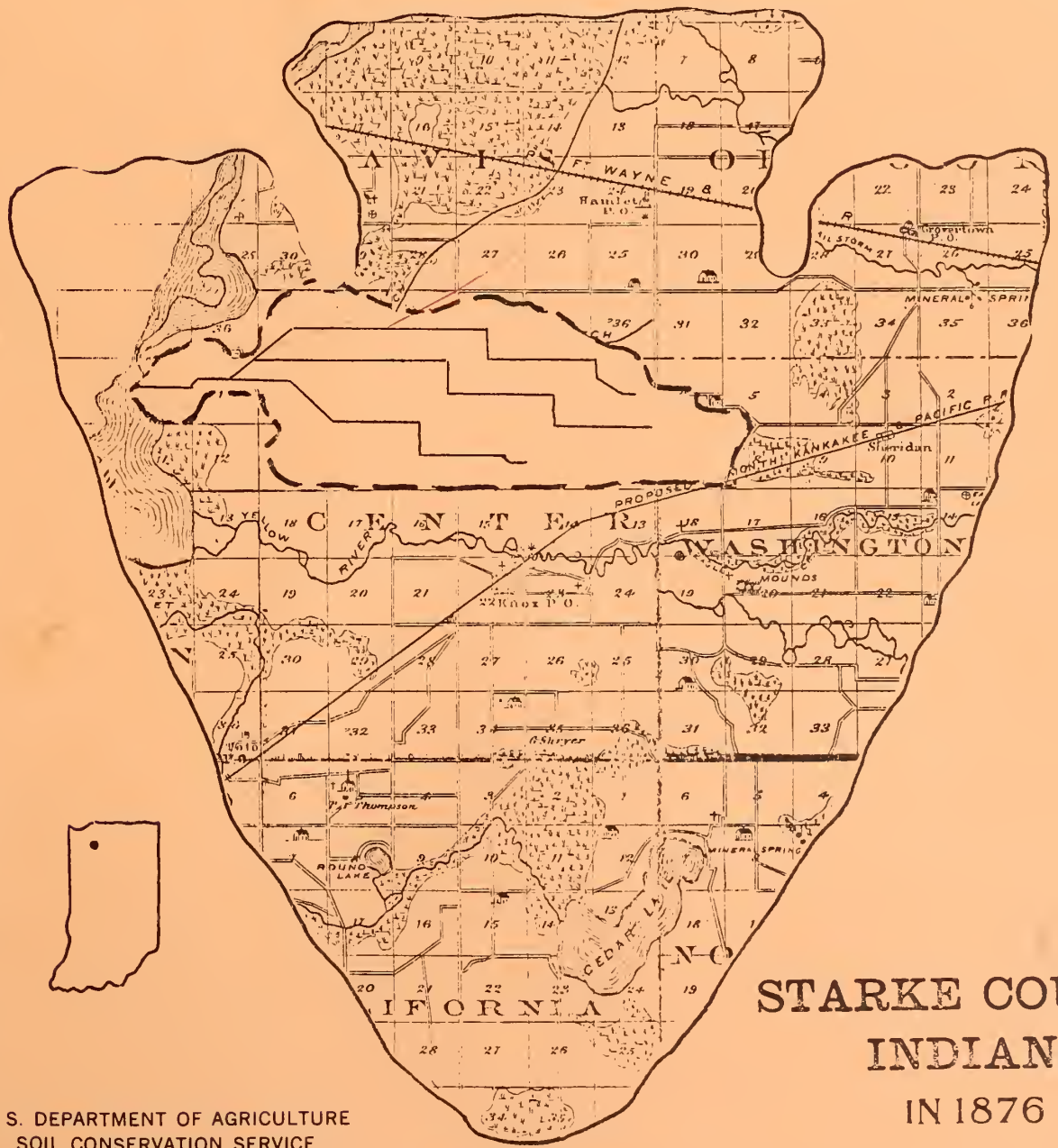
WATERSHED PLAN
AND
ENVIRONMENTAL IMPACT STATEMENT
BAILEY-COX-NEWTSON WATERSHED



STARKE COUNTY,
INDIANA
IN 1876

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MAY 1976

WATERSHED PLAN

and

ENVIRONMENTAL IMPACT STATEMENT

BAILEY-COX-NEWTSON WATERSHED

Starke County, Indiana

Prepared Under the Authority of the Watershed Protection
and Flood Prevention Act
(Public Law 566, 83d Congress, 68 Stat. 666),
as Amended and in accordance with the
National Environmental Policy Act
of 1969, Section 102(2)(C)
Public Law 91-190, as Amended

Prepared by:

Starke County Soil and Water Conservation District
Bailey-Cox-Newtson Conservancy District
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service

May 1976

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Environmental Impact Statement

WATERSHED PLAN AGREEMENT

between the

Starke County Soil and Water Conservation District

and the

Bailey-Cox-Newtson Conservancy District

(hereinafter referred to as the Sponsoring Local Organizations)

State of Indiana

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Bailey-Cox-Newtson Watershed, State of Indiana, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsiblity for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Bailey-Cox-Newtson Watershed, State of Indiana, hereinafter referred to as the watershed plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed plan, and further agree that the works of improvement as set forth in said plan can be installed in about five (5) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed plan:

1. The Bailey-Cox-Newtson Conservancy District will acquire, with other than PL-566 funds such land rights as will be needed in connection with the works of improvement. (Estimated Cost $267,400.)

2. The Bailey-Cox-Newtson Conservancy District assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Bailey-Cox-Newtson Conservancy District and the Service as follows:

	Bailey-Cox-Newtson Conservancy District (percent)	Service (percent)	Estimated Relocation Payment Costs* (dollars)
Relocation Payments	54.1	45.9	0

3. The Bailey-Cox-Newtson Conservancy District will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Bailey-Cox-Newtson Conservancy District and by the Service are as follows:

Works of Improvement	Bailey-Cox-Newtson Conservancy District (percent)	Service (percent)	Estimated Construction Cost (dollars)
All Measures	25.0	75.0	624,960

*Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost shared in accordance with the percentages shown.

5. The percentages of the engineering costs to be borne by the Bailey-Cox-Newtson Conservancy District and the Service are as follows:

Works of Improvement	Bailey-Cox-Newtson Conservancy District (percent)	Service (percent)	Estimated Engineering Cost (dollars)
All Measures	0	100.0	62,000

6. The Bailey-Cox-Newtson Conservancy District and the Service will each bear the costs of Project Administration which it incurs, estimated to be $18,700 and $125,000, respectively.

7. The Starke County Soil and Water Conservation District will obtain agreements from owners of not less than 50 percent of the land above each structural measure that they will carry out conservation farm or ranch plans on their land.

8. The Starke County Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Bailey-Cox-Newtson Conservancy District will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed plan is contingent on the availability of appropriations for this purpose.

    A separate agreement will be entered into between the Service and the Bailey-Cox-Newtson Conservancy District before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organizations have failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organizations in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organizations or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of or delegate of Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Starke County Soil and Water Conservation District

By /s/ Walter H. Paegel
Walter H. Paegel

R.R. 1, Box 19
Knox, Ind. 46534
Address Zip Code

Title Chairman

Date 5/25/76

The signing of this agreement was authorized by a resolution of the governing body of the Starke County Soil and Water Conservation District adopted at a meeting held on May 25, 1976

/s/ Wayne Emigh
Wayne Emigh
Secretary, Starke County Soil and Water Conservation District

May 25, 1976
Date

R. 2, Box 115
Knox, Ind. 46534
Address Zip Code

Bailey-Cox-Newtson Conservancy District

R. 4, Box 244
Knox, Ind. 46534
Address Zip Code

By /s/ Frank Pulver
Frank Pulver

Title Chairman

Date May 25, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Bailey-Cox-Newtson Conservancy District adopted at a meeting held on May 5, 1976

/s/ Wm. Shaw
William Shaw
Secretary, Bailey-Cox-Newtson
Conservancy District

Date May 25, 1976

804 So. Pearl St.
Knox, Ind. 46534
Address Zip Code

Appropriate and careful consideration has been given to the environmental impact statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

/s/ Cletus J. Gillman
Cletus J. Gillman
State Conservationist

May 25, 1976
Date

SUMMARY

The Bailey-Cox-Newtson Watershed includes approximately 18.86 square miles (12,070 acres) in north-central Starke County, Indiana. Three main manmade ditches, the Bailey, Cox, and Newtson, flow westward and join to form the Bailey Ditch about two miles prior to entering the Kankakee River. One small community, Brems, is located within the watershed; and the town of Knox is approximately two miles south.

The topography is level to nearly level with approximately an 80-foot elevation differential between the outlet of the Bailey Ditch and the extreme eastern end of the watershed. The watershed is within the Northern Lake and Moraine Region and has undergone relatively little change since the Wisconsin glaciation. The surficial geology consists chiefly of Pleistocene unconsolidated deposits of glaciofluvial sand, gravel, and silt with some occurrences of eolian (wind-blown) sand and recent alluvium. Three soil associations occur in the watershed: the Maumee-Gilford, the Morocco-Maumee-Brems, and the Rensselaer-Milford. The coarse textured soils of the watershed are droughty during extended periods of low rainfall. Areas in which the hazard of wind erosion is most severe are mainly confined to the eastern two-thirds of the watershed.

The project is sponsored by the Starke County Soil and Water Conservation District (SWCD) and the Bailey-Cox-Newtson Conservancy District (Conservancy District).

Watershed problems covered by the plan are: inadequate land and water management, floodwater damage, erosion, inadequate drainage and droughty soil conditions.

Land treatment measures will be installed by individual landowners and operators primarily through cooperative agreement with the Starke County SWCD. Technical assistance will be provided to the SWCD by the Soil Conservation Service (Service) and the Indiana Department of Natural Resources (IDNR), Division of Forestry, in cooperation with the U.S. Forest Service. Land treatment practices considered applicable for installation in the watershed include: conservation cropping systems, crop residue use, critical area planting, drainage field ditches, field border, field windbreaks, grade stabilization structures, hedgerow planting, minimum tillage, livestock exclusion, pasture and hayland management, pond, subsurface drains, stripcropping, wildlife habitat management (upland and wetland), and woodland improvement. Application of these conservation measures will provide benefits and alleviate problems covered by the plan. The Other cost (all funds other than Public Law 566) of the land

treatment measures is estimated at $352,770 which includes $2,900 for forest land measures. Estimated Public Law 566 (PL-566) cost for technical assistance is $19,730.

Structural measures consist of 26.2 miles of multiple purpose flood prevention and drainage channel work (19.0 miles of deepening and/or enlargement and 7.2 miles of selective clearing only), 6,900 lineal feet of dike, a pump station at the watershed outlet, 14 structures for water control, and a 14-acre area for spawning. All channel work, except 1.2 miles of new construction, will be performed on intermittent, manmade channels. Installation of the proposed measures will benefit 2,317 acres from joint floodwater damage and drainage impairment, provide drainage benefits to 4,183 acres, and relieve flooding on 2,810 acres. The estimated total cost of the structural measures is $1,098,060, of which $655,720 is PL-566 and $442,340 is Other cost. Estimated annual cost is $67,430. Annual operation and maintenance cost to be borne by the sponsors is estimated at $20,420. The total annual cost of installation and operation and maintenance is $87,850. The total installation cost (land treatment and structural measures) is estimated at $1,470,560, with $675,450 being PL-566 cost and $795,110 Other cost.

Total average annual benefits from structural measures are an estimated $156,250, which includes flood damage reduction benefits of $48,100 more intensive land use benefits of $12,060, agriculture water management (drainage) benefits of $46,870, and local secondary benefits of $49,220.

A five-year installation period is planned.

The ratio of average annual benefits of $156,250 to the average annual cost of $87,850 is 1.8 to 1.0.

INTRODUCTION

The plan and environmental impact statement for Bailey-Cox-Newtson Watershed has been combined into one document. Part I, Watershed Plan, has been briefed to avoid excessive duplication with information required in the Environmental Impact Statement, Part II. Part II should be reviewed for additional information on the environmental setting, water and related land resource problems, project formulation, planned project, and the effects of works of improvement. The project map is included in Part II, as Appendix B.

PLANNED MEASURES

Land Treatment Measures

Land treatment measures will be installed voluntarily by individual landowners and operators primarily through cooperative agreement with the SWCD. Technical assistance will be provided to the SWCD by the Service and the IDNR, Division of Forestry, in cooperation with the U.S. Forest Service. Land treatment practices considered appropriate for installation in the watershed are: conservation cropping systems, crop residue use, critical area planting, drainage field ditches, field border, field windbreaks, grade stabilization structures, hedgerow planting, minimum tillage, livestock exclusion, pasture and hayland management, pond, subsurface drains, stripcropping, tree planting, wildlife habitat management (upland and wetland), and woodland improvement. These measures include the needed conservation practices having hydrologic, pollution, erosion, and sediment control significance in reducing floodwater damage and those which contribute to achieving agricultural water management benefits.

Structural Measures

The structural measures consist of approximately 19.0 miles of channel excavation and 7.2 miles of selective clearing. These measures will require modifications to 11 culverts and bridges.

The work includes 6,900 lineal feet of dike and a pump near the downstream end of the watershed. Also provided are 14 structures for water control in the middle portion of the watershed and a 14-acre area west of the dike (south of Bailey Ditch) that includes 4,000 lineal feet of spawning ditches.

The pump station will be equipped with drainage gates at elevation 666.0 MSL and 668.0 MSL to enable seasonal flooding for waterfowl of 44 acres after fall harvest and before the pumps are needed in the spring.

Thirty-nine acres of woody vegetation will be planted along the channel (see Exhibit 4) and a 25-foot strip along the water side of the dike. The strip along the dike will also help to minimize wave action on the dike.

A detailed discussion of planned measures is located in Part II (EIS), Planned Project. Also see Table 3 (Structure Data Channels) and Appendix B (Project Map) for remaining details.

INSTALLATION COSTS--MONETARY

Land Treatment Measures

The installation cost of land treatment measures is estimated to be $372,500. The Other cost of the land treatment measures is estimated at $352,770 which includes $2,900 for forest land measures. Estimated total cost for technical assistance is $33,830, of which $32,730 will be paid from Soil Conservation Service funds (PL-566 $19,730) and $1,100 from the going Cooperative Forest Management Programs. (See Table 1.)

The estimated schedule of PL-566 and Other technical assistance obligations for installation of land treatment is indicated as follows:

Fiscal Year	Technical Assistance PL-566	Technical Assistance Other	Installation Cost Landowners & Operators
1st	$3,946	$2,820	$67,734
2nd	3,946	2,820	67,734
3rd	3,946	2,820	67,734
4th	3,946	2,820	67,734
5th	3,946	2,820	67,734
Total	$19,730	$14,100	$338,670

Structural Measures

Installation costs for structural measures as shown in Table 2 include construction, land rights, engineering, and project administration costs. The table shows the total PL-566 and Other costs.

Construction costs are the estimated contract cost for constructing structural measures. It includes all materials, labor, and machinery involved in construction (including mitigation and preservation measures). A contingency is added to the estimated contract cost for all works of improvement to defray any unexpected cost that may occur during construction.

Engineering costs are the costs for preparing construction plans for the structural measures. These costs include the direct cost of engineers, geologists, and technicians for construction surveys and investigations; soil and foundation drilling and testing; and design and preparation of construction plans and specifications.

INSTALLATION COSTS--MONETARY

Structural Measures--cont'd

Land rights costs include, but are not necessarily limited to, all expenditures for: (1) acquisition of land rights for construction and mitigation, the value of which is estimated by the sponsoring local organizations; (2) relocation or reconstruction of property line fences; (3) relocation, alteration, or removal of pipelines and/or utility lines; (4) modifications to 11 culverts and bridges; and (5) all legal fees and surveys associated with acquisition of land rights. Land required for channel work includes a permanent easement on that land between the outside edge of the buffer strip on the unconstructed side and the crest of the spoil bank on the constructed side. A distance of 15 feet from the top of ditch bank on the unconstructed side is required (when one side construction is used).

Project administration costs are the PL-566 and Other administrative costs associated with the installation of structural measures including the cost of contract administration, relocation assistance advisory services, administrative functions connected with relocation payments, review of engineering plans prepared by others, government representatives, and necessary inspection service during construction to insure that structural measures are installed in accordance with the plans and specifications.

Relocation assistance advisory services are not to be confused with other administrative functions associated with relocation payments. The advisory services include such items as: (1) determination of needs; (2) obtaining current pertinent information concerning housing programs, costs, etc.; (3) developing and handing out brochures; (4) assurance of replacement dwellings; and (5) assisting in getting established. The other administrative functions to be provided as needed include such items as (1) providing by first-class mail written notice of displacement and appropriate application forms to each displaced person, business, or farm operation; (2) assistance in filing applications; (3) reviewing and taking action on applications for assistance; (4) reviewing and processing grievances; and (5) making relocation payments.

Cost Allocation and Cost Sharing

Costs for all planned structural measures are allocated 50 percent to flood prevention and 50 percent to drainage.

One hundred percent of construction costs allocated to flood prevention and 50 percent of the construction costs allocated to drainage are PL-566 costs. All engineering costs will be 100 percent PL-566 funds. All land rights costs will be paid by Other funds.

Cost Allocation and Cost Sharing--cont'd

The construction of protective fencing, armor plating, wildlife habitat plantings and habitat boundary markers are considered construction costs and cost sharing for these items will be the same as for other construction.

Project Costs

A summary of the estimated installation costs is shown in the following table:

	PL-566	Conservancy District	Total
Construction	$468,720	$156,240	$624,960
Engineering Services	62,000	--	62,000
Land Rights	--	267,400	267,400
Project Administration	125,000	18,700	143,700
Total	$655,720	$442,340	$1,098,060

An estimated schedule of PL-566 and Other obligations for installation of the structural measures by fiscal year, including project administration cost, is tabulated in dollars as follows:

Fiscal Year	PL-566	Conservancy District
1st	$ 39,340	$190,200
2nd	334,420	137,130
3rd	281,960	115,010
Total	$655,720	$442,340

Non-Project Costs

There are no known or anticipated non-project costs for this project. Should any non-project costs occur, they must be borne by the Conservancy District. This subject is covered here to avoid possible misunderstanding during contract negotiations and construction.

Non-project costs include all additional costs resulting from changes of, or additions to, project works of improvement for non-project purposes or maintenance such as: (1) distributing and leveling spoil or disposing of excavated material primarily to improve land; (2) filling depressional areas outside of the right-of-way; or (3) modifying planned works of improvement for the convenience of the Conservancy District.

BENEFITS--MONETARY

Total average annual benefits from structural measures are estimated to be $156,250. This total includes flood damage reduction benefits of $48,100, more intensive land use benefits of $12,060, agriculture water management (drainage) benefits of $46,870, and local secondary benefits of $49,220 (Table 6).

Flood damage reduction benefits will be realized as a result of reduced flood damages to cropland and roads and bridges. Joint benefits accrue on cropland as a result of project measures which alleviate problems caused by floodwater and impaired drainage.

Only those secondary benefits generated by the project through increased demands on local suppliers of goods and services and on local processing, transporting and marketing facilities were evaluated. Benefits accruing through an enhancement of the overall environment of the watershed area, although significant locally, were not evaluated. Benefits of a secondary nature from a national viewpoint were not considered pertinent and were, therefore, not evaluated.

COMPARISON OF BENEFITS AND COSTS

Average annual costs, benefits, and comparison of benefits and costs are shown in Tables 4 and 6. The ratio of average annual benefits, excluding secondary benefits, of $107,030 to average annual cost of $87,850 is 1.2 to 1. The ratio of benefits to cost is $156,250 to $87,850 or 1.8 to 1.

INSTALLATION PROVISIONS

Land Treatment Measures

The Starke County SWCD will provide assistance for the application of the land treatment measures. The measures will be installed by private landowners and operators within a 5-year period. The Service will provide personnel to assist the SWCD in providing landowners and operators technical assistance to develop conservation plans and to install planned practices. Technical assistance for the forest land measures will be furnished by the IDNR, Division of Forestry, in cooperation with the U.S. Forest Service.

Structural Measures

All works of improvement will be installed during a 3-year period. Construction plans and specifications on contracts will be completed by the Service after land rights have been obtained by the sponsors. Mitigation measures are considered construction costs and will be a part of each construction contract. In order to make efficient use of personnel and to realize the most benefit from the structural measures, the works of improvement will be installed in the following yearly sequence:

1. Land rights acquisition & detailed design
2. Dike & pump station
3. Channel work and structures for water control

The Conservancy District is the sponsoring local organization qualified under state law to carry out works of improvement outlined in the plan. The Conservancy District has the powers of eminent domain and taxation, as provided by the Indiana Conservancy Act, and will use these powers as necessary to assure scheduled completion of the project. The Conservancy District will be responsible for securing land rights, including necessary appraisals from qualified appraisers, and administering contracts. The Conservancy District will be responsible for 100 percent of the cost of land rights and 50 percent of the construction cost allocation to drainage. Donations of land, easement, and rights-of-way will go directly toward decreasing the Conservancy District's land rights cost.

The IDNR, in accordance with state laws and regulations, will review and approve plans and specifications for the structural works of improvement.

An interdisciplinary team comprised of representatives from the IDNR, U.S. Fish and Wildlife Service, landowners and sponsors, and the Service will participate in the development of design plans and

Structural Measures--cont'd

specifications and operation and maintenance procedures. These cooperatively developed plans and specifications will be adhered to unless determined inappropriate during construction; however, all members of the team will be provided the opportunity to develop the necessary revisions.

OPERATION, MAINTENANCE, AND REPLACEMENT PROVISIONS

Land Treatment Measures

The land treatment measures will be operated and maintained by the owners and operators of farms under agreement with the Starke County SWCD. Technical assistance will be provided by the Service.

Forest land treatment measures will be maintained by the landowners and operators with technical assistance furnished by IDNR, Division of Forestry, in cooperation with the U.S. Forest Service under the going Cooperative Forest Management Programs.

Structural Measures

Operation and maintenance costs include all necessary expenditures after installation to realize the estimated benefits during the 100-year project evaluation period.

The Conservancy District will assume responsibility for operation and maintenance of all measures including mitigation measures for fish and wildlife. The operation and maintenance work will consist of such items as spraying or controlling of excessive vegetative growth within the channel and on channel side slopes, removing debris and/or excavation of shoal deposits as required to reduce accelerated bank erosion, maintaining channel capacity, repairing of critical areas by seeding, sodding or placement of riprap, and protection of project mitigation features within the permanent easement areas. Operating agreements will include provisions as indicated in the revegetation plan. Operation and maintenance will be conducted in a manner to minimize adverse environmental effects. State and federal agency restrictions on pesticides will be recognized when providing maintenance on project rights-of-way.

Operation agreements will also include details of the Conservancy District's operating procedures of the pump station and the structures for water control.

The Conservancy District has the authority to finance this work by either taxation or special assessment. The Conservancy District shall budget annually the necessary funds to meet the probable expenses of operation and maintenance.

The total estimated annual operation, maintenance and replacement cost is $20,420.

A period of time is prescribed to provide for the establishment of adequate vegetative cover for measures. This "establishment period" applies only to vegetation installed as a structural measure.

OPERATION, MAINTENANCE, AND REPLACEMENT PROVISIONS

Structural Measures--cont'd

The establishment period terminates when the Service notifies the Conservancy District that adequate vegetative cover is established or after two growing seasons have elapsed after the initial installation of the vegetative measure. During the establishment period for vegetative measures, the Service may approve PL-566 cost-sharing for additional work required to obtain an adequate vegetative cover.

A Service representative will make a joint inspection with the sponsors annually, after severe floods, and after the occurrence of any unusual conditions that might adversely affect the structural measures. These joint inspections will continue for three years following the acceptance of the works of improvement for operation and maintenance by the local sponsors. Inspections after the third year will be made annually by the sponsors. A report will be prepared of any such inspections and the Service representative will receive a copy. The IDNR will be invited to participate in any scheduled inspections. A record of each inspection will be kept in the sponsor's file and will be available for authorized review.

Specific operation and maintenance agreements and plans will be executed between the sponsors and the Service prior to signing land rights, relocation or project agreements. These agreements will use as a basis the Service State Watershed Operations and Maintenance Handbook. These agreements will contain, in addition to specific sponsor responsibilities for nonstructural and structural measures, specific provisions for retention and disposal of property acquired or improved with PL-566 financial assistance.

Channels

Sediment and other debris will be removed periodically from the channels. It is anticipated that a dragline or large backhoe will be contracted about once every three years to perform maintenance which has been identified by regular inspections. Other items requiring maintenance and or replacement are fences, vegetative markers, vegetation (including trees and shrubs), and drainage appurtenances. The estimated average annual operation, maintenance and replacement cost for the channels is $3,430.

Dike

The dike will be patrolled periodically and especially after severe storms. Any weakness will be repaired immediately. Trees and brushy growth will not be permitted to remain on the dike. Where rodent damage is a problem, measures will be taken to discourage them from burrowing into the dike.

Structural Measures--cont'd

During periods of high flood, the elevation of the water in the interior ditch will be maintained as high as possible to reduce the possibility of dike failure.

The estimated average annual operation, maintenance, and replacement cost for the dike is $1,760.

Pumps and pumping station

The pumps will be designed to operate automatically and, therefore, will require a minimum of attention. However, frequent visits will be necessary to insure proper operation. Maintenance will be in accordance with manufacturer's recommendations.

The replacement schedule is as follows: pumps--16 years, electric motors--25 years, trash racks and gates--25 years, concrete structure--50 years.

The periods of pump operation are shown below:

Period	Dates	Pumps	Gravity Gates
1	Jan. 1 to March 15	Off	Open
2	March 15 to June 15	On	Open & Closed
3	June 15 to Sept. 15	Off	Open
4	Sept. 15 to Dec. 1	On	Open & Closed
5	Dec. 1 to Dec. 31	Off	Open

The gravity gates may be open when the pumps are not in operation. The pumps will be operated when the elevation of the Kankakee River impairs drainage within the Bailey Ditch system. The pumps will operate annually 15 percent of the time. The estimated operation, maintenance, and replacement cost is $11,030.

Structures for water control

The structures will be operated to prevent excessive drainage in areas adjacent to the channel where deepening is required and to control the subsurface water level to provide for better conservation of summer rains.

The structures will be operational during the period of June 15 to August 15. Control boards will be installed in the spring and removed in the fall. The boards will be stored in the pump shelter. The estimated annual operation, maintenance, and replacement cost is $3,200.

OPERATION, MAINTENANCE, AND REPLACEMENT PROVISIONS

Structural Measures--cont'd

Spawning area

Natural wetland vegetation will be allowed to develop in the spawning area. Selective shearing of woody vegetation will be necessary to maintain herbaceous cover. It is estimated that shearing will be necessary once every five years.

The replacement schedule of the spawning area is 20 years.

The estimated average annual operation, maintenance, and replacement cost is $1,000.

Winter waterfowl area

The pump station will be constructed to permit 44 acres to flood after fall harvest and until the pumps are needed in the spring. This will be done by closing the lower drainage gates (Elev. 660.0 MSL), opening the higher drainage gates (Elev. 668.0 MSL), and disconnecting the pumps. See Pumps and pumping station for maintenance and replacement schedule.

The cost of operation, maintenance, and replacement of the gates is included under Pumps and pumping station.

FINANCING PROJECT

Federal financial assistance for carrying out the works of improvement set forth in this plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (PL-566, 83rd Congress, 68 Stat. 666), as amended. Federal financial assistance is contingent on the appropriation of funds to carry out this plan.

Land Treatment Measures

Technical assistance for installation of all accelerated land treatment for which the Service has responsibility will be provided with PL-566 funds. Technical assistance for forest land treatment measures will be provided by the IDNR, Division of Forestry, in cooperation with the U.S. Forest Service through the Cooperative Forest Management Program.

Any cost-sharing for installation of approved land treatment measures will be provided through the Agricultural Conservation Program (ACP), administered by the Agricultural Stabilization and Conservation Service, or by other funds as might be appropriated by Congress.

Structural Measures

The Conservancy District was organized in 1972. It has levied a general tax over the watershed to carry out the necessary functions since that time. Negotiations are underway with the Farmers Home Administration to secure a loan to meet financial needs during installation. The Conservancy District will, through tax or assessment levies, secure funds for annual expenses of operations, maintenance and replacement, and repayment of loans.

The Conservancy District is reponsible for the following installation cost:

1. 100 percent of the land rights--est. $267,400
2. 25 percent of the construction costs--est. $156,240
3. Project administration costs--est. $18,700

Invitations to bid on the construction of planned structural measures will be issued after the project agreements are executed. These agreements will be executed when the following conditions have been met: (1) PL-566 funds have been appropriated; (2) the Conservancy District has funds available and is prepared to fulfill its responsibilities; (3) necessary land rights have been obtained; (4) construction plans and specifications have been prepared and approved as required; and (5) operation and maintenance agreements have been executed.

Structural Measures--cont'd

Prior to entering into agreements that obligate funds of the Service, the Conservancy District will have a financial management system for control, accountability, and disclosure of PL-566 funds received and for control and accountability for property and other assets purchased with PL-566 funds.

Program income earned during the grant period will be reported on the sponsor's request for advance or reimbursement from the Service. For this purpose, the grant period shall extend from the effective date of the Service's fund obligating agreement until the date on which the Service formally notifies the sponsors that the undertaking has been satisfactorily completed.

Program income may include, but is not limited to, income from service fees, usage, or rental fees and sale of assets purchased with federal funds under a Service-fund agreement.

TABLE 1 - ESTIMATED PROJECT INSTALLATION

Bailey-Cox-Newtson Watershed, Indiana

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) *					
			P.L. 566 Funds		Other			
			Non-Federal Land		Non-Federal Land			
		Non-Federal Land	SCS**	Total	SCS**	FS**	Total	Total
LAND TREATMENT								
Land Areas***								
Cropland	Ac.	7820	-	-	303,600	-	303,600	303,600
Pastureland	Ac.	130	-	-	18,180	-	18,180	18,180
Forestland	Ac.	125	-	-	-	1,800	1,800	1,800
Other Land	Ac.	175	-	-	15,090		15,090	15,090
Technical Assistance			19,730	19,730	13,000	1,100	14,100	33,830
TOTAL LAND TREATMENT	Ac.	8,250	19,730	19,730	349,870	2,900	352,770	372,500
STRUCTURAL MEASURES								
Construction								
Pumping Station	No.	1	133,550	133,550	44,520	-	44,520	178,070
Dike	Mi.	1.3	89,095	89,095	29,695	-	29,695	118,790
Structure for Water Control	No.	14	45,000	45,000	15,000	-	15,000	60,000
Channel Modification****								
(M)	Mi.	25.0	191,875	191,875	63,925	-	63,925	255,800
(O)	Mi.	1.2	9,200	9,200	3,100		3,100	12,300
Subtotal - Construction	-	-	468,720	468,720	156,240	-	156,240	624,960
Engineering Services	-	-	62,000	62,000	-	-	-	62,000
Relocation Payments	-	-	-	-	-	-	-	-
Project Administration								
Construction Inspection	-	-	50,000	50,000	-	-	-	50,000
Other			75,000	75,000	18,700	-	-	93,700
Relocation Assistance Advisory Services			-	-	-	-	-	-
Subtotal - Administration	-	-	125,000	125,000	18,700	-	18,700	143,700
Other Costs								
Land Rights	-	-	-	-	267,400	-	267,400	267,400
Subtotal Other	-	-	-	-	267,400	-	267,400	267,400
TOTAL STRUCTURAL MEASURES	-	-	655,720	655,720	442,340	-	442,340	1,098,060
TOTAL PROJECT	-	-	675,450	675,450	792,210	2,900	795,110	1,470,560

* Price Base: 1975

** Federal agency responsible for assisting in installation of works of improvement.

*** Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

**** (M)-manmade ditch or previously modified channel; (O)-none or practically no defined channel.

May 1976

TABLE 1A--STATUS OF WATERSHED WORKS OF IMPROVEMENT

(At Time of Plan Preparation)

BAILEY-COX-NEWTSON WATERSHED, INDIANA

Measure	Unit	Applied To Date	Total Cost (Dollars)*
District Cooperators	No.	28	--
Conservation Plans	No.	22	--
Conservation Plans (Rev.)	No.	3	--
Standard Soil Survey	Ac.	5,240	--
Conservation Cropping System	Ac.	3,685	18,425
Grade Stabilization Structures	No.	8	9,600
Minimum Tillage	Ac.	2,856	8,568
Crop Residue Use	Ac.	3,684	11,052
Subsurface Drain	Ft.	80,000	64,000
Drainage Field Ditches	Ft.	26,400	18,480
Drainage Main or Lateral	Ft.	80,300	120,450
Pasture and Hayland Planting	Ac.	43	3,225
Tree Planting	Ac.	5	175
Pond	No.	2	4,000
Pumping Plants	No.	4	4,800
TOTAL			262,775

*Price Base 1975

May 1976

TABLE 2--ESTIMATED STRUCTURAL COST DISTRIBUTION

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)*

Item	Installation Cost PL-566 Funds			Installation Cost--Other Funds			Total Installation Cost
	Construction**	Engineering	Total PL-566	Construction**	Land Rights***	Total Other	
Pumping Station	133,550	18,000	151,550	44,520	2,000	46,520	198,070
Dike#	89,095	12,000	101,095	29,695	37,800	67,495	168,590
Structures for Water Control	45,000	6,000	51,000	15,000	--	15,000	66,000
Channel Modification##							
M	191,875	25,080	216,955	63,925	216,710	280,635	497,590
0	9,200	920	10,120	3,100	10,890	13,990	24,110
Subtotal	468,720#	62,000	530,720	156,240#	267,400	423,640	954,360
Project Administration	XXXXXXX	XXXXXX	125,000	XXXXXXX	XXXXXXX	18,700	143,700
GRAND TOTAL	XXXXXXX	XXXXXX	655,720	XXXXXXX	XXXXXXX	442,340	1,098,060

* Price base 1975.

** Includes $19,070 ($14,300 PL-566; $4,770 Other) for reinforcing, underpinning, or reconstructing existing railroad and public road bridge piers and abutments necessitated by modification of the channel.

*** Includes $40,000 for new and alterations to existing culverts and bridges.

\# Cost includes $57,570 for mitigation and preservation, including spawning area ($43,180 PL-566; $14,390 Other).

(M) - Manmade ditch or previously modified channel;
(0) - None or practically no defined channel.

May 1976

TABLE 2A--COST ALLOCATION AND COST SHARING SUMMARY

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)*

Item	COST ALLOCATION			COST SHARING					
	PURPOSE			P.L. 566			OTHER		
	Flood Prevention	Drainage	Total	Flood Prevention	Drainage	Total	Flood Prevention	Drainage	Total
All Measures	477,180	477,180	954,360	343,480	187,240	530,720	133,700	289,940	423,640
GRAND TOTAL	477,180	477,180	954,360	343,480	187,240	530,720	133,700	289,940	423,640

* Price Base 1975

May 1976

TABLE 3 - STRUCTURE DATA

CHANNELS

Bailey-Cox-Newtson Watershed, Indiana

Channel Name and Reach	Station	Drainage Area Sq. Mi.	Required Capacity cfs.	Channel Dimensions 1/ & 2/ Bottom Width	Bottom Grade	Depth of Flow	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Purpose 3/	Before Project Type of Channel 4/	Before Project Flow Condition 5/
Bailey	556+00 602+00	1.8	32	4	.0009	2.5	.040	.030	1.4	1.8	MP	M	I
Ditch	602+00 655+00	2.8	46	6	.0013	2.4	.040	.030	1.9	2.0	MP	M	I
	655+00 681+00	3.1	50	8	.0015	2.1	.040	.030	1.9	2.3	MP	M	I
	681+00 786+00	6.0	88	10	.0007	3.2	.040	.030	1.6	2.0	MP	M	I
	786+00 1,005+00	19.0	230	18	.0003	5.5	.035	.028	1.4	1.7	MP	M	I
Cox Ditch	480+00 533+00	1.8	32	4	.0009	2.5	.040	.030	1.4	1.8	MP	O	
	533+00 568+50	1.8	32	4	.0009	2.5	.040	.030	1.4	1.8	MP	M	I
	568+50 594+50	2.7	46	6	.0009	2.6	.040	.030	1.6	1.9	MP	M	I
	594+50 723+00	3.8	60	Selective Clearing							MP	M	I
	723+00 775+00	3.8	60	10	.0015	2.2	.040	.030	1.9	2.4	MP	M	I
	775+00 853+50	5.2	90	10	.0003	4.1	.040	.030	1.2	1.5	MP	M	I
	853+50 909+50	5.2	90	Selective Clearing							MP	M	I
Lateral #1	76+00 114+00	1.2	23	4	.0003	2.7	.040	.030	0.9	1.1	MP	M	I
	114+00 127+00	1.2	23	4	.0003	2.7	.040	.030	0.9	1.1	MP	O	
	127+00 168+00	1.2	23	4	.0003	2.7	.040	.030	0.9	1.1	MP	M	I
Lateral #2	50+00 162+00	1.2	23	4	.0003	2.7	.040	.030	0.9	1.1	MP	M	I
Newtson	627+00 822+50	3.8	60	Selective Clearing							MP	M	I
Ditch	822+50 930+50	6.5	95	12	.0003	3.9	.040	.030	1.2	1.5	MP	M	I

1/ Type of work - Channel excavation except as noted.

2/ Depths shown are normal depths for the capacity required; side slopes on constructed side are 2:1.

3/ Purpose: MP - Multiple purpose

4/ M - Manmade ditch or previously modified channel, O - none or practically no defined channel.

5/ I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.

May 1976

TABLE 4--ANNUAL COST

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)*

Evaluation Unit	Amortization of Installation Cost**	Operation, Maintenance, and Replacement Cost	Total
All Measures	58,610	20,420	79,030
Project Administration	8,820	XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX	8,820
GRAND TOTAL	67,430	20,420	87,850

* Price base: 1975

**100 years @ 6 1/8 percent interest.

May 1976

TABLE 5--ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)*

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	45,190	380	44,810
Nonagricultural--			
Road & Bridge	1,000	---	1,000
Indirect	2,310	20	2,290
Total	48,500	400	48,100

*Price base - Agriculture Prices current Normalized (WRC-Oct. 1974). Other items current 1975.

May 1976

TABLE 6--COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)

Evaluation Unit	Average Annual Benefits*					Avg. Annual Cost **	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Drainage	Secondary	Total		
All Measures	48,100	12,060	46,870	49,220	156,250	79,030	2.0:1.0
Project Administration	XXXXXXXXXX	XXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXX	8,820	XXXXXXX
GRAND TOTAL	48,100	12,060	46,870	49,220	156,250	87,850	1.8:1.0

*Price base = Agriculture prices current normalized (WRC-Oct. 1974). Other items current 1975.

**From Table 4

May 1976

ADDENDUM

to the

BAILEY-COX-NEWTSON WATERSHED PLAN

Starke County, Indiana

INTRODUCTION

This addendum was developed in accordance with phase-in procedures adopted by the Water Resources Council.

Part I of this addendum shows the effect of evaluating the structural measures using 1975 installation costs, a 6 1/8 percent discount rate, current normalized prices for agricultural products (WRC--Oct. 1974), and 1975 prices for values other than agricultural products.

Part II of the addendum displays an abbreviated alternative plan developed to emphasize environmental quality. This is a hypothetical plan, not to be installed, which presents information for comparison with the selected plan.

Part III of the addendum displays the effects of the selected plan as evaluated for each of the separate accounts--national economic development, environmental quality, regional development, and social well-being.

ADDENDUM PART I

BAILEY-COX-NEWTSON WATERSHED

EFFECT OF USING CURRENT VALUES FOR EVALUATIONS

The following tabulation shows the effect of evaluating the structural measures using a 6 1/8 percent discount rate, 1975 installation costs, 1975 prices for values other than agricultural products, and current normalized prices (WRC--Oct. 1974) for agricultural products.

Average Annual Costs	$ 87,850
Average Annual Benefits:	
Primary Benefits	107,030
Secondary	49,220
Total Benefits	$156,250
Benefit to Cost Ratios:	
Total Benefits to Cost	1.8:1.0
Without Secondary Benefits	1.2:1.0

ADDENDUM PART II

BAILEY-COX-NEWTSON WATERSHED

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

ENVIRONMENTAL PROBLEMS

Areas of Natural Beauty

The watershed has a limited variety of scenery because of land use patterns and topography; lack of lakes, perennial streams, major water courses, and other natural features. About 85 percent of the area is devoted to agricultural uses with 4 percent in forest land, and 11 percent other land.

Recreational Resources

Recreational activities are limited throughout the watershed. Individual recreational activities such as bird watching, hiking, nature walking, hunting, and fishing are the only activities available to the general public in the watershed. Landowners' permission for entry must be obtained before participating in most of these activities.

Water and Land Quality

About 8,800 acres of cropland or 75 percent of the watershed has some degree of wind erosion. The most severe wind erosion occurs on approximately 20 acres. The most serious damage from wind erosion is the separation of clay and silt particles and organic matter from the soil surface. Relatively infertile sandy material is left behind. Sediment in the channel produces debris blocks that impede waterflow, particularly at road culverts.

Sediment yields from the watershed are low. The average annual sediment yield from the entire watershed is estimated at 118 tons/year.

About 7,700 acres of droughty soils are located within the watershed. These soils result in a sizeable yield reduction for row crops which require larger amounts of moisture. Grass and/or woodland are better suited for the soil capabilities.

The watershed lies within the Kankakee River Basin. The soils have a seasonal high water table; therefore, the dominant soils in the watershed have severe limitations for septic tank absorption fields.

ENVIRONMENTAL PROBLEMS--cont'd

Biological Resources and Selected Ecosystems

The predominant agricultural monoculture provides a low quality unvaried habitat for many wildlife species. Clean tillage practices destroy suitable habitat for wildlife species that favor upland agriculture. The watershed is short of permanent surface water habitat for fish and wildlife.

COMPONENT NEEDS

1. Improve water and land quality by controlling erosion, sedimentation, and other pollutants.

2. Reduce residential and industrial development on soils possessing severe limitations for septic tank absorption fields.

3. Proper land use on droughty soils.

4. Establish, improve, and manage fish and wildlife habitat.

5. Establish recreational activities where resources are available within the watershed.

6. Provide diversity of landscape.

PLAN ELEMENTS

1. Install appropriate land treatment measures on about 9,743 acres. Land treatment measures to be applied include: minimum tillage, crop residue use, grade stabilization structures, field windbreak and other measures as needed. Soil conserving mechanical practices and cropping systems would be applied on all croplands. Pasture would be used and managed to protect stand cover and maintain vigor of desired plant species. Forest land treatment measures would be used where needed to control erosion and adjust land use to land capability throughout the watershed. The estimated cost of installation including technical assistance is $439,911.

2. Implement proper land use within capability. Convert 8,880 acres of cropland composed of soils susceptible to wind and sheet erosion and 7,700 acres of soil with moderate to severe drought limitations to pastureland and forest land. (Most of this acreage is overlapping.) Improve land use by restricting urban sprawl to areas where sanitary sewers are available. The estimated installation cost, including technical assistance is $749,340.

PLAN ELEMENTS--cont'd

3. Obtain and convert about 378 acres of cropland into parcels of forest land. These parcels should be 10 acres or larger and should be scattered throughout the watershed on soils suited to desired tree species. The estimated installation cost of this conversion, including technical assistance and cost of land, is $38,367.

4. Establish about 554 acres of upland wildlife areas in scattered blocks such as in "off field" areas along fence rows and ditch banks. The vegetation should be a mixture of trees, shrubs, and herbaceous plants which have a high value for wildlife food and/or cover. The estimated establishment cost, including technical assistance and cost of land, is $49,024.

5. Management of 120 acres subject to annual flooding for a seasonal waterfowl area. Properly managed, this area would provide excellent waterfowl habitat during the non-cropping season. Pumps could be shut off after harvest and remain off until drainage is needed in preparation for crop planting. This non-cropping season is normally expected to be between mid-November and mid-March.

6. Restrict land use for a distance of 50 feet from each edge of the stream or ditch banks. The acreage involved could be considered as part of the 554 acres of upland wildlife habitat previously mentioned. The estimated installation cost, including technical assistance, is $25,116.

7. Establish and maintain needed recreational facilities. Develop facilities for the following recreational activities: bicycling, hiking and nature walking, hunting, picnicking, playground and playfield. Existing woodland provides an excellent opportunity to develop an outdoor lab to further conservation education in the community. The estimated installation cost, including technical assistance, is $125,123.

Total estimated cost of all plan elements is $1,426,881.

INSTITUTIONAL ARRANGEMENT

Institutional arrangements available and needed for the implementation of the Environmental Quality Plan. Legal entities of government are in existence for assisting in the implementation of the EQ Plan. They include township and county governments and the SWCD. County governments have the powers of eminent domain and taxation by law.

INSTITUTIONAL ARRANGEMENT--cont'd

State and federal programs are available, providing financial assistance both for land acquisition and for establishment of measures to implement the EQ Plan, namely:

State Programs

Indiana Department of Natural Resources

a. Forestation Program--provide tree planting stocks and technical assistance; and

b. Private Land Wildlife Habitat Improvement Program--provide technical assistance to create wildlife habitat on private lands.

Federal Programs

U.S. Department of Agriculture

a. Resource Conservation and Development--financial and technical assistance involving human and natural resources;

b. Agricultural Conservation Program--provides cost sharing assistance to individual landowners for application of conservation practices; and

c. Loans and Advances--provide loans and advances to sponsoring organizations.

U.S. Department of Interior

a. Pitman-Robertson Funds--provide for wildlife research and financial and technical assistance in developing wildlife habitat areas. Administered by the state; and

b. Dingell-Johnson Funds--provide for fishery research and financial and technical assistance in developing fishery habitat areas. Administered by the state.

Technical assistance including educational and onsite assistance of these programs is available from:

INSTITUTIONAL ARRANGEMENT--cont'd

a. Starke County Soil and Water Conservation District

b. Cooperative Extension Service

c. Indiana Department of Natural Resources

d. USDA including Soil Conservation Service and Forest Service

e. USDI, U.S. Fish and Wildlife Service

EFFECTS

The implementation of the Environmental Quality Plan will provide increased variety of scenery throughout the watershed and will improve land use patterns.

Establishing a corridor of grasses and shrubs within the permanent easement area will enhance the beauty of the streams and provide upland wildlife habitat. Public access to the easement area will add areas for hiking, nature walking trails, and bird watching. The proper management of the seasonal flooding areas of the watershed will increase the waterfowl populations of the area. Hunting will be expected to increase with the increased waterfowl populations.

The establishment and maintenance of a community park along State Highway 35 will provide picnic, playground, and playfield facilities. A conservation education program for the benefit of schools and the general public can be provided by establishing an outdoor educational laboratory.

The installation of the land treatment measures will reduce soil loss on 8,880 acres of cropland susceptible to wind and sheet erosion. This reduction will reduce sediment and agricultural pollutants carried by sediment which now enter watercourses.

Implementation of land use compatible with the soils capability can reduce erosion and sedimentation in the same manner as land treatment. Converting cropland to grassland and woodland will result in less intensive land use on the soils with drought limitations.

Restricting residential development, to areas where sanitary sewers are available or on soils with slight limitations for septic tank absorption fields, will prevent future waste disposal problems.

EFFECTS--cont'd

The installation of the forest land, upland, wildlife habitat, seasonal waterfowl area, and the 50-foot strip on each side of the stream will increase desirable habitat for fish and wildlife considerably over the existing conditions.

The nature of the habitat (upland, wetland, forest land) will be compatible with many species of plants and animals that are now scarce or nonexistent in the watershed.

ADDENDUM PART III

BAILEY-COX-NEWTSON WATERSHED

SELECTED PLAN--NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Dollars

Components	Measures of Effects Average Annual	Components	Measures of Effects Average Annual
Beneficial Effects		Adverse Effects	
A. The value to users of increased outputs of goods and services.		A. The value of resources required for a plan.	
1. Flood prevention	60,160	1. Channel work	
2. Drainage	46,870	Project installation*	58,610
		Project administration*	8,820
		OM&R	20,420
TOTAL BENEFICIAL EFFECTS	107,030	TOTAL ADVERSE EFFECTS	87,850
		NET BENEFICIAL EFFECTS	19,180

*Amortized at 6 1/8 percent interest for 100 years.

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III. SELECTED PLAN--ENVIRONMENTAL QUALITY ACCOUNT

COMPONENTS

Beneficial and Adverse Effects:

A. Areas of Natural Beauty

1. Destroy 33 acres of woody wildlife habitat as a result of channel work.

2. Planting 130 acres of grasses, legumes, trees, and shrubs on the slopes and berms.

3. Preserve four known archaeological and historical sites.

4. Afford management to 125 acres of forest land.

5. Protect 70 acres of existing woody material within the permanent easement.

6. Establish a maintenance program for channels and streambanks.

7. Provide livestock exclusion along the channel rights-of-way.

B. Quality Considerations of Water, Land, and Air Resources

1. Increase noise, air, and water pollution during construction.

2. Protect 7,490 acres of droughty soils.

3. Provide soil erosion control on minor sheet and major wind erosion areas.

4. Provide joint flooding and drainage relief on nearly 2,317 acres, flooding relief on 2,810 acres, and drainage relief on 4,183 acres.

5. Provide livestock exclusion along the channel rights-of-way.

C. Biological Resources and Selected Ecosystems

1. Destroy 33 acres fish and wildlife habitat as a result of channel work.

2. Loss of spring waterfowl resting grounds.

3. Planting of 130 acres of grasses, legumes, trees, and shrubs on slopes and berms.

COMPONENTS--cont'd

4. Afford management to 125 acres of forest land.

5. Protect 70 acres of existing woody material within the permanent easement.

6. Provide livestock exclusion along the channel rights-of-way.

D. Irreversible and Irretrievable

The total permanent easement consists of 240 acres. Approximately 149 acres of the permanent easement will be altered during channel improvement. The remainder of the permanent easement will be preserved in its natural state. Before and after land usage within that portion of the permanent easement being altered is as follows: (Bailey, Cox, and Newtson Ditches)

Land Use	Present (ac.)	Future (ac.)
Cropland	39	--
Forest land	0	--
Grassland	10	--
Other land	100	149

These conversions are to be committed for the project life.

III. SELECTED PLAN--REGIONAL DEVELOPMENT ACCOUNT

Dollars

Components	Measures of Effects Average Annual **Region #1	Rest of Nation
Income		
Beneficial Effects		
A. The value of increased output of goods and services to users residing in the region.		
1. Flood prevention	60,160	--
2. Drainage	46,870	--
3. Secondary	49,220	--
TOTAL BENEFICIAL EFFECTS	156,250	--

Components	Measures of Effects Average Annual **Region #1	Rest of Nation
Income		
Adverse Effects		
A. The value of resources contributed from within the region to achieve the outputs.		
1. Channel work		
Project installation*	26,020	32,590
Project administration*	1,150	7,670
OM&R	20,420	--
TOTAL ADVERSE EFFECTS	47,590	40,260
NET BENEFICIAL EFFECTS	108,660	-40,260

*Amortized at 6 1/8 percent interest for 100 years.
**Indiana Planning and Development Region #1--this region is the seven counties in the northwest corner of Indiana.

May 1976

III. SELECTED PLAN--REGIONAL DEVELOPMENT ACCOUNT

COMPONENTS		MEASURES OF EFFECTS	REST OF NATION
B. Employment	1.	During the period of construction, approximately 33 man-years of labor will be required for the installation.	--
	2.	During the life of the project, about 0.5 man-years will be required annually for the operation and maintenance for structural and associated land treatment measures.	--
C. Regional Economic Base & Stability		The average net income increase will be approximately $1,340 annually.	--

III. SELECTED PLAN--SOCIAL WELL-BEING ACCOUNT

COMPONENTS	MEASURES OF EFFECTS
Real income distribution	1. Create regional income benefit distribution of $156,250 by income class as follows:

Income Class ($)	Adjusted Gross Income in Class (%)	Benefits in Class (%)
Less than $5,000	27	10
$5,000 to $10,000	33	55
More than $10,000	40	35

2. Local costs to be borne annually by region total $47,590 with distribution by income class as follows:

Income Class ($)	Adjusted Gross Income in Class (%)	Continuation in Class (%)
Less than $5,000	27	10
$5,000 to $10,000	33	55
More than $10,000	40	35

USDA-SCS-EIS-WS-(ADM)-76-4(F)-IN

BAILEY-COX-NEWTSON WATERSHED

Starke County, Indiana

FINAL ENVIRONMENTAL IMPACT STATEMENT

Cletus J. Gillman, State Conservationist

Soil Conservation Service

Sponsoring Local Organizations:

Bailey-Cox-Newtson Conservancy District
Rt. 4, Knox, Indiana 46534

Starke County Soil & Water Conservation District
Enterprise Building, Rt. 1, Box 19
Knox, Indiana 46534

May 1976

Prepared By:

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
5610 Crawfordsville Road
Indianapolis, Indiana 46224

USDA ENVIRONMENTAL IMPACT STATEMENT

Bailey-Cox-Newtson Watershed Project

Starke County, Indiana

Prepared in accordance with
Sec. 102(2)(C) of PL 91-190

SUMMARY SHEET

I. Final

II. Soil Conservation Service

III. Administrative

IV. Description of Action

A project for watershed protection, flood prevention, and drainage in Starke County, Indiana, to be implemented under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666), as amended.

Channel work includes 7.2 miles of selective clearing and debris removal from the stream channel and streambank, 17.8 miles of excavation that will alter the present channel, and 1.2 miles of new channel construction. (The channels are classified as manmade intermittent.) Fourteen structures for water control will be installed to provide control of groundwater level. A pumping station and associated 6,900 lineal feet of dike will be installed at the Kankakee River. A 14-acre area for spawning is provided for mitigation. Conservation land treatment measures will be installed on 8,250 acres to adequately treat the land for use within its capabilities.

V. Summary of Environmental Impacts

Conservation practices will be installed to adequately treat an additional 8,250 acres bringing the total number of acres adequately treated to 10,350 or 86 percent of the watershed. The conservation practices to be installed will provide soil erosion control on minor sheet erosion areas and major wind erosion areas. The project will provide joint flooding and drainage relief on 2,317 acres, backwater and flooding relief on 2,810 acres, and drainage relief on 4,183 acres. Known archaeological and historical sites will be preserved. Livestock exclusion will be provided along the channel rights-of-way.

Upland wildlife habitat will be improved by vegetative land treatment measures. Proper woodland management will be afforded on 125 acres of forest land within the watershed. Undisturbed woody habitat and idle land within the easement area on the unconstructed side of the channel will be protected. Legumes and grasses will be planted on the slopes and berms on the constructed side for erosion control and wildlife habitat.

Northern pike spawning will be reduced by restricting the migration of the adults by the pump station, destroying vegetation on the banks and channel bottom, and fluctuation of the water level on the vegetation used for spawning. A 14-acre area designed for spawning will be constructed between the Kankakee River and the dike. The waterfowl resting grounds in the watershed will be damaged by removing surface water during the spring waterfowl migration period. The pump station will be constructed to permit 44 acres to flood from the time fall harvest is completed until spring pumping is started.

Minimal damage will result to the unconstructed side of the channel during the installation of surface field ditches, grassed waterways, and grade stabilization structures by individual landowners after the project is completed. Noise, air, and water pollution (turbidity) will be increased and local traffic patterns will be temporarily disrupted during construction.

VI. List of Alternatives Considered

(1) Accelerated land treatment only; (2) Channel excavation (enlargement including deepening where necessary), 1.2 miles of new channel construction, pump station at the watershed outlet, dike construction, structures for water control, and 2,600-acre irrigation system along with accelerated land treatment; (3) Channel excavation (enlargement including deepening where necessary), 1.2 miles of new channel construction, pump station at the watershed outlet, and dike construction and structures for water control along with accelerated land treatment; (4) Minor channel work (debris and flow impeding brush removal), pump station at the watershed outlet, and dike construction along with accelerated land treatment; (5) No PL-566 project--no local action; (6) Dike construction, lateral water collection trenches, pump stations, and accelerated land treatment; and (7) Channel excavation, selective clearing, dike construction, pumping station, structures for water control, waterfowl area, fish spawning area, and accelerated land treatment.

VII. Agencies from which written comments were received for the draft statement:

Department of the Army
Department of Health Education and Welfare
Department of Transportation
Environmental Protection Agency
Upper Mississippi River Basin Commission
Indiana Department of Natural Resources (For Governor)
Indiana State Clearinghouse
Indiana State Board of Health
Kankakee-Iroquois Regional Planning Commission

VIII. The draft statement was transmitted to CEQ on February 24, 1976.

USDA SOIL CONSERVATION SERVICE

FINAL ENVIRONMENTAL IMPACT STATEMENT*
for
Bailey-Cox-Newtson Watershed, Starke County, Indiana

AUTHORITY

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83d Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Starke County Soil and Water Conservation District (SWCD) and Bailey-Cox-Newtson Conservancy District (Conservancy District).

PROJECT PURPOSES AND GOALS

Watershed protection (conservation land treatment)

The SWCD will encourage landowners and operators to install vegetative treatment and adopt improved farming methods for erosion control and water management. Their goal is to have at least 10,350 acres (86 percent) of the total watershed adequately treated at the end of the installation period. One effect of adequate treatment will be to reduce sedimentation in stream channels. Also, soil loss will be reduced on cropland that is subject to wind erosion. These effects will provide lower maintenance costs for planned structural measures.

Flood prevention

The objective of the landowners along the major channels is to reduce the backwater and headwater flooding to acceptable levels consistent with present cropland or about a three-year level of protection.

Drainage

Another goal of the sponsors is to provide safe and timely removal of excess water from approximately 6,500 acres. Subsurface water removal is desirable as a part of the project works of improvement. Removal of excess water within a 24-hour period is the general goal of the sponsors.

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*All information and data, except when otherwise noted by reference to source, were collected during watershed planning activities by the Soil Conservation Service and Forest Service, U.S. Department of Agriculture.

Another objective of the sponsors is to relieve the droughtiness during portions of the growing season. Approximately 7,700 acres of cropland are subject to droughty conditions.

PLANNED PROJECT

Land treatment

An accelerated land treatment program will be installed in the watershed.

The land treatment measures to be installed during the five-year project installation period include conservation practices on 7,820 acres of cropland, 130 acres of pastureland, 125 acres of forest land, and 175 acres of other land. Adequate treatment will be achieved on 10,350 acres covering 86 percent of the total watershed at the end of the installation period.

Conservation practices to be applied on cropland include conservation cropping system, crop residue use, drainage mains or laterals, drainage field ditches, grade stabilization structures, minimum tillage, subsurface drains, and stripcropping.* A combination of two or more practices is often needed to achieve adequate treatment of land. The Soil Conservation Service Technical Guide will be used in planning alternatives for adequate land treatment.

Pastureland treatment measures to be installed include pasture and hayland planting and pasture and hayland management.

Forest land treatment measures to be installed are tree planting on open lands where necessary to control erosion and adjust land use to land capability throughout the watershed. Adapted species for planting will be recommended by the Indiana Department of Natural Resources (IDNR) in cooperation with the U.S. Forest Service. Hydrologic conditions will be improved by manipulation of stand composition, protection from grazing, and implementing management plans. The multiple-use forest land treatment program was cooperatively developed by IDNR, Division of Forestry and the U.S. Forest Service.

There are 107 farms in the watershed. Twenty-eight landowners and operators (26 percent) have voluntarily signed cooperative agreements with the SWCD. The SWCD plans to emphasize getting voluntary agreements signed by all landowners and/or operators in the watershed.

The sponsors estimate that 64 additional landowners or operators will become district cooperators with the SWCD and develop conservation plans during the project installation period.

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*See Exhibit 1 for definition of practices.

At present, 5,240 acres of the watershed have been soil mapped. Plans are to map an additional 6,830 acres during the installation period.

The Soil Conservation Service (Service) will provide the needed technical assistance to the SWCD for soil surveys, conservation planning and application of conservation practices.

Structural measures

The structural measures consist of approximately 19.0 miles of channel excavation. Also included are 7.2 miles of selective clearing. These measures will require modifications to eleven culverts and bridges.

The work includes 6,900 lineal feet of dike and a pump station near the downstream end of the watershed. Also provided are 14 structures for water control in the middle portion of the watershed and a 14-acre area west of the dike (south of Bailey Ditch) that includes 4,000 lineal feet of spawning ditches. (See Project Map, Appendix B.)

The National Park Service and State Historic Preservation Officer will be notified if any previously unidentified evidence of cultural values is discovered during detailed investigations or construction, and the procedures in PL 93-291 will be followed.

Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archaeological and historical resources.

Channels

The channel work consists of enlargement and, where necessary, minor realignment. Construction on Bailey Ditch starts at its confluence with the Kankakee River and extends upstream to a point near the center of Section 1, T.33N., R.2W. This point is also located about 1,300 feet east of the intersection of county road 250 North and the Penn. Central railroad tracks.

Work on the Cox Ditch starts at its confluence with Bailey Ditch. From this point to county road 100 East, the work is limited to selective clearing. Starting at county road 100 East and continuing upstream to a point where the ditch crosses county road 300 East, channel excavation (enlargement) is planned. Starting at the point where the ditch crosses county road 300 East and extending upstream to county road 500 East, the work is again limited to selective clearing. Channel excavation starts again at county road 500 East and extends upstream to county road 700 East as shown on the project map, Appendix B. Lateral #1 to Cox Ditch includes 1.7 miles of channel excavation.

This work starts at a point on the Cox Ditch located 600 feet west of county road 600 East and continues upstream first 0.4 mile north then generally east and south to a point near the SE corner of Section 6, T.33N., R.1W. About 0.4 mile of new channel will be constructed on Cox Ditch, Lateral #1 to avoid a large woods in the SW 1/4 of Section 6, T.33N., R.1W. Lateral #2 to the Cox Ditch includes 2.1 miles of channel excavation. This work starts near the NE corner of the NW 1/4 of Section 12, T.33N., R.2W. and proceeds generally south and east to a point where the ditch reaches county road 700 East.

Channel work on the Newtson Ditch starts at its confluence with Bailey Ditch in the NE 1/4 of Section 1, T.33N., R3W. and extends upstream 5.7 miles to State Highway 35 near the NE corner of the SE 1/4 SE 1/4 of Section 10, T.33N., R.2W. Channel excavation will be conducted from the starting point to county road 100 East, a distance of 2.0 miles. The remainder of the work, 3.7 miles, will be selective clearing.

Channel excavation will deepen the existing channel for drainage and also widen it where additional capacity is required. Channel work is planned to follow existing alignment except as indicated. Excavation will be done from one side to reduce damage to wildlife habitat (Appendix D, Exhibit 3). Significant trees will be left standing on the constructed side, if at all practicable, during construction. All flow impeding brush and unstable or fallen trees will be removed from both banks. Removal will be carried out from the side designated for spoil. Armor plating (gravel blanket) will be used to protect unstable soils on all sharp curves. A 12-foot maintenance travelway or berm will be constructed on the side designated for spoil. A strip 15-feet from the top of the channel bank will be maintained as a vegetated buffer strip on the unconstructed side to protect the channel from farming operations and also serve as a travel lane for wildlife.

Modifications will be necessary to 11 culverts and bridges as required by design channel capacity and excavation. Modifications include lowering, replacing, or installing culverts, and replacing a bridge with a culvert.

Thirty-nine acres of woody vegetation will be planted along the channel (see Exhibit 4) and a 25-foot strip along the water side of the dike.

Fences will be installed to protect vegetative cover where there is a potential for livestock use of the area adjacent to the channel. Vegetative control markers will be used to delineate the boundaries of wildlife habitat plantings where needed to prevent encroachment of wildlife areas. Appurtenances are planned for all channels to safely lower surface water into channels. All existing subsurface drain outlets disturbed by construction will be replaced.

The 7.2 miles of selective clearing involves the removal of flow impeding brush, unstable or fallen trees, and sediment bars. Permanent easements in the channel excavation reaches extend 15 feet from the top of the bank on the unconstructed side to the crest of the spoil typically 25 feet beyond the top of the bank on the constructed side. Sections where construction is performed on both sides (new cuts in cropland), the permanent easement will extend from spoil crest typically 64 feet. Care will be exercised to minimize damage to wildlife habitat. An interdisciplinary team will be consulted when the scope of the removal has been determined prior to construction operations. This team will be comprised of representatives from the IDNR, U.S. Fish and Wildlife Service, landowners and sponsors, and a representative of the Service.

Permanent easements in the selective clearing reaches extend 15 feet from the top of each bank. Right-of-entry extends an additional 60 feet beyond the permanent easement.

Every effort will be made to minimize the amount of construction sediment. Sediment traps will be installed at a rate of one per mile or more often if needed. Cleared material will be buried or disposed of by other acceptable means.

Land rights will consist of approximately 240 acres of permanent easements, approximately 350 acres of temporary easements, and 110 acres of right-of-entry. The temporary easement and right-of-entry areas are in mostly cropland. All areas will not be available to the public without the permission of the landowner.

Woody vegetation will be established and maintained within the permanent easement area to mitigate habitat destroyed by the structural improvements. Tree and shrub seedlings will be planted in a strip about 10 feet wide on the spoil area within the permanent easement. The vegetated buffer strip on the unconstructed side of the channel within the permanent easement includes existing woody material that can be utilized for wildlife habitat. Approximately 80.2 acres of grasses and legumes will be seeded on the disturbed areas within the permanent easement in the main channel.

Four sites of archaeological significance have been identified within the permanent easement area. These sites will be protected during construction. Construction will be done from the opposite side; the sites will not be leveled; and equipment traffic will be routed around these small knolls.

Condensed profiles of the planned channel work are attached as Appendix D, Exhibit 5A.

Dike

A continuous dike will be constructed along the Kankakee River commencing at a point approximately 660 feet west of the SE corner of Section 2, T.33N., R.3W. The dike will proceed west along the south boundary of Section 2 about 1,600 feet, thence angles northwesterly to a point on the Bailey Ditch located 500 feet upstream of the Kankakee River. The dike then angles northeast to a point 700 feet southeast of the Kankakee River, Norfolk and Western Railroad bridge, as measured along the Norfolk and Western Railroad tracks. Approximately 6,900 lineal feet of dike is planned.

Dike design elevations were based upon stage-frequency data developed during the Kankakee River Basin Study, which determined the 25-year frequency elevation of 673.1 MSL at the mouth of Bailey Ditch. The dike will be constructed to elevation 676.4 MSL using requirements for a class II dike. This will provide a 25-year level of protection under present conditions with allowances for wave action and freeboard. The dike will have a 10-foot top width with a 3:1 slope on the water side and a 2.5:1 slope on the land side. The dike will be constructed with material taken from the land side of the dike so as to form a seepage collection ditch. (See Appendix D, Exhibit 5C.) Additional borrow will be taken from the spawning area. A 25-foot strip of wildlife plantings will be established 10 feet from the toe of the slope on the water side of the dike to provide wildlife habitat and to dissipate wave action. The dike will be seeded to approved varieties of grasses to control erosion. No woody vegetation will be allowed on the dike.

Structures for water control

Fourteen (14) structures for water control are planned on the Bailey Ditch, Cox Ditch, and Newtson Ditch commencing from a point approximately two miles downstream from U.S. Highway 35 to the upper end of the watershed. Eight of the structures are corrugated metal in conjunction with road culverts. The location of the structures are shown on the project map. Details of the structures are shown on Exhibit 5B-1 and 5B-2. The inlet and outlet sections of these structures will be protected from erosion with riprap.

The structure locations on the Project Map are preliminary; and as more data becomes available, locations will be adjusted.

Pumps and pumping station

The pumping station will be located approximately 500 feet upstream of the Bailey junction with the Kankakee River. The pumping station will be of reinforced concrete construction with a provision for gravity flow when the Kankakee is at a low stage.

The pump system selected by the Conservancy District is one 20-inch and three 36-inch electric pumps. This system gives a net pumping rate of 0.28 inches per 24 hours.

The pump station will be equipped with drainage gates at elevation 666.0 MSL and 668.0 MSL to enable seasonal flooding of 44 acres after fall harvest and before the pumps are needed in the spring.

Spawning Area

A 14-acre spawning area for northern pike will be constructed between the dike and the Kankakee River adjacent to the Bailey Ditch. This will consist of 4,000 lineal feet of spawning ditches. (See Appendix D, Exhibit 5D-1.)

A low level dike will be constructed along the south side of the spawning area, using the requirements of a class III dike. This dike will provide water with little or no current in the spawning area during minor flooding yet allow the passage of floods that are greater than the annual event. (See Appendix D, Exhibit 5D-2.)

Operation, maintenance, and replacement

Land treatment measures

The land treatment measures will be operated and maintained by the owners and operators of farms under agreement with the SWCD. Technical assistance will be provided by the Service.

Forest land treatment measures will be maintained by the landowners and operators with technical assistance furnished by IDNR, Division of Forestry, in cooperation with the U.S. Forest Service under the Cooperative Forest Management Program.

Structural measures

Operation and maintenance costs include all necessary expenditures after installation to realize the estimated benefits during the 100-year project evaluation period.

The Conservancy District will assume responsibility for operation and maintenance of all measures including mitigation measures for fish and wildlife. The operation and maintenance work will consist of such items as spraying or controlling of excessive vegetative growth within the channel and on channel side slopes; removing debris and/or excavation of shoal deposits as required to reduce accelerated bank erosion; maintaining channel capacity; repairing of critical areas by seeding, sodding or placement of riprap; and protection of project mitigation features within the permanent

easement areas. Operating agreements will include provisions as indicated in the revegetation plan. Operation and maintenance will be conducted in a manner to minimize adverse environmental effects. State and federal agency restrictions on pesticides will be recognized when providing maintenance on project rights-of-way.

Operation agreements will also include details of the Conservancy District's operating procedures of the pump station and the structures for water control.

The Conservancy District has the authority to finance this work by either taxation or special assessment. The Conservancy District shall budget annually the necessary funds to meet the probable expenses of operation and maintenance.

The total estimated annual operation, maintenance, and replacement cost is $20,420.

A period of time is prescribed to provide for the establishment of adequate vegetative cover for measures. This "establishment period" applies only to vegetation installed as a structural measure.

The establishment period terminates when the Service notifies the Conservancy District that adequate vegetative cover is established or after two growing seasons have elapsed after the initial installation of vegetative measure. During the establishment period for vegetative measures, the Service may approve PL-566 cost-sharing for additional work required to obtain an adequate vegetative cover.

A Service representative will make a joint inspection with the sponsors annually, after severe floods, and after the occurrence of any unusual conditions that might adversely affect the structural measures. These joint inspections will continue for three years following the acceptance of the works of improvement for operation and maintenance by the local sponsors. Inspections after the third year will be made annually by the sponsors. A report will be prepared of any such inspections, and the Service representative will receive a copy. The IDNR will be invited to participate in any scheduled inspections. A record of each inspection will be kept in the sponsor's file and will be available for authorized review.

Specific operation and maintenance agreements and plans will be executed between the sponsors and the Service prior to signing land rights, relocation, or project agreements. These agreements will use as a basis the Soil Conservation Service, State of Indiana, Watersheds Operation and Maintenance Handbook. These agreements will contain, in addition to specific sponsor responsibilities for nonstructural and structural measures, specific provisions for retention and disposal of property acquired or improved with PL-566 financial assistance.

Channels

Sediment and other debris will be removed periodically from the channels. It is anticipated that a dragline or large backhoe will be contracted about once every three years to perform maintenance which has been identified by regular inspections. Other items requiring maintenance and/or replacement are fences, vegetative markers, vegetation (including trees and shrubs), and drainage appurtenances. The estimated average annual operation, maintenance, and replacement cost for the channels is $3,430.

Dike

The dike will be patrolled periodically and especially after severe storms. Any weakness will be repaired immediately. Trees and brushy growth will not be permitted to remain on the dike. Where rodent damage is a problem, measures will be taken to discourage them from burrowing into the dike.

During periods of high flood, the elevation of the water in the interior ditch will be maintained as high as possible to reduce the possibility of dike failure.

The estimated average annual operation, maintenance, and replacement cost for the dike is $1,760.

Pumps and pumping station

The pumps will be designed to operate automatically and, therefore, will require a minimum of attention. However, frequent visits will be necessary to insure proper operation. Maintenance will be in accordance with manufacturer's recommendations.

The replacement schedule is as follows: pumps--16 years, electric motors--25 years, trash racks and gates--25 years, concrete structure--50 years.

The periods of pump operation are shown below:

Period	Dates	Pumps	Gravity Gates
1	Jan. 1 to March 15	Off	Open
2	March 15 to June 15	On	Open & Closed
3	June 15 to Sept. 15	Off	Open
4	Sept. 15 to Dec. 1	On	Open & Closed
5	Dec. 1 to Dec. 31	Off	Open

The gravity gates may be open when the pumps are not in operation. The pumps will be operated when the elevation of the Kankakee River impairs drainage within the Bailey Ditch system. The pumps will operate annually 15 percent of the time. The estimated operation, maintenance, and replacement cost is $11,030.

Structures for water control

The structures will be operated to prevent excessive subsurface drainage in areas adjacent to the channel where deepening is required. These structures will provide control of the subsurface water level on cropland soils having a high permeability rate. This control will maintain the ground water level for increased crop utilization of available moisture during the summer periods of low rainfall.

The structures will be operational during the period of June 15 to August 15. Control boards will be installed in the spring and removed in the fall. The boards will be stored in the pump shelter. The estimated annual operation, maintenance, and replacement cost is $3,200.

Spawning area

Natural wetland vegetation will be allowed to develop in the spawning area. Selective shearing of woody vegetation will be necessary to maintain herbaceous cover. It is estimated shearing will be necessary once every five years.

The replacement schedule of the spawning area is 20 years.

The estimated average annual operation, maintenance, and replacement cost is $1,000.

Winter waterfowl area

The pump station will be constructed to permit 44 acres to flood after fall harvest and until the pumps are needed in the spring. This will be done by closing the lower drainage gates (Elev. 660.0 MSL), opening the higher drainage gates (Elev. 668.0 MSL), and disconnecting the pumps. See Pumps and pumping station for maintenance and replacement schedule.

The cost of operation, maintenance, and replacement of the gates is included under Pumps and pumping station.

Project costs

A summary of the estimated installation costs is shown on the following table:

	PL-566	Other	Total
Total Construction Cost	$468,720	$156,240	$624,960
Total Project Installation	675,450	795,110	1,470,560

ENVIRONMENTAL SETTING

Physical resources

The Bailey-Cox-Newtson Watershed is in northwestern Indiana in Starke County. It drains approximately 12,070 acres or 18.86 square miles. Knox, the county seat, is about 2 miles south of the watershed boundary. The only town within the watershed is Brems--unincorporated. Relative locations of some important cities follow: Chicago, Illinois, 58 miles northwest; Detroit, Michigan, 200 miles northeast; South Bend, Indiana, 32 miles north-northeast; Fort Wayne, Indiana, 88 miles east-southeast; and Indianapolis, Indiana, 110 miles south-southeast.

The population of Starke County is 19,280 of which 3,519 is urban and 15,761 is rural.* Population within the watershed is approximately 700.

This watershed is part of the Upper Mississippi Region and the Upper Illinois Subregion. It is also part of the Kankakee River Basin and is within National Land Resource Area 98, the Southern Michigan Drift Plain.**

Land use and problems of this watershed are similar to other watersheds in the Kankakee River Basin. Only two watersheds in the subregion are being developed. The subject watershed is in active planning status. Salt Creek Watershed in Illinois is in operational status.

Flooding, impaired drainage outlets, and droughty soils are the major problems in the watershed. Approximately 9,310 acres are affected by floodwater and drainage problems. Of this acreage, about 362 average annual acres are flooded by backwater from the Kankakee River; and about 2,483 average annual acres are flooded by overbank water from the ditches. About 7,700 acres in the watershed have potential for groundwater control systems. Water erosion is not a major problem in the watershed. However, in about 75 percent of the watershed, the hazard of wind erosion is severe if the soils are not well protected.

The predominately coarse textured soils of the watershed are droughty during extended periods of low rainfall. In cultivated areas, wind erosion occurs when the soils are dry and a protective plant cover has not become established. Wind-blown soil particles cause damage through their abrasive effect on young crops and through deposition

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*The 1970 Census of Population, U.S. Dept. of Commerce, Bureau of the Census.

**Atlas of River Basins of the United States, U.S. Dept. of Agriculture, Soil Conservation Service, 1970.

in roadside and drainage ditches. The most serious damage from wind erosion is the separation and removal of clay, silt, and organic matter from the soil surface. Relatively infertile sandy material is left behind. Areas in which wind erosion is most severe are mainly confined to the eastern two-thirds of the watershed, but the entire watershed area is somewhat affected by this type of soil erosion.

Flooding occurs along the Kankakee River and the lower reaches of the main drainage channels. The Kankakee River does not have a well-defined flood plain. Consequently, when the river overflows its banks, a considerable area is affected by the floodwaters. Most floodwater damage is concentrated in the western one-third of the watershed, roughly that area west of county road 300E. (See Project Map.)

The major drainage ditches have deteriorated to such a degree that in many places they provide inadequate outlets for field ditches and tile systems. Until recently there has been very little maintenance on any of the larger ditches since they were first constructed in the 1920's.

The soils in the watershed have been placed in three associations: the Maumee-Gilford association, the Morocco-Maumee-Brems association, and the Rensselaer-Milford association. (See Appendix D, Exhibit 6C.)

The watershed is within the Northern Lake and Moraine Region. This physiographic province is subdivided into several smaller units. One of these units, the Kankakee Outwash and Lacustrine Plain, is the subdivision in which this watershed is situated.* This nearly flat outwash and lacustrine plain is broken by occasional sand dunes. Except for changes which have occurred through the development of agriculture, the area has undergone relatively little change since the Wisconsin glaciation.

The surficial geology of the watershed consists chiefly of Pleistocene unconsolidated deposits of glaciofluvial sand, gravel, and silt with some occurrences of eolian (wind-blown) sand and recent alluvium. The thickness of the glaciofluvial deposits ranges from 100 to 200 feet. During the latter part of the Wisonsin glacial period, the Lake Michigan ice lobe on the north and the Erie-Saginaw ice lobe on the east contributed tremendous amounts of outwash to the Kankakee Basin. As the glaciers retreated, much of the outwash was deposited by streams. The flatness of the area and the absence of a well-defined drainage pattern created an extensive marsh or lake over the entire western part of Starke County. While the lake was in existence, it received sediment from various streams. The coarser particles were

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*Wm. J. Wayne, Thickness of Drift and Bedrock Physiography of Indiana North of the Wisconsin Glacial Boundary, Indiana Dept. of Conservation, Geol. Surv., 1956.

laid down as delta and channel deposits or were thrown up by wave action as beaches and islands or as sand bars along the shoreline. The finer particles were carried into the deeper, quieter waters and were deposited as layers of silt and clay.

As the lake filled with these sediments and drained away westward, some of the deposits were further sorted and reworked by the wind. The finer particles were blown away, and the coarser sandy material was piled high as sand dunes. At the extreme western end of the watershed, alluvium was deposited in broad areas by floodwaters from the Kankakee River directly over the old sand plain.

Devonian bedrock underlies the Pleistocene deposits. This bedrock consists of about 50 feet of Antrim Shale. Devonian and Silurian limestones underlie the shale and are continuous, as demonstrated by logs from oil test wells, at least to a depth of 700 feet.

The topography of the watershed is level to nearly level. The only relief occurs as scattered wooded ridges of dune sand trending southeast to northwest. Elevation ranges from about 670 MSL at the outlet of Bailey Ditch to 750 MSL at the extreme eastern end of the watershed.

Mean annual precipitation is 36 inches. The greater part of the total precipitation occurs in the spring and summer. Precipitation is lowest during the winter months. The total amount of rainfall for the driest year on record is 26 inches and for the wettest year, 46 inches.

The climate of Starke County is continental. It is somewhat modified by the proximity of Lake Michigan. Temperatures of 0^{o} F and below seldom last for more than 2 to 5 days. Long periods of hot weather seldom occur though occasionally temperatures of 95^{o} to 100^{o} are reached for 2 to 4 days in summer. Mean annual temperature, as reported at LaPorte in nearby LaPorte County, is 49^{o}. The maximum temperature recorded is 108^{o}, occurring in July, and the minimum is -21^{o}, recorded in February. Average date of the last killing frost in spring is May 1 and of the first in fall, October 5. The growing season is 156 days.

Currently there are no mineral extraction operations within the watershed. However, a few sand and gravel pits were once operative in the surrounding area. There is potential for development of sand pits in the watershed. The sand ridges that are scattered throughout the watershed might be utilized as a source for building sand. This dune sand is relatively free of any silt or clay sized particles and can be classified as clean sand.

Ground water is abundant within the watershed. The chief source of this water is the sandy outwash that comprises the Kankakee Aquifer. The water table is very close to the surface for the greater part of the year. Most domestic wells are relatively shallow, generally less than 50 feet deep. Except in an extremely droughty year, these wells provide adequate water for domestic needs. There are several deep wells within the watershed, some of which penetrate the local acquifer to a depth of 110 feet or more. Hardness of ground water, as measured in parts per million ranges from 100 to more than 300. Ground water increases in hardness from east to west through the watershed. The greater part of the watershed has ground water ranging from 100 to 200 in hardnesss. Adequate ground water is available from this acquifer and from the underlying porous limestones. The potential for ground water development is excellent. Yields to wells completed in sand and gravel may range from 250 to 750 gpm.

Bailey Ditch is an intermittent stream. It begins in the SE¼ of Section 1, T.33N., R.2W. From the source to U.S. 35, the channel has a top width of 12 to 30 feet, bottom width of 3½ to 10 feet, and depth of 2½ to 6 feet. Along much of this section, the channel banks have fairly heavy woody plant cover. Several small feeder ditches enter Bailey Ditch just east of county road 500E. Part of these smaller ditches have recently been reconstructed. From U.S. 35 to county road 300E, the channel has a top width of 25 to 50 feet, bottom width of 8 to 24 feet, and depth of 4½ to 7 feet. Local farmers have completed some recent reconstruction on the ditch from county road 300E to county road 50W. Along this section, top width ranges from 35 to 48 feet, bottom width from 13 to 20 feet, and depth from 7½ to 12 feet. West of county road 50W to the Kankakee River, Bailey Ditch has a top width of 42 to 50 feet, bottom width of 14 to 22 feet, and depth of 7 to 9 feet. Two lateral ditches with pumping stations enter Bailey Ditch just before the outlet into the Kankakee River. Total length of Bailey Ditch is 10.63 miles. Except for areas where recent reconstruction has been completed, most of the channel banks have vegetation consisting of fairly dense woody growth or heavy grass and herbaceous cover. In those reconstructed sections, the plant cover was removed from one side only.

Cox Ditch is an intermittent stream. It (lateral #1 on project map) begins near the intersection of county roads 700E and 200N. It flows due west for two-thirds of a mile then heads north and makes several other course changes from north to west through a wooded area. Along this wooded section, the channel is only 2½ to 4 feet deep and has a top width of 8 feet and a bottom width of only 3 feet. Many large trees are growing along the sides and in the bottom of the ditch. Once the channel leaves this wooded area, it flows through cropland for nearly the rest of its length. The direction of flow is predominately westward, although several course changes occur, from west to north to west, in the eastern and central parts of the watershed. Cox Ditch receives water from one small ditch in the extreme southeastern part of the watershed. This feeder ditch (lateral #2 on

project map) and a segment of Cox Ditch are currently being deepened and widened by local farmers. The area of this reconstruction is in Section 7, T.33N., R.1W. and Section 12, T.33N., R.2W. From the intersection of Cox Ditch and county road 200N to U.S. 35, the channel has a top width of 24 to 31 feet, bottom width of 11 to 16 feet, and depth of 5 to 8 feet. Along many sections of the channel in this area, there is a heavy growth of woody vegetation. From U.S. 35 to county road 100E, Cox Ditch has a top width of 25 to 39 feet, bottom width of 10 to 20 feet, and depth of 5 to 8 feet. There has been some recent channel reconstruction from county road 100E to the confluence of Cox Ditch and Bailey Ditch. Along this section of Cox Ditch, top width ranges from 34 to 40 feet, bottom width from 9 to 12 feet, and depth from 8 to 8½ feet. Much of the woody vegetation that is characteristic of the channel banks has been cleared from the north side of this reconstructed segment. Reconstruction was done from one side. Total length of Cox Ditch is 6.96 miles.

Newtson Ditch begins at U.S. 35 near the southern watershed boundary. It flows through cropland and is an intermittent stream for its entire length, about 5.8 miles. From U.S. 35 to county road 100E, the ditch has a top width of 27 to 49 feet, bottom width of 16 to 20 feet, and depth of 4 to 7 feet. From approximately 800 feet east of Range Road to its confluence with Bailey Ditch, new construction has recently been completed along Newtson Ditch. In this reconstructed section, top width ranges from 42 to 46 feet, bottom width from 12 to 22 feet, and depth from 5½ to 8½ feet. Newtson Ditch receives drainage from more feeder ditches than either Bailey or Cox Ditches. These feeder ditches are in Sections 6, 7, 8, 9, and 10 of T. 33N., R.2W. Most areas along the channel banks of Newtson Ditch have a dense cover of woody vegetation.

Ten small farm ponds are in the watershed. They range in size from one-tenth to three-fourths of an acre. A one-tenth acre pond is in the SE¼ of Section 6, T.33N. R.2W., near the New York, Chicago, and St. Louis Railroad. Another small pond about one-third acre in size is located on the east side of county road 325E in the SW¼ of Section 3, T.33N., R2W. There is a one-half acre pond on the east side of county road 200E in the SW¼ of Section 4, T.33N., R.2W. A three-fourths acre pond is in the NW¼ of Section 6, T.33N., R.2W. and is near Newtson Ditch. Near the center of Section 31, T.34N., R.2W. is a small pond of about one-third acre which lies just south of Bailey Ditch. Another pond is in the NE¼ of Section 33, T.34N., R.2W. It is just inside the northern watershed boundary and is approximately one-half acre in size. Two one-half acre ponds are in Section 7, T.33N., R.2W. One is in the SE¼, and the other is in the NW¼. In the eastern part of the watershed, there are two one-half acre ponds. One is in the NE¼ of Section 2, and the other is in the NE¼ of Section 11, T.33N., R.2W. All of these farm ponds are supplied by ground water and fluctuate with changes in the depth to the water table.

Land use in the watershed is as follows: cropland 82 percent or 9,910 acres; pasture 3 percent or 390 acres; woodland 4 percent or 480 acres; and other land 11 percent or 1,290 acres.

Drainage is needed throughout the watershed except on the sand hills. Irrigation would be beneficial to the eastern two-thirds of the area. Establishing windbreaks will help control soil blowing which is a hazard on approximately 8,880 acres. Vegetative cover is needed in critical areas where blowouts have formed.

Three wetland areas are within the watershed boundaries. A two-acre type 2 wetland is located just south of the mouth of Bailey Ditch. A type 3 wetland about one-fourth acre in size is located in the NW¼ NE¼ of Section 31, T.34N., R.2W. and is south of county road 400N. One hundred twenty acres which are subject to annual flooding are classified as type 1 wetland. This area is near the mouth of the Bailey Ditch and is below elevation 671.0 MSL.

Quantity of base flow at the mouth of Bailey Ditch is 1.41 cfs. Water quality is generally good throughout the watershed. The United States Geological Survey, Water Resources Division in Indianapolis, initiated a water quality assessment of the watershed in early May 1975.* On May 5 during a period of high spring base flow, the first of four seasonal samples was collected. Field water quality and stream flow measurements were made and samples collected for laboratory analysis for some or all of the following: common inorganic constituents, selected metals, nutrients, bacteria, insecticides, and certain fractions of the biological community. Further sampling was carried out on July 29, October 10, and November 25, 1975; and on January 23, March 5, and March 22, 1976. Water quality and analytical data are found in Appendix D, Exhibits 9A, 9B, 9C, and 9D.

Stream waters in the watershed are basically calcium bicarbonate types with slightly different levels of mineralization. Concentrations of dissolved iron in the watershed stream waters were below problem-causing levels, but dissolved manganese concentrations were equal to or above desired levels.

Temperature, pH, and dissolved oxygen content are typical of the time of year and existing flow conditions when sampling was conducted.

Nutrient concentrations, nitrate, phosphate, and organic carbon are typical for an agricultural watershed and should not be a problem with respect to public use. Nitrate concentrations are unusually low.

Fecal coliform and fecal streptococci bacteria concentrations in the watershed were very low, probably reflecting normal background levels.

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*A Water Quality Assessment of the Bailey-Cox-Newtson Watershed, Starke County, Indiana, USGS, Water Resources Division, Indianapolis, 1975 (Interim Report).

Insecticides present in bottom materials are typical of those found in an agricultural stream. The concentration of these insecticides is not high; however, it is an indication that persistent compounds have entered the waterways and thus have potential for accumulating in local biologic food chains. (See Appendix D, Exhibit 9C.)

Samples of the phytoplankton communities indicate a lack of organic enrichment. Phytoplankton communities were dominated by Navicula sp. and Nitzchia sp. at the sites sampled on May 5, while Navicula sp., Nitzchia sp., and Oscillatoria sp. were dominant on October 10. (See Appendix D, Exhibit 9D.)

Present and projected population

The 1970 census shows the population of Starke County as 19,280, a 7.6 percent increase above the 1960 population. The estimated population of the watershed is 700. It is estimated that the population of Starke County will double in the next fifty years. Estimation for the project area was not attempted. There are no minority residents in the watershed.

Economic resources

The watershed is agricultural, devoted to farming and associated uses. The agricultural area is under private ownership. Land in public ownership consists of public roads and 320 acres in the Starke County Airport.

Cash grain is the major farm enterprise. There are approximately 107 farms in the watershed. The average size farm is 120 acres with the average farming unit being about 135 acres.

Corn is the major crop grown, comprising 54 percent of the cropland. Soybeans comprise 27 percent of the cropland. The average yield is 95 bushels per acre for corn and 30 for beans.

Land values vary in the watershed. The average value of upland is $750 per acre, flood plain land is $500 per acre, and other problem areas are $400 per acre.

The Penn Central and the New York, Chicago, and St. Louis Railroads furnish rail transportation for the farm products. State Highways 8 and 39 and U.S. Highway 35 provide highway transportation and easy access to markets and service to the area. A good system of bituminous and all-weather gravel roads furnish easy access to these traffic arteries.

Unemployment is not a problem in the watershed. Approximately five percent of the farms use hired help or seasonal, part-time help. Off-farm employment is an important contributor to the disposable income of the area. Approximately 35 percent of the farmers are employed off

the farm 100 days or more per year. The median income of the rural farm population for Starke County, which is representative of the watershed, in 1970 was $8,322.*

The watershed is located in the Kankakee River Basin study area and in the Arrowhead Resource Conservation and Development (RC&D) project area.

Plant and animal resources

In the late 1800's as the agricultural possibilities of the area became evident, small drains were built in the higher lands. These drains discharged their collected water into the broad flat plains below. The ditching work continued toward the river as the need for better outlets grew. A vast network of lateral drains now cover the entire former "Grand Marsh." Most of the swamps have been drained as a result of the need for additional agricultural producing land. Populations of plant and animal species depending on the wetland habitat have been greatly reduced.**

The watershed contains approximately 82 percent cropland, 4 percent woodland, 3 percent pasture and hayland, and 11 percent other land. Other land includes roads, farmsteads, towns, lanes, fence rows, channels, wildlife areas, etc.

Ninety-three percent of the cropland acreage is in row crop production, 6 percent in production of small grains, and 1 percent in related meadow. Winter wheat is the predominant small grain. The greatest percentage of cropland is in the western portion of the watershed with less cropland to the east due to the droughty soil types.

A large portion of the pasture and hayland is located east of U.S. Highway 35 where droughty soil types are found. The remaining pasture and hayland is evenly distributed throughout the watershed west of U.S. Highway 35.

The forest land is all privately owned in small, farm based ownerships and located on upland sites.*** The forest land is predominantly hardwood with oak-hickory the major forest type. (See Appendix D, Exhibit 8C, for specific species in the watershed.) Stands are generally well stocked and are well distributed throughout the watershed. The stand size class is as follows: sawtimber--60 percent, poletimber--10 percent, and seedling and sapling size stands--30 percent.***

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*General, Social and Economic Characteristics, Table 137, U.S. Dept. of Commerce, 1970.

**Kankakee River Basin Main Report, Chapters III, IV, and V, February 1974--Draft.

***Forestland Plan Preliminary Investigation Report, Bailey-Cox-Newtson P.L. 566 Watershed, Starke County, Indiana, USDA Forest Service, November 1968.

Marketing of forest products is provided by a good federal, state, and county road system.*

The wildlife habitat value in the watershed is low because of the small amount of woodland. The dominate row-crop monoculture in this watershed reduces the carrying capacity of the area for total numbers of wildlife and the diversity of species.** The brushy and occasionally woody "edge" of the basin's waterways represent an important part of the available wildlife cover. These borders often represent the key wildlife habitat in many large acreages of land. The greatest numbers of wildlife are found in areas where different types of habitat merge. Diversity of habitat provides both food and cover that wildlife need to survive.

Fox population is good everywhere in the watershed except along the Kankakee River. Fox do well in brushy areas next to open fields. Muskrat population is fair throughout the watershed. Since few marshes now exist, muskrats are found mainly along ditches. The best ditches are those with structures for holding water and having vegetated banks. Waterfowl and shore bird populations are excellent in the lower and extreme upper reaches of Bailey Ditch with the remaining watershed being fair. A five-year study made by IDNR between 1966 and 1970 of the waterfowl species found in the northwestern quarter of Indiana and the percentages of each species found of the total are as follows:***

Species	Percent
Mallard	65
Black duck	12
Wood duck	6
Blue-winged teal	1
Green-winged teal	2
Miscellaneous dabblers	3
Divers	3
Canada goose	6
Blue and Snow goose	2

Raccoon and pheasant populations are good throughout the watershed. Deer population is excellent in the lower reaches and good in the upper reaches. Many of the trees along the channels provide excellent denning and nesting habitat for squirrel and wood ducks. Quail population is poor along the Kankakee River, fair west of U.S. Highway 35,

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*Forestland Plan Preliminary Investigation Report, Bailey-Cox-Newtson P.L. 566 Watershed, Starke County, Indiana, USDA Forest Service, November 1968.

**Monoculture in Agriculture: Extent, Cause and Problems, USDA Task Force Report, October 1973.

***Joseph E. Lamendola, Statewide Wildlife Surveys, Project No. W-25-R(S1)-3, 1972.

and good east of U.S. Highway 35. Cottontail rabbit population is fair to good.* (See Appendix D, Exhibit 8B, for additional mammals occurring in the watershed and vicinity.)

The IDNR information shows that of all hunting efforts in the area rabbits supply about 37 percent; squirrel, 18 percent; quail, 13 percent; pheasant, 15 percent; migratory birds, 8 percent; and other hunting, 9 percent.

Many species of songbirds utilize the woody cover which serves as a safe travel lane through large areas of cropland. Tall trees are nesting places for the great horned owl, redtailed hawk, Baltimore oriole, scarlet tanager and many others. Dead and hollow trees invite flickers, red-headed woodpeckers, bluebirds, sapsuckers, house wrens and other species of birds. Shrubby border and fence rows attract cardinals, mockingbirds, catbirds, cedar waxwings, brown thrashers, indigo buntings, goldfinches, song sparrows, vireos and chipping sparrows. (See Appendix D, Exhibit 8A, for other species identified in the watershed and vicinity.)

The sport fishing in the watershed is limited. The lower two miles of Bailey Ditch receive the heaviest use for sport fishing. There are areas on all three ditches used by northern pike for spawning. The U.S. Fish and Wildlife Service and IDNR made five different fish shocking studies on the main channels in the watershed downstream from U.S. Highway 35 in 1975. Twenty-five species of fish were collected during the study of which the following were found the most often: black bullhead, spotted sucker, northern pike, white sucker, bluegill, green sunfish, carp, black crappie, largemouth bass, and grass pickerel. The upper reaches of Bailey, Cox, and Newtson dry up in the summer and maintain no permanent fish population.**

Public access to existing resources is available only by permission of the landowners or at bridge intersections.

No rare or endangered plant or animal species have been identified in the watershed as being dependent upon conditions unique to this watershed. The American peregrine falcon, Falco perigunees anatum, migrates through Indiana and the young southern bald eagle, Haliaeetus leucocephalus, occasionally visits parts of the state.

The badger, Franklin ground squirrel, plains pocket gopher, and star-nosed mole are peripheral species. A peripheral species is one whose occurrence in Indiana is at the edge of its natural range and/or which is rare or endangered within the state although not in its range as a whole.

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*An Appraisal of Potential for Outdoor Recreational Developments in Starke County, Indiana: Prepared by the Starke County Soil and Water Conservation District, 1971.

**Biology Survey and Report, U.S. Dept. of Agriculture, Soil Conservation Service, May 1975.

Because a large percentage of the area has been cleared and drained for agricultural crop production, many of the native species that were dependent on large blocks of natural forest and wetland are gone. In their place are species which were able to adapt to an agricultural situation.

Recreational resources

The following recreational activities are rated as having a high potential for development in Starke County: canoe and pack trips, sports area games, bicycling, picnicking, warm water fishing, waterfowl hunting, and shooting preserves.*

There has been very little interest shown by the local people in developing recreational resources.

Archaeological, historical and unique scenic resources

There are no entries for Starke County, Indiana, in the National Register of Historic Places.** The Kankakee State Fish and Game Area and Bass Lake are listed in "Natural Areas in Indiana and their Preservation."*** The Indiana Guide to Historic Places lists Koontz Lake, in addition to those previously mentioned.**** None of the sites listed in these references are located within the watershed; however, local landowners consider the "Indian Hill Sand Blowout" and "Oak Grove Cemetery" as historical or unique areas. Neither area will be affected by the planned project. There are no known sites eligible for inclusion in the National Register of Historic Places.

The State Historic Preservation Officer, Division of Nature Preserves (IDNR) and Starke County Historical Society were contacted; but no additional sites were identified.

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*An Appraisal of Potentials for Outdoor Recreational Developments in Starke County, Indiana: Prepared by the Starke County Soil and Water Conservation District, 1971.

**National Register of Historic Places: National Park Service, February 1975.

***Natural Areas in Indiana and Their Preservation: Department of Biology, University of Notre Dame, May 1970.

****Indiana Guide to Historic Places: Indiana Department of Commerce, 1973.

An archaeological study conducted by the Indiana Historical Society was completed in May 1975.* Following is a summary of the study:

The high areas in the topography are represented by very light brown sand and could be seen literally as islands standing above and surrounded by the waters of the marsh throughout most of an average year in the prehistoric and recent historic past. Though an occasional artifact may be turned up by the plow in the low dark soil areas, the concentrations of materials suggestive of a prehistoric occupation are found exclusively on these "islands" or hills of light brown sand. Four sites were found within the temporary easement and could possibly be disturbed. All four sites were considered significant enough to be retained in their natural state or be salvaged.

Past and present surveys suggest that the sand "islands" were occupied intermittently over a long period of time in the prehistoric past. Diagnostic materials in the hands of local collectors suggest that the earliest regular usage of these sites began in the early Archaic Period ca. 6000 B.C., and extended right up to the time of European contact in the early Historic Period.

The nature of the sites' locations (islands in a large marsh area) and the nature of the debris scattered on these sites (small clusters of materials scattered over the entire island) would suggest that these sites were occupied by small groups of prehistoric peoples for brief periods of time. The exploitation of this marsh area appears to have been regular but for brief periods of time over a long period of some 7,000 to 8,000 years. The exact nature of this marsh exploitation is as yet unknown due to the lack of intensive excavation in the area.

The cultural relationships of the Kankakee River are much closer to the materials of the lower Illinois River Valley, 300 or 400 miles away, than they are to the upper Wabash River drainage only a few miles to the south. The importance of the sites in this area is two-fold. First, an intensive investigation of the area may help us understand the processes of culture change in time and culture movement in space so that we could begin to explain why this above-mentioned positive correlation of culture area boundary and natural area boundary is so nearly the same. Secondly, to fully understand the ecological adaptation of the prehistoric inhabitants of the lower Illinois River Valley, it will be necessary to understand why they so regularly exploited the resources of the marsh and swamp areas of the headwater area of their watershed.

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*Archaeological Investigation and Report of the Bailey-Cox-Newtson Watershed: Indiana Historical Society, May 1975.

Soil, water, and plant management status

The present trend in land use is essentially stable with a slight decrease each year in cropland with an accompanying increase in pasture, forest land, and other land. Anticipated changes during the installation period of the project are summarized below:

	Cropland	Pasture	Forest Land	Other Land
Present	9,910	390	480	1,290
Future	9,790	460	500	1,320
Change	-120	+70	+20	+30

The change in land use as indicated above is attributable mainly to economic and technical conditions rather than project action. The major factors involved in the change are: the high cost of land, equipment, labor, and capital.

Adequate forest fire protecton is provided for the forest land by the IDNR, Division of Forestry, in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Forest Fire Control Program.

There are 107 farms in the watershed and 22 (20 percent) of the farms have conservation plans with the SWCD.

Acres and percentages of land considered adequately treated by land use are: 1,760 acres cropland, 18 percent; 80 acres pasture, 38 percent; 160 acres forest land, 55 percent; and 100 acres other, 36 percent. This represents 2,100 acres which comprise 20 percent of the total land needs of the watershed.

Conservation practice units needed in the watershed and percent applied on the land are as follows:

Practice*	Practice Units Needed**	Percent Applied
Stripcropping	560 Ac.	00
Grade Stabilization Structures	45 No.	18
Conservation Cropping System	11,506 Ac.	32
Crop Residue Use	10,265 Ac.	36
Subsurface Drains	261,000 Ft.	31
Drainage Field Ditches	62,400 Ft.	42
Pasture and Hayland Management	131 Ac.	00
Ponds	5 No.	40
Pasture and Hayland Planting	153 Ac.	28
Tree Planting	10 Ac.	50
Livestock Exclusion	281 Ac.	56
Woodland Improvement	50 Ac.	00
Wildlife Upland Habitat Mgmt.	175 Ac.	00
Field Border	3,300 Ft.	00
Hedgerow Planting	6,200 Ft.	00
Field Windbreak	9,300 Ft.	00
Critical Area Planting	10 Ac.	00
Minimum Tillage	6,556 Ac.	30

Cost sharing for some conservation practices is available through the Agricultural Stabilization and Conservation Service which administers the Agricultural Conservation Program.

Adequate local funds are available for applying needed individual farm land treatment practices. Also, there is no shortage of local contractors to apply conservation practices.

The watershed is serviced by the SWCD which provides technical assistance to landowners and operators in the preparation of conservation plans and the application of land treatment measures.

Projects of other agencies

The United States Department of Agriculture is presently conducting a comprehensive Type IV river basin investigation and survey of the Kankakee River Basin in Indiana. Completion of the study is scheduled for November 1976. Bailey-Cox-Newtson Watershed is a part of this study.

There are no other water resource development projects in operation, or being considered by other agencies or groups that would affect or be affected by the installation of measures proposed in this plan.

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*Exhibit 1.

**Practice units on the land and planned for completion during project installation. Appropriate practices may be substituted for those listed as conditions and technology change.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and water management

Many areas of the watershed now under cultivation have soils with erosion, drainage and/or droughty limitations. The ability of these soils to sustain efficient production depends on the establishment and maintenance of needed conservation measures (see Appendix D, Exhibit 2).

Flooding and drainage are problems on approximately 9,310 acres. Of this area, 2,810 acres are subject to flooding. Damaging effects of the drainage problem is evidenced through impaired root and plant growth, increased disease, greater competition from weeds, reduced crop quality and delayed field work. Drought damage occurs during periods of low rainfall and results in decreased yields on approximately 7,700 acres. Low economic returns as a result of these problems do not permit the landowner or operator to apply management for top efficiency.

Overall economic capabilities of landowners and operators present no limitation to application of conservation practices. There is no need for additional conservation contractors.

There is a continuing need for information and education programs to effectively reach and motivate the landowner and operator who must carry out the land treatment measures.

Floodwater damage

The flood problem in the watershed is linked to high flows of long duration on the Kankakee River. Normal outflow from the watershed during these periods is restricted, thereby causing high water levels to be built up and maintained in drainage ditches throughout the area. Flooding occurs from seepage through levees, concentrated local rainfall, and lateral water movement through permeable soil layers. Flooding begins at about the 0.5-year frequency storm. The average annual acres flooded without project are 1,990 acres on the Bailey Ditch, 623 acres on the Newtson Ditch, and 232 acres on the Cox Ditch.

The overall problem is increasing as sediment encroaches further on existing channel capacity of the Kankakee River. Occurrence of floods is concentrated in the period, October through May, with few events reported in the intervening period.

Effects of the problem are experienced yearly and are evident in reduced crop yields and crop quality and increased production cost. Yield reduction arises through interruption in the timing of normal farm

operations. Excess moisture and discoloration of the crop lower its acceptability in the market; whereas, increased wear of farm machinery, added expense for replanting, and lengthened time requirements for performing necessary farm operations increase the overall cost of growing the crop.

Corn is the predominant crop in the flood plain with a lesser amount of soybeans. There are approximately 35 landowners affected by out-of-bank flooding. High water in the flooded area has a limiting effect on septic systems.

Erosion and sediment damage

The only soils in the watershed subject to appreciable water erosion are the Plainfield soils. Most areas of Plainfield soils are wooded, and soil losses in these areas are negligible. About 64 acres of Plainfield soils are used for crops. Slopes range from 2 to 6 percent. The soil loss on the cropped acreage is 3.25 tons/acre/year, as calculated using the Universal Soil Loss Equation. This amount is well within the soil loss tolerance of 5 tons/acre/year for Plainfield soils.

The hazard of soil loss due to wind erosion is a major concern in the watershed. Approximately 20 acres of blowouts (depressions excavated by wind) are in the watershed. These blowouts are formed in soils that have inadequate plant cover. Sediment transported by wind damages young crops and is deposited in road ditches and drainageways. Maumee, Morocco, Brems, and Plainfield soils are very susceptible to wind erosion (see General Soil Map, Appendix D, Exhibit 6C).

Field examination indicated that erosion and sediment damages were not severe enough to warrant a detailed economic and physical evaluation.

Sediment yields are low. The average annual sediment yield from the entire watershed is estimated at 118 tons/year. With the installation of the project measures, sediment yields may be reduced to an estimated 26 tons/year.

Drainage problems

Agricultural drainage problems exist on approximately 6,500 acres due to inadequate channel depth, capacity, and restricted outflow during high stages of long duration on the Kankakee River. Open and closed drains are restricted during floods. The most significant problems are recurring patterns of drainage impairment and flooding which occur throughout the growing season. Damaging effects are expressed through impaired root and plant growth, increased plant disease, greater competition from weeds, reduced crop quality, and delayed field work.

Due to the existing flooding and drainage problems, crop production costs are higher and crop yields are lower when compared with production on land without these problems. Thus, less maintenance, labor, and material are applied by landowners and operators in the problem areas. Average annual yields in the area affected by poor drainage outlets are reduced by an estimated 26 bushels per acre for corn and 12 bushels per acre for soybeans.

The lack of adequate drainage outlets in the lower reaches of Bailey-Cox-Newtson has resulted in a large portion of these drains becoming inoperative. In some sections, drains are now inadequate for either passage of floodwater or to serve as suitable drainage outlets.

The most severely affected problem areas studied are scattered surface depressions and low areas. Storm runoff concentrations in these areas remain for prolonged periods of time. Crop yields are greatly reduced, and complete crop failure is frequently a result of prolonged ponding.

Plant and animal problems

The watershed was originally part of the "Grand Marsh" in the late 1800's. Most of the swamps have been drained resulting in only a small fraction of the original "Grand Marsh" remaining today. Much of the plant and animal species depending on the wetland habitat no longer exist in this area. The remaining forest, wetland, pasture, wildlife, and recreation land provides only fair permanent cover for wildlife. Approximately 9 percent of the watershed is presently covered with woody vegetation. This 9 percent woody vegetation includes the forest land and about 50 percent of the other land which has woody cover.

Since 82 percent of the watershed is cropland, the wildlife populations will be substantially influenced by the agricultural land use and management practices. Farm ponds, wildlife habitat development and other vegetative erosion-control practices are beneficial to wildlife existence.

The number of individual woodlots and canopy cover increased while the acres of woodland, average woodlot size, and percent of woodlots with shrubs decreased from 1937 to 1965. Miles of fence rows decreased 25 percent from 1935 to 1965.*

The hydrologic condition of the forest land varies from poor to fair. The forest land is in a generally poor condition either because it was formerly cleared land which has reverted to trees or it has been

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*Preliminary Investigation Report for Bailey-Cox-Newtson Watershed, Starke County, Indiana, U.S. Department of Agriculture, Forest Service, November 1968.

abused through poor management such as poor logging practices, grazing, and fires. This condition has contributed to an increase in the frequency of flooding, erosion, and sediment damages.

Although only 4 percent of the watershed is forested, it is important for this portion of the land to receive treatment if the overall condition is to be improved.

Most of the forest land is, and has been, moderately grazed by cattle and hogs in the past 5 years. Local markets for veneer and sawlogs are good, but are generally lacking for most other forest products.*

Backwater flooding occurs in lower reaches several times annually and prevents such ground nesting species as quail and rabbits from developing populations of great importance.

Water quality problems

Water quality is generally good for agricultural use. Dissolved phosphate was normal for an agricultural watershed, but dissolved nitrate concentrations were unusually low. Insecticide concentrations in the stream bottom materials are not high. (See Appendix D, Exhibit 9C.)

Concentrations of dissolved manganese are close to problem causing levels but should not be considered alarming. The manganese is associated with iron and is found in small deposits throughout the watershed. The manganese enters the surface water through ground water seepage. Black stain is noticeable; however, no odor or taste is associated with existing concentrations.

A detailed account of water quality is presented in the Watershed Resources--Environmental Setting, Physical Resources section.

Economic and social problems

The watershed is not considered an economically depressed area. This area is one of the better producing areas in Starke County.

Unemployment is not a problem in Starke County. The farms in the watershed are family farms. Off-farm employment is an important contributor to the disposable income of the area. Approximately 35 percent of the farmers are employed off the farm 100 days or more per year. Approximately five percent of the farms use hired help or seasonal, part-time help.

There is an increasing need for sewage and waste disposal in the watershed with the development of small residential areas, small manufacturing and the new airport.

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*Preliminary Investigation Report for Bailey-Cox-Newtson Watershed, Starke County, Indiana, U.S. Department of Agriculture, Forest Service, November 1968.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

The watershed is developed primarily for use as cropland and pasture. There is a small amount of residential use other than for landowner and operator.

The watershed has made a slight gain in population over the period 1960-1970. While there is a consistent loss of farm population, the gain is attributed to an influx of non-farm residents.

The Starke County Area Plan Commission has developed a land use plan for Starke County, Indiana. The watershed is zoned agricultural with the exception of two areas zoned I-2, (Heavy Industrial), and the small town of Brems. All structural works of improvement under the PL-566 program would be done in the area zoned as agricultural. The project proposals are not in conflict with any other proposal, and they enhance present land use.

ENVIRONMENTAL IMPACTS

Conservation land treatment

The application of planned land treatment measures will bring an additional 8,250 acres under adequate treatment. The combined effect of applying the needed conservation measures will reduce the movement of soil through wind erosion and thereby reduce maintenance requirements of drainage and roadside ditches.

Removal of surplus water through installation of subsurface drains, drainage field ditches, and drainage mains and laterals will improve 4,100 acres of cropland with a wetness limitation. Reduced production costs, improved crop quality, and increased yields will increase the efficiency of farm enterprises.

Pasture management practices to be applied on 130 acres will improve the overall quality and production of pasture areas. Such areas, when properly treated and managed, complement the overall farm operation, contributing significantly to farm income with a minimum of erosion.

Creation of a good humus layer on forested areas will reduce runoff and erosion. Approved cultural operations and livestock exclusion from forest land will improve the overall quality of future forest land production as well as increase the quantity of production.

Many species of wildlife will benefit from vegetative land treatment measures that contribute to the quality of wildlife habitat. Some of these measures are stripcropping, crop residue management, pasture and hayland planting, pasture and hayland management, tree planting, critical area planting, wildlife habitat management (upland and wetland), and livestock exclusion.

Structural measures

The beneficial and adverse environmental effects are closely related to periods of pump operation and periods of gravity outlet conditions. The typical periods are shown below:

Period	Dates	Pumps	Gravity Gates
1	Jan. 1 to March 15	Off	Open
2	March 15 to June 15	On	Open & Closed
3	June 15 to Sept. 15	Off	Open
4	Sept. 15 to Dec. 1	On	Open & Closed
5	Dec. 1 to Dec. 31	Off	Open

It is estimated the pumps will be running 30 percent of the time during the spring of the year when northern pike use the channels for spawning. Their spawning will be reduced by restricting adult migration through the pump station and by the fluctuating water level on the channel bank vegetation which may destroy spawn. The structures for water control will destroy a portion of the vegetation on the channel banks which northern pike use for spawning habitat. A 14-acre area will be used between the dike and the river for northern pike spawning.

By removing surface water in the spring on cropland, the waterfowl resting areas will be reduced. The pump station will be constructed to permit 44 acres to flood from the time fall harvest is completed until the pumps are started in the spring.

The planned channel work will temporarily disturb fish and wildlife habitat in and along the channel. This disruption will be limited to mainly the constructed side of the channel excavation portion which is about 19 miles. Only minor disturbance will take place on the unconstructed side and the selective clearing sections. Thirty-three acres of woody vegetation along the channel will be destroyed, and 39 acres will be planted along the channel, by the spawning area, and between the dike and river.

One sided construction will preserve the vegetative canopy. Wildlife markers will be installed to protect the permanent easement area for wildlife use.

Downstream water pollution (turbidity) will be reduced by the construction of sediment traps.

Modifications of the 11 culverts and bridges will temporarily disrupt established local traffic patterns. These modifications will be scheduled at different times during construction to facilitate re-routing of traffic.

The channel work will help provide joint flooding and drainage relief on nearly 2,317 acres, flooding relief on 2,810 average annual acres, and drainage relief on 4,183 acres. This will provide about a three-year level of protection from flooding. The structures for water control will prevent excessive drainage in areas adjacent to the channel where deepening is required and will control the subsurface water level to provide for better conservation of summer rains. Fish will be able to survive in the middle and upper reaches of the channel in the summer months due to the storage of surface water in the channel when the structures are operational. For details of typical structures, see Appendix D, Exhibits 5B-1 and 5B-2.

Economic and social

During the period of construction, approximately 33 man-years of labor will be required for installation. During the life of the project, about 0.5 man-years will be required annually for the operations and maintenance.

The quality of living for the beneficiaries of the project should be improved because of the benefits realized from the project. The average benefit for eighty farm units will be approximately $1,340 annually.

Secondary effects generated by the project will be through increased demands on local suppliers of goods and services and on local processing, transporting, and marketing facilities.

Total average annual benefits are estimated to be $156,250, which include flood damage benefits of $48,100, more intensive land use benefits of $12,060, agricultural water management (drainage) benefits of $46,870, and local secondary benefits of $49,220.

The ratio of average benefits of $156,250 to the average annual cost of $87,850 is 1.8 to 1.0 (see Appendix A--Comparison of Benefits & Cost).

Favorable environmental effects

The following project effects are considered favorable to the total environment:

1. Adequately treat 8,250 additional acres, bringing the total to approximately 10,350 acres (86 percent of the watershed).

2. Provide soil erosion control on minor areas subject to water erosion and major wind erosion areas.

3. Provide flood relief on 2,810 average annual acres, joint flooding and drainage relief on 2,317 acres, and drainage relief on 4,183 acres.

4. Preserve four known archaeological and historical sites.

5. Provide livestock exclusion along the channel rights-of-way.

6. Protect 70 acres of woody habitat within the permanent easement on the unconstructed side.

7. Plant 91 acres of grasses and legumes on the disturbed areas.

8. Protect 240 acres of permanent easement for wildlife habitat.

9. Improve summer fish habitat upstream of structures for water control.

Adverse environmental effects

The following project effects are considered adverse:

1. Temporary disturbance to fish habitat during construction.

2. Damage to unconstructed side of channel during installation of surface field ditches, grassed waterways, and grade stabilization structures.

3. Increased noise, air, and water pollution (sediment and turbidity) during construction.

4. Temporary disruption of local traffic patterns during construction.

ALTERNATIVES

Accelerated conservation land treatment only

An accelerated land treatment program will reduce erosion, thereby reducing sediment contribution to Bailey, Cox, and Newtson Ditches. Reduced erosion and sedimentation will improve soil and stream conditions. Livestock exclusion from woodland will increase production and protect wildlife habitat. Other woodland, cropland, and pastureland treatment measures will improve hydrologic conditions. Many species of wildlife will benefit from these vegetative land treatment measures.

This alternative will limit income to landowners due to continued flood, drainage, and drought damages. Floodwater damages would remain nearly identical to present conditions. Drainage will remain unimproved and continue to deteriorate and cause increased damages as suitable outlets would not be available. Soils with moderate to severe drought limitations will remain unimproved and continue to cause decreased crop yield.

The estimated installation cost is $372,500.

Channel excavation (enlargement including deepening where necessary); 1.2 miles of new channel construction; pump station at the watershed outlet; dike construction; structures for water control; and 2,600-acre irrigation system along with accelerated land treatment.

This alternative includes channel excavation on 25.0 miles of existing channel and 1.2 miles of new channel construction to provide an adequate outlet where drainage is now impaired and reduce future maintenance; installation of a dike and associated pumps at the watershed outlet to provide flooding and drainage relief; structures for water control to prevent excessive drainage and control subsurface water level to provide for better conservation of summer rains; and an associated 2,600-acre irrigation system to provide needed moisture to droughty soils. The land treatment benefits, level of protection, and environmental effects would be similar to the planned project. The estimated total project installation cost is $1,970,090.

Channel excavation (enlargement including deepening where necessary); 1.2 miles of new channel construction; pump station at the watershed outlet; dike construction; and structures for water control along with accelerated land treatment.

This alternative is identical to the above except for the 2,600-acre irrigation system. The estimated total project installation cost is $1,697,600.

Minor channel work (debris and flow-impeding brush removal); pump station at the watershed outlet; and dike construction along with accelerated land treatment.

Channel work would be limited to removal of brush and debris throughout Bailey, Cox, and Newtson Ditches. Installation of the dike and associated pump station at the watershed outlet will provide flooding and some drainage relief. This alternative would minimize destruction of wildlife habitat along the channel and the effects of construction on stream fishery. Environmental effects of the dike and pump station would be the same as in the planned project. Land treatment benefits will be similar to those found in the planned project. The estimated total project installation cost is $789,970.

No PL-566 project--local action only.

The present land treatment program will in time reduce sediment contribution to Bailey, Cox, and Newtson Ditches; however, floodwater, drainage, and droughtiness will continue to cause damages. The estimated net annual monetary benefits that would be foregone by not implementing the planned project are $68,400.

Drainage and flooding have been a concern of the local people for several years. Small drains were first constructed in the late 1800's as the agricultural potential of the area became evident. Larger ditches were constructed in the 1920's as the need for better outlets increased. Within their economic resources, landowners will continue a piecemeal effort to provide drainage and flood protection to agricultural lands. This effort will usually be carried out with little regard for environmental safeguards.

In addition to the monetary loss, a "no project action" would preempt the opportunity to encourage landowners, through a federally assisted project, to conform to a comprehensive land and water management program with the proper balance of environmental considerations.

Dike construction, lateral water collection trenches, pump stations, and accelerated land treatment.

Dikes would be constructed from the river upstream on both sides of the Bailey, Cox, and Newtson Ditches to an elevation of 676.0 MSL. Lateral water collection trenches would be installed on cropland having a flooding problem. Pumping stations would be installed at these trenches to pump the water into the ditches. The estimated total project installation cost is $1,620,400.

This alternate would minimize destruction of fish and wildlife habitat. Spawning grounds would be preserved as the Bailey, Cox, and Newtson Ditches would remain in their existing free-flowing condition. Kankakee

River backwater areas would be retained for waterfowl use. Backwater flooding from the Kankakee River would continue, while some relief from flood and drainage damages would be afforded other cropland areas.

Channel excavation, selective clearing, dike construction, pump station, structures for water control, waterfowl area, fish spawning area, and accelerated land treatment.

This alternate would include all the work in the planned project plus the purchase of a 50-acre tract of land to be used as a northern pike spawning area and waterfowl area. The area to be purchased lies on the land side of the dike, south of the Bailey Ditch, and west of county road 125 West. A dike would be constructed around the area, and the pumping station would be constructed to permit reversal of the pumps to flood the area during winter and spring. Fifteen acres of this tract would be constructed for both waterfowl use and as a spawning area, and the remainder would be designed for waterfowl use only.

This alternate would replace both the spawning grounds disturbed by channel excavation and the migrating waterfowl resting area damaged by the dike construction. A farm unit would be disrupted, and 50 acres of cropland would be lost by this alternative.

The estimated total project installation cost is $1,570,410.

SHORT-TERM VS. LONG-TERM USE OF RESOURCES

Land use is expected to remain reasonably stable with a minor decrease in cropland and corresponding increases in pasture, forest, and other land. The entire watershed is agriculturally oriented, being 82 percent cropland. The area is best suited for cropland, pasture, and woodland. The Maumee, Gilford, Milford, and Rensselaer soils are predominant and the most productive in the county. The project will make possible the most efficient use of this valuable resource. The project is considered compatible with these trends.

The project will provide relief from erosion, sedimentation, drainage, and flooding problems within the watershed. Drought related problems will be partly corrected through the installation of structures for water control. Also, project measures will allow individual landowners to install irrigation systems in the future. With the specified operation and maintenance program, the structural measures will function over the designed project life or longer.

The project will reduce options for long-term use of the 240 acres to be included within the permanent easement area along the channels. This area will be totally committed to other land.

The project is compatible with projected future long-term uses of the land, water, and other natural resources as outlined in the Kankakee River Basin Report now in draft form. The selected plan, including the dike, was adopted from the alternatives presented from the Kankakee Study.

Within the Upper Mississippi Subregion, the status of the watershed activity is as follows: (Indiana portion) authorized for construction but inactive--1; authorized for planning--1; applications received and awaiting further action--7.

The Bailey-Cox-Newtson Watershed has an area of 18.86 square miles which comprises 0.2 percent of the Upper Mississippi Subregion. The watershed comprises only 0.4 percent of the Kankakee River Basin watershed. Therefore, any effect it would have on the subregion is considered negligible.

Cumulative environmental effects within the watershed will include the improvement of the quality of wildlife habitat through installation of land treatment measures.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The funds required for the project are $1,470,560 including costs for land and labor.

The energy expended for project installation is irretrievable.

The total permanent easement consists of 240 acres. Approximately 149 acres of the permanent easement will be altered during channel improvement. The remainder of the permanent easement will be preserved in its natural state. Before and after land usage within that portion of the permanent easement being altered is as follows: (Bailey, Cox, and Newtson Ditches)

Land Use	Present (ac.)	Future (ac.)
Cropland	39	--
Forest land	0	--
Grassland	10	--
Other land	100	149

These conversions are to be committed for the project life.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

General

Local action to provide relief from flooding, poor drainage, wind and sheet erosion, and yield reduction on droughty soils was initiated by conducting an educational and informational meeting, May 9, 1967.

About 50 percent of the watershed landowners attended the meeting to express interest and elect the Steering Committee. Records indicate that the Service was contacted at that time to study the needs and provide a solution for the problems of water management.

An application for planning assistance under PL-566 was made July 11, 1967. The application was approved by IDNR, September 21, 1967.

A preliminary investigation report was initiated in late 1967 and completed February 1969. The report emphasized: land treatment measures; 24.7 miles of channel improvement for flood prevention, drainage, and irrigation; a dike along the Kankakee River; structures for water control along the ditches; and a pump station.

To carry out the general formulation of the preliminary investigation report, a petition to form the Bailey-Cox-Newtson Conservancy District was initiated in December 1971. With the Natural Resources Commission approval and after the final hearing at the Starke County Circuit Court in October 1972, a conservancy district was organized.

USDA planning authorization was requested February 1975 and was received May 1975. A meeting was held in Knox, Indiana, March 19, 1975, between the Conservancy District and the Service to discuss the watershed's relationship with the Kankakee River Basin Study. The Conservancy District was informed that an environmental assessment of the watershed was going to be conducted. Cooperation and assistance of the Conservancy District was requested in completing necessary inventories.

The following agencies, groups, and organizations were contacted and given an opportunity to participate in the preparation of the environmental assessment.

University of Notre Dame
- Department of Geology
- Department of Biology

Purdue University, Department of Geosciences
Valparaiso University, Department of Geography
Ball State University, Natural Resources Department
Indiana University, Department of Recreation and Park Administration
Environmental Protection Agency
United States Department of Agriculture, Forest Service
United States Department of Interior
- Fish and Wildlife Service
- Geological Survey, Water Quality

Upper Mississippi River Basin Commission
Starke County Historical Society
Indiana Historical Society
Indiana Farm Bureau, Inc., Natural Resources Department
Indiana Conservation Council, Inc.
Indiana Department of Natural Resources
- Director (State Historical Preservation Officer)
- Division of Water Pollution Control
- Division of Air Pollution
- Division of Water
- Division of Outdoor Recreation
- Division of Nature Preserves
- Division of Fish and Wildlife
- Division of Forestry

National Speleological Society
Amos W. Butler Audubon Society
Izaac Walton League of America
Hoosier Group Sierra Club

Information received from the agencies, groups, and organizations was used to determine environmental impacts on the various project alternatives.

The State Historic Preservation Officer has concluded that none of the sites identified during the archaeological investigation are eligible for inclusion in the National Register of Historic Places.

Biology field reviews were conducted during the preparation of the fish and wildlife inventories. Representatives of U.S. Fish and Wildlife Service, IDNR, Division of Fish and Wildlife; and the Service participated in these reviews.

On June 12, 1975, a public meeting was held in Knox, Indiana, at which time Service personnel presented project alternatives and anticipated environmental impacts.

During the review stage for the first draft to the plan and environmental impact statement, the following groups or agencies were asked to review and comment on the documents:

United States Department of Agriculture, Forest Service
United States Department of Interior, Fish and Wildlife Service
Indiana Department of Natural Resources
Bailey-Cox-Newtson Conservancy District
Starke County Soil & Water Conservation District
Starke County Drainage Board

A public meeting was held on February 19, 1976, in Knox, Indiana, to discuss the engineering, economic, and environmental aspects of the planned project.

Discussion and Disposition of each Comment on Draft Environmental Statement

Comments were requested from the following agencies, groups, and individuals:

Department of the Army
Department of Commerce*
Department of Health Education and Welfare
Department of the Interior*
Department of Transportation
Environmental Protection Agency
Office of Equal Opportunity, USDA*
Federal Power Commission*
Upper Mississippi River Basin Commission
Indiana Department of Natural Resources (For Governor)**
Indiana State Clearinghouse
Kankakee-Iroquois Regional Planning Commission
Natural Resources Defense Council*
Friends of the Earth*
National Wildlife Federation*
National Audubon Society*
Environmental Impact Assessment Project*

*Did not respond.

**The Director of IDNR is designated as the State Historic Preservation Officer. Comments from him are considered as encompassing both responsibilities.

Summary of Comments and Responses

Each issue, problem or objection is summarized; and a response given on the following pages. Comments are serially numbered. The original letters of comment appear in Appendix C.

Department of the Army

1. Comment: An Army Corps of Engineers permit under Section 404 of the F.W.P.C.A. of 1972 will be required for this project.

   Response: An application for a permit will be submitted by the Conservancy District prior to construction.

2. Comment: What effects will the subject project have on the three wetland areas described on page II-22?

   Response: The implementation of the project will not result in an adverse effect on any of the wetlands in the watershed.

3. Comment: Additional adverse impacts stated earlier in the Statement should be restated on page II-40, Adverse environmental impacts.

   Response: As set forth in revised SCS guidelines, only the impacts which have not been mitigated are to be recognized as adverse effects. The "impacts" listed on page II-40 are the net adverse effects as a result of the project.

Department of Transportation

1. Comment: The manner in which the Abbreviated Environmental Quality Plan is presented in Part II of the Addendum is confusing. It gives the appearance of being the plan proposed except as noted on page I-23 which indicates the plan is hypothetical and not to be installed. It would appear this could be presented as an alternative plan and discussed as such.

   Response: The Abbreviated Environmental Quality (EQ) Plan was developed in accordance with phase-in procedures adopted by the Water Resources Council. Because of the limited time for the phase-in plans, problems' needs and solutions described in the abbreviated EQ Plan were not inventoried in sufficient detail to be considered as a viable alternative. The EQ Plan addressed different types of problems from those described in the EIS, and therefore is not an alternative means of achieving the effects described in the selected plan.

2. Comment: Page II-23, paragraph 5, under Economic Resources, lists transportation facilities available within the watershed area. However, the impacts of the proposed watershed project on these facilities were not discussed.

   Response: The project will not induce flood or drainage damage to roads and bridges nor provide significant benefits to these facilities. A discussion of the impacts on local traffic patterns has been included on page II-38.

Environmental Protection Agency

1. Comment: Part of the project design is to retain water within portions of ditches during the summer months to provide irrigation.

   Response: The water stored by the structures for water control will not be used for irrigation. The structures will prevent excessive drainage in areas adjacent to the

channel where deepening is required and will control the subsurface water level to provide for better conservation of summer rains. A discussion of these structures is included on pages I-19, II-15, and II-38 and has been revised for clarification.

2. Comment: From our site inspection of the project, we found several areas which may have questionable pollutional discharges which should be eliminated or cleaned up prior to project implementation.

Response: The State Stream Pollution Control Board and State Board of Health are responsible for water quality standards within the state. Also, these agencies are responsible for the monitoring and policing of compliance with these standards. The local sponsoring organizations are not constructing measures that will create additional problems but, in fact, will facilitate more rapid drainage relief and lessen concentrations. The sponsors will continue to be alert during operation of the project for pollution sources and will work with appropriate authorities to correct the problem.

The pipes outletting into the Newtson Ditch along Co. Rd. 300E are tile drains for the removal of surface water from the housing area. The water quality study discussed on page II-22 indicates there is insignificant pollution in this area. The ratio of fecal coliform to fecal streptococci colonies is 0.14:1 as shown in Appendix D, Exhibit 9B for water quality sampling site number 8.

The visible pollution in the feeder ditch to Newtson Ditch at the Starke County Airport is caused by the leaching of iron deposits in the ditch banks.

3. Comment: Prior to the commencement of any channel work, samples of the channel sediment should be taken to determine the characteristics of the sediments.

Response: Insecticide concentrations in bottom materials were analyzed; and the data are shown in Appendix D, Exhibit 9C. A discussion of this data is presented on page II-23 and has been expanded for clarification.

The sediment removed will be placed on the ditch bank and shaped as shown in Appendix D, Exhibits 4B and 4C. The spoil bank will be seeded to grasses and legumes immediately after construction to provide stability and erosion control which will minimize the quantity of sediment reentering the ditches.

4. Comment: From the information on II-37, the project will permit farming upon 4,100 acres which have been too wet to farm previously.

   Response: The narrative on page II-37 has been revised to include the present land use of the 4,100 acres. This area is cropland which is scattered throughout the watershed on poorly to very poorly drained soils as described in Appendix D, Exhibit 6D. As shown on page II-29, there will be a decrease of 120 acres of cropland after project installation.

   The Environmental Setting section includes a discussion of the transition of the "Grand Marsh" to agricultural producing land. Restoration of the area to a wetland was not considered a viable alternative as it would not meet the sponsors' objectives. Also, considerable environmental benefits would need to result to offset the economic and social losses to residents in the area.

   The "No PL-566 Project" alternative, page II-42, has been expanded to include a discussion of the effects of not developing a comprehensive land and water resource plan.

5. Comment: However, by making additional lands available for agricultural uses, the wind erosion problem may be aggravated. If marginal lands are to be used to obtain adequate crop yields, additional amounts of fertilizers and pesticides will be necessary. The addition of these chemicals could have adverse impacts upon water quality and air quality. Therefore, the development of additional land which could be subject to wind and water erosion should be thoroughly analyzed before the decision to implement the project is made.

   Response: The wind erosion problem will not be aggravated as additional lands are not being made available for agricultural uses.

   A large portion of contaminants enter streams attached to soil particles or dissolved in water. Project measures will reduce soil erosion and flooding, thereby reducing contaminants entering the channels.

6. Comment: A better description of 14 islands to be placed in the drains should be provided.

   Response: The 14 "islands" are the structures for water control. The term "island type" has been deleted on page II-11 to avoid confusion. Details of the structures are shown in Appendix D, Exhibits 5B-1 and 5B-2.

7. Comment: Since fences will be placed to prevent livestock from entering the channels, we suggest shrub type vegetation also be used. The shrub vegetation would provide aesthetic improvement and avian habitat.

   Response: Refer to pages II-9, II-10, and Exhibits 4A and 4B. Where fences are needed to protect the vegetative cover, they will be installed at the edge of the permanent easement.

Indiana Department of Natural Resources

1. Comment: On page II-11, the plan discusses structures for water control but does not mention benefits from these structures. The plan does not discuss why these structures are proposed or what effects these structures are to produce. If the benefits are included in the report, they are not shown in such a way that they can be recognized. If the benefits are classified as irrigation, we can see a need for an additional map showing the area to be benefited from irrigation.

   Response: The purposes of the structures for water control are discussed on pages I-19 and II-15. The environmental impact of these structures is discussed on page II-38. These structures were not planned for irrigation but as a drainage component of the total water management system. They were designed to prevent excessive drainage, therefore providing drainage benefits.

2. Comment: The benefited area shown on the project map which lies north of Bailey Ditch and between the proposed dike and Kankakee River should be changed from benefited to a different land use since this area is subject to constant flooding.

   Response: Concur. The Project Map has been corrected.

3. Comment: Exhibit 5C which shows the spawning area is very confusing. The symbols may be improperly used. Is there a dike on the south side of the spawning area? If so, why is it needed and what will be the effect on flood flows along the Kankakee River? The plan doesn't present any data on the dike.

   Response: A discussion of the spawning area has been included in the Planned Project section, page II-12. Exhibits 5D-1 and 5D-2 have been added in Appendix D to further clarify the details of the spawning area.

4. Comment: Will the old spoil bank on the east side of the Kankakee River be removed?

   Response: The old spoil bank on the east side of the Kankakee River will not be removed. The spawning channel will allow floods, greater than the annual event, into the flood plain. See Appendix D, Exhibit 5D-1.

5. Comment: The profile on the Bailey, Cox, and Newtson Ditches show water surface elevations with and without the pumps discharging. It is noted that these two profiles never come together. We question whether the effects of the pumps would effect the profile that much.

   Response: The water surface profile with the pumps discharging represents the profile of the 3-year frequency flood. This profile takes into consideration that the pumps have lowered and maintained the water table at the low stage prior to the onset of the 3-year frequency event. Increased storage in the soil horizons and greater soil infiltration, due to the lower ground water table, have been taken into account in developing this profile.

6. Comment: It is almost impossible to make any technical review of the plan with the information presented. Damages and benefits are only presented for the entire watershed and not by reaches. The plan does not state what level of flood protection is proposed. Table 3 presents some design discharge flows, but no information as to what frequency these discharges represent. No information is presented on the height of levee along the Kankakee River or what degree of protection is provided from flooding from the Kankakee River.

   Response: This is a small watershed and was evaluated as a single unit. Since the lower portions of the laterals have a common flood plain and benefited area, it would not be practical to separate benefits by individual laterals.

   A 3-year level of protection is provided as stated on pages II-5 and II-38. The design discharges in Table 3 are 3-year frequency flows. The dike details are discussed in the next response.

7. Comment: The plan states that the proposed project is compatible with the Kankakee River Basin Study. This cannot be determined from the plan, particularly in regards to the height of the levee along the Kankakee River.

Response: The discussion of the dike has been expanded in the Planned Project section, page II-11, to include height and frequency. Also, a typical cross-section of the planned dike has been added as Appendix D, Exhibit 5C. The planned project is compatible with the wide levee alternative included in the Kankakee River Basin study. The dike provides a 25-year level of protection under present conditions. With future development of the Kankakee basin, the dike will provide approximately a 1-year level of protection.

8. Comment: Table 8D, shows that some of the scientific names for several species of fish have been omitted from the text.

Response: Concur. The scientific names have been included in Appendix D, Exhibit 8D.

9. Comment: It is noted that there are four significant archaeological sites identified in this project; but if any archaeological sites are discovered during construction, they should be reported to this office.

Response: The Planned Project section, page II-8, includes a discussion on procedures to be followed should any previously unidentified evidence of cultural values be discovered during detailed investigations or construction.

Indiana State Board of Health

1. Comment: After reviewing these projects, we have the following comments to make:

That the generation of dust during construction must be kept to a minimum. This may be achieved by the use of water sprays or other methods.

That no open burning is allowed in the State of Indiana without the written permission of the Indiana Air Pollution Control Board.

Response: The installation of project measures will be carried out in compliance with local, state, and federal regulations. Specific details will be included in final design construction specifications.

Kankakee-Iroquois Regional Planning Commission

1. Comment: What essentially will be the effect of the B-C-N on possible project proposals of the Kankakee River Basin Study? Albeit, the question asked would be hard to answer given the fact no firm proposal has come out the years of study on the Kankakee, a cursory assessment would be in order. This could be in relation to channel work (widening and deepening) and levee work. This would expand on the statement on page II-45.

   Response: Data developed during the Kankakee River Basin Study was utilized in formulating a plan for the watershed. The study identified the watershed as being one of the tributaries with potential for development. The watershed was included in the alternatives evaluated in the study and was determined to be compatible with future uses of land and water resources within the basin.

2. Comment: An indication of sites of some archaeological significance was identified by the "Archaeological Investigation and Report of the Bailey-Cox-Newtson: Indiana Historical Society, May 1975. One agency of review in relation to archaeological sites is missing, which is the Glen A. Black Laboratory of Archaeology at Indiana University.

   Response: The Indiana Historic Preservation Officer is the designated official responsible for evaluation of archaeological data. A copy of the plan was furnished to the Glen A. Black Laboratory of Archaeology for their information. Also, their services are used for interpreting the significance of archaeological data.

3. Comment: From conversations with individuals in the area, one of the mandates of the S.C.S. and S.W.C.D.'s has been overlooked to a certain degree in the watershed project, and that is education of people, both farmers and nonfarmers, as to good land practices. I am sure the people involved in the B-C-N will do their utmost to educate individuals as to their purposes, problems and solutions to the areas features.

   Response: The educational program has always been recognized as an important aspect in the implementation of a watershed project. Traditionally, this educational program is carried out by the local sponsors, assisted by the Cooperative Extension Service and Soil Conservation Service.

LIST OF APPENDICES

APPENDIX A - Comparison of Benefits and Costs for Structural Measures

APPENDIX B - Project Map

APPENDIX C - Letters of Comment Received on the Draft Environmental Impact Statement

APPENDIX D - Exhibits

Exhibit 1 - Definition of Conservation Practices and Land Use
2 - Conservation Problems and Solutions
3 - Illustration of One-Side Channel Work
4 - Typical Channel Cross-Section
5A - Channel Profiles
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6A - Estimated Soil Limitations or Suitabilities for Selected Uses
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7 - Generalized Surficial Geologic Map
8A - Birds in Bailey-Cox-Newtson Watershed and Vicinity
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9A - Surface Water Quality Sampling Stations
9B - Surface Water Quality Analyses
9C - Insecticide Concentrations in Bottom Materials
9D - Biological Data, Phytoplankton Communities

Approved By: Cletus J. Gillman

Cletus J. Gillman
State Conservationist

Date: May 14, 1976

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bailey-Cox-Newtson Watershed, Indiana

(Dollars)

Evaluation Unit	Average Annual Benefits*					Avg. Annual Cost**	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Drainage	Secondary	Total		
All Measures	48,100	12,060	46,870	49,220	156,250	79,030	2.0:1.0
Project Administration	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					8,820	XXXXXXX
GRAND TOTAL	48,100	12,060	46,870	49,220	156,250	87,850	1.8:1.0

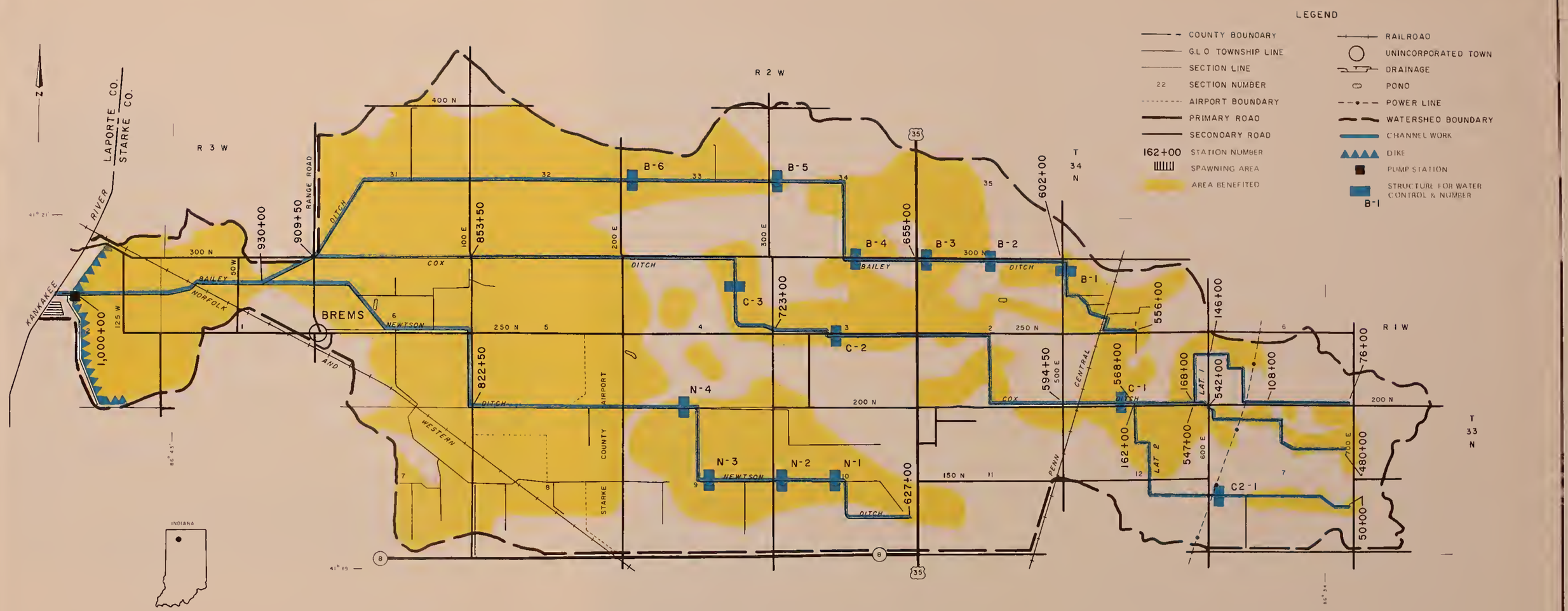
*Price base = Agriculture prices current normalized (WRC-Oct. 1974). Other items current 1975.

**Installation cost amortized 100 years @ 6 1/8 percent interest.

May 1976

U S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



PROJECT MAP

BAILEY-COX-NEWTSON WATERSHED

STARKE COUNTY, INDIANA

APPENDIX B

SOURCE
SCS DRWG. NO. 5-P-35,259 (5-75)
AND INFORMATION FROM FIELD
TECHNICIANS. POLYCONIC PROJECTION

SCALE 1/36,000

SCALE 3000 0 3000 6000 FEET

3-2-76
5,0-35,592

USDA-SCS-LINCOLN, NEBR. 1976

DEPARTMENT OF THE ARMY
Chicago District, Corps of Engineers
219 South Dearborn Street
Chicago, Illinois 60604

NCCPD-ER

28 April 1976

Mr. Cletus J. Gillman
State Conservationist
U. S. Dept. of Agriculture
Soil Conservation Service
Atkinson Square West,
Suite 2200
5610 Crawfordsville Road
Indianapolis, Indiana 46224

Dear Mr. Gillman:

Your letter of 24 February 1976 to Colonel James N. Ellis, District Engineer, Louisville District, has been referred to us, the Chicago District, Army Corps of Engineers, as we have jurisdiction over the subject project. We have reviewed the Draft Copy Plan and Environmental Impact Statement for Bailey-Cox-Newtson Watershed and have the following comments:

(1) An Army Corps of Engineers permit under Section 404 of the F.W.P.C.A. of 1972 will be required for this project.

(2) What effects will the subject project have on the three wetland areas described on page II-22?

(3) Additional adverse impacts stated earlier in the Statement should be restated on page II-40, Adverse environmental impacts.

Thank you for giving us the opportunity to review this statement. Please send us a copy of the Final Environmental Impact Statement.

Sincerely yours,

MELVIN H. FARRAR
LTC, Corps of Engineers
Acting District Engineer

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION V
300 SOUTH WACKER DRIVE
CHICAGO, ILLINOIS 60606

OFFICE OF
THE REGIONAL DIRECTOR

April 8, 1976

Mr. Cletus J. Gillman
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
5610 Crawfordsville Road
Atkinson Square West, Suite 2200
Indianapolis, Indiana 46224

RE: Draft Environmental Impact Statement
Bailey-Cox-Newtson Watershed
Starke County, Indiana

Dear Mr. Gillman:

We have reviewed the Draft Plan and Environmental Impact Statement for the above project. To our knowledge, and based on the information provided, this project will not impact to any significant degree on the health, education or welfare of the population.

Thank you for providing us the opportunity of reviewing the statement.

Sincerely,

Robert A. Ford

Robert A. Ford
Regional Environmental Officer

cc: Charles Custard, OEA
Warren Muir, CEQ

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE (202) 426-2262

8 APR 1976

Mr. Cletus J. Gillman
State Conservationist
Soil Conservation Service
5610 Crawfordsville Road
Indianapolis, Indiana 46224

Dear Mr. Gillman:

This is in response to your letter of 24 February 1976 addressed to the Coast Guard Water Resources Coordinator concerning a draft environmental impact statement for the Bailey-Cox-Newtson Watershed, Starke County, Indiana.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Federal Highway Administration had the following comments to offer:

(1) "The manner in which the Abbreviated Environmental Quality Plan is presented in Part II of the Addendum is confusing. It gives the appearance of being the plan proposed except as noted on page I-23 which indicates the plan is hypothetical and not to be installed. It would appear this could be presented as an alternative plan and discussed as such. If for any reason the community park along State Highway 35 is incorporated into the final plan, it is requested that the U. S. Department of Agriculture coordinate closely with the State and Counties in order that sufficient rights-of-way may be set aside to accommodate future expansion of existing facilities that may be required. The time consuming requirements of Section 4(f) and Section 6(f) could be avoided if such coordination is undertaken early in the planning process.

(2) "Page II-23, paragraph 5, under Economic Resources, lists transportation facilities available within the watershed area. However, the impacts of the proposed watershed project on these facilities were not discussed."

The Department of Transportation has no other comments to offer nor do we have any objection to this project. The final statement, however, should address the concern of the Federal Highway Administration.

The opportunity to review this draft statement is appreciated.

Sincerely,

D. J. RILEY
Captain, U. S. Coast Guard
Deputy Chief, Office of Marine
Environment and Systems
By direction of the Commandant

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

RE: 76-020-932
D-SCS-F36035-WI

Mr. Cletus J. Gillman
State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
3610 Crawfordsville Road
Atkinson Square West, Suite 2200
Indianapolis, Indiana 46224

APR 23 1976

Dear Mr. Gillman:

We have completed our review of the Draft Environmental Impact Statement (EIS) and Watershed Work Plan (WWP) for the Bailey-Cox-Newtson Watershed, Starke County, Indiana. Our review and comments were requested in your letter of February 24, 1976. Based on the information provided in the EIS and the WWP, we have reservations concerning the impacts which result from this project's implementation. Our principle reservations to the implementation of this proposal are the potential adverse water quality impacts which may result from the clearing and channelizing of the drains, the irrigation of agricultural lands and the conversion of 4100 acres of land to agricultural uses. Furthermore, we believe additional information concerning the compliance with water quality standards, the pollutional characteristics of the excavated material and the impacts upon Type 1 wetland areas should be provided. The following comments are offered for your consideration in the preparation of the Final Watershed Work Plan and Environmental Impact Statement.

(1) Part of the project design is to retain water within portions of ditches during the summer months to provide irrigation. This impounded water will have to meet the requirements of the Indiana Water Quality Standards prior to discharge downstream. The use of impounded waters for irrigation of fields could create a dissolved solids problem. Impoundment evaporation, transpiration, leaching, and evaporation during irrigation can cause return flows to have higher levels of dissolved solids. If necessary, a monitoring program downstream of the impoundments should be established, to assure compliance with the applicable standards.

(2) From our site inspection of the project, we found several areas which may have questionable pollutional discharges which should be eliminated or cleaned up prior to project implementation.

1. Newtson Ditch between structures N-2 and N-3. There is a housing development along County Road 300 E, pipe outfalls to the ditch are evident from both the front and back areas of the houses. Septic tank leachings or agricultural enrichment could reach the ditch through these pipes.

2. South Branch of Newtson Ditch where it crosses County Road 200 E. at the Starke County Airport. A feeder ditch to Newtson Ditch in this area is the most visibly polluted watercourse in the area.

It is the practice of your agency when providing channel improvements to place the dredged material upon one of the banks. (3) Prior to the commencement of any channel work, samples of the channel sediment should be taken to determine the characteristics of the sediments. If, after analysis, the samples are found to be polluted, this material will have to be disposed in an area which eliminates leaching of sediment back into the aquatic environment.

The EIS indicated there are 120 acres of Type 1 wetland riverward of the dike which would not be directly affected by this project. These wetlands, although they do not have a permanent water level throughout the year, still provide a valuable area service for flood control and wildlife habitat. (4) From the information on page II-37, the project will permit farming upon 4,100 acres which have been too wet to farm previously. It was further indicated, the entire area was once a wetland. The EIS should describe these 4,100 acres in greater detail, providing information on its past wetland quality and the potential for return to wetland habitat whether or not the project is implemented. The quantity of wetland areas have been seriously reduced to date and if an area can be restored or protected, the environmental benefits of such a possibility should be investigated.

The project area has a severe wind erosion problem. We realize it is the intent of the proposal to reduce wind erosion impacts through proper agricultural practices and irrigation of droughty areas. (5) However, by making additional lands available for agricultural uses, the wind erosion problem may be aggravated. If marginal lands are to be used to obtain adequate crop yields, additional amounts of fertilizers and pesticides will be necessary. The addition of these chemicals could have adverse impacts upon water quality and air quality. Therefore, the development of additional land which could be subject to wind and water erosion should be throughly analyzed before the decision to implement the project is made.

(6) A better description of the 14 islands to be placed in the drains should be provided. Since these islands will be in the drainage way, the material used for construction of the islands should be described as to their suitability and erodability. Maintenance procedures for the islands should also be discussed in greater detail.

(7) Since fences will be placed to prevent livestock from entering the channels, we suggest shrub type vegetation also be used. The shrub vegetation would provide asethic improvement and avian habitat.

Based upon information provided in the EIS, we have classified the project as ER (Environmental Reservations) and categorized the EIS as Category 2 (Additional Information Necessary). The date and classification of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on other Federal agencies projects. We appreciate the opportunity to review this Draft EIS and Watershed Work Plan. When the Final EIS and Watershed Work Plan are filed with the Council on Environmental Quality, please forward three copies to us.

Sincerely yours,

Gary A. Williams

Gary A. Williams
Chief,
Environmental Review Section

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

MAY 12 1976

Mr. Cletus J. Gillman
State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
5610 Crawfordsville Road
Atkinson Square West, Suite 2200
Indianapolis, Indiana 46224

Dear Mr. Gillman:

In response to your letter of April 30, 1976, we have reviewed the (Draft Copy) Plan and Environmental Impact Statement (EIS) for Bailey-Cox-Newtson Watershed located in Starke County, Indiana. The responses to our comments of April 23, 1976 are adequately addressed. However, we believe that further clarification of the method to relieve droughtiness should be provided in the EIS.

Thank you for responding to our comments. Your cooperation is appreciated.

Sincerely yours,

Gary A. Williams

Gary A. Williams
Chief,
Environmental Review Section

UPPER MISSISSIPPI RIVER BASIN COMMISSION
FEDERAL BUILDING, ROOM 510, FORT SNELLING, TWIN CITIES, MINNESOTA 55111, PHONE: 612-725-4690
REG. OFFICE, ROOM 342 FEDERAL BLDG. - P.O., 657 2ND AVE. N., FARGO, N.D. 58102 (701) 237-5771 EXT. 5355

March 31, 1976

Mr. Cletus J. Gillman, State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
Atkinson Square West, Suite 2200
5610 Crawfordsville Road
Indianapolis, Indiana 46224

Dear Mr. Gillman:

Thank you for your letter of February 24, 1976, requesting our review and comment on the Draft Plan and Environmental Impact Statement for the Bailey - Cox - Newtson Watershed in Indiana. To date, Staff limitations and work loads have prevented the Staff from reviewing documents of this nature in detail. However, a cursory review of this document indicates that the document contains a great deal of information which will be useful to the Commission as we proceed in the development of our Comprehensive, Coordinated Joint Plan for the management and conservation of the water and related land resources in the Upper Mississippi Region.

Sincerely yours,

George W. Griebenow

George W. Griebenow
Chairman

GWG:dm

STATE of INDIANA

INDIANAPOLIS, 46204

DEPARTMENT OF NATURAL RESOURCES
JOSEPH D. CLOUD
DIRECTOR

April 26, 1976

Mr. Cletus J. Gillman
State Conservationist
US Department of Agriculture
Soil Conservation Service
Atkinson Square West, Suite 2200
5610 Crawfordsville Road
Indianapolis, Indiana 46224

Dear Mr. Gillman:

This letter is in response to your letter of February 24, 1976, in regard to review of and comments on the Draft Plan and Environmental Impact Statement on the Bailey-Cox-Newtson Watershed.

(1) On Page 11-11, the plan discusses structures for water control but does not mention benefits from these structures. The plan does not discuss why these structures are proposed or what effects these structures are to produce. If the benefits are included in the report, they are not shown in such a way that they can be recognized. If the benefits are classified as irrigation, we can see a need for an additional map showing the area to be benefited from irrigation.

(2) The benefited area shown on the project map which lies north of Bailey Ditch and between the proposed dike and Kankakee River should be changed from benefited to a different land use since this area is subject to constant flooding.

(3) Exhibit 5C which shows the spawning area is very confusing. The symbols may be improperly used. Is there a dike on the south side of the spawning area? If so, why is it needed and what will be the effect on flood flows along the Kankakee River? The plan doesn't present any data on the dike.

(4) Will the old spoil bank on the east side of the Kankakee River be removed?

(5) The profile on the Bailey, Cox and Newtson Ditches show water surface elevations with and without the pumps discharging. It is noted that these two profiles never come together. We question whether the effects of the pumps would effect the profile that much.

⑥ It is almost impossible to make any technical review of the plan with the information presented. Damages and benefits are only presented for the entire watershed and not by reaches. The plan does not state what level of flood protection is proposed. Table 3 presents some design discharge flows, but no information as to what frequency these discharges represent. No information is presented on the height of levee along the Kankakee River or what degree of protection is provided from flooding from the Kankakee River.

⑦ The plan states that the proposed project is compatible with the Kankakee River Basin Study. This cannot be determined from the plan, particularly in regards to the height of the levee along the Kankakee River.

⑧ Table 8D, shows that some of the scientific names for several species of fish have been omitted from the text.

⑨ It is noted that there are four significant archaeological sites identified in this project; but if any archaeological sites are discovered during construction, they should be reported to this office.

If we can be of further assistance, please advise.

Sincerely,

Joseph D. Cloud
Director
Department of Natural Resources

JDC/CCM/adf

Clearinghouse Use Only
St. Identification No.
76021250175
Date Received
2-27-76
Review Terminated
3-31-76

Indiana State Clearinghouse
State Budget Agency
212 State House
Indianapolis, Indiana 46204

AUTHORIZATION TO FILE APPLICATION

TO: Mr. Cletus J. Gillman
State Conservationist

PROJECT: Bailey-Cox-Newton Watershed - Starke County

DOA-SCS
Federal Program Title; Agency and FDA Catalog No.

Amount of Funds Requested

The State Clearinghouse has reviewed the summary notification pertaining to the above project. With regard to the summary notification, the Clearinghouse makes the following disposition concerning this application:

__X__ The proposed project is in accord with State plans, goals, and objectives at this time.

_____ Refer to the attached comments.

You may now complete and file your formal application with the appropriate Federal Agency. This form, with comments if any, is to be attached to that application, and the lower portion of this form is to be completed by you, detached, and returned to the State Clearinghouse when the formal application is submitted.

Sally Corn
Signature (Mrs. Sally Corn)
State Clearinghouse Reviewer
Title

March 31, 1976
Date

Indiana State Clearinghouse
State Budget Agency
212 State House
Indianapolis, Indiana

St. Identification No. 76021250175

The formal application for Baley-Cox-Newton Watershed-Starke Co. (Name of Project) was submitted to the DOA (Federal Agency) on _____ (Date) by _____ (Name of Applicant)

_____
Signature

STATE OF INDIANA

STATE BOARD OF HEALTH

An Equal Opportunity Employer

INDIANAPOLIS

Address Reply to:
Indiana State Board of Health
1330 West Michigan Street
Indianapolis, IN 46206

April 12, 1976

Mr. Cletus J. Gillman
United States Department
of Agriculture
Soil Conservation Service
5610 Crawfordsville Road
Suite 2200
Indianapolis, IN 46224

Dear Mr. Gillman:

Re: Environmental Impact Assessments

Recently, you have sent to this Division several Environmental Impact Assessments for watershed projects in the State of Indiana. After reviewing these projects, we have the following comments to make:

1. That the generation of dust during construction must be kept to a minimum. This may be achieved by the use of water sprays or other methods.

2. That no open burning is allowed in the State of Indiana without the written permission of the Indiana Air Pollution Control Board.

If the above comments are followed, the watershed projects will be consistent with the Indiana Plan of Implementation. Furthermore, if future projects are proposed that are similar to the projects we have thus far reviewed, it will not be necessary for this agency to review them.

I am enclosing a copy of our regulations APC 2 and APC 20 which cover open burning and fugitive dust. If we can be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Harry D. Williams

Harry D. Williams, Director
Air Pollution Control Division

WEM/lk

Kankakee-Iroquois
Regional Planning Commission
P. O. Box 684, Francesville, Ind. 47946
Telephone: (219) 567-9432

Executive Director
RONALD R. FLETCHER

April 23, 1976

Mr. Cletus J. Gillman
State Conservationist
U.S.D.A., S.C.S.
5610 Crawfordsville Road
Atkinson Square West, Suite 2200
Indianapolis, IN 46224

Mr. Gillman:

Please accept the enclosed comments from this agency in regards to the "Bailey-Cox-Newtson Watershed Project".

Thank you and have a fine day!

Sincerely,

Jeffrey L. Tupper

Jeffrey L. Tupper
Regional Planner

JLT/rm

Comments on Draft Watershed Plan and Environmental Impact Statement, Bailey-Cox-Newtson Watershed.

It is evident that the projects proposed for the Bailey-Cox-Newtson Watershed in regards to flood protection are needed to increase agricultural production and retain public and private investment in buildings and structures. A field trip was made to the watershed approximately one week after a mild rain event. The extent of land "under water" both as standing water and debris lines on roads and fences could be observed from about 1 mile East of Brems to the mouth of the Bailey.

The remainder of the project goals dealing with drainage, soil erosion, forestland and other land treatment and structural measures are adequately assesed as to potential beneficial and adverse impacts. Encouragement of the projects completion ranks high amongst this agency and those individuals who have worked long and hard on the project.

There are several questions which should be answered concerning the B-C-N project in relation to other existing and potential projects.

1. What essentially will be the effect of the B-C-N on possible project proposals of the Kankakee River Basin Study? Albeit, the question asked would be hard to answer given the fact no firm proposal has come out the years of study on the Kankakee, a cursory assesment would be in order. This could be in relation to channel work (widening and deepening) and levee work. This would expand on the statement on page II-45

2. An indication of sites of same archaeological significance was identified by the "Archaeological Investigation and Report of the Bailey-Cox-Newtson: Indiana Historical Society, May 1975. One agency of review in relation to archaeological sites is missing, which is the Glen A. Black Laboratory of Archaeology at Indiana Universtiy.

A point could be made that given the Indiana Historical Societies review and interest on the part of the Conservancy District and other Starke County individuals selection of one of the four sites could be scientifically investigated by trained individuals. Any significant findings could be displayed locally as an education tool about the areas prehistoric past.

The idea here would be to derive both an historical benefit from the project in conjunction with the project measures.

Are there funds through the PL566 program which could be used to implement such an investigation given cooperator and district interest?

(3.) From conversations with individuals in the area one of the mandates of the S.C.S. and S.W.D.D's has been overlooked to a certain degree in the watershed project, and that is education of people, both farmers and non-farmers, as to good land practices. I am sure the people involved in the B-C-N will do their utmost to educate individuals as to their purposes, problems and solutions to the areas features. But it would seem that something a bit more permanent and scheduled could be implemented as mentioned on page I-31 in relation to a park. I do not believe the B-C-N should turn into a park or even operate or maintain a small park due to cost, time and manpower. But, I do believe a small permanent structure could be established to house educational material, maps, diagrams and progress maps concerning the B-C-N and treatment problems and measures in general. Scheduled use of this structure on a reservation basis, for schools, civic groups and interested parties could be implemented. Even an existing structure could be used.

Has much thought been put to furthering the educational potential of the project? The project could be used as an example for other landowners and farmers from surrounding areas in implementing sould and productive treatment measures.

In closing, the implementation of the Bailey-Cox-Newtson Watershed project will add a "feather-in-the-cap" of Starke county and watershed residents as a prime example of cooperation to solve mutual problems.

Thank you for considering these comments.

APPENDIX D, EXHIBITS

DEFINITION OF CONSERVATION PRACTICES AND LAND USE

CONSERVATION PRACTICES

CONSERVATION CROPPING SYSTEM

Growing crops in combination with needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops.

CROP RESIDUE USE

Using plant residues to protect cultivated fields during critical erosion periods.

CRITICAL AREA PLANTING

Stabilizing sediment producing and severely eroded areas by establishing vegetative cover. This includes woody plants, such as trees, shrubs or vines, and adapted grasses or legumes established by seeding or sodding to provide long-term ground cover. (Does not include tree planting mainly for the production of wood products.)

DRAINAGE FIELD DITCHES

A shallow graded ditch for collecting water within field, usually constructed with flat side slopes for ease of crossing. (This does not include drainage main or lateral, or grassed waterway or outlet.)

DRAINAGE MAIN OR LATERAL

An open drainage ditch constructed to a designed size and grade. Does not include drainage field ditch.

FIELD BORDER

A border or strip of perennial vegetation established at the edge of a field by planting or by converting it from trees to herbaceous vegetation or shrubs.

FIELD WINDBREAK

A strip or belt of trees or shrubs established within or adjacent to a field.

EXHIBIT 1--cont'd

GRADE STABILIZATION STRUCTURE

A structure to stabilize the grade or to control head cutting in natural or artificial channels. (Does not include structures used in drainage and irrigation systems primarily for water control.)

HEDGEROW PLANTING

Establishing a hedgerow or living fence of shrubs or trees within, across, or around a field.

LIVESTOCK EXCLUSION

Excluding livestock from an area where grazing is not wanted.

MINIMUM TILLAGE

Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage.

PASTURE AND HAYLAND MANAGEMENT

Proper treatment and use of pastureland or hayland.

PASTURE AND HAYLAND PLANTING

Establishing and re-establishing long-term stands of adapted species of perennial, biennial or reseeding forage plants. (Includes pasture and hayland renovation. Does not include grassed waterway or outlet on cropland.)

POND

A water impoundment made by constructing a dam or embankment, or by excavating a pit or "dugout."

STRIPCROPPING, WIND

Growing wind-resisting crops in strips alternating with row crops or fallow and arranged at angles to offset adverse wind effects. (Includes any herbaceous vegetative wind barrier that reduces wind velocities of both the leeward and windward, but predominantly the leeward flow of air across a land surface.)

SUBSURFACE DRAIN

A conduit, such as tile, pipe, or tubing, installed beneath the ground surface and which collects and/or conveys drainage water.

TREE PLANTING

Planting tree seedlings or cuttings.

WILDLIFE UPLAND HABITAT MANAGEMENT

Retaining, creating or managing wildlife habitat other than wetland.

WILDLIFE WETLAND HABITAT MANAGEMENT

Retaining, creating, or managing wetland for wildlife.

WOODLAND IMPROVEMENT

Improving woodland by removing unmerchantable or unwanted trees, shrubs, or vines.

LAND USE

CROPLAND

Cropland includes all cultivated land used for field crops or hay in pasture or rotation; cropland temporarily idle or diverted from production under government programs; permanent hayland, orchards, vineyards and bush fruits; and open land from cropped and not converted to another use.

FOREST OR WOODLAND

Forest or woodland includes land that is at least 10% stocked with forest trees and capable of producing forest products or influencing a water regime, land that formerly grew trees and is not currently developed for non-forest use, and land that has been planted to trees.

OTHER LAND

Other land is non-federal rural land which is not classified as cropland, pasture or forest land. It includes strip mines, borrow and gravel pits, farmsteads, farm roads, ditches, rural non-farm residences, and idle, open rural non-farm land.

EXHIBIT 1--cont'd

PASTURE

Pasture includes lands producing forage plants, principally introduced species, primarily for grazing and not included in cropland rotation; includes native pasture and may contain shade or timber trees if canopy is less than 10%.

(Reproduced from SCS Technical Guide Section IV and Indiana Soil and Water Conservation Inventory 1968)

EXHIBIT 2A

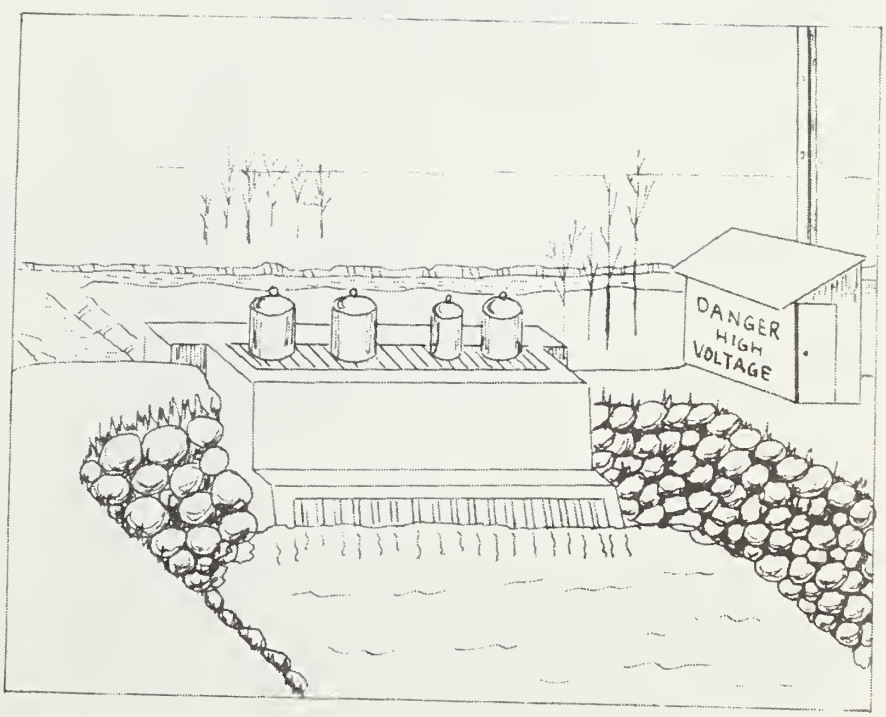
PROBLEMS....

Wind erosion causes soil loss, sand deposits, and crop damage. It can be reduced by . . . . . .

Backwater flooding delays spring planting and destroys standing crops. It can be prevented by . . . . .

...SOLUTIONS

...use of windbreaks and crop residues to intercept wind and "nail" soils down.



...installing levees and large lift pumps to hold back river flooding while pumping.

EXHIBIT 2C

PROBLEMS. . .

Heavy brush inhibits flow, builds drift piles that cause side-cutting. See Exhibit 3

Sediment restricts flow and causes downstream damage. See Exhibit 3.

Provisions for adequate flow and reduction of sediment, as well as wildlife food and cover, are available in one-side construction. Berms and slopes are seeded, and woody growth is planted in protected areas.

TYPICAL CHANNEL CROSS-SECTION - SELECTIVE CLEARING

Cox Ditch (594+50 to 723+00)
Cox Ditch (853+50 to 909+50)
Newtson Ditch (627+00 to 822+50)

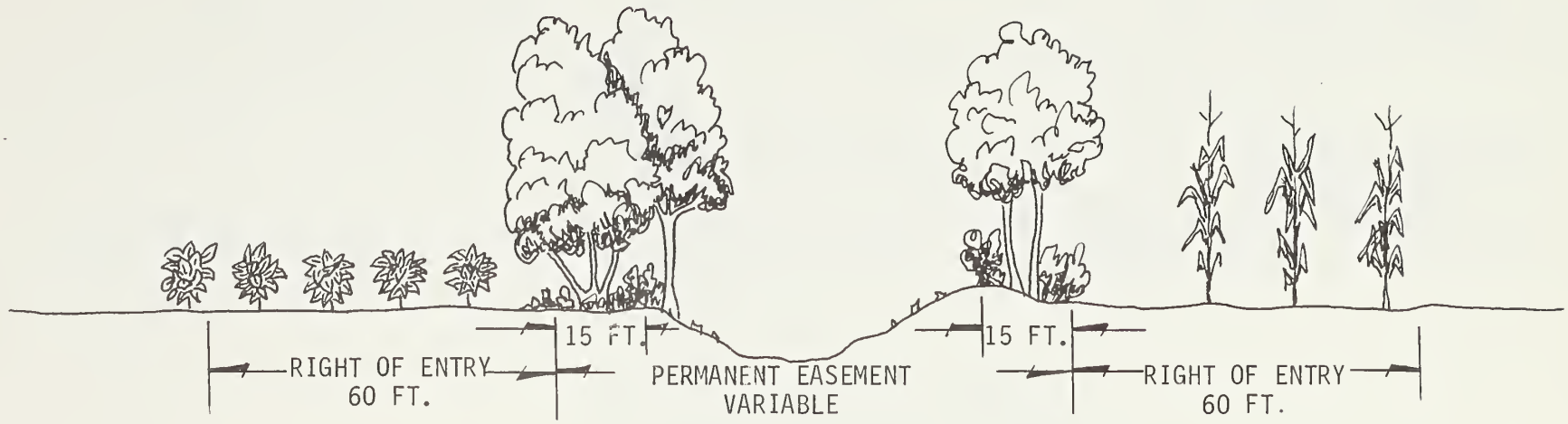
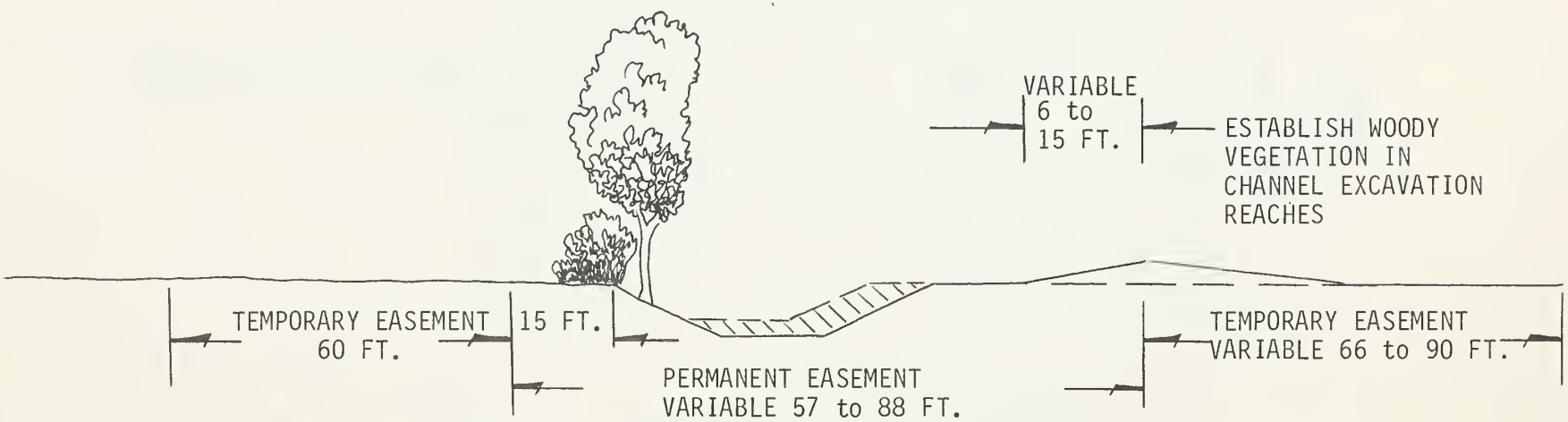


EXHIBIT 4A

EXHIBIT 4B

TYPICAL CHANNEL CROSS-SECTION - CHANNEL EXCAVATION (Existing Ditch)

Bailey Ditch (556+00 to 1005+00)
Cox Ditch (480+00 to 594+50)*
Cox Ditch (723+00 to 853+50)
Cox Lateral No.1 (76+00 to 168+00)*
Cox Lateral No.2 (50+00 to 162+00)
Newtson Ditch (822+50 to 930+50)



*Note - Except new ditch sub-reaches. See next page.

TYPICAL CHANNEL CROSS-SECTION - CHANNEL EXCAVATION (New Ditch)

Cox Ditch (480+00 to 533+00)
Cox Lateral No.1 (114+00 to 127+00)

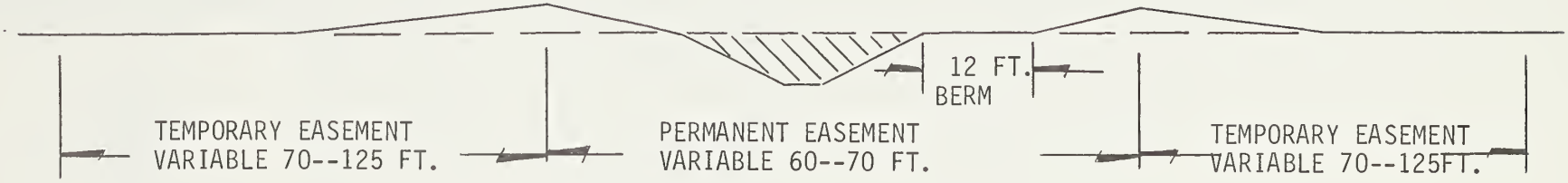


EXHIBIT 4C

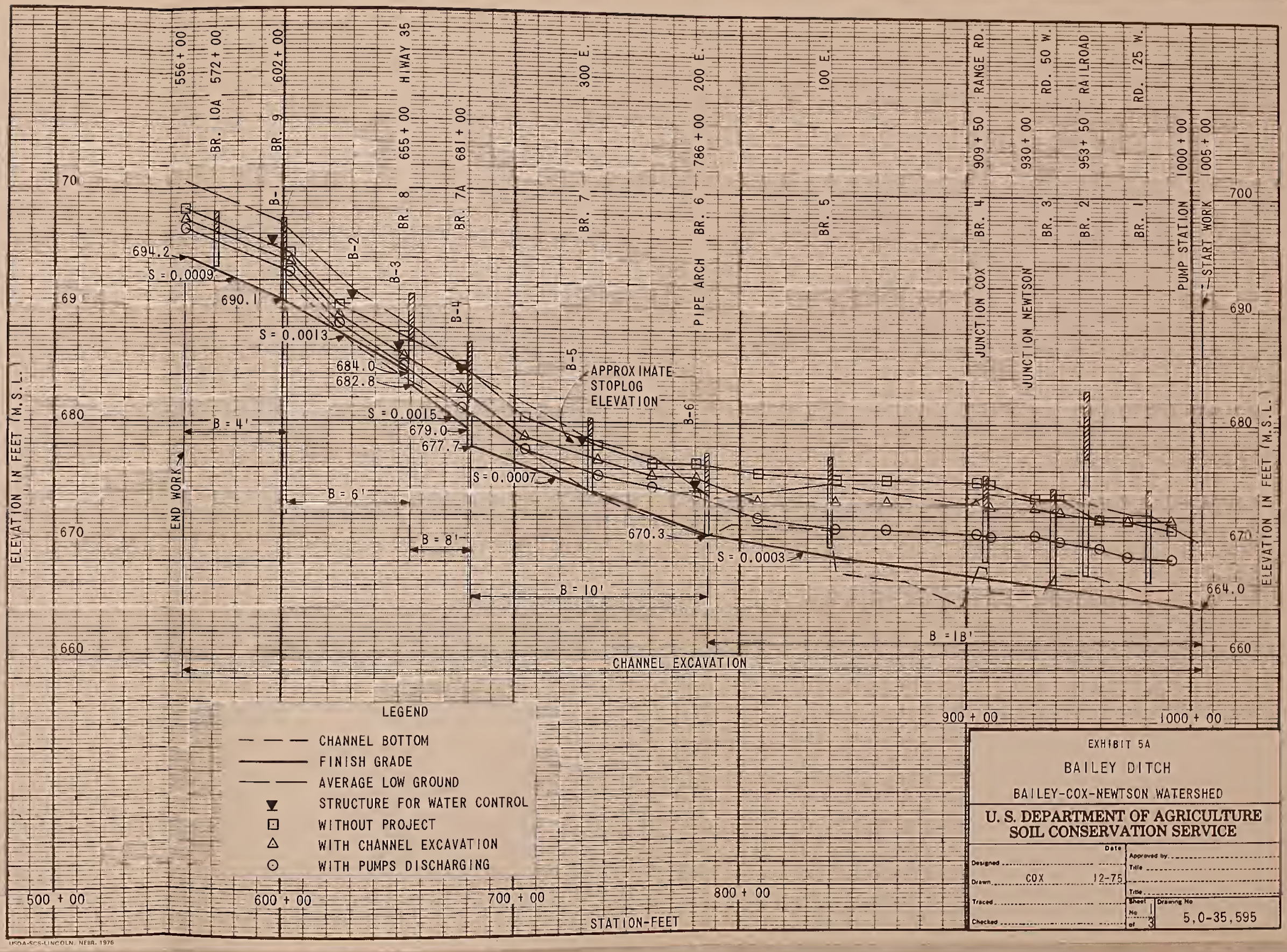


EXHIBIT 5A

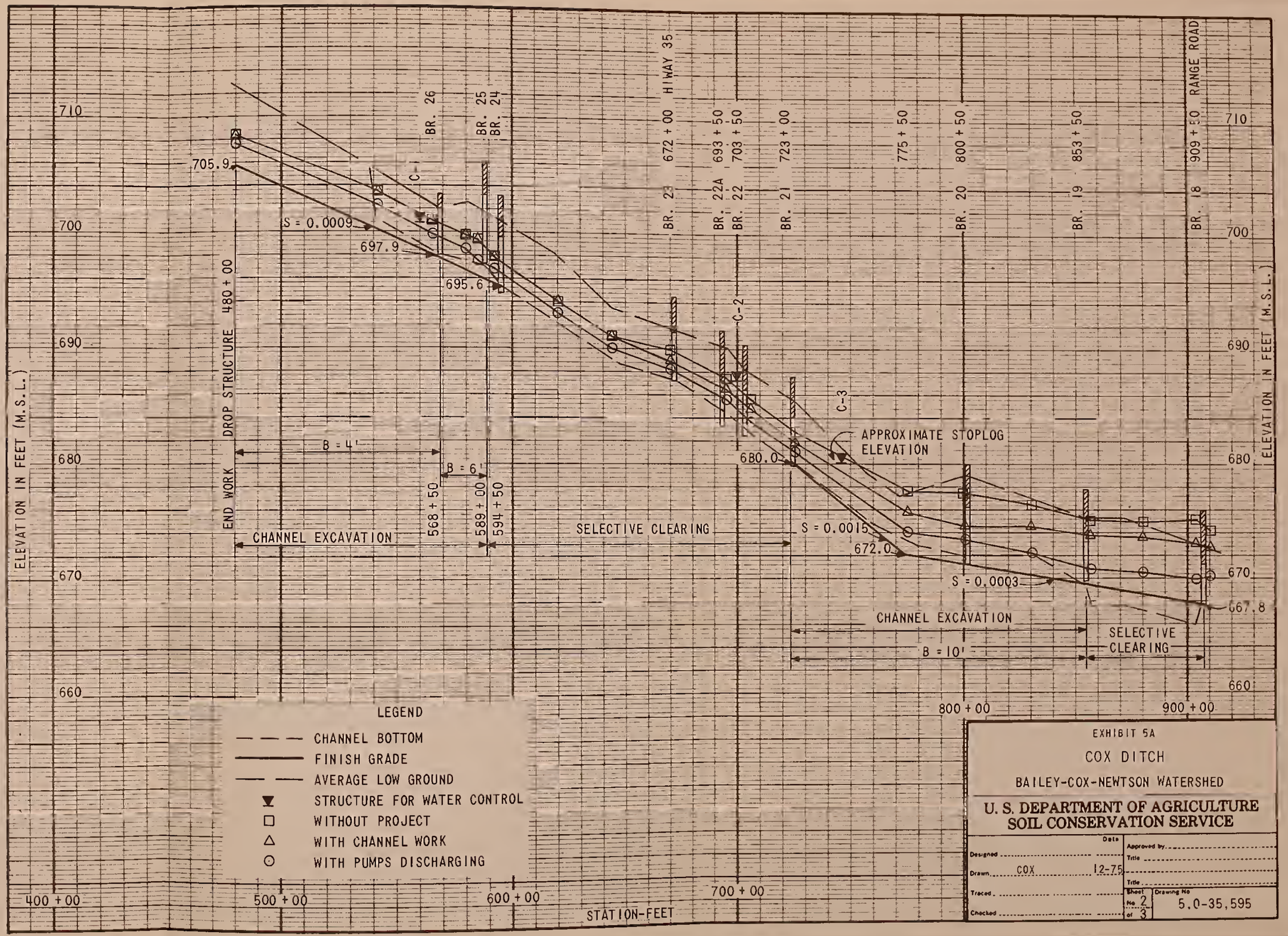
BAILEY DITCH

BAILEY-COX-NEWTSON WATERSHED

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn	COX 12-75	Title	
Traced		Title	
Checked		Sheet No. 1 of 3	Drawing No. 5,0-35,595

USDA-SCS-LINCOLN, NEBR. 1976


ELEVATION IN FEET (M.S.L.)
710
700
690
680
670
660
705.9
697.9
695.6
S = 0.0009
C-1
BR. 26
BR. 25
BR. 24
DROP STRUCTURE 480 + 00
END WORK
B = 4'
B = 6'
568 + 50
589 + 00
594 + 50
CHANNEL EXCAVATION
SELECTIVE CLEARING
HIWAY 35
672 + 00
693 + 50
703 + 50
723 + 00
775 + 50
800 + 50
853 + 50
909 + 50
RANGE ROAD
BR. 23
BR. 22A
BR. 22
BR. 21
BR. 20
BR. 19
BR. 18
C-2
C-3
APPROXIMATE STOPLOG ELEVATION
680.0
672.0
S = 0.0015
S = 0.0003
667.8
CHANNEL EXCAVATION
B = 10'
SELECTIVE CLEARING
400 + 00
500 + 00
600 + 00
700 + 00
800 + 00
900 + 00
STATION-FEET
LEGEND
CHANNEL BOTTOM
FINISH GRADE
AVERAGE LOW GROUND
STRUCTURE FOR WATER CONTROL
WITHOUT PROJECT
WITH CHANNEL WORK
WITH PUMPS DISCHARGING
EXHIBIT 5A
COX DITCH
BAILEY-COX-NEWTSON WATERSHED
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn COX 12-75
Traced
Checked
Approved by
Title
Sheet No 2 of 3
Drawing No 5.0-35,595

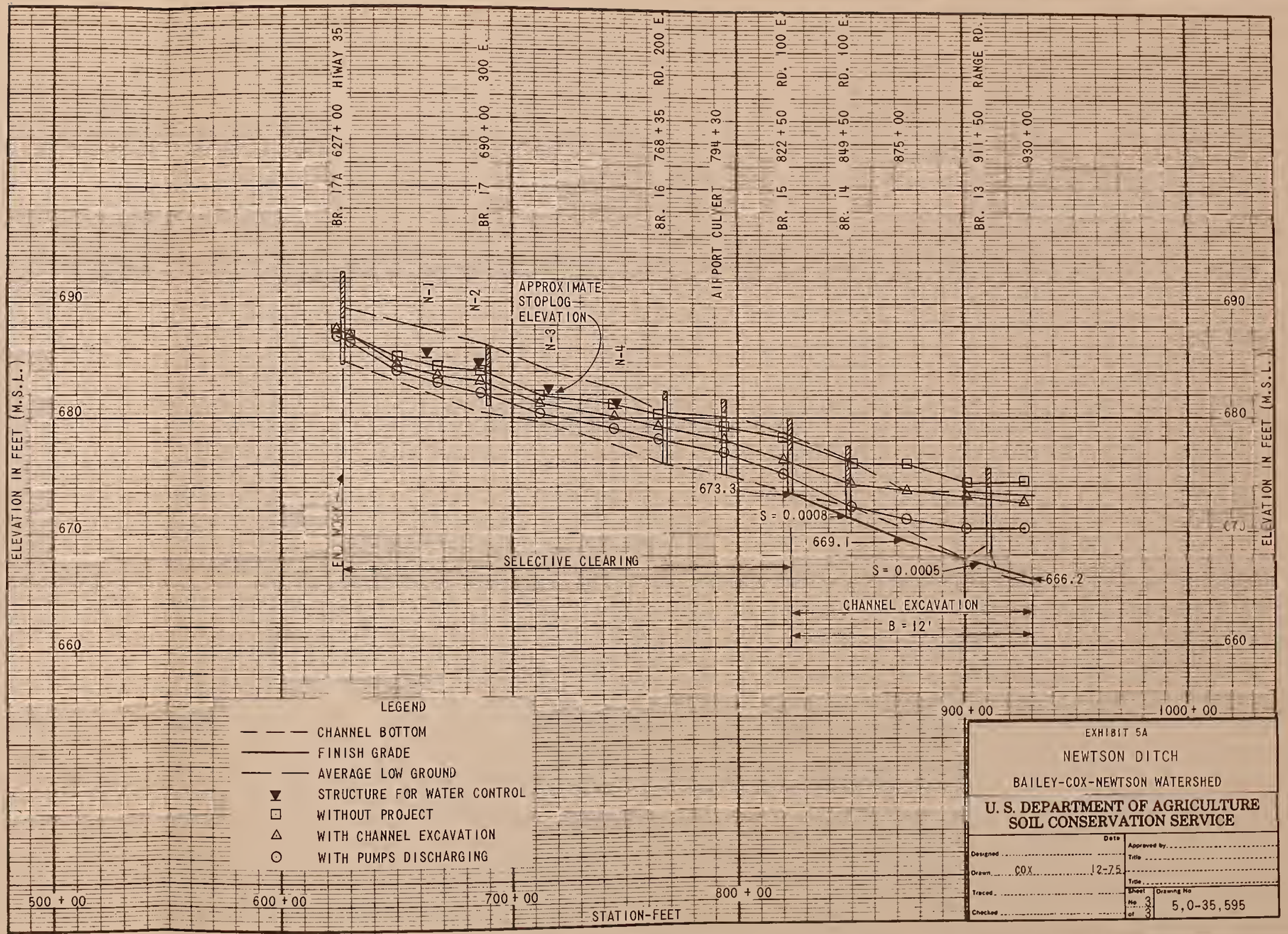


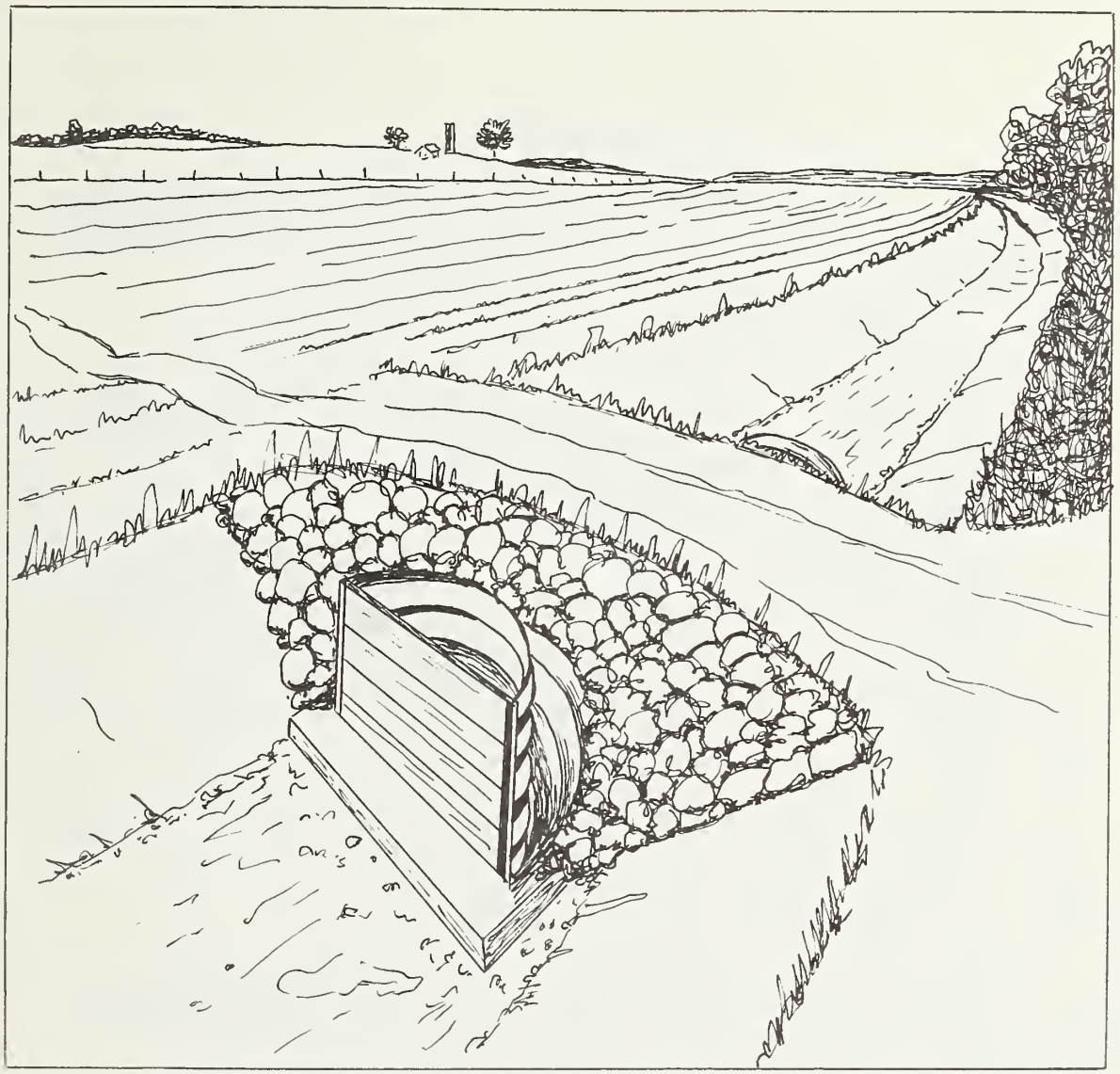
EXHIBIT 5A

NEWTSON DITCH

BAILEY-COX-NEWTSON WATERSHED

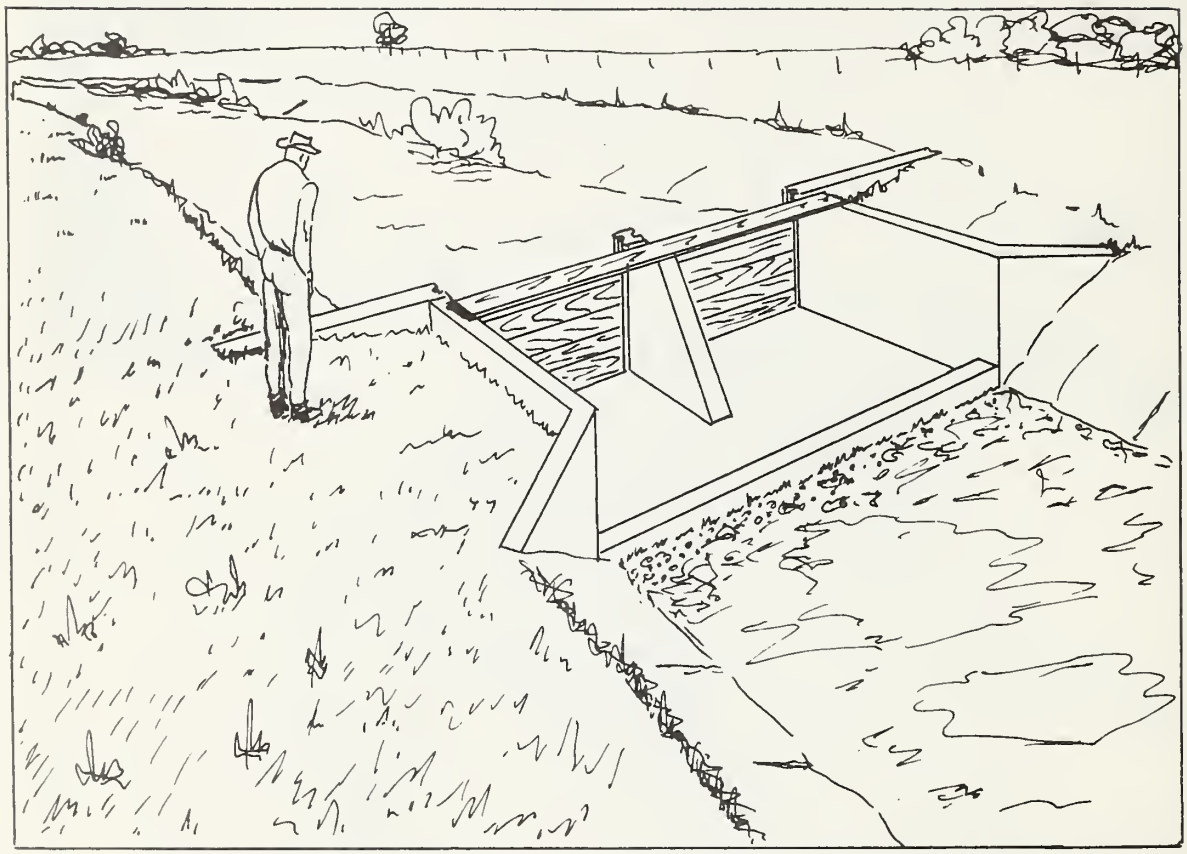
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn	COX 12-75	Title	
Traced		Title	
Checked		Sheet No. 3 of 3	Drawing No. 5,0-35,595

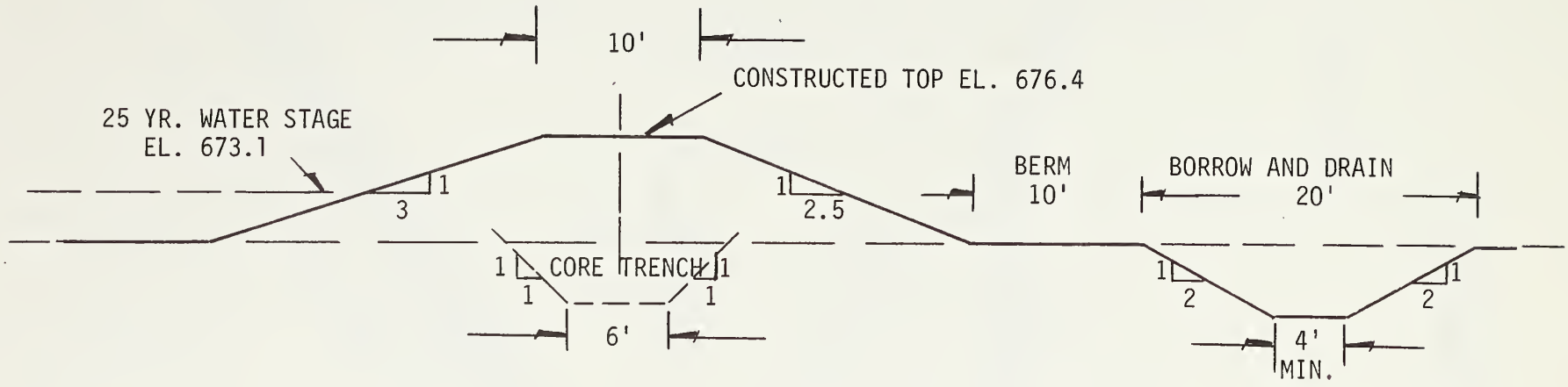


TYPICAL STRUCTURE FOR WATER CONTROL MADE FROM CORRUGATED METAL AND WOOD STOPLOGS. THE INLET AND OUTLET AREAS WILL BE RIP-RAPPED TO PREVENT EROSION.

EXHIBIT 5B-2



TYPICAL STRUCTURE FOR WATER CONTROL MADE FROM CONCRETE AND WOOD STOPLOGS. THE AREAS UPSTREAM AND DOWNSTREAM OF THE STRUCTURE WILL BE RIP-RAPPED TO PREVENT EROSION.

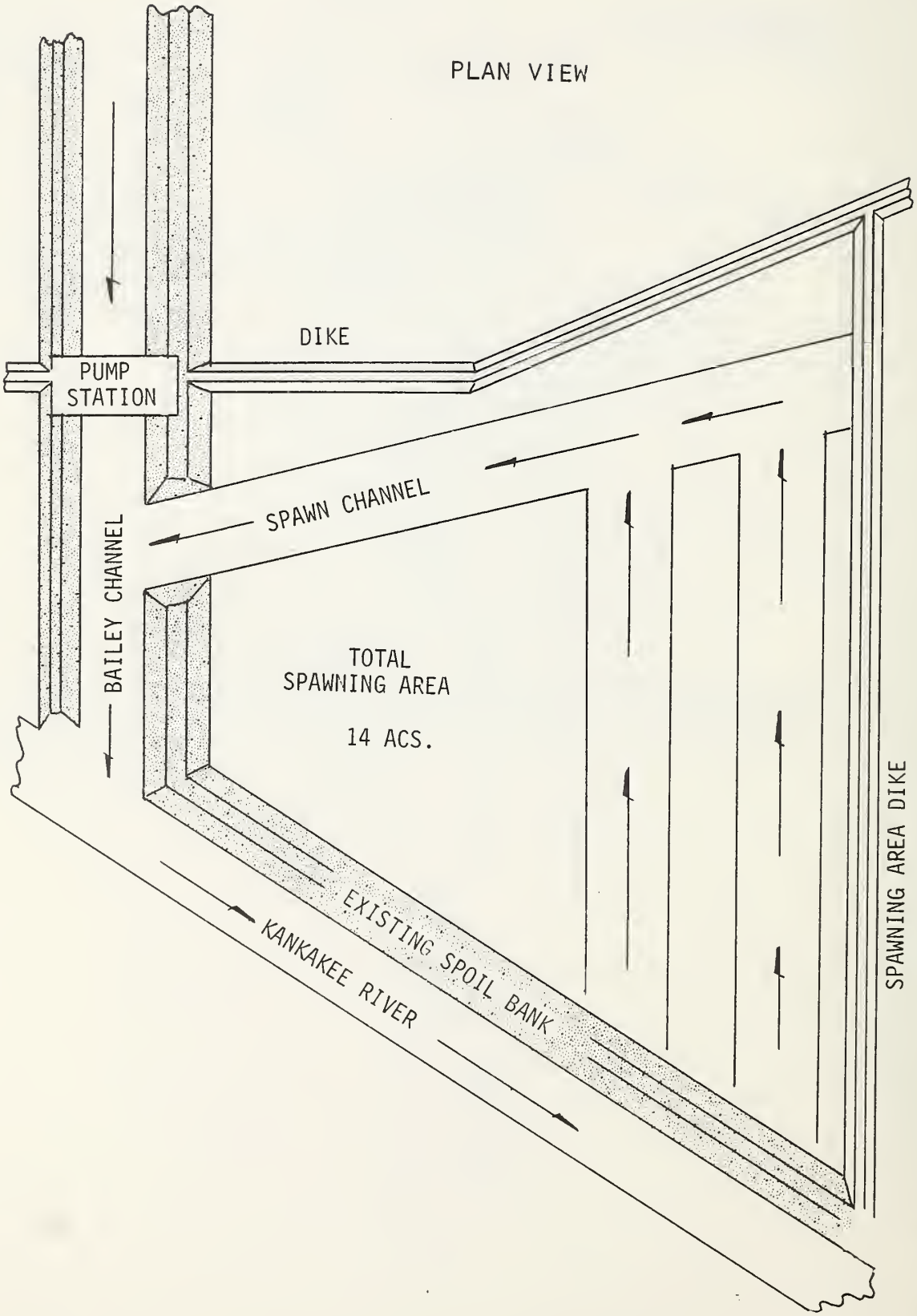


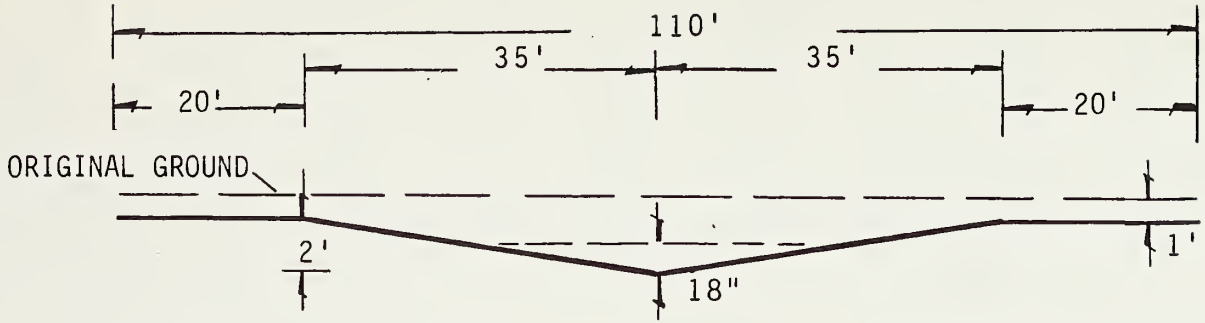
TYPICAL DIKE SECTION

EXHIBIT 5C

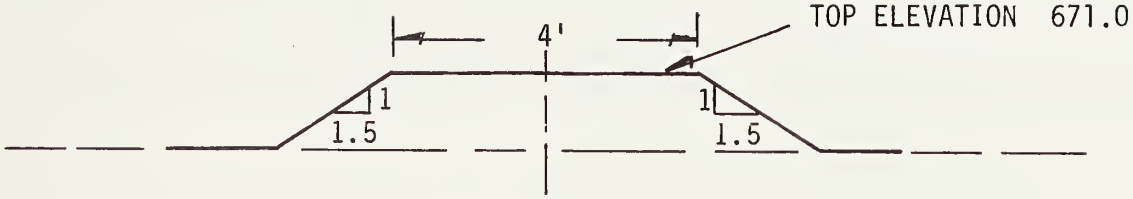
EXHIBIT 5D-1

SPAWNING AREA





SPAWN CHANNEL



SPAWNING AREA DIKE

TYPICAL SPAWNING AREA SECTIONS

EXHIBIT 5D-2

BAILEY-COX-NEWTSON WATERSHED

ESTIMATED SOIL LIMITATIONS OR SUITABILITIES FOR SELECTED USES

SOIL ASSN. 1/ & % OF WATERSHED	SOIL SERIES 2/	DWELLINGS 3/		WASTE DISPOSAL 4/		LOCAL ROADS 5/ STREETS & PARKING AREAS	SUITABILITY AS SOURCE OF 6/			RECREATION 7/		8/ INTN. CROP-PING	9/ WOODLAND PRODUCT-TIVITY
		WITH BASEMENTS	WITHOUT BASEMENTS	SEPTIC TANK ABSORPTION FIELDS	SEWAGE LAGOONS		SAND	GRAVEL	ROADFILL	CAMPING AND PICNIC AREAS	PLAYGROUNDS & ATHELETIC FIELDS		
1 68%	Maumee Gilford	Severe: 3 Severe: 3	Severe: 3 Severe: 3	Severe: 3 Severe: 3	Severe: 3,7 Severe: 3,7	Severe: 3 Severe: 3	Fair Fair	Unsuited Unsuited	Poor Poor	Severe: 3 Severe: 3	Severe: 3 Severe: 3	Good Good	No Data No Data
2 31%	Morocco Maumee Brems	Severe: 3 Severe: 3 Moderate:3	Moderate:3 Severe: 3 Slight	Severe: 3 Severe: 3 Moderate:3	Severe: 7 Severe: 3,7 Severe: 7	Moderate:3 Severe: 3 Slight	Fair Fair Good	Unsuited Unsuited Unsuited	Poor Poor Good	Moderate:3,6 Severe: 3 Moderate:6	Moderate:3,6 Severe: 3 Severe: 6	Fair Good Fair	No Data No Data No Data
3 1%	Rensselaer Milford	Severe: 3 Severe:3,5	Severe: 3 Severe:3,5	Severe:3,2 Severe:3,2	Severe: 3 Slight	Severe:3,5 Severe:3,5	Unsuited Unsuited	Unsuited Unsuited	Poor Poor	Severe: 3 Severe: 3	Severe: 3 Severe: 3	Good Good	No Data No Data

KEY TO POSSIBLE SOIL LIMITATIONS: 1. Slope 2. Slow permeability 3. Seasonal high water table 4. Flood hazard 5. Poor stability 6. Adverse soil texture 7. Excessive permeability

1/ Soil Association: The numbers in this column correspond with the numbered soil associations on the General Soil Map of the watershed. Each soil association is named for the major soils. The percent of each soil association in the watershed is shown.

2/ Soil Series: This column shows the name of each major soil in each association.

3/ Dwellings

With Basements: Ratings are for undisturbed soils that are evaluated for single family dwellings and other structures with similar foundation requirements. Excluded are buildings of more than three stories and other buildings with foundation loads in excess of those equal to three story dwellings. No specific bearing strength is estimated or implied.

Without Basements: The same qualifications as given above for dwellings--with basements apply here except that seasonal high water tables are not as restrictive.

4/ Waste Disposal

Septic Tank Absorption Fields: Ratings are for shallow, subsurface tile absorption fields and do not include alternative systems.

5/ Local Roads, Streets, & Parking Areas: Ratings are for improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, and are expected to carry automobile traffic all year.

6/ Suitability As A Source Of

Sand: This column provides guidance about where to look for sand. Soil rated "good" contains a source of clean sand. "Fair" indicates sand with some fine material. "Poor" indicates fine material costly to remove. "Unsuited" indicates sand is not available.

Gravel: The purpose of this column is to provide guidance about where to look for gravel. The explanation of the ratings for sand" (above) apply also to "gravel".

Roadfill: Refers to soil material moved from its original location and used in road construction. Generally it serves as the subgrade or foundation for the road. The whole soil, to a depth of six feet, is given one rating, assuming it will be mixed in handling.

7/ Recreation

Camp and Picnic Areas: Ratings apply to soils to be used intensively for tents and small camp trailers and the accompanying activities of outdoor living and for park-type picnic areas.

Playgrounds and Athletic Fields: Ratings apply to soils to be used intensively for playgrounds for baseball, football, volleyball and other similar organized games. These areas are subject to intensive foot traffic.

8/ Intensive Cropping: The ratings are based on the potential productivity of soils to produce sustained corn yields under high levels of management.

9/ Woodland Productivity: The ratings are based on the potential productivity of soils for their primary adapted species.

Exhibit 6A

GENERAL SOIL INFORMATION

The General Soil Map (Exhibit 6C) of the Bailey-Cox-Newtson Watershed shows three main patterns of soils called soil associations. Each association contains a few major soils and several minor soils and is named for the major soils. The soils in one association may be in another, but in a different pattern.

The General Soil Map is useful to people who want a general idea of the soils, who want to compare different parts of the watershed, or who want to know the location of large tracts that are suitable for a certain kind of farm or nonfarm land use. Such a map is not suitable for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the soils in any one association ordinarily differ in slope, depth, drainage, or other characteristics that affect management.

Detailed soil maps and information on soils and specific uses are available for much of the area encompassed by the watershed. This information is available in the field office of the Soil Conservation Service in Starke County.

SOIL INTERPRETATIONS

The interpretive table (Exhibit 6B) provides soil interpretations for 12 specific uses for each of the 3 soil associations shown on the General Soil Map of the Bailey-Cox-Newtson Watershed. The approximate percent of each association in the watershed is given. Estimated limitations or suitability for each of the named soils for each of the 12 uses is given in terms of slight, moderate, or severe limitations or good, fair, poor or unsuited suitability. Beside each of the ratings, the limiting soil properties or features are given by listing one or more numbers. These numbers correspond with those listed in the "Key to Principal Soil Limitations," at the bottom of the table. Soils rated as slight are estimated to have no principal soil limitations and are not referenced to the key.

SOIL LIMITATION CLASSES

Soils rated as "slight" have few or no limitations for the use. Soils rated as "moderate" have limitations which reduce to some degree their desirability when used for the purpose being considered. They require some corrective measures. Soils rated as "severe" have unfavorable soil characteristics that severely restrict their use and desirability for the purpose. A severe rating does not mean the soil cannot be used for a specific use. It does indicate problems during or after application. Special design, engineering or other corrective measures are needed to overcome the limitations. Costs are usually greater than on soils rated slight or moderate, and many times costs are prohibitive.

SOIL SUITABILITY RATING

"Good," "fair," "poor," and "unsuited" are terms used to rate soils as a source of sand, gravel, and roadfill. Soils rated as "good" have qualities such that they can be considered as a suitable resource material. Soils rated "fair" have some problems in the material that make them less desirable. Soils rated as "poor" have problems that greatly limit their suitability as a source. Soils rated as "unsuited" are physically unfit, or it is not practical to process the material.

Where used for "intensive cropping," "good" indicates soils are capable of producing sustained corn yields of 110 to 155 bushels or corn per acre under high levels of management. "Fair" indicates soils that will produce 70 to 110 bushels of corn and "poor" indicates those soils that will produce less than 70 bushels of corn per acre.

Where used for "woodland productivity," "good" indicates soils are capable of producing greater than 335 board feet per acre per year for adapted tree species. "Fair" indicates soils that will produce 260 to 335 feet and "poor" indicates those soils that will produce less than 260 board feet per acre per year.

USDA SOIL CONSERVATION SERVICE

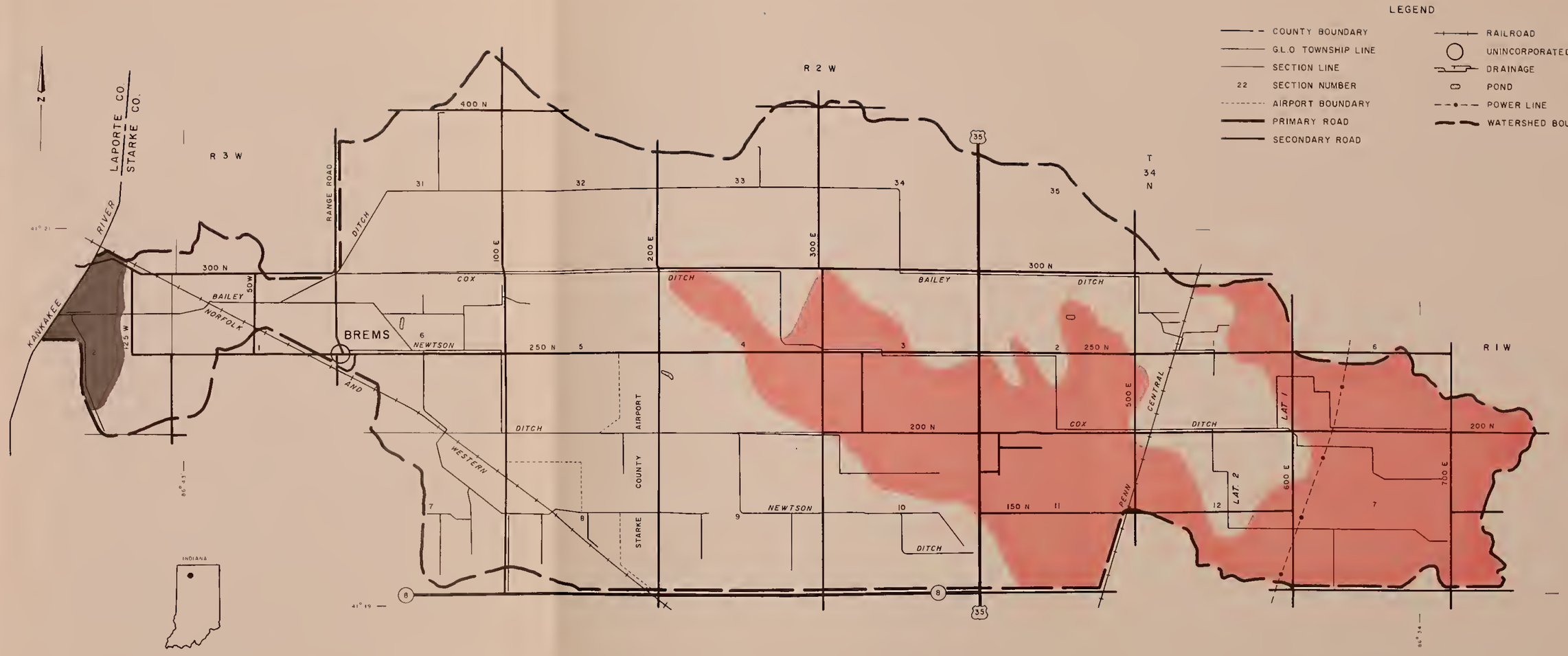
IN COOPERATION WITH

PURDUE UNIVERSITY

AGRICULTURAL EXPERIMENT STATION

U S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



SOIL ASSOCIATIONS

MAUMEE-GILFORD ASSOCIATION 68%

MOROCCO-MAUMEE-BREMS ASSOCIATION 31%

RENSSELAER-MILFORD ASSOCIATION 1%

SCALE 1/36,000

SCALE 3000 0 3000 6000 FEET

GENERAL SOIL MAP

BAILEY-COX-NEWTSON WATERSHED

STARKE COUNTY, INDIANA

EXHIBIT 6C

SOURCE
SCS DRWG. NO. 5,P-35,259 (5-75)
AND INFORMATION FROM FIELD
TECHNICIANS. POLYCONIC PROJECTION

3-2-76
5,O-35,593

USDA-SCS-LINCOLN, NEBR. 1976

DESCRIPTIONS OF SOIL ASSOCIATIONS ON THE GENERAL SOIL MAP

The General Soil Map shows three soil associations in the watershed. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soil and at least one minor soil, and it is named for the major soil. The soils in one association may occur in another, but in a different pattern.

A description of each soil association on the General Soil map follows:

1. Maumee-Gilford association: Deep, very poorly drained, coarse or moderately coarse textured, nearly level soils on lake plains.

   This association is on nearly level lake plains or outwash plains throughout the watershed, and makes up 68 percent of the total area. The dominant soil in the association is Maumee. Gilford soils are of about the same extent and the remaining is less extensive soils.

   Maumee soils are deep, nearly level and very poorly drained. They formed in sandy glacial water laid materials. Their surface layer typically is black, loamy fine sand about 16 inches thick. The subsoil is about 23 inches thick. The upper 5 inches is mottled black, very friable, loamy fine sand and the lower 18 inches is mottled light brownish gray, loose, fine sand. Below this to a depth of 60 inches the underlying material is light brownish gray, fine sand. Below a depth of 4 feet, loamy material may be present.

   Gilford soils are deep, nearly level and very poorly drained. They formed in moderately coarse textured outwash materials. Typically the surface layer is black, fine, sandy loam about 22 inches thick. The subsoil about 16 inches thick, is mottled dark gray, friable sandy loam. Between 38 and 50 inches the underlying material is light brownish gray, loose medium sand, and below this for a depth of 60 inches is brownish yellow and yellowish brown fine and medium sand. At this depth loamy material may also be present.

   There are moderately sloping to steep ridges of sand in this association that were deposited by wind action. The dominant soil on such small areas is Plainfield fine sand.

2. Morocco-Maumee-Brems association: Deep, very poorly drained to moderately well drained, coarse textured, nearly level and gently sloping soils on outwash plains.

This association is on nearly level and gently sloping outwash plains in the south central and eastern part of the watershed, and makes up 31 percent of the total area. The major soils are listed in accordance to their extent. Less extensive soils are also present in the association.

Morocco soils are deep, nearly level and somewhat poorly drained. They formed in strongly acid to very acid sand. Their surface layer typically is dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is mottled pale brown sand about 6 inches thick. The subsoil is about 16 inches thick. The upper 5 inches is mottled pale brown, gray, and reddish yellow, loose, fine sand and the lower 11 inches is mottled reddish yellow, gray and red, loose fine sand. Between 30 and 48 inches the underlying material is mottled, very pale yellow fine sand. Below this to a depth of 60 inches the underlying material is light gray, loose sand.

Maumee soils are deep, nearly level and very poorly drained. They formed in sandy glacial water laid materials. Their surface layer typically is black, loamy fine sand about 16 inches thick. The subsoil is about 23 inches thick. The upper 5 inches is mottled black, very friable, loamy fine sand and the lower 18 inches is mottled light brownish gray, loose, fine sand. Below this to a depth of 60 inches the underlying material is light brownish gray, fine sand. Below a depth of 4 feet loamy material may be present.

Brems soils are deep, nearly level and gently sloping and moderately well drained. They formed in strongly acid to extremely acid sandy material that has been reworked by wind. Their surface layer is typically very dark gray fine sand about 5 inches thick. The subsoil is about 31 inches thick. The upper 16 inches is yellowish brown, loose fine sand. Between 36 and 50 inches the underlying material is mottled very pale brown fine sand. Below this to a depth of 60 inches the underlying material is mottled light gray fine sand.

There are numerous moderately sloping to steep ridges if sand that were deposited by wind action. Plainfield soils are dominant on such small areas.

3. Rensselaer-Milford association: Deep, poorly drained and very poorly drained, medium and moderately fine textured, nearly level soils, on lake plains.

This association is in the extreme western part of the watershed and makes up about 1 percent of the association. The major soil is Rensselear and the less dominant soil is the Milford. There are a few less extensive soils.

Rensselaer soils are deep, nearly level and very poorly drained. They formed in moderately fine textured lacustrine deposits. Their surface layer typically is black loam in the upper 10 inches and black, light clay loam in the lower 4 inches. The subsoil is 28 inches thick. In sequence from the top the upper 13 inches is mottled dark grayish brown firm clay loam.

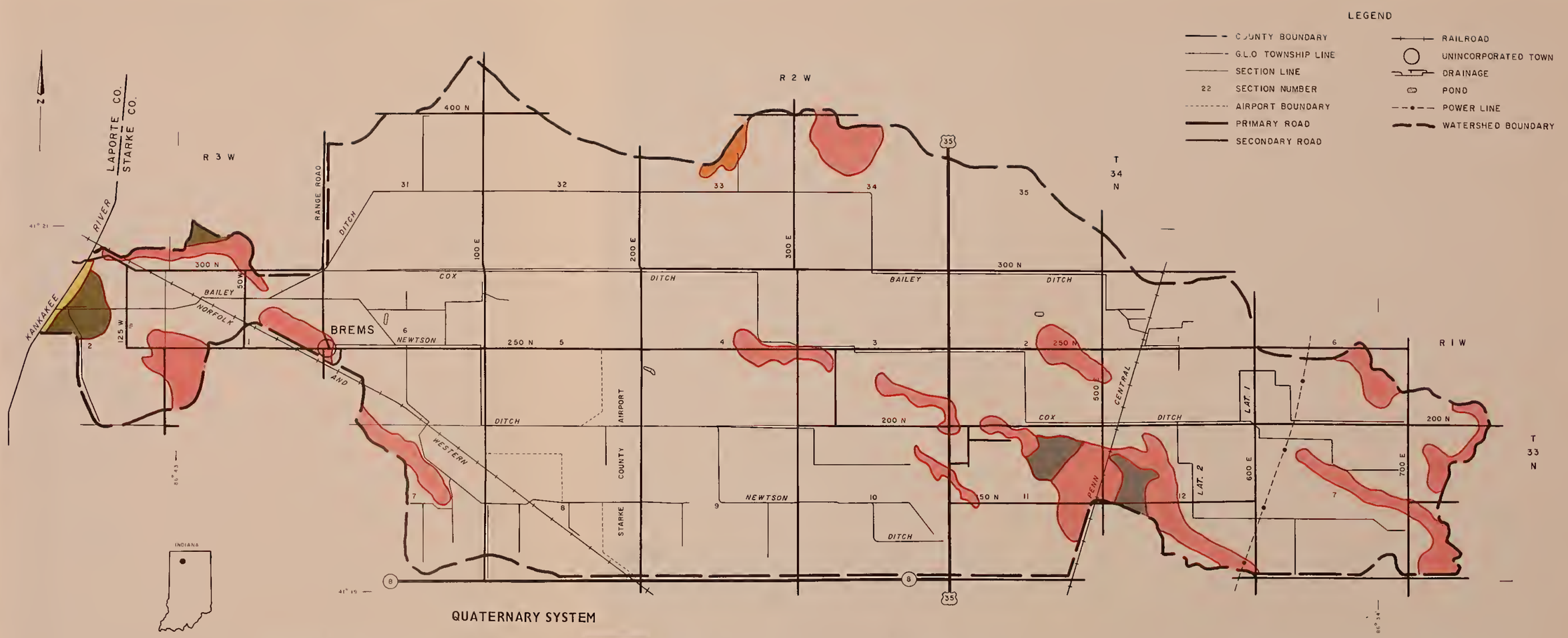
The next 8 inches is mottled olive gray, firm clay loam, and the lower 7 inches is mottled gray, firm clay loam. The underlying material between 42 and 48 inches is mottled gray, silty clay loam. Below this to a depth of 60 inches, the underlying material is mottled gray, yellowish brown, and grayish brown interbedded fine sand and silt.

Milford soils are deep, nearly level and poorly drained or very poorly drained. They formed in moderately fine textured and fine textured lacustrine deposits. Typically their surface layer is black, silty clay loam in the upper 9 inches and mottled very dark gray, silty clay loam in the lower 8 inches. The subsoil is about 20 inches thick. The upper 6 inches is mottled dark gray, firm, light silty clay, and the lower 16 inches is mottled gray, firm silty clay. Below this to a depth of 60 inches the underlying material is mottled gray silty clay loam.

There are a few small areas of soils developed in alluvial material near the Kankakee River.

U S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



QUATERNARY SYSTEM

- OUTWASH-PLAIN DEPDSITS OF GRAVEL, SAND, AND SILT.
- DUNE DEPDSITS OF SAND AND SOME SILT.
- OUTWASH, LACUSTRINE, AND SOME BEACH DEPDSITS OF SAND AND SOME FINE GRAVEL THAT HAVE BEEN REWORKED BY WIND ACTION.
- OUTWASH DEPOSITS OF SAND AND GRAVEL OVERLAIN BY MUCK OR SILT.
- MOSTLY RECENT ALLUVIUM CONSISTING OF SAND, SILT, AND GRAVEL.
- MUCK, PEAT, AND MARL.

GEOLOGY MODIFIED FROM:
SCHNEIDER, A.F. AND KELLER, S.J., 1970 GEOLDGIC MAP OF THE 1^{o} X 2^{o} CHICAGD DUADRANGLE, INDIANA, ILLINOIS, MICHIGAN, AND OHIO, SHOWING BEDRDCK AND UNCONSDLIDATED DEPDSITS. INDIANA GEOLOGICAL SURVEY REGIONAL GEOLOGIC MAP ND. 4.

GENERALIZED SURFICIAL GEOLOGY MAP

BAILEY-COX-NEWTSON WATERSHED

STARKE COUNTY, INDIANA

EXHIBIT 7

SCALE 1/36,000

SCALE 3000 0 3000 6000 FEET

SOURCE
SCS DRWG. NO. 5-P-35,259 (5-75)
AND INFORMATION FROM FIELD
TECHNICIANS. POLYCONIC PROJECTION

3-2-76
5,O-35,594

USDA-SCS-LINCOLN, NEBR. 1976

EXHIBIT 8A

BIRDS IN BAILEY-COX-NEWTSON WATERSHED AND VICINITY

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
LOONS			
Common Loon Gavia immer	M*	Large Lake	Rarely
Red-throated Loon Gavia stellata	M	Lakes	Rarely
GERBES			
Horned Gerbe Colymbus auritus	M	Ponds & Lakes	Rarely
Pied-billed Gerbe Podilymbus podiceps	R&M**	Ponds & Marshes	Common M, Uncommon
Double-crested Cormorant Phalacrocorax auritus	M	Large Lakes & Rivers	Rarely
HERONS			
Great Blue Heron Ardea herodies	SR&M***	Any Shallow Water	Common
Green Heron Butorides virescens virescens	SR&M	Any Shallow Water	Common
Little Blue Heron Florida caerulea caerulea	M	Wet Fields	Uncommon
Cattle Egret Bubuleus ibis	SR	Pasture Areas	Uncommon
American Egret Casmerodius albus egretta	SR&M	Any Shallow Water	Occasionally
Black-crowned Night Heron Nycticorax nycticorax hoactli	M	Ponds & Marshes	Uncommon
Yellow-crowned Night Heron Nyctanassa violacca	M	Marshes	Uncommon

* M--Migrant
** R&M--Resident & Migrant
*** SR&M--Summer Resident & Migrant

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
BITTERNS			
Least Bittern Ixobrychus exilis exilis	SR&M	Cattail Marshes	Common M, Uncommon SR
American Bittern Botarus lentiginosus	SR&M	Marshes	Common M, Uncommon SR
SWANS			
Mute Swan Cygnus olor	M	Ponds & Lakes	Rarely
Whistling Swan Cygnus columbionus	M	Ponds & Lakes	Rarely
GEESE			
Canada Goose Branta canadensis	SR&M	All Water & Fields	Common M, Uncommon SR
White-fronted Goose Anser albifrons	M	All Water & Fields	Occasional
Snow Goose Chen hyperborea	M	All Water & Fields	Occasional
Blue Goose Chen caerulescens	M	All Water & Fields	Common
DUCKS			
Mallard Anas platyrhynchos	R&M	All Water	Common
Black Duck Anas rubripes	WR&M*	All Water	Common
Gadwall Anas strepera	M	All Water	Common
Pintail Anas acuta tzitzihoa	M	All water	Common
Green-winged Teal Anas carolinensis	M	All Water	Common

* WR&M--Winter Resident & Migrant

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Blue-winged Teal *Anas discors*	SR&M	All Water	Common
American Widgeon *Mareca americana*	M	All Water	Common
Shoveler *Spatula clypeata*	M	All Water	Common
Wood Duck *Aix sponsa*	SR&M	All Water, Near Woods Preferred	Common
Redhead *Aythya americana*	M	All Water, Open Areas Preferred	Common
Ring-necked Duck *Aythya collaris*	M	All Water	Common
Canvasback *Aythya valisineria*	M	All Water, Open Areas Preferred	Common
Greater Scaup *Aythya marila neartica*	M	All Water, Open Areas Preferred	Uncommon
Lesser Scaup *Aythya affinis*	M	All Water, Open Areas Preferred	Common
Common Goldeneye *Glaucionetta americana*	WR&M	All Water, Open Areas Preferred	Common
Borrow's Goldeneye *Glaucionetta islandica*	M	All Water, Open Areas Preferred	Uncommon
Bufflehead *Glaucionetta albeola*	M	All Water, Open Areas Preferred	Common
Ruddy Duck *Erismatura jamaicensis rubida*	M	All Water, Open Areas Preferred	Uncommon
Hooded Merganser *Lophodytes cucullatus*	SR&M	All Water, Near Woods Preferred	Rare, SR, Common M
American Merganser *Mergus merganser americanus*	M	All Water, Open Areas Preferred	Common

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Red-breasted Merganser *Mergus serrator*	M	All Water, Open Areas Preferred	Common
VULTURES			
Turkey Vulture *Cathartes aura*	R	All Areas, Some Woods Preferred	Common
Black Vulture *Coragyps atratus*	SR	All Areas, Some Woods Preferred	Uncommon
HAWKS & EAGLES			
Goshawk *Accipters gentilis otricapillus*	M	Forested Areas, Especially Coniferous	Rarely
Sharp-shinned Hawk *Accipiter striatus velox*	R	Wooded Areas	Common
Cooper's Hawk *Accipiter cooperii*	R	Wooded Areas	Uncommon
Red-tailed Hawk. *Buteo jamaicensis*	R	Open Woods and Marshes	Common
Red-shouldered Hawk *Buteo lineatus*	R	Open Woods	Common
Broad-winged Hawk *Buteo platypterus platypterus*	SR	Deciduous Woods	Uncommon
Rough-legged Hawk *Buteo lagopus*	WR	Open Areas	Occasional
Golden Eagle *Aquilachrysaetos canadensis*	M	Wooded Areas	Rarely
Bald Eagle *Haliaeetus leucocephalus*	M	Wooded Areas Near Water	Rarely

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Marsh Hawk *Circus cyaneus hudsonius*	R&M	Marshes, Fields	Common
Osprey *Pandion haliaetus carolinensis*	M	Near Water	Occasional
Peregrine Falcon *Falco peregrinus anatum*	M	Cliffs, High Buildings	Rarely
Pigeon Hawk or Merlin *Falco columbarius columbarius*	M	Woodlands	Rarely
Sparrow Hawk or American Kestrel *Falco sparverius*	R&M	Open Areas	Very Common
UPLAND GAME BIRDS			
Bobwhite *Colinus virginianus*	R	Brushlands	Common
Ring-necked pheasant *Phasianus colchicus torquatus*	R	Brushy Edges in Farm	Common
Gray Partridge *Perdix Perdix Perdix*	R	Fields & Brushy Edges	Rarely
CRANE			
Sandhill Crane *Grus canadensis*	M	Marshes and Open Areas	Occasional
RAILS			
King Rail *Rallus elegans elegans*	SR&M	Marshes	Common
Virginia Rail *Rallus limicola limicola*	SR&M	Marshes	Common
Sora *Porzana carolina*	SR&M	Marshes	Common

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Yellow Rail *Coturnicops noveboracensis noveboracensis*	M	Wet Meadows	Uncommon
Black Rail *Laterallus jamaicensis pygmaeus*	M	Grassy Edges of Marshes	Rarely
Florida Gallinule *Gallinula chloropus cachinnans*	SR&M	Marshes	Common
Coot *Fulica americana*	SR&M	All Water	Common
PLOVER			
Simipalmated Plover *Charadrius hiaticula semipalmatus*	M	Wet Fields	Uncommon
Killdeer *Charadrius vociferus Vociferus*	R&M	Fields, Open Areas Often Near Water	Common
Am. Golden Plover *Pluvialis dominica dominica*	M	Marshes & Fields	Uncommon
Black-bellied Plover *Squatarola squatarola*	M	Wet Meadows, Fields and Marshes	Uncommon
WOODCOCK, SNIPE & SANDPIPER			
American Woodcock *Philohela minor*	SR&M	Swamps, Wet Woods, and Thickets	Common
(Wilson's) Common Snipe *Capela gallinago delicata*	M	Meadows and Marshes	Common
Upland Plover *Bartramia longicauda*	SR&M	Pastures & Prairies	Occasional
Spotted Sandpiper *Actitis macularia*	SR&M	Water Edges	Common

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Solitary Sandpiper *Tringa solitaria solitaria*	M	Water Edges	Uncommon
Greater Yellowlegs *Totanus Melanoleucus*	M	Marshes & Shallow Water Areas	Common
Lesser Yellowlegs *Totanus flavipes*	M	Marshes & Shallow Water Areas	Common
Pectoral Sandpiper *Erolia melanotos*	M	Grassy Marshes	Uncommon
Baird's Sandpiper *Erolia bairdii*	M	Grassy Areas & Shore Lines	Uncommon
Least Sandpiper *Erolia minutilla*	M	Wet Fields	Uncommon
Dunlin (Red-backed) Sandpiper *Erolia alpina pacifica*	M	Water Edges	Uncommon
Short-billed Dowitcher *Limnodromus griseus*	M	Marshes, Water	Uncommon
Simipalmated Sandpiper *Ereunetes pusillus*	M	Water Edges	Uncommon
Hudsonian Godwit *Limosa haemastica*	M	Marshes, Wet Fields & Water Edges	Uncommon
Sanderling *Crocethia alba*	M	Water Edges	Occasional
Wilson's Phalarope *Stegaropus tricolor*	SR	Shallow Water Areas	Rarely
Northern Phalarope *Lobipes lobatus*	M	Ponds & Lakes	Rarely

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
GULLS			
Herring Gull *Larus argentatus*	R&M	Open Water Areas	Common
Ring-billed Gull *Larus delawarensis*	R&M	Open Water Areas	Common
Bonaparte's Gull *Larus philadelphia*	M	Open Areas, Often Near Large Streams	Uncommon
TRENS			
Common Tren *Sterna hirundo hirundo*	M	Open Water Areas	Common
Black Tren *Chlidonias nigra surinamensis*	M	Marshes, Shallow Water Areas	Common
DOVES			
Rock Dove *Columba livia*	R	Buildings	Common
Mourning Dove *Zenaidura macroura*	R&M	Open Woodlands & Farmlands	Common
CUCKOOS			
Yellow-billed Cuckoo *Coccyzus americanus americanus*	SR&M	Second Growth Woods and Thickets	Common
Black-billed Cuckoo *Coccyzus erythrophtalmus*	SR&M	Second Growth Woods & Thickets	Common
OWLS			
Barn Owl *Tyto alba pratincola*	R	Wood Edges & Farmlands	Uncommon
Screech Owl *Otus asio*	R	Open Woods	Common
Great Horned Owl *Bubo virginianus*	R	Deep Woods	Common

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Snowy Owl *Nyctea scandiac*	M	Marshes & Farmlands	Rarely
Barred Owl *Strix viria*	R	Moist Woods	Common
Long-eared Owl *Asio otus wilsonianus*	WR	Evergreens or Mixed Woodlands	Common
Short-eared Owl *Asio flammeus flammeus*		Marshes, Meadows, and Open Areas	Common
Saw-whet Owl *Aegolius acadica acadica*	SR	Evergreens & Swamps	Rarely
Whip-poor-will *Caprimulgus vociferus*	SR&M	Woods Near Fields	Common
Nighthawk *Chordeiles minor*	SR&M	Open Areas	Common
Chimmney Swift *Chaetura pelagica*	SR&M	Open Areas Near Buildings	Common
Ruby-throated Hummingbird *Archilochus colubris*	SR&M	Gardens & Areas with Wild Flowers	Common
Belted Kingfisher *Megaceryle alcyon alcyon*	SR&M	Water Edges	Common
WOODPECKERS			
Yellow-shafted Flicker *Colaptes auratus*	SR&M	Wood Edges & Open Woods	Common
Red-bellied Woodpecker *Centurus carolinus*	R	Woods, Edges & Swamps	Common
Red-headed Woodpecker *Melanerpes erythrocephalus*	R	Open Woods & Farmlands	Common
Yellow-bellied Sapsucker *Sphyrapicus varius varius*	WR	Wooded Areas	Common
Hairy Woodpecker *Dendrocopus villosus*	R	Wooded Areas	Common

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Downy Woodpecker *Dendrocopus pubescens*	R	Open Woods & Edges	Common
FLYCATCHERS			
Eastern Kingbird *Tyrannus tyrannus*	SR&M	Farms, Meadows, & Water Edges	Common
Great Crested Flycatcher *Myiarchus crinitus*	SR&M	Wooded Areas	Uncommon
Eastern Phobe *Sayornis phoebe*	SR&M	Farmlands & Stream Edges	Common
Yellow-bellied Flycatcher *Empidonax flaviventris*	SR&M	Stream Edges	Uncommon
Acadian Flycatcher *Empidonax virescens*	SR&M	Woodlands	Uncommon
Traill's Flycatcher *Empidonax traillii traillii*	M	Dry Uplands	Uncommon
Least Flycatcher *Empidonax minimus*	M	Stream Edges & Farmlands	Common
Eastern Wood Pewee *Contopus virens*	SR&M	Pine Woods & Shade Trees	Common
Olive-sided Flycatcher *Nuttallornis borealis*	M	Woods Near Water	Occasional
Horned Lark *Eremophila alpestris*	R	Open Areas and Marshes	Common
SWALLOWS			
Tree Swallow *Iridoprocne bicolor*	SR&M	Open Areas Near Water	Common
Bank Swallow *Riparia riparia riparia*	SR&M	Meadows, Ponds, & Banks	Uncommon
Rough-winged Swallow *Stelgidopteryx ruficollis serripennis*	SR&M	Open Areas Near Water	Common

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Barn Swallow *Hirundo rustica erythrogaster*	SR&M	Meadows & Marshes Near Open Water	Common
Cliff Swallow *Petrochelidon pyrrhonota albifrons*	SR&M	Meadows & Marshes	Uncommon
Purple Martin *Progne subis subis*	SR&M	Meadows & Open Grassy Areas	Common
Bluejay *Cyanocitta cristata*	R	Woods & Edges	Common
Common Crow *Corvus brachyrhynchos*	R	Fields & Woods	Common
Black-capped Chickadee *Parus atricapillus*	R	Woods & Edges	Common
Tufted Titmouse *Parus bicolor*	R	Swamps & Woods	Common
White-breasted Nuthatch *Sitta carolinensis*	SR&M	Wooded Areas	Common
Red-breasted Nuthatch *Sitta canadensis*	WR	Wooded Areas	Uncommon
Brown Creeper *Certhia familiaris*	WR	Swamps & Woods	Common
WRENS			
House Wren *Troglodytes aedon*	SR&M	Woods, Thickets & Farmlands	Common
Winter Wren *Troglodytes troglodytes*	WR	Thickets & Brush-lands	Uncommon
Bewick's Wren *Thryomanes bewickii*	SR	Woods, Thicket & Farmlands	Uncommon
Carolina Wren *Thryothorus ludovicianus*	R	Swamps, Woods & Thickets	Occasional

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Long-billed Marsh Wren *Telmatodytes palustris*	SR&M	Cattail Marshes	Uncommon
Short-billed Marsh Wren *Cistothorus plantensis stellaris*	SR&M	Grassy Marshes	Common
Mockingbird *Mimus polyglottos polyglottos*	R	Farmlands & Towns	Common
Catbird *Dumetella carolinensis*	SR&M	Thickets & Fencerows	Common
Brown Thrasher *Toxostoma rufum rufum*	SR&M	Thickets	Common
THRUSHES			
Robin *Turdus migratorius*	R	Open Areas & Swamps	Abundant
Wood Thrush *Hylocichla mustelina*	SR&M	Moist Woods	Common
Hermit Thrush *Hylocichla guttata faxoni*	M	Moist Woods	Uncommon
Olive-backed Thrush *Hylocichla ustulata*	M	Woodlands	Occasional
Grey-cheeked Thrush *Hylocichla minima*	M	Woodlands	Occasional
Veery *Hylocichla fuscescens*	M	Swamps & Wet Woods	Uncommon
Eastern Bluebird *Sialia sialis*	R&M	Wood Edges & Farmlands	Common
Blue-gray Gnatcatcher *Polioptila caerulea caerulea*	SR	Thickets & Swamps	Uncommon

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Golden-crowned Kinglet *Regulus satrapa satrapa*	M&WR	Thickets & Swamps	Common
Ruby-crowned Kinglet *Regulus calendula calendula*	M	Thickets & Swamps	Uncommon
Water Pipit *Anthus spinoletta rubescens*	M	Fields	Rarely
Bohemian Waxwing *Bombyclla garrulus pallidiceps*	R&M	Woodlands & Edges	Occasional
Cedar Waxwing *Bombycilla cedrorum*	R&M	Woodlands & Edges	Common
Northern Shrike *Lanis excubitor borealis*	WR&M	Open Areas & Swamps	Occasional
Loggerhead Shrike *Lanis ludovicianus*	SR&M	Farmlands	Occasional
Starling *Sturnus vulgaris vulgaris*	R	All areas	Very Abundant
VIREO			
White-eyed Vireo *Vireo griseus*	SR&M	Thickets Near Water	Common
Bell's Vireo *Vireo bellii bellii*	SR&M	Thickets	Uncommon
Yellow-throated Vireo *Vireo flavifrons*	SR&M	Open Woodlands	Uncommmon
Solitary Vireo *Vireo solitarius*	M	Open Woodlands	Uncommon
Red-eyed Vireo *Vireo olivaceus*	SR&M	Woodlands	Common

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Philadelphis Vireo *Vireo philadelphicus*	M	Wood Edges Near Water	Occasional
Warbling Vireo *Vireo gilvus gilvus*	SR&M	Open Woodlands	Occasional
WARBLERS			
Black & White Warbler *Mniotilta varia*	SR&M	Woodlands	Common
Prothonotary Warbler *Protonotaria citrea*	SR&M	Swamps & Moist Woods	Uncommon
Worm-eating Warbler *Helmitheros vermivorus*	SR&M	Woodlands	Uncommon
Golden-winged Warbler *Vermivora chrysoptera*	M	Thickets & Wood Edges	Uncommon
Blue-winged Warbler *Vermivora pinus*	M	Thickets & Wood Edges	Uncommon
Tennessee Warbler *Vermivora peregrina*	M	Thickets & Wood-lands	Common
Orange-crowed Warbler *Vermivora celata celata*	M	Open Woods	Occasional
Nashville Warbler *Vermivora ruficapilla*	M	Wood Edges	Common
Parula Warbler *Parula americana*	SR&M	Swamps & Wood Edges	Common
Yellow Warbler *Dendroica petechia*	SR&M	Swamps & Thickets Near Water	Common
Magnolia Warbler *Dendroica magolia*	M	Woodlands & Edges	Common
Cape May Warbler *Dendroica tigrina*	M	Wood Edges	Uncommon
Black-throated Blue Warbler *Dendroica caerulescens*	M	Open Woods	Uncommon

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Myrtle Warbler Dendroica coronata coronata	M	Open Woods	Common
Black-throated Green Warbler Dendroica virens	M	Woods, Often Conifers	Common
Cerulean Warbler Dendroica cerulea	SR&M	Open Woods	Common
Blackburnian Warbler Dendroica fusca	M	Deep Woods	Common
Yellow-throated Warbler (Sycamore) Dendroica dominica)	SR&M	Moist Woodlands	Occasional
Chestnut-sided Warbler Dendroica pensylvanica	M	Second Growth Woods & Thickets	Common
Bay-breasted Warbler Dendroica castanea	M	Open Woods	Common
Blackpoll Warbler Dendroica striata	M	Open Woods	Common
Pine Warbler Dendroica pinus	M	Open Woods	Uncommon
Prairie Warbler Dendroica discolor	SR&M	Second Growth Woods	Uncommon
Palm Warbler Dendroica palmarum	M	Open Areas & Swamps	Common
Ovenbird Seiurus aurocapillus	SR&M	Woodlands	Common
Northern Waterthrush Seiurus noveboracensis	M	Stream Sides	Uncommon
Louisiana Waterthrush Seiurus motacilla	SR&M	Marshes and Stream Edges	Uncommon
Kentucky Warbler Oporornis formosus	SR&M	Moist Thickets & Swamps	Uncommon

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Connecticut Warbler *Oporornis agilis*	M	Moist Thickets & Swamps	Uncommon
Mourning Warbler *Oporornis philadelphis*	M	Moist Thickets & Swamps	Common
Yellow Throat *Geothlypis trichas*	SR&M	Thickets	Common
Hooded Warbler *Wilsonia citrina*	M	Thickets Near Water	Common
Wilson's Warbler *Wilsonia pusilla pusilla*	M	Thickets Near Water	Common
Canada Warbler *Wilsonia canadensis*	M	Thickets Near Water	Common
American Redstart *Setophage ruticilla*	M	Woodlands & Swamps	Common
English Sparrow *Passer domesticus domesticus*	R	All Areas	Very abundant
Bobolink *Dolichonyx oryzivorus*	M	Marshes & Meadows	Common
Eastern Meadowlark *Sturnella magna*	R	Marshes & Meadows	Common
Western Meadowlark *Sturnella nelecta*	R	Marshes & Meadows	Occasional
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	SR	Fields, Marshes, & Farmlands	Rarely
Redwinged Blackbird *Agelaius phoeniceus*	R	Fields, Marshes & Edges	Abundant
Orchard Oriole *Icterus spurius*	SR&M	Orchards & Farmlands	Common
Baltimore Oriole *Icterus galbula*	SR&M	Open Woods	Common

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Rusty Blackbird *Euphagus carolinus*	M	Swamps, Marshes & Fields	Uncommon
Brewer's Blackbird *Euphagus cyanocephalus*	SR	Farmlands	Uncommon
Common Grackle *Quiscalus quiscula*	R	All Areas	Abundant
Brown-headed Cowbird *Molothrus ater ater*	SR&M	Open Areas	Common
Summer Tanager *Piranga rubra rubra*	SR&M	Woodlands	Occasional
Scarlet Tanager *Piranga Olivacea*	SR&M	Woodlands	Common
Cardinal *Richmondena cardinalis*	R	Thickets	Common
Rose-breasted Grosbeck *Pheucticus ludovicianus*	M	Open Woods, Edges & Thickets	Common
Indigo Bunting *Passerina cyanea*	SR&M	Brush Lands & Edges	Common
Dickcissel *Spiza americana*	SR&M	Meadows & Prairies	Common
Purple Finch *Carpodacus purpureus purpureus*	WR&M	Woodlands	Common
Evening Grosbeck *Hesperiphona vespertina vespertina*	WR&M	Wood Edges	Common
Pine Grosbeck *Pinicola enucleator leucura*	WR	Wood Edges	Occasional
Common Redpoll *Acanthus flammea*	WR	Swamps & Fields	Common

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Pine Siskin *Spinus pinus pinus*	WR&M	Woodlands & Thickets	Common
American Goldfinch *Spinus tristis tristis*	R	Open Areas	Common
Red Crossbill *Loxia curvirostra*	WR&M	Coniferous Area	Occasional
White-winged Crossbill *Loxia leucoptera leucoptera*	WR	Coniferous Areas	Occasional
Rufous-sided Towhee *Pipilo erythrophthalmus*	R	Woodlands, Edges & Thickets	Common
SPARROWS			
Savanah Sparrow *Passerculus sandwichensis*	M	Water Edges & Meadows	Uncommon
Grasshopper Sparrow *Ammodramus savannarum*	SR&M	Meadows & Farmlands	Uncommon
LeConte's Sparrow *Passerherbulus caudacutus*	M	Marshes & Meadows	Uncommon
Sharp-tailed Sparrow *Ammosqiza caudacuta*	M	Marshes	Occasional
Vesper Sparrow *Poaecetes gramineus gramineus*	WR&M	Dry meadows	Common
Lark Sparrow *Chondestes grammacus grammacus*	M	Dry Meadows & Open Woods	Uncommon
Bachman's Sparrow *Aimophila aestivalis*	SR&M	Open Woods & Brushlands	Occasional
Slate-colored Junco *Junco hyemalis*	WR&M	Edges & Open Areas	Common
Oregon Junco *Junco oreganus*	WR	Edges & Open Areas	Rarely

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Tree Sparrow *Spizella arborea arborea*	SR&M	Brushlands & Second Growth Woods	Common
Chipping Sparrow *Spizella passerina passerina*	SR&M	Wood Edges & Meadows	Common
Clay-colored Sparrow *Spizella pallida*	SR&M	Meadows & Brush-lands	Occasional
Field Sparrow *Spizella pusilla pusilla*	R	Meadows & Brushlands	Common
Harris Sparrow *Zonotrichia querula*	WR	Thickets	Common
White-crowned Sparrow *Zonotrichia leucophrys*	M	Thickets	Common
White-throated Sparrow *Zonotrichia albicollis*	WR&M	Thickets	Common
Fox Sparrow *Passerella iliaca iliaca*	WR&M	Open Woods, Edges & Thickets	Common
Lincoln's Sparrow *Melospiza lincolnii lincolnii*	M	Wet Areas, Thickets & Edges	Common
Swamp Sparrow *Melospiza georgiana*	WR&M	Marshes and Swamps	Common
Song Sparrow *Melopiza melodia*	R	Thickets	Common
Smith's Longspur *Calcarius pictus*	SR&M	Meadows	Rarely
Lapland Longspur *Calcarius lapponicus lapponicus*	WR&M	Meadows	Occasional

EXHIBIT 8A--cont'd

Species	Migrant or Resident	Habitat Preference	Occurrence in Area
Snow Bunting *Plectrophenax nivalis nivalis*	WR	Fields & Marshes	Uncommon

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References:

Peterson, Roger Troy, A Field Guide to the Birds, 1947.

Robbins, Brunn, and Zim, Birds of North America, 1966.

Audubon Society, A Checklist for Indiana.

EXHIBIT 8B

MAMMALS IN BAILEY-COX-NEWTSON WATERSHED AND VICINITY

Name	Habitat Preference	Notes on Local Population
Oppossum *Didelphis marsupialis*	Farming areas and bordering woodlands	Abundant
Masked Shrew *Sorex cinereus*	Moist meadows, woods, and brush	Common
Short-tailed Shrew *Blarina brevicauda*	Anywhere with vegetation and litter	Common
Least Shrew *Cryptotis parva*	Open grassy areas and marshes	Uncommon
Eastern Mole *Scalopus aquaticus*	Well-drained soil in open areas	Common
Star-nosed Mole *Condylura cristata*	Moist ground near water	Possibly present but very uncommon
Little Brown Bat *Myotis lucifugus*	Caves, hollow trees, buildings, under loose bark, shingles, etc.	Colonial, common
Keen's Bat *Myotis keeni*	Caves, hollow trees, culverts, buildings in wooded areas	Common
Indiana Bat *Myotis sodalis*	Limestone caves in winter, hollow trees in summer	Colonial in winter, may be present on edge of range. Considered *rare* nationally
Silver-haired Bat *Lasionycteris noctivagans*	Wooded areas	In summer, males solitary, females gregarious. Probably present.
Big Brown Bat *Eptesicus fuscus*	Varied, caves, mines, crevices, and buildings	Common
Red Bat *Lasiurus borealis*	Wooded areas	Probably present
Hoary Bat *Lasiurus cinereus*	Wooded areas	Probably present
Eastern Cottontail *Sylvilagus floridanus*	Brush, woodlots with open areas nearby, edges of marsh, weed patches	Common

EXHIBIT 8B--cont'd

Name	Habitat Preference	Notes on Local Population
Woodchuck Marmota monar	Open woods, brushy areas, meadows, and roadsides	Common
Thirteen-lined Ground Squirrel Citellus triceem-limeatus	Grassy areas, roadsides	Probably present
Franklin's Ground Squirrel Citellus franklini	Prairies and pastures	Could occur, but very uncommon. Extreme east edge of range.
Eastern Chipmunk Tamias striatus	Hardwood forest, brushy areas	Common
Gray Squirrel Sciurus carolinensis	Hardwood forest, parks with nut trees	Present
Fox Squirrel Sciurus niger	Open hardwood lots	Common
Red Squirrel Tamiasciurus hudsonicus	Evergreen forest, less common in hardwoods	Common in pine areas
Southern Flying Squirrel Glaucomys volans	Woodlands of deciduous or mixed deciduous and coniferous	Common, nocturnal
Plains Pocket Gopher Geomys bursarius	Deep soiled open areas	Extreme east edge of range. If present, very uncommon.
Beaver Castor canadensis	Streams, lakes, & ditches	Uncommon
Deer Mouse Peromuscus maniculatus	Woods, meadows, brush lands, and farms	Common
White-footed Mouse Peromuscus leucopus	Woods, thickets, stream sides	Common
Lemming Mouse Synaptomus cooperi	Low damp areas with heavy ground vegetation	Probably present

EXHIBIT 8B--cont'd

Name	Habitat Preference	Notes on Local Population
Meadow Vole Microtus pennsylvanious	Low moist areas or high grass lands with rank growths of vegetation near water	Common
Prairie Vole Microtus ochrogaster	Meadows, fence rows, and farm fields	Common
Pine Vole Microtus penetorum	Deciduous forests, orchards, gardens, and fields	Common in habitat type
Muskrat Ondatra aibethica	Marshes, lakes, ponds, water-courses	Common
Norway Rat Rattus norvegicus	Buildings, dumps, and fields	Common
House Mouse Mus musculus	Buildings, dumps, & fields	Common
Meadow Jumping Mouse Zapus hudsonius	Damp meadow and wooded areas	May be present
Coyote Canis latroms	Prairies, open forest land, and farmlands	Uncommon
Red Fox Vulpes fulva	Dry upland with open areas preferred	Common
Gray Fox Urocyon cinereoargenteus	Brush, wooded lowlands	Common, but less than Red Fox
Raccoon Procyn lotor	Woods, swamps	Nocturnal, Common
Least Weasel Mustela rixosa	Open woods, and meadows	Probably present, uncommon throughout range
Long-tailed Weasel Mustela frenata	Farmlands, meadows, woods, and marshes. Near water	Nocturnal, Common
Mink Mustela vision	Near water	Nocturnal, Common

EXHIBIT 8B--cont'd

Name	Habitat Preference	Notes on Local Population
Badger *Taxidea taxus*	Open lands	Rare but may be present. Protected by law, considered rare and endangered in Indiana.
Striped Skunk *Mephitis mephitis*	Woods, meadows, & farmlands	Nocturnal, Common
White-tailed Deer *Odocoileous virginianus*	Mixed woods and edges	Common but secretive

EXHIBIT 8C

FLORA IN BAILEY-COX-NEWTSON WATERSHED AND VICINITY

Trees

Scientific Name	Common Name
Acer negundo	box elder, ash-leaved maple
Acer rubrum	red maple
Acer saccharinum	silver maple
Acer saccharum	sugar maple
Betula lutea	yellow birch
Betula nigra	river birch
Bidens frondosa	beggar tick
Carpinus cardliniana	blue beech
Carya ovata	shagbark hickory
Carya tomentosa	mockernut hickory
Catalpa speciosa	catalpa
Celtis occidentalis	bigleaf hackberry
Cercis canadensis	redbud
Corylus americana	American hazelnut
Fagus grandifolia	American beech
Fraxinus americana	white ash
Fraxinus quadrangulata	blue ash
Fraxinus tomentosa	pumpkin ash
Gleditsia triacanthos	honey locust
Gymnocladus dioica	Kentucky coffee tree
Juglans nigra	black walnut
Juniperus virginiana	eastern red cedar
Liriondendron tulipifera	yellow poplar
Maclura pomifera	osage orange
Morus rubra	red mulberry
Nyssa sylvatica	black gum
Ostrya virginiana	hop-hornbeam or ironwood
Pinus strobus	eastern white pine
Platanus occidentalis	American sycamore
Populus deltoides	cottonwood
Populus grandidentata	big-tooth aspen
Prunus serotina	black cherry
Quercus alba	white oak
Quercus bicolor	swamp white oak
Quercus imbricaria	shingle oak
Quercus macrocarpa	bur oak
Quercus muehlenbergii	chinquapin oak
Quercus palustris	pin oak
Quercus rubra	red oak
Quercus velutina	black oak
Salix nigra	black willow
Sambucus canadensis	American elder
Sassafras albidum	Sassafras
Tilia americana	Basswood
Ulmus americana	American elm
Ulmus rubra	slippery elm

EXHIBIT 8C--cont'd

Shrubs

Scientific Name	Common Name
Alnus rugosa	hazal alder
Amelanchier canadensis	oblong-leaf Juneberry
Amelanchier medic	Juneberries
Amorpha canescens	leadplant
Aralia spinosa	Hercule's club, devil's walking stick
Aronia floribunda	purple chokecherry
Aronia melanocarpa	black chokeberry
Asimina triloba	common pawpaw
Benzoin aestivale	spicebush
Berberis thunbergii	Japanese barberry
Betula pumila	dwarf birch
Campsis radicans	trumpetcreeper
Celastrus scandens	American bittersweet
Cephalanthus occidentalis	bottombush
Chamaedaphne calyculata	leatherleaf
Cornus alternifolia	pagoda dogwood
Cornus florida	flowering dogwood
Cornus obliqua	pale dogwood
Cornus racemosa	gray dogwood
Cornus stolonifera	red-osier dogwood
Crataegus crus-galli	cockspur thorn
Crataegus mollis	downy hawthorn
Diervilla lonicera	Northern bush-honeysuckle
Euonymus atropurureus	wahoo or burning bush
Euonymus obovatus	strawberry bush
Gaultheria procumbens	wintergreen
Grossularia cynosbati	pasture gooseberry
Grossularia missouriensis	Missouri gooseberry
Hamamelis virginiana	witch-hazel
Hydrangea arborescens	smooth hydrangea
Hypericum prolificum	shrubby St. Johnswort
Ilex verticillata	common winterberry
Lonicera canadensis	American fly honeysuckle
Lonicera dioica	smooth honeysuckle
Lonicera sempervirens	trumpet honeysuckle
Malus coronaria	American crabapple
Mitchella repens	partridgeberry
Myrica asplenifolia	sweetfern
Parthenocissus quinquefolia	Virginia creeper
Potentilla fruticosa	shrubby cinquefoil
Prunus americana	American plum
Prunus pumila	sand cherry
Prunus virginiana	common chokecherry
Ptelea trifoliata	common hoptree
Pyrus Coronaria	wild sweet crab

Scientific Name	Common Name
Rhamnus lanceolata	lance-leaved buckthorn
Rhus copallina	dwarf sumac
Rhus glabra	smooth sumac
Rhus radican	poison ivy
Rhus vernix	poison sumac
Ribes americanum	American black currant
Robinia pseudoachcia	black locust
Rosa carolina	pasture rose
Rosa multiflora	multiflora rose
Rosa palustris	swamp rose
Rosa setigera	prairie rose
Rubus allegheniensis	blackberries
Rubus flagellaria	dewberry
Rubus hispidus	swamp dewberry
Rubus ideaus var. strigosus	red raspberries
Rubus occidentalis	black raspberries
Salix candida	sage willow
Salix discolor	pussy willow
Salix longifolia	sandbar willow
Sambucus canadensis	common elder
Smilax hispida muhlenberg	bristly greenbrier
Smilax rotundifolia	common greenbrier
Spiraea alba	meadow spirea
Staphylea trifolia	American bladdernut
Symphoricarpos orbiculatus	corolberry
Vaccinium corymbosum	highbrush blueberry
Vaccinium pennsylvanicum	lowbush blueberry
Viburnum acerifolium	maple leaf vibernum
Viburnum lentago	nannyberry
Viburnum molle	Kentucky viburnum
Viburnum prunifolium	blackhaw
Vitis cinerea	sweet winter grape
Vitis vulpina	riverbank grape

Grasses

Agropyron caninum	bearded wheat grass
Agrostis alba	redtop
Agrostis hiemalis	rough hair grass
Agrostis perennans	upland bent grass
Agrostis stulonifera	redtop
Alopecurus aequalis	short-awn foxtail
Andropogon geroadi	big blue stem
Andropogon scorporius	little blue stem
Aristida purpurascens	---
Brachyelytrum erectum	---

EXHIBIT 8C--cont'd

Scientific Name	Common Name
Bromus arensis	field brome
Bromus inermis	smooth brome
Calamagrostis canadensis	bluejoint
Cinna arundinacea	wood reed grass
Dactylis glomerata	orchardgrass
Digitaria ischaemum	crab grass
Digitaria sanguinalia	crab grass
Echinochloa crusgalli	barnyard grass
Eleusine indica	goose grass
Elymus canadensis	canada rye grass
Elymus virginicus	wild rye grass
Eragrostis hypnoides	creeping eragrostis
Eragrostis pectinacea	---
Festuca arundinacea	tall fescue
Festuca obtusa	nodding fescue
Festuca rubra	fescue creeping red
Glyceria plicata	floating monna grass
Glyceria striata	nerved manna grass
Hierochloe odorata	vanilla grass
Koeleria cristata	koeler's grass
Leersia lenticalaris	---
Leersia oryzoides	rice cut-grass
Leptoloma cognatum	---
Lolium multiflorium	ryegrass, annual
Lolium perenne	ryegrass, perennial
Muhlenbergia mexicana	nimble N
Muhlenbergia schreberi	nimble will
Muhlenbergia sobolifera	nimble D
Muhlenbergia tenuiflora	nimble N, D
Muhlenbergia umbrosa	nimble D
Panicum colambianum	panic grass
Panicum dichotomum	panic grass
Panicum implicatum	panic grass
Panicum lindheimeri	panic grass
Panicum pseudopubescens	panic grass
Panicum spretum	panic grass
Panicum villosissimum	panic grass
Panicum virgatum	switchgrass
Paspalum	---
Phalaris arundinacea	reed canarygrass
Phleum pratense	timothy
Poa annua	annual blue grass
Poa compressa	Canada blue grass
Poa pratensis	Kentucky blue grass
Setaria lutescens	yellow foxtail
Sorghastrum nutans	Indian grass

Scientific Name	Common Name
Sorghum halepense	Johnsongrass
Sorghum vulgare	sorghum
Sporobolus asper	dropseed
Sporobolus vaginaeflorus	dropseed
Stipa spartea	porcupine grass
Triodia flava	tall redtop
Zizania aquatica	common wild rice
Legumes	
Cornoilla varia	crown vetch
Lespedeza cuneota	sericea leopedeza
Lotus corniculatus	birdfoot trefoil
Medicago sativa	alfalfa
Melilotus alba	sweet clover
Trifolium hybridum	alsike clover
Trifolium incarnation	crimson clover
Trifolium pratense	red clover
Trifolium repens	white clover
Trifolium repens var. latum	ladino clover
Vicia villosa	hairy vetch
Wildflowers	
Abutilon theopharsti	velvet leaf, Indian mallow
Acalypha virginica	three-seeded mercury
Actaea pachypoda	white baneberry
Ambrosia artemisiifolia	common ragweed
Ambrosia trifida	giant ragweed, horseweed, kinghead
Amphicarpa bracteata	hog-peanut
Anthemis cotula	mayweed, dog fennel
Antennaria plantaginifolia	plantain-leaved everlasting, cat's paw
Apocynum cannabinum	Indian hemp, dogbane
Arctium lappa	great burdock
Arctium minus	burdock
Arisaema atrorubens	woodland jack-in-the-pulpit
Arisaema dracontium	green dragon, dragon arum
Asarum canadense	wild ginger
Asclepias syriaca	common milkweed
Asclepias verticillata	whorled milkweed
Aster pilosus	white heath aster
Aster spp.	asters
Bidens bipinnata	Spanish needles
Bidens frondosa	beggar tick, sticktight, devil's pitchfork
Brassica juncea	Indian mustard
Brassica nigra	black mustard

EXHIBIT 8C--cont'd

Scientific Name	Common Name
Campanula americana	tall bellflower
Capsella bursa-pastoris	shepherd's purse
Caulophyllum thalictroides	blue cohosh
Cerastium vulgatum	mouse-ear checkweed
Chenopodium album	lampsquarters
Chenopodium ambrosioides	Mexican tea
Chrysanthemum leucanthemum	oxeye daisy, field daisy
Cichorium intybus	chicory
Cicuta maculata	water hemlock
Cirsium arvense	Canada thistle, creeping thistle
Claytonia virginica	spring-beauty
Convolvulus arvensis	field bindweed, creeping jenny, small morning glory
Convolvulus sepium	hedge bindweed
Datura stramonium	jimson weed
Daucus carota	wild carrot, Queen Anne's lace
Dicentra cucullaria	Dutchman's-breeches
Dipsacus sylvestris	teasel
Echinocystis lobara	wild cucumber
Epifagus virginiana	beechdrops
Erigeron canadensis	horseweed, marestail
Erigeron divaricatus	dwarf fleabane
Erigeron strigosus	daisy feabane
Erythronium Spp.	lilly
Euphorbia corollata	flowering spurge
Eupatorium rugosum	white snakeroot
Galium aparine	bedstraw, cleavers
Galium circaezans	white wild licorice
Galium triflorum	fragrant bedstraw
Geranium carolinianum	cranesbill, wild geranium
Geranium spp.	cranesbills
Geum canadense	white avens
Glainsoga parviflora	galinsoga, quickweed
Glechoma hederacea	ground ivy, creeping charlie
Gnaphalium obtusifolium	cudweed, everlasting
Helianthus tuberosus	Jersualem artichoke
Hepatica acutiloba	sharp-lobed hepatica
Hydrophyllum appendiculatum	appendaged waterleaf
Hypericum perforatum	St. John's wort, Klamath weed
Impatiens capensis	spotted touch-me-not
Impatiens pallida	pale touch-me-not, jewelweed
Ipomoea hederacea	ivy-leaved morning glory
Jeffersonia diphylla	twinleaf
Lactuca canadensis	tall lettuce, wild lettuce
Lactuca spp.	blue lettuces
Lamium amplexicaule	henbit
Lappula echinata	sticktight, blue stickseed

Scientific Name	Common Name
Leonurus cardiaca	motherwort
Lepidium campestre	field peppergrass, cow cress
Lepidium virginicum	peppergrass
Malva neglecta	roundleaved mallow, chesses
Medicago lupulina	black medic, yellow trefoil
Menispermum canadense	Canada moonseed
Mirabilis nyctaginea	wild four-o'clock, umbrella wort
Oenothera biennis	evening primrose
Osmorhiza longistylis	sweet cicely
Oxalis stricta	yellow wood sorrel
Pastinaca sativa	wild parsnip
Phryma leptostachya	lopseed
Physalis heterophylla	ground cherry
Phytolacca americana	pokeweed, pokeberry
Pilea pumila	clearweed
Plantago major	common plantain, broad-leaved plantain
Podophyllum peltatum	May-apple, mandrake
Polemonium reptans	Greek valerian
Polygonum aviculare	knotweed, doorweed
Polygonatum biflorum	Solomon's-seal
Polygonum coccineum	swamp smartweed, tanweed
Polygonum convolvulus	wild buckwheat, black bindweed
Polygonum pennsylvanicum	Pennsylvania smartweed
Polygonum persicaria	ladysthumb, smartweed
Portulaca oleracea	purslane, pusley
Potentilla norvegica	rough cinquefoil
Potentilla recta	upright cinquefoil
Prunella vulgaris	heal-all, self-heal
Ranunculus abortivus	small-flowered buttercup
Ranunculus acris	tall buttercup, meadow buttercup
Rudbeckia hirta	black-eyed susan, cone flower
Rudbeckia laciniata	green-headed coneflower
Rumex acetosella	red sorrel, sheep sorrel
Rumex crispus	curled dock, sour dock
Rumex obtusifolius	broad-leaved dock
Salanum dulcamara	bitter nightshade
Sanguinaria canadensis	bloodroot
Sanicula marilandica	black snakeroot
Saponaria officinalis	bouncing bet, soapwort
Side spinosa	prickly sida, spiny sida
Silene noctiflora	night-flowering catchfly
Sisymbrium officinale	hedge mustard
Smilacina racemosa	false solomon's-seal
Smilax herbacea	carrion-flower
Solanum nigrum	black nightshade
Solidago nemoralis	gray goldenrod, field goldenrod
Stellaria media	common chickweed
Streptopus spp.	Mandarin

EXHIBIT 8C--cont'd

Scientific Name	Common Name
Taraxacum officinale	dandelion
Thalictrum spp.	meadow-rue
Tradescantia spp.	spiderwort
Tragopogon pratensis	yellow goatsbeard
Trillium flexipes	drooping trillium
Trillium nivale	nodding trillium
Trillium recurvatum	prairie trillium
Trillium sessile	toadshade. sessile trillium
Urtica procera	stinging nettle, nettle
Verbascum blattaria	moth mullen
Verbascum thapsus	common mullen
Verbena hastata	blue vervain
Verbena stricta	hoary vervain
Verbena urticaefolia	white vervain
Veronica baldwini	Western ironweed
Veronica peregrina	purslane speedwell
Viola papilionacea	common blue violet
Viola pubescens	downy yellow violet
Xanthium pennsylvanicum	cocklebur, clotbur

EXHIBIT 8D

FISH IN BAILEY-COX-NEWTSON WATERSHED AND VICINITY

Name	Notes on Local Population	Habitat
Bowfin *Amia calva linnaeus*	Occasional	Various, highly tolerant
Gizzard Shad *Dorosoma cepedianum*	Uncommon	Large rivers and main tributaries
Central Mudminnow *Umbra limi*	Rarely	Soft-bottomed creeks, ditches and lakes
Grass Pickerel *Esox americanus vermiculatus*	Very common	Weedy lakes, streams & ditches
Northern Pike *Esocidae*	Uncommon	Weedy lakes and streams
Carp *Cyprinus carpio*	Uncommon	Weedy streams and lakes with soft bottoms
Blacknose Dace *Rhinichthys atratulus*	Abundant	Cool streams with hard bottoms
Creek Chub *Semotilus atromaculatus*	Abundant	Creeks, often gravel bottomed
Hornyhead Chub *Hybopsis biguttata*	Common	Creeks, usually gravel bottomed
Bluntnose Minnow *Pimephales notatus*	Common	Various, highly tolerant
Pugnose Minnow *Opsopoeodus emiliae*	Uncommon	Slow streams with muddy bottoms
Silverjaw Minnow *Ericymba buccata*	Common	Sand bottom streams & lakes
Golden Shiner *Notemigonus crysoleucas auratus*	Uncommon	Slow-moving pools or lakes with mucky bottoms
Redfin Shiner *N. umbratilis*	Uncommon	Creeks and streams

EXHIBIT 8D--cont'd

Name	Notes on Local Population	Habitat
Steelcolor Shiner *Notropis whipplei*	Uncommon	Large and medium streams
Common Shiner *Notropis cornutus*	Common	Streams
Silver Shiner *Notropis photogenis*	Rarely	Fast water in large streams
Rosyface Shiner *Notropis rubellus*	Uncommon	Hard-bottomed streams
Pugnose Shiner *Notropis anogenus*	Rarely	Slow, muddy bottomed streams
Blacknose Shiner *Notropis heterolepis heterolepis*	Rarely	Lakes and slow streams, weedy areas
Blackchin Shiner *Notropis heterodon*	Occasional	Quiet, weedy areas in lakes and streams
Ironcolor Shiner *Notropis chalybaeus*	Occasional	Quiet, weedy areas
Pallid Shiner *Notropis amnis*	Rarely	Streams with sand bar
Spotfin Shiner *Notropis spilopterus*	Rarely	Clear, heavily vegetated ditches
River Shiner *Notropis blennius*	Occasional	Sand & gravel bottomed large streams
Sand Shiner *Notropis stramineus*	Common	Sand bottomed streams
Suckermouth Minnow *Phenacobius mirabilis*	Uncommon	Fast water streams
Stoneroller *Campostoma anomalum*	Very common	Streams with hard bottoms
Quillback *Carpiodes cyprinus*	Common	Rivers and streams
River Carpsucker *Carpiodes forbesi*	Rarely	Rivers and streams
Bigmouth Buffalo *Megastomatobus cyprinella*	Rarely	Slow portions of large streams

Name	Notes on Local Population	Habitat
Black Buffalo *Ictiobus niger*	Rarely	Large streams and lakes
Smallmouth Buffalo *Ictiobus bubalus*	Rarely	Rivers, streams, bayous and swamps
Spotted Sucker *Minytrema melanops*	Uncommon	Streams and lakes with soft bottoms
Lake Chubsucker *Erimyzon sucetta kennerlii*	Uncommon	Streams & lakes in weedy areas, soft bottoms
Black Redhorse *Moxostoma duquesnii duquesnii*	Rarely	Small and medium streams with hard bottoms
Silver Redhorse *Moxostoma anisurum*	Rarely	Large and medium streams with hard bottoms
Golden Redhorse *Moxostoma erythrurum*	Common	Small and medium streams with hard bottoms
Shorthead Redhorse *Moxostoma breviceps*	Common	Rivers and medium streams with hard bottoms
Northern hogsucker *Jypentelium nigricans*	Common	Small stream with hard bottom
White Sucker *Catostomus commersonnii commersonnii*	Abundant	Varied, generally clear, flowing water
Yellow Bullhead *I. Natalis*	Very common	Slow streams & lakes with soft bottoms
Brown Bullhead *Ameiurus nebulosus nebulosus*	Common	Slow streams & lakes with soft bottoms
Black Bullhead *Ameiurus melas melas*	Uncommon	Slow streams & lakes with soft bottoms
Channel Catfish *Ictalurus punctatus*	Uncommon	Rivers and lakes
Stonecat *Noturus flavus*	Common	Medium and large streams with rock or gravel bottoms

EXHIBIT 8D--cont'd

Name	Notes on Local Population	Habitat
Tadpole Madtom *Schilbeodes mollis*	Uncommon	Slow, weedy, soft-bottomed streams
Pirate Perch *Aphredoderus sayanus gibbosus*	Occasional	Weedy areas in clear streams
Blackstripe Topminnow *Fundulus notatus*	Uncommon	Weedy areas in streams & lakes
Starhead Topminnow *Fundulus dispar dispar*	Rarely	Weedy areas in streams and lakes
Brook Silverside *Labidesthes sicculus sicculus*	Occasional	Streams--lakes
Mottled Sculpin *Cottus b. bairdi*	Abundant	Riffles in streams & creeks
Largemouth Bass *Huro salmoides*	Common	Lakes and streams, rivers
Smallmouth Bass *Micropterus dolomieu dolomieu*	Common	Gravel-bottomed streams & lake areas
Warmouth *Chaenobryttus coronarius*	Occasional	Slow streams and lakes with soft bottoms
Green Sunfish *Lepomis cyanellus*	Abundant	Lakes and creeks, weedy areas
Longear Sunfish *Leopmis megalotis peltastes*	Rarely	Lakes and streams
Bluegill *Lepomis macrochirus macrochirus*	Common	Lakes and pools in streams, weedy areas
Pumpkinseed *Lepomis gibbosus*	Common	Lakes and streams
Redear Sunfish *Lepomis microlophus*	Rarely	Lakes and streams
Rockbass *Ambloplites rupestris rupestris*	Common	Hard bottomed streams

Name	Notes on Local Population	Habitat
White Crappie *Promoxis annularis*	Rarely	Lakes and streams, mud bottoms, clear or turbid
Black Crappie *Pomoxis nigro-maculatus*	Common	Lakes and streams, mud bottoms, clear, weedy areas
Yellow Perch *Perca flavescens*	Rarely	Lakes and some streams
Walleye *Stizostedio vitreum vitreum*	Rarely	Lakes, rivers, and streams
Logperch *Percina caprodes*	Rarely	Riffles in rivers & streams
Blackside Darter *Hadropterus maculatus*	Uncommon	Pools in small & medium streams
Slenderhead Darter *Hadropterus phoxocephalus*	Uncommon	Riffles in creeks & ditches
Dusky Darter *Percina sciera*	Common	Fast, shallow streams with gravel bottom
Greenside Darter *Etheostoma blenniodes*	Common	Riffles in small and medium streams
Johnny Darter *Etheostoma nigrum*	Very common	Lakes and quiet waters of streams with sand or gravel bottoms
Orangethroat Darter *E. s. spectabile*	Rarely	Creeks with riffles

REPTILES AND AMPHIBIANS IN BAILEY-COX-NEWTSON WATERSHED AND VICINITY

Name	Comments
Common Snapping Turtle *Chelydra serpentina*	Range covers the state
Spotted turtle *Clemmys guttata*	Range covers north one-fourth of state

EXHIBIT 8D--cont'd

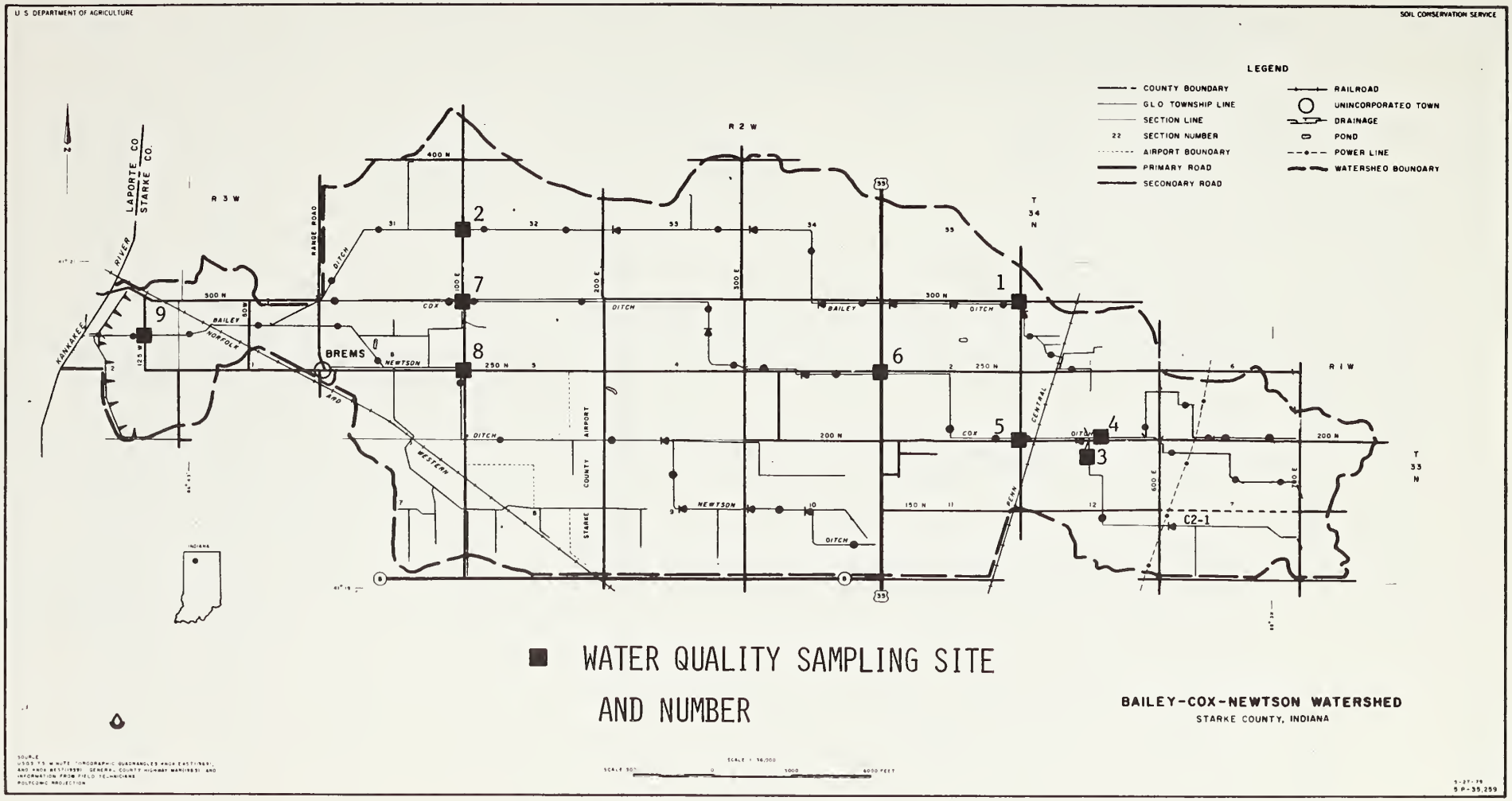
Name	Comments
Stinkpot (Musk Turtle) Sternothaerus odoratus	Range covers the state
Map Turtle Graptemys geographica	Range covers the state
Midland Painted Turtle Chrysemys picta marginata	Range covers the state
Red-Eared Turtle Pseudemys scripta elegans	Range covers west one-half of state
Ornate Box Turtle Terrapene ornata ornata	Range covers prairie areas on west side of state
Eastern Box Turtle Terrapene carolina carolina	Range covers the entire state except small section of northwest corner
Blanding's Turtle Emydoidea blandingi	Range covers north one-fourth of state
Eastern Spiny Softshell Trionyx spinifer spinifer	Range covers the state
Five-Lined Skink Eumeces fasciatus	Range covers the state except small area in northwest corner
Western Slender Glass Lizard Ophisaurus attenuatus attenuatus	Range covers west edge of state
Midland Brown Snake Storeria dekayi wrightorum	Range covers state
Northern Water Snake Natrix sipedon sipedon	Range covers north two-thirds of state
Kirtland's Water Snake Natrix kirtlandi	Range covers the state except southwest corner
Queen Snake Natrix septemvittata	Range covers the state except southwest corner and area in northwest corner
Butler's Garter Snake Thamnophis butleri	Range covers north two-thirds of west one-half of state

Name	Comments
Eastern Garter Snake Thamnophis sirtalis sirtalis	Range covers the state
Eastern Ribbon Snake Thamnophis sauritus sauritus	Range covers the state except area in northwest corner
Western Smooth Green Snake Opheodrys vernalis blanchardi	Range covers northwest corner of state
Eastern Hognose Snake Heterodon platyrhinos	Range covers the state
Blue Racer Coluber constrictor foxi	Range covers north two-thirds of state
Western Fox Snake Elaphe vulpina vulpina	Range covers northwest corner of state
Black Rat Snake Elaphe obsoleta obsoleta	Range covers the state except area in northwest corner
Eastern Milk Snake Lampropeltis doliata triangulum	Range covers all of state except southwest corner
Prairie King Snake Lampropeltis calligaster calligaster	Range covers west one-fourth of state
Eastern Massasaugas Sistrurus catenatus catenatus	Range covers north one-half of state & north edge of southwest one-fourth
Bull Snake Pituophis melanoleucus sayi	Range covers northwest corner of state
Mudpuppy Necturus maculosus	Range covers the state
Western Lesser Sirens Siren intermedia nettingi	Range covers west one-fourth & area three-fourths across central part of state
Central Newt Diemictylus viridescens louisianensis	Range covers west one-half of state

EXHIBIT 8D--cont'd

Name	Comments
Blue-Spotted & Jefferson Salamanders Ambystoma laterale	Range covers east three-fourths & northwest corner of state
Spotted Salamander Ambystoma maculatum	Range covers the state except small area of northwest corner
Tremblay's Salamander Ambystoma tremblayi	Northern part of state
Eastern Tiger Salamander Ambystoma tigrinum tigrinum	Range covers the state
Red-Backed Salamander Plethodon cinereus cinereus	Range covers the state except small area of northwest corner
Two Lined Salamander Eurycea bislineata rivicola	Range covers south three-fourths of state
American Toad Bufo americanus	Range covers the state except southwest one-fourth
Fowlers Toad Bufo woodhousei fowleri	Range covers the state
Northern Spring Pepper Hyla crucifer crucifer	Range covers the state
Eastern Gray Tree Frog Hyla versicolor versicolor	Range covers the state
Blanchard's Cricket Frog Acris crepitans blanchardi	Range covers the state
Western Chorus Frog Pseudacris triseriata triseriata	Range covers the state
Pickerel Frog Rana palustris	Range covers the state except areas of northwest & southwest corners
Northern Leopard Frog Rana pipiens pipiens	Range covers north one-half & east edge of state
Green Frog Rana clamitans melanota	Range covers the state

Name	Comments
Wood Frog Rana sylvatica	Range covers the state
Bullfrog Rana catesbeiana	Range covers the state


U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LEGEND
COUNTY BOUNDARY
G L O TOWNSHIP LINE
SECTION LINE
22 SECTION NUMBER
AIRPORT BOUNDARY
PRIMARY ROAD
SECONDARY ROAD
RAILROAD
UNINCORPORATED TOWN
DRAINAGE
POND
POWER LINE
WATERSHED BOUNDARY
R 3 W
R 2 W
R 1 W
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T 33 N
LAPORTE CO
STARKE CO.
KANKAKEE RIVER
MANDE ROAD
DITCH
BAILEY
NORFOLK
COX
NEWTSON
BREMS
WESTERN
COUNTY AIRPORT
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WATER QUALITY SAMPLING SITE
AND NUMBER
BAILEY-COX-NEWTSON WATERSHED
STARKE COUNTY, INDIANA
SCALE 1 : 36,000
5-27-79
S.P.-35,259

EXHIBIT 9A

EXHIBIT 9B

SURFACE WATER QUALITY ANALYSES

Site (Exhibit 9A)	May 5, 1975			July 29, 1975		
	2	7	8	2	7	8
Time (EST)	1800	1645	1530	1330	1300	1200
Drainage area (mi^2)	4.9	5.5	2.7	4.9	5.5	2.7
Discharge (ft^3/s)	11	9.9	6.2	0.5	0.3	0.15
Water temp. (°C)	18.5	17.0	18.0	--	--	21.5
ph, Field	--	--	--	--	--	7.1
Specific Cond. (umhos)	439	320	364	--	--	397
Dissolved oxygen (%sat.)	66	114	111	--	--	85
Dissolved oxygen	6.1	10.8	10.3	--	--	7.4
Calcium	68	46	53	74	43	52
Magnesium	16	11	14	16	10	14
Potassium	1.2	1.0	1.4	.8	.9	1.0
Sodium	4.3	3.0	4.0	4.0	3.0	5.6
Bicarbonate	169	111	135	188	120	159
Carbonate	0	0	0	0	0	0
Chloride	15	10	15	14	8.9	16
Fluoride	.4	.3	.3	.2	.1	.1
Sulfate	66	49	53	63	42	43
Silica, dissolved	10	6.9	7.9	7.9	11	12
Dissolved solids	268	185	220	273	180	224
Total alkalinity (as $CaCO_3$)	139	91	111	154	98	130
Total hardness (as $CaCO_3$)	240	160	190	250	150	190
Noncarb. hardness (as $CaCO_3$)	97	69	79	96	50	57
Ammonia, dissolved (as N)	.15	.05	.08	.01	0	.04
Organic nitrogen dissolved (as N)	.30	.14	.19	.48	.28	.40
Kjeldahl nitrogen, dissolved (as N)	.45	.19	.27	.49	.28	.44
Nitrite, dissolved (as N)	.03	.03	.04	.01	.01	.02
Nitrate, dissolved (as N)	.57	.63	.93	.05	.30	.29
Orthophosphate, dissolved (as P)	.01	.03	.02	.01	.02	.04
Phosphate, dissolved (as P)	.01	.03	.02	.03	.05	.05
Organic carbon, dissolved	6.3	7.6	7.0	--	--	--
Iron, dissolved	.21	.09	.07	.20	.09	.07
Manganese, dissolved	.19	.11	.31	.12	.05	.31
Fecal coliform*	15**	40**	20**	--	--	--
Fecal streptococci*	65**	120	140	--	--	--

Milligrams per litre

SURFACE WATER QUALITY ANALYSES

	October 10, 1975			November 25, 1975		
Site (Exhibit 9A)	2	7	8	2	7	8
Time (EST)	1330	1300	1230	1350	1320	1250
Drainage area (mi^2)	4.9	5.5	2.7	4.9	5.5	2.7
Discharge (ft^3/s)	.13	.5	.03	2.3	2.4	.8
Water temp. (°C)	14.9	14.6	13.4	5.0	5.0	4.0
pH, Field	7.7	7.6	7.5	7.9	7.8	7.6
Specific Conductance (umhos)	472	334	412	445	345	420
Dissolved oxygen (% sat.)	102	80	78	--	--	--
Dissolved oxygen	9.2	7.2	7.0	--	--	--
Calcium	66	42	53	61	46	36
Magnesium	16	11	15	16	12	10
Potassium	1.8	1.9	2.5	1.4	1.5	1.5
Sodium	5.0	4.5	5.6	3.8	3.1	3.3
Bicarbonate	191	127	157	170	123	144
Carbonate	0	0	0	0	0	0
Chloride	16	11	18	15	12	18
Fluoride	.1	.4	.1	.1	.2	.1
Sulfate	65	46	40	62	46	50
Silica, dissolved	9.4	8.4	8.4	9.6	9.3	9.2
Dissolved solids	275	191	221	254	192	201
Total alkalinity (as $CaCO_3$)	157	104	129	139	101	118
Total hardness (as $CaCO_3$)	230	150	190	220	160	130
Noncarbonate hardness (as $CaCO_3$)	74	46	65	79	63	13
Ammonia, dissolved (as N)	.0	.0	.01	.06	.04	.06
Organic nitrogen dissolved (as N)	.45	.34	.41	.32	.21	.26
Kjeldahl nitrogen, dissolved (as N)	.45	.34	.42	.38	.25	.32
Nitrite, dissolved (as N)	.01	.01	.01	.01	.00	.01
Nitrate, dissolved (as N)	.11	.20	.19	.22	.31	.36
Orthophosphate, dissolved (as P)	.01	.57	.09	.01	.04	.02
Phosphate, dissolved (as P)	.03	.65	.05	.03	.07	.04
Organic carbon, total	5.2	7.2	3.8	--	--	--
Iron, dissolved	.07	.29	.17	.23	.06	.02
Manganese, dissolved	.52	.07	.15	.21	.06	.12
Turbidity (JTU)	6	2	5	--	--	--

Milligrams per litre

SURFACE WATER QUALITY ANALYSES

Site (Exhibit 9A)	January 23, 1976			March 5, 1976		
	2	7	8	2	7	8
Time (EST)	1130	1100	1030	1245	1215	1255
Drainage area (mi^2)	4.9	5.5	2.7	4.9	5.5	2.7
Discharge (ft^3/s)	1.0	3.0	.2	34	18	12
Water temp. (°C)	.4***	.4***	.5***	7.8	8.2	7.9
pH, Field	7.6	7.7	7.8	7.4	7.4	7.6
Spceific Conductance (umhos)	406	323	346	228	285	262
Dissolved oxygen (% sat.)	59	67	48	78	74	78
Dissolved oxygen	8.1	9.2	6.6	8.8	8.4	8.6
Calcium	70	41	21	24	32	26
Magnesium	17	10	6.7	6.5	8.5	7.5
Potassium	.9	1.0	.6	6.7	2.0	3.8
Sodium	3.9	3.0	2.3	2.0	2.9	2.6
Bicarbonate	178	118	126	69	89	76
Carbonate	0	0	0	0	0	0
Chloride	9.0	11	11	8.2	10	11
Fluoride	.1	.1	.1	.2	.2	.2
Sulfate	66	46	29	27	38	32
Silica, dissolved	2.0	9.4	3.7	4.6	7.4	6.0
Dissolved solids	213	183	140	117	150	130
Total alkalinity (as $CaCO_3$)	126	97	103	57	73	62
Total hardness (as $CaCO_3$)	240	140	80	87	120	96
Noncarbonate hardness (as $CaCO_3$)	120	47	0	30	42	33
Ammonia, dissolved (as N)	.13	.11	.10	.12	.09	.08
Organic nitrogen, dissolved (as N)	.32	.19	.00	.70	.30	.61
Kjeldahl nitrogen, dissolved (as N)	.45	.30	.00	.82	.39	.69
Nitrite, dissolved (as N)	.01	.01	.01	.03	.02	.02
Nitrate, dissolved (as N)	.42	.69	.75	.76	.95	.63
Orthophosphate, dissolved (as P)	.01	.03	.06	.05	.04	.07
Phosphate, dissolved (as P)	.03	.05	.09	.10	.06	.09
Organic carbon, total	6.5	3.1	3.7	12	5.7	10
Iron, dissolved	.43	.05	.02	.27	.250	.18
Manganese, dissolved	.25	.11	.15	.09	.150	.16

Milligrams per litre

*Colonies per 100 millilitres.
**Estimated value based on non-ideal colony count.
***Complete ice cover.

INSECTICIDE CONCENTRATIONS IN BOTTOM MATERIAL SAMPLES

(micrograms per kilogram)

Insecticide	May 5, 1975			October 10, 1975			March 22, 1976		
	Site 2	Site 7	Site 8	Site 2	Site 7	Site 8	Site 2*	Site 7	Site 8
Aldrin	1.9	1.6	1.1	3.0	.0	.0	.0	.0	.0
Chlordane	6	5	2	14	0	16	7	0	0
DDD	5.0	4.0	1.3	16	.0	9.1	1.3	.0	0.3
DDE	1.2	.9	.4	2.2	.0	.0	.5	.0	0.6
DDT	2.0	.0	.5	5.3	.0	.0	9.0	2.3	0.8
Dieldrin	11	4.3	3.6	5.2	1.1	3.2	2.2	.3	0.4
Endrin	.0	.0	.0	.0	.0	.0	.0	.0	.0
Heptachlor	0	0	0	.0	.4	.0	.0	.0	.0
Heptachlor Epoxide	1.0	.1	.7	.0	.0	.0	.0	.0	.0
Lindane	0	0	0	0		0	.0	.0	.0
PCB	0	0	0	0		0	0	0	0
PCN	0	0	0	0		0	--	--	0
Toxaphene	0	0	0	0		0	0	0	0

*Sampled one mile above site 2 in Bailey Ditch.

EXHIBIT 9C

BIOLOGICAL DATA--PHYTOPLANKTON COMMUNITIES

Genera	Algal Group*	Percent of Total Count						
		May 5, 1975				October 10, 1975		
		site 2	site 7	site 8	site 9	site 2	site 7	site 8
Navicula sp	d	54	24	9	35	100	3	9
Nitzchia sp	d	29	39	77	14		11	86
Cocconeis sp	d	4						4
Cyclotella sp	d	4	3		14			
Anacystis sp	bg			11			3	
Gemphonema sp	d		3	3	3			
Melosira sp	d		15					
Synedra sp	d		10		11		3	
Gyrosigma sp	d		3					
Rhoiocosphonia sp	d		3				3	
Asterionella sp	d	9			14			
Cymatopleura sp	d				3			
Amphora sp	d				3			
Calcieis sp	d				3			
Oscillatoria sp	bg						76	
Surirella sp	d							1
Total Percent		100	100	100	100	100	100	100
Total Count (cells per millilitre)		1,200	980	2,200	1,100	1,800	930	34,000
Diversity Index (d)		7	9	8	9	3	8	6

*d=diatom, bg=blue green algae

Exhibit 9D