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P.L. 566 Land Treatment Evaluation Conservation Options Procedure

Preface

The purpose of this Technical Note is to describe a method of economic evaluation called the Conservation Options Procedure (COP), which analyzes systems of conservation practices in P.L. 566 watersheds and other project work. The Conservation Options Procedure may be used instead of the Incremental Analysis Procedure (IAP) described in National Bulletin Number 200-3-10 dated May 20, 1983. If watershed planners prefer, they may continue to use the Incremental Analysis Procedure. The Conservation Options Procedure uses cost efficiency, net benefits, and nonmonetary factors to evaluate conservation options. The procedure ultimately identifies the National Economic Development (NED) plan, the Resource Protection (RP) plan, and the Recommended plan. The Incremental Analysis Procedure identifies the NED plan by using incremental benefit cost ratios to evaluate practices and combinations of practices.

I. Introduction

The Conservation Options Procedure is comprised of three stages. The first stage is a cost efficiency analysis of practices and systems of practices, Conservation Options, that are technically feasible. The second stage is a net monetary benefit analysis performed on the alternative systems of practices identified in Stage I as being efficient. Stage III adds nonmonetary factors; addresses the trade-offs among the Stage II alternatives; and documents the rationale for selecting the National Economic Development, Resource Protection, and the recommended plans. The Conservation Options Procedure can be condensed to:

* Stage I - Cost Efficiency Analysis
* Stage II - Net Monetary Benefit Analysis
* Stage III - Identify NED, RP, and Other Alternative Plans and Select Recommended Plan

The Conservation Options Procedure makes the economic evaluation process more practical. It may also reduce the time required to analyze an evaluation unit. Additionally, the procedure incorporates modifications in the handling of production costs and changes in cropping sequence to ensure that the benefits from conservation of soil and water drive the evaluation process. These modifications, the way production costs and changes in cropping sequence are handled, are also applicable to the Incremental Analysis Procedure.

II. General

II.A. Introduction

This section discusses a collection of issues beginning with the technical and policy constraints that form the foundation for the analysis of erosion control practices in P.L. 566 projects. The following two sections define in detail the costs and benefits associated with soil conservation practices. The subsequent sections discuss interdependent gullies and the use of other studies.

II.B. Technical and Policy Constraints

Although Watershed Protection plans are not water resource projects as defined by Principles and Guidelines (P&G), these plans follow the evaluation procedures outlined in Principles and Guidelines. Accordingly, a National Economic Development plan is formulated which "... reasonably maximizes net national economic development benefits, consistent with the Federal objective... " (P&G Section 1.6.3). The analysis of accelerated land treatment in structural watershed projects also follows the P&G evaluation procedures.

Although yield enhancement and efficiency gains may not be used to formulate watershed protection plans, these benefits may be used in computing net benefits for alternative plans.

In addition, watershed planners are encouraged to use nonmonetary factors to evaluate conservation options.

Finally, an economic analysis of onsite effects is not necessary for conversion of cropland to permanent vegetation.

II.C. Costs

Conservation Option Procedure costs should be expressed in average annual dollars not annualized costs (average annual equivalents). For the purpose of project evaluation, management costs are defined as any Added Production Input Costs (APIC) (including any increase in the management costs), not the net change in budget costs. When financial assistance is provided for management practices, the amortized value of Incentive Payments (IP) should be included with the Added Production Input Cost as a project cost. Efficiency Gains (EG) are the net change in budget costs. This change is the difference between Added Production Input Costs and Reduced Variable Production Costs (RVPC) (which include any reduction in management costs). The Reduced Variable Production Costs are viewed as benefits. Care should be taken to avoid double counting of the costs.

The cost for enduring practices includes the amortized Installation (I) cost, the amortized present value of the Replacement (R) costs, and the annual Operation and Maintenance (OM) cost. The I and R costs should be amortized at the relevant Federal water resource discount rate for the evaluation period or project life (25 years) not the period of analysis which is the sum of the evaluation period and the installation period. In addition, if there are any APIC costs associated with an enduring practice, they should be included in the cost of that practice.

Because the Conservation Options Procedure uses average annual dollar values in its evaluation, it is not necessary to develop an installation schedule until the Recommended Plan is selected. The installation schedule is used to compute annualized costs and benefits (i.e. discounted and amortized over the period of analysis) for the Recommended Plan as it is displayed in the Watershed Plan.

Technical Assistance (TA) or Project Administration (PA) costs should not be included when evaluating conservation options in Stages I and II. These costs are not applicable to individual conservation options but they need to be included in the net benefit displays for alternative plans in Stage III.

The following table summarizes COP costs.

Table 1

Cost Summary

Cost	I	R	OM	APIC	IP	PA	TA	Ave Ann	Annualized
Stage I									
EPC	x	x	x	x				x	
MPC				x	x			x	
Stage II									
EPC	x	x	x	x				x	
MPC				x	x			x	
Stage III									
EPC	x	x	x	x		x	x	x	
MPC				x	x	x	x	x	
Watershed Plan (Recommended Plan)									
EPC	x	x	x	x		x	x		x
MPC				x	x	x	x		x

I = Installation Cost; R = Replacement Cost; OM = Operation and Maintenance Cost, APIC = Added Production Input Costs, IP = Incentive Payments, PA = Project Administration Costs, TA = Technical Assistance Costs, Ave Ann = Average Annual Costs (Amortized over project life), Annualized = (Amortized over the period of analysis), EPC = Enduring Practice Cost, MPC = Management Practice Cost.

II.D. Benefits

The starting point for the benefit analysis is the input from the physical scientists. Beneficial effects will probably fall into one of the following categories.

* Onsite
    * Long term Productivity
    * Concurrent Damage Reduction
    * Changes in Cropping Sequence
    * Yield Enhancement
    * Reduced Variable Production Costs
* Offsite
    * Water Quality
    * Sedimentation
    * Floodwater

Long term Productivity (LP) benefits are related to the maintenance of future soil resource base productivity. They are commonly measured in terms of a reduction in the rates in which soil depth and crop yields decline. Concurrent Damage Reduction (CDR) benefits are associated with the reduction in year-to-year erosion damages. Concurrent Damage Reduction benefits include the effects of conservation practices on yields through reduced runoff of applied nutrients; reduced seed and plant washout; and decreased sedimentation of seeds and plants. These effects have sometimes been referred to as "now time effects." Reduced Variable Production Costs (RVPC) benefits are defined as the reduction in "without treatment" variable input costs associated with a practice. Fixed costs in the "with treatment" condition are assumed to be the same as the "without treatment" fixed costs. For example, farmers generally do not sell their conventional tillage equipment when reduced tillage is adopted. Therefore, their fixed costs are not reduced. The Added Production Input Costs caused by the conservation option are considered project costs in this procedure. In a partial budget format, Efficiency Gains (EG) are the difference between the (RVPC) and the Added Production Input Costs (APIC).

$$EG = RVPC - APIC$$

Again, Added Production Input Costs (APIC) are treated as project costs. Therefore, the Reduced Variable Production Costs (RVPC) represent Efficiency Gains in Stages II and III.

Benefits from changes in the crop sequence are associated with modification in the crops grown. An example of such a modification is the conversion from continuous corn to a corn-hay rotation. To simplify the analysis and to ensure that the effects of changes in the cropping sequence do not adversely affect the evaluation of conservation options, it is assumed that the overall mix of crops will not change. Specifically, it is assumed that hay must be already produced on other fields and therefore the corn and hay are moved around among fields. That is, corn will be used for both the without and with treatment conditions. In summary, when computing long term productivity benefits and there are changes in the cropping sequence, measure the change in net income in terms of the original cropping sequence. This will ensure that the long term productivity benefits are based on reduced damage to the resource base, not to budget changes.

Offsite (OFF) benefits accrue to individuals who have no control over the source of damage. In general, they are derived from reducing the runoff of water, sediment, and associated chemicals. The reduced runoff, in turn, decreases damages or diminishes the resource use impairment.

II.E. Interdependent Gully Erosion

In evaluation units where significant (i.e. control requires enduring practices) ephemeral or permanent gully erosion is interdependent with sheet and rill erosion, each of the Conservation Options must treat the gully erosion as well as the sheet and rill erosion problems. When listing Conservation Options in Stage I, note those Options which completely solve the gully erosion problems. By following this instruction, the cost efficiency analyses is based on the cost of gully and sheet and rill practices per ton of reduced sheet and rill erosion. Ranking the Conservation Options by an efficiency measure such as reduced sheet and rill erosion will not change the relative position of each Conservation Option because the effect on ephemeral erosion is constant across Conservation Options within an evaluation unit.

II.F. Use of Other Studies

Planners are encouraged to make use of information from other watershed projects or comparable studies. In order to make use of such information practical and acceptable, these other studies should be in areas with similar soils, crops, problems, and needs.

III. Conservation Options Procedure Stage I

As described in 503.10(b) of the National Watershed Manual, the first steps in an evaluation are to identify and analyze the nature and scope of the resource problems. Once this has been done an interdisciplinary group of technical specialists should develop a list of technically feasible systems of practices which address the resource problems. These Stage I systems of practices are called Conservation Options (CO).

Since each Conservation Option will affect the identified problems in varying degrees, it is necessary to select a common base for comparing the Options. In all cases the appropriate common denominator depends on the nature of the identified problems. If the primary problem is loss of long term productivity, then the basis for comparison might be cost per ton of reduced sheet and rill erosion. If the primary problem is offsite sedimentation, then the basis for comparison might be cost per ton of reduced sediment. When other damages are the major resource problem different common denominators, such as, pounds of nutrients or biological oxygen demand levels may be used.

In evaluation units where ephemeral gully or permanent gully erosion are interdependent with sheet and rill erosion; ephemeral erosion is severe enough to require water disposal systems; and onsite damages are predominant, Stage I requires that the watershed planners only note the presence of significant gully erosion. Estimates of the amount of gully erosion (tons per acre per year) are needed primarily for the evaluation of sediment problems. As such, when Conservation Options are developed, include options which completely solve the gully erosion problem. This means that in evaluation units where gully erosion is severe, water disposal systems are the foundation of any Conservation Option. The cost efficiency analysis, in this case, will be based on the cost of gully and sheet and rill practices per ton of reduced sheet and rill erosion.

Onsite gully damages can be computed without estimating the amount (i.e. tons per acre per year) of gully erosion. The only erosion related information needed is an estimate of the dimensions (i.e. length and width) of the voided and the depreciated areas. The computation of onsite and offsite damages is discussed in Stage II.

Table 2 provides a suggested display for an evaluation unit where: (1) the ephemeral gully erosion is severe enough to required enduring practices, (2) the ephemeral erosion is interdependent with the sheet and rill erosion, and (3) the major problem is loss of long term productivity. The purpose of Table 2 is to document what Conservation Options were considered and to systematically screen out Conservation Options that are not technically feasible.

Table 2

List of Conservation Options
Evaluation Unit A

Conservation Option	Gully * Permanent (Yes/No)	Gully * Ephemeral (Yes/No)	Sheet & Rill ** Eros Rate (TAY)	Sheet & Rill ** Eros Redc (TAY)
1. Without Treatment				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

* For the Without Treatment condition enter a "Yes" if ephemeral gully or permanent gully is a significant problem which requires a water disposal system. For the remaining Conservation Options enter a "YES" if the problem remains.

** When cost effectiveness is related to other physical problems use an appropriate parameter such as tons of sediment.

Those Conservation Options that are not technically feasible, based on the judgement of the interdisciplinary team, should be deleted from further consideration. The next step in Stage I is to perform a cost efficiency analysis on the remaining Conservation Options using the relevant physical effect, in this example, tons of soil saved per acre per year.

For project evaluation purposes, management practice costs are defined as Added Production Input Costs. These are the costs of added inputs such as insecticides, herbicides, or a no-till planter instead of the net change in budget costs. When financial assistance is provided for management practices, the amortized value of Incentive Payments should be included. Stage I management practice costs (average annual dollars per acre) are defined as:

$$MPC = APIC + IP$$

Where: MPC = Average Annual Management Practice Cost
APIC = Average Annual Added Production Input Cost
IP = Average Annual Incentive Payment Cost

Enduring practice costs are defined as the sum of the amortized Installation cost, the amortized present value of the Replacement costs, the annual Operation and Maintenance costs and any Added Production Input Costs associated with an enduring practice. Do not include technical assistance or project administration costs in Stage I. These costs are not applicable to individual Options but they need to be included in the net benefit analysis in Stage III. Costs are described in more detail in Section II.C. of this Technical Note. In summary, Stage I enduring practice costs (average annual dollars per acre) are defined as:

$$EPC = I + R + OM + APIC$$

Where:
EPC = Average Annual Enduring Practice Cost
I = Average Annual Installation Cost
R = Average Annual Replacement Cost
OM = Average Annual Operation and Maintenance Cost
APIC = Average Annual Added Production Input Cost

Table 3 is an example of how the cost efficiency analysis of Stage I might be displayed for an evaluation unit where the primary problem is loss of long term productivity caused by interdependent sheet and rill and severe ephemeral gully erosion. Those Conservation Options that appear in Table 2 but do not appear in Table 3 were deleted for technical reasons.

Table 3

Cost Efficiency
Evaluation Unit A

Conservation Option	Perm Gully (Yes/No)	Ephem.* Gully (Yes/No)	Sheet & Rill Eros Rate TAY	Sheet & Rill Eros Redc TAY	Consrvtion Option Cost ($/A/Y)	Consrvtion Option Cost/RedTon ($/T/Y)
1. Without						
2.						
5.						
6.						
7.						
9.						
10.						

* A "No" is entered in the permanent and ephemeral gully columns if the conservation option solves the problem. Record a "Yes" if the Conservation Option does not solve the gully erosion problem.

Sheet and rill erosion should be expressed as tons per acre per year. The erosion reduction is the difference between the without treatment and the with Conservation Option conditions. The first Conservation Option listed should be the without treatment option. For display purposes the Conservation Options in Table 3 may be ranked by cost per ton of reduced erosion. Graphing the information in Table 3 may also assist in analyzing and displaying the information.

Those Conservation Options that are not cost efficient can be deleted from further consideration in the identification of the NED, RP, and recommended plans. Determining which Conservation Options are efficient, and therefore to be analyzed as alternative conservation systems in Stage II, is not based on an absolute standard. Instead, the interdisciplinary team must use their collective experience to decide which Options are efficient.

IV. Conservation Options Procedure Stage II

Stage II is a net monetary benefit analysis of the alternative conservation systems identified in Stage I. The first step in the net monetary benefit analysis is for the interdisciplinary team to quantify the physical effects of the conservation options. As such, before monetary values can be estimated the agronomist, sedimentation geologist, resource conservationist, recreation specialist, biologist, soil scientist, and water quality specialist must complete their estimates of the physical effects of the project.

A problem associated with calculating onsite benefits of conservation is the degree to which current normalized prices and standard crop budgets produce realistic estimates of absolute net income. To solve this problem, partial budgeting will be used because it focuses on those budget items that tend to have a readily known market value rather than many of the fixed budget costs that are more farm specific. In this case, benefits are determined by subtracting gross returns without treatment from gross returns with treatment and then adding the Reduction in Variable Production Costs. This relative measure of income change is probably more reasonable than absolute measures of levels of income derived from whole budget analysis. The basic formula for computing gross onsite benefits is:

$$OSB = (GR_w - GR_{w/o}) + RVPC$$

Where:
- OSB = Onsite Benefits
- GR_w = Gross Returns With Treatment
- $GR_{w/o}$ = Gross Returns Without Treatment
- RVPC = Reduced Variable Production Costs.

Since added production input costs are handled as project costs the RVPC represent the reduction of without treatment variable production costs. This is based on the assumption that farmers will continue to incur their current fixed costs.

Once all monetary benefits, including offsite effects, have been valued, the next step is to compute the net benefits for each of the conservation options identified in Stage I as being cost efficient. Table 4 displays this information.

Table 4

Net Benefit Analysis
Evaluation Unit A

Conservation Option	Eros Rate (TAY)	Eros Reduc (TAY)	AA Cost ($/A)	AA Bene ($/A) LP	CDR	OFF	YE	RVPC	AA Net Bene Dmg Red ($/A)	Total ($/A)
1.										
2.										
3.										
4.										

Where LP is Long term Productivity; CDR is Concurrent Damage Reduction; RVPC is Reduced Variable Production Costs; YE is Yield Enhancement; and OFF are Offsite Damage reduction benefits; AA is Average Annual; Dmg Red is Damage Reduction which is the sum of LP, CDR, and OFF.

V. Conservation Options Procedure Stage III

At this point in the evaluation, the nonmonetary effects, expressed in quantitative and qualitative terms, are combined with the information developed in Stages I and II. The NED and RP plans are identified and the trade-offs among the Stage II alternatives are displayed in monetary and nonmonetary terms. In addition, the rationale for selecting the recommended plan is described. The alternative with the greatest net monetary benefits is designated as the NED plan, and the alternative that achieves an acceptable level of resource protection is designated as the RP plan. It is the role of the interdisciplinary team to define the RP plan criteria. Table 5 provides an example display of the Stage III results. When appropriate, items other than those displayed should be used.

In Stage III technical assistance and project administration costs are to be included in the costs of alternative plans. The total costs (the Stage II costs of management practices and enduring practices plus technical assistance and project administration) should be amortized for the evaluation period. In the watershed plan the costs and benefits of the recommended plan need to be annualized for the period of analysis.

Table 5

Comparison of Alternatives

ITEM	Alt 1.	Alt 2.	Alt 3.	Alt 4.
Erosion Rate				
Erosion Reduction				
Sediment Reduction				
Costs				
Install PL566				
Install Other				
Average Annual				
Economic Benefits				
Onsite				
Offsite				
Net Economic Benefits				
Social Effects				
Environmental Effects				

EXAMPLE

Conservation Options Procedure (COP)

CORNHUSKER WATERSHED

August 1988

BACKGROUND****EVALUATION UNIT A

Evaluation unit A consists of 15,000 acres. The land use is as follows:

Cropland	12,500
Pasture	1,000
Forestland	100
Other	1,400
TOTAL ACRES	15,000

The major problems in evaluation unit A are:

1. Sheet and rill erosion on cropland
2. Permanent and ephemeral gully erosion on cropland
3. Streambank erosion
4. Sedimentation
5. Poor quality fish and wildlife habitat
6. Expensive water treatment for the Village of Big Red
7. Road and bridge repair and maintenance

Each problem area will now be evaluated.

1. Sheet and rill erosion on cropland

Cropland soils are primarily Marshall on ridgetops and Monona and Ida on steep slopes of 9 to 18 percent. These soils are well drained prairie soils formed in deep loess.

The cropland is being farmed using a rotation of corn and soybeans. Resource management systems (RMS) or basic conservation systems (BCS) have been applied to 3,000 acres of cropland. Erosion has been controlled on these 3,000 acres by installing a system of terraces, grassed waterways, and reduced tillage. The remaining 9,500 acres of cropland are eroding at an average rate of 37 tons per acre per year. The watershed directors feel that 7,600 acres of the 9,500 acres (80%) will be treated as a result of the Food Security Act of 1985 and a 95 percent participation rate for land treatment practices on the remaining 1,900 acres is attainable (1,800 acres).

Stage I-Cost Efficiency Analysis

An interdisciplinary team of technical specialists has identified and analyzed the nature and scope of the resource problems and options. Table 2 illustrates the conservation options (see appendix 1 for detailed information on each option).

Table 2

Stage I - LP

List of Conservation Options

Evaluation Unit A

Existing Condition and Conservation Options	Gully* Permanent (Yes/No)	Gully* Ephemeral (Yes/No)	Sheet/Rill** Eros Rate (TAY)	Sheet/Rill** Eros Redc (TAY)
A. Existing Condition	Y	Y	37	--
B. BCS	N	N	4	33
C. Cons Alt #1	N	N	10	27
D. Cons Alt #2	Y	N	15	22
E. Cons Alt #3	Y	Y	30	7

*For the Existing Condition and Conservation Options enter a "Yes" or "Y" if ephemeral gully or permanent gully erosion is a significant problem which requires a water disposal system. Enter a "No" or "N" if gully erosion is not a problem.

**When formulating for other physical problems such as offsite damages, use an appropriate parameter such as tons of sediment.

Based on the judgment of the interdisciplinary team, conservation alternative #3 was not effective, complete or acceptable, therefore, it was deleted from further consideration.

A cost efficiency analysis is performed on the remaining conservation options by comparing the cost per ton of soil saved per acre per year. The annual cost of the BCS is estimated to be $54.70 per acre. The annual cost of conservation alternative #1 is $28.60 per acre per year and conservation alternative #2 is $20.82 per acre per year (see appendix 2 for detailed cost information). Table 3 illustrates the cost efficiency analysis of stage I.

Table 3

Stage I - LP

Cost Efficiency

Evaluation Unit A

Existing Condition and Conservation Options	Gully* Permanent (Yes/No)	Gully* Ephemeral (Yes/No)	Sheet/Rill Eros Rate (TAY)	Sheet/Rill Eros Redc (TAY)	Conservation Option Cost ($/A/Y)	Conservation Option Cost/Ton Saved ($/T/Y)
A. Existing Condition	Y	Y	37	--	--	--
B. BCS	N	N	4	33	$54.70	$1.66
C. Cons Alt #1	N	N	10	27	28.60	1.06
D. Cons Alt #2	Y	N	15	22	20.82	.95

*For the Existing Condition and Conservation Options enter a "Yes" or "Y" if ephemeral gully or permanent gully erosion is a significant problem which requires a water disposal system. Enter a "No" or "N" if gully erosion is not a problem.

For display purposes the conservation options in Table 3 may be ranked by cost per ton of soil saved. Graphing the information may also assist in analyzing the information.

Those conservation options that are not cost efficient can be deleted from further consideration in the identification of the NED, RP, and recommended plans. Determining which conservation options are efficient is not based on an absolute standard. Instead, the interdisciplinary team must use their collective experience to decide which options are efficient. In this analysis, the team has decided that all of the remaining options in Table 3 are efficient and acceptable.

Stage II-Net Monetary Benefit Analysis

Stage II is a net monetary benefit analysis of the alternative conservation systems identified in Stage I. The first step in the net monetary benefit analysis is for the interdisciplinary team to quantify the physical effects of the conservation options. As such, before monetary values can be estimated, the agronomist, sedimentation geologist, resource conservationist, recreation specialist, biologist, soil scientist, and water quality specialist must complete their estimates of the physical effects of each alternative.

The next step is to compute the net benefits for each of the conservation options identified in Stage I as being cost efficient. Table 4 displays this information. See the appropriate appendix for the various category of benefits.

Benefits	Appendix
LP	3
CDR	4
OFF	5
YE	6
RVPC	7

Table 4

Stage II - LP

Net Benefit Analysis

Evaluation Unit A

Item	BCS	Cons. Alt 1	Cons. Alt 2
Average Annual Benefits ($/Ac)			
Damage Reduction			
LP	26.31	19.84	13.22
CDR	9.98	9.17	7.55
OFF	.19	.19	.17
Subtotal (Dmg Red)	36.48	29.20	20.94
Other			
YE	4.09	3.70	3.29
RVPC	14.22	14.30	14.30
Subtotal (Other)	18.31	18.00	17.59
Total Average Annual Benefits	54.79	47.20	38.53
Total Average Annual Cost	54.70	28.60	20.82
Net Benefits	0.09	18.60	17.71

LP = Long-Term Productivity

CDR = Concurrent Damage Reduction

RVPC = Reduced Variable Production Costs

YE = Yield Enhancement

OFF = Offsite Damage Reduction Benefits

Dmg Red = Damage Reduction which is the sum of LP, CDR, and OFF

Table 4 provides a clear display of a given conservation option's contribution to public benefits. The decision maker may use this information to delete from further consideration those conservation options that have insignificant net public benefits.

Stage III - Identify Alternative Plans

At this point in the evaluation the nonmonetary effects, expressed in quantitative and qualitative terms, are combined with the information developed in Stages I and II. The NED and RP plans are identified and the trade-offs among the Stage II alternatives are displayed in monetary and nonmonetary terms. In addition, the rationale for selecting the recommended plan is described. The alternative with the greatest net monetary benefits is designated as the NED plan, and the alternative that achieves an acceptable level of resource protection is designated as the RP plan. It is the role of the interdisciplinary team to define the RP plan criteria. Table 5 provides an example display of the Stage III results. When appropriate, items other than those displayed should be used.

In Stage III, technical assistance and project administration costs are to be included in the costs of alternative plans. The total costs (which include the initial costs of management practices and enduring practices, replacement, operation and maintenance, technical assistance, and project administration) should be amortized for the evaluation period (see table 5 and appendix 8).

Table 5

Stage III

Comparison of Alternatives

ITEM	Existing Condition	BCS	Conser. Alt 1	Conser. Alt 2
Eros Rate (TAY)	37	4	10	15
Eros Reduction (TAY)	--	33	27	22
Sediment Reduction (TAY)	--	--	--	--
Costs				
Install PL 566		525,075	186,190	127,475
Install Other		193,725	68,596	46,964
Total Installation Cost		718,800	254,786	174,439
Average Annual Cost		114,779	57,285	41,451
Economic Benefits				
Onsite		98,280	84,618	69,048
Offsite		342	342	306
Total Annual Benefits		98,622	84,960	69,354
Net Economic Benefits		- 16,157	27,675	27,903
Social Effects				
Environmental Effects				

Conservation Alternative 2 has the greatest net monetary benefits and is designated the NED plan. The interdisciplinary team decides that the BCS plan achieves an acceptable level of resource protection and is designated the Resource Protection (RP) plan.

The sponsors, after having looked at the costs and effects of all plans, have decided to install Conservation Alternative #1. This plan now becomes the watershed plan (recommended plan). In the watershed plan, the costs and benefits of the recommended plan need to be expressed as average annual equivalents for the period of analysis (see table 6 and appendix 9). NATIONAL BULLETIN NO. 200-4-2, dated February 3, 1984, provides two methods for calculating average annual equivalents.

Table 6

Annualized Cost Summary

Watershed Plan

Evaluation Unit A

Average annual equivalent benefits	$69,942
Average annual equivalent costs	47,161
Average annual equivalent net benefits	$22,781

B:C Ratio 1.48:1

Appendix 1, EXCOP 1

Evaluation Unit A

The interdisciplinary team has developed the following data:

1. Existing condition - corn, soybean rotation

The current soil loss with the corn, conventionally tilled, is estimated to be 34 tons per acre annually. The current soil loss with soybeans is estimated to be 40 tons per acre annually. The rotation average is 37 tons per acre per year. Gully erosion, both permanent and ephemeral, is occurring and causing serious onsite and offsite damages.

2. RMS/BCS - corn, soybean rotation

The soil loss with the corn, no-tilled, terraced and with grassed waterways, is estimated to be 2 tons per acre annually. The soil loss with soybeans, chisel tilled, terraced and with grassed waterways is estimated to be 6 tons per acre annually. The average annual soil loss for this rotation is estimated to be 4 tons per acre, (T); (2 tons for the corn and 6 tons for the soybeans). Permanent and ephemeral gully erosion will be controlled.

3. Conservation alternative no. 1 - corn, soybean rotation

The soil loss with the corn, no-tilled, with grassed waterways, WASCOBS and contouring is estimated to be 8 tons per acre annually. The soil loss with soybeans, chisel tilled, and with grassed waterways, WASCOBS and contouring is estimated to be 12 tons per acre annually. The average annual soil loss for this rotation is estimated to be 10 tons per acre, (8 tons for the corn and 12 tons for the soybeans). Permanent and ephemeral gully erosion will be controlled.

4. Conservation alternative no. 2 - Corn, soybeans rotation

The soil loss with the corn chisel tilled, and with grassed waterways, contouring and WASCOBS is estimated to be 13 tons per acre per year. The average annual soil loss for soybeans chisel tilled, and with grassed waterways, WASCOBS and contouring is estimated to be 17 tons per acre. The average annual soil loss for this rotation is estimated to be 15 tons per acre, (13 tons for the corn and 17 tons for the soybeans). Some minor permanent gully erosion will remain, however, ephemeral gully erosion will be controlled.

5. Conservation alternative no. 3 - corn, soybeans rotation

The soil loss with the corn farmed on the contour is estimated to be 27 tons per acre annually. The soil loss with contour farmed soybeans is estimated to be 33 tons per acre annually. The average annual soil loss for this rotation is estimated to be 30 tons per acre, (27 tons for the corn and 33 tons for the soybeans). This alternative will have little affect on the permanent and ephemeral gully erosion.

Appendix 2, EXCOP1

Evaluation Unit A

The interdisciplinary team has developed the following costs:

1. EXISTING CONDITION - corn, soybean rotation

NO CONSERVATION COSTS INCURRED

2. RMS/BCS - corn, soybean rotation

A. I, R and OM Costs - corn and soybeans

1. Terrace system for a typical 40 acre field-20 year life

ITEM	TOTAL	PER ACRE
5,700 feet of terrace @ $2 per foot	$11,400	$285.00
AMORT. 20 YEARS @ 8 5/8 % (.10663)	1,215.58	30.39
AMORT. 25 YEARS @ 8 5/8 % (.09873)	1,125.52	28.14
Replacement cost	$90.06	$2.25
O&M, 3 percent of installation cost	$342.00	$8.55

TERRACE SUMMARY - EPC

I	=	$28.14
R	=	2.25
O&M	=	8.55
TOTAL	=	$38.94

2. Grassed waterway for a typical 40 acre field-20 year life

ITEM	TOTAL	PER ACRE
2 acres @ $450 per acre	$900.00	$22.50
AMORT. 20 YEARS @ 8 5/8 % (.10663)	95.97	2.40
AMORT. 25 YEARS @ 8 5/8 % (.09873)	88.86	2.22
Replacement cost	$7.11	$0.18
O&M, 3 percent of installation cost	$27.00	$0.68

GRASSED WATERWAY SUMMARY - EPC

I	=	$2.22
R	=	.18
O&M	=	.68
TOTAL	=	$3.08

ROTATION (TOTAL PRACTICE) SUMMARY - EPC

I		$30.36
R		2.43
O&M		9.23
TOTAL	=	$42.02

B. APIC

1. EPC

NONE IDENTIFIED

2. MPC

a. Corn-conventional till to no-till

a. Paraquat	$11.60
b. No-till planter, variable costs	8.67
	$20.27
CNP factor (National Bulletin No. 200-7-4; 8/26/87)[1/]	.87
APIC - CORN	$17.63

b. Soybeans-conventional till to chisel till

a. Chisel, variable costs	$ 4.58
	$ 4.58
CNP factor (National Bulletin No. 200-7-4; 8/26/87)[1/]	.87
APIC - SOYBEANS	$ 3.98

The rotation average is $21.61 / 2 = $10.80

ROTATION SUMMARY - APIC - MPC

APIC = $10.80

C. IP

The state government pays an annual $15 per acre incentive payment on no-till for a 3-year period. $15 x 2.54831 (PV of an annuity of 1 for 3 years) = $38.22; $38.22 x .09873 (amortization factor for 25 years) = $3.77. No incentive payment on the soybeans. The average incentive payment is $3.77 / 2 = $1.88.

ROTATION SUMMARY - IP

No-till = $1.88

3. CONS ALT NO. 1 and CONS ALT NO. 2 - corn, soybean rotation

The above procedures were used to calculate the values for conservation alternatives #1 and #2, results are shown in the following tables.

Evaluation Unit A

COSTS BY CROP

BCS

Costs	Corn	Soybeans	Rotation Average
I, R, OM	$42.02	$42.02	$42.02
APIC	17.63	3.98	10.80
IP	3.77	--	1.88
TOTAL	$63.42	$46.00	$54.70

1/ Assumed a without support program price for corn and soybeans. If a support program price had been used for corn and soybeans a CNP factor adjustment would not be required.

Cons Alt No. 1

Costs	Corn	Soybeans	Rotation Average
I, R, OM	$14.73	$14.73	$14.73
APIC	19.08	4.76	11.92
IP	3.90	--	1.95
TOTAL	$37.71	$19.49	$28.60

Cons Alt No. 2

Costs	Corn	Soybeans	Rotation Average
I, R, OM	$10.90	$10.90	$10.90
APIC	15.87	3.97	9.92
IP	--	--	--
TOTAL	$26.77	$14.87	$20.82

STAGE 1 COST SUMMARY
Evaluation Unit A - BCS

COST	I	R	OM	APIC	IP	PA	TA	Ave Ann	Annualized
Stage I									
EPC	30.36	2.43	9.23	--				42.02	
MPC				10.80	1.88			12.68	
				Conservation Option Cost				54.70	

STAGE I COST SUMMARY
Evaluation Unit A - Cons Alt No. 1

COST	I	R	OM	APIC	IP	PA	TA	Ave Ann	Annualized
Stage I									
EPC	10.75	2.16	1.82	--				14.73	
MPC				11.92	1.95			13.87	
				Conservation Option Cost				28.60	

STAGE I COST SUMMARY
Evaluation Unit A - Cons Alt #2

COST	I	R	OM	APIC	IP	PA	TA	Ave Ann	Annualized
Stage I									
EPC	7.36	1.90	1.64	--				10.90	
MPC				9.92				9.92	
				Conservation Option Cost				20.82	

Appendix 3, EXCOP1

Evaluation Unit A

Table 4 (LP Support Data)

An interdisciplinary team of technical specialists has developed the following data:

Production records indicate the current corn yield is 130 bushel per acre with a soil loss of 34 tons per acre annually. Physical scientists have determined that if this rate of soil loss continues, the yield is expected to be 90 bushels in 25 years. The current soybean yield is 40 bushels per acre with a soil loss of 40 tons per acre annually. If this rate of soil loss continues the yield is expected to be 20 bushels in 25 years. Gully erosion, both permanent and ephemeral, is occurring and causing serious onsite and offsite damages.

With the installation of the basic conservation system, the 130 bushel corn yield will be maintained and the annual soil loss will be 2 tons per acre. The 40 bushel soybean yield will be maintained and the annual soil loss will be 6 tons per acre. Permanent and ephemeral gully erosion will be controlled.

With the installation of conservation alternative #1, the corn yield will decrease to 120 bushels per acre over the 25-year period and the annual soil loss will be 8 tons per acre. The soybean yield will decrease to 35 bushels per acre over the 25-year period and the annual soil loss will be 12 tons per acre. Permanent and ephemeral gully erosion will be controlled.

With the installation of conservation alternative #2, the corn yield will decrease to 110 bushels per acre over the 25-year period and the annual soil loss will be 13 tons per acre. The soybean yield will decrease to 30 bushels per acre over the 25-year period and the annual soil loss will be 17 tons per acre. Ephemeral gully erosion will be controlled, however there will be some remaining permanent gully erosion.

LP - Support Data for Table 4
Evaluation Unit A

CROP: corn EVAL PERIOD: 25 years INTEREST RATE: 8 5/8

	Annual Soil loss Per acre (Ton)	Soil Loss Reduction (Ton)	Current Yield (Bu)	Yield In 25 years (Bu)	Average Annual Yield (Bu)*	Average Annual Benefit (Bu)	Average Annual Benefit ($)**	Annual Conserv Cost/ac ($)***	Average Annual net Benefit ($)	Cost per Ton Reduction ($)
Exis. cond.	34	--	130	90	117.2	--	--	--	--	--
RMS/BCS	2	32	130	130	130.0	12.8	26.62	63.42	-36.80	1.15
Cons Alt #1	8	26	130	120	126.8	9.6	19.97	37.71	-17.74	.68
Cons Alt #2	13	21	130	110	123.6	6.4	13.31	26.77	-13.46	.64

* Existing condition--average annual yield; 130 - 90 = 40 x .32 = 12.8; 130 - 12.8 = 117.2

Basic conservation system--average annual yield; 130 - 130 = 0 x .32 = 0; 130 - 0 = 130.0

Conservation alternative #1--average annual yield; 130 - 120 = 10 x .32 = 3.2; 130 - 3.2 = 126.8

Conservation alternative #2--average annual yield; 130 - 110 = 20 x .32 = 6.4; 130 - 6.4 = 123.6

** Marginal net benefit from a bushel of corn is $2.08 (CNP of $2.27 less the variable harvesting costs of $.19)

***From Appendix 2, corn only.

LP - Support Data for Table 4
Evaluation Unit A

CROP: soybeans EVAL PERIOD: 25 years INTEREST RATE: 8 5/8

	Annual Soil loss Per acre (Ton)	Soil Loss Reduction (Ton)	Current Yield (Bu)	Yield In 25 years (Bu)	Average Annual Yield (Bu)*	Average Annual Benefit (Bu)	Average Annual Benefit ($)**	Annual Conserv Cost/ac ($)***	Average Annual net Benefit ($)	Cost per Ton Reduction ($)
Exis. cond.	40	--	40	20	33.6	--	--	--	--	--
RMS/BCS	6	34	40	40	40.0	6.4	29.50	46.00	-16.50	.49
Cons Alt #1	12	28	40	35	38.4	4.8	22.13	19.49	+2.64	-.09
Cons Alt #2	17	23	40	30	36.8	3.2	14.75	14.87	-0.12	.01

* Existing condition--average annual yield; 40 - 20 = 20 x .32 = 6.4; 40 - 6.4 = 33.6

Basic conservation system--average annual yield; 40 - 40 = 0 x .32 = 0; 40 - 0 = 40.0

Conservation alternative #1--average annual yield; 40 - 35 = 5 x .32 = 1.6; 40 - 1.6 = 38.4

Conservation alternative #2--average annual yield; 40 - 30 = 10 x .32 = 3.2; 40 - 3.2 = 36.8

** Marginal net benefit from a bushel of soybeans is $4.61 (CNP of $4.93 less the variable harvesting costs of $.32)

***From Appendix 2, soybeans only.

Rotation Benefits Per Acre - LP

	BCS	Cons. Alt #1	Cons. Alt #2
Corn	$26.62	$19.97	$13.31
Soybeans	29.50	22.13	14.75
	$56.12	$42.10	$28.06
Composite AA	$28.06	$21.05	$14.03
Adjusted Composite AA	$26.31*	$19.84**	$13.22***

* 2.5 acres (6.25%) of the 40 acres was taken out of production to install the basic conservation system. This leaves 93.75% of the field for production. The adjusted benefit is $26.31 ($28.06 x .9375).

** 2.3 acres (5.75%) of the 40 acres was taken out of production to install conservation alternative #1. This leaves 94.25% of the field for production. The adjusted benefit is $19.84 ($21.05 x .9425).

***2.3 acres (5.75%) of the 40 acres was taken out of production to install conservation alternative #2. This leaves 94.25% of the field for production. The adjusted benefit is $13.22 ($14.03 x .9425).

Appendix 4, EXCOP1

Evaluation Unit A

Table 4 (CDR Support Data)

An interdisciplinary team of technical specialists has developed the following data:

BCS

Sheet and Rill

Physical scientists have determined that the annual concurrent damage from sheet and rill erosion on the corn yield is 2 bushels per acre. If controlled, the net benefit per bushel is $2.08 (from appendix 3) or $4.16 per acre. After adjusting for the land used in the BCS the average annual benefit per acre is $3.90. The soybean yield damage is 1 bushel per acre. If controlled, the net benefit per bushel is $4.61 (from appendix 3) or $4.61 per acre. After adjusting for the land used in the BCS the average annual benefit per acre is $4.32. The annual benefit for the rotation is $4.11 per acre.

Ephemeral

Physical scientists have determined that the annual concurrent damage from ephemeral erosion on the corn yield in the affected area is 95 bushels per acre (130 bushels per acre to 35 bushels per acre). The net benefit per bushel of corn is $2.08 (from appendix 3) or $197.60 per acre. The soybean yield damage is 25 bushels per acre (40 bushels per acre to 15 bushels per acre). The net benefit per bushel of soybeans is $4.61 (from appendix 3) or $115.25 per acre. The average annual benefit for the rotation is $156.42 per acre.

The physical scientists have also determined that on an average annual basis 4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.5 acres have been removed from production by the BCS. This leaves 1.5 acres (3.75%) to benefit from an increase in production. Prorating the benefits over the 40 acre field results in an average annual benefit of $5.87 ($156.42 x .0375) for the rotation.

The annual CDR benefits are $9.98 ($4.11 + $5.87) per acre, (see table at end of appendix).

CONS ALT NO.1

Sheet and Rill

Physical scientists have determined that if the concurrent damage from sheet and rill erosion were controlled by the installation of conservation

alternative No. 1, the benefits would be 85 percent of those resulting from the BCS (see table at end of appendix for the dollar values).

Ephemeral

Physical scientists have determined that if the concurrent damage from ephemeral erosion were controlled by the installation of conservation alternative No. 1, the benefits would be 85 percent of those resulting from the BCS.

On an average annual basis, 4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.3 acres have been removed from production by conservation alternative No. 1. This leaves 1.7 acres (4.25%) to benefit from an increase in production (see table at end of appendix for the dollar values).

CONS ALT NO. 2

Sheet and Rill

Physical scientists have determined that if the concurrent damage from sheet and rill erosion were controlled by the installation of conservation alternative No. 2, the benefits would be 70 percent of those resulting from the BCS (see table at end of appendix for the dollar values).

Ephemeral

Physical scientists have determined that if the concurrent damage from ephemeral erosion were controlled by the installation of conservation alternative No. 2, the benefits would be 70 percent of those resulting from the BCS.

On an average annual basis, 4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.3 acres have been removed from production by conservation alternative No. 2. This leaves 1.7 acres (4.25%) to benefit from an increase in production (see table at end of appendix for the dollar values).

Rotation Benefits - CDR

ITEM	BCS	Cons Alt #1	Cons Alt #2
		(SHEET AND RILL)	
Corn	$4.16	$3.54	$2.91
Soybeans	4.61	3.92	3.23
	$8.77	$7.46	$6.14
Composite AA	$4.39	$3.73	$3.07
Adjusted Composite AA	$4.11*	$3.52**	$2.90***

		(EPHEMERAL)	
Corn	$197.60	$167.96	$138.32
Soybeans	115.25	97.96	80.68
	$312.85	$265.92	$219.00
Composite AA	$156.42	$132.96	$109.50
Adjusted Composite AA	$5.87#	$5.65##	$4.65###
TOTAL ADJUSTED COMPOSITE	$9.98	$9.17	$7.55

1 * 2.5 acres (6.25%) of the 40 acres was taken out of production to install the basic conservation system. This leaves 93.75% of the field for production. The adjusted benefit is $4.11 ($4.39 x .9375).

4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.5 acres have been removed from production by the BCS. This leaves 1.5 acres (3.75%) to benefit from an increase in production. Prorating the benefits over the 40 acre field results in an average annual benefit of $5.87 ($156.42 x .0375).

** 2.3 acres (5.75%) of the 40 acres was taken out of production to install conservation alternative #1. This leaves 94.25% of the field for production. The adjusted benefit is $3.52 ($3.73 x .9425).

4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.3 acres have been removed from production by conservation alternative #1. This leaves 1.7 acres (4.25%) to benefit from an increase in production. Prorating the benefits over the 40 acre field results in an average annual benefit of $5.65 ($132.96 x .0425).

*** 2.3 acres (5.75%) of the 40 acres was taken out of production to install conservation alternative #2. The adjusted benefit is $2.90 ($3.07 x .9425).

4 acres (10%) of the 40 acre field is damaged by ephemeral erosion. Of the 4 acres, 2.3 acres have been removed from production by conservation alternative #2. This leaves 1.7 acres (4.25%) to benefit from an increase in production. Prorating the benefits over the 40 acre field results in an average annual benefit of $4.65 ($109.50 x .0425).

Appendix 5, EXCOP1

Evaluation Unit A

Table 4 (OFF Support Data)

An interdisciplinary team of technical specialists has developed the following data:

Ditch Maintenance

BCS

Without the BCS, the ditches will need a cleanout every 8 years at a cost of $500 per mile. At 8 5/8 percent interest, the annual cost is $89 per mile. With the BCS in place, the ditches will need a cleanout every 20 years at a cost of $500 per mile. The annual cost is $53 per mile. The average annual benefits are $36 per mile or .00682 cents per foot. There are 16 feet of road per acre resulting in average annual benefits of $.11 per acre. Land in evaluation unit A is estimated to be contributing 90% of the problem. The average annual benefits are $.10 per acre.

CONS ALT NO. 1

Conservation alternative No. 1 will provide essentially the same degree of benefits as the BCS, $.10 per acre annually.

CONS ALT NO. 2

Conservation alternative No. 2 will provide 90 percent of the benefits resulting from the BCS, or $.09 ($.10 x .90) per acre.

Water Treatment

BCS

Water treatment experts working with the local water board estimate that with the installation of the BCS on the 1800 acres of cropland the Village of Big Red will save approximately $200 a year in water treatment costs. Controlling erosion in evaluation unit A is estimated to be accounting for 85 percent of the benefit ($170) or $.09 per acre per year.

CONS ALT NO. 1

Conservation alternative No. 1 will provide essentially the same degree of benefit as the BCS, $.09 per acre annually.

CONS ALT NO. 2

Conservation alternative No. 2 will provide 90 percent of the benefits resulting from the BCS, or $.08 ($.09 x .90) per acre annually.

While other offsite benefits exist, such as improved fish and wildlife habitat, no additional economic evaluations were made.

OFF Summary

Average Annual Benefits Per Acre

Conservation Options	Ditch Maintenance	Water Treatment	Total
BCS	.10	.09	.19
Cons Alt No. 1	.10	.09	.19
Cons Alt No. 2	.09	.08	.17

Appendix 6, EXCOP1

Evaluation Unit A

Table 4 (YE Support Data)

An interdisciplinary team of technical specialists has developed the following data:

BCS

The BCS will improve the moisture holding capacity, increase the organic matter, improve the tilth, etc., so that the corn yield is expected to increase from 130 bushels to 135 bushels and soybean yields from 40 bushels to 43 over the 25 year evaluation period.

Net Benefit Of Increase	AVERAGE ANNUAL VALUE*
Corn -- 5 bu @ $2.08 = $10.40	$3.74
Soybeans -- 3 bu @ $4.61 = $13.83	$4.98
TOTAL VALUE OF INCREASE = $24.23	$8.72

Composite AA = $4.36

Adjusted
Composite AA = $4.09**

* Average annual values were calculated using the Average Annual Enhancement Factor table. For 25 years @ 8 5/8 percent the factor is .36.

** 2.5 acres (6.25%) of the 40 acres were taken out of production to install the basic conservation system. This leaves 93.75% of the field for production. The adjusted benefit is $4.09 ($4.36 x .9375).

CONS ALT NO. 1

Conservation alternative No. 1 will provide 90 percent of the benefits resulting from the BCS, $3.92 ($4.36 x .90).

Composite AA = $3.92

Adjusted
Composite AA = $3.70***

*** 2.3 acres (5.75%) of the 40 acres were taken out of production to install conservation alternative #1. This leaves 94.25% of the field for production. The adjusted benefit is $3.70 ($3.92 x .9425).

CONS ALT NO. 2

Conservation alternative No. 2 will provide 80 percent of the benefits resulting from the BCS, $3.49 ($4.36 x .80).

Composite AA = $3.49

Adjusted
Composite AA = $3.29****

**** 2.3 acres (5.75%) of the 40 acres were taken out of production to install conservation alternative #2. This leaves 94.25% of the field for production. The adjusted benefit is $3.29 ($3.49 x .9425).

Appendix 7, EXCOP1

Evaluation Unit A

Table 4 (RVPC Support Data)

RVPC

1. Corn-conventional till to no-till		
a. Conventional till-total variable prod cost		$145.52
b. No-till-total variable prod cost	$140.20	
Less APIC (from appendix 2)	$20.27	
	$119.93	$119.93
RVPC		$ 25.59
CNP factor (National Bulletin No. 200-7-4; 8/26/87)1/		.87
RVPC - CORN		$ 22.26
2. Soybeans-conventional till to chisel till		
a. Conventional till-total variable prod cost		$ 96.38
b. Chisel-till-total variable prod cost	$91.67	
Less APIC (from appendix 2)	$4.58	
	$87.09	$ 87.09
RVPC		$ 9.29
CNP factor (National Bulletin No. 200-7-4; 8/26/87)1/		.87
RVPC - SOYBEANS		$ 8.08

Rotation Benefits Per Acre - RVPC

	BCS	Cons Alt #1	Cons Alt #2
Corn	$22.26	$22.26	$22.26
Soybeans	8.08	8.08	8.08
	$30.34	$30.34	$30.34
Composite AA	$15.17	$15.17	$15.17
Adjusted Composite AA	$14.22*	$14.30**	$14.30***

* 2.5 acres (6.25%) of the 40 acres were taken out of production to install the basic conservation system. This leaves 93.75% of the field for production. The adjusted benefit is $14.22 ($15.17 x .9375).

** 2.3 acres (5.75%) of the 40 acres were taken out of production to install conservation alternative #1. This leaves 94.25% of the field for production. The adjusted benefit is $14.30 ($15.17 x .9425).

*** 2.3 acres (5.75%) of the 40 acres were taken out of production to install conservation alternative #2. This leaves 94.25% of the field for production. The adjusted benefit is $14.30 ($15.17 x .9425).

1/ Assumed a without support program price for corn and soybeans. If a support program price had been used for corn and soybeans a CNP factor adjustment would not be required.

FILE A AREA CODE 310 1 1 ENTERPRISE CODE 726009156 BUDGET ID NUMBER 18051

TITLE: INDIANA-CORN-CONVENTIONAL TILLAGE-130 BU. YEAR 1987
STATE BUDGET SCS BUDGET
MEDIUM LEVEL MANAGEMENT

YEAR	MONTH	OPERATION	PERF. RATE (ACRES/HR.)	FUEL (OWNER SHIP)	POWER UNIT (OPER-ATING)	MACHINERY (OWNER SHIP)	MACHINERY (OPER-ATING)	MATERIALS	LABOR	TOTAL
				$ PER ACRE						
0	APR	TANDEM DISK>15	9.164	1.17	1.37	1.30	0.18	0.0	1.04	5.06
0	APR	ANHY APPL.	9.745	1.10	1.29	0.[illegible]	0.23	0.0	0.98	4.21
0	MAY	FIELD CULT. <23	10.182	1.05	1.24	0.47	[illegible]	0.0	0.94	3.79
0	MAY	TRLR SPREAD DRY	12.994	0.52	0.61	1.03	0.57	0.0	0.73	3.26
0	MAY	PLANTER W/FERT	6.700	1.00	1.18	3.09	1.40	[illegible]	1.42	8.08
0	MAY	SPRAYER-PTO	11.818	0.57	0.67	0.42	0.13	0.0	0.81	2.58
0	JUNE	ANHY APPL.	9.745	1.10	1.29	0.62	0.23	0.0	0.98	4.21
0	JUNE	ROW CULTIVATOR	4.655	1.44	1.69	1.12	0.24	0.0	2.[illegible]	6.53
0	OCT	SP COMB-CORN 6R	4.582	0.0	0.0	20.42	5.26	0.0	2.06	27.74
0	OCT	TRUCK SINGLE 2T.	1.000	0.0	0.0	3.44	3.00	0.0	3.31	9.75
0	NOV	MB PLOW 5B+	2.911	3.69	4.33	2.36	0.73	0.0	3.27	14.36
XXX		TOTAL	XXX	11.61	13.66	34.89	11.87	0.0	17.57	89.60

1. GROSS RECEIPTS $ 214.50
2. COST OF INPUTS
   OPERATIONALLY APPLIED $ 89.60
3. COST OF INPUTS
   NOT OPERATIONALLY APPLIED+

11	SEED	$ 19.58
12	NITROGEN	$ 17.85
13	PHOSPHATE	$ 11.70
14	POTASH	$ 5.95
15	CUSTOM LIME APPL	$ 6.00
16	ATRAZINE	$ 4.38
17	LASSO	$ 9.40
18	INSECTICIDE	$ 10.80
XX	DRYING COSTS	$ 11.14
XX	INTEREST ON OP. CAP.	$ 5.62
XX	TOTAL	$ 102.42

4. RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT $ 22.48
5. OTHER CHARGES
   MANAGEMENT (10.0% VAR PROD COST) $ 14.55
6. COSTS OF CONSERVATION TREATMENT
   AVERAGE ANNUAL AT 8.625 PERCENT COST/ACRE
   TOTAL RESOURCE MANAGEMENT SYSTEM $ 0.0
7. NET RETURNS $ 7.92

RVPC
ID 18057 (no till)
total variable cost $140.20
less the APIC 20.27
$119.93

ID 18051 (conventional tillage)
total variable cost $145.52
- 119.93
RVPC $ 25.59

$13.66
11.87
17.57
102.42
$145.52

FOOTNOTE: PEIL 91 UPDATED-1986-87 PRICES 04/15/87
MACH COMP NO. 18 (ENC200/ENC2) NORM ROLLAG
DATA REPRESENTS STATE AVERAGE 04/16/87

PFIL 8 AREA CODE 318 1 1 ENTERPRISE CODE 720039 BUDGET ID NUMBER 18057

TITLE: INDIANA-CORN-NO-TILL-130 BU. YEAR 1987
STATE BUDGET SCS BUDGET
MED. LEVEL MANAGEMENT

YEAR	MONTH	OPERATION	PERFORMANCE RATE (ACRES/HR.)	POWER UNIT OWNER-SHIP	POWER UNIT OPER-ATING	MACHINERY OWNER-SHIP	MACHINERY OPER-ATING	MATERIALS	LABOR	TOTAL
				$ PER ACRE						
0	APR	ANHY APPL.	9.745	1.10	1.29	0.62	0.23	0.0	0.98	4.21 ✓
0	MAY	TRLR SPREAD DRY	12.994	0.52	0.61	1.03	0.37	0.0	0.73	3.26 ✓
0	MAY	NO-TILL PLANTER	5.482	1.22	1.44	3.78	1.71	0.0	1.74	9.88 + 1.80
0	MAY	SPRAYER-PTO	11.818	0.57	0.67	0.42	0.13	0.0	0.81	2.58 ✓
0	JUNE	ANHY APPL.	9.745	1.10	1.29	0.62	0.23	0.0	0.98	4.21 ✓
9	OCT	SP COMB-CORN 6R	4.582	0.0	0.0	20.42	5.26	0.0	2.06	27.74 ✓
9	OCT	TRUCK SINGLE 2T.	1.000	0.0	0.0	3.44	3.00	0.0	3.31	9.75 ✓
XXX		TOTAL	XXX	4.50	5.29	30.33	10.92	0.0	10.60	61.65 -

APIC
2x till planter
1.44
3.78
1.71
1.74
$ 8.67

Paraquat
11.60
$ 20.27

1. GROSS RECEIPTS $ 214.50
2. COST OF INPUTS
   OPERATIONALLY APPLIED $ 61.65
3. COST OF INPUTS
   NOT OPERATIONALLY APPLIED*

11	SEED	$ 19.58 ✓	
12	NITROGEN	$ 17.85 ✓	
13	PHOSPHATE	$ 11.70 ✓	
14	POTASH	$ 5.95 ✓	
15	CUSTOM LIME APPL	$ 6.00 ✓	
16	ATRAZINE	$ 4.38 ✓	
17	LASSO	$ 9.40 ✓	
18	INSECTICIDE	$ 10.80 ✓	
19	PARAQUAT	$ 11.60	+ $ 11.60
XX	DRYING COSTS	$ 11.14 ✓	
XX	INTEREST ON OP. CAP.	$ 4.99	- .63
XX	TOTAL	$ 113.39	

Variable Costs
$ 5.29
10.92
10.60
113.39
$ 140.20

4. RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT $ 39.47
5. OTHER CHARGES
   MANAGEMENT (10.0% VAR PROD COST) $ 14.02
6. COSTS OF CONSERVATION TREATMENT
   AVERAGE ANNUAL AT 8.625 PERCENT COST/ACRE
   TOTAL RESOURCE MANAGEMENT SYSTEM $ 0.0
7. NET RETURNS $ 25.44

FOOTNOTE: PFIL 91 UPDATED-1986-87 PRICES 04/15/87
MACH COMP NO.18 (ENC220/ENC8) NORM ROLLAG
DATA REPRESENTS STATE AVERAGE 04/16/87

IL 8 AREA CODE 318 1 1 ENTERPRISE CODE 8811091 BUDGET ID NUMBER 18060

TITLE: INDIANA-SOY BEANS-CONVENTIONAL TILLAGE-40 BU. YEAR 1987
STATE BUDGET SCS BUDGET
MED. LEVEL MANAGEMENT

YEAR	MONTH	OPERATION	PERFORMANCE RATE (ACRES/HR.)	POWER UNIT OWNER-SHIP	POWER UNIT OPER-ATING	MACHINERY OWNER-SHIP	MACHINERY OPER-ATING	MATERIALS	LABOR	TOTAL
				$ PER ACRE						
0	APR	TANDEM DISK>15	9.164	1.17	1.37	1.30	0.18	0.0	1.04	5.06 ✓
0	MAY	FIELD CULT. <23	10.182	1.05	1.24	0.47	0.10	0.0	0.94	3.79 ✓
0	MAY	PLANTER W/FERT	6.700	1.00	1.18	3.09	1.40	0.0	1.42	8.08 ✓
0	MAY	ROTARY HOE	10.227	0.65	0.77	0.58	0.08	0.0	0.93	3.02 ✓
0	MAY	SPRAYER-PTO	11.818	0.57	0.67	0.42	0.13	0.0	0.81	2.58 ✓
0	JUNE	ROW CULTIVATOR	4.655	1.44	1.69	1.12	0.24	0.0	2.05	6.53 ✓
0	OCT	SP COMB-CORN 6R	4.582	0.0	0.0	20.42	5.26	0.0	2.06	27.74 ✓
0	OCT	TRUCK SINGLE 2T.	1.000	0.0	0.0	2.95	2.57	0.0	2.83	8.36 ✓
0	NOV	MB PLOW 5B+	2.911	3.68	4.33	2.36	0.73	0.0	3.27	14.36
0	NOV	TRLR SPREAD DRY	12.994	0.52	0.61	1.03	0.37	0.0	0.73	3.26 ✓
XXX	TOTAL		XXX	10.07	11.85	33.74	11.07	0.0	16.08	82.80

1. GROSS RECEIPTS $ 192.00
2. COST OF INPUTS
   OPERATIONALLY APPLIED $ 82.80
3. COST OF INPUTS
   NOT OPERATIONALLY APPLIED*
   11 SEED $ 10.56 ✓
   12 PHOSPHATE $ 9.75 ✓
   13 POTASH $ 5.10 ✓
   14 CUSTOM LIME APPL $ 6.00 ✓
   15 LOROX $ 11.60 ✓
   16 LASSO $ 9.40 ✓
   XX INTEREST ON OP. CAP. $ 4.98
   XX TOTAL $ 57.39
4. RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT $ 51.81
5. OTHER CHARGES
   MANAGEMENT (10.0% VAR PROD COST) $ 9.64
6. COSTS OF CONSERVATION TREATMENT
   AVERAGE ANNUAL AT 8.625 PERCENT COST/ACRE
   TOTAL RESOURCE MANAGEMENT SYSTEM $ 0.0
7. NET RETURNS $ 42.17

RVPC

ID 18063 (chisel till)
total variable cost $91.67
less the APIC 4.58
$87.09

ID 18060 (conventional tillage)
total variable cost 96.38
- 87.09
RVPC $ 9.29

FOOTNOTE: PETL 91 UPDATED-1986-87 PRICES 04/15/87
MACH COMP NO.18 (ENC200/ENC14) NORM ROLLAG
DATA REPRESENTS STATE AVERAGE 04/13/87

Appendix 8, EXCOP1

Evaluation Unit A

Table 5 Support Data - BCS

Estimated Project Installation Cost

Installation Cost Item	Unit	Number Non-Fed Land	Estimated Cost PL 566 Non-Fed	Estimated Cost Other Non-Fed	Estimated Cost Total
Construction					
Terraces	feet	256,500	333,450	179,550	513,000 1/
Grassed waterways	acres	90	26,325	14,175	40,500 2/
Subtotal - Construction			359,775	193,725	553,500
Other					
Technical Assistance			110,000	--	110,000
Project Administration			55,300	--	55,300
Subtotal - Other			165,300	--	165,300
TOTAL - Project Installation Cost			525,075	193,725	718,800

Estimated Average Annual Cost

Construction cost	$ 54,647 3/
Replacement cost	4,374 4/
O & M cost	16,614 5/
APIC	19,440 6/
IP	3,384 7/
Technical Assistance	10,860 8/
Project Administration	5,460 8/
Total	$114,779

1/ 256,500 feet @ $2 = $513,000; PL 566 (65%) = $333,450; Other (35%) = $179,550

2/ 90 acres @ $450 = $40,500; PL 566 (65%) = $26,325; Other (35%) = $14,175

3/ 553,500 x .09873 = $54,647 or $30.36 (annual construction cost per acre from appendix 2) x 1,800 acres = $54,647

4/ $2.43 (annual replacement cost per acre from appendix 2) x 1,800 acres

5/ $9.23 (annual O & M cost per acre from appendix 2) x 1,800 acres

6/ $10.80 (annual APIC cost per acre from appendix 2) x 1,800 acres

7/ $1.88 (annual IP cost per acre from appendix 2) x 1,800 acres

8/ Amortized over 25 years at 8 5/8% (.09873)

ECONOMIC BENEFITS
(Average Annual)

Onsite Benefits

LP	$47,358[1/]
CDR	17,964[2/]
YE	7,362[3/]
RVPC	25,596[4/]
Subtotal	$98,280

Offsite Benefits

OFF	$ 342[5/]
Subtotal	$ 342

Total Annual Benefits - $98,622

[1/] $26.31 (LP benefits from table 4 of example) x 1,800
[2/] $9.98 (CDR benefits from table 4 of example) x 1,800
[3/] $4.09 (YE benefits from table 4 of example) x 1,800
[4/] $14.22 (RVPC benefits from table 4 of example) x 1,800
[5/] $0.19 (OFF benefits from table 4 of example) x 1,800

Table 5 Support Data - Conservation Alt. 1

Estimated Project Installation Cost

Installation Cost Item	Unit	Number Non-Fed Land	Estimated Cost PL 566 Non-Fed	Estimated Cost Other Non-Fed	Estimated Cost Total
Construction					
WASCOBS and Grassed Waterways			127,393	68,596	195,989
Subtotal - Construction			127,393	68,596	195,989
Other					
Technical Assistance			39,198	--	39,198
Project Administration			19,599	--	19,599
Subtotal - Other			58,797	--	58,797
TOTAL - Project Installation Cost			186,190	68,596	254,786

Estimated Average Annual Cost

Construction cost	$ 19,350 1/
Replacement cost	3,888 2/
O & M cost	3,276 3/
APIC	21,456 4/
IP	3,510 5/
Technical Assistance	3,870 6/
Project Administration	1,935 6/
Total	$57,285

1/ 195,989 x .09873 = $19,350 or $10.75 (annual construction cost per acre from appendix 2) x 1,800 acres = $19,350
2/ $2.16 (annual replacement cost per acre from appendix 2) x 1,800 acres
3/ $1.82 (annual O & M cost per acre from appendix 2) x 1,800 acres
4/ $11.92 (annual APIC cost per acre from appendix 2) x 1,800 acres
5/ $1.95 (annual IP cost per acre from appendix 2) x 1,800 acres
6/ Amortized over 25 years at 8 5/8% (.09873)

ECONOMIC BENEFITS
(Average Annual)

Onsite Benefits

LP	$35,712[1/]
CDR	16,506[2/]
YE	6,660[3/]
RVPC	25,740[4/]
Subtotal	$84,618

Offsite Benefits

OFF	$ 342[5/]
Subtotal	$ 342

Total Annual Benefits - $84,960

1/ $19.84 (LP benefits from table 4 of example) x 1,800
2/ $9.17 (CDR benefits from table 4 of example) x 1,800
3/ $3.70 (YE benefits from table 4 of example) x 1,800
4/ $14.30 (RVPC benefits from table 4 of example) x 1,800
5/ $0.19 (OFF benefits from table 4 of example) x 1,800

Table 5 Support Data - Conservation Alternative 2

Estimated Project Installation Cost

Installation Cost Item	Unit	Number Non-Fed Land	Estimated Cost: PL 566 Non-Fed	Estimated Cost: Other Non-Fed	Estimated Cost: Total
Construction					
WASCOBS and Grassed Waterways			87,220	46,964	134,184
Subtotal - Construction			87,220	46,964	134,184
Other					
Technical Assistance			26,837	--	26,837
Project Administration			13,418	--	13,418
Subtotal - Other			40,255	--	40,255
TOTAL - Project Installation Cost			127,475	46,964	174,439

Estimated Average Annual Cost

Construction cost	$ 13,248 1/
Replacement cost	3,420 2/
O & M cost	2,952 3/
APIC	17,856 4/
Technical Assistance	2,650 5/
Project Administration	1,325 5/
Total	$41,451

1/ 134,184 x .09873 = $13,248 or $7.36 (annual construction cost per acre from appendix 2) x 1,800 acres = $13,248
2/ $1.90 (annual replacement cost per acre from appendix 2) x 1,800 acres
3/ $1.64 (annual O & M cost per acre from appendix 2) x 1,800 acres
4/ $9.92 (annual APIC cost per acre from appendix 2) x 1,800 acres
5/ Amortized over 25 years at 8 5/8% (.09873)

ECONOMIC BENEFITS
(Average Annual)

Onsite Benefits

LP	$23,796[1/]
CDR	13,590[2/]
YE	5,922[3/]
RVPC	25,740[4/]
Subtotal	$69,048

Offsite Benefits

OFF	$ 306[5/]
Subtotal	$ 306

Total Annual Benefits - $69,354

1/ $13.22 (LP benefits from table 4 of example) x 1,800
2/ $7.55 (CDR benefits from table 4 of example) x 1,800
3/ $3.29 (YE benefits from table 4 of example) x 1,800
4/ $14.30 (RVPC benefits from table 4 of example) x 1,800
5/ $0.17 (OFF benefits from table 4 of example) x 1,800

Appendix 9, EXCOP 1

Evaluation Unit A

Watershed Plan

Average annual equivalents (annualized)
8 5/8 percent interest, 25-year evaluation period, 3-year installation period, 28-year period of analysis

	Installation Expenditures			OM&R APIC and IP Cost and Benefits					
Year	Annual Increment of Capital Expenditure (Col 1)	P.V. of 1 yrs. Hence (Col 2)	Present Value of Capital Expenditure (Col 1 x Col 2)	Annual Increment of OM&R, APIC & IP Accrual (Col 4)	Annual Increment of Benefit Accrual (Col 5)	P.V. of an Annuity of 1 for 25 years (Col 6)	P.V. of 1[1/] yrs. Hence (Col 7)	P.V. of OM&R, APIC & IP Cost (Col 8) (Col 4 x Col 6 x Col 7)	P.V. of Benefits (Col 9) (Col 5 x Col x Col 7)
1	85,000	.92060	78,251			10.12867	1.00000		
2	85,000	.84750	72,038	10,700	28,300	10.12867	.92060	99,772	263,882
3	84,786	.78021	66,151	10,700	28,300	10.12867	.84750	91,849	242,929
				10,730	28,360	10.12867	.78021	84,794	224,115
TOTAL	254,786		216,440	32,130	84,960			276,415	730,926
Average Annual Equivalent[2/]			20,711					26,450	69,942

Average annual equivalent benefits $69,942.
Average annual equivalent costs $47,161.

B:C Ratio 1.48:1

[1/]The calculation of a present value (Col. 4 or 5 x Col. 6) will determine that value at the beginning of the year, therefore, the P.V. of 1, years hence must be adjusted to account for this by shifting forward one year.

[2/]Amortized over the 28-year period of analysis (.09569).