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# FINAL ENGINEERING REPORT

## LEWIS & CLARK RURAL WATER SYSTEM

*Organized to bring Missouri River water to northwest Iowa, southwest Minnesota and southeast South Dakota.*

Report Prepared For:

**Lewis and Clark Rural Water System, Inc.**

Sioux Falls, South Dakota

Final Engineering Report Prepared By:

**Banner Associates, Inc.**

Brookings, South Dakota

**HDR Engineering, Inc.**

Sioux Falls, South Dakota

Draft Environmental Assessment (not attached) Prepared By:

**TRC Mariah Associates Inc.**

Laramie, Wyoming

**May 2002**

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# LEWIS & CLARK RURAL WATER SYSTEM FINAL ENGINEERING REPORT

PROJECT: FINAL ENGINEERING REPORT

LOCATION: SOUTHEAST SOUTH DAKOTA,  
NORTHWEST IOWA AND SOUTHWEST  
MINNESOTA

OWNER: LEWIS AND CLARK RURAL WATER  
SYSTEM, INC.

PROJECT NUMBER: 20000.00.01

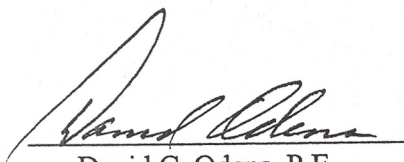
REPORT DATE: MAY, 2002

ENGINEER: BANNER ASSOCIATES, INC.  
BROOKINGS, SOUTH DAKOTA

HDR ENGINEERING, INC.  
SIOUX FALLS, SOUTH DAKOTA



I hereby certify that this report was prepared by me or under my direct personal supervision, and that I am a duly registered Professional Engineer under the laws of the State of Minnesota.



5/20/02

David C. Odens, P.E.  
Minnesota Reg. No. 17745

May 20, 2002

Pamela A. Bonrud, Executive Director  
Lewis and Clark Rural Water System, Inc.  
401 East 8<sup>th</sup> Street  
Suite 306  
Sioux Falls, SD 57103

**SUBJECT: Final Engineering Report – Lewis & Clark Rural Water Project  
Letter of Transmittal and Executive Summary**

Dear Ms. Bonrud:

Attached is the Final Engineering Report (FER) for the construction of the Lewis & Clark Rural Water System located in southeast South Dakota, northwest Iowa and southwest Minnesota. The Design Team has addressed the comments made to the draft report and incorporated the appropriate revisions into this FER. Responses to the comments are included in Appendix D.

The purpose of this FER is to provide design criteria for system components; evaluation of system alternatives; an evaluation and layout of the proposed improvements; opinions of probable costs; business plan and a water conservation program. Environmental evaluation of the project is included in the *Draft Environmental Assessment for the Lewis and Clark Rural Water System, South Dakota, Minnesota and Iowa* (May 2002). The draft Environmental Assessment is a separate document and was prepared for this project by TRC Mariah Associates Inc. for Reclamation.

The following summarizes our findings during preparation of the FER. Additional details follow in the body of the report.

**A. Introduction and History of the Project.** Lewis and Clark Rural Water System, Inc. (Lewis & Clark) was formed in 1990 to provide clean and plentiful water to people for whom safe, reliable drinking water has never been a consistent commodity. Regional water problems include shallow wells and aquifers prone to contamination and drought, compliance with new Federal drinking water standards, and insufficient resources to meet increasing water demand due to population growth and economic expansion.

Lewis & Clark proposes a project to develop a groundwater supply adjacent to the Missouri River and a water treatment facility in southeast South Dakota near Vermillion. Treated water will be piped to member municipalities and rural water systems. When complete, the project will provide safe, reliable drinking water to approximately 200,000 people in South Dakota, Minnesota, and Iowa. Lewis & Clark's member systems would use this new source of water to replace or supplement existing sources of supply.

The Lewis and Clark Rural Water System Act was signed into law (Public Law 106-246) by the President on July 13, 2000. The Lewis and Clark Rural Water System Act authorized \$213,887,700 (1993 costs, subject to cost indexing) in the form of a Federal grant for planning and construction of the project. The states and local project sponsors will provide the remaining funds necessary to complete construction of the \$272,800,000 project (1993

costs, subject to cost indexing and other adjustments as described later in this Executive Summary and Final Engineering Report). The original state share was \$27,280,000 and the original local share was \$31,632,300 (these costs are in 1993\$)

**B. Lewis & Clark's Member Systems.** Lewis & Clark will address concerns regarding low quality, contamination vulnerability, and insufficient supply of existing drinking water sources for its members. Lewis & Clark's member systems include the following municipalities and rural water systems:

South Dakota	Iowa	Minnesota
Beresford	Boyden	Luverne
Centerville	Hull	Worthington
Harrisburg	Sheldon	Rock County RWS
Lennox	Sibley	Lincoln - Pipestone RWS
Madison	Sioux Center	
Parker	Clay Regional RWS	
Sioux Falls	Rural Water No. 1	
Tea	Rock Rapids <sup>1</sup>	
Lincoln County RWS		
Minnehaha Community Water Corporation		
South Lincoln RWS		

**C. Projected Water Demands.** The Lewis & Clark system, as envisioned in the system's 1993 Feasibility Study and later authorized in 2000, had a total system reserved capacity of 23.47 MGD (million gallons per day) for the 22 original member systems. The reserved capacity was based on water needs identified by the member systems and forwarded to Lewis & Clark for project planning purposes.

Following project authorization in the summer of 2000, Lewis & Clark contacted its current membership to determine if the reserved capacity identified in the 1993 Feasibility Study was still appropriate. Concurrently, Lewis & Clark also contacted other water systems to see if they would be interested in participating in the project.

Lewis & Clark gained one potential new member (Rock Rapids, IA – 0.30 MGD) and eight existing members increased their reserved capacity (3.42 MGD). The total increase in reserved capacity is 3.72 MGD. For the purpose of this Final Engineering Report, the project was sized to deliver 27.19 MGD treated water to its member systems. Project facilities will be designed for a slightly higher flow range to account for project operational water requirements and anticipated transmission pipeline system losses.

**D. Evaluation of Alternatives.** Several alternative components have been evaluated for the proposed Lewis & Clark system since the early 1990's. These alternatives were further narrowed for detailed evaluation in the FER. The evaluation of alternatives considered the three major components of the Lewis & Clark system:

- ? Well field (layout and type of wells including horizontal collector, vertical and angle well alternatives)
- ? Water treatment (process and layout of conventional lime softening and membrane filtration alternatives)
- ? Raw and treated water pipeline systems (alignment, system layout and operational criteria alternatives)

The FER identifies alternatives for these component systems and presents an evaluation. In addition to the evaluation of alternatives presented in the FER, a value engineering (VE) review was initiated by Reclamation in February 2002 of a draft of the first five chapters of this FER. The VE Team developed a report that included ten

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<sup>1</sup> At the time of this report, Lewis & Clark and Rock Rapids Municipal Utilities were in the process of negotiating a Commitment Agreement for Rock Rapids to become a member of Lewis & Clark.

proposals for consideration and evaluation by Lewis & Clark.<sup>2</sup> These proposals were evaluated and Lewis & Clark accepted four of the VE Proposals (with modifications) which are incorporated into this FER.

**E. Proposed Project Facilities.** Based on the results of the evaluation of alternatives, and previous studies, the proposed project components for the Lewis & Clark system include:

- Construction of one radial collector well, and a series of angle and vertical wells south and southwest of Vermillion, South Dakota. The well field, when fully developed, should have a capacity of approximately 30 MGD with the highest yielding well out of production;
- Construction of a Raw Water Pipeline consisting of approximately 14.3 miles of various size pipes to convey water from the wells to the Water Treatment Plant facilities;
- Construction of Water Treatment Plant north of Vermillion with a nominal capacity of 27.2 MGD (28.6 MGD, including an allowance for 5% pipeline losses). The plant will be a conventional treatment process (lime softening) with filtration; and
- Construction of a Treated Water Transmission Pipeline System consisting of approximately 385 miles of various size pipes. The pipeline system will also include:
  - Seven water storage reservoirs will be distributed throughout the service area. The reservoirs will have a combined capacity of 29.5 million gallons.
  - Six main line booster pump stations to provide pressure along the main transmission line and eight service line booster pump stations at specific service connections.
  - Twenty-seven service connections to deliver and meter water into the members' water systems (some systems have two delivery points). And,
  - Other pipeline appurtenances, including isolation valves, air release/air vacuum valves, blowoff valves, corrosion control measures, hydraulic surge suppression measures and telemetry/control systems.

**F. Proposed Project Schedule.** The pace of construction activity will depend upon the availability of funding. The project will be split into discrete phases and will be based on a logical progression of work. The duration of the project is expected to extend over a ten to twelve year period based on the experience of similar projects in the State of South Dakota.

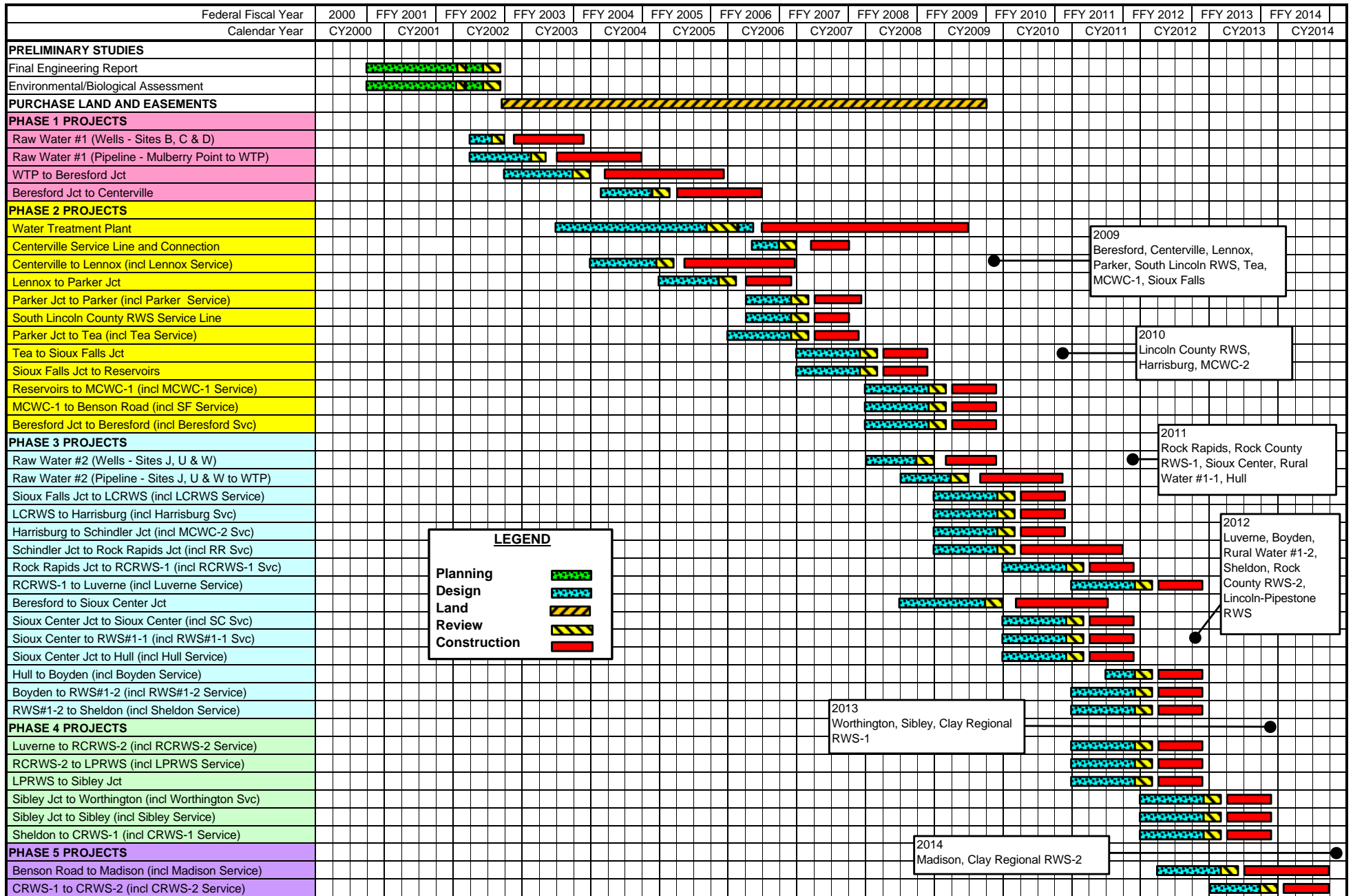
In general, the progression of pipeline construction will radiate from the water treatment plant. The bar chart on the following page illustrates a possible construction schedule and sequence of connections to member systems. One of the major considerations driving the schedule and levels of funding is the need to deliver water to Sioux Falls between 2009 and 2012 to meet the city's growing demand. Also, other member systems need an additional water supply as soon as possible, including Boyden, Sheldon, Sibley, Luverne and Lincoln-Pipestone RWS.

**G. Project Costs.** Construction of the Lewis & Clark project will span several years and indexing of the project budget is required to account for inflation. The Federal authorizing legislation for the Lewis & Clark project includes a provision for adjustment of the level of Federal grant participation on the basis of construction cost index adjustments. The level of grant participation in the authorizing legislation was based on the project scope and cost described in the 1993 Feasibility Study and subsequent annual adjustments using construction cost indices. The result of indexing revises the amount of Federal funding from \$213,887,700 (1993) to \$276,462,395 (2001).

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<sup>2</sup> *Value Engineering Final Report – Lewis and Clark Rural Water System* (A10-1940-0001-001-02-0-0 (6) (6B256), March 8, 2002, Bureau of Reclamation, Technical Service Center, Denver, CO

## LEWIS AND CLARK RURAL WATER SYSTEM Preliminary Project Schedule - Subject to Revision



This schedule is preliminary and subject to revision. It is based on the assumption adequate funding would be available to maintain the level of construction activities to meet the above completion dates.

Some member systems have increased their reserved capacity since the 1993 Feasibility Study. The incremental cost for system changes (increases in capacity) is the difference between the present estimate of project costs and the adjusted (indexed) cost for the original project scope. Funding for these incremental costs will come from sources separate from the Federal grant authorized for the project.

Opinions of probable cost have been developed for the construction of the various project components and OM&R (operation, maintenance & repair). The opinion of probable construction cost (work remaining) will be updated annually to account for inflation using Reclamation's indexing method. The total project opinion of probable construction cost is summarized in the following table:

Project Component	Construction Cost	Land Cost	Total Cost	Percent of Total
Collector Well System (6 Sites)	\$ 8,701,000	\$ 90,000	\$ 8,791,000	3.10%
Raw Water Pipeline System	\$ 17,312,000	\$ 322,000	\$ 17,634,000	6.22%
Water Treatment Plant	\$ 36,134,000	\$ 480,000	\$ 36,614,000	12.92%
Treated Water Pipeline System	\$ 211,695,000	\$ 8,626,000	\$ 220,321,000	77.75%
<b>Totals</b>	<b>\$ 273,842,000</b>	<b>\$ 9,518,000</b>	<b>\$ 283,360,000</b>	<b>100.00%</b>

Construction Costs	\$ 273,842,000	
Construction Contingencies	\$ 32,861,000	12.0%
Engineering	\$ 34,504,000	12.6%
Legal/Administration	\$ 9,584,000	3.5%
Land	\$ 9,518,000	
Environmental Mitigation	\$ 2,585,000	
<b>Total Project Cost (2001)</b>	<b>\$ 362,894,000</b>	

The opinion of probable annual costs for OM&R is important in order to budget funds, set water rates and generate revenue to properly keep the system functioning and maintained so the system can provide a reliable water supply. The projected OM&R costs for the Lewis & Clark system, when fully operational, are listed in the following table.

Cost Component	Estimated Annual Cost			
	Wells & Raw Water Pipeline	Water Treatment Plant	Treated Water Pipeline System	Cost Component Total
Power	\$ 630,000	\$ 1,436,000	\$ 700,000	\$ 2,766,000
Chemical	\$ -	\$ 994,000	\$ 50,000	\$ 1,044,000
Labor	\$ 29,000	\$ 1,456,000	\$ 233,000	\$ 1,718,000
R&R Account	\$ 90,000	\$ 251,000	\$ 350,000	\$ 691,000
Miscellaneous	\$ 20,000	\$ 346,000	\$ 200,000	\$ 566,000
<b>Totals</b>	<b>\$ 769,000</b>	<b>\$ 4,483,000</b>	<b>\$ 1,533,000</b>	<b>\$ 6,785,000</b>

Labor cost assumes 0.5 FTE (full-time employee) for Raw Water System, 25 FTE's for Water Treatment Plant and 4 FTE's for Treated Water Pipeline System. This does not include administrative staff.

The assumed annual average day demand is estimated to be 22 to 23 MGD when the system is fully operational at full development. The estimated annual cost of \$6,785,000 represents a cost of \$0.81 to \$0.84 per 1,000 gallons sold for OM&R. The cost per 1,000 gallons may vary during the early phases of the project from \$0.89 to \$1.07 per 1,000 gallons sold for OM&R.

Lewis & Clark will also have on-going administrative costs that will continue through the construction period and during the operational phase. These administrative costs are in addition to the personnel costs listed in the above table. The estimated annual administrative cost of \$500,000 represents a cost of approximately \$0.06 per 1,000 gallons sold when the system is fully operational. During the construction phase, some of the above costs would be an eligible expense under the construction-funding package such as legal and administrative costs and are included in the project opinion of probable construction costs.

**H. Project Funding.** Funding for construction of the Lewis & Clark system will come from a Federal grant, state grants and fees paid by the membership. The mechanism for receiving Federal grant funds for the project was established in the project authorizing legislation and the Cooperative Agreement. State grant funds for the project were established in the authorizing legislation passed by the state legislatures in each of the three participating states. The balance of the funds required for construction will come from the member systems.

The Federal grant funds provided in this Act represent 80% of the project costs for 21 of the 22 original members and 50% of the incremental cost to include enough capacity to serve the City of Sioux Falls as identified in the 1993 Feasibility Study. The authorizing legislation and Cooperative Agreement provide a commitment of Federal grant funds for the project scope as defined in the 1993 Feasibility Study. Grant funds for added costs due to changes in scope and increases in capacity are not included in the Federal funding plan.

The following table summarizes the sources of funding for the project indexed to 2001 dollars:

Federal Grant Funds.....	\$276,462,395
State Grant Funds:	
South Dakota.....	\$24,022,670
Iowa.....	\$6,986,384
Minnesota.....	\$4,251,950
Subtotal – State Grant Funds .....	\$35,261,004
Local Funds:	
Original Cost from 1993 Feasibility Study .....	\$40,886,636
Added Costs for Increased Capacity .....	\$10,283,965
Subtotal – Local Funds .....	<u>\$51,170,601</u>
Total Funding Required .....	\$362,894,000

The above briefly summarizes the contents of the FER. It has been the distinct pleasure of Banner, HDR and TRC Mariah to serve Lewis & Clark during the preparation of this document

Respectfully Submitted on Behalf of the Design Team:

**BANNER ASSOCIATES, INC.**

David C. Odens, PE  
Project Manager