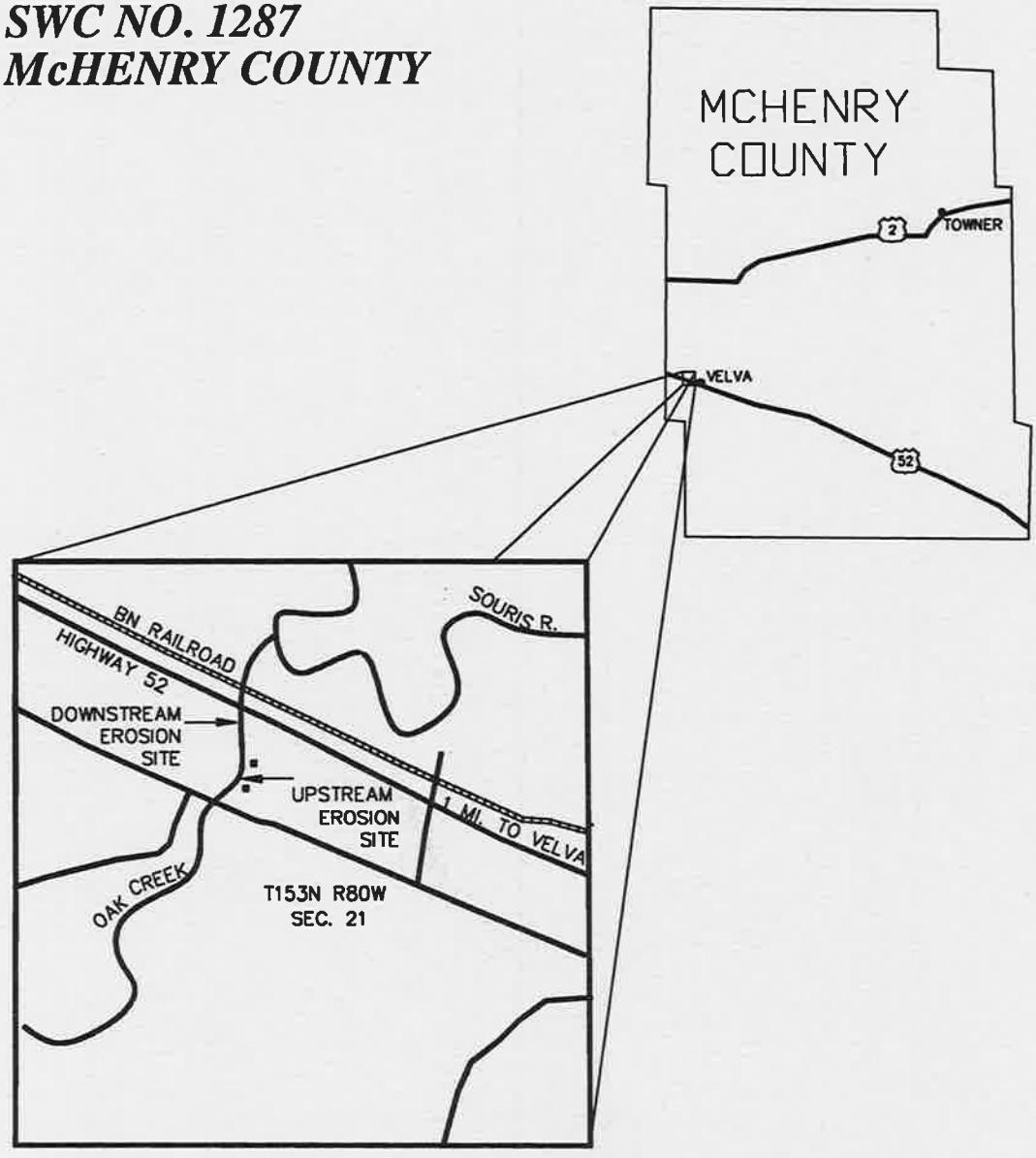
PRELIMINARY ENGINEERING REPORT

OAK CREEK BANK STABILIZATION

SWC NO. 1287
McHENRY COUNTY



NORTH DAKOTA STATE WATER COMMISSION
February 1993

PRELIMINARY ENGINEERING REPORT

Oak Creek
Streambank Stabilization

SWC Project #1287

February 1993

North Dakota State Water Commission
900 East Boulevard
Bismarck, North Dakota 58505-0850

Prepared by:

C. Gregg Thielman
Water Resource Engineer

Submitted by:

Dale L. Frink, Director
Water Development Division

Approved by:

David A. Sprynczynatyk, P.E.
State Engineer

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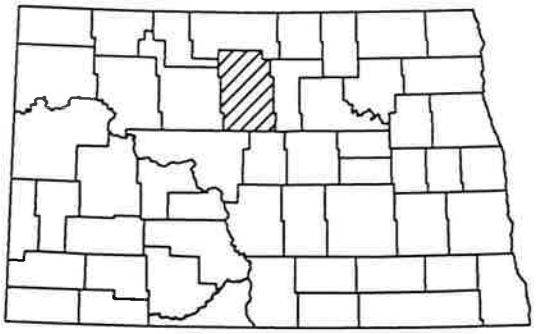
I. INTRODUCTION

Study Objectives:

In January of 1992, the North Dakota State Water Commission and the McHenry County Water Resource District entered into an agreement to investigate the feasibility of stabilizing the streambank of Oak Creek near the Mary Anderson Hustad farm. The agreement called for the State Water Commission to conduct a field survey of the project area; design alternatives to prevent further streambank erosion; prepare preliminary cost estimates for viable alternatives; and prepare a preliminary engineering report presenting the results of the investigation. A copy of the agreement is contained in Appendix A.

Project Location and Purpose:

The project is located approximately one mile west of Velva, North Dakota, in the NW¼, Section 21, Township 153 North, Range 80 West, in McHenry County. Two erosion sites have been identified. The first site, which will be referred to as the downstream erosion site, is located near the entrance to the Mary Anderson Hustad farm. At this site, the streambank is eroding near the road leading to the farm. Continued erosion will likely wash out the road. The second site, which will be referred to as the upstream erosion site, is located near the farm house. At this site, the streambank has eroded to within 20 feet of the house. Continued erosion will likely damage the house. Figure 1 shows the location of the project within the state.



OAK CREEK BANK STABILIZATION
SWC # 1287
LOCATION MAP

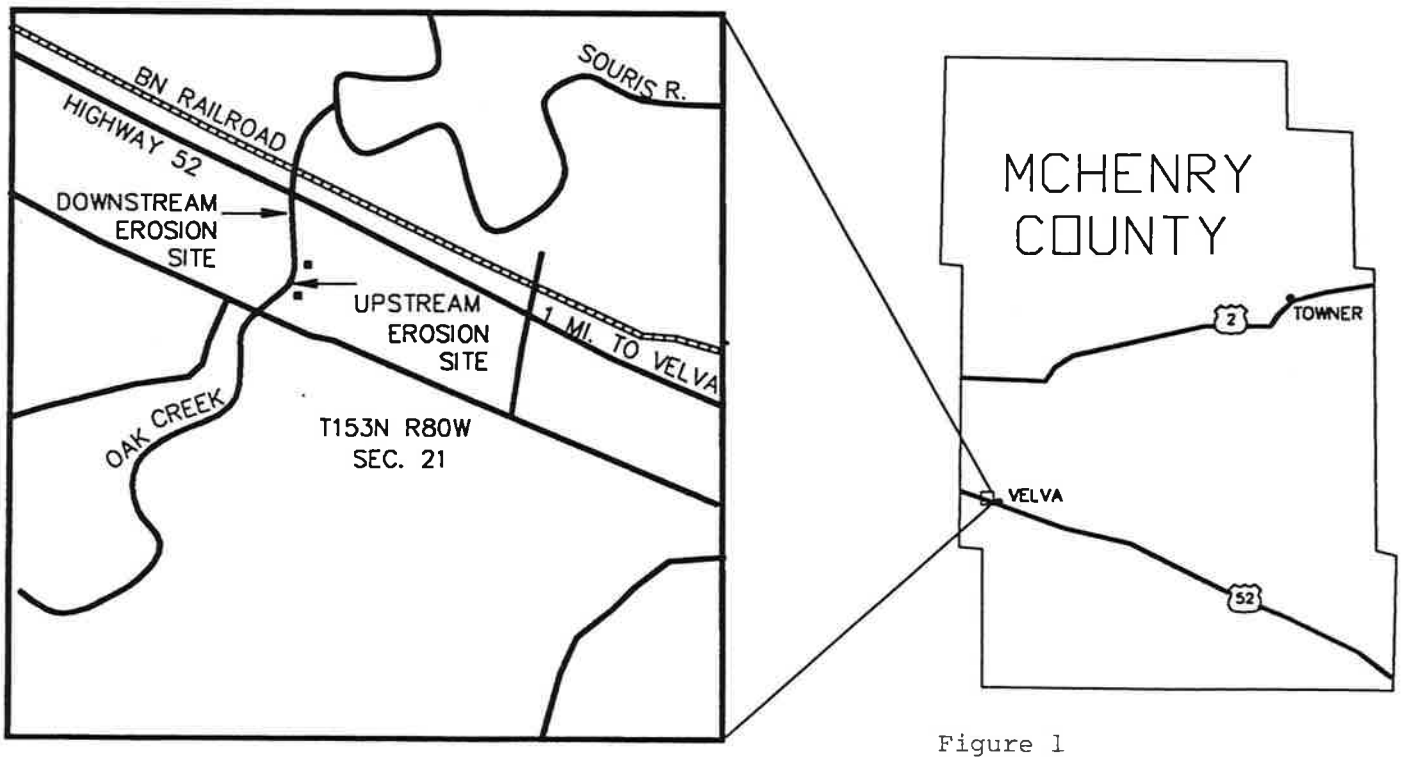


Figure 1
Location of Project

This investigation evaluates alternatives to prevent further streambank erosion from occurring at the two sites.

II. ALTERNATIVE STREAMBANK PROTECTION METHODS

Alternative One - Continuous Revetment:

The two streambank erosion sites that are being studied as part of this investigation occur at the outside edge of bends in the Oak Creek channel. The increased flow velocity that occurs at the outside of the bends has resulted in streambank erosion. This alternative consists of placing a continuous revetment, which consists of a layer of rock riprap, along the bank to protect it from these high velocities.

Prior to placing the revetment, the streambank will be resloped to a 2:1 (2 Horizontal to 1 Vertical) slope. The resloped bank will be overlayed by 0.5 feet of filter material. A 1.5-foot thick layer of rock riprap will be placed on top of the filter material. The riprap will consist of broken field stone. The riprap will extend from the top of the streambank to the channel invert. Figure 2 shows a typical section of the protected streambank.

A windrow refusal, which consists of a row of buried rock running perpendicular to the bank, will be placed at the upstream end of the revetment at both erosion sites to prevent water from flowing behind the bank protection. This refusal will extend approximately 10 feet back from the bank. A longer windrow refusal will not be used since the bank protection extends past the area where the most severe erosion occurs. Figure 3 shows a typical section of a windrow refusal.

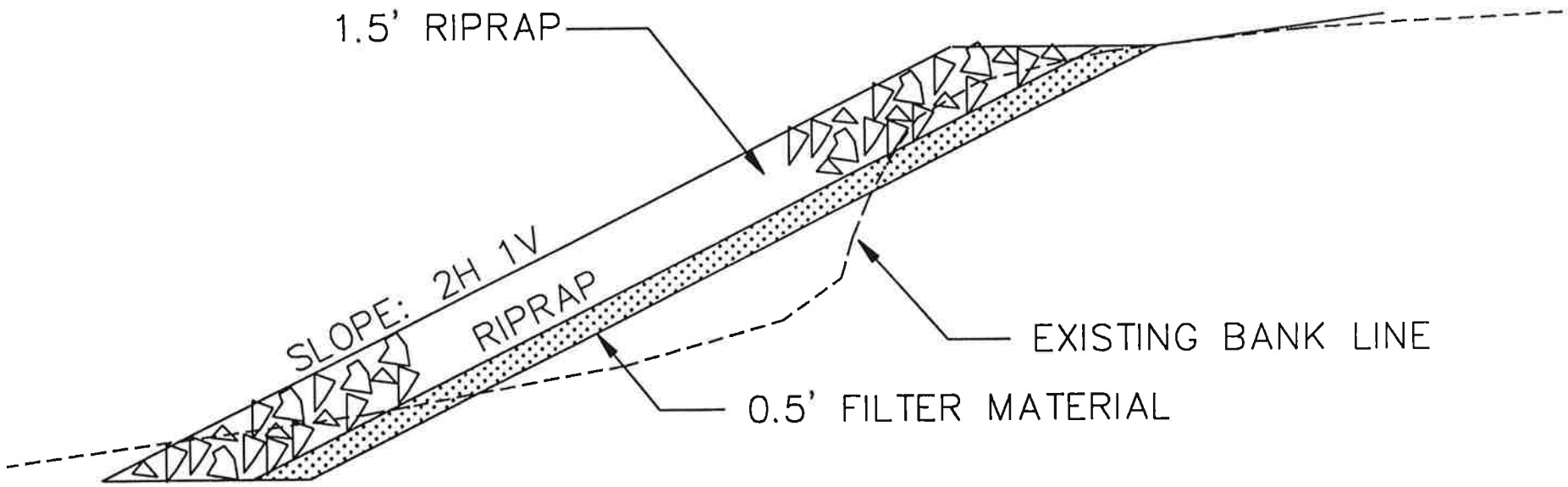
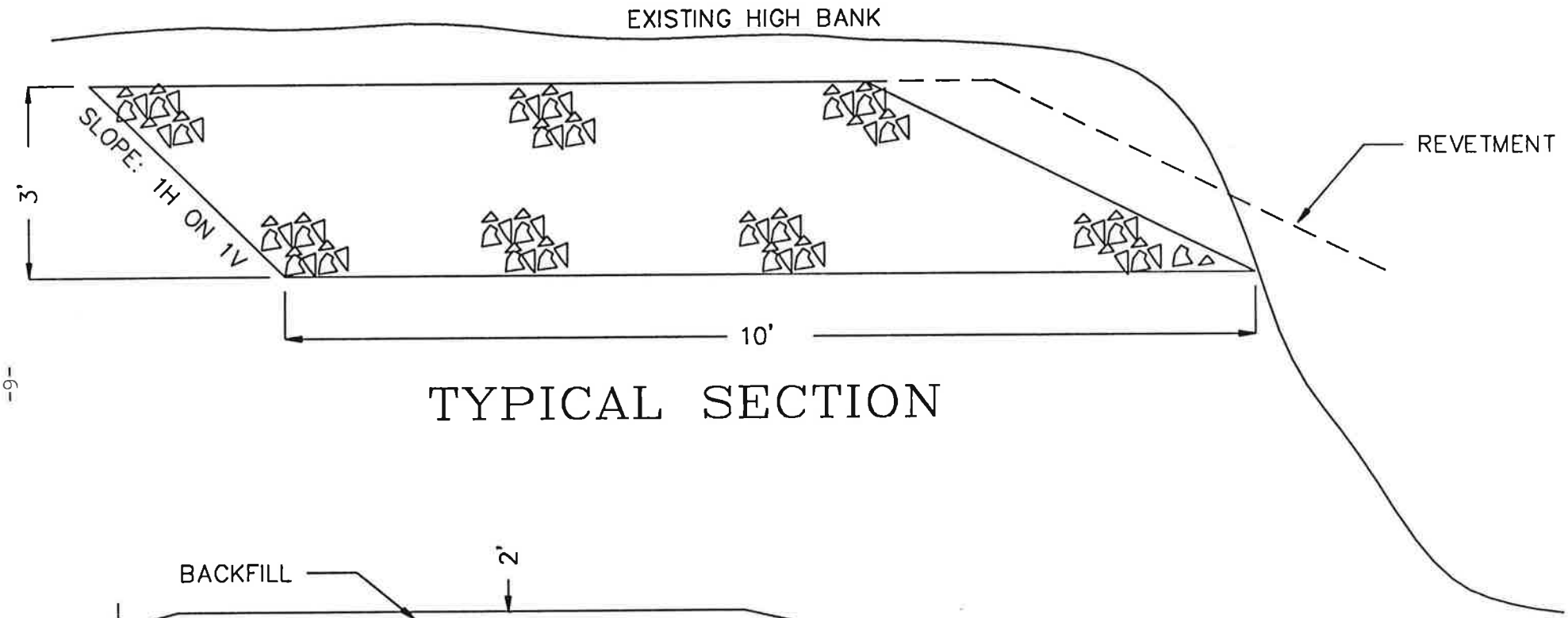


Figure 2
Typical Section of Protected Streambank

OAK CREEK BANK STABILIZATION
SWC # 1287
TYPICAL CROSS SECTION

WINDROW REFUSAL



TYPICAL SECTION

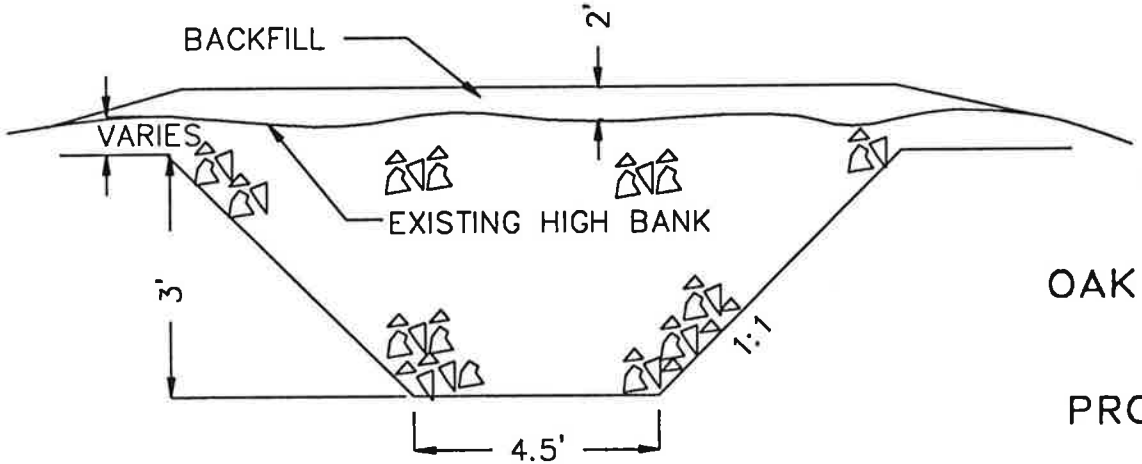


Figure 3
Typical Section of a Windrow Refusal

OAK CREEK BANK STABILIZATION
SWC # 1287
WINDROW REFUSAL
PROFILE AND TYPICAL SECTION

The reach length that will be protected at the downstream erosion site is approximately 165 feet long. Resloping the streambank to a 2:1 slope will require that the road leading to the Mary Anderson Hustad farm be rerouted. This will consist of curving the road around the resloped streambank. Figure 4 shows the alignment of the revetment as well as the alignment of the new road. The cost to construct a continuous revetment at the downstream erosion site is estimated to be $32,000. Table 1 shows the cost breakdown for Alternative One at the downstream erosion site.

Table 1 - Cost Estimate for Alternative One at Downstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$2,500.00	$ 2,500
Clearing and Grubbing	1	LS	3,000.00	3,000
Excavation	1,350	CY	2.50	3,375
Filter Material	150	CY	15.00	2,250
Rock Riprap	400	CY	30.00	12,000
Relocate Power Poles	1	LS	500.00	500
Relocate Roadway	1	LS	600.00	600
Seeding	1	LS	300.00	300
Subtotal				$24,525
Contingencies			(+/- 10%)	2,491
Contract Administration			(+/- 10%)	2,492
Engineering			(+/- 10%)	2,492
Total				$32,000

The reach length that will be protected at the upstream erosion site is approximately 80 feet long. Currently, the streambank has eroded to within 20 feet of the house. This limits the alignment that can be used to construct the revetment. A 2:1 side slope is recommended to properly place the riprap on the bank. Therefore, the proposed streambank modifications include excavating a portion

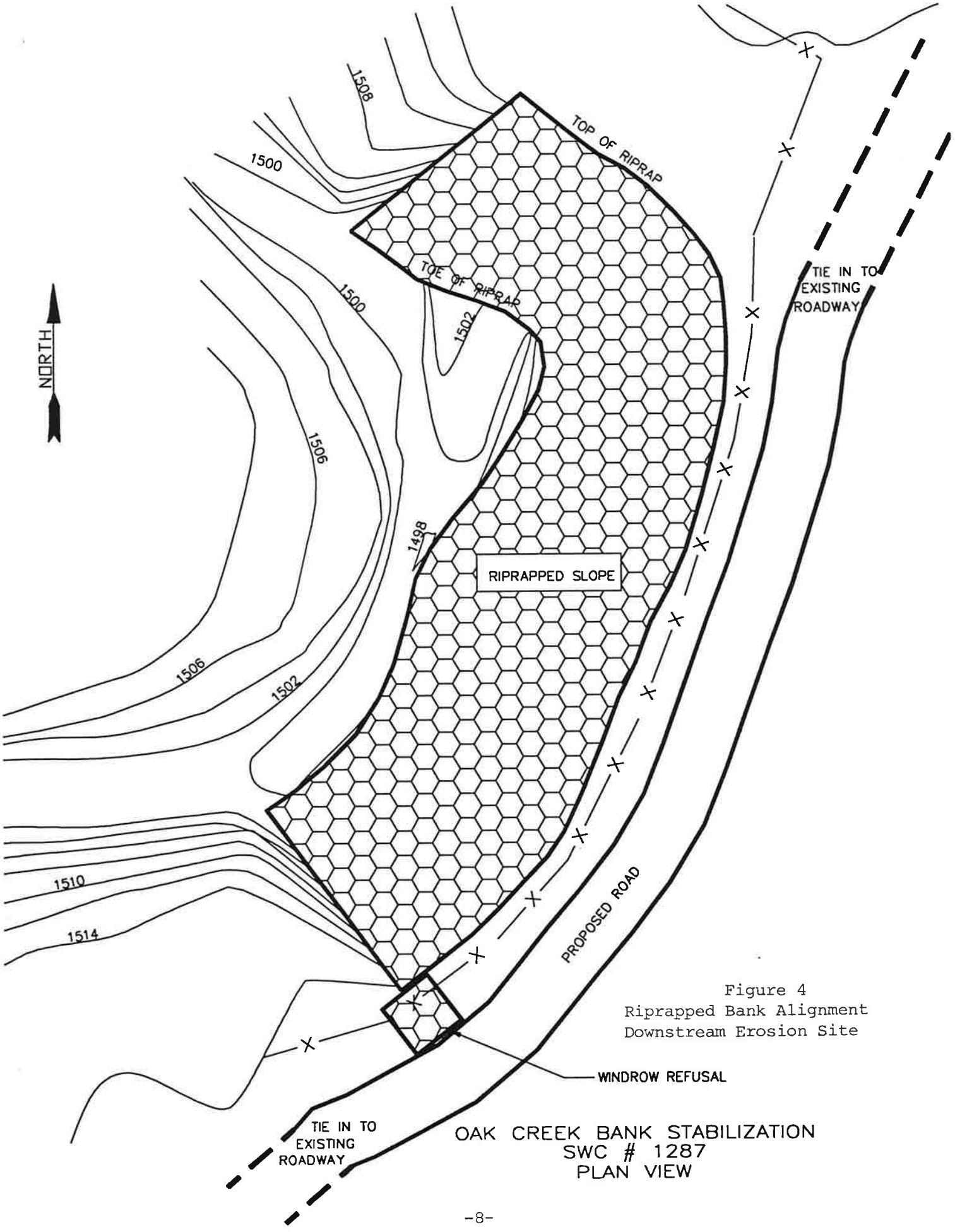


Figure 4
Riprapped Bank Alignment
Downstream Erosion Site

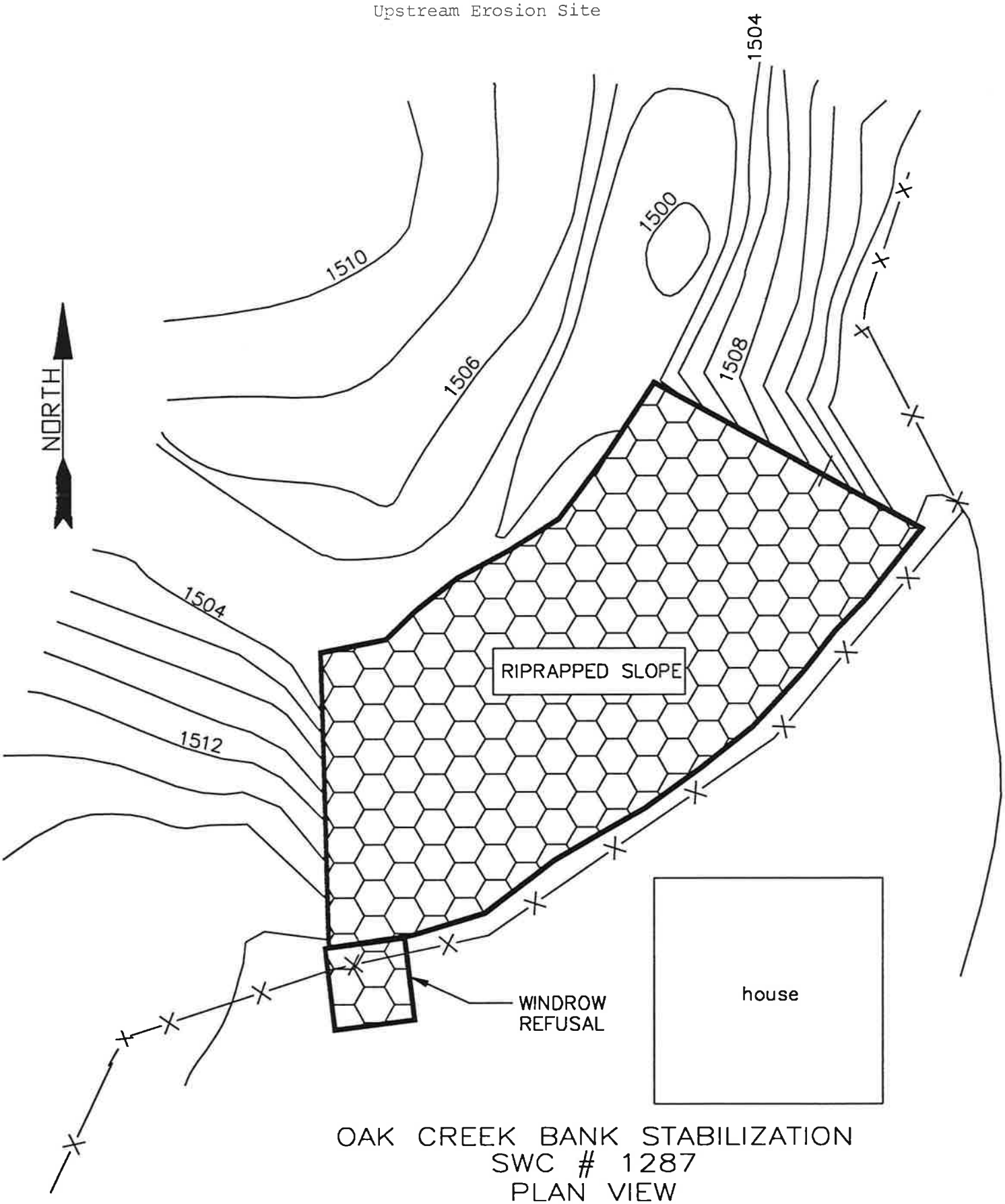
of the bank to a 2:1 side slope as well as placing fill in a portion of the channel to a 2:1 side slope. The riprap and filter material will then be placed on the slope. The edge of the revetment will be approximately 10 feet from the house. Figure 5 shows the alignment of the modified streambank. The cost to construct a continuous revetment at the upstream erosion site is estimated to be $20,000. Table 2 contains a cost estimate for Alternative One at the upstream erosion site.

Table 2 - Cost Estimate for Alternative One at Upstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$2,500.00	$ 2,500
Clearing and Grubbing	1	LS	5,000.00	5,000
Excavation	400	CY	2.50	1,000
Filter Material	70	CY	15.00	1,050
Rock Riprap	200	CY	30.00	6,000
Subtotal				$15,550
Contingencies			(+/- 10%)	1,483
Contract Administration			(+/- 10%)	1,483
Engineering			(+/- 10%)	1,484
Total				$20,000

A hydraulic analysis of the Oak Creek channel was performed at the upstream erosion site to determine the effects that the proposed channel modifications will have on the water level in the channel for various flows. The hydraulic analysis was performed using the HEC-2 computer model, developed by the U.S. Army Corps of Engineers. HEC-2 computes water surface profiles for steady, gradually varied flow in natural or man-made channels. The analysis indicated that the channel modifications will not increase the water level that occurs in the Oak Creek channel during flow events.

Figure 5
Riprapped Bank Alignment
Upstream Erosion Site



OAK CREEK BANK STABILIZATION
SWC # 1287
PLAN VIEW

Alternative Two - Wood Pile:

This alternative involves driving wood piles on 12-inch centers vertically in a line along the Oak Creek channel to protect against erosion. Individual 8- to 10-inch diameter wood piles will be tied together after installation using wire rope near the top of the piling. The length of the wood pile is dependent upon site characteristics which can be determined by a geotechnical analysis. A rule of thumb used to approximate the required pile length is to drive the pile into the ground a distance equal to twice the length of the exposed pile.

The channel reach that will be protected by wood piling at the downstream erosion site is approximately 165 feet long. At each end of the reach, five pilings will be installed at an angle to prevent scour behind the piling. The top of the piles will be at elevation 1513 msl. The channel will pass a flow of approximately 4,000 cfs before exceeding this level. The streambank above this level will be resloped to a 3:1 slope and seeded to grass. The approximate pile length at the downstream erosion site is 45 feet. Figure 6 shows a typical cross section of the streambank following installation of the wood pile.

The cost to install wood piling at the downstream erosion site is estimated to be $166,000. Table 2 shows the cost breakdown for Alternative Two at the downstream erosion site.

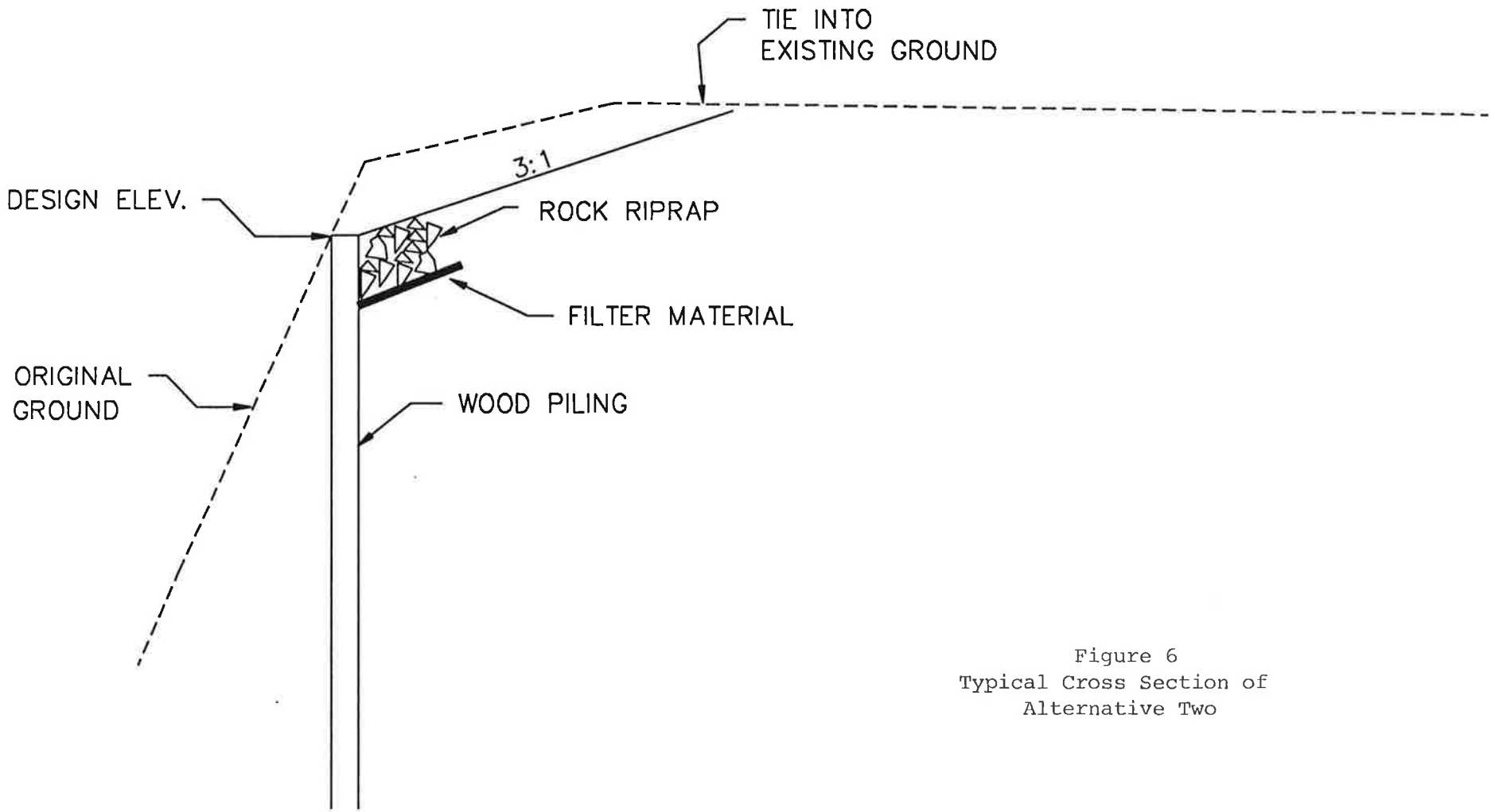


Figure 6
Typical Cross Section of
Alternative Two

OAK CREEK BANK STABILIZATION
SWC # 1287
TYPICAL CROSS SECTION
OF WOOD PILE ALTERNATIVE
(no scale)

Table 2 - Cost Estimate for Alternative Two at Downstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$4,000.00	$ 4,000
Clearing and Grubbing	1	LS	2,000.00	2,000
Excavation	42	CY	2.50	105
Filter Material	4	CY	15.00	60
Rock Riprap	7	CY	30.00	210
Miscellaneous Materials	1	LS	2,000.00	2,000
Wood Pile	7,785	LF	15.00	118,125
Seeding	1	LS	500.00	500
Relocate Power Poles	1	LS	500.00	500
Subtotal				$127,500
Contingencies			(+/- 10%)	12,833
Contract Administration			(+/- 10%)	12,833
Engineering			(+/- 10%)	12,834
Total				$166,000

The channel reach that will be protected by wood piling at the upstream erosion site is approximately 80 feet long. At each end of the reach, five pilings will be installed at an angle to prevent scour behind the piling. The top of the piles will be at elevation 1515 msl. The channel will pass a flow of approximately 4,000 cfs before exceeding this level. The streambank above this level will be resloped to a 3:1 slope and seeded to grass. The approximate pile length at the upstream erosion site is 38 feet.

The cost to install wood piling at the upstream erosion site is estimated to be $75,000. Table 3 shows the cost breakdown for Alternative Two at the upstream erosion site.

Table 3 - Cost Estimate for Alternative Two at Upstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$4,000.00	$ 4,000
Clearing and Grubbing	1	LS	1,000.00	1,000
Excavation	40	CY	2.50	100
Filter Material	2	CY	15.00	30
Rock Riprap	5	CY	30.00	150
Miscellaneous Materials	1	LS	1,000.00	1,000
Wood Pile	3,420	LF	15.00	51,300
Seeding	1	LS	500.00	500
Subtotal				$57,880
Contingencies			(+/- 10%)	5,706
Contract Administration			(+/- 10%)	5,707
Engineering			(+/- 10%)	5,707
Total				$75,000

Alternative Three - Sheet Pile:

This alternative is the same as Alternative Two, except that sheet pile will be used instead of wood pile. The sheet pile will interlock and will be approximately 1.5 feet wide.

The cost to install sheet piling at the downstream erosion site is estimated to be $180,000. Table 5 shows the cost breakdown for Alternative Three at the downstream erosion site.

Table 5 - Cost Estimate for Alternative Three at Downstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$4,000.00	$ 4,000
Clearing and Grubbing	1	LS	2,000.00	2,000
Excavation	42	CY	2.50	105
Filter Material	4	CY	15.00	60
Rock Riprap	7	CY	30.00	210
Sheet Pile	5,250	LF	25.00	131,250
Seeding	1	LS	500.00	500
Relocate Power Poles	1	LS	500.00	500
Subtotal				$138,625
Contingencies			(+/- 10%)	13,791
Contract Administration			(+/- 10%)	13,792
Engineering			(+/- 10%)	13,792
Total				$180,000

The cost to install a sheet pile barrier at the upstream erosion site is estimated to be $82,000. Table 6 shows the cost breakdown for Alternative Three at the upstream erosion site.

Table 6 - Cost Estimate for Alternative Three at Upstream Erosion Site

Item	Quantity	Unit	Unit Price	Total
Mobilization	1	LS	$4,000.00	$ 4,000
Clearing and Grubbing	1	LS	1,000.00	1,000
Excavation	40	CY	2.50	100
Filter Material	2	CY	15.00	30
Rock Riprap	5	CY	30.00	150
Sheet Pile	2,280	LF	25.00	57,000
Seeding	1	LS	300.00	300
Subtotal				$62,580
Contingencies			(+/- 10%)	6,473
Contract Administration			(+/- 10%)	6,473
Engineering			(+/- 10%)	6,474
Total				$82,000

III. REGULATORY REQUIREMENTS

The construction of streambank protection structures on Oak Creek will result in the loss of some land and trees. Although clearing of trees within the project area will be minimized, a revegetation plan, including tree plantings will likely be needed for mitigation of the disturbed areas. A Section 404 permit must also be obtained from the Corps of Engineers before any fill can be placed in a waterway.

IV. SUMMARY

The feasibility of stabilizing the streambank of Oak Creek near the Mary Anderson Hustad farm has been examined. Two erosion sites were studied as part of this investigation. At the downstream site, the streambank is eroding near the road leading to the farm. At the upstream site, which is located near the farm house, the streambank has eroded to within 20 feet of the house.

Three alternatives were considered as potential solutions to the erosion problem. Alternative One, which is the least expensive alternative, consists of resloping the streambank and overlaying it with a continuous revetment of rock riprap. Alternative One is estimated to cost $32,000 at the downstream erosion site and $20,000 at the upstream erosion site.

Alternative Two involves driving wood piles vertically in a line along the Oak Creek channel to protect against erosion. Alternative Two is estimated to cost $166,000 at the downstream erosion site and $75,000 at the upstream erosion site.

Alternative Three involves driving sheet pile vertically in a line along the Oak Creek channel to protect against erosion. Alternative Three is estimated to cost $180,000 at the downstream erosion site and $82,000 at the upstream erosion site.

V. RECOMMENDATIONS

Alternative One will provide sufficient streambank protection to reduce the erosion that is occurring. It is also the least costly alternative. Therefore, Alternative One is preferable.

The McHenry County Water Resource Board should carefully consider any cost-sharing for this project since it provides protection for a private residence. In order for the Board to cost-share, the Board will have to declare the project to be in the public interest. The Board should also consider all the factors, including but not limited to how long the buildings have been in existence, and whether there have been recent public developments or factors that may be contributing to the erosion which are not attributable to the landowner.

BIBLIOGRAPHY

1. Morrison, Maierle, Montgomery, James River Stabilization Study, Prepared for the United States Department of the Interior, Bureau of Reclamation, Final Report, Appendix A, July, 1988.

2. U.S. Army Corps of Engineers, HEC-2 Water Surface Profiles, September, 1990.

3. U.S. Army Corps of Engineers, Streambank Protection Guidelines for Landowners and Local Governments, October, 1983.

Appendix A - Copy of Agreement

SWC Project #1287
January 13, 1992

A G R E E M E N T

Investigation
of a
Streambank Stabilization Project
on Oak Creek

I. PARTIES

THIS AGREEMENT is between the North Dakota State Water Commission, hereinafter Commission, through its Secretary, David A. Sprynczynatyk; and the McHenry County Water Resource District, hereinafter District, through its Chairman, Glenn Wunderlich.

II. PROJECT, LOCATION, AND PURPOSE

The District has requested the Commission to investigate the feasibility of stabilizing the streambank of Oak Creek near the Mary Anderson Hustad farm. The Project is located in the NW1/4, Section 21, Township 153 North, Range 80 West.

III. PRELIMINARY INVESTIGATION

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

1. A field survey of the project area, including topographic data and the location and elevation of any significant structures;
2. A preliminary design of alternatives to reduce the streambank erosion;
3. A preliminary cost estimate for viable alternatives; and
4. Prepare a preliminary engineering report presenting the results of the investigation.

IV. COSTS

The District shall pay the Commission $700.00 to help defray the field costs associated with this investigation. Payment must be received before the Commission will perform any field work.

V. RIGHTS-OF-ENTRY

The District agrees to obtain written permission from any affected landowners for field investigations by the Commission, which are required for the preliminary investigation.

VI. INDEMNIFICATION

The District agrees to indemnify and hold harmless the State of North Dakota, the Commission, its Secretary, their employees and agents, from all claims, suits or actions of whatsoever nature resulting out of the design, construction, operation, or maintenance of the project. In the event a suit is initiated or judgment is entered against the State of North Dakota, the Commission, its Secretary, their employees or their agents, the District shall indemnify any or all of them for all costs and expenses, including legal fees, and any judgment arrived at or satisfied or settlement entered.

VII. MERGER CLAUSE

This agreement constitutes the entire agreement between the parties. No waiver, consent, modification or change of terms of this agreement shall bind either party unless in writing, signed by the parties, and attached hereto. Such waiver, consent,

modification or change, if made, shall be effective only in the specific instance and for the specific purpose given. There are no understandings, agreements, or representations, oral or written, not specified herein regarding this agreement.

NORTH DAKOTA STATE WATER COMMISSION

By: _____

DAVID A. SPRYNCZYNATYK
for Secretary

WITNESS: _____

DATE: 13 JAN 92

MCHENRY COUNTY WATER RESOURCE DISTRICT

By: _____

GLENN WUNDERLICH
Chairman

WITNESS: _____

DATE: 2-11-92