrigable acreage. For estimating purposes, however, a cost from \$1 to \$4 per acre is expected for Phase 2.

Phase 3

We envision a training program for project farmers that would identify the best irrigation management practices. This is a proven method to take advantage of all the information previously developed that might otherwise be overlooked. During the review of natural resource information for the Master Plan, it became obvious that the key to successful, sustained irrigation would be good farm and water management practices.

Chapter VIII PROJECT FORMULATION AND EVALUATION

INTRODUCTION

Unlike most large irrigation projects, the CENDAK project is being developed to serve only those lands within the six counties which have made a contribution toward project implementation. The areas were identified on 1":2,000' maps, and irrigation systems were laid out for those lands. Due to time and budgetary constraints, the initial layouts are preliminary only and are intended to be representative of the best systems that can be developed. More efficient systems could be designed by dropping certain tracts from the service area. However, this was not done for the initial layout, since the criteria were to serve essentially all "paid-up" tracts. The philosophy and effects of selective exclusion of high cost lands will be discussed later. Cost curves were developed for canals, pumping plants, canal structures, pipelines, etc., and were used to estimate project costs.

PLAN DESCRIPTION

The proposed project development plan incorporates several initial facilities of the inactive Oahe Unit, as well as other facilities to serve approximately 396,000 acres. The plan utilizes the nearly completed Oahe Pumping Plant, the partially completed Pierre Canal, and the planned Blunt Dam and Reservoir, which is not yet constructed. A large percentage of the lands within the reservoir has already been purchased.

Of the approximately 396,000 acres to be served by the project, 335,000 acres would be covered by the 2,481 pivots, assuming 135 acres per quarter pivot system. The remaining acres are contained in field corners, ditches, roads, etc. It is anticipated that the net acreage irrigated could be expanded to the full area served by fine-tuning water delivery schedules, utilizing off-peak water deliveries, reducing operational waste and reuse of runoff water.

East of Blunt Reservoir, project facilities are planned to serve those lands whose owners have shown "paid" interest. Since these lands do not correspond to the lands within the Oahe project, new canal alignments were made in most areas.

Figure 3 (pocket) depicts the alignments selected to serve the proposed irrigated lands. Again, these alignments should be viewed as preliminary only and subject to revision during feasibility level studies. Pertinent facility information is tabulated in Table 5. The sizes of the facilities

Table 5
FACILITY DESCRIPTIONS
CENDAK MASTER PLAN

Facility	Initial Capacity cfs	Length Miles	Area Irrigated Acres
Oahe Pumping Plant	3,200	NA	335,000
Pierre Canal	3,200	34.1	335,000
Blunt Reservoir	381,000 ^a	NA	325,000
Higmore Canal	7,300	39.1	325,000
South Hyde Canal	1,190	55.4	54,700
South Hyde Pumping Plant No. 1	1,190	NA	54,700
South Hyde Pumping Plant No. 2	1,043	NA	51,200
Higmore Branch Pumping Plant	220	NA	11,200
Higmore Branch	220	11.8	11,200
North Hyde Canal	350	14.5	16,900
North Hyde Pumping Plant No. 1	350	NA	16,900
North Hyde Pumping Plant No. 2	246	NA	12,420
South Hand Canal	3,500	46.7	154,440
Miller Branch	200	23.5	14,200
North Beadle Canal	1,450	32.9	66,700
Broadland Branch	420	15.5	24,980
South Beadle Canal	1,030	42.3	47,400
North Hand Canal	150	4.0	7,970
Spink Canal	800	42.5	37,000
Redfield Branch	320	18.0	15,500
Faulk Canal	870	27.0	40,100
Orient Branch	170	2.4	8,640
Faulton Branch	260	13.0	13,200

^aMeasured in acre-feet; active storage between elevations 1677 and 1701 msl; total storage 631,000 A.F.

are based on that capacity required to meet peak demand, allowing for canal, lateral, and on-farm losses.

Figure 4 provides an indication of typical canal cross-sections and dimensions.

HYDROPOWER POTENTIAL

Once water crosses the "Highmore Pass" at about an elevation of 1677 feet, it drops to elevations of 1400 feet and lower in eastern Hand and western Beadle Counties and to below 1300 feet near the James River. This "drop" provides an opportunity to consider installation of low-head hydropower plants in the pertinent canals. Three sites for potential hydropower installation were identified on the North Beadle Canal, and other sites may be available on the South Beadle and Spink Canals. Evaluation of these sites should be carried out during further feasibility studies.

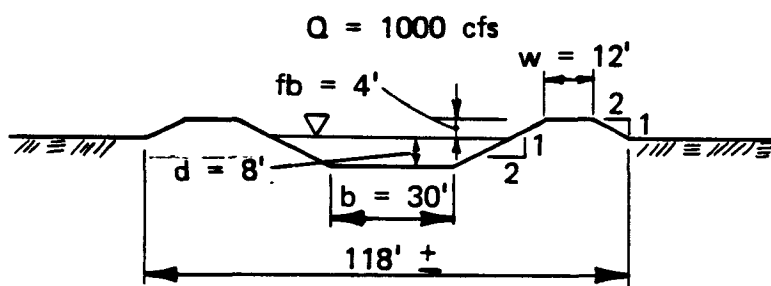
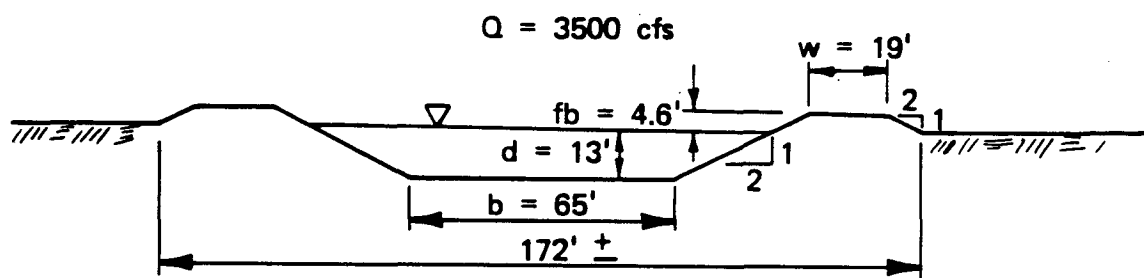
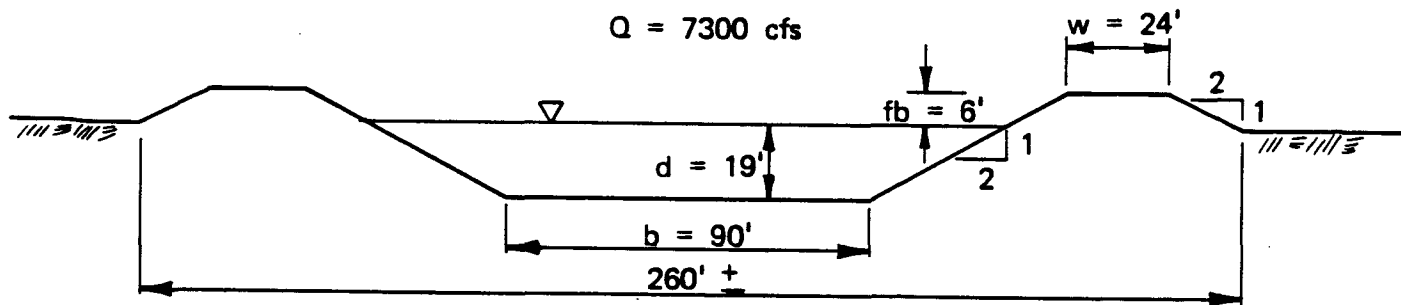
COST SUMMARY

Cost curves were used to estimate project costs for the development plan of the CENDAK project. Costs were developed for all major facilities. Canal costs were estimated for all canals with capacities of 100 cfs or greater. Smaller laterals and individual pumps and discharge lines are not included. A separate report provides cost curves and procedures to estimate costs of the smaller laterals and on-farm facilities for both open ditch and pipe systems. Table 6 presents a summary of the pertinent costs for each major facility or system.

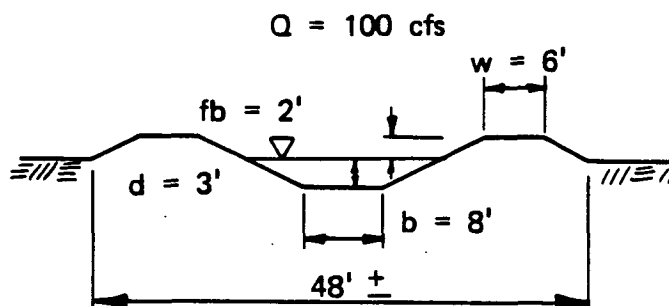
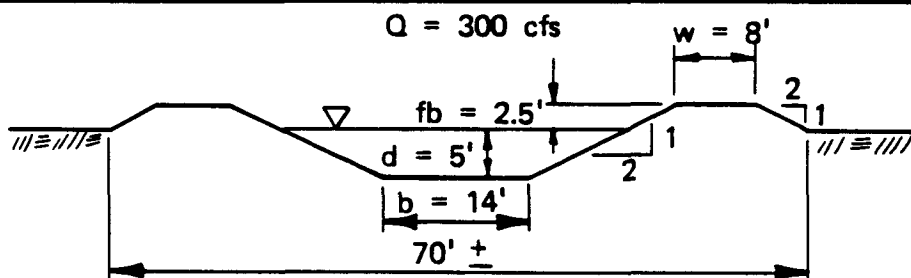
The unit cost per acre served can be calculated in several different methods. Based on the 396,000 acres served and including funds already spent for the existing facilities and land acquisition, the cost per acre is \$950. A more conservative method would be to base cost strictly on the areas to be irrigated by center pivots, 335,000 acres. On this basis, the average unit cost is \$1,120 per acre, including contingency and engineering, legal and administrative costs.

LATERAL DISTRIBUTION COSTS

Rather than calculate and show the cost for each lateral distribution system of less than 100 cfs and on-farm facilities, a procedure has been developed to provide appraisal level cost estimates based on typical designs. This procedure, based on average cost curves, allows for individual cost estimating for any type of lateral and pivot layout.



Scale: $1'' = 50'$



Scale: $1'' = 20'$

FIGURE 4
TYPICAL CANAL CROSS SECTIONS



Table 6
FACILITY COSTS
CENDAK MASTER PLAN
(1981 Dollars)

Facility	Basic Canal and Pipe Construction (\$1,000)	Structures Including Checks, Siphons, Bridges Cross Drainage (\$1,000)	Land & Damage Costs (\$1,000)	Subtotal (\$1,000)	Contingency 20 Percent (\$1,000)	Engineering, Legal, and Administrative (\$1,000)	Total Project Cost ^a (\$1,000)
Oahe Pumping Plant ^b	\$ 0	\$ 0	\$ 0	\$ 25,700	\$ 0	\$ 0	\$ 25,700
Pierre Canal ^b	(not itemized)	(not itemized)	(not itemized)	25,300	5,060	4,554	34,900
Blunt Reservoir ^b	24,300	10,000	15,400	49,700	9,940	8,946	68,600
Highmore Canal	56,300	3,800	900	61,000	12,200	10,980	84,200
South Hyde Canal	11,200	5,700	800	17,700	3,540	3,186	24,400
Pumping Plant #1	0	0	0	6,800	1,360	1,224	9,400
Pumping Plant #2	0	0	0	5,600	1,120	1,008	7,700
Highmore Branch	0	0	0	1,500	300	270	2,100
Pumping Plant	1,300	600	100	2,000	400	360	2,800
Highmore Branch	3,300	600	160	4,060	812	731	5,600
North Hyde Canal	0	0	0	1,800	360	324	2,500
Pumping Plant #1	0	0	0	800	160	144	1,100
Pumping Plant #2	16,800	8,500	1,100	26,400	5,280	4,752	36,400
South Hand Canal	1,500	2,000	300	3,800	760	684	5,200
Miller Branch	5,600	4,500	500	10,600	2,120	1,908	14,600
North Beadle Canal	1,600	2,000	200	3,800	760	684	5,200
Broadland Branch	5,400	3,700	600	9,700	1,940	1,746	13,400
South Beadle Canal	200	500	40	740	148	133	1,000
North Hand Canal	4,600	3,100	600	8,300	1,660	1,494	11,500
Spink Canal	1,400	3,400	200	5,000	1,000	900	6,900
Redfield Branch	3,000	2,700	350	6,050	1,210	1,089	8,300
Faulk Canal	1,000	100	30	1,130	226	203	1,600
Orient Branch	200	700	100	1,000	200	180	1,400
Faulkton Branch							
TOTAL				\$278,480	\$50,556	\$15,500	\$374,500

^a Rounded.

^b Totals include approximately \$25 million in costs previously expended for construction and land acquisition.

For purposes of the master plan, two basic lateral systems were considered. One covers an open ditch system originating at a main canal and terminating at a farm pumping station to provide the necessary water delivery under pressure to operate one or more pivot systems. See Figure 5 for a typical layout. This type of open ditch lateral system would be used where topography and individual farmer's desires would allow it. Generally it will be less expensive than the pressure pipe system. The second lateral distribution system is a pressure pipe system where a pumping station on the main canal will feed a pressure pipe serving one or more pivots. The pumping station provides sufficient pressure to operate all pivots on the line without additional booster pumps. See Figure 6 for typical layouts.

The cost curves and procedure was used to determine total and unit cost for the open ditch lateral system shown in Figure 5. These costs are summarized in Table 7. Other lateral layouts and density distributions will result in different per acre costs.

The pressure pipe system layouts, as shown on Figure 6, were also costed out. These costs are summarized in Table 8. Other pressure pipe layouts and density distributions will also result in different per acre costs.

ANNUAL OPERATION AND MAINTENANCE

Estimates of annual operation and maintenance (O&M) costs for the main delivery system were prepared. These costs are composed of two primary components: the general O&M of all major facilities described in Table 5 and the annual power cost for pumping at the Oahe Pumping Plant and for pumping stations on the South Hyde Canal, North Hyde Canal, and Highmore Branch. All other main canals would be gravity fed. Pumping costs for the open-ditch laterals and pressure-pipe laterals (both less than 100 cfs) are included in the procedures to determine lateral distribution system costs.

General O&M costs for the major facilities are based upon a percentage of the construction cost as determined from other major irrigation projects. In this case a factor of 0.75 percent was used. The general O&M cost is calculated at \$2.8 million per year or \$8.36 per acre. This compares favorably to the \$11 per acre used for some Nebraska systems and to the ratio of general O&M cost to construction cost for the main facilities proposed for the Oahe Unit.

Pumping costs depend upon the electrical rates used. At this point no one knows if Pick-Sloan Missouri Basin Program irrigation set-aside power at 2.5 mills per kilowatt hour would be available. With wheeling charges, etc., this

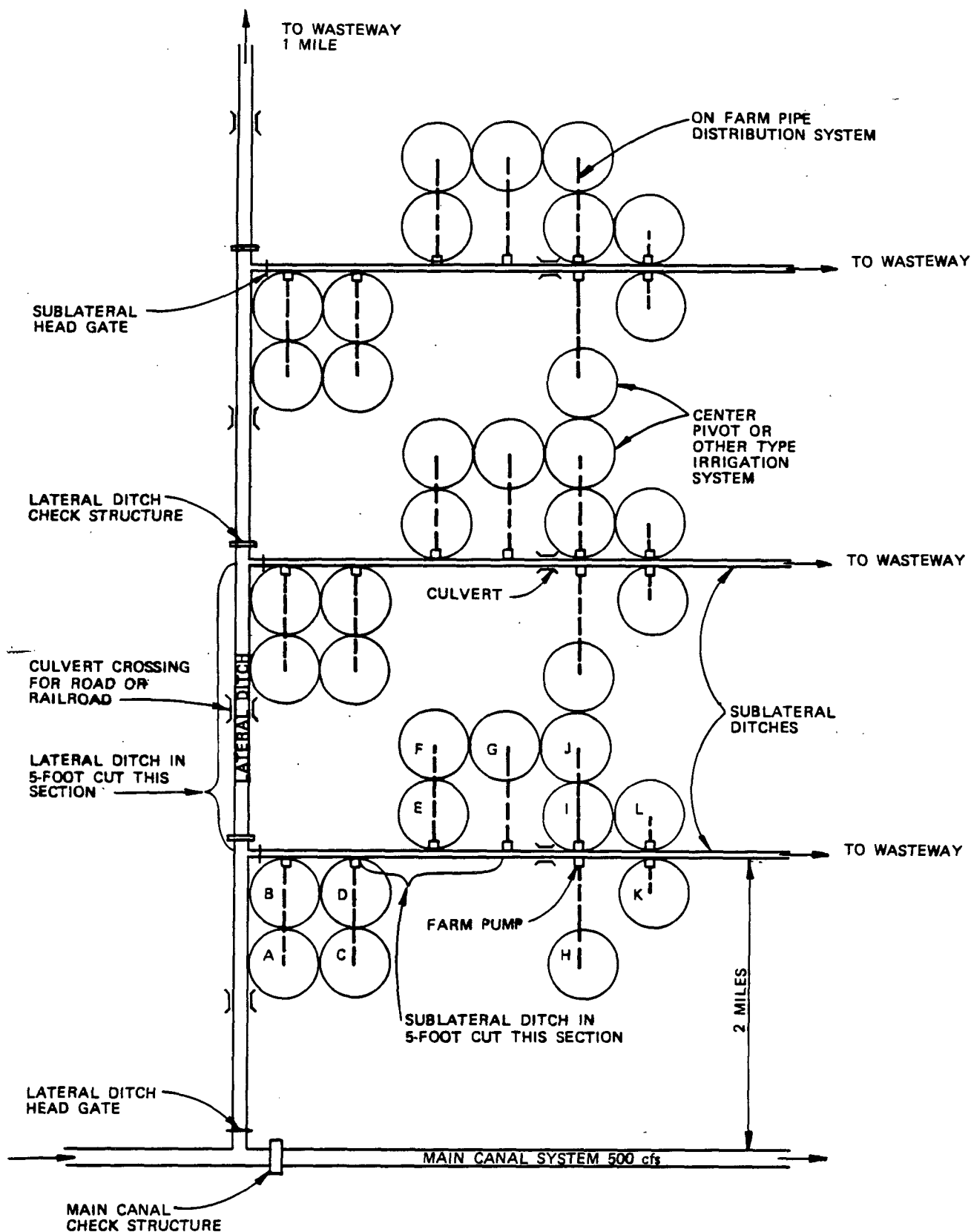


FIGURE 5
TYPICAL OPEN DITCH LATERAL SYSTEM
 (50% OF LANDS ALONG LATERAL ARE PARTICIPATING)

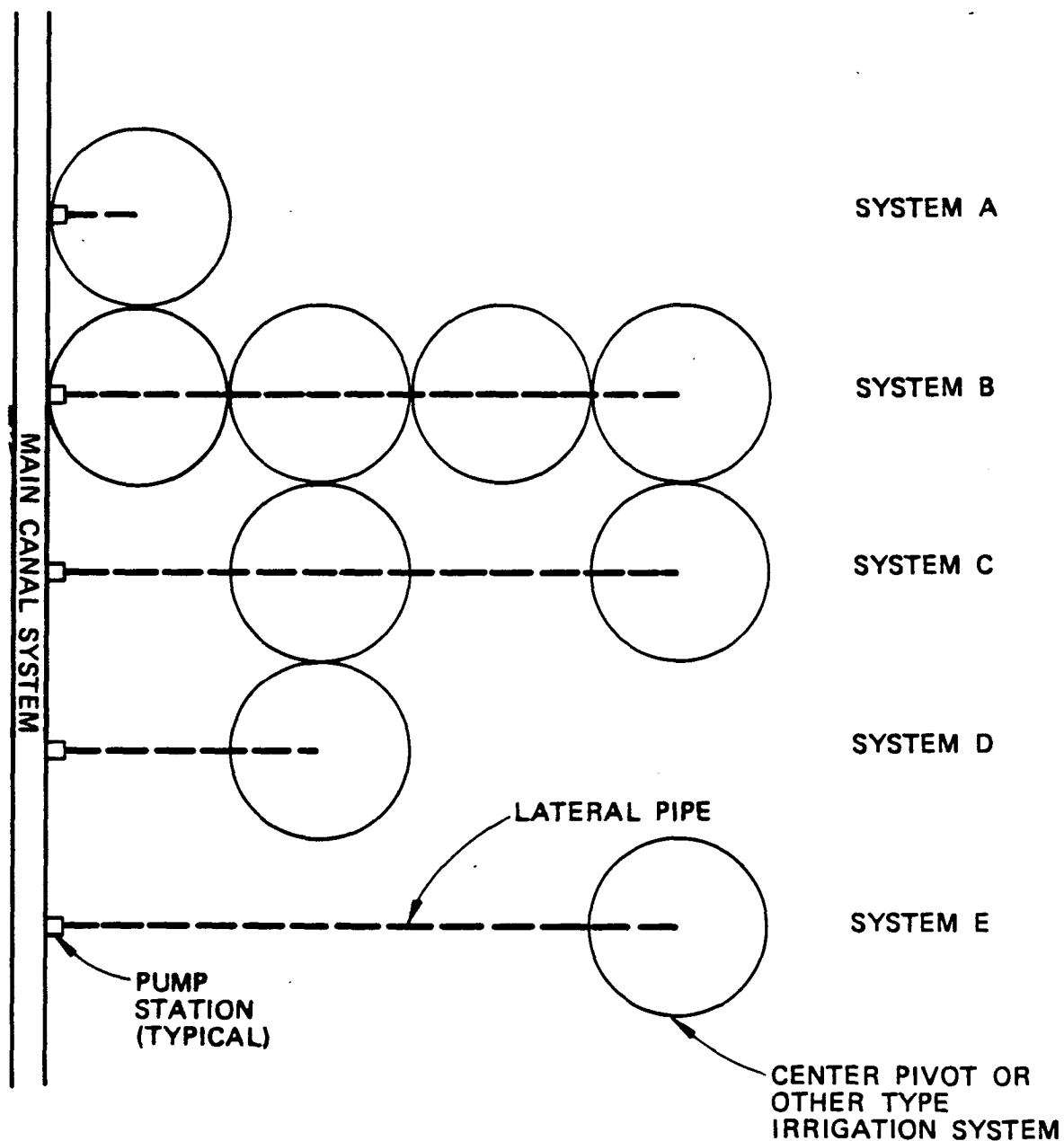


FIGURE 6
TYPICAL PRESSURE PIPE LATERAL SYSTEMS

Table 7
TYPICAL SUMMARY
OPEN DITCH LATERAL SYSTEM COSTS
CENDAK MASTER PLAN

Category	Cost	
	Dollars	Dollars/Acre
Main Canal check structures	100,000	
Lateral system headgate	10,000	
Lateral Ditch system	990,000	
Lateral Ditch check and gate structures	32,000	
Culverts	24,000	
Lateral system subtotal	1,156,000	240
Pump Stations	648,000	130
On-farm pipe network	822,000	170
Center Pivot irrigation systems	1,260,000	260
On-farm cost subtotal	2,730,000	560
Total open ditch lateral and on-farm costs	3,886,000	800

Note: Assumes supplying 36 center pivots or 4,860 acres distributed as shown on accompanying figure.

Table 8
SUMMARY OF TYPICAL PRESSURE PIPE
LATERAL SYSTEM
CENDAK MASTER PLAN

Item	SYSTEM				
	A	B	C	D	E
Cost Pumping Plant	\$18,000	\$ 72,000	\$ 36,000	\$18,000	\$ 18,000
Cost per Acre	130	130	130	130	130
Cost Center Pivots	35,000	140,000	70,000	35,000	35,000
Cost per Acre	260	260	260	260	260
Cost of Piping	13,000	165,000	103,000	38,000	88,000
Cost per Acre	100	310	380	280	650
Total Cost per Acre	490	700	770	670	1,040

project power could come to \$0.015 per kilowatt hour. Without any power subsidy, power costs used in project estimates should be in the range of \$0.06 per kilowatt hour.

Total power required for the Oahe Pumping Plant and the additional pumping plants on the main canals is given in Table 9. It is assumed the Oahe Pumping Plant can be serviced at 2.5 mills since there is no wheeling charge to transfer power from the power plant to the pumping plant at the same site. It is further assumed the main delivery system power plants will be served at 1.5 cents per kilowatt hour to include wheeling charges. These rates are reflected in Table 9 to give a main delivery system project cost per acre. Other power cost to deliver water to laterals of less than 100 cfs and to on-farm pumping stations are included in the procedures to determine costs for the lateral distribution systems.

Table 9 shows the effect of serving the higher elevation lands that require pumping. As the number of lifts increase there is a corresponding increase in power cost to deliver the water.

EVALUATION

Evaluation of the project fully, is beyond the scope of this appraisal study. Many of the details can not be covered within the time and budget allowed for the appraisal study. However, certain features and relationships stand out:

- o The cost of major delivery facilities are high but not out of the realm of possibility if the costs can be spread over enough users.
- o The use of the Blunt Reservoir for system regulation is necessary. Additional downstream storage reservoirs would be beneficial in either serving more users or cutting the capacities of major delivery canals.
- o The use of excessive pumping to deliver water to higher lands quickly runs the unit cost up both from a construction and O&M standpoint.
- o The greater the density of pivots the less costly it is to serve the lands. On the other hand, greater density of pivots may mean a reduction in the total number of farm units served.
- o The use of Pick-Sloan Missouri Basin irrigation power set aside at 2.5 mills or 1.5 cents after wheeling charges are added would clearly enhance the operation of the CENDAK system.

Table 9
MAIN DELIVERY SYSTEM POWER COSTS
CENDAK MASTER PLAN

<u>Pumping Plant</u>	<u>Area Served Acres</u>	<u>Annual Power Requirement kw Hr</u>	<u>Power Rate Dollars</u>	<u>Total Annual Cost Dollars</u>	<u>Cost Per Acre Dollars</u>	<u>Accumulated Cost Per Acre Dollars</u>
Oahe	335,000	136,000,000	0.0025	340,000	1.01	1.01
South Hyde No. 1	54,700	17,000,000	0.015	255,000	4.66	5.67
South Hyde No. 2	44,400	13,000,000	0.015	195,000	4.39	10.06
Higmore Branch	11,000	4,100,000	0.015	61,500	5.49	15.55
North Hyde No. 1	16,900	4,700,000	0.015	70,500	4.17	5.18
North Hyde No. 2	12,400	2,300,000	0.015	34,500	2.78	7.96

- o The allocation of assigned costs from the Pick-Sloan Missouri Basin program would be detrimental to the economic feasibility of the project.

Cost Allocations

While final cost allocations can not be given at this time, some of the underlying philosophy can be stated. Basically, the system should be cost-effective where each user pays his equitable share of the local costs, both construction, operation, and maintenance. Secondary uses, such as for livestock water, rural domestic, municipal, industrial, recreational, and fish and wildlife can be expected to pay their equitable share based on cost to deliver the raw water. Any storage and/or treatment will be an added cost assumed by the user. It is anticipated these secondary uses and consequent revenues will be small.

The allocation of costs among the individual irrigators would most likely follow a standard practice, whereby the cost of the gravity delivery system is distributed equally among the users on a per acre basis. Since all water must be pumped at the Oahe Pumping Plant and the bulk of the water will be temporarily stored in the Blunt Reservoir, the cost of these two features should be distributed equally among all users. When it comes to installing pumping plants on other major canals and laterals, the costs of those pumping plants from both a construction and O&M standpoint should be distributed only to the lands served. The canals and laterals downstream from such pumping plants can be considered as part of the overall project costs as if they were gravity fed. Pumping plants and sublaterals to serve individual pivots or small groups of pivots, i.e., less than 100 cfs capacities, can be considered as individual costs assigned strictly to the units being served.

Effects of Excluding Certain Lands

As indicated earlier, the average unit cost based on lands to be irrigated by center pivots is \$1,120 per acre. However, by excluding certain higher cost areas this average can be reduced as shown in Table 10. Also shown in Table 10 is the effect of transferring water delivery to the higher cost lands to interior areas where no additional main delivery system cost would be incurred. Many other combinations would be possible and are part of the detailed project formulation process to obtain the optimum project. In addition to the increased construction cost per acre to serve the higher elevation lands, there is a corresponding increase in O&M and power cost. The power cost is significant, increasing from an estimated \$1.01 per acre per year for the project as a whole to a maximum of \$15.55 to deliver water

Table 10
EFFECTS OF EXCLUDING CERTAIN AREAS
CENDAK MASTER PLAN

AREA OR FACILITY	Area Irrigated Acres	Total Project Cost ^a \$1,000	Cost Per Acre Irrigated Dollars/Acre	Cost Per Acre With ^b Transfers Dollars/Acre
Highmore Branch Pumping Plant and Canal (HB)	11,200	4,900	438	--
Remaining Project excluding HB	323,800	369,600	1,141	1,103
North Hyde Canal and Pumping Plants (NH)	16,900	9,200	544	--
Remaining Project excluding NH	318,100	365,300	1,148	1,090
Remaining Project excluding both NH and HB	306,900	360,400	1,174	1,076
South Hyde Canal and Pumping Plants (SH HB)	54,700	46,400	848	--
Remaining Project excluding SH and HB	280,300	328,100	1,170	979
Remaining Project excluding SH, HB, and NH	263,400	318,900	1,211	952
Spink Canal beyond Mile 20.5 (SC)	22,000	10,900	495	--
Remaining Project excluding SC	313,000	363,600	1,162	1,085
Remaining Project excluding SC, SH, HB, NH	241,400	308,000	1,276	919

^aThis assumes no reduction in design capacities of facilities with resultant cost savings.

^bAssumes the lands to be excluded will be transferred to interior lands that can be served by remaining project facilities to maintain a project of 335,000 acres.

into the Highmore Branch. Also, any final power cost to the individual irrigator must include cost of pumping if necessary from the main canal system to his on-farm pivot.

Secondary Uses

Details for providing water supplies for secondary uses such as livestock water, rural domestic use, municipal and industrial use, recreation, and fish and wildlife are beyond the scope of this master plan. The volume of water required for such uses within the project area is very small in comparison to the volume of water required for irrigation. For example, a previous study by C2M HILL for the Corps of Engineers projected total water use by the year 2000 under the most likely scenario for the counties involved in the CENDAK area to be 7,100 acre feet for municipal use, 1460 acre feet for rural household use, and 6,020 acre feet per year for livestock use. This totals 14,590 acre feet per year. Assuming no more than a third of this would be supplied by the CENDAK Project, the total demand would be only 5000 acre feet. If another 10,000 acre feet was provided specifically for fish and wildlife and recreational purposes this would mean about 1.5 to 2.0 percent of the irrigation water delivery could be used for secondary purposes. This is well within the design allowance of the project facilities.

A second factor to consider is the mitigation of unavoidable losses of wildlife habitat. The major concern will be with loss of wetlands. While every effort will be made to design around such areas, certain wetland areas will be directly impacted. The general philosophy will be to replace such areas from lands within the CENDAK project area, in other words those gaining direct irrigation benefits will provide for the wildlife mitigation.

Chapter IX ECONOMIC ANALYSIS

GENERAL

A full economic analysis of the CENDAK project is beyond the scope of this Master Report. However, some considerations will be presented and discussed. In the final analysis, the operators of the proposed system will have to decide if the proposal is economically feasible on an individual basis. Caution is urged not to make that decision too early and without full consideration of all financing potentials.

The Department of Water and Natural Resources has asked the economic department at South Dakota State University and the University of South Dakota to utilize an econometric model to analyze both on-farm and off-farm effects of irrigation in South Dakota. Unfortunately, the results of this study will not be available until after November 1, 1981. It will, however, provide valuable data to assess the full economic impacts of a major irrigation development such as the CENDAK project.

For purposes of this Master Plan, data have been collected, analyzed, and presented on the CENDAK project area as a whole. Since most agricultural economic data are presented on a county basis, it has been assumed that the portions of the counties included in the CENDAK project area can be represented by average countywide data. Table 11 shows the area and proportion of county included in the CENDAK project area.

PRESENT AGRICULTURAL ECONOMY

Farm Type and Sizes

The livestock enterprise is the basic type of farming in the area. A limited number of farms operate on a cash-grain cropping pattern and a few farms are strictly livestock ranching.

The number of farms and average sizes by county are given in Table 12. The weighted average size is 1,195 acres. Of this, an average is 38 percent in cropland and the balance in pastureland. Roughly one-third of the utilized cropland has been proposed for irrigation from the CENDAK project.

Current Cropping Patterns

Table 13 summarizes an analysis of current (1979) cropping patterns as reported by the South Dakota Crop and Livestock

Table 11
AREA BY COUNTY
CENDAK PROJECT AREA

<u>County</u>	<u>Area in County Square Miles</u>	<u>Area in CENDAK Square Miles</u>	<u>Acres</u>	<u>Percent of County in CENDAK</u>
Hughes	784	784	501,760	100
Hyde	870	870	556,800	100
Hand	1,436	1,436	919,040	100
Sully (part)	1,076	216	138,240	20.0
Faulk (part)	998	432	276,480	43.3
Spink (part)	1,509	432	276,480	28.6
Beadle (part)	<u>1,265</u>	<u>864</u>	<u>552,960</u>	68.3
Total	7,938	5,034	3,221,760	

Table 12
NUMBER OF FARMS, AVERAGE SIZE, AND CROPLAND UTILIZED
CENDAK PROJECT AREA

<u>County</u>	<u>Number of Farms</u>	<u>Average Sizes Acres</u>	<u>Cropland Utilized</u>	
			<u>1,000 Acres</u>	<u>% of Total</u>
Hughes	260	1,730	168	33
Hyde	260	1,960	125	22
Hand	740	1,215	345	38
Sully (part)	64	1,940	58	42
Faulk (part)	199	1,305	110	40
Spink (part)	283	935	147	53
Beadle (part)	<u>744</u>	<u>725</u>	<u>265</u>	<u>48</u>
Total	2,550	1,195 ^a	1,218	38

^aWeighted average.

Source: South Dakota Agricultural Statistics, by South Dakota Crop and Livestock Reporting Service, May 1976.

Table 13
SUMMARY OF CROPPING PATTERNS
CENDAK PROJECT AREA

<u>Crop</u>	<u>Acreage Planted</u>	<u>Percent of Total</u>
Corn	234,100	18.8
Soybeans	5,500	0.4
Sorghum	31,100	2.5
Sunflowers	74,200	6.0
Flaxseed	9,100	0.7
Oats	160,300	12.9
Barley	56,000	4.5
All wheat	393,800	31.6
Rye	44,300	3.6
Alfalfa	<u>236,200</u>	<u>19.0</u>
Total	1,244,600	100.0

Reporting Service. Wheat, corn, and alfalfa are the pre-dominate crops. Sunflowers have increased considerably in recent years and could be expected to continue to increase.

Current Livestock Production

The latest year livestock numbers are readily available on a county basis is 1975. Statewide figures are available for later years. Utilizing the statewide trends, estimates of livestock numbers within the CENDAK project area are estimated. These total 328,000 cattle, 73,600 hogs, 65,100 sheep, and 244,000 chickens. These number reflect the basic livestock base of the area.

Typical Farm

The typical farm in the CENDAK project area, based upon average data, would be described as a general livestock enterprise encompassing approximately 1,200 acres of which 456 acres would be utilized for crops and 744 acres for pasture and hayland. The farm would run 130 head of cattle, basically a cow-calf beef production hers; 30 head of hogs; 26 head of sheep; and approximately 100 chickens. Again, based upon averages, the 456 acres of cropland would be planted to 86 acres of corn, 144 acres of wheat, 86 acres of alfalfa, 59 acres of oats, and the balance to sunflowers, sorghum, soybens, flaxseed, barley, or rye.

PROJECTED AGRICULTURAL ECONOMY WITH PROJECT

General

The development of the CENDAK project would have impact on the agricultural economy of the area overall; however, the impact on each operator would not be as great as in most irrigaiton projects. This is due to the concept that irrigation will be supplemental to the existing farm enterprises. In most cases, only a portion of each farm was considered for irrigation; in fact, only about one-third of the cultivated land is proposed for irrigation. The cultivated land represents approximately three-eighths of the total area.

One the typical 1,200-acre farm, with 456 acres of cropland, irrigation would be proposed for approximately 150 acres based upon an even distribution of irrigation throughout the project area. This is somewhat misleading since it is known that many of the farms were not signed up for irrigation. Unfortunately, it is not known the total number of farms the 396,000 acres of proposed irrigation would actually affect. For purposes of analysis, it is assumed that each "typical irrigated" farm of 1,200 acres would have 320 acres of irrigation on the 456 acres of cultivated land.

Farm Budget Analysis

To judge the CENDAK proposal existing farm-budget analysis developed for the Grass Rope Unit by the Bureau of Reclamation will be utilized. Grass Rope is an irrigation project in an area quite similar to the CENDAK area. It is located approximately 40 miles southwest of the center of the CENDAK project area. The cropping pattern on the Grass Rope Unit (27 percent alfalfa, 50 percent corn, 20 percent dry beans, 3 percent silage) is similar to that anticipated for the CENDAK project. The CENDAK project would probably have more silage and a substitution of soybeans and sunflowers for dry beans however.

Projected irrigation crop yields after 15 years of operation used for the Grass Rope benefit analysis are as follows:

Alfalfa hay	7.4 ton/acre
Corn Grain	178.0 bu/acre
Corn silage	25.5 ton/acre
Dry beans	25.0 cwt/acre
Pasture, rotation	17.5 AUM/acre

Representative prices used in the Grass Rope analysis are given in Table 14, along with the 5-year (1976 through 1980) commodity prices utilized by the Nebraska Natural Resources District in evaluating irrigation projects in 1981.

Farm expense prices used in the Grass Rope analysis were generally those experienced in the late 1970s. A representative sample of prices paid for agricultural products and inputs as used in the analysis is given in Table 15.

The final results of the Grass Rope farm-budget analysis is given in Table 16. This is based upon one farm irrigating 340 acres and with a livestock feeding operation of 120 feeders. This could be somewhat typical of the operation found in the CENDAK project. The budget analysis does include an on-farm irrigation operation and maintenance cost, but does not include capital costs for the on-farm sprinkler units which were assumed to be provided as part of the irrigation project.

Discussion

The annual adjusted net farm income benefit of \$267 per acre calculated for the Grass Rope Irrigation Project may be somewhat in range for the CENDAK project. A comparable number calculated for the Lake Andes-Wagner Irrigation Project in 1978 using the same mix of crops and including livestock feeding, would be \$229 per acre. Both of these numbers are based on prices 3 to 5 years old and should be

Table 14
 REPRESENTATIVE PRICES UTILIZED FOR AGRICULTURE PRODUCTS

<u>Item</u>	<u>Unit</u>	<u>Grass Rope Unit 1976 Normalized</u>	<u>Nebraska 5-year Average (1976-1980)</u>
Corn grain	bu	\$ 2.36	\$ 2.57
Corn silage	ton	16.00	NA
Dry beans	bu	15.10	19.58
Pasture	AUM	10.00	13.63
Alfalfa hay	ton	47.50	45.54
Potatoes	cwt	3.20	4.66
Straw	ton	36.00	NA
Livestock			
Steers	cwt	40.30	52.39
Calves, feeder steers	cwt	41.50	64.01
Calves, feeder heifers	cwt	38.10	NA

Table 15
PRICES PAID FOR AGRICULTURAL PRODUCTS AND INPUTS
(1976 Normalized Prices)

<u>Commodity</u>	<u>Unit</u>	<u>Price</u>
Feeders		
Steers, choice 400-500 lbs	cwt	\$ 41.50
Livestock expenses		
Supplemental feeds Soybean meal	cwt	10.02
Crop expenses		
Seed costs		
pasture, rotation	lb.	.89
dry beans	lb.	.188
alfalfa-certified	lb.	1.01
corn, hybrid	lb.	.722
potatoes	lb.	.061
Fertilizer costs		
Nitrogen solutions, 32% N	ton	130.00
Super phosphate, 46% P	ton	146.00
Muriate of potash, 60% K	ton	150.00
General expenses		
Hired labor	hr.	3.00
Marketing livestock	cwt	.75
Insurance		
Dwelling	\$100	.50
Other buildings	\$100	.50
Regular gasoline, bulk	gal	.50
Lubricating oil	gal	2.24
Diesel fuel	gal	.37

Table 16
BENEFIT BUDGET SUMMARY
GRASS ROPE UNIT

<u>Item</u>	
Irrigable acres	340
Farm investment	\$338,682
Total labor (hours)	3,366
Operator and family labor (hours)	(2,837)
Hired labor (hours)	(529)
Crop sales	\$156,153
Livestock sales	\$ 56,973
Farm prerequisites	<u>\$ 2,580</u>
Gross Farm Income	\$215,706
Less farm expenses ^a	<u>\$118,755</u>
Net Farm Income	\$ 96,951
Adjusted net farm income ^b	\$ 90,843
Annual per-acre benefit	\$ 267

^aDoes not include the cost of on-farm sprinkler irrigation units.

^bReflects a 3-year development period factor (.937).

updated with completion of the SDSU/USD Econometric Model Study. These numbers do not include the cost of water delivery to the unit, including both fixed cost and annual O&M and power cost.

From the Project Formulation and Evaluation Chapter an estimate of total project construction cost was made. These estimates are as follows:

Open Ditch Delivery System:

Main delivery system	\$1,120/acre
Open ditch lateral system (typical)	240/acre
On-farm pump station, pipe, and pivot	560/acre
Total	\$1,920

Pressure Pipe Delivery System:

Main delivery system	\$1,120/acre	\$1,120/acre
Pressure pipe system layout A	490	1,040
Pressure pipe system layout E		
Total	\$1,510	\$2,150

Pressure pipe system layout A is a minimum-cost system in that the irrigated quarter section lies adjacent to a main canal. Layout E is a maximum-cost system in that the irrigated quarter section is 2 miles from the main canal and there is no intervening irrigation.

The conversion of construction cost to annual cost depends upon the time period selected for the economic life of the project and the interest rate to be used. A realistic assumption on the main delivery system would be a 50-year payout period with interest at 7.5 percent, the current Federal interest rate being used on water projects. The open ditch laterals and/or pumping plants and pressure pipes could be considered for a 25-year payout period at 10-percent interest. The on-farm pivot system could realistically be considered on a 15-year payout period at 15-percent interest rates. Using these assumptions plus a "typical" layout for the open ditch system and a range of layouts for the pressure pipe system (i.e., those used in the examples in the report, "Procedures to Determine Costs for the Lateral Distribution System"), the annual cost of facilities are as follows:

Per Acre Annual

Open Ditch System

Main delivery system	\$ 86.32
Sublateral open ditches	26.44
On-farm pumping plant, pipe and pivot	<u>87.85</u>
Total	\$200.61

Pressure Pipe System

Main delivery system	\$ 86.32
Pumping station	14.32
Pivot	73.53
Pipe layout range	<u>11.07 to 71.61</u>
Total	\$185.19 to 245.78

Added to these annual equivalent costs would be annual operation and maintenance costs, of which power cost would be the major factor. The Grass Rope farm-budget analysis did include "on-farm" facility O&M cost plus power for the pivots and booster stations. Thus, the only L&M cost missing from the above analysis is that required for the main delivery system. An O&M cost for the main delivery system of \$8.35 per acre, exclusive of power, is estimated based upon similar large irrigation projects. Power cost for the main delivery system is estimated to range from \$1.01 per acre for the build of the system, up to \$15.55 an acre for the area served by the Highmore Branch.

CONCLUSIONS

The purpose of the above discussion is not to provide a definite determination as to the economic feasibility of the CENDAK project. The level of confidence in the appraisal-level cost estimates and the assumptions used in applying the Grass Rope Unit farm budget to this project prohibits a definitive answer to the question of economic feasibility. The information presented does, however, show that the project is in range of being economically feasible based upon direct benefits to the individual operation. The effects of secondary benefits to communities and the state as a whole would be in addition to those direct benefits shown.

Chapter X INSTITUTIONAL AND FINANCIAL ARRANGEMENTS

INTRODUCTION

This chapter discusses the institutional and financial arrangements that will be necessary to fully develop the CENDAK Irrigation Project. Three areas are of concern: establishing a sponsoring entity, obtaining valid water rights, and developing a sound financial plan. Several options are examined in each of these areas.

SPONSORING ENTITY

South Dakota law governs the establishment and operation of a legal entity empowered to develop and operate a multi-million-dollar irrigation project. While state statutes can be modified through legislative action and/or new governmental entities created, it appears best to work within the existing statutory framework.

Criteria

In order to effectively develop and manage the project as previously described in this Master Plan, it appears that certain criteria must be met by the institutional entity established. These criteria are summarized in Table 17.

Options

A review of South Dakota water statutes indicates that there are five viable options for creating the institutional entity to sponsor the project. These options are listed in Table 18, along with the governing statutes.

A completely new governing entity could be created by the legislature or the State of South Dakota itself, through the State Water Resources Management Act, could sponsor and develop the CENDAK project. The state would thus become the managing entity, just as it now develops and manages a state highway system. These two options do not appear to be politically viable at this time, although state technical and financial assistance to a local sponsoring entity is a strong possibility.

Comparisons

Table 19 provides a brief comparison of the institutional options. A complete comparison is beyond the scope of this study, but for purposes of determining which entity appears more favorable for the CENDAK project, the information in Table 19 can be used as a starting point.

Table 17
CRITERIA TO JUDGE INSTITUTIONAL OPTIONS
FOR CENDAK PROJECT

1. Ability to develop and manage a multi-million-dollar water project.
2. Ability to contract with all levels of government and individuals.
3. Ability to raise and administer multi-million-dollar funding.
4. Ability to withstand lawsuits and initiate lawsuits (to sue and be sued).
5. Ability to acquire land, rights-of-way, and other rights by eminent domain.
6. Ability to acquire future use and other water rights.
7. Ease of establishment.
8. Ability to "add to or subtract from" easily in terms of area.
9. Establishment of a governing body that equitably represents all interested parties.
10. Acceptability by local, state, and Federal governmental agencies, both executive and legislative.

Table 18
CENDAK INSTITUTIONAL OPTIONS

<u>Type</u>	<u>Statutory Authority</u>
Nonprofit corporation/association	SDCL 10-36A
Water user district	SDCL 46-16
Irrigation district	SDCL 46-12 through 15
Separate conservancy subdistrict	SDCL 46-18-11
Oahe conservancy subdistrict	SDCL 46-18

Name	Nonprofit Corporation	Water User District	Irrigation District	Separate Conservancy Subdistrict	Oahe Conservancy Subdistrict
Statutes	SDCL 10-36A	SDCL 46-16	SDCL 46-12, 13, 14, 15	SDCL 46-18-11	SDCL 46-18
Establishment					
Steps required	File Articles of Incorporation with Secretary of State	Circulate petition, Advetise, File petition with DWR	Circulate petition, File petition with County Commission, Hold hearing, Advetise election, Hold election	Circulate petition, File petition with DWR, Advetise election, Hold election	None as subdistrict is established
Approval agencies	None	DWR	DWR and County Commission	DWR	--
Estimated time required	Few days	2-3 months	6 months	4-5 months	--
Area required	Not specified	Allows non-contiguous	Contiguous lands	Rural areas of County, Municipalities included separately	--
Inclusion of municipalities	Not applicable	Yes	No	Yes	--
Powers					
Legal powers	Limited	Broad	Broad	Broad	--
Administrative powers	Limited	Broad	Broad	Broad	--
Approvals required	None	None	Specified items by DWR	Budget approval by DWR	--
Governing body					
Initial selection	In initial bylaws	In petition	By election	In petition	--
Number	Not specified	5 to 13	3 to 10	Up to 11	--
Term of office	Usually annual	3 years	3 years	4 years	--
Meetings required	Annually	Not specified	Monthly	Not specified	--
Administration					
Requirements for administration	Not specified	Very broad	Very specific	Broad	--
Staff availability	Not specified	As needed	As needed	As needed	--
Long-term operation and maintenance	Yes	Yes	Yes	Yes	--
Financing					
Taxation	No	No	Yes	Yes, 0.1 mill; 1.0 mill upon electoral approval	--
Bonds	Revenue	Revenue	General obligation	No	--
Service contracts	Yes	Yes	Yes	Yes	--

Although not listed in Table 19, the period in which the statutes for each of the options enacted greatly influences its adaptability to the CENDAK project. For example, the basic irrigation statutes were first adopted in 1917. Although amended many times since then, these statutes reflect conditions of 60 years ago. The irrigation district statutes have never been fully updated or modernized. Trying to meet every requirement of every statute which relates to a multi-million-dollar development would be most difficult.

The water user district statutes were first adopted in 1939; however, they were extensively updated throughout the 1970s to make them applicable to development of larger rural water systems. Although some provisions are limiting in nature, the overall act is working well for the rural water systems.

The Conservancy Sub-District Act was adopted in 1959 and has proved workable over the last 22 years; however, none of the six conservancy subdistricts in the state has fully developed and managed a large project. A 1981 amendment does allow an area to withdraw from an established subdistrict and create its own separate subdistrict. The separate subdistrict would then be bound by the same statutory requirements as existing subdistricts.

Recommendations

It is recommended that the CENDAK Steering Committee seriously consider the establishment of a water user district as its sponsoring entity in preference to any of the other options. The advantages are:

- o A water user district is relatively easy to establish, requiring only that 25 percent of the landowners in the proposed district sign the petition. It is recommended, however, that essentially 100 percent of the landowners sign the petition; this will be explained in later paragraphs.
- o The lands included in the district need not be contiguous.
- o A district may include all or part of a municipality, but a district may serve a municipality with water even though it is not part of the district.
- o A district has full power to construct and operate systems of works for the conservation, storage, distribution, and utilization of water.

- o A district has rights of eminent domain, both within the district lands and outside the district lands.
- o A district may acquire both future use water rights and other water rights.
- o A district may add or subtract area relatively easily through the petition process.
- o The governing body can be no less than 5 nor more than 13, elected either at large or by election divisions. The term of office is 3 years.
- o The district does not have the power to levy taxes or assessments, but must rely upon service charges for its revenue.
- o The district does not have lien power on a given tract of land for failure to pay taxes or assessments.
- o The district can accept funds from any source and can contract with any individual or level of government.

There are some disadvantages to a water user district as it relates to the development and management of the CENDAK project. These include:

- o Without taxing power, a water user district may have a difficult time raising initial planning and administrative funding prior to the time that water service contracts are established. This could be overcome by indicating in the organizing petition that administration of the District and preparing the necessary planning studies are a service to be provided, therefore an equitable annual assessment will be made. If a member refuses to pay that assessment, he will be dropped from the District and refused future water service.
- o Most Federal reclamation funding contracts require some type of land security to back the reclamation loans or repayment schedules. A water user district cannot provide such security. However, this requirement has been waived in some projects by providing relatively long-term water service contract agreements.
- o The degree of acceptability by private financing institutions is unknown, due to the first two factors.

Establishment

The Department of Water and Natural Resources has summarized the procedures for organizing a water user district; these are referenced in Appendix 1.

In organizing a water user district for the CENDAK project, it is recommended that every effort be made to obtain 100 percent of the landowner signatures for those lands to be included in the district. In essence, the individual landowner is given a choice of whether he wants to become a member and have the potential for irrigation; this choice is given at the time that the district is established. It can be expected that many landowners will enroll only portions of their holdings; i.e., those areas that they anticipate irrigating, rather than the full farm or ranch area. While other tracts may be added to the district later, a heavy financial penalty should be imposed. Ultimately, the design capacity of the irrigation system will limit further additions.

Timing

The timing for establishment of the sponsoring entity is critical. Since the cost of organizing a water user district is less than that of an irrigation district or separate conservancy subdistrict, it can be done relatively early. It is suggested that if an acceptable Master Plan is developed that it form the basis for organizing the water user district, rather than delay until a full-fledged feasibility study is completed. Two to three months of concentrated work should be allowed for organizing the district.

WATER RIGHTS

Compared to most rivers and streams in the western United States, the source of water for the CENDAK project is under-appropriated. Obtaining the necessary water rights should not be a major problem. The logical sequence would be to obtain a future use permit for the general area based upon the Master Plan proposals. As sections of the plan are finalized for construction, the future use permit would be converted to a regular water right permit. Upon completion of the various sections and utilization of water, applications could be made for certificates of construction and water licenses.

Future Use Permit

CENDAK does have the option of requesting that the Oahe Conservancy Sub-district release a portion of its future use permit for the Oahe Unit to the CENDAK project. Some of the

same lands and many of the same water sources are common to both projects. Of some significance would be the Oahe's future use rights on the intermediate streams, such as Medicine Knoll Creek, Cresbard Creek, and the James River, as well as the Missouri River. The advantage would be an earlier priority date than that currently received. Conversely, if the Oahe Unit is never developed, these future use rights will eventually be cancelled, and the water would revert to satisfying later priorities.

The second option would be to file for a future use permit as soon as is legally possible. Essentially, a sponsoring entity, such as a water user district, must first be organized, and an application filed. Since the application will be in excess of 10,000 acre-feet annually, legislative approval will be required.

Timing

Upon completion of an acceptable Master Plan and creation of a sponsoring entity, the future use water right application should be prepared and filed. It could be filed in time for the 1982 legislative session, provided that the sponsoring entity is created in a relatively short time.

FINANCING ARRANGEMENTS

Currently, all financing for the CENDAK project comes from contributed time and monies from interested landowners. The assessment of \$0.25 to \$0.50 per acre has raised sufficient funds to initiate an organization, assess the local wants and needs, and prepare this Master Plan. Any further studies will require additional funding.

Continued Study

It has been suggested that the CENDAK project follow the traditional progression of development, to include:

WANTS AND NEEDS INVENTORY

MASTER PLAN

PRELIMINARY DESIGN AND FEASIBILITY

FINAL DESIGN

CONSTRUCTION

OPERATION

Interwoven is the requirement to organize a strong sponsoring entity, apply for the necessary water rights and other permits, negotiate with the Federal agencies for use of existing facilities, and develop a viable financing plan.

If the next major step is a preliminary design and feasibility study, including the necessary field investigations, then consideration must be given to major financing. From 1 to 2 percent of total anticipated construction costs should be spent on this phase of the study. A \$400 million project would require \$4 million to \$8 million to be spent on the preliminary design and feasibility study. This would be equivalent to \$10 to \$20 per acre over the estimated 400,000 acres in the project. Potential sources of funds would include:

- o Contributions at the rate of \$10 to \$20 per acre from the 400,000 acres included in the proposed project.
- o Expenditures by either the Oahe Conservancy Sub-district or county government, with funding from general property taxes in the project area.
- o Appropriation from the General Fund or other funds by the state legislature.
- o Appropriation from Congress on either a loan or grant basis.
- o Some combination of these factors.

It is recommended that Federal funding be sought on the basis that continued Federal involvement will greatly enhance the opportunity for development of the project. The overall projected benefits of the Pick-Sloan Missouri Basin Plan will not be met until major irrigation development takes place. A joint local-state-Federal partnership in making that development happen can start with the CENDAK project.

Construction

The financing of the construction of a project the size of CENDAK will require extraordinary means. Total project costs just for the major delivery system, including engineering, legal, and administration, are in the range of \$375 million. Additional costs are associated with the smaller laterals and on-farm facilities.

Potential sources of funding include:

- o A Federal government appropriation based on completion of the Pick-Sloan Missouri Basin Plan, with or without power revenue payback.
- o State bonding proceeds, thus requiring major legislative approval and/or a constitutional amendment, depending upon how this task is undertaken.
- o District bonding proceeds, utilizing private financing for all or a portion of the cost.
- o A combination of these factors.

Although final decisions on project construction financing should await the outcome of more definitive feasibility studies, early consideration of this item is necessary. It is recommended efforts be made to utilize Pick-Sloan Missouri Basin Program irrigation power set-asides and power revenues to help finance the project. This will mean continuation of long-term financing commitments made by the Federal government at the time the basin program was being developed. Those long-term commitments to basic production investments and public works expansion still make sense in view of South Dakota demographic and economic conditions.

Chapter XI FEASIBILITY STUDY

The preliminary information developed for the CENDAK Project shows sufficient promise such that a detailed feasibility study on the project should be conducted. The three basic purposes are to determine:

1. Engineering feasibility - can a project be constructed to serve the project area or are there significant constraints to project development?
2. Economic Feasibility - are the project benefits equal to or greater than the project costs?
3. Financial Feasibility - can the project be financed in such a way that the project costs can be repayed?

The following sections briefly describe the major activities that will be undertaken in the feasibility study.

I. Service Area Determination

The preliminary information developed by the Master Plan will be used in contacting farmers who have shown interest in the CENDAK project. A reaffirmation of interest will be ascertained based upon expected project costs. Based upon these discussions, a new set of project area maps will be produced.

II. Preliminary Project Layouts

Using the service areas designated above, several alternative major canal alignment routes will be identified. Once the alternative major canal alignments have been established, lateral canal or pressure pipelines will be identified. Preliminary cost estimates will be prepared for each alignment and the results submitted to the Steering Committee for review. Based upon this review, a preliminary alignment will be selected for detailed study.

III. Cropping Patterns

Once interest in the project is determined, a survey will be taken to determine the most likely cropping patterns. These patterns will be used in subsequent tasks to determine peaking and total water usage.

IV. Availability of Water and Storage Requirements

The preliminary layouts established in Task II will be used to determine the pumping and peaking requirements and required storage volumes. The project is constrained by the capacity of the existing Oahe Pumping Plant. Though storage in Blunt Reservoir is shown in the Master Plan, other reservoir sites will be investigated. Once the diversion capacity and reservoir location and capacities are determined, water rights filings will be initiated.

V. Geotechnical Studies

Once the project facilities have been preliminarily determined, a feasibility level geotechnical investigation will be developed. These will be coordinated with those studies previously undertaken by the Bureau of Reclamation for the Oahe Project. The major consideration here will be on dam sites and major structure locations and the determination of suitability for these structures.

VI. Soils Capability

The studies to be undertaken here were previously described in detail in Chapter VII. The purpose of these studies will be to identify soils that are unsuitable for irrigation development and to determine the need for drainage facilities.

VII. System Refinement and Preliminary Cost Estimate

The previous studies will be incorporated in the preliminary plan and a refined delivery system will be developed. Studies will be initiated to determine the system power needs, the source of the power, and an estimation of the power costs. Once the system has been finalized, a preliminary cost estimate will be prepared.

VIII. Environmental Studies

With the project facilities now defined, the environmental studies will be initiated. Contacts with appropriate state and Federal agencies will be made and public meetings will be held to obtain input on the project. Preliminary studies will be conducted to identify critical habitat, wetlands, etc., and other areas that should be avoided by the project. Where possible, the project will be

modified to eliminate identified concerns. Mitigation plans will be developed when impacts are unavoidable.

IX. Economic Studies

Based upon estimated project cost data, anticipated cropping patterns, and related data, preliminary economic studies will be conducted. Budgets will be prepared and benefits will be determined and compared with project cost. Socio-economic studies will be conducted to determine impacts on the project area.

X. Financial Studies

Studies will be undertaken to determine methods of financing the project. This will include public financing through state and Federal programs as well as private financing through the bond market. Combinations are also a possibility.

XI. Draft and Final Reports

A draft report will be developed and distributed for review. Public meetings and hearings will be held. Comments and concepts presented at the hearings will be incorporated into the draft report and a final report produced.

PROCEDURES FOR ORGANIZING A WATER USER DISTRICT

1. The Water User District must be organized under the provisions of SDCL 46-16.
2. It must be of public interest, welfare, convenience, and necessity and the construction of works for the conservation, storage, distribution, and utilization of water. SDCL 46-16-1.
3. A petition addressed to the South Dakota Board of Natural Resource Development is required according to SDCL 46-16-4 containing the following items:
 - A. Name of the proposed district. Examples: Randall Community Water District. North Grand Water User District.
 - B. The objective and purpose of the system together with a general description of the nature, location, and method of operation.
 - C. Description of the lands constituting the proposed district along with its boundaries including names of any municipality included.
 - D. The location of the principal place of business.
 - E. A statement that the proposed district shall not have the power to levy taxes or assessments.
 - F. The number of members of the Board of Directors shall be no less than five, no more than 13 and elected at large or be apportioned to election divisions. The names and addresses of the first board shall be included in the petition.
4. Before signing of the petition, a copy of the same may be submitted to the Department of Natural Resource Development to determine if it is in proper form and legal pursuant to SDCL 46-16.
5. The lands included in the district need not be contiguous parcels.
6. A district may include all or part of a municipality. A separate petition is needed for the municipality and must be signed by 25% of landowners in the municipality. If the District plans to sell water service to the municipality in bulk, then the municipality does not have to become part of the District.

7. The number of signatures required is 25% of the landowners, including the wives, relatives, or other individuals who may also have their name listed on the land deed. If land is sold under contract for deed which is of record, both the vendor and vendee shall be treated as landowners. Records in Register of Deeds and Director of Equalization offices will be used to determine ownership. Although only 25% of the landowners' signatures is required, an attempt should be made to have the highest percent possible.
8. SDCL 46-16-10 gives the form for the affidavit of circulator as to signatures. Each sheet of signatures should have this affidavit.
9. Pursuant to SDCL 46-16-11, maps, plans, and estimates must accompany the petition. The normal consulting engineers preliminary plans are sufficient.
10. The petition must then be published in each county, in which the lands are located, in some newspaper of general circulation once each week for at least two successive weeks before the petition is officially filed with the Department of Natural Resource Development. SDCL 46-16-13.
11. After determination that the petitioners have complied with the requirements of the law, the Department of Natural Resource Development will make an immediate investigation of the proposed works, systems or plans and of the engineering feasibility of the project.
12. Within 90 days of the official filing of the petition, the Board of Natural Resources will act on the petition. If the Board determines the project is feasible and conforms to public convenience and welfare, it shall execute a certificate of organization and file same with Secretary of State and each Auditor in county where district lands are located. The District is now organized.
13. A nonprofit corporation or association may transfer all its assets, liabilities, contracts and other obligations to a water user district upon approval of a majority vote of the water user district membership voting in an election thereon. SDCL 46-16-40.1.

* * * * *

THE ABOVE BRIEFLY OUTLINES ORGANIZATION OF A WATER USER DISTRICT. IT IS RECOMMENDED LEGAL COUNSEL BE USED IN ORGANIZING A DISTRICT. THE DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT WILL PROVIDE ASSISTANCE UPON REQUEST.

For the Water Management Board

at 10A: M. The Board is authorized to make a determination on this application at the hearing. All interested persons may appear and be heard. Any person who may be affected by a Board decision who desires to present evidence or cross-examine witnesses according to SDCL 1-26 may notify the Board in writing prior to the hearing or orally at the hearing.

This Application No. 4031-3 will be considered by the Water Management Board at Howard Johnson Motel, 3300 W Russell, Sioux Falls SD upon the 2nd day of December, 1961

~~Intimate details for multiple use~~

of Section 6, Twp. 111N, Range 70W. Said water to be used for the purpose of providing irrigation on portions of the following described land:

address is _____ Box 69, Miller
in accordance with the provisions of SDCL 46-1-1 thru 46-1-14;
46-2-9 thru 46-2-11, 46-2-13; 46-5-1 thru 46-5-8, 46-5-10 thru 46-5-22, 46-5-25, 46-5-38,
46-5-41, and Board Rules ARSD 52:01:01:01 thru 52:01:01:13; 52:01:01:21 thru 52:01:01:24,
for a permit to appropriate for beneficial use _____ cubic feet of water per second
_____ annually

(one million five hundred thousand) _____ through the _____ CNDAK Water Supply System,
~~the Missouri River Reservoir~~ _____
the point(s) of diversion of which is (are) _____ to be located in the _____

Notice is hereby given ~~CRIMAK, Water Supply System, Inc.~~ whose post office

November 18, 1981

Pierre, South Dakota 57501

NOTICE OF HEARING ON
APPLICATION TO APPROPRIATE WATER

Publish first publication, on or before November 20, 1981



Department of Water & Natural Resources

Joe Foss Building
Pierre, South Dakota 57501

Water Rights Division
(605) 773-3352

No. 4831-3

November 18, 1981

Bob Hipple
CAPITOL JOURNAL
Pierre SD 57501

Dear Mr. Hipple:

Enclosed is a Notice of Intent to Appropriate Water by CENDAK Water Supply System, Inc.

Application No. 4831-3, in Hughes County, South Dakota. Please publish this notice once each week for two consecutive weeks in your paper, as provided for in SDCL 46-5-17 amended. The first publication should be on, or

before November 20, 1981. The second publication must occur at least four days before the first day of the Water Management Board Meeting.

The Applicant should verify to you that the notice is to be published, before you make the first publication. The applicant is to pay the costs of publication and should make the necessary arrangements with you to pay these costs.

Please receipt for this notice immediately after first publication attaching thereto a copy of the first publication so that it may be compared with the records. For your convenience, you may use the printed form below for this purpose.

After final publication, please complete the enclosed Form 8 to furnish Proof of Publication. The permit to appropriate water cannot be issued until this proof of final publication is received. This Proof of Publication must be filed within 60 days of this notice for the applicant to retain his priority.

For the Water Management Board,

encl: Forms 6 & 8

cc: Applicant

Betty Westlund, Water Rights Specialist

No. 4831-3

Date _____

TO: Water Rights Division
Joe Foss Building
Pierre, SD 57501

Dear Sirs:

We are in receipt of your letter of _____, 19____ enclosing Notice of Proposed Appropriation of Water, as proposed in Application No. _____ which was first published in our issue of _____, 19____. ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.

Sincerely,

NAME _____

NEWSPAPER _____

WNR-807-10/81 Letter to Publisher

No. 4813-3

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
County Hughes) ss.

I, Beverly Jones hereby

certify that the annexed printed copy of Notice of Intent to Appropriate

Water was taken from the Daily Capital Journal

A newspaper which during the whole time of publication of said notice
herein after stated, has been and is printed and published in the

City of Pierre

County of Hughes and State of South Dakota;
that the said notice was published in said newspaper on the following
two dates:

11-20-81 + 11-27-81

Beverly Jones
(Signature)

Bkkeeper
(Title)

11-30-81
(Date Signed)

Karen L. Kern

Cost of Printing: 25.19

WNR-808-7/79
Proof of Publication

No. 5340 2d dly 11-20 & 11-27

No. 4831-3

Publish first publication, on or
before November 20, 1981

NOTICE OF HEARING ON
APPLICATION TO
APPROPRIATE WATER

Pierre, South Dakota 57501
November 18, 1981

Notice is hereby given
CENDAK, Water Supply Sys-
tem, Inc. whose post office
address is Box 69, Miller, South
Dakota, has made an applica-
tion in accordance with the
provisions of SDCL 46-1-1 thru
46-1-9, 46-1-12 thru 46-1-14; 46-2-9
thru 46-2-11, 46-2-13; 46-5-1 thru
46-5-8, 46-5-10 thru 46-5-22,
46-5-25, 46-5-38, 46-5-41, and
Board Rules ARSD 52:01:01:01
thru 52:01:01:13; 52:01:01:21
thru 52:01:01:24, for a permit to
appropriate for future bene-
ficial use 1,500,000 acre feet of
water annually (one million five
hundred thousand) from the
Missouri River (Oahe Reser-
voir) through the CENDAK
Water Supply System, the
point of diversion of which is to
be located in the NW 1/4 of
Section 6, Twp. 111N, Range
79W. Said water to be used for
the purpose of providing future
water supplies for multiple use.

This Application NO. 4831-3
will be considered by the Water
Management Board at Howard
Johnson Motel, 3300 W. Russell,
Sioux Falls, SD upon the 2nd
day of December, 1981 at 10
A.M. The Board is authorized to
make a determination on this
application at the hearing. All
interested persons may appear
and be heard. Any person who
may be affected by a Board
decision who desires to present
evidence or cross-examine wit-
nesses according to SDCL 1-26
may notify the Board in writing
prior to the hearing or orally at
the hearing.

This hearing is an adversary
proceeding. Any person has the
right to be present or to be
represented by a lawyer. These
and other due process rights
will be forfeited if they are not
exercised at the hearing. De-
cisions of the Board may be
appealed to the Circuit Court
and the State Supreme Court as
provided by law.

Any handicapped person
wishing to attend this hearing
can contact the Water Rights
Division, DWNR, Joe Foss
Building, Pierre SD, prior to the
hearing date for assistance to
assure access to the hearing.

For the Water
Management Board
BETTY WESTLUND,
Water Rights Specialist

cc: applicant
WNR-806B-10-81 Notice of Intent
to Appropriate Water
SURFACE WATER-FUTURE
USE

January 20, 1962

Honorable Walter D. Miller
Speaker of the House
State Capitol Building
Pierre, South Dakota 57501

Dear Representative Miller:

In accordance with SDCL 46-5-20.1, transmitted herewith is a copy of CENDAK Water Supply System, Inc. Application No. 4831-3 to appropriate 1,500,000 acre feet annually from the Missouri River (Oahe Reservoir Storage) for future use purposes. The Water Management Board is submitting the application to the Legislature without recommendation. A copy of a draft resolution is also enclosed.

Very truly yours,

Warren R. Neufeld, Secretary

Enclosure

cc: Governor Jenkinson
CENDAK Water Supply System, Inc.

c11304dh.pub

HOUSE JOINT
RESOLUTION NO.

Introduced by:

A JOINT RESOLUTION, approving application number 4831-3 for future water needs.

BE IT RESOLVED BY THE HOUSE OF REPRESENTATIVES OF THE STATE OF SOUTH DAKOTA, THE SENATE CONCURRING THEREIN:

WHEREAS, pursuant to § 46-5-20.1, CENDAK Water Supply System, Inc. a South Dakota non-profit corporation has made application numbered 4831-3 to the department of water and natural resources and the water management Board to appropriate water for future water needs, in the amount of 1,500,000 acre-feet annually to be taken from unappropriated flows of the Missouri River (Oahe Reservoir Storage), and

WHEREAS, the department of water and natural resources after studying this future use water application and, based solely upon its interpretation of 46-5-38, recommended that the water management board not accept this application numbered 4831-3, and

WHEREAS, the water management board at its regular meeting, held in December 1981 in Sioux Falls, South Dakota voted to submit this application to the Legislature without recommendation, and

WHEREAS, the future use contemplated by this application numbered 4831-3 includes future irrigation, municipal, commercial, industrial, and recreational water uses, and

WHEREAS, In the event a future use permit is granted and feasibility supports such uses, the applicant will be required to demonstrate that the proposed use is beneficial and in the public interest, and

NOW BE IT HEREBY RESOLVED that the future use water permit application numbered 4831-3 is hereby approved and is hereby transmitted back to the water management board for final action.

A11201JH.wr

State of South Dakota

FIFTY-SEVENTH SESSION
LEGISLATIVE ASSEMBLY, 1982

SENATE	S.J. Page	Aye	Nay
Assigned to Committee on:			
Senate			
Committee Report:			
Do Pass Amend Table			
Legislative Action on Amendments:			
Adopted Not Adopted			
Second Reading and Final Passage:			
Pass Fail			
HOUSE	H.J. Page	Aye	Nay
Assigned to Committee on:			
House			
Committee Report:			
Do Pass Amend Table			
Legislative Action on Amendments:			
Adopted Not Adopted			
Second Reading and Final Passage:			
Pass Fail			

400E773

SENATE JOINT RESOLUTION NO. 3

Introduced by: Senators Shanard, Harding and McClure and Representatives Volesky and Burg

1 A JOINT RESOLUTION, Approving application number 4831-3 for future
2 water needs.

3 BE IT RESOLVED BY THE SENATE OF THE STATE OF SOUTH DAKOTA, THE HOUSE
4 OF REPRESENTATIVES CONCURRING THEREIN:

5 WHEREAS, pursuant to § 46-5-20.1, CENDAK Water Supply System, Inc.
6 a South Dakota nonprofit corporation has made application numbered
7 4831-3 to the department of water and natural resources and the water
8 management board to appropriate water for future water needs, in the
9 amount of 1,500,000 acre-feet annually to be taken from unappropriated
10 flows of the Missouri River (Oahe Reservoir Storage), and

11 WHEREAS, the department of water and natural resources after
12 studying this future use water application and, based solely upon its
13 interpretation of 46-5-38, recommended that the water management board
14 not accept this application numbered 4831-3, and

15 WHEREAS, the water management board at its regular meeting, held
16 in December 1981 in Sioux Falls, South Dakota voted to submit this
17 application to the Legislature without recommendation, and

18 WHEREAS, the future use contemplated by this application numbered

Insertions into existing statutes are indicated by underscores.
Deletions from existing statutes are indicated by ~~overstrikes~~.

1 4831-3 includes future irrigation, municipal, commercial, industrial
2 and recreational water uses, and

3 WHEREAS, in the event a future use permit is granted and feasi-
4 bility supports such uses, the applicant will be required to demon-
5 strate that the proposed use is beneficial and in the public interest,
6 and

7 NOW, THEREFORE, BE IT RESOLVED, by the Senate of the Fifty-seventh
8 Legislature of the state of South Dakota, the House of Representatives
9 concurring therein, that the future use water permit application num-
10 bered 4831-3 is hereby approved and is hereby transmitted back to the
11 water management board for final action.

Feb. 16 Title amended. S.J.

LAST SCREEN OF DOCUMENT

Senate Joint Resolution No. 0003:

By Senators Shanard, Harding and McClure and Representatives Volesky
and Burg

ENTITLED, Approving application number 4831-3 for future water needs.

Jan. 18 Introduced, referred to State Affairs. S.J. 213.

Jan. 22 Committee hearing set for Jan. 25.

Feb. 02 Committee hearing set for Feb. 3.

Feb. 03 Committee report, do pass. S.J. 498.

Feb. 04 Deferred. S.J. 551.

Feb. 05 Passed Senate, AYES 35, NAYS 0. S.J. 577.

Feb. 08 Received from Senate. H.J. 660.

Feb. 08 Referred to State Affairs. H.J. 702.

Feb. 10 Committee hearing set for Feb. 12.

Feb. 12 Committee report, do pass. H.J. 820.

Feb. 16 Passed House, AYES 64, NAYS 5. H.J.