BENEFIT-COST ANALYSIS ON PUBLIC LAW 566 PROJECTS IN MICHIGAN

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Dale W. Adams

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A THESIS

Submitted to the School for Advanced Graduate Studies
of Michigan State University of Agriculture
and Applied Science in partial fulfillment
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ABSTRACT

Michigan offers a number of potential small watershed investment projects. Many of these investments appear physically possible under Public Law 566. When and if these projects are undertaken their economic justification will rely on the benefit-cost analysis. This study attempts to evaluate some of the techniques and variables within the benefit-cost analysis as it has been applied in Michigan to Public Law 566 projects. Prime emphasis is placed on presenting variables in a manner that will be helpful to various decision makers.

The method followed in this study was: (1) to present some historical background on the benefit-cost analysis, (2) to trace the development of Public Law 566, (3) show how Public Law 566 affected Michigan, (4) discuss various problems in the actual application of the benefit-cost techniques to small watersheds in Michigan, and (5) to present an independent land value method as a check on benefit-cost data.

Much of the data used here was derived from Soil Conservation Service publications, various Congressional hearings, personal interviews with individuals concerned, and various books dealing with this general area.

The estimated Federal cost share for projects in Michigan was 54 percent, exclusive of planning costs. Addition of planning costs may increase the Federal cost share to over 60 percent.

The estimated construction cost for at least one project in Michigan has come in for major revisions. These revisions were necessary because of new structural requirements, a change in costs over time, and some original planning errors.

The estimated project installation costs in Michigan range from $65 to $100 per acre. On-farm associated costs may run an additional $100 - $125 per acre to install drainage.

The computation of benefits hinge heavily on physical measurements. Price and yield assumptions plus costs of production appear to be critical variables in benefit computation.

The use of the difference in before project and after project land values as a project benefit check appears worthwhile. When the estimated S.C.S. benefits for the Muskrat Creek project are capitalized at 5 percent a land value increase of $226 is derived. At the time this project was installed lands of improved quality in that area were selling for around $250 per acre.

The use of lower product price assumptions by land buyers appears the major cause of divergence between market and S.C.S. capitalized/benefits figures.

The land value approach for checking directly-computed benefits has many weaknesses but it does appear worthwhile as a reliability check on claimed benefits.

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INTRODUCTION

Since the early part of the 20th Century a type of benefit-cost analysis has been used to aid our governing bodies in decision making in the area of public and semi-public water improvements. Flood control, irrigation, drinking water, navigation, and power development are but a few of the areas in which benefit-cost analysis has been used. Many benefit-cost reports have not been as useful in their role of aiding decisions as most lawmakers and economists would desire. With the passage of the Watershed Protection and Flood Prevention Act, Public Law 566, where costs and benefits are shared between local groups and the Federal Government, it becomes increasingly important to have a tool refined enough to measure the incidence of costs and benefits to a great degree of tolerance.

An economically reliable benefit-cost analysis should enable decision-makers to invest scarce factors in our society, where the greater degrees of social and private satisfaction will be earned. Public Law 566 projects offer a potentially large area for investment. One estimate of the magnitude of this investment is 25-29 billion dollars.[1] This,

[1]Edward F. Renshaw, Toward Responsible Government, An Economic Appraisal of Federal Investment in Water Resource Programs, (Chicago: Idyia Press, 1957) p.14 and p.70.

plus other government agencies spending in the water resource area may put the total expenditure well over 100 billion dollars during the next generation.[1]

Michigan, with some 36,000 miles of rivers and streams, offers a large number of potential watershed investment projects. A state inventory of watersheds showed 99 out of the 187 specified needing some type of investment program.[2] The watersheds needing either flood prevention, erosion control, drainage improvement, expanded irrigation, or some recreational inhancement included 20,984,758 acres.[3] A majority of these projects appear physically possible under Public Law 566. The later economic evaluation and justification will almost assuredly rest on the benefit-cost analysis. As an aid to economic planners and decision-makers this thesis will examine some techniques and variables currently used in the benefit-cost analysis, and show the effect alternative techniques and assumptions have on the economic results. It is hoped by the author that this information will enable decision-makers to better understand and evaluate economic estimates presented by various watershed work plans.

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[1]President's Water Resource Policy Commission, A Water Policy for the American People, Vol. 1, (Wash.,D.C. Government Printing Office, 1950) p. 93.

[2]U.S. Department of Agriculture, Soil Conservation Service, An Inventory of Watershed Project Needs, State of Michigan, March: 1960. On file in the Soil Conservation Service Office. p. 1.

[3]Ibid.

Methodology

Historical highlights of the benefit-cost analysis, and Public Law 566 will be discussed in Chapters I and II. From this review certain objectives and limitations of the economic analysis and the Public Law 566 will be drawn. Various special features and problems of Public Law 566 in Michigan will also be discussed in Chapter II.

Sources for this historical summary will be found in numerous Congressional hearings and records. Many books and articles have been published recently on these two topics, and these will be relied upon to sum much of the information.

With the expressed and/or latent goals of Public Law 566 in mind, the analysis in Chapter III will attempt to point out some basic weaknesses in our present economic analysis, by applying different assumptions to some of the variables. Examples will be drawn from some of the Michigan projects to illustrate these variables.

Sources of material for Chapter III's analysis will come from the Soil Conservation Service's work plans, work sheets, and personal interviews with responsible agents. Some practical and theoretical articles and books will be covered to broaden the analysis.

Chapter IV will attempt to assess the value of using an indirect approach to an economic evaluation of Public Law 566 projects rather than a detailed direct benefit analysis. (An indirect approach for benefits is based on the difference between market values of similar use-capacity lands

before and after a project's completion.) The sources for this analysis will duplicate many of the previously used references, but will place a heavier emphasis on several typical Michigan projects where this approach seems more applicable. Certain farm account records, property appraisal values, and recent sales will be relied upon as a base for market values.

Any conclusion which can be reached from this survey and analysis will be included in Chapter V. The list of the useful references follows in the bibliography.

Definition of Terms

1. Public Law 566 -- The Watershed Protection and Flood Prevention Act, as amended. (P.L. 566 83rd Congress, 68 Stat. 666; P.L. 1018, 84th Congress, 70 Stat. 1088; P.L. 85-624, 85th Congress, 72 Stat. 563; P.L. 85-865, 85th Congress, 72 Stat. 1605.) Hereafter Public Law 566 as amended will be designated as P.L. 566.
2. Cost -- Cost will be used in the broad sense of any sacrifice by an individual or group of individuals, and also in the narrow sense of out-of-the pocket monetary expense.
3. Benefit -- The word benefit will be used in the broad sense of including any quantity of satisfaction gained, whether by a physical increase of goods or an improvement as measured by ones value

system. Benefit will also be used in the narrow sense of in-the-pocket-increases occurring through some planned or unplanned action.

CHAPTER I

HISTORICAL BACKGROUND ON THE BENEFIT COST ANALYSIS

The term benefit-cost analysis is an old concept dressed up in different terminology. This concept has been with us since man started to compute in his own mind the satisfaction received(benefit)and satisfaction given up(cost) by an act of trade or exchange. The early businessman knew the benefit-cost analysis when he carried out the exchange of goods for money so as to maximize his profits, or benefits over costs. Present budgeting and marginal analysis procedures are a further application of this principle.

Historical Highlights

The benefit-cost analysis has a varied history in Federal Government practices.[1] The Army Corps of Engineers has used a form of benefit-cost in connection with river and harbor improvements for almost sixty years. The River and

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[1]Much of the following information was taken from R.J. Hammond, Benefit-Cost Analysis and Water-Pollution Control, (Stanford: Food Research Institute, 1960) and, Commission on Organization of the Executive Branch of the Government, Task Force Report on Water Resources and Power (Washington: U.S. Government Printing Office, 1955) Vol.'s I, II.

Harbor Act of 1902[1] provided for the creation within the Corps of a board of officers who:

> shall submit to the Chief of Engineers recommendations as to the desirability of commencing or continuing any and all improvements upon which reports are required. And in the consideration of such works and projects the board shall have in view the amount and character of commerce existing or reasonably prospective which will be benefited by the improvement, and the relation of the ultimate cost of such work, both as to cost of construction and maintenance, to the public commercial interests involved, and the public necessity for the work and propriety of its construction, continuance or maintenance at the expense of the United States...[2]

An act of 1920 gave explicit instructions for this process of assessment to be used as a means of charging local individuals with some of the costs of improvement:

> Every report submitted to Congress (in respect to river and harbor works)...Shall contain a statement of special or local benefit which will accrue to localities affected by such improvements, and a statement of general or national benefits with recommendations as to what local cooperation should be required, if any, on account of special or local benefits.[3]

The Corps of Engineers used simple techniques that were intelligible and fairly effective when confined to tangible costs and benefits. This is not to say the Corps of Engineers was the first to arrive at assessing the benefits and costs of some action, but they seem to have been the most

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[1]U.S. Congress, Public Law 154, Statutes at Large, Vol. 32, Pt. 1, pp. 372-73.

[2]Ibid.

[3]U.S. Congress, Public Law 263, Statutes at Large, Vol. 41, Pt. 1, pp. 1009-10.

systematic about its early application.

In 1934, a National Water Resources Committee was formed. Its report recommended "the development of an equitable system of distributing the costs of water-resource projects, which should include not only private but social accounting - a striking revision of costing technique," as stated in the board's own words.[1] The board goes on to point out that a narrow accounting system should not stand in the way of expenditures which are deemed for the public good. The problems of measuring intangibles, that is benefits or costs whose characteristics do not lend themselves to translation into a common denominator, and the new value of employment of people who are unemployed stands out in this report. The benefit-cost analysis was broadened in an attempt to include benefits not included by the Corps of Engineers. This was an attempt to justify public works programs in a socially reliable manner.

The Flood Control Act (1936)[2] amplified the National Resource Board's recommendations; the National Government might participate in plans of flood control "if the benefits to whomsoever they may accrue are in excess of estimated costs, and if the lives and social security of people are

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[1]National Resources Board, "A Report on National Planning and Public Works...With Findings and Recommendations," Washington, December 1, 1934, p. 28.

[2]H. R. 8455 (1936).

otherwise adversely affected." This neatly side-stepped the problem of justifying flood control in terms of some improved navigational facility, which the Corps of Engineers had been faced with prior to this act. A new national value was formed in the name of protecting and saving lives through flood protection. This carries down into our present day P.L. 566 where the bulk of all flood control costs are borne by the Federal Government.

No specific requirement in the Flood Control Act called for a benefit-cost analysis, but the practice was carried out more frequently by various government agencies. This spread was encouraged by the desire of Congress to see a benefit-cost ratio in excess of unity regardless of how it was derived, or how valid the ratio was. A wide range of applications, by various agencies, was apparently used merely to produce an acceptable ratio, which would justify further government spending in the water resource areas. Some variables used to increase the summed benefits were interest rates, life of the project, and time period in which benefits would occur. Little attempt was made to curb Federal expenditures before the national goals shifted from increasing employment to winning a war late in 1941.

An executive order in 1943 requiring agencies to submit reports on Federal public works and improvement projects to the Bureau of the Budget, increased the discussion about the benefit-cost analysis.[1] Serious consideration was given to

[1]Executive Order No. 9384, October 4, 1943.

the procedures, adopted by the various agencies at this time, by Congressional members and economists. Two general paths were being followed by governmental agencies. The first was an attempt to follow the economic causal chain to compute indirect or secondary costs and benefits from a given project. Secondly, agencies widened their field in an attempt to include intangibles under some type of economic analysis with recreation and scenery being two of the areas most often included.[1] Local interests entered in this field of "discovering" nonreimbursable benefits because of the Federal funds available to cover portions of costs incurred by projects with this type of return.

Because of the various procedures used by twenty-five different government agencies and the general confusion these methods produced in the form of vastly different ratios for the same project, the Federal Inter-Agency River Basin Committee appointed a sub-committee to look into the methods of computing benefits and costs. From 1946 to 1950 this inter-departmental sub-committee hammered out a few basic points and submitted suggested procedures in this area. The report by the sub-committee proposed some mutually acceptable principles and procedures for determining bene-

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[1]For a recent attempt at economic evaluation of recreational facilities see: Marion Clawson, Methods of Measuring the Demand for and Value of Outdoor Recreation, Resources for the Future, Inc., Washington D.C., February, 1959.

fits and costs of government agencies in the water resource area.[1] The "Green Book" provides the general rubric under which benefit-cost analyses are presently carried out.

This short historical survey of the benefit-cost concept shows several different goals. The Corps of Engineers was early interested in measuring direct benefits and/or costs from various projects, with the idea in mind of assessing costs according to direct benefits to those concerned. We next see the benefit-cost ratio as a decision making tool used by Congress to justify government expenditures in the water resource area. Later as projects outnumbered the funds available, attempts were made to use the benefit-cost ratio as a ranking mechanism to determine the most "beneficial" projects to be undertaken first.

The purpose of the benefit-cost analysis, on the national level, seems to have centered first on substantiation of a subsidy to various groups, and second on gaining the maximum social benefits from a given outlay of resources. It will be with these values or goals as background that the benefit-cost analysis will be evaluated in the following pages.

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[1] U.S. Federal Inter-Agency River Basin Committee, Sub-Committee on Benefits and Costs, Proposed Practices for Economic Analysis of River Basin Projects, ("Green Book") May, 1950: revised May, 1958.

Current Controversial Portions

No attempt will be made here to present or discuss all of the benefit-cost analysis. Only those portions of benefit-cost which have received the most attention in the literature will be reviewed. Later chapters will discuss some specific variables which appear critical in the benefit-cost analysis as applied to P.L. 566 projects in Michigan.

Two major areas of controversy appear in the literature: (1) the criterion to use in the investment decision and (2) the determination of what interest rate to use. (A third general area will be presented which enumerates a number of other controversial points presently under discussion)

Benefit-Cost Criterion

The problem of what criterion to use in the benefit-cost area includes two general sub-problems. The first problem deals with which projects will be called favorable and which unfavorable. The second problem arises as a more general application of the first where an overall ranking of projects is desired so that better projects can be undertaken first. Since the first problem is usually resolved by calling projects favorable if they have a benefit-cost ratio equal to or greater than unity the ranking problem has received most of the attention in the literature.

A criterion for ranking projects has been presented in several different forms. Projects could be ranked on the difference between benefits and costs, a benefit to cost

ratio, an average rate of return, or an internal rate of return. The literature on each of these criteria will be examined.

The first criterion of benefits minus costs, or net benefits, is dismissed by the "Green Book" because it obviously favors large projects over small.[1] By rejecting this criterion they tacitly assume monies for these types of investment alternatives are in short supply, i.e., capital rationing. The same type of decision could be based on a benefit-cost ratio greater than unity if capital rationing was not the case.

Capital rationing appears to be the more common condition under which governmental and private investments are made.[2] Several authors have recognized this and proceeded to set up criterion whereby a formal ranking of projects according to economic justification could be used to aid decision-makers who are faced with limited supplies of capital.

Otto Eckstein points out that a different ranking of projects can be obtained where the benefit-cost ratios are used in one case and the average rates of return in the

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[1] "Green Book", op.cit., p. 14.

[2] A Michigan Soil Conservation Service official reported that ample funds have been available to date to handle all planned P.L. 566 projects in Michigan with estimated benefits greater than costs. It is assumed this condition will cease as the number of projects proposed become larger.

other.[1] He defines the average rate of return as the expected future annual benefits minus annual operating cost over the original fixed capital investment. In contrast to this the benefit-cost ratio is the expected annual benefit over a sum of both the annual operating cost and an annual amortized cost on the initial investment.[2]

The different ranking results are caused by projects having different proportions of operating costs to fixed initial installation costs. This ratio is called the O/K value. Eckstein points out that the benefit-cost ratio is a suitable criterion only when the costs are reasonably uniform, there are no extreme variations in capital intensity, and projects have roughly equal uncertainty and life spans. Eckstein argues that the average rate of return would be "fallacious for agricultural projects, since the decision whether or not to make a certain commitment of resources for this kind of program is not primarily a decision about a fixed investment, but is a commitment for a large flow of resources consisting of...conservation payments..., technical assistance, plus large private costs of both an investment and operating kind."[3]

In cases where there is a constraint on the Federal

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[1]Otto Eckstein, Water Resource Development (Cambridge: Harvard University Press, 1958) pp. 53-65.

[2]Ibid., pp. 56-57.

[3]Ibid., p. 60.

expenditure budget Eckstein argues that the benefit-cost ratio is the preferable criterion to use. This in effect places reimbursable costs outside the constraint and treats them as a negative benefit.[1]

Roland McKean points out a different method for ranking projects on an economic basis. He states that the ratio of gross benefits to gross costs shows very little except an expected net return. As a solution to the ranking problem he proposes the use of the internal rate of return as the only logical criterion guide.[2]

Both Eckstein and McKean point out that in using a benefit-cost ratio certain maintenance or recurring costs are included into the denominator of the ratio that do not belong there. McKean states, "the correct denominator is the cost which the nation's water-resource budget is really supposed to cover; and this is essentially construction costs ...Hence, those projects that are not interrelated might be ranked more accurately according to the....marginal internal rate of return."[3] McKean defines an internal rate of return as "the rate of discount which makes the present value of the project's receipt stream equal to the present value of its

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[1] Ibid., pp. 64-65.

[2] Roland N. McKean, Efficiency in Government Through Systems Analysis, (New York: J. Wiley and Sons, 1958) pp.108-111.

[3] Ibid., p. 122.

cost stream."[1]

Of these methods the one selected hinges on which cost factor is of central interest to the decision-makers. Later discussion will show that P.L. 566 is a joint undertaking with Federal, local organization, and individuals participating. Federal funds and local funds are used in installing projects with local funds carrying the bulk of the recurring costs, which are a large percentage of total annual costs. This type of cost sharing indicates that recurring costs should bear heavily in the investment decisions of these projects where both local and Federal funds are participating.

Interest Rate

A number of writers have dealt with the general problems surrounding the theoretical determination of an interest rate to be used in reducing costs to an annual basis. Neoclassical economists discussed interest rates in terms of postponement of consumption, i.e., some reflection of the marginal time preference. Later Keynes defined the rate of interest as the reward for parting with liquidity, i.e., some reflection of the marginal liquidity preference.

The "Green Book" states that prevailing interest rates are a reflection of both time and risk elements.[2] It suggests that the average yield on long-term Federal bonds be

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[1] Ibid., p.77.

[2] "Green Book," op.cit., p.22.

used, "as an approximation of the expected long-term, essentially risk-free rate."[1] Methods suggested by the "Green Book" for handling uncertainties or risks include conservative benefit estimates, a conservative economic life projection, or including a risk component in the discount rate.[2]

In 1952 the Bureau of the Budget made this average long-term Federal bond rate the applicable interest rate on all Federal investments in water resource projects.[3] The rate is computed as an average of the interest payable by the Treasury on all obligations with terms to maturity of 15 years or more. This rate is presently about 2.6 percent.

Several problems arise from an interest rate which is politically determined: (1) Is this rate indicative of the social marginal time preference rate? (2) Is this rate applicable to local and private funds invested along with Federal funds?[4] (3) Does the interest rate determined in this manner carry any allowance for risk?

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[1] Ibid., p.24. The assumption here is that a risk-free rate approximates social marginal time preference

[2] Ibid., p. 23.

[3] Executive Office of the President, Bureau of the Budget, Circular No. 47, December 31, 1952, Washington D.C., p. 14.

[4] Arthur C. Bunce, "Time Preference and Conservation," Journal of Farm Economics, Vol. 22, August, 1940, pp.533-43. In this article Bunce discusses the social private time preference problem.

In the past 10 or 15 years, writings on the interest rate problem, in connection with the benefit-cost analysis, have tended toward an opportunity cost concept. This shift of emphasis was brought about because the variables of marginal time preference and risk premium appear impossible to quantify.

One of the most complete discussions of interest as an opportunity cost is found in Krutilla and Eckstein's book.[1] They attempt to estimate the social cost of capital raised by Federal taxation. The social cost is defined as "the opportunities foregone in the private sector of the economy, either because of curtailed investment or of curtailed consumption."[2] As a result of their study they recommend that a rate of 5 to 6 percent would reflect a public opportunity cost.[3] They readily admit their formulation takes into consideration only desires of the present generation. "Children and unborn generations have no vote in the market place."[4]

Renshaw points out that the current rate of interest used by the SCS (2.5 percent) to convert construction outlays to an equivalent annual cost does not reflect an

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[1] J.V. Krutilla and O. Eckstein, Multiple Purpose River Development (Baltimore: J. Hopkins Press, 1958) pp. 78-130.

[2] Ibid., p. 125.

[3] Ibid.

[4] Ibid.

opportunity return that could be earned on the same funds invested elsewhere.[1] He goes on to recommend a 5 percent discount rate as being closer to the market rate.

McKean states the rate of 2.5 percent used in Federal installation costs does not allow for the productivity of capital if it were put to other uses, and that the interest rate is thus probably too low.[2] Tolley also supports this position that a 2.5 percent discount rate is too low.[3]

The author feels that whatever rate is used, either for private or public funds, it should at least reflect its opportunity cost in alternative investment or the actual cost of securing the money in the money market.[4] The question of the right rate of interest to use cannot be settled here, but the effect of various rates on the benefit-cost ratio will be shown in Chapter III, Table VI.

Other Controversial Variables

A review of current literature reveals a large number of other major and minor problem areas which are under discussion in connection with the benefit-cost analysis. Some of these will be discussed at length in Chapters III and IV. Though many of these points will not be discussed here, it

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[1]Edward F. Renshaw, op.cit., p.80.

[2]McKean, op.cit., p.199.

[3]Tolley, op.cit., p.659.

[4]Eckstein, op.cit., pp.94-104. In this reference Eckstein sums much of the work done in his book with Krutilla. He again heavily emphasizes opportunity cost of capital.

seems proper to list them for reference purposes.

The lack of reliable physical data for benefit estimation is widely discussed in the literature. Under this topic falls crop yields before and after a project, rain fall, and physical flood damage. Most of this type of information is sorely lacking for good economic evaluations.

In the economic area price projection for use in future benefit and cost estimations have been dealt with rather widely. Expected economic life of a project, secondary benefits and costs, and intangible benefits and costs have also received rather wide coverage. Certain planning costs not included in cost data, and what scale of project to construct to maximize benefits appear to need further clarification in the literature.

In the social-political area a problem of what legal structures will properly handle the disassociation of cost and benefits appears to need further development. Along this line it also appears that more information is needed on actual cost sharing incidence; e.g., Federal and private cost shares.

CHAPTER II

THE DEVELOPMENT OF PUBLIC LAW 566

The passage of P.L. 566 in 1954 placed government agencies deeper into water-resource projects, but Federal action in the water resource area is not new. In February, 1908, President Theodore Roosevelt sent Congress a message which was a preliminary report of his Inland Waterways Commission. The report pointed out that the National Government had a leading part to play in the largest possible use of our waterways for navigation.[1] Previous to this there was some government expenditure in the areas of flood control, water power development, and navigation improvement, but most of these actions were designed to help private enterprise handle the problems at hand.

Water-resource undertakings were expanded during the twenties and thirties. The Federal Water Power Act in 1920, the Tennessee Valley Authority in 1933, and the various multi-purpose large river developments carried out were examples of these undertakings. Federal action has continued to expand in the water resource area. Navigation and flood

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[1]Ben Moreell, Our Nation's Water Resources - Policies and Politics (Chicago: University of Chicago, 1956) p. 37.

control works are now almost completely financed by Federal monies. Less than 2 percent of navigation improvement costs and less than 6 percent of the flood control costs are being paid directly by private individuals.[1]

The Flood Control Acts of 1936, 1938, and 1944 placed the controlling of floods throughout the country mainly in the hands of the Federal Government. It was in these acts that the National Government assumed almost all of the financial responsibility of flood control and the bulk of the planning expense.

A complex organization stands behind water resource development. There are 25 principal agencies in the executive branch alone dealing directly with water resources and power.[2] The major departments acting in this area are: the Department of Agriculture, the Department of Interior, and the Department of Defense.

Besides the general increase of Federal participation in public water-works, there has been an increasing interest, locally and nationally, in handling water problems on a river basin or watershed basis.[3] The realization that upstream

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[1] Ibid., p. 40.

[2] Ibid., p. 59.

[3] For more detailed discussion of river basins and watersheds cf. Henry C. Hart, The Dark Missouri, (Madison: University of Wisconsin Press, 1957) Krutilla and Eckstein, op.cit., The USDA'S 1955 Yearbook of Agriculture titled WATER, (Washington: The U.S. Government Printing Office, 1955) especially pp. 161-218.

interests conflict with downstream interests has made wider planning perspectives necessary if all interests are to be served.

The Flood Control Act of 1936 delegated the upstream flood prevention tasks to the Department of Agriculture. A later act of 1944 authorized 11 river basin surveys to be carried out which led to the 11 authorized Flood Prevention Watersheds covering 30 million acres. The estimated costs (1952) on these projects total $175,230,382. The third major Federal action in the small watersheds came in 1953 when Congress appropriated $5 million with which some 65 pilot watershed projects were started. In 1954 the P.L. 566 Watershed Protection and Flood Prevention Act was passed by the 83rd Congress. Major amendments were added in 1956 and 1958 to the original law. A closer look into committee hearings and congressional action around this subject seems appropriate.[1]

The Watershed Protection and Flood Prevention Act (P.L. 566, 83rd Congress) originated in the House Committee on Agriculture. Hearings were started in August, 1950, on the subject of floodwater and sediment damages in upstream watershed areas. The hearings were continued in October and November of 1951. From these hearings the subcommittee con-

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[1] A complete list of relevant hearings and bills appears in USDA Soil Conservation Service, Interim Watershed Protection Handbook," Sec. 26 (Washington: USDA, April, 25, 1955) pp. i-x.

cluded that upstream conservation and downstream flood protection were closely related and that there was a serious gap in the coordination of the attack on the general problem. Specifically the subcommittee pointed out that present approaches by the Corps of Engineers did not reach far enough upstream nor the work of the Soil Conservation Service far enough downstream.

The subcommittee went on to point out that most of these small upstream projects could be carried out without a complete plan for developing the resources of the river since each project's impact would be mostly local in nature. In addition the subcommittee felt that 25 to 75 percent of all flood damage occurs in the upstream areas. On the basis of these conclusions a bill (H.R. 7868, 82nd Congress) was introduced by Mr. Poage, the chairman of the subcommittee. Further hearings were held in June of 1952 and a new bill (H.R. 8243, 82nd Congress) was introduced. This bill died in committee. During the 83rd Congress the bill was reintroduced with slight modifications (H.R. 4877). After review by the Bureau of the Budget and slight revision, Mr. Hope introduced the bill as H.R. 6788 on August 1, 1953. Senator Aiken introduced the companion bill (S 2549) in the Senate on the same day. The bill passed in this form and stands with only a few alterations.

In most of the hearings before the Senate and the House committees the Corps of Engineers and the Soil Conservation Service were the main participants. Along with these

governmental agencies interested in watershed development, a group of local watershed representatives met with the President and expressed their interest in a program of small watershed improvement. On July 31, 1953, the President sent a message to Congress expressing his desire for action in this area of conservation. The result was the authorization of the 65 pilot projects. These watersheds were widely scattered. The experience gained on these early projects is now being used as a guide in setting up watersheds under P.L. 566.

Although some pressure for formation of a watershed protection act did come from local organizations much of the stimulus appeared to come from the Department of Agriculture. The Department of Agriculture's Soil Conservation Service pushed the need for authority to control small floods and thus conserve soil while the Corps of Engineers favored building large main stem dams. The hearings before the Senate Committee on Agriculture and Forestry are probably the most informative of the many held.[1]

At the opening of this hearing Senator Aiken stated the bill under discussion was related to conservation of our soil and water resources. Secretary of Agriculture Benson pointed out that the dominant purpose of the bill would be flood prevention and water management. (Here we see a

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[1]U.S. Congress, Senate Committee on Agriculture and Forestry, "Cooperative Soil Conservation and Flood Prevention Projects" (Committee hearing on S.2549) 83rd Congress, 2nd Session, January 14, 15, and February 15, 1954.

wedding of conservation and flood control into the aims of the bill.) The Soil Conservation Service argued that most of the damaged land in the upper watersheds was used for farming, and that much of this damage could be prevented by proper land and soil management, but that some retention structures would be needed. The Corps of Engineers based their case on the fact that the Secretary of Agriculture already had broad powers to carry out soil and water conservation under the Flood Control Act of 1936 and 1944, and that no additional legislation was needed. The Corps did not attack the sacred concept of conservation but did argue about the size of structures which the Secretary of Agriculture would be authorized to build. The Corps suggested a maximum sized water retention structure of around 500 acre-feet. This was far below the 5000 acre-feet maximum submitted by the Soil Conservation Service. Further Corps' arguments followed the Hoover Commission's recommendation for elimination of duplication in government. They argued against another bureau of government having a duplicate engineering and technical staff to handle dams and other flood control structures.

Besides the size of structure which the Department of Agriculture would be authorized to construct, the amount of drainage area the dam would contain came under discussion. The proposed watershed size of 250,000 acres was thought by western representatives to be too small. The Corps of Engineers did not mention any objection to this point since it

is the size of the retaining strucutre and not the amount of area which drains into it that determines the cost and ultimate appropriation.

The Corps of Engineers continued their objections to the transfer of some flood control projects to the Department of Agriculture even after P.L. 566 was in force. The Senate Committee objected to the seeming slow up of proposed P.L. 566 projects by the Corps of Engineers.[1] Under certain provisions of P.L. 566 the views and recommendations of the Corps of Engineers are required for projects of specific size. The Corps of Engineers did not break any records in sending back these recommendations.

A point only hinted at by the Corps of Engineers during the various hearings was the fear that some upstream watershed improvement projects would reduce the benefits from proposed downstream Corps' projects enough to hamper their economic feasibility.

Besides the conflict of interests between the Soil Conservation Service and the Corps of Engineers, several other interesting points cropped up during the formation and passage of P.L. 566. Several times during the hearings drainage was mentioned as only a very minor portion of the overall plan. (Later amendments tended to emphasize agricultural water management more.) However, as will be shown later the role of drainage in some projects is quite large. Also

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[1]U.S. Congress, Senate Commission on Agriculture and Forestry, "Hearings on Watershed Projects," 84th Congress, 2nd Session, May 7 and 29, 1956.

heavy emphasis was placed on keeping as much control and initiative on the local and state level as possible. The value of having local interests share in costs according to their benefits and local maintenance of structures upon completion shows traces of the free enterprise concept.

Another value which seems quite implicit in the formation and passage of P.L. 566 is the thought that work in the small watershed area will result in a net benefit to farmers, and will in some way compensate for the low portion of the national income which he receives. Support for this statement comes from prima-facie evidence such as: (1) most of the supporting testimony for the small watershed projects came from farm or farm allied groups (2) the bills were boosted mainly by farm-state Congressmen (3) the bills were sponsored by Agricultural committees and given to the Department of Agriculture to administer.

We have pointed out the goals of P.L. 566 namely; flood prevention - conservation, land development, and to some extent a subsidy to farmers. Some of the conflicts of interests which went into the law's makeup were also pointed out. The following section may shed more light on the actual working of P.L. 566, especially as it has developed in Michigan.[1]

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[1] For more detail on Federal flood control policy see; Commission on Organization of the Executive Branch, op.cit., Vol. II, pp. 719-87.

The Watershed Protection and Flood Prevention Act in Michigan

After P.L. 566 was passed it took little time for many states to have proposed projects ready for authorization. The pilot projects previously mentioned plus some local and state sponsored projects similar to P.L. 566 gave much of the needed basic information.

Table I gives some perspective of Michigan's watershed planning when compared with national totals.

TABLE I

Status of P.L. 566 Watershed Applications as of May, 1960 *

	Washington received	(1000) acres	Authorized for planning	(1000) acres	Authorized for planning	(1000) acres
Michigan	6	290.7	5	195.8	3	29.0
National totals	1,286	91,267.5	549	38,192.7	229	13,289.2

* U.S. Department of Agriculture, Soil Conservation Service, Inter-Office Mimeo, Washington, May 1, 1960 (in the files of the SCS).

It is interesting to notice, in the interoffice mimeo quoted in Table I, that all of the first eight states in number of projects submitted to Washington for planning authorization are southern or southwestern. These eight states have been allocated over 55 percent of the total appropria-

tions alloted through P.L. 566.[1] It seems evident that P.L. 566 is just getting a start in Michigan. As time passes more emphasis will be placed on northern flood and drainage problems as critical southern flood areas are completed. If and when this occurs there are a great many possible watersheds in Michigan which offer potential projects.

Local Procedures

Local procedures for getting a project started require some type of local sponsoring agency. The organization must have authority under state law to carry out, maintain and operate any works constructed under P.L. 566. Since 1954, when P.L. 566 was passed, over forty states have enacted new or amendatory legislation to further cooperation between state and local agencies and the Secretary of Agriculture in activities of P.L. 566. Michigan, as yet, has not been one of these states.

There are presently five general groups of state legislation all establishing different local sponsors. The groups are: (1) state agencies (2) counties, cities, and towns, or similar local subdivisions of a state (3) soil conservation districts (4) watershed districts, and (5) other special-purpose districts.[2] It is interesting to note

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[1]U.S. Department of Agriculture, Soil Conservation Service, Interoffice mimeos, Washington, January, 1960 (on file in the SCS).

[2]U.S. Department of Agriculture Soil Conservation Service publication "Progress in State Legislation Relating to the Watershed Protection and Flood Prevention Act,1955-1957," SCS-TP-135 (Washington: USDA-SCS, January, 1958).

which of the five general groups above was the most popular in its usage. The use of soil conservation districts was the most popular with 25 states. The use of special legislation was second with 14 states. The use of some state agency was third with 12 states. The use of some local governing body was fourth with 7 states. The use of watershed districts was last in number with only 6 states choosing this method.[1]

All of the states bordering Michigan chose to use the soil conservation districts as one of their organizations under which P.L. 566 projects could be implemented. Although there is no specific legislation, Michigan's P.L. 566 watershed projects have been setup under the sponsorship of soil conservation districts, drainage boards and districts, and some township and city organizations.[2]

The soil conservation districts lack the authority to tax so other organizations were worked in to provide the authority. All of the projects' proposes, so far, in Michigan have had a soil conservation district as the co-sponsoring local agency. They have provided the initiative for action but have lacked all the necessary tools. The use of the drainage districts, which have taxing authority, has em-

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[1]Some states have two or three alternative laws so that P.L. 566 can be handled under any one of two or three groups.

[2]Opinions of the Attorney General (Michigan) Number 2791, February 6, 1957.

phasized drainage in Michigan projects more than the original intent of P.L. 566 seemed to imply.

No P.L. 566 project in Michigan has been proposed except in areas and counties where soil conservation districts are organized. This is almost true on a national basis with only three out of 216 projects in the United States not being in areas where soil conservation districts were present. (April 1, 1960).

New Land

Another problem in Michigan is the liberal interpretation of the Department of Agriculture's limitation on bringing new land into production.[1] It is understandable that the Secretary of Agriculture would not want to bring new land into production with one program while paying to take land out with another. Yet the wording in the Watershed Protection Handbook of: "No Federal financial or technical assistance will be provided for projects in which the monetary benefits accrue primarily from bringing new land into agricultural production...," leaves ample room for local interpretation.[2,3]

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[1] U.S. Department of Agriculture Soil Conservation Service, "Watershed Protection Handbook," (Washington: USDA, July, 1957) Sec. 2, p.12.

[2] Ibid.

[3] The underlying assumption used in this paper is not that of the Malthusian Doctrine, i.e., a population growing faster than the food supply. Professor Bonnen's conclusion

Mechanics of Getting Authorization

Leaving aside the legal and theoretical problems of P.L. 566 in Michigan, it may be useful to discuss more of the mechanics of getting authorization and appropriations for small watershed projects in the state. The soil conservation districts are typically the local organization that initiates a request for P.L. 566 assistance. The preliminary request is forwarded to the State Soil Conservation Committee. This committee acts for the governor of the state in helping decide which projects are justified. The committee then selects a Watershed Technical Review Committee from various interested agencies. This technical committee surveys the proposed project and advises the State Soil Conservation Committee whether they think a formal survey is justified. If, after this preliminary survey, the technical committee believes the methods and objectives of the proposed project are likely to be economically and legally justified, the local organization is encouraged to file a formal application.

The formal application is forwarded to the Secretary of Agriculture requesting authorization for Soil Conservation Service planning assistance. If approved for planning by the Secretary, the state office of the Soil Conservation

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that surplus agricultural stocks and continued imbalances between production and consumption will be present for a number of years to come will be held as an assumption for this paper. James T. Bonnen, "American Agriculture in 1965," U.S. Congress, Joint Economic Committee, Papers Submitted by Panelists Appearing Before the Subcommittee on Agricultural Policy, 1st Session, 1957, pp. 145-156.

Service develops a detailed work plan showing costs of construction and the benefits which are expected. If the watershed is small all, or almost all, of the affected parties will be interviewed to determine costs and benefits. If the watershed is large only a sample of each type of the affected parties is taken. When the work plan is completed the local sponsoring agencies are presented with the details and asked if they still want to assume their portion of the costs as estimated and continue on with an appropriation request. If the local agencies agree to the work plan, the plan is forwarded to the Secretary of Agriculture for his approval and fund allocation. If long periods of time elapse before money is available for the project, new surveys and hearings may be held to bring the work plans and local agreement on them up to date before construction starts.

In cases where several areas want assistance at the same time, the projects are informally ranked by the Soil Conservation Committee. The rankings may follow size, pressing nature of the flooding, or the length of time that the local people have been working on the project.

Three of the P.L. 566 projects under consideration in Michigan were originally surveyed by the Corps of Engineers. A prime reason for asking P.L. 566 assistance seemed to be Corps' requirement of having all the local area's share of costs in hand before starting construction. The Soil Conservation Service in contrast requires only the local share of structural costs, namely easements, right-of-ways, and

property acquisition to be acquired before construction starts. The inability of drainage boards to market bonds cuts out the possibility of raising the money from other sources than taxing benefited property owners. Landowners usually are not willing to be taxed far in advance so that the Corps' requirements can be met.

Two examples of this have occurred in the Saginaw River Basin. Surveys were carried out by the Corps during and after 1948 upon request by Congressional members.[1] Parts of this plan included the South Branch of the Cass and the Misteguay Creek Watershed, both recently proposed or planned P.L. 566 projects.

People in the local organizations felt that it was impossible to raise the needed monies for the Corps to start construction, and that under P.L. 566 assistance the job would be done faster. Many felt the Corps was dragging its feet in releasing these projects to the Soil Conservation Service. It is understandable that the Corps felt that a dismemberment of the larger project into a series of small watershed projects would lessen local interests in their overall basin project.

Some attempt was made by the author to compare economic data estimated by the Corps and the Soil Conservation Service.

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[1] U.S. Congress, House of Representatives, Committee on Flood Control, Saginaw River, Michigan, 84th Congress, 2nd Session, (Washington: Government Printing Office, 1957).

The comparison shows very little because standards of flood prevention, safety factors and extent of surveys varied widely. An example is the 100 year protection level used in determining flood structures by the Corps, versus usual 5-25 year protection by the Soil Conservation Service. The information of the Corps' proposed improvements on the Misteguay covered very little of the area analyzed by the Soil Conservation Service, centering mainly in the lower reaches of the creek. From the wide divergence of criteria and information no valid comparison could be made.

Up through August, 1960, nineteen requests for P.L. 566 assistance have been filed with the Michigan State Soil Conservation Committee. Seven of these were approved and forwarded to the Secretary of Agriculture for planning assistance authorization.

Six proposed projects are awaiting the technical committee's review, and the State Soil Conservation Committee's advice on whether to proceed further. Six projects were reviewed and thought not to be worth further work under present provisions of P.L. 566.

The characteristics of the plans discouraged were widely different. A small watershed of 1300-1600 acres of Red Run in Cass County was not recommended because the benefit-cost ratio was estimated at only .3. It was also felt that the problem of silting along the river could be more cheaply handled by removal of the sediment. There was serious question whether retention structures of any rea-

sonable type would hold enough of the watershed's runoff to be effective. No further action was taken after the Technical Committee report.

A project on Brush Creek was also turned down because it was primarily a wildlife project with no flooding involved.

Another project, also in the southern end of the state, was the Bean Creek Watershed. This proposed project was to be part of the larger Maumee Watershed project in Ohio. As part of the larger project, water retention structures were to be built in Hillsdale and Lenawee Counties of Michigan to help reduce critical downstream flows into Ohio. During the Technical Committee's review of Bean Creek, it was pointed out that little benefit would accrue to the local area in Michigan from these structures. Because of the lack of coordination in Ohio on the overall project, and the technical question of whether the Michigan retention structures were too far removed from the flooding to be of practical value, the Bean Creek project was set aside until a future date.

The Bean Creek type project puts extra strain on the methods of assessing costs and benefits. People in a local area such as this are only willing to pay for the direct tangible benefits accruing to their area. Unless these benefits are fairly sizable and measurable the local and state organizations are not very interested. The area and state receiving the bulk of the benefits must stand ready to pay almost all of the costs, or provision for extra Federal

government cost sharing must be provided to enable a full interstate watershed plan to be carried out.

Other applications for P.L. 566 assistance discouraged by the Technical Review Committee were the Benzie and Heiring Lake Watersheds. These watersheds are located mainly in Benzie County and empty into Lake Michigan. The big problem in this area is wind erosion with a very small amount of flooding. Most of the additional benefits would be derived through recreational improvements. The project's benefit-cost ratio was not determined because this particular watershed problem did not seem to fit under the spirit of P.L. 566.

The proposal for a P.L. 566 project on the Tawas River in Iosco County was also discouraged. The area flooded each year was quite small, 120 acres estimated, and there seemed to be adequate authority in the form of state drainage legislation to meet the problem. Again no benefit-cost ratio was derived, but it was thought to be unfavorable.

In summary, the number of projects in Michigan is not very large when compared to other states. The lack of proper enabling legislation may have slowed the development of the small watershed in Michigan, but the availability of taxing powers in drainage districts, cities and townships has been an adequate substitute, at least from the legal standpoint. The incorporation of drainage districts with soil conservation districts has placed a heavy emphasis on the drainage of projects in conjunction with the P.L. 566 schemes. The main push behind the P.L. 566 projects in

Michigan is the soil conservation districts through the State Soil Conservation Committee. This organizational structure has formed the planned projects small enough in nature so that the 250,000 acre limit has been no problem. The State Conservation Committee relies very heavily on the benefit-cost analysis to encourage or discourage the formal applications for P.L. 566 assistance.[1]

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[1]Much of this material on P.L. 566 in Michigan was provided in a series of interviews with Russell G. Hill, Executive Secretary, Michigan State Soil Conservation Committee and Earl E. Fenton, Agricultural Economist, Soil Conservation Service, August, 1960. Various correspondence and rough work copies of the benefit-cost analysis were also surveyed during interviews.

CHAPTER III

VARIOUS PROBLEMS IN THE APPLICATION OF BENEFIT-COST TECHNIQUES TO PUBLIC LAW 566 PROJECTS IN MICHIGAN

A treatment of the techniques used within the benefit-cost analysis in P.L. 566 must be preceded by some notions concerning the goals or ends in mind from these projects. Quite often various means such as flood prevention, watershed protection, or conservation are confused with ends. The confusion allied with the term conservation appears serious enough to merit further elaboration.

Conservation is popularly used to cover any action whereby a resource is used more slowly, maintained in a status-quo, or even increased in quality. Each of these separate actions have different policy implications for the decision-maker. For the purposes of this study the term depletion will apply to any process whereby the quality of a given input is decreased with a resulting decrease in unit productivity over time. Conservation will be used in the strict sense of retention of a given quality of inputs and thus the maintenance of a given production function over time.[1] Accretion will apply to any process which tends to

[1]Earl O. Heady, Economics of Agricultural Production and Resource Use, (Englewood Cliffs: Prentice-Hall Co., 1952) p. 782.

increase the quality of inputs and places the production process on a higher productivity function.

Actions of depletion, conservation, and accretion are only the means to attain some end such as national welfare. This is the expressed goal of the Watershed Protection and Flood Prevention Act. The specific means implied in this act for attaining national welfare were: (1) accretion or an increase in production through improved quality of inputs (2) a subsidy out of public funds based on egalitarian motives to groups receiving unequal treatment through the present economic or social system.

This analysis of P.L. 566 projects in Michigan will dwell mainly on the first point——development of the production process. Some attention will be paid to whether production actually furthers national welfare, but only as a side light to the main analysis.

As pointed out before, the economic variables under study are far too numerous to be fully covered in this work. A general breakdown of costs and benefits will be followed, with only the major variables in each area being covered. Data which is available from Michigan or Federal sources will be used as a factual base for the breakdown.

Costs

Cost Sharing

Public Law 566 provides that local interests shall pay the costs for their direct identifiable benefits from im-

proved agricultural water management. Congress also states that payment for flood prevention will be assumed by Federal funds.

A recent report by the Soil Conservation Service listed the field cost estimates of 267 projects authorized for operations under P.L. 566. Table II lists a summary of this information.

TABLE II

A National Summary of Field Cost Estimates-
267 Authorized P.L. 566 Projects,
P.L. 566 Share and Other *

	Cost Sharing				
	P.L. 566 Funds	%	Other Sources	%	Total
Land treatment	$ 13,943,078	11	$110,622,665	89	$124,565,743
Structures	195,625,407	83	38,839,591	17	234,464,998
Evaluation	125,127	91	12,564	9	137,691
TOTAL	$209,693,612		$149,474,820		$359,168,432
AVERAGE	$ 785,369	58	$ 559,831		$ 1,395,200

* U.S. Department of Agriculture, Soil Conservation Service, "Field Cost Estimate Report - National Summary - 267 Projects," an interoffice report dated July 5, 1960.

A similar breakdown is shown in Table III for the Michigan projects for which completed work plans are available.

A better picture of the Federal contribution can be derived from Table III if the approximate schedules of reimbursement by other Federal agencies is included to show

TABLE III

A Summary of Field Cost Estimates by Projects for Four Planned P.L.566 Projects in Michigan*

	Cost Sharing				
	P.L. 566 Funds	%	Other Sources	%	Total
Little Black					
Land treatment	$ 3,501	14	$ 21,858	86	$ 25,359
Structures	23,419	86	36,923	14	268,342
TOTAL	234,920	80	58,781	20	293,701
Sanborn					
Land treatment	0	0	47,131	100	47,131
Structures	18,691	50	18,960	50	37,651
TOTAL	18,691	22	66,091	78	84,782
Misteguay					
Land treatment	150,694	5	2,612,304	95	2,762,998
Structures	551,944	56	428,592	44	980,536
TOTAL	711,271	19	3,032,263	81	3,743,534
Muskrat					
Land treatment	5,670	7	78,093	93	83,763
Structures	33,000	62	20,549	38	53,549
TOTAL	38,670	28	98,641	72	137,312
4 Projects Average					
Land treatment	39,966	5	689,847	95	729,813
Structures	208,764	62	126,255	38	335,019
TOTAL	$248,730	23	$816,103	77	$1,064,832

* Taken from the various Work Plans dealing with these projects in Michigan.

Federal and non-Federal cost sharing. Agricultural Conservation Program payment shares plus Forest Service cost sharing for certain land treatment measures including drainage are

included in estimated Federal costs in Table IV.

TABLE IV

Cost Sharing Federal and Non-Federal for the 4 Planned P.L. 566 Projects in Michigan*

	Cost Sharing			
	Federal	%	Non-Federal	%
Little Black				
Land treatment	$ 19,617	77	$ 5,742	23
Structures	231,419	86	36,923	14
TOTAL	251,036	85	42,665	15
Sanborn				
Land treatment	20,180	43	26,951	57
Structures	18,691	50	18,960	50
TOTAL	38,871	46	45,911	54
Misteguay				
Land treatment	1,351,443	49	1,411,555	51
Structures	579,931	59	400,605	41
TOTAL	1,946,638	52	1,796,896	48
Muskrat				
Land treatment	44,168	53	39,595	47
Structures	33,000	62	20,549	38
TOTAL	77,168	59	60,144	41
4 Projects Average				
Land treatment	358,852	49	370,961	51
Structures	215,760	64	119,259	36
TOTAL	$574,612	54	$490,220	46

* Other Federal costs were based on cost sharing schedules in the Agricultural Conservation Program Handbook for 1961 for Michigan, dated August, 1960. An assumption that 100 percent participation will occur is carried out in these computations.

Comparison of these three tables (II, III, IV) shows that Michigan projects are a good deal lower than the national average in share of total costs covered by P.L. 566 funds. If a comparable breakdown for Federal and non-Federal funds expended on a national level were available it would also show Michigan with a lower average of Federal funds included within the projects. Several reasons for this difference appear on the surface. First, Michigan's projects tend to involve more land treatment and less expensive structural measures for which Federal sharing is larger. Second, the smaller projects in Michigan tend to have a larger portion of their costs in land purchases and easements than do the larger projects. (The land, right-of-way, and easements costs being covered almost wholly by non-Federal funds.)

A primary cost that is conspicuous by its absence in the computation of the benefit-cost ratio is the planning costs by governmental agencies, who do the necessary paper work for a P.L. 566 project. A rough indication of the size of these investigation and planning costs is shown by Table V.

Though these planning costs tend to reflect a number of projects planned but not yet showing up in the works of improvement column, it does give an approximate estimate of what percent future planning costs will run of total works costs. The 1959 figures show planning costs to be 16 percent of works costs. This percentage may tend to drop as more projects are built and experience is gained on them.

The 1960 fiscal year costs for planning are not available but total man-hours spent on planning and investigation for P.L. 566 run to approximately 1.8 million. This indicates total planning costs may have gone up if an average hourly cost of much over $2.00 is used.[1]

TABLE V

P.L. 566 Investigation-Planning Costs and Works of Improvement Obligations by Fiscal Years*

	1955	1956	1957	1958	1959	Total
United States			(Dollars)			
Works of Improvement	-	16,338	3,519,534	6,337,257	21,213,716	31,086,845
Investigation & Planning	943,936	2,291,910	2,766,532	3,223,491	3,397,955	12,623,824
Michigan						
Works of Improvement	-	-	-	5,409	19,518	24,927
Investigation & Planning	2,598	3,079	47,179	39,329	30,778	122,963

* Information source was Interoffice reports titled, "Watershed Protection (P.L. 566) Investigations and Planning Obligations by Fiscal Years," Published periodically by USDA, SCS, Washington.

Certain institutional blocks to cost sharing have

[1]U.S. Department of Agriculture, Soil Conservation Service, "Work Report on Watershed Protection," (234 P.L.566 Projects) Washington, October 14, 1960.

arisen in Michigan. The Laird Creek project presently under investigation has wildlife improvement possibilities within its scope. These features can be added at some additional cost, but a question has been raised whether the Michigan drain laws allow the drainage board to tax drainage district land for the local share of wildlife improvement costs.

Another institutional block arises in the disassociation of benefit from costs. The Bean Creek Watershed, which is in the upper reaches of an Ohio watershed project, points out problems of watersheds which cross state lines. Little or no benefit will occur to Michigan residents from this proposed project.

The Misteguay Creek Watershed has a similar disassociation with some upstream people getting the bulk of the benefits in the form of new drain outlets, while society as a whole is paying the biggest share of costs on retention structures. These structures are designed to protect downstream interests from present and additional flooding, thus helping to remove a present court injunction against drainage improvements upstream.

These types of disassociation are a prime justification for society to absorb some of the project costs.

Cost Amortization

To compare properly a stream of benefits over time with a cost figure some cost of capital must be assumed, that is some opportunity in an investment alternative is

foregone. This is usually given as a simple interest rate by which investment costs are amortized for an annual outlay figure. The long term borrowing rate for government bonds is the rate presently used. With the payments for the use of money rather high during the past few years this rate is tending to inch up from its approximate 2.5 percent base.

All installation costs are amortized at this rate over the expected average service life of the project. Associated costs are usually amortized at a higher rate, as on the Muskrat Creek project where 6 percent was used.

It is impossible in this study to deal completely with problems of the magnitude found within the interest rate controversy which has been much discussed in the literature. As noted in Chapter I many authors feel the present interest rate is too low.

The project's life is also an important assumption when trying to arrive at an annual amortized cost. Present practice in Michigan tends to center around using the figure of 50 years. The Economic Guide for Watershed Protection and Flood Prevention suggests the analysis period should cover estimated project life of 50 years or whichever is shorter.[1] Table VI shows some examples of the effects of different interest rates and time periods on the annual cost

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[1]U.S. Department of Agriculture, Soil Conservation Service, "Economic Guide for Watershed Protection and Flood Prevention," (Washington: Soil Conservation Service, December, 1958) Chapter 1, p.10.

figure. The total installation cost is assumed to be $293,701, annual recurring cost $1,790, and total estimated annual benefits $12,272.[1]

TABLE VI

Annual Costs Computed at Various Interest Rates and Lengths of Economic Life (Total Installation Cost of $293,701)

Interest Rate	20 Years	30 Years	40 Years	50 Years	100 Years
0	$16,475	$11,580	$ 9,133	$ 7,664	$4,727
2	17,975	13,099	10,749	9,340	6,814
2.5	18,826	14,039	11,689	10,368	8,018
3	19,737	14,979	12,717	11,425	9,281
5	23,555	19,120	17,123	16,065	-
6	25,611	21,323	19,531	18,651	-

Using Table VI and the average annual benefit figure, the points where the benefit-cost ratio becomes unfavorable can be determined.[2] Any interest rate higher than 2.5 percent, and assuming less than a 50 year project life would

[1]The total cost of $293,701 is the estimated cost figure for the Little Black River project.

[2]Maintenance costs and annual benefits are those stated by the Re-evaluation of the Little Black Watershed Project. Interoffice Letter, Soil Conservation Service, East Lansing, Michigan, June 20, 1960.

make the ratio less than unity for this particular example.

A question of whether these projects will be producing a net value product in 50 years is an open question. It is a certainty that channel improvements and certain drainage structures will not last that long without good periodic maintenance. Certain channel improvements made in the South Branch of the Cass 30 or 40 years ago are now almost worthless because of lack of upkeep. This lack of upkeep has been mainly caused by court injunctions by downstream interests against upstream drainage improvement.

The land treatment costs such as strip cropping, drains, etc., occurring as part of the overall project are not included when computing annual costs through amortization.[1] The Congress has stated that all land treatment benefits will and do excede costs, therefore these measures need not be evaluated. If an investment return was expected from the whole project's cost rather than just the installations cost, present benefit-cost ratios would be materially reduced. Table VII shows the benefit-cost ratios under these new assumptions. It should be pointed out that this is only partly indicative of the situation since no data are available to show increased returns from land treatment on the benefit side.

The only economic justification in the Work Plans for the land treatment costs are shown by estimating flood

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[1]Watershed Protection Handbook, op.cit., Sec. 6, p. 2.

TABLE VII

Amortization of Cost Data Using Installation and Total Costs Including Land Treatment 1/

Project	Est. Annual Benefit 2/	Est. Annual Installation Cost	Est. Annual Maintenance Cost	Est. Total Annual Cost	Est. B/C
Little Black	12,479	9,462	1,790	11,252	1.1
Sanborn	8,078	1,327	535	1,862	4.3
Misteguay	438,805	34,573	11,166	45,739	9.6
Muskrat	16,847	1,164	1,560	3,448	4.9
Average	119,052	11,632	3,763	15,395	7.2

(cont')

Project	Est. Annual Cost All Costs Amortized	Est. Annual Maintenance Cost	Est. Total Annual Cost	Est. B/C
Little Black	10,368	1,790	12,158	1.02
Sanborn	2,993	535	3,528	2.29
Misteguay	131,281	11,166	142,447	3.08
Muskrat	4,847	1,560	6,407	2.63
Average	37,372	3,763	41,135	2.89

1/ All the data was taken from Watershed Work Plans. A standard 2.5 percent rate was used for amortization.

2/ Benefits from land treatment are not included except as they affect flooding.

damages before land treatment and after land treatment. This is done primarily to establish that structures are needed to reduce damages significantly. Only two projects in Michigan have this semi-formal estimate included in the Work Plan. The Little Black lists land treatment costs as $25,359 and total annual identifiable benfits from flood retardation as $122. This is an estimated return on investment of only ½ of 1 percent when land treatment benefits are assumed to be all flood retardation. This is, of course, not all of the land treatment benefits. It does seem for such a large expenditure there should be more justification for it in the benefit-cost information.

The Misteguay Creek Watershed Work Plan lists only two-tenths of one percent as the rate of return on land treatment costs from benefits of flood retardation. If the land treatment adds such a small portion of flood retardation benefits the question arises why they are included in the analysis.

Physical Problems in Cost Measurement

The measurement problems in determining the basic economic information are formidable. Historical stream flows and rain fall data are inadequate to evaluate properly flood frequencies and magnitudes. The use of interviews to determine this information is not highly reliable.

A reoccurring recommendation by various commissions, committees, and conferences on water resources has been that

more basic data is needed.[1] Without a reliable physical data base the economic house, regardless of how tight its theory and structure are, is built on sand.

Besides the needed historical information, some perspective of what the passage of time will do to estimated costs is necessary. As an example, Table VIII shows the original May, 1957, economic data on the Little Black Watershed Project, and also data submitted in the economic re-evaluation of June 20, 1960.[2] The change in costs reflects an upward trend in construction costs and structural requirements.

TABLE VIII

The Economic Evaluation (1957) and Later Re-evaluation of the Little Black River Watershed (1960)

	May 1957	June 1960	Percent Change
Land treatment Costs	25,359	25,359	-0-
Federal Installation Costs	95,189	231,419	+143
Non-Federal Installation Costs	36,923	36,923	-0-
Total Costs	157,471	293,701	+ 87
Average Annual Costs	6,173	11,252	+ 82
Average Annual Benefits	7,443	12,474	+ 68
Benefit-cost ratio	1.21	1.11	-

[1] Commission on Organization of the Executive Branch of the Government, op.cit., Vol. II, p. 766.

[2] Interoffice Letter, June 20, 1960, op.cit.

The Little Black has a large time lag between planning and construction. This time span, and the fact that this was the first project evaluated in Michigan, caused the wide variance in cost estimates. The increase in benefits was derived from certain residential and industrial land enhancement and railroad bed flood damage prevention. A similar increase in construction costs was experienced on the Muskrat Creek Project. Estimated construction costs (October, 1959) totaled $37,103. The tentative contract (December, 1960) is around $60,000 for about a 60 percent increase in construction costs.[1]

The marginal analysis carried out by the watershed planning units to justify each segment of the project is recognized as an excellent procedure. That is, each segment must have benefits greater than costs. Further application of this should be made around the principle of having a higher and lower level of flood protection and drainage included as alternatives within the work plan. This would put the selection of a specific level of flood protection on a firmer economic footing.

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[1] U.S.D.A. watershed evaluation reports do not provide any useful comparison for other areas because they fail to show how estimated and actual costs compare. Cf., Agricultural Research Service and Soil Conservation Service, Watershed Program Evaluation Interim Progress Reports, ARS 43-51; ARS 45-85; and ARS 43-97 (Washington, D.C.).

Comparative Land Accretion Costs

For decision making purposes a cost per unit of input or output may offer a useful reference when similar projects are being compared. The ideal cost figure for a productive project would appear to be costs per unit of physical output, when a decision-maker is interested in inter-project comparisons. For example, a useful formulation may be, given certain conditions, X costs for fertilizer will result in Y increases of corn output; whereas X costs for P.L. 566 projects will result in Z output increases in corn. Since information for this type of formulation was not available the alternative of computing costs per acre of land under P.L. 566 development was selected. It is recognized by the author that units of land tend to be extremely heterogeneous, yet costs on a per acre basis at least resolve cost figures into a commonly understood denominator. This gives some information for comparisons with alternative means of accretion.

Table IX presents the raw total costs per acre, as computed from the watershed work plans. (It should be remembered that cost and benefit estimates may be over or understated.)

These cost per acre figures are somewhat meaningless in that they do not indicate the state of productivity before and after the investment. They also do not indicate what economies are involved, namely new farm units or additions to existing units.

TABLE IX

Michigan P.L. 566 Projects Cost Per Acre*

	Average Cost**	Agricultural Land***	City Land
Little Black	$392.00	$97.90	$525.81
Sanborn	65.00	65.00	N/R
Misteguay	79.16	79.16	N/R
Muskrat	92.28****	92.28	N/R

N/R = Not relevant; no city land was included in these projects.

* Material taken from various work plans. Total improved area was divided into total project cost for average figures. This area ranges from new land to only slightly improved land.

** Average costs per acre includes only work plan installation costs. The associated costs on land are not included. For those areas where an average drainage system is installed cost per acre will run from $100-$125 for associated on-farm costs.[1] The S.C.S. is presently using a cost of $102.00 per acre as on-farm drainage costs for the project on the South Branch of the Cass River.

*** A separation of costs on the Little Black was done on the basis of claimed estimated benefits expected from agricultural land and city property.

**** If the tentative construction costs are used rather than work plan estimates this figure goes up to $108 per acre.

[1] The SCS has used this range of on-farm costs for the three P.L. 566 projects planned so far.

If purely physical units are used as a base on the Muskrat Creek Watershed project, total product is shown to have increased by 46 percent. When shifts of units to higher valued products are considered, real productivity is projected to increase over 50 percent.[1] Speaking in terms of one commodity, estimated costs of around $100 per acre will result in an increased production of corn of about 18 bushels per acre when that cost is applied to the P.L. 566 project in the Muskrat Creek Watershed.

Table X presents some comparative costs of improving more land.

TABLE X

Comparative Costs of Restoration and Reclamation of Land *

	Area	Average Cost Per Acre	Year of Estimate
Restoration of Lands	Average U.S.	30.00	1949
Drainage	General New Areas	15.00-40.00	1946
Irrigation	Columbia Basin	233.00	1950
Irrigation	Central Valley	300.00-690.00	1950

* Paul B. Sears, "Comparative Costs of Restoration and Reclamation of Land," The Annuals of the American Academy of Political and Social Science, Vol. 281, May, 1952, pp. 126-134.

[1] Taken from Soil Conservation Service work sheets on the before and the after productivity of agricultural land in the Muskrat Creek Watershed.

Though the figures in Table X are quite dated, they are useful as a basis for updating to present project costs per acre.

Benefits

Physical Problems in Benefit Measurement

The reliability of the benefit-cost analysis rests on the correctness of yield estimates before and after projects installation. A basically agricultural project like the Muskrat Creek Watershed, which derives major portions of its total benefits from increases in land productivity, can show large percentage changes in benefits through slight alterations of yield estimates. A farmer's estimations that present yield is between 50 and 60 bushels of corn per acre, leaves areas for planner's judgment which can vary benefits 100 percent.

Table XI shows Soil Conservation Service benefit-cost figures on the Muskrat Creek Watershed and comparable figures using actual 1959 price and yield estimates for Clinton County.[1] The benefit-cost ratio is also recalculated using the current estimated contract cost for the project.

The effects of various other assumptions in price projections alone are shown in Table XII. The yields used are the same as those used in making up the S.C.S. work plan, except for navy beans because of an error made in the original work plan.

The benefit-cost ratios in Tables XI and XII point out

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[1]The inference here is not that 1959 prices and yields should be used but rather to indicate that projected figures can be a good deal different than current rates.

TABLE XI

Muskrat Creek Watershed's Benefit-Cost Analysis
When 1959 Price-Yield-Cost Figures Are Applied

	Annual Figures	S.C.S. Work Plan	Estimated Using 1959 Price and Yield*
1.	Gross Benefits less Production Costs	28,825	17,769
2.	Associated Costs	11,270	11,270
3.	Net Benefits	17,555	6,499
4.	60 Percent Flood Protection	10,533	3,899
5.	40 Percent Drainage	7,022	2,600
6.	50 Percent of Drainage No Disc.	3,511	1,300
7.	45 Percent of Drainage 5 Yr. lag**	2,803	874
8.	TOTAL PRIMARY BENEFIT***	16,847	6,073
9.	SCS Cost Estimate	3,448	3,448
10.	B/C Ratio (1959)	4.9	1.76
11.	Current Cost Estimate (December, 1960)	4,396	4,296
12.	B/C Ratio Using (December, 1960) Costs	3.8	1.38

* Yields taken from area 5 data, 1960, Farming Today-What it Costs, How it Pays, MSU Cooperative Extension Service, p. 7 (average for 227 farms) and p. 21 (1959 prices). See Appendix I, Table I for these and other prices. It should be noted that the yields are averages for area 5 and that Clinton County is only a part of this area.

** Discounted at 6 percent straight line and assuming 95 percent of proposed projects will be installed (S.C.S. procedure).

*** A summation of lines 4, 6, 7.

TABLE XII

Muskrat Creek Watershed's Benefit-Cost Ratios
With Various Projected Price Assumptions

Price Base Used*	Estimated B/C With Annual Original SCS Work Plan Costs	Estimated B/C With Annual Revised Current Costs
USDA Work Plan**	4.9	3.8
USDA Work Plan Adjusted***	4.0	3.1
1959 Market Prices****	1.8	1.4
USDA less 10 percent	2.9	2.3
USDA less 25 percent	1.3	1.0
Free Production and Marketing*****	.4	.3

* All prices used are listed in Appendix A.

** Price projections used by SCS in computing benefits for work plans are found in: USDA, ARS and AMS, Agricultural Price and Cost Projections for Use in Making Benefit and Cost Analyses of Land and Water Resource Projects, (Washington, D. C., December, 1957)

*** All assumptions of price and yield used in the work plan were used except for navy beans where the yield was adjusted downward from 50 bushels per acre to 20 bushels per acre.

**** Prices and yields assumed in Table XI.

***** Prices quoted by: U.S. Senate, 86th Congress, 2nd Session, "Farm Price and Income Projections (1960-65)," (Ellender Report) (Washington D.C.: Government Printing Office, January 20, 1960) p. 23. The report assumed a free type market with few effects present from a large surplus stockpile.

the heavy impact price assumptions have on the ratio. For example, if a free market price is approximated for agricultural products the benefit-cost ratios can be seen to be very unfavorable in the Muskrat Creek Project. However, a general price decline of 25 percent still leaves a favorable ratio in this particular case.

The subjectivity of interviews as a basis for yield estimates and the problems of using large area averages as typical of small area production, points out the necessity of furnishing planners with better measures through certain physical sciences. However, even good reliable measurements by soil scientists would leave the management quality factor to contend with.

Speaking of the management factor brings out several interesting questions. A certain proportion of the possible land shift uses will not be undertaken by the unit managers within the watershed. The proportion this will be, and the time lag of those installing improvements are not known. An important policy question is, if the improvements are possible, but not undertaken, can society claim the benefit for the potential. These are the type of questions which should be answered by re-evaluations in the future.

Referring back to Table XII again, selection of the projected price assumptions seems almost an impossible task. The institutional structure has a great bearing on what present and future prices will be paid for agricultural products. If an approximate free market and producing plant is

assumed, prices will probably be at or below 1959 levels.[1] High price supports and acreage controls would reverse this downward price trend.

No attempt is made to answer the price projection problem here. It is suggested that the effect of price variability on each benefit-cost ratio be included in the analysis of each project. Also it appears that a standard government wide set of conservative price projections would lend more comparability between various bureaus' projects.

Another physical problem appearing in the benefit-cost analysis is the measurement of secondary benefits which are used for cost sharing purposes, but not for project justifications.[2] In theory secondary benefits constitute the increase in benefits to other individuals from activities induced by the project investment. This may be more grain elevators, slaughter houses, or soup factories. It is estimated by taking value added to original product value. Though the Soil Conservation Service uses certain conversion factors to compute these secondary benefits it can be said that they are only guesses. No proven technique is available to measure benefits to society from an investment act,

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[1] U.S. Senate, 86th Congress, 2nd Session, Doc. No.77, "Farm Price and Income Projections 1960-65 Under Conditions Approximating Free Production and Marketing of Agricultural Commodities," (Washington: Government Printing Office, January 20, 1960).

[2] See U.S.D.A.: Watershed Protection Handbook, op.cit., Section 6, p.11, for present procedure used in computing secondary benefits.

though a great deal of work has been done on the subject.

Social-Private Benefit

For the most part the individual farmer or city dweller who participates in the P.L. 566 program receives expected benefits in excess of estimated costs. This is shown most visibly by the fact that he participates in the program.[1] The big question area lies around what is the social benefit?

If it is assumed that P.L. 566 projects in Michigan are primarily for accretion and productive purposes rather than egalitarian, it seems reasonable to assess their increase in production as a major source of society's benefits. The claim that P.L. 566 in Michigan is primarily based on drainage benefits rather than flooding benefits again depends on the definition of flooding and drainage.

If Professor Bonnen's thesis is accepted, that serious imbalance between production and consumption of food items will continue to be a national problem for a good many years to come, then a social paradox arises.[2] For example, when land in Clinton County is developed at a combined social and private cost of around $200 per acre, and in the very same area land is standing idle in a government sponsored

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[1]This excludes cases where certain serious benefit-cost disassociations occur. See John F. Timmons, "Economic Framework for Watershed Development," Journal of Farm Economics, Vol. XXXVI, No. 5, December, 1954.

[2]James T. Bonnen, "American Agriculture in 1965," op.cit.

conservation reserve program at annual payments of around $15.00 per acre, how are the two programs rationalized?[1]

The argument that only small amounts of new land are being brought into production by P.L. 566 is misleading. In the end there is no difference in bringing new land into production which will raise 50 bushel of corn per acre and improving drainage on land which increases yields from 20 bushels to 70 bushels. The Department of Agriculture's requirement that no more than 50 percent of claimed benefits can be received from "new" land is less meaningful if taken in this light.[2]

Table XIII shows the present status of drainage under the various Soil Conservation Service's watershed development programs. Professor Huffman reports that roughly 100 million acres were improved by organized drainage in 1950.[3] This would indicate Soil Conservation Service Watershed actions have added less than one-half of one percent to total drained area. This is a small percentage, but the program is just getting underway and it is only a part of a

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[1] Conservation reserve program payments for Clinton County, 1960, were 15.42 per acre on the average. The source of this information was the state ASC office in East Lansing, Michigan.

[2] This assumes the limit was placed by the Secretary of Agriculture to reduce new land coming into production and not to save some wildlife enthusiasts' interests.

[3] Roy E. Huffman, "The Reclamation of Land for Agricultural Purposes," Commission on Organization, op.cit., Vol. III, p. 1185.

TABLE XIII

Acres of Drainage Applied on Various U.S. Watershed Development Programs*

Program	Number of Programs	Acres
P.L. 566	(234)	91,192
Authorized Watersheds	(11)	287,750
Pilot Projects	(58)	22,344
TOTAL		401,286

* Taken from various Soil Conservation Service Work Reports on Watershed Protection, National Totals, 1960 Fiscal Year and Cumulative Totals to June 30, 1960.

number of government programs, e.g., A.C.P.

It may well be argued that more agricultural production has a negative value to society, and thus secondary benefits would be computed as loss rather than gain.

P.L. 566 projects are a type of local economic development, but the effects on individual incomes are not included in present SCS analyses. Some attempt was made to determine the type and size of farms within the watershed, which received the major benefit from P.L. 566 projects. No significant characteristics about these farms stood out. Their average size was a bit below the entire watershed average farm size, but not enough so that any general con-

clusion could be drawn.[1]

Time Lag of Benefits

In Chapter I a general discussion of the problems associated with determining an interest rate was presented. The interest rate to use in discounting benefits, and the time lag to assume for the benefits are closely linked problems.

Examples in Michigan may help point out how time lag in benefits is computed. In the Muskrat Creek Project, it is assumed 95 percent of the needed drainage improvements will be carried out — 50 percent during the installation period, and 45 percent within 5 years. No discount is applied to the benefits occurring during installation, but a straight line 6 percent is computed on the flow of 45 percent during a 5 year period. The procedure seems clear in this case (see Table XI, lines 6 and 7).

The re-evaluation of the Little Black River Watershed shows a bit different application.[2] In the city of Cheboygan, which lies in the Little Black's flood plain, are approximately 282 building lots which will be improved enough, by proper flood protection, to justify residential housing.

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[1]The watershed Workplans report 181 farms generally affected by the projects in the Little Black, 60 in the Muskrat and 1350 farms in the Misteguay. No survey of the number of farms affected by the Watershed Program was presented for the Sanborn.

[2]Re-evaluation Letter on the Little Black, op.cit., p.4.

Projections were made as to future time utilization of the properties. It was estimated 30 percent of the lots would be used within 10 years and the remainder during the following 40 years. Only the lots utilized after 10 years were discounted at a 4 percent rate. Failure to discount a stream of benefits covering 10 years seems to be a questionable procedure.

Another aspect of the Little Black re-evaluation is the logic behind determining urban and industrial site enhancement values. From a social point of view it is questionable whether all of the enhancement value increase derived from some work of improvement can be called a net social benefit. It must be considered that units of land might be available in other locations which are <u>almost</u> perfect substitutes for those units improved through a public financed project.

<u>Decision Making Implication</u>

The discussion of the criterion used for ranking water-resource projects in Chapter I assumed all projects economically justified if their primary benefit-cost ratio is equal to or greater than unity. The problem variables of the benefit-cost analysis discussed in the preceding pages point out that this assumption may not be a reliable one. The interest rate used and economic life computed to a project can both make wide ranges in estimated annual costs possible as shown in Table VI. Changes in price projections

and yield assumptions can also cause wide changes in the benefit-cost ratio as shown in Tables XI and XII.

A decision-maker cannot easily recompute a primary benefit-cost ratio using what he feels are logical assumptions about interest rates, project's economic life, and price projections. The process would be time consuming and expensive. An alternative method for estimating a project's benefits is therefore presented in Chapter IV.

CHAPTER IV

AN INDIRECT METHOD FOR COMPUTING PROJECT BENEFITS BY THE USE OF LAND VALUES

The purpose of this chapter is to point out an independent method which may be used as a reliability check on derived benefit-cost data. In brief, this method will utilize Soil Conservation Service figures on benefits claimed per acre of agricultural land capitalized to give an income capitalized value. This derived value will then be compared with market values and income/capitalized values derived from certain farm account records. Where current census data on land value are available it will also be noted.[1] The entire comparison will rest upon the assumption that P.L. 566 improvements should be worth the difference between before and after land values. Land which is subject to flooding and drainage problems should be worth no more after improved than similar quality land with no flooding or drainage problems.

The author recognizes the complexities of determining

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[1]This approach is used by Fred A. Clarenbach, "Reliability of Estimates of Agricultural Damages from Floods," Commission of Organization of Executive Branch, op.cit., Vol. III, pp. 1275-1298; also by Renshaw, op.cit., pp. 68-81.

land values by an income capitalization approach and also the frequent deviation between this value and market price. It is also recognized that because of the imperfect market for land, sales prices may not reflect the worth or value society would place on that particular property. With these qualifications in mind it is hoped that this approach would still be valuable for comparison purposes.

Table XIV shows the dollar benefits claimed per acre by the respective S.C.S. watershed work plans in Michigan capitalized at a 5 percent rate. In computing farm account crop income per acre in the Muskrat Creek area a capitalization rate of 5 percent was found by the author to capitalize that income into the approximate market value of the land. All income/capitalized figures will therefore be based on 5 percent.

Table XIV shows a range of increased capitalized value for agricultural land ranging from $78.00 in the Little Black to $226.00 in the Muskrat Creek area.

To help evaluate the validity of these S.C.S. claimed benefits a case study will be used. The best detailed information available was on the Muskrat Creek Watershed for this type of analysis. It is exclusively an agricultural project with channel clearance the main structural feature. The project included bringing in 186 acres of new land within its 1488 acres of improved land. Claimed benefits were listed for the productivity of the new land as well as the other land which would be used more intensively. This

TABLE XIV

Increases in Land Values Based on S.C.S. Estimated Benefits Per Acre When Capitalized at 5 Percent

	Acres	Est. Total Direct Annual Benefits *	Est. Annual Benefits Per Acre	Increase in Land Value When Income is Capitalized at 5 percent
Little Black (Ag)	240	$ 940	$ 3.90	$ 78.00
(Urban)	510	11,534	22.61	452.20
Sanborn	1,311	8,078	6.16	123.20
Misteguay	47,288	438,803	9.28	185.60
Muskrat	1,488	16,847	11.32	226.40
AVERAGE	50,797	476,204	9.37	187.40

* Associated costs have been deducted.

information is presented in Table XV along with revised benefit estimates when 1959 price and yield assumptions are applied.[1]

The switch in viewpoint applied in Table XV deserves further comment. Throughout this previous analysis prime emphasis has been placed on an ex ante, or planners point of view. This includes computation of opportunity costs for amortization purposes and the necessity of expecting a given rate of return on investment. In Table XV, an ex post anal-

[1]Price and yield estimates are based on Area 5 farm account data cited in Table XI.

TABLE XV

Benefit/Capitalized Land Values on the Muskrat Creek Watershed, S.C.S. Values Compared With Revised Prices and Yields

	Acres	Total increase in net revenue *	Per acre increase in net revenue	Increase in income per acre capitalized at 5 percent
Improved Acres				
S.C.S.	1488	$28,851	$19.46	$389.20
Revised**	1488	17,769	11.94	239.00
New Land				
S.C.S.	186	7,725	41.53	830.60
Revised**	186	3,735	20.08	401.60

* This is computed on estimated difference between before and after production revenues minus added production costs. No investment costs in works of improvement are subtracted, nor are associated costs subtracted.

** Price and yield estimates are revised to conform with Area 5 farm account data referred to in Table XI. Prices are those paid in Michigan during 1959.

ysis is applied to derive a figure comparable with a market value. This figure is based on estimated future net benefits, where any improvements such as drainage and clearing made to land receives only the residual income after all other factors have been paid. This is to say that all permanent improvements made in the land are simply lumped by the

market into a land resource.[1] The fixed nature of the land improvements makes their historical investment costs of no influence on future market price.

Table XIV presents a capitalized land value where a rate of return on associated costs is deducted from benefits before the land value is computed. This would assume that owners feel a rate of return to land improvements is required as an operating expense rather than assuming it an historical expense.

It might be noted that no return on other direct project costs are subtracted from the benefits for this land value approach since they seem clearly fixed and historical in nature.

What then will be the worth of the land after improvements as gaged by what a willing buyer would pay a willing seller? Table XV indicates that the average acre of land in the Muskrat Creek Watershed project will increase in value $389.00 based on S.C.S. assumptions for yields and prices. It seems reasonable to assume that land before improvements may have a value in excess of $50-$100 since much of it is presently cropped. This would give an ex post land value well in excess of $400.00 when based on income earning capacity and a 5 percent capitalization rate.

Informed sources in Clinton County, where the Muskrat is located, report improved farms with adequate drainage

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[1]Raleigh Barlowe, Land Resource Economics The Political Economy of Rural and Urban Land Resource Use (Englewood Cliffs: Prentice-Hall, Inc., 1958) pp. 9-10.

are selling for $200-250 per acre in that area.[1] This includes farm buildings and other improvements. The 1959 preliminary census data shows $191.75 per acre as the average price for all of Clinton County.[2] This census data may understate value in the Muskrat since it is somewhat better land than the county average.

To further substantiate the land value of improved land in the Muskrat Creek Watershed the author computed a residual income to land based on certain farm account records in the Muskrat Creek area. This was done on the basis of assuming a model farm of average acreage with a typical cropping pattern, and using crop yields and expenses typical of that area for the 1959 farming season.[3] This rough computation showed the model farm to be worth $225 per acre based on the crop production and prices during the 1959 season with net income capitalized at 5 percent.

Subjective as these figures are, they tend to indicate that $250 per acre is a reasonable value for improved farm

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[1]The county agent, Federal Land Bank officials, and extension specialists all tended to give figures within this range when asked market value of land in the Muskrat area.

[2]U.S. Department of Commerce, Bureau of the Census, 1959 Census of Agriculture - Preliminary Report on Clinton County, Michigan (Washington: Bureau of Census, November, 1960).

[3]Michigan State University Cooperative Extension Service, Department of Agricultural Economics, Farming Today What it Costs How it Pays, Area 5, 1960, East Lansing, Michigan.

land in the Muskrat area. This is around $150-$200 less than the claimed benefits for the P.L. 566 project as estimated by S.C.S.

Possible Reason For Divergence In Estimates

A number of variables are present within the benefit-cost analysis which could have caused the divergence between capitalized S.C.S. estimated benefits and actual land values in the Muskrat Creek area. Data in Table XV indicated S.C.S. land improvement benefits will increase land values by $389 per acre. Using revised prices and yields this figure was reduced to $239 per acre for improved land. If the unimproved value of this land is between $50-$100 total land values after the project's installation will be near $450 per acre using S.C.S. figures, and near $300 using the adjustments mentioned in Table XV.

If the S.C.S. estimated increase in benefits per acre on the Muskrat Creek is arbitrarily adjusted by single variables to bring it in line with a total land value of $250 per acre, the following results are noted: (1) holding all other variables constant, a uniform decrease in price assumptions of about 43 percent would be needed to reduce expected net benefits capitalized at 5 percent to a figure which would justify the market value of land, (2) again holding all variables at estimated work plan levels but increasing induced production costs about 66 percent would yield the same results as was noted for the price adjustment, with the

Soil Conservation Service estimating production costs increase,[1] (3) taking the average net increase in returns for the whole project of $19.46 per acre, as determined in the work plan, and applying a capitalization rate of approximately 7.78 percent would yield a capitalized/income value of around $250 per acre.

(4) Referring to Table XV again, the Work Plan's estimate that the 186 acres of new land brought into production will average annual net revenue of $41.53 per acre seems a bit high. Questions concerning the type of units these pieces of new land will enter into, already existing commercial farms or new farm units, will, of course, determine the production expense schedule. If any major adjustment is made in productivity, time lag of on-farm improvements installed, or percent of possible improvements installed the benefits from these new lands can be greatly shifted downward.

(5) If the 1959 price and yield assumptions are applied to the S.C.S. figures, and it is further assumed that only 75 percent of all possible improvements will be made, and further that many of these improvements will be applied only after an appreciable time lag then the computed land value would again be near $250 per acre.

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[1]The increase in production costs are estimated by the Soil Conservation Service on the average cost of present production. This average cost was used as an approximation to derive the total net returns on the 1488 acres of improved land in the Muskrat by the author. When the average cost estimate is projected over the whole watershed, it assumes no economies of scale.

Decision Making Implication

The determination of a primary benefit-cost ratio on small watersheds is almost totally based on benefits to private land owners since no secondary benefits enter the ratio. The benefit portion of the ratio should be reflected in changes in land values. The land value increases derived from S.C.S. figure are a good deal higher than a market value comparison would indicate as being likely. Explanations for these differences could be explained as follows: (1) Land buyers tend to estimate future crop prices on the basis of current prices. (2) Land buyers may tend to impute a shorter economic life or horizon to land resources than do S.C.S. planners. This would result in a higher capitalization rate. (3) Land buyers may intuitively be using higher costs of production than S.C.S. planners, and assigning a higher opportunity cost to capital than the 2.5 percent used by S.C.S. planners. (4) Land buyers may be using more conservative yield expectation than the S.C.S.[1]

A Recommendation for the Use of Land Values

Adding a countercheck economic appraisal to an already expensive planning process may be out of reason unless it can be done cheaply and easily. The following steps are a suggested procedure for carrying out this countercheck.

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[1]The author's judgment is that the use of certain assumptions concerning price and economic life of the Muskrat Creek project are the variables which cause the most significant deviations between S.C.S. estimates and land values which results from individual market transactions.

1. After the formal benefit-cost analysis has been conducted a qualified appraiser should determine the present market value and the income/capitalized value of the land to be improved by the P.L. 566 project.

2. The land quality after improvement should be specified, and land in the vicinity of similar quality should be appraised for a market and income/capitalized value.

3. The difference between appraised market land values before improvements and projected market land values of similar land after improvement would give the approximate increase in land value attributable to the project.

4. The capitalization rate could be based on the rate applied to the income/capitalization figures in the appraisers report which brought similar land's value figure in line with the present market values.

5. The capitalization rate used in the above determination would be multiplied by the increase in land value for an annual net increase in return per acre caused by the project.

6. The net return per acre as determined by the direct benefit-cost analysis and the net return determined by the indirect land value approach could then be compared.

With this type of countercheck on estimated benefits, serious discrepancies in the direct method of benefit computation can be seen more easily. A question which could be raised here is, does the market price on a piece of land reflect the capitalized benefits to society or only the value

to the individual owner? The market value will tend to reflect the relative worth of land as a factor in production to a similar degree that the price of a product, used in the primary benefit approach, would reflect that product's marginal value to society. In spite of this problem it seems to the author that the extra cost and time involved in computing land value increases would be a worthwhile supplement to the direct benefit-cost analysis.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

An attempt was made in this study to determine the reliability of the benefit-cost analysis as it is applied to P.L. 566 projects in Michigan. Various variables within the analysis were examined to show interested decision-makers how critical certain assumed variables can be on the final economic results. Recognition of the impact of changes in these variables should help decision-makers to better plan projects for national welfare through programs of developmental or egalitarian nature.

The goal of P.L. 566 appears to be improving national economic welfare through projects of accretion and/or subsidy. The reliability of the benefit-cost analysis in helping decision-makers attain this goal rests on its ability to predict the costs and benefits accurately and consistently. The resulting economic data should be presented in such a form that alternative means of attaining this goal can be compared. The following conclusions should throw some light on this reliability.

Costs

The calculation of direct project costs should be the

most reliable part of the benefit-cost analysis. A review of the P.L. 566 economic evaluations in Michigan shows several critical variables within the cost figures, when looked at from a decision-maker's viewpoint.

1-) The cost sharing data presented on Michigan's P.L. 566 projects indicates P.L. 566 funds bear an average 23 percent of total estimated project costs. When all cost sharing projects within the P.L. 566 plan are broken down the Federal share is seen to be an average 54 percent of total project costs. Federal cost sharing on a national basis may run a good deal higher than in Michigan. About 58 percent of total costs on a national basis are borne by P.L. 566 funds. Total Federal cost sharing, estimated as P.L. 566 costs plus one-half of other source's funds, might run as high as 75 percent. This is due to cost sharing by the A.C.P. and Forest Service. Neither state nor national figures indicate including planning costs which are borne by Federal agencies, and may account for 10 percent of total project costs. It is recommended that estimated Federal and non-Federal shares for planning and installation costs be specified.

2-) The cost amortizing problem contains some of the most critical variables. If, as many authors have voiced, the interest rate used on water resource projects is too low then an unsatisfactory allocation of resources is taking place. The same faulty allocation is occurring if the economic life of the project is overstated. The example

given in Table VI, Chapter III, shows that the economic justification of Little Black Watershed project is especially vulnerable to changes in interest rate and economic life assumptions. In general, it can be said that any project with a low benefit to cost ratio needs careful economic justification of interest rates used and projected economic life assumed.

The author's recommendations concerning amortization procedures include using an interest rate which reflects costs of obtaining the money, and using an economic life of the project which is likely under present institutional structures. Current government long term bond rates are near 3.75 percent.[1] Costs for private borrowing range from 5-7 percent. Both of these rates are far from the 2.6 percent presently being used on all installation costs, public and local.

The author also feels that using a 50 year economic life assumption on channel improvement in Michigan may be too optimistic. Past institutions for maintenance and upkeep of these improvements have not justified this length of economic life, and present institutions have been little modified to handle further works of improvement.

3-) Problems of physical cost measurement lie heavily on the amount of experience planners and construction people have in P.L. 566 type projects. This was pointed out in

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[1] The Wall Street Journal, Midwest Edition, April 24, 1961, p. 20 (Government Securities)

Table VIII where the original evaluation and later re-evaluation of the Little Black Watershed showed some wide percentage changes in estimated benefits and costs. These weaknesses should be recognized and eliminated by later economic evaluations on projects not yet under construction. These re-evaluations should be made whenever the passage of time has significantly changed any of the major variables making up the analysis. A requirement for a yearly review of projects authorized but not yet under construction may help eliminate some planning mistakes.

4-) The accretion costs[1] for Michigan P.L. 566 projects have run around $100 per acre for direct estimated installation costs in farm areas. The associated on-farm costs will also average near $100. The total cost of some $200 per acre may be well below certain western irrigation projects costs per acre. But, alternatives for increasing production by drainage and flood prevention may be far more expensive than additional expenditure on fertilizers, insecticides, and variety improvements. These alternative accretion costs should be available to decision-makers on a per acre and per unit of product basis.

Benefits

In many respects the estimation of a project's benefits is the most difficult and error prone portion of the

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[1]Accretion is defined in Chapter III.

benefit-cost analysis. This arises in three general areas: (1) the problem of predicting prices, yields, and production costs (2) the presence of benefits unmeasured in a common denominator (3) the difficulty in predicting when and if certain possible on-farm improvements will be made.

(1) The price and yield prediction problem shows up in the Muskrat Creek Watershed project. Table XI in Chapter IV shows the affect a slight downward assumption of yields and prices can make on an economic ratio. The S.C.S. ratio of 4.9 was reduced 64 percent to 1.76 when these prices and yields were applied. The bulk of this ratio reduction was due to a 25 percent decrease in corn prices from $1.40 per bushel used by S.C.S. to $1.05 per bushel which approximates the 1959-60 price figure.

Table XII shows the affect other assumptions about price have on the benefit-cost ratio. When using estimated free production and free marketing prices for agricultural goods the Muskrat Creek's benefit-cost ratio becomes only .4, and economically unfavorable.

The estimation of current and future production costs presents a rather hidden variable in the analysis. Besides price changes, the use of current average production costs may or may not reflect actual future costs. More justifying data are needed on types of farming units the new and improved land will enter. If the potential increased production is on-farm units already operating the average cost schedule for this increased production will likely be lower

than on newly formed units. No data was presented in this work to show how serious this variable can be.

(2) The presence of unmeasured benefits will always be a problem in public projects. Most of these benefits could be called social in nature—with the exception of certain intangibles that occur to local individuals. These secondary or associated benefits are usually imputed as value added to a product, or enhancement value added to a piece of land.

The value added to products (secondary benefits) is truly a project benefit only if the product produced is needed and/or if the extra employment is desired. In cases where the product produced is not desired the secondary benefit may be negative. For this reason it appears more fitting that additional justification is needed before secondary benefits can be used by decision-makers in allocating funds for agricultural accretion projects.

The methods used to compute urban land enhancement values in the Little Black River project suffers from the same shortcomings as secondary benefits computation. The practice of imputing the full land value increase brought about through a project's implementation overlooks the lost opportunity suffered by a substitute quality landowner. The author feels that certain discount measures should be taken on projected land enhancement values unless the supply of land for the desired purpose is quite inelastic.

(3) Predicting the implementation time and degree of

application of possible on-farm improvements constitutes another large problem. The practice used on the Muskrat Creek Watershed project was to assume 95 percent of all possible improvements were expected to be applied. Half of the benefits were assumed to occur immediately after the project was completed. The remaining 45 percent was anticipated to occur evenly over a five year span. Only time can prove or disprove whether 95 percent of the possible land improvements will be undertaken.

A recommendation by the author for justifying the percent of possible improvements applied would include: (a) an area description of the tenure situation (b) some indication concerning the willingness of the farmers in the area to adopt new technology (c) and a statement dealing with the availability of on-farm funds to make these improvements.

A general impression gathered by the author while reviewing the benefit-cost reports on P.L. 566 projects in Michigan is that benefit projections are optimistic. These projections are also based on assumptions which are not well defined for decision-making purposes. Because the variables within the benefit portion of the analysis are so difficult to quantify and fully justify the indirect method of determining benefits was explored.

Indirect Benefit Computation

The use of induced property value increases to check the reliability of directly estimated project benefits has several advantages. (1) It is rather cheaply carried out

once the direct data has been gathered. (2) Decision-makers can countercheck direct benefit estimates in terms of a more commonly recognized criteria than a benefit-cost ratio.

Data presented in Chapter IV, Table XIV, shows affected land's value in the Muskrat Creek Watershed should increase $226.00 using capitalized S.C.S. estimated benefits. This assumes an ex ante view with a return on installation cost being deducted from capitalized land benefits.

Table XV showed the increase in the benefit/capitalized land values in the Muskrat Creek area when historical investment costs are not assumed to effect land values. Under this assumption the increase in capitalized-benefit land value for all improved lands on the Muskrat Creek would be around $390.00, based on S.C.S. estimates.

Informed sources in the Muskrat Creek area report good quality crop land in that area selling for around $250 per acre. This would indicate that an increased capitalized primary benefit claim of $390 would be too high in this case.

Some of the variables in the direct benefit-cost analysis which may be giving inflated benefit figures when compared with the indirect approach are: (1) long term price values (2) a lower production cost figure than land buyers use in computing land values (3) a longer economic time horizon than private individuals possess (4) higher yields and less natural risk than a land purchaser would impute.

A general criticism of the indirect method of computing

benefits is that land value increases only reflect the benefits which occur to the private individual and in no way measure the secondary benefits accruing to society. For this reason the indirect method should only be used as a countercheck against the estimated primary project benefits. The primary benefits for farm land are largely benefits which occur to private individuals and are thus parallel with the land value method.

Suggestions For Further Study

The author feels there are a number of possible areas which might yield worthwhile future research in connection with the benefit-cost analysis and Public Law 566 in Michigan. A few of these suggestions are given here.

1. A study of estimated and actual costs of various P.L. 566 projects after a number of projects have been completed would be worth-while to decision-makers. The experience and knowledge gained by planners and construction people would probably show up in a decreasing spread between actual and estimated costs.

2. A study of actual planning costs could be very meaningful if decision-makers are trying to determine costs of all resources used in implementing a project.

3. The use of actual project costs and actual productivity increases on a group of P.L. 566 projects could enable decision-makers to draw some conclusions about the economies of using P.L. 566 projects to increase productivity.

This implies that alternative costs per unit of production were also quantified.

4. A study concerning what percentage of possible on-farm improvements were made and when these improvements were installed after the project was completed would also appear useful. Along with this study the accuracy of crop-shift estimates and the increase in production cost associated with the increased production could also be evaluated.

5. The long run economic life of P.L. 566 projects will be of interest to future decision-makers. An indirect method of getting at this would be to use a case history study of drainage and flood prevention structures put up in Michigan. From this type of study some more useful conclusions could be reached concerning the expected useful life of P.L. 566 projects under similar institutional set-ups.

6. On a state and national level it would seem meaningful to know how many possible P.L. 566 type projects there are, their expected costs, and the expected increases in production that could be expected from them.

APPENDIX A

TABLE I

Various Commodity Price Schedules

	Unit	U.S.D.A. Projections*	Michigan 10 Year Average*	Michigan 1959***	No Production Controls****
			1949-58		
Corn	Bu	1.40	1.34	1.05	80
Wheat	Bu	1.60	2.00	1.75	1.00
Oats	Bu	.76	.72	.65	.42
Alfalfa Hay	Ton	18.20	22.13	18.50	-
Beans	Cwt	6.00	7.49	5.60	-

* U.S.D.A., A.R.S., and A.M.S., Agricultural Price and Cost Projections, op.cit., Projections are for prices received by farmers in Michigan. Assumptions based on relatively high employment, a trend toward peace, continued population and economic growth, and a stable general price level.

** Farming Today, op.cit., p. 21.

*** The average prices received by Michigan farmers in 1959. Michigan Department of Agriculture, Michigan Agricultural Statistics, July 1960, Lansing, Michigan, p.46.

**** Farm Price and Income Projections, op.cit., p.23. Prices used are those estimated for 1960. Price estimates are based on assumptions that all production controls are removed and an orderly reduction of present stocks would take place of a 7-10 year period.

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