

**Wall Lake (EPA 314) Dredging Project
Final Report 1989-1993**

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**Prepared for
U.S. Environmental Protection Agency
Region VIII, Denver, Colorado**

**Submitted By
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Minnehaha Conservation District
February 1995**

WALL LAKE RESTORATION PROJECT EPA-314 PROGRAM WORK PLAN 1989 - 1993

I. INTRODUCTION

Wall Lake is a 215 acre lake located in the southwestern part of Minnehaha County, approximately 12 miles west of Sioux Falls, South Dakota (Figure 1). It is a popular recreational area and receives heavy public use year round. The lake is used for fishing, swimming, skiing, and boating. Approximately 60 permanent homes and cabins are located around the lake shore. The estimated population within a 65 mile radius of the lake is 300,000.

The Wall Lake watershed contains 3,680 acres. The watershed is made up of 55% cropland, 29% pasture, and 14% in lake property. The watershed is approximately 3.5 miles long and 2.5 miles wide, with its axis on a west to east orientation (Figure 1). The watershed consists of moderately undulating glacial uplands in the southwest portion of the Big Sioux River Basin. The valleys of the watershed are flat and wide; local relief is usually 20 to 50 feet. At first the lake was believed to be a small shallow kettle lake. However, after the dredging began, it was found to be a relatively deep kettle lake that may have been formed by a glacial block. In any event, the lake is surrounded by clay hills that retard seepage to underground sources. Watershed soils are generally silt to clay loam on till-covered uplands. Agriculture is the primary industry of the region with row crops and small grain being dominant. There are seven active feedlots in the watershed and many wetlands near the lake. Beneficial uses of Wall Lake include warm water semi-permanent fish propagation, immersion recreation, limited contact recreation, wildlife propagation, and stock watering.

Preface

This report is a summary of lake restoration activities conducted at Wall Lake. Wall Lake is located 12 miles west of Sioux Falls, South Dakota.

Financial assistance was made available through EPA Section 314 and 319 Lake Restoration Grant Funds. This report covers dredging activities from November 1989 through December 1993. Dredging was performed in Wall Lake in 1989 through 1992 with financial assistance largely provided through an EPA section grant. The project was originally funded for four years. However, with more sediment in the lake than originally estimated, dredging was extended into 1993. The report also covers other restoration activities from 1989 through the 1995 season.

IV. WATERSHED ACTIVITIES

A high priority of this project was to work with the land owners and operators to establish best management practices in the watershed area. The total watershed area is 3,680 acres, of which approximately 55% is cropland. The following practices were installed on cropland in the watershed to prevent sediment and nutrients from entering the lake:

- Crop residue management
- No-till/ridge-till farming
- Permanent vegetative cover
- Terracing
- Contour farming
- Grassed waterways
- Dams
- Tree Planting

The remaining acres were being used as pasture for grazing and wetlands for wildlife. The land immediately adjacent to the lake (107.9 acres) was put into the federal Waterbank Program (a 10-year set-aside program). No grazing or cropping is permitted on these acres for ten years, and the contract may be eligible for renewal when it expires. Within this 107.9 acres, 19 acres were drained wetlands that have been restored by closing channels. These 19 acres are under a perpetual lease with the US Fish and Wildlife Service. Three earthen dams have also been constructed on this property.

VII. TOWNSHIP ROAD

It was evident that constructing sediment storage ponds on either side of the road would interfere with drainage. The Project Sponsor, Project Coordinator and the Township Board met to discuss the drainage problem. It was decided that at the end of the project, the township road would be re-graded and shaped.

In the summer of 1994, the township road was designed and staked by the Project Coordinator and SCS personnel. Drainage problems were alleviated by designing the water to flow south and installing a tile system. The bids were let for the road construction. The construction contract was awarded to Ramsted Construction of Colton, South Dakota. In November 1994, the road construction was completed.

VIII. WALL LAKE PARK

The Wall Lake Park is the property of Minnehaha County, and is operated by the Minnehaha County Parks Department. The park and the adjacent Girl Scout camp are heavily used during the summer months. Because of the heavy use, the County has modernized and made many improvements. The following improvements and associated costs were made to the Park from 1985 through 1993:

| | |
|---|-------------------------|
| - Restroom, parking lot, fence & lighting | \$56,000 |
| - Footbridge | 1,500 |
| - Water line & fountains | 3,411 |
| - Blacktop parking lot | 16,481 |
| - Storage building | 5,900 |
| - Sign - Wall Lake Park | 400 |
| - Picnic shelter | 6,100 |
| - Picnic tables | 2,950 |
| - Grills | 300 |
| - Beach sand | 4,000 |
| - Play equipment | 2,200 |
| - Stone pillars (entrance decor) | 1,624 |
| - Sidewalks | 500 |
| - Construct modern restroom | 42,536 |
| - Repairs to Girl Scout Lodge | 9,190 |
| - Planting trees | <u>820</u> |
| TOTAL | <u>\$157,912</u> |

V. SEDIMENT PONDS

Eighteen sediment holding ponds were constructed from 1989 through 1992. The locations of these ponds are identified in Figure 2. These ponds were designed and staked by the Project Coordinator and SCS personnel, thus eliminating engineering costs. The ponds were designed in a series to best filter the sediments from the water that would return to the lake. The combined capacity was adequate to store and de-water the 1.5 million cubic yards of sediment that was removed from Wall Lake. The total cost for constructing these ponds was \$240,102.29.

Reclamation activities began in the summer of 1994. Because of the extremely wet conditions of 1993, the ponds became infested with tree seedlings. This impeded the reclamation process in some of the ponds. Lowe & Son Construction was hired to remove tree seedlings and level off the pond berms. The cost of reclamation activities to date is \$54,638.08. Reclamation activities will resume in the fall of 1995. It is estimated that \$35,000 will be needed to complete the project.

III. Wall Lake Sanitary District

The construction of a sanitary system around the lake was a prerequisite to any restoration work that was to be completed at Wall Lake. Previous efforts to clean up Wall Lake had caused the Minnehaha County Commission to authorize the Charter of the Wall Lake Sanitary District on June 1, 1974. The Sanitary District had remained dormant until it was decided that the restoration of Wall Lake made it a necessary part of the project. The Wall Lake Sanitary District was brought back into operation in 1988. The Sanitary District Board was elected September 20, 1988.

Engineering firms were then contacted to submit bids for the design of the sewer system, plus the cost of preparing their plans. Dewild, Grant, and Reckert of Rock Rapids, Iowa was awarded the engineering contract. Bid letting was then conducted for the construction of the sewer system. The construction contract was awarded to Metro Construction of Sioux Falls, South Dakota. The cost of the construction was \$768,000.

Construction began in 1991. The system initially called for hooking up a total of 68 users, which included one commercial property, the facilities at the beach, and the Girl Scout camp. The Sanitary District borrowed \$78,000 to cover the local share. The remainder of the money came from an EPA grant and additional grants that were provided by the State of South Dakota. Construction of the sewer system was completed in 1992. Two homeowners refused to hook up to the system. Legal action was initiated and they were forced to comply. All users were connected to the system in 1994.

VI. WETLAND PURCHASE

To help further reduce sediment and nutrients from entering the lake, landowners were contacted to create a wetland on the west inlet. Several different options were discussed, including a short or long term lease or land purchase. The Task Force discussed the options and decided that if a fair purchase price could be obtained and the funds were available, purchasing the land would be the best option. In the fall of 1993, a combination of project funds and Wall Lake homeowner funds were used to purchase 28 acres from Dwayne Atkins.

In the spring of 1994, the South Dakota Department of Transportation was making plans to extend Highway 42 west of Sioux Falls. By improving the road, wetlands would be destroyed. This resulted in the need for mitigation to create wetlands. The Project Coordinator contacted The Department of Transportation with a proposal to purchase an additional 31.3 acres adjacent to the 28 acres previously purchased. An earthen block would then be installed in the channel to create an 18-acre wetland, which the Department of Transportation could use as mitigation.

Purchase prices were agreed upon with the three landowners involved. The total costs associated with the D.O.T. land purchase and installation of the proposed practices (listed below) was \$40,000. The cost figures were given to Department of Transportation personnel for their review. In November of 1994, a contract was signed between the Minnehaha Conservation District and the Department of Transportation to accept the land purchase plan. The land has been purchased and the following practices will be installed in 1995:

IX - PUBLIC INFORMATION

The Wall Lake Restoration Project is considered to be one of the most extensive lake restoration projects in South Dakota. The following information efforts have kept the public informed about the restoration project:

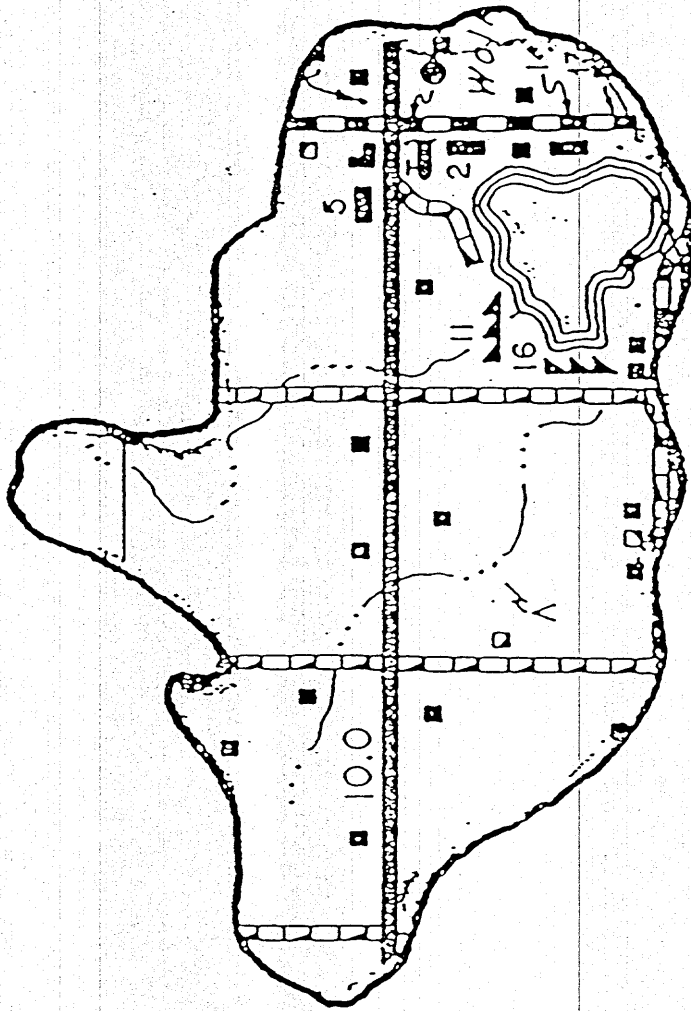
1. Monthly Task Force Meetings
2. Public meetings
3. News articles
4. Television news coverage
5. Tours
6. Programs and presentations
7. Feature stories - Farm Journal & The Advantage (Butler Machinery Company)
8. Final wrap-up - News coverage and BBQ

X. - PROJECT SUMMARY

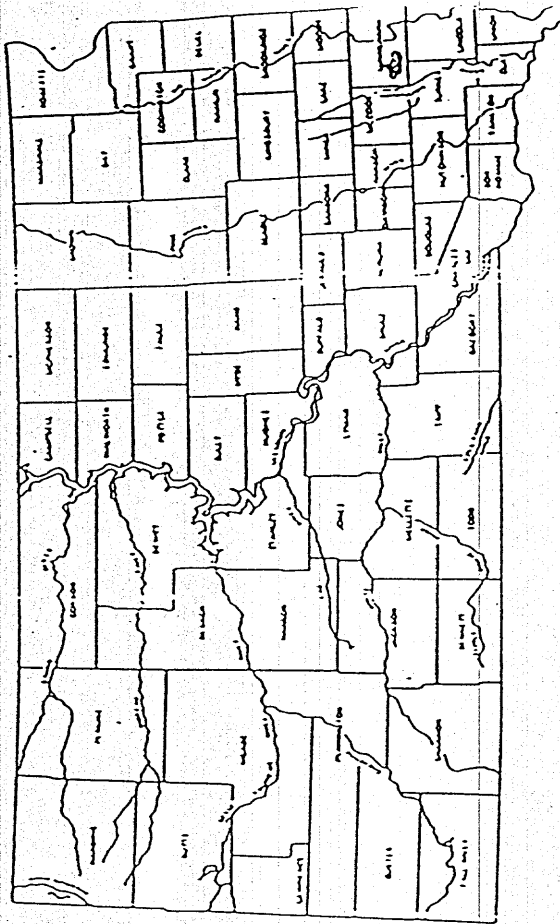
The Wall Lake Restoration Project is considered to have been a success. Cooperation by the local residents, contributors, and agencies involved has created a model for future restoration projects within the State of South Dakota and the Midwest region. Without the commitment of the local residents, contributing organizations and agencies, this project would have been impossible. The Minnehaha Conservation District and Project Coordinator, Ron Adamson, wish to thank everyone that had a part in this endeavor. It has been proven that people working together towards a common goal can achieve great things.

Wall Lake

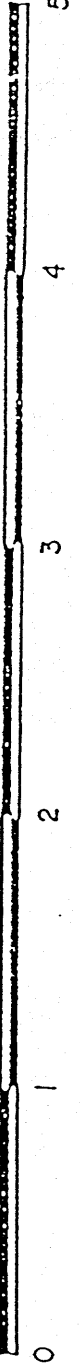
FIGURE 1



SOUTH DAKOTA

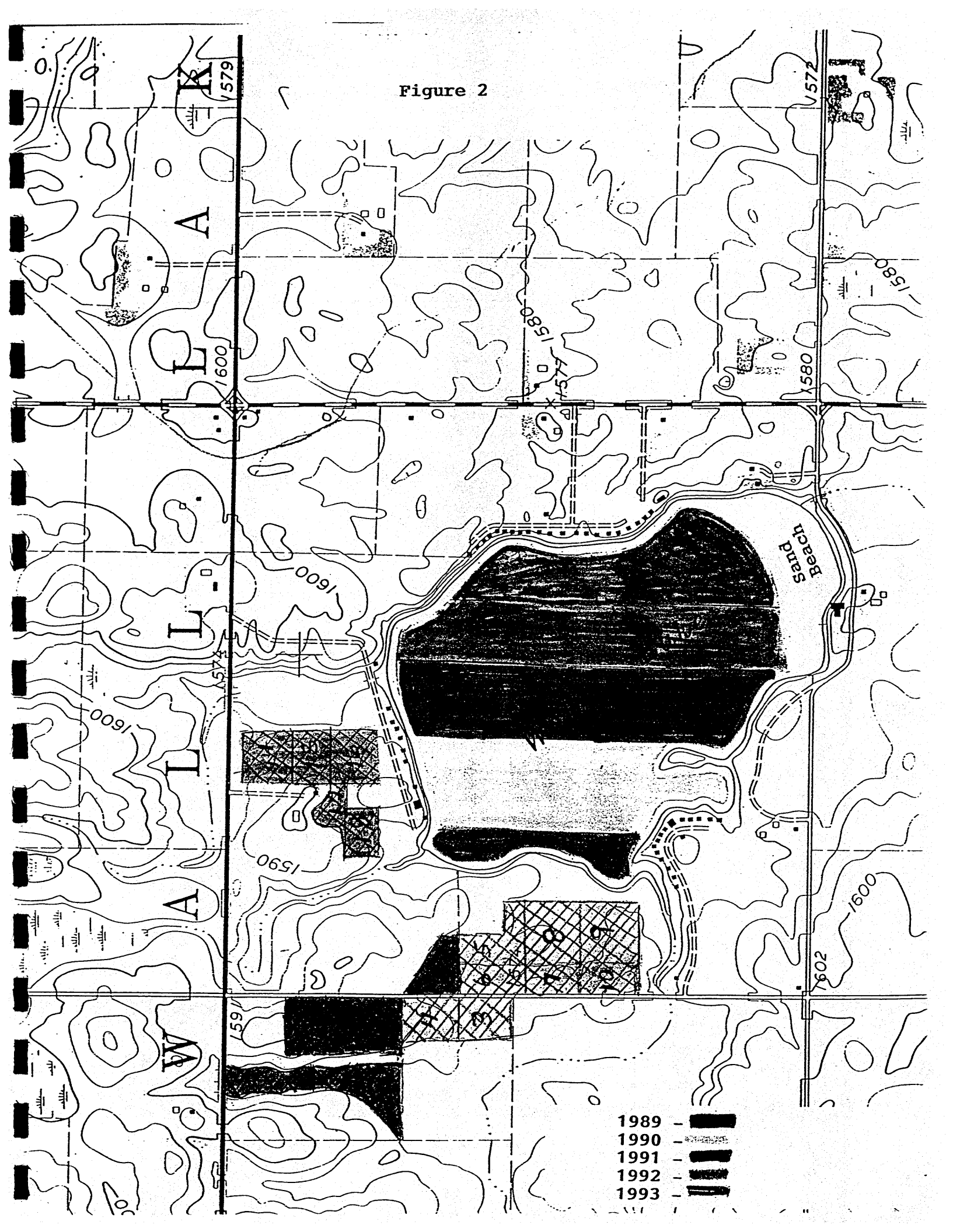


Scale



Miles

Figure 2



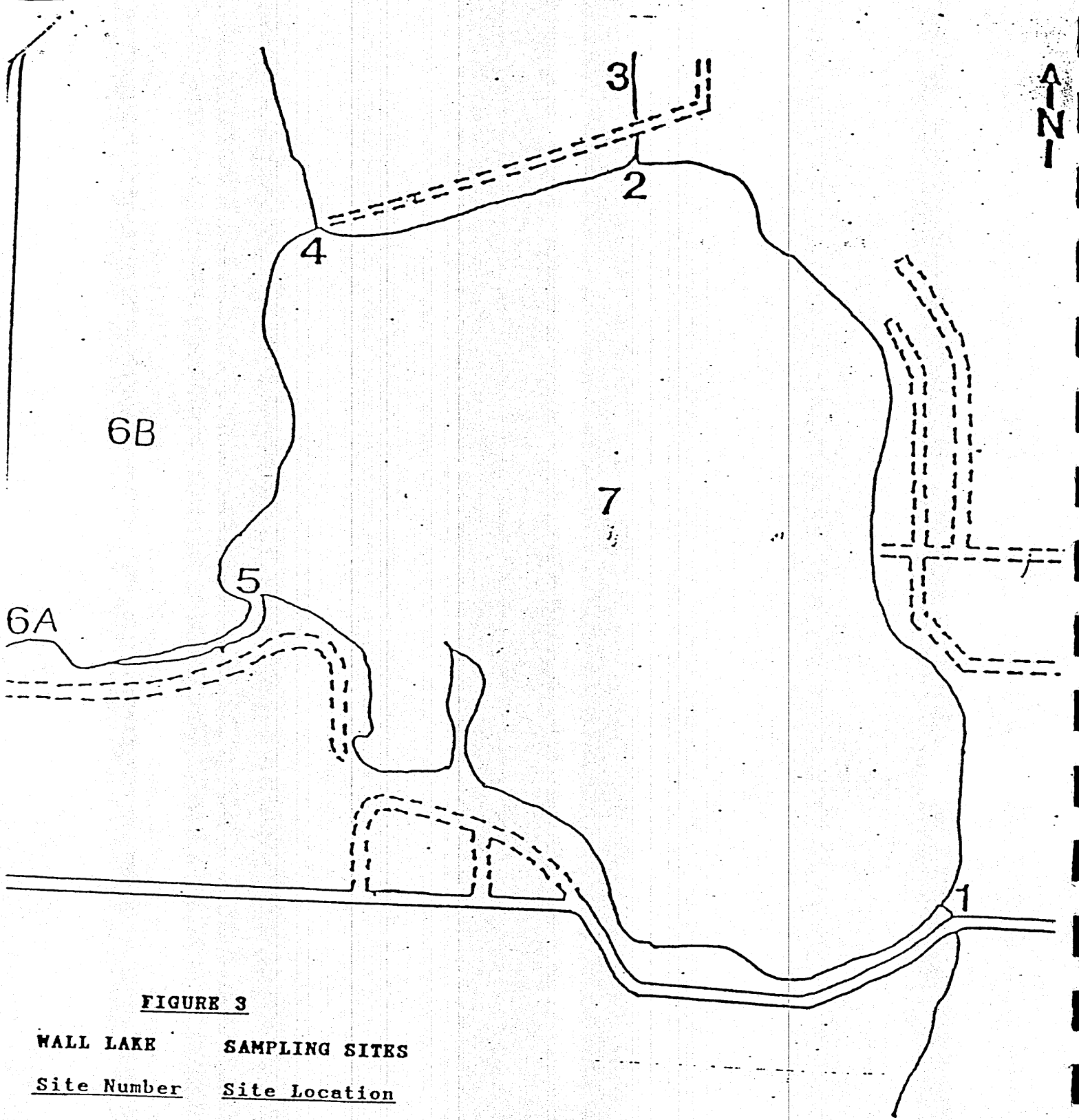


FIGURE 3

WALL LAKE SAMPLING SITES

Site Number Site Location

- 1. Outlet
- 2. North Tributary-mouth
- 3. North Tributary-between pond by road and feedlot
- 4. Northwest Tributary-mouth
- 5. West Tributary-mouth
- 6A. West Tributary-at culvert on north-south road
- 6B. Return water at outlet pipes of dredge ponds
- 7. Inlake-centrally located

WALL LAKE INCOME AND EXPENSE FOR 1989 - 1995 (22 Feb 95)

Table 1

| INCOME | 1989 - 1995 | | | | | | TOTAL |
|------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|-----------------------|
| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | |
| WERF | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| State CWFCF | \$50,000.00 | \$72,000.00 | \$60,000.00 | \$2,338.44 | \$0.00 | \$0.00 | \$2,338.44 |
| Carryover CWFCF | | | | \$90,000.00 | \$52,252.87 | \$49,198.56 | \$373,449.43 |
| Minnehaha County | \$28,752.00 | \$39,502.00 | \$42,500.00 | \$42,500.00 | \$40,000.00 | \$0.00 | \$30,000.00 |
| East Dakota WDD | \$28,752.00 | \$39,502.00 | \$42,500.00 | \$42,500.00 | \$10,000.00 | \$0.00 | \$193,254.00 |
| Wall Lake Assn | \$2,552.00 | \$0.00 | \$0.00 | \$0.00 | \$27,350.00 | \$0.00 | \$29,902.00 |
| Private Donations | \$0.00 | \$0.00 | \$0.00 | \$1,250.00 | \$0.00 | \$257.69 | \$1,507.69 |
| Refunds | \$0.00 | \$0.00 | \$0.00 | \$1,058.30 | \$37.80 | \$0.00 | \$1,096.10 |
| TOTAL NON-FEDERAL | \$110,056.00 | \$151,004.00 | \$145,000.00 | \$179,846.74 | \$159,640.67 | \$49,454.25 | \$794,801.66 |
| EPA - 319 | \$368,722.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$368,722.00 |
| Transfer - 319 | | \$25,793.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$25,793.00 |
| EPA - 314 | \$0.00 | \$0.00 | \$131,866.82 | \$72,000.00 | \$0.00 | \$0.00 | \$203,866.82 |
| Carryover | \$0.00 | \$0.00 | \$0.00 | \$85,000.00 | \$0.00 | \$0.00 | \$85,000.00 |
| TOTAL FEDERAL | \$368,722.00 | \$25,793.00 | \$131,866.82 | \$157,000.00 | \$0.00 | \$0.00 | \$683,381.82 |
| TOTAL INCOME | \$478,778.00 | \$176,797.00 | \$276,866.82 | \$336,646.74 | \$159,640.67 | \$49,454.25 | \$1,478,183.28 |
| EXPENSES: Non Federal | | | | | | | |
| Equipment Rental | \$0.00 | \$0.00 | \$0.00 | \$5,932.77 | \$15,521.73 | \$0.00 | \$21,454.50 |
| Dredge Moving | \$39,006.32 | \$0.00 | \$0.00 | \$0.00 | \$16,012.92 | \$0.00 | \$55,019.24 |
| Pond Construction | \$64,000.00 | \$66,519.87 | \$76,118.95 | \$33,463.47 | \$0.00 | \$0.00 | \$240,102.29 |
| Dredge (Pay Benefits) | \$0.00 | \$12,092.10 | \$0.00 | \$43,226.13 | \$50,036.65 | \$0.00 | \$105,354.88 |
| Supplies Fuel | \$0.00 | \$0.00 | \$0.00 | \$22,518.18 | \$13,972.87 | \$0.00 | \$36,491.05 |
| Lease Payments | \$0.00 | \$0.00 | \$0.00 | \$1,889.70 | \$5,797.00 | \$0.00 | \$30,637.80 |
| WERF | \$0.00 | \$7,643.20 | \$4,994.00 | \$25,075.00 | \$12,000.00 | \$0.00 | \$71,813.00 |
| W/Q Monitoring | \$0.00 | \$23,507.00 | \$11,231.00 | \$4,557.62 | \$4,180.75 | \$0.00 | \$18,403.32 |
| Project Coordinator | \$2,075.50 | \$1,691.25 | \$5,888.20 | \$14,423.22 | \$30,577.29 | \$0.00 | \$107,189.03 |
| Miscellaneous | \$2,884.62 | \$25,965.59 | \$25,000.04 | \$2,452.79 | \$1,141.90 | \$536.34 | \$9,217.80 |
| District Admin. Fees | \$243.50 | \$1,844.37 | \$2,998.90 | \$5,000.00 | \$11,500.00 | \$1,948.68 | \$54,638.08 |
| Reclamation | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$4,189.85 | \$50,438.23 | \$20,604.50 |
| Watershed Implementation | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$19,879.50 | \$725.00 | \$0.00 |
| TOTAL: Non Federal | \$108,209.94 | \$139,263.38 | \$126,241.09 | \$158,538.88 | \$184,820.46 | \$67,143.52 | \$789,374.27 |

EXPENSES: Federal

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | TOTAL |
|-------------------------|--------------|--------------|--------------|--------------|--------------|-------------|------------|----------------|
| Equipment Rental | \$0.00 | \$0.00 | \$0.00 | \$5,932.77 | \$0.00 | \$0.00 | \$0.00 | \$5,932.77 |
| Pond Construction | \$16,964.00 | \$0.00 | \$0.00 | \$33,463.47 | \$0.00 | \$0.00 | \$0.00 | \$50,427.47 |
| Lease Payments | \$0.00 | \$0.00 | \$0.00 | \$4,364.80 | \$0.00 | \$0.00 | \$0.00 | \$4,364.80 |
| Dredging (Pay-Benefits) | \$96,951.10 | \$82,886.57 | \$59,123.92 | \$43,226.13 | \$0.00 | \$0.00 | \$0.00 | \$282,187.72 |
| Supplies/Fuel/Equip | \$60,256.85 | \$60,256.85 | \$39,308.14 | \$20,182.48 | \$0.00 | \$0.00 | \$0.00 | \$179,984.32 |
| WERF | \$4,911.50 | \$18,595.50 | \$11,231.00 | \$25,075.00 | \$0.00 | \$0.00 | \$0.00 | \$59,813.00 |
| WQ Monitoring | \$0.00 | \$0.00 | \$0.00 | \$4,557.62 | \$0.00 | \$0.00 | \$0.00 | \$4,557.62 |
| Project Coordinator | \$0.00 | \$0.00 | \$0.00 | \$14,423.22 | \$0.00 | \$0.00 | \$0.00 | \$14,423.22 |
| Miscellaneous | \$0.00 | \$0.00 | \$7,954.00 | \$794.51 | \$0.00 | \$0.00 | \$0.00 | \$8,748.51 |
| Indirect | \$13,993.32 | \$11,545.72 | *\$12,302.50 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$37,841.54 |
| Administration | \$7,024.33 | \$14,048.65 | \$9,037.67 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$30,110.65 |
| Reserves | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Wetland | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Feedlot | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| District Admin. Fees | \$0.00 | \$0.00 | \$0.00 | \$5,000.00 | \$0.00 | \$0.00 | \$0.00 | \$5,000.00 |
| TOTAL: Federal | \$200,091.10 | \$187,333.29 | \$138,957.23 | \$157,000.00 | \$0.00 | \$0.00 | \$0.00 | \$683,381.62 |
| TOTAL EXPENSES: | \$308,301.04 | \$326,586.67 | \$265,198.32 | \$315,538.88 | \$184,820.46 | \$67,143.52 | \$5,157.00 | \$1,472,756.89 |

* See attached letter dated 5 Nov 1993

RECAP

| | |
|--------------------------|----------------------|
| Total Local Funds | \$794,801.66 |
| Total Local Expenses: | <u>\$789,374.27</u> |
| Balance | \$5,427.39 |
| Cash on hand (22 Feb 95) | \$5,427.39 |
| | |
| Total EPA Funds: | \$683,381.62 |
| Total EPA Expense: | <u>\$683,381.62</u> |
| Balance | \$0.00 |
| | |
| 1993 CWFCG Allocation | \$104,000.00 |
| 1993 Received to Date | (\$52,252.27) |
| 1994 Received to Date | <u>(\$49,196.56)</u> |
| | |
| Total Retained by State: | \$2,550.57 |
| | |
| Cash on Hand (15 Feb 95) | \$5,427.39 |
| 1993 CWFCF Balance | \$2,550.57 |

Table 1

WALL LAKE FINANCIAL STATUS 1989-1990

| <u>INCOME</u> | | | |
|---|---|--|---------------------|
| | <u>1989</u> | <u>1990</u> | <u>Total</u> |
| State CWFCF | \$50,000 | \$72,000 | \$122,000 |
| Minnehaha County | \$28,752 | \$39,502 | \$68,254 |
| East Dakota WDD | \$28,752 | \$39,502 | \$68,254 |
| Wall Lake Assoc | \$2,552 | \$0 | \$2,552 |
| TOTAL NONFEDERAL | \$110,056 | \$151,004 | \$261,060 |
| EPA 319-Wall Lake | | | \$368,722 |
| Transfer 319 | | \$25,793 | \$25,793 |
| TOTAL FEDERAL | | | \$394,515 |
| TOTAL 2-YR FUNDS | | | \$655,575 |
| <u>EXPENSES 1989</u> | | | |
| <u>EXPENSES</u> | <u>NONFEDERAL</u> <u>(state & local)</u> | <u>FEDERAL</u> <u>(EPA 319 grant)</u> | <u>TOTAL</u> |
| Dredge Moving | \$39,006.32 | \$0 | \$39,006.32 |
| Pond Construction | \$64,000.00 | \$16,964.00 | \$80,964.00 |
| Dredging (pay/benes) | \$0 | \$96,951.10 | \$96,951.10 |
| Supplies/Fuel/Equip | \$0 | \$60,256.85 | \$60,256.85 |
| WERF | \$0 | \$4,911.50 | \$4,911.50 |
| WQ Monitoring | \$2,075.50 | \$0 | \$2,075.50 |
| Project Coordinator | \$2,884.62 | \$0 | \$2,884.62 |
| Miscellaneous | \$243.50 | \$0 | \$243.50 |
| Administration | | \$7,024.33 | \$7,024.33 |
| Indirect | | \$13,983.32 | \$13,983.32 |
| 1989 TOTALS | \$108,209.94 | \$200,091.10 | \$308,301.04 |
| <u>EXPENSES 1990</u> | | | |
| <u>EXPENSES</u> | <u>NONFEDERAL</u> <u>(state & local)</u> | <u>FEDERAL</u> <u>(EPA 319 grant)</u> | <u>TOTAL</u> |
| Pond Construction | \$66,519.87 | \$0 | \$66,519.87 |
| Lease Payments | \$7,643.20 | \$0 | \$7,643.20 |
| Dredging (pay/benes) | \$12,092.10 | \$82,886.57 | \$94,978.67 |
| Supplies/Fuel/Equip | \$0 | \$60,256.85 | \$60,256.85 |
| WERF | \$23,507.00 | \$18,595.50 | \$42,102.50 |
| WQ Monitoring | \$1,691.25 | \$0 | \$1,691.25 |
| Project Coordinator | \$25,965.59 | \$0 | \$25,965.59 |
| Miscellaneous | \$1,844.37 | \$0 | \$1,844.37 |
| Administration | | \$14,048.65 | \$14,048.65 |
| Indirect | | \$11,545.72 | \$11,545.72 |
| Reserves: | | | |
| Wetland Restoration | | | \$6,000.00 |
| Feedlot Management | | | \$7,500.00 |
| 1990 TOTALS | \$139,263.38 | \$187,333.29 | \$340,096.67 |
| 1989-1990 TOTALS (with reserves) | \$247,473.32 | \$387,424.39 | \$648,397.71 |
| BALANCE AS OF 31 DEC 1990 | | | \$7,177.29 |
| (Local = \$86.68, EPA = \$7,090.61) | | | |

DIAGNOSTIC REVIEW

General Morphology

Wall Lake is a shallow, glacial lake located in Minnehaha County approximately 12 miles west of Sioux Falls, SD. The lake covers 215 surface acres to an average depth of 9 feet and a maximum depth of 13 feet. The lake basin is generally bowl-shaped and consists of sand and gravel in the littoral or shoreline areas out to the 10 foot depth contour. The remaining central section of the basin is covered with an average of 3.5 feet of sediment. Three intermittent streams feed the lake from the north, northwest and west. The outlet is located on the southeast corner of the lake. Only minor groundwater connections have been detected (SDGS 1980).

The watershed associated with Wall Lake extends, generally, to the west and northwest encompassing 3680 acres of primarily agricultural land. Land use in the watershed is 55% cropland, 29% pasture and 16% other, which consists of water, farmsteads and residential areas (Table 1). Approximately 70 homes or cabins are currently situated adjacent to the lake. Of the 55% cropland, estimates by the Minnehaha County Conservation District and the Department of Water and Natural Resources indicate that 20% or 404 acres are in need of Best Management Practices.

Current beneficial uses and subsequent standards applied to Wall Lake are: warmwater semipermanent fish life propagation, immersion recreation, limited contact recreation and wildlife propagation and stock watering. Table 2 lists the beneficial uses and assigned standards.

Summary of Existing Information

A number of studies have been done on Wall Lake. Risking oversimplification of complex and lengthy studies, the following brief summaries are provided.

A) SCS Soil Erosion Study (1980):

- * 65% of the watershed (1,982 of 3,072 acres) needs Best Management Practices (BMP's) treatment.
- * Total erosion per year is 13,121 tons, with 12,693 tons per year coming from cropland.
- * Total sediment yield (sediment deposited in Wall Lake) is 1,205 tons per year with 1,049 tons (87%) coming from agricultural land.

B) SDGS Hydrology Study (1981)

- * A small outwash deposit of sand and gravel was found along the west inlet of 21 feet thick from 1 foot to 22 feet below the land surface.
- * Another deposit occurred along the east shore at 6 to 17 feet below land surface.

* A third deposit occurred at the outlet at 1 to 9 feet below land surface.

* There appears to be no important groundwater connections to Wall Lake.

C) Wall Lake Water Quality Study (1985)

| * Parameter | <u>In-lake status</u> | <u>Tributary status</u> |
|--------------|-----------------------|-------------------------|
| D.O. | acceptable | low |
| Alkalinity | acceptable | acceptable |
| Diss. Solids | high | excessive |
| Susp. Solids | high | high |
| B.O.D. | acceptable | acceptable |
| pH | excessive | acceptable |
| Tot. Phos. | excessive | excessive |
| F. Coliforms | acceptable | excessive |
| TKN | high | excessive |
| Ammonia | high | high |
| Nitrate | acceptable | acceptable |
| Nitrite | acceptable | high |
| Inorg. N | high | high |
| Org. N | excessive | excessive |

* Limiting factor appears to be nitrogen.

* Phosphorus and nitrogen loads in 1979 were well above the dangerous level.

* Majority of nutrients (88% phosphorus, 85% nitrogen) came from the watershed feeding the west inlet.

* Loads to the lake from the west and northwest inlets were dangerously high.

* Snowmelt and stormwater runoff are the principle sources of phosphorus and nitrogen to the lake.

* Failing or poor septic tanks are a secondary problem.

* No serious sediment pesticide problems exist, all except atrazine are below detectable limits. Atrazine appears adhered to soil particles and does not release to the water column.

D) Ordinary High Water Mark Study (1983)

* OHWM established at elevation of 1559.5 feet MSL (mean sea level).

E) Individual Feedlot Survey (1986)

* Private pollution control facility located directly north of Wall Lake meets state and federal requirements, but proper operation and maintenance of facility is imperative for continued abatement of nutrient input to the lake.

F) Sediment Nutrient Flux Study (1983)

* Sediments show high concentrations of nutrients but they contribute little to the water column loading.

* Bottom is apparently acting as a nutrient sink.

* Lake should be categorized as HYPEREUTROPHIC.

* Levels of dissolved nitrogen and phosphorus are high in the lake water and provide nutrition for extensive algal blooms which occur throughout the summer and fall.

* Algal production would be limited by nitrogen.

* Anaerobic conditions in the water column occur infrequently during ice-free times.

* Lake has high potential for severe oxygen depletion under ice. Depletion will cause extensive mortality of fish and other aquatic organisms.

* Consolidation of sediments is much greater than reported in previous studies.

* Release of sediment nutrients by wind-caused wave action is not considered an important factor.

* A general flux (movement) of phosphorus appears to be going INTO the sediment from the overlying water column.

* Sediment appears to be releasing ammonia and nitrate-nitrogen.

* Levels of nutrients remain constant throughout a 50 cm sediment profile.

* Dredging is NOT recommended at this time to improve water quality, although it would improve recreational potential and fisheries.

G) Septic Leachate Study (1985-1986)

- * Subsurface discharge of septic effluent does not seem to be a significant problem, but does contribute a small amount of loading to the lake.
- * Three sites are primary contributors of high phosphorus and fecal coliforms through surface discharges. They are:
 - 1) north Inlet (feed-lot runoff area)
 - 2) northwest Inlet
 - 3) west Inlet (main channel)

H) Wall Lake Dredging Feasibility Study - COE (1979-1980)

- * Selective dredging of 2 to 4 feet of sediment would remove approximately 949,000 cubic yards of material.
- * Approximately 56.8 tons of phosphorus and 11.3 tons of nitrogen would be removed by selective dredging.
- * The dredged material disposal area would require approximately 124 acres.
- * COE claims dredging would yield:
 - 1) decreased potential for winterkills (more diss. oxygen)
 - 2) decreased nutrient availability
 - 3) decreased algal bloom severity
 - 4) decreased turbidity
 - 5) improved fishery management potential
 - 6) improved aesthetics
 - 7) potential agricultural benefits
- * Dredging at 4 foot depth would increase lake volume by approximately 688 acre-feet.
- * Total project cost would equal approximately \$792,000.

I) Copper Intake Study (1981)

- * Dr. Emmerick (SDSU, Chem. Dept.) conducted growth and copper intake studies on corn and soybeans grown on Wall Lake Sediment.
- * Copper Intake was only slightly higher than controls and no problems should exist in converting dredged material to cropland.

J) Wall Lake Septic Tank Survey (1978)

- * Data was gathered from 52 of the approximately 70 lakeshore landowners.
- * Of the 52 septic tanks reported, 27 (52%) are located less than 100 feet from the lake shore.
- * Year-round use of septic systems was reported by 32 (62%) of the 52 lakeshore landowners surveyed, while 20 landowners (38%) reported seasonal or part-time use.
- * Nearly half the septic systems (48%) are used for wash disposal, while 87% accept kitchen wastes.

WALL LAKE
LAND USE SURVEY
GENERAL DATA

Total watershed area: 3680 acres

| | | |
|----------|------------|-----|
| Cropland | 2024 acres | 55% |
| Pasture | 1067 acres | 29% |
| Other | 589 acres | 16% |

| <u>LAND USE</u> | <u>PERCENTAGE</u> |
|-----------------------|-------------------|
| Row crops | 38% |
| Small grains | 6% |
| Grass-pasture | 29% |
| Alfalfa | 7% |
| Fallow | 4% |
| Slough | 3% |
| Farmstead-residential | 7% |
| Water | 6% |

20% of the cropland or 404 acres are in need of treatment for erosion control

TABLE 1

Table 2
Wall Lake Beneficial Uses, As
Appears In the South Dakota
Water Quality Standards

1. Warm water semipermanent fish life propagation
2. Immersion recreation
3. Limited contact recreation
4. Wildlife propagation and stock watering

| <u>Parameter</u> | <u>Concentration*</u> |
|-------------------------|------------------------|
| Nitrate as N | <50 |
| Total Cyanide | <0.02 |
| Free Cyanide | <0.005 |
| Hydrogen Sulfide | <0.002 |
| Suspended Solids | <90 |
| Temperature (°F) | <90 |
| Fecal Coliform | 200/100ml |
| Total Alkalinity | <750 |
| Conductivity | <2500 micromhos/cm@25° |
| Dissolved Oxygen | >5.0 |
| Total Dissolved Solids | <2500 |
| Total Chlorine Residual | <0.02 |
| Un-ionized Ammonia | <0.04 |
| pH | 6.0<—>8.3 SU |

*All values in mg/l unless otherwise stated

Not all property owners residing in the Sanitary District are required to be on-line. The system was intended to surround the lake. Those living an adequate distance away from the lake are permitted to remain on septic systems, as long as they are in compliance with county codes.

The lagoons are capable of handling an additional discharge. Any new construction adjacent to the lake will require the residence or commercial property to be placed on-line.

Current user fees for a residence, cabin, the county facilities at the beach, and the Girl Scout camp are \$30.00 per month. A separate rate was established for commercial use.

1993

In 1993, the South Dakota Legislature discussed whether the State should be involved in dredge ownership. Legislation was enacted to sell all four of the State- owned dredges. The 14-inch dredge, "Dakotah", was sold to McCook Lake Izaak Walton League, which is located near North Sioux City, South Dakota. The other three dredges were purchased by the South Dakota Lakes and Streams Association. A meeting was held with the Wall Lake homeowners for their input to determine their commitment to financially support another year of dredging with the smaller dredge. They agreed to financially commit to another year of dredging if additional funds could be obtained. With carryover funds remaining from 314 funding, and contributions from Minnehaha County, Wall Lake homeowners, and East Dakota Water Development District, the dredging was extended through 1993. An agreement was signed between the South Dakota Lakes and Streams Association and Minnehaha Conservation District to lease the 10-inch Kenner Marine dredge, "Lake Lady", for the 1993 season.

The "Lake Lady" and support equipment needed to be mobilized from McCook Lake to Wall Lake. The dredge needed extensive repairs before it was operational, therefore, dredging did not begin until June 15, 1993. From June through mid- October approximately 65,000 cubic yards of sediment was removed from the lake. The dredge and support equipment were then removed from the lake and prepared to be moved to Swan Lake for the 1994 season.

II. WALL LAKE DREDGING PROJECT

Background

Wall Lake has been the subject of study, planning, and speculation for at least 25 years without significant improvement in water quality or recreational benefits. Several studies have indicated the need to remove sediment from Wall Lake. The 1980 Soil Erosion Study conducted by the Soil Conservation Service indicated that 65% of the drainage area entering the lake was in need of best management practices. The 1981 hydrology study conducted by the South Dakota Geologic Survey showed that deposits of sand and gravel were found along the east and west shore. The Project was originally expected to remove approximately 900,000 cubic yards of sediment from the lake, and an additional 50,000 cubic yards were to be removed from the west inlet and west bay area.

In September of 1989, a contract was signed between the South Dakota Department of Water and Natural Resources and Minnehaha County. Minnehaha County was named Project Sponsor for the Wall Lake Restoration Project and Project Coordination responsibilities were given to the Minnehaha Conservation District. The financial contributors to the Wall Lake Restoration Project are outlined on the attached Table 1.

The following will list year by year accomplishments of the dredging activities. The yearly progress for sediment removal and pond construction is illustrated on the attached Figure 2.

1989

Activities which were conducted prior to dredging included:

1. Sediment probes were used to determine quantities and location of silt deposits.
2. Archaeological investigations of silt disposal areas were conducted.
3. Contour maps for dredging sites and silt disposal areas were prepared.
4. Equipment rental versus equipment purchase options were reviewed.
5. Approval of sediment disposal ponds was secured.
6. Sediment disposal ponds were designed.
7. Bids for construction of sediment ponds were reviewed and contracts awarded.
8. Sediment disposal ponds were staked and constructed.
9. Maintenance and operational schedule for ponds were developed.
10. The dredging crew was employed.

In May of 1989, a final schedule/workplan for the Wall Lake Restoration Project was developed. In October, a 14-inch hydraulic cutterhead dredge, the "Dakotah", was moved from Lake Mitchell to Wall Lake. On November 13, the dredge "Dakotah" was launched to begin dredging operations. Approximately 60,000 cubic yards of sediment were removed before the winter shutdown on December 6, 1989. The dredge was removed from the lake for winter storage.

1990

In the spring of 1990, the "Dakotah" once again began dredging. The dredging season began on April 18, and continued through October 19. Approximately 500,000 cubic yards of sediment were removed from the lake. This amount of sediment removal was a record year for dredging by the "Dakotah". Approximately 80% of the watershed flows through the west inlet. Over the years, the west inlet had become less functional due to a build-up of silt from adjoining farmland. In addition, septic discharge from adjacent cabins was allowing harmful nutrients to enter the lake. To stop these highly nutrient-laden sediments from entering the lake, it was imperative to clean out the inlet before the dredging operation continued. In April of 1990, approximately 3,000 cubic yards of sediment was removed by land-based equipment and transported by trucks to cropland away from the inlet. The disturbed area was seeded to minimize erosion. The total cost of the clean-out was \$12,000. Wetland restoration, improved feedlot management, a variety of best management practices, and the implementation of a sanitary sewer system will ensure that the inlet remains clean and open.

In the fall of 1990, Ron Adamson (Project Coordinator) recommended cleaning out a channel which connects the two bays and is divided by a peninsula located on the south side of the lake. The South Dakota Department of Water and Natural Resources, with the approval of the South Dakota Department of Game, Fish, and Parks, used project equipment to remove sediment from the channel and allow the natural flow to resume. The channel had been a popular fishing site, and boaters had once used the channel to pass from one bay to the next. The channel clean-out will allow water to pass back and forth from the bays and will help keep the water from becoming stagnant.

1991

In the fall of 1990, the progress of the dredge moving across the lake was noticeably behind schedule. It became evident that there was more sediment in the lake area that had been dredged than was previously estimated. In February of 1991, borings were taken at Wall Lake to determine the amount of silt remaining in the non-dredged portion of the lake. The survey was completed by members of the Minnehaha Conservation District, Soil Conservation Service, and the South Dakota Department of Environment and Natural Resources. Soil borings were taken through the ice, and the locations were recorded and mapped. These borings indicated that there was in excess of 15 feet of sediment still remaining in the area yet to be dredged. An approximate amount of silt was calculated by using the map of the lake, and the location of sediment borings. Over 1.5 million cubic yards of sediment still remained in the lake. The Wall Lake Task Force determined that it was cost prohibitive to remove all the sediment, and directed the Project Coordinator and dredge crew to remove approximately 8 feet of sediment from the non-dredged part of the lake. The "Dakotah" removed 447,000 cubic yards of sediment from the lake between April and October in 1991. Because of the very low water level, the dredge was anchored and winterized on the west shoreline.

1992

In 1992, the South Dakota Legislature prohibited the South Dakota Department of Environment and Natural Resources from operating dredges. Therefore, DENR asked that Minnehaha County, as project sponsor, take over the operation of the dredge. The Minnehaha County Commission was reluctant to assume this responsibility. Therefore, on March 31, 1992, a special Task Force meeting was held. The meeting resulted in the Minnehaha Conservation District becoming both project sponsor and accepting responsibility for the operation of the dredge. Minnehaha County agreed to retain the financial administration of the project.

The "Dakotah" resumed dredging in April, and ran through October. The dredge removed approximately 425,000 cubic yards of sediment. The dredge was again anchored to the west shore and winterized.

MAP NOT TO SCALE
THIS IS NOT AN OFFICIAL WETLAND MAP



The Agriculture Non-Point Source (AGNPS) computer model was used to analyze the feedlots in the watershed area. Three of the seven feedlots in the watershed were identified as being potential problems for adding nutrients to the lake. The names and solutions for these three are:

1. Larson feedlot--The owner of this feedlot, which is adjacent to the lake, decided not to establish a waste system but instead moved the cattle to a different site.

2. Lukes feedlot--A waste facility, approved by DENR, has been installed and is working properly. The proper permits were obtained for straightening the creek channel. This area was seeded and fenced to keep it free of cattle. It also serves as a filter strip to prevent nutrients and sediment from entering the lake.

3. Graves feedlot--A diversion was installed to divert snow runoff and other foreign water from entering his feedlot. A retention structure was constructed below this feedlot to catch runoff and prevent it from entering the tributary which feeds the lake.

1. Earthen plug to create wetland. Done
2. Construct a wildlife pond with nesting island.
3. Clean out two dugouts. *planned for 2001*
4. Plant trees. Done
5. Seed native grasses on former cropland. Done
6. Fence area to exclude livestock. Done
7. Build a crossing to make entire area accessible.

When the above items are completed, the conservation district plans to use this area as an outdoor classroom. No cropping, grazing or hunting will be allowed on the property. With the purchase of the property and completion of the proposed practices, along with conservation practices already applied on this tributary, sediment and nutrients entering the lake will be minimal.