



Economic Analysis and the Efficiency of Government: Ninety-first Congress, first session, September 22, 23, and 24, 1969

By Dr. Mason Gaffney

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ECONOMIC ANALYSIS AND THE EFFICIENCY OF GOVERNMENT

HEARINGS BEFORE THE SUBCOMMITTEE ON ECONOMY IN GOVERNMENT OF THE JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES NINETY-FIRST CONGRESS FIRST SESSION

PART 2

SEPTEMBER 22, 23, AND 24, 1969

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ECONOMIC ANALYSIS AND THE EFFICIENCY OF GOVERNMENT

TUESDAY, SEPTEMBER 23, 1969

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMY IN GOVERNMENT,
JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The Subcommittee on Economy in Government met at 11:05 a.m., pursuant to recess, in room S-407, the Capitol, Hon. William E. Proxmire (chairman of the subcommittee) presiding.

Present: Senator Proxmire.

Also present: Robert H. Haveman and Richard F. Kaufman, economists; and George D. Krumbhaar, minority economist.

Chairman PROXMIRE. First, gentlemen, I want to apologize for being tardy. We had to postpone this meeting from 10 o'clock to 11 o'clock this morning because of another critical hearing I had over in the New Senate Office Building that I simply could not avoid. This is certainly a labor of love as far as I am concerned, and I would have preferred to be here at 10 o'clock, but the other was a matter of duty, so duty triumphed over love.

Today the Subcommittee on Economy in Government begins the fifth day of hearings on "Economic Analysis and the Efficiency of Government." The testimony we have been receiving relates to the defense and civilian agencies of the executive branch, and concerns the expenditures and regulatory functions of the Government agencies.

Expert witnesses have discussed the limited use of economic analysis within the agencies of the Federal Government.

Yesterday we began a series of case studies and heard from experts in the field of urban affairs, medical care, and higher education. Today we continue with case studies in Federal natural resources policies—irrigation and flood control policy, Federal pollution control policy, and the Federal helium program.

Tomorrow we will discuss the maritime policy, aviation policy, and the highway and navigation programs.

Dr. Mason Gaffney, who will discuss the U.S. Irrigation and Flood Control Policy, is originally from Winnetka, Ill.

I am glad to hear that. I am originally from Lake Forest, Ill. So we are practically neighbors—two suburbs of Wisconsin—I mean Chicago. Wisconsin, too.

Dr. Gaffney received his B.S. degree from Reed College in Portland, Oreg., and his Ph. D. from the University of California at Berkeley. He is currently a professor of economics at the University of Wisconsin in Milwaukee. So it is a suburb of Milwaukee after all.

He has authored numerous articles in the area of natural resources policy, as well as a significant book entitled "Extractive Resources and Taxation."

Dr. Gaffney, you may proceed.

**STATEMENT OF MASON GAFFNEY, PROFESSOR OF ECONOMICS,
UNIVERSITY OF WISCONSIN, MILWAUKEE**

MR. GAFFNEY. Thank you, Senator Proxmire. I have also shaken your hand at three county fairs, at least.

Chairman PROXMIRE. Very good.

MR. GAFFNEY. I gather from the instructions—

Chairman PROXMIRE. You are even better qualified than I thought you were.

MR. GAFFNEY. Witnesses are supposed to begin finalizing their remarks as they begin, so I will be just as brief as I possibly can. Fortunately, other economists who have appeared before this committee in the past have touched on water policy at some length and said a number of things that I would have said if they had not. But since they did, I will specialize and supplement what they have already contributed to your volumes with a few points which I think they overlooked.

Four specific problems which my written testimony dwells on are, first of all—this is a loaded word, I suppose, but the giveaway policy which characterizes our Federal, and State, too, attitudes toward water resources. Essentially, no charge is made by the Federal Government for its property and the water resources of the country are essentially the property originally of the Federal Government, as these are made available to either private developers or public developers who supply private individuals. It is as though we gave away the drilling rights to offshore oil to Texaco without any charge.

Now, in mineral resources and forest resources, too, we do have some competitive bidding. In the field of water resources, this has not been the practice.

There are at least five basic problems that follow from this. No. 1 is a serious abatement of the pressure to put these resources to their highest and best use.

No. 2, which is quite universal and quite serious, is prematurity of development. Anything which is given away free has a value in anticipation long before it has a value in fact. In order to acquire effective possession and control of this resource, one must put it to use at a time when it is still of zero or negative value. The result is racing to collar or collect control of water resources, which one does by developing them before those greedy other fellows get their hands on them.

This tendency toward prematurity is reinforced by income tax matters in that the early losses may usually be expensible—that is, written off in the year in which they are incurred, even though they are really a capital investment whose purpose is to capture control of an appreciating resource.

The racing for farm quotas is also a reinforcing factor. The old devil logrolling is definitely a factor, and the specified problem here is that in order to assure people in different congressional districts that they will get something from the trading process that occurs, something has to be started everywhere at once. This means that instead of

focusing funds on a few projects which are ripe, funds have to be dissipated over many, many jurisdictions.

Finally, the process of regulating public utilities supplements this bias, since utilities are often seeking to magnify their rate base and by investing capital in premature submarginal projects, even though those projects incur losses, they are able to increase their rates or avoid reducing their rates charged in their rich surplus-yielding territory.

Now, a third problem that follows from the giveaway is a distributional problem. Those who are able to invest money prematurely and undergo a long waiting period are, of course, the wealthy, and they tend, therefore, to be the ones who secure ownership of the resources which the Federal Government gives away.

A fourth problem is rigidity of allocation. That which has been received without payment is not received in clear title and the person who controls these water resources is unable to sell them and he is not paying any rent, which would urge him to do something with them when his use becomes obsolete, if indeed, it ever is the most economical use.

Finally, there is a bias toward underpricing and great waste of water, with, of course, its complement, a continual crisis and a continual reaching out for remote supplies when supplies near at hand are not being economically used. This is characteristic of the whole structure of public works development in the field of water resources. All this is under the general heading of the giveaway problem.

A second problem is one of imbalance. Too much money is going into public works, too little money is going into the complementing private works. A second aspect of this is that too much money is going specifically into water-related capital, both public and private, too little into complementary kinds of capital.

A third general problem is that of slow payout. Investment in water public works, partly because of its prematurity, partly because of its massive character, is an investment which does not yield a return for years or decades, and sometimes never. At a time when we were primarily concerned about matters other than inflation, this was often obscured. Now it is crystal clear that any policy which encourages investment and does not produce goods at the end of the production pipeline within a reasonably short period can only be inflationary.

A fourth general problem which my paper takes up is that of the regressive distribution of benefits and costs; that is to say, the benefits are progressively received and the costs are regressively distributed. The recipients of the benefits in some cases are landowners whose holdings exceed 100,000 acres. Some outstanding areas where this is the case are the Tulare Lake Basin, the west side of the San Joaquin Valley and the Delta of the Mississippi River. There are others. The people who pay for these on the other hand are the general taxpayers.

There was a time when everybody knew or thought he knew that the United States had a system of taxation which was progressive. Not everyone knows this any longer, I am happy to say. I am not happy to say it is not true, but I am happy to say we know it is not true. As Congress works in the area of tax reform, it will also be working in the area of reform of the distributive problems associated with water development.

In terms of policy recommendations, first of all, I am inclined to endorse, and second, the recommendations made by previous witnesses whose statements are in the PPB volumes. In terms of the topics which I raised myself, I think the most basic recommendation I have to suggest is that a charge or a set of charges be levied for the use and appropriation of waters in which the Federal Government has a legitimate property interest. This involves, of course, defining the Federal Government's property interest in water, which has never been clearly done.

Secondly, it involves tax reform of such a nature as to expose to the full fury of Federal tax rate increments in land values which are enjoyed by the primary beneficiaries of Federal water development. At the present time, if you work for a living, you pay the full tax rate. If you can convince the United States to improve your land for you, your income comes in the form of capital gains; that is, the accrual of land value which not only is taxable at lower rates, it is really not taxable at all if you consider the 25 or 30 different ways that a good lawyer can advise a landowner to handle this problem and avoid paying taxes.

My third recommendation is that of full funding of projects and establishing priorities in preference to the present practice of spreading money almost indiscriminately over large numbers of projects in many areas, including many submarginal.

Finally, I would recommend doing away with the concept of regional development which is a meaningless concept, which, if it has a meaning, can only be interpreted as a thin cover for the maintenance of obsolete congressional districts.

Thank you. I think I have run through my 10 minutes.

Chairman PROXMIRE. Thank you very much. You did a superb job of summarizing your paper, which is a fine paper. Without objection, the full paper will be printed in the record.

(The prepared statement of Mr. Gaffney follows:)

PREPARED STATEMENT OF MASON GAFFNEY

1. "FEDERAL WATER POLICY"

In the compendium of papers submitted to this subcommittee on the "PPB System" earlier this year, several economists testified on wasteful policies and procedures in Federal water programs. I will not repeat what they have said, but generally endorse it, without dwelling on minor differences I might have. Rather I will supplement their testimony by discussing important questions they have omitted.

I. WASTEFUL PRACTICES AND THEIR CONSEQUENCES

A. Giving away public resources.

Public water policy has been dominated by a giveaway psychology. Damsites, water rights, and *de facto* licenses to pollute water have gone free of any but occasional nominal charges of individuals, corporations, and municipalities. It is as though the Interior Department gave Texaco the rights to offshore oil *gratis*—and then paid for their drilling rigs to help develop the country.

Previous witnesses have rightly condemned the use of submarket interest rates in appraising Federal works. The use of zero-interest for all costs that ingenuity can allocate to "irrigation" benefits of a project is an outstanding outrage. The use of zero rent on public sites and waters is equally outstanding.

The resulting damages are several:

1. The pressure to put resources to their best use is abated. When valuable land and water inputs are entered at zero value, any of several projects can show super-unitary benefit: cost ratios and appear economical. When these

resources are appraised at their highest and best use, and their value entered as a cost, only one use plan for a given resource is economical: the best. It has a ratio of one: all others fall below. (It is not, incidentally, the same project whose ratio is highest when no rent is charged. Rather, it is the project yielding the greatest excess of benefits over costs, i.e. net benefits or surplus.)

That is just elementary economics, one of the first things we teach freshmen. But analysts of public projects often overlook it, perhaps trying to accommodate themselves to the giveaway tradition. The result is often to fail to scan all alternatives for a site or stream. For example, a recreational use might be highest for Canyon X, but if a power company gets it before the Park Service does and can show a ratio of 1.01, it's gone.

2. The pressure to develop water prematurely, pre-emptively, is paramount. The prospect of future rents has a present value long before there are any present rents. Enjoyment of those future rents goes to him who establishes his claim, usually by first possession and use. It takes little imagination to foresee the results, which one observes everywhere. Scores of State and Federal agencies, municipalities, corporations, and individuals race for one resource after another, not because they need it now, but to keep those greedy other fellows from hogging it.

Congressmen will recognize the same uneconomic motivation at work in the scrambles for broadcast licenses, air routes, quotas, trucking routes, pipeline routes, bank charters, and other valuable resources and monopolies it gives away without competitive bidding.

At least four congressional policies reinforce the overwhelming pressure towards premature capture and development of water.

One is an income tax matter. The premature developer of a resource may lose money for years while it is submarginal. These losses are currently expensable, i.e. shared by the Treasury each year. Actually they should not be, for they are a long term investment designed to capture the resource while it rises in value. Now if Congress had accepted the advice of eminent tax consultants such as Joseph Pechman, William Vickrey, and Richard Musgrave, and moved to a "Comprehensive Income Tax Base" (often called a "Haig-Simons" definition of income) as Canada's Carter Commission has recommended there, and subjected the capital gains accrual of resource value to the same effective tax rates as ordinary income, it would be all right to expense those early losses. But Congress has not done so. So the taxpayer can expense early operating losses which he invests to capture a resource, while he pays no tax on the resource appreciation which he captures.

Looking at this in terms of "tax expenditures," the U.S. is not only giving away water resources, it is advancing some half of the private investment required to capture the resource with little hope of ever getting its principal back. The best it could do through future taxes is recover its own principal with interest. The private investor's interest is tax free.

A second reinforcing policy is racing for farm production quotas. During the Korean War, for example, cotton quotas were eased. The availability of water let California expand cotton acreage and establish histories of production. After the war when quotas were reimposed, California was "in"—more accurately, those landowners were "in" who had access to uncommitted land and water at the crucial time.

A third reinforcing policy is that old devil, "log-rolling." Whenever there is a giveaway, naturally everyone wants some. Since a Congress cannot very well commit its successor to honor cloakroom bargains, everyone wants some right now. A concrete start is the most convincing commitment Congress can give. And so we have chronically too many starts and too few completions. The economist would say, rank your projects and give priority to those that generate the most surplus of benefits over costs (present-value basis). The exigencies of vote-marshaling interfere with such priorities, and say, start something everywhere at once.

A fourth reinforcing policy is in the public regulation of utilities. Rates are reckoned so as to allow a specified return on the "rate base," or invested capital less depreciation. Every utility seeks to magnify its rate base. One way is to invest in submarginal waters. Regulatory policy lets utilities recoup the losses by charging higher rates in their rich, surplus-yielding territory.

Of course Congress has only limited influence on state regulation, but it has greater influence on federal commissions, and potentially could dominate most power utility regulation because of interstate ties and the use of Federal property.

3. A third damage from giveaways is distributional. The successful early pre-emptors of submarginal waters are those with the greatest waiting power. That is, they are the wealthy. But regardless of who they were before, they become wealthy and powerful once they have nailed down the resource, and it rises in value. They become a privileged class.

4. Water is misallocated. Some submarginal projects remain submarginal, but they do not lose control of their water. Some allocations, that once were economical, obsolesce and stop yielding surpluses; but they keep their water. Water is very hard to transfer, once allocated, because the beneficiaries generally have no clear title they can convey—after all, they never thought one. The Federal owner is not charging them any rent, so they hand on without cost to themselves.

5. Water is underpriced and wasted. Underpricing results not merely from the water giveaway, of course, but from that plus other subsidies like zero interest.

The wastes that ensue are more than meet the eye. It is often assumed that cheap water encourages intensive farming, but the reverse is true. If California farmers had to pay \$20 an acre-foot for water they would feed the world. It takes intensive farming to pay such prices, and this may be observed in areas of dear water. As one moves from south to north in California, for example, the humidity rises and the agriculture declines. Cheap water favors sloppy, extensive farming, with water being substituted for labor and farm capital.

This in turn affects project costs. To achieve a given output, when water is cheap, more water must be delivered per acre, and more acres served. Distribution being the costliest element of water supply systems, this magnifies costs.

Dear water from Federal projects would encourage economy not just of water but of land. The Bureau of Reclamation does not sell direct to individuals, but wholesales water to irrigation districts. These pass on the cost to their landowners, but not entirely as user charges. They also levy land taxes, and these encourage early, compact, and intensive use of land under the ditch.

B. Imbalance, deferred impact and the unknown.

Considering the several subsidies involved, capital obviously flows easier into water projects than into ordinary private investments like barns, fences, or machines. Thus public investment tends to get ahead of matching private land development. This adds to the waiting period during which the public investment is sterile.

The balance is partly redressed, but on the whole probably worsened, by the impact of Federal taxes on land developers.

The favored treatment of capital gains makes it very attractive simply to hold land while federally financed flood control or water supply enhance its value. The result is "irrigation sprawl", or simply agricultural sprawl, in flood-protected areas. Land speculation jeopardized land development long before income tax accounting became a major factor; now the holdout motives are redoubled. Federal subsidies also mean that local property taxes are minimized, and those that do come are deductible, i.e., shared by the Treasury.

On the hand, capital investments in "water conservation" are expensable. Expensing of capital investments is tantamount to complete tax exemption or more, because the most the Treasury can recover is interest on its own investment. This, coupled with SCS subsidies, has certainly caused enormous capital to be invested on private land.

Some of this capital must complement public works and help redress the balance. On the other hand, some of it no doubt is completely substitutional. Indeed, the assessments paid to irrigation districts, through which public water must be distributed, are not deductible, so tax shelter is denied to the most complementary of all local water inventories. Regardless of the balance between public and private works, there is clearly a bias towards water-related capital.

Here we are flying blind. No one seems to know how much capital has been invested in farm water systems. There is a reasonable gap between 13 billion dollars of net farm income estimated by Commerce and U.S.D.A. and two and a half billion dollars reported to the Internal Revenue Service, which no one can explain, except that the discrepancies are on the cost side. Expensing of capital investments is certainly involved. Big capital items that may be expensed are breeding stock, soil conservation, and water conservation. The enhanced land value that results from the last two is virtually tax-exempt income for anyone with a good lawyer.

So Congress is continuing to subsidize a particular kind of capital outlay without much knowledge of how much has been sunk already. It is reasonable

to infer that water-related capital has now gotten far ahead of its complements, and further subsidy is undesirable.

C. Slow payout.

Premature investments, and sub-market interest rates, and logrolling, and waiting for capital gains, all imply a long wait between investment and payout.

From a certain narrow political view this has attractions. Many constituents are enriched by unrealized, untaxed capital gains. And since production increase is a minimum, prices are sustained, letting more and more land to be enhanced elsewhere.

When we look at some other burning issues, the picture changes. One is inflation. Investments whose output is small or deferred are inflationary, creating demand without supply.

Another is poverty. Investments which lie on the land passively for decades before turning over are complementary to land but not to labor. Just as water which is recycled rapidly can do more work and complement more other inputs which is recycled slowly, so capital turning fast employs more men, and relieves more poverty, than the same capital turning slow. Every time capital turns over and is reinvested it employs men, and feeds their families. Federal policy tends to freeze capital in massive monuments from which it is seldom recovered fast. Federal works are capital-intensive; they create a minimum of jobs per thousand (or in this case million) dollars sunk.

When the Bureau of Reclamation began business in 1902 it had something called a "revolving fund". It was to recover this each ten years and reinvest it, so the same capital would by now have been used several times. It was a splendid idea, but that the fund has yet to complete the first revolution. This, I am afraid, symbolizes the whole dreary tale of dragging, lagging results and payouts from Federal water enterprises.

D. Regressive distribution.

The prime beneficiaries of Federal water and flood control projects are land-owners. The holdings are often very large, the benefits narrowly focused on a small number. No one at all familiar with the Tulare Basin, the West Side of the San Joaquin Valley, or the Mississippi Delta will question this for a moment. These are extreme cases, where some ownerships exceed 100,000 (sic) acres receiving benefits, and more elsewhere. Obviously in other service areas ownerships may be smaller but still represent large fortunes.

The costs are borne by the Federal taxpayer. Until recently, "everyone knew" that the Federal income tax was highly progressive. This year, thank goodness, the truth has dawned and everyone knows that the Federal income tax has devolved into a payroll tax, with high exemptions of property income.

The income of the wealthy beneficiaries of water service may be very lightly taxed. A recent U.S.D.A. study shows that of the largest 66,000 farms in the U.S. two-thirds reported net losses from farming! These, incidentally, are those large farms which "everyone knows" are more efficient. As to their accrual of land value, that is virtually exempt from income tax in practice. I ask leave to submit an appendix on the many routes by which land income escapes taxation.

II. IS REFORM POSSIBLE?

Water institutions have proven peculiarly refractory to reformers. Ten years ago I had a go at them, and soon felt like the melodious Paul Simon whose "words like silent raindrops fell, and echoed in a well of silence." Lest this seem like a personal Cassandra complex, I and others have found a warm welcome in tax reform; but, other critics of water policy have been equally unavailing. Few policies, indeed, have been so exposed and pilloried by so many economists, and so little defended, with so little result.

Nothing improves. On the contrary, wilder and wilder plans are seriously discussed in these very halls. That "great land-locked" Tulsa is soon by your hand to become an ocean port, and I do not doubt the Corps of Engineers would carry the channel to the summit of Pike's Peak should you authorize it. Of NAWAPA an analyst has concluded its prime function would be to amaze future archeologists.

The line-up of vested interests opposing reform is formidable. Water law is a WPA for lawyers. Every project is a WPA for civil engineers, who have been defined by Boulding as men who can tell you the best way to do something that should not be done at all. Many projects and WPAs for marginal mountain coun-

ties who sell their votes for local dams. Every project is a consumer of cement. Every project extends the job security of bureaucrats, whose motto might be "pour cement or perish." And above all the beneficiary landowners are constantly lobbying, and playing on the hysteria so easily aroused in matters regarding water. It may not be irrelevant that water and land are symbols of motherhood. Who, then, will speak for mankind? Is there any hope of a breakthrough? I believe I see several counter-forces developing.

One is the Universities. For years, their influence was thrown the other way under the sway of Keynesian doctrines that endorsed all public spending. Today they are dropping that and analyzing choices among alternatives. Since one major alternative is the university itself . . . need I go on? Governor Reagan dramatized the point recently by offering to trade a university for a new water source.

Another is the acute capital shortage of our times. High interest rates are the market's way of signaling the shortage of housing, inventories, gymnasiums, equipment, urban sewers, and a hundred other capital items we have failed to replace and expand while freezing our treasure into cement yielding 3% or nothing, and quite irrecoverable for years (wouldn't it be nice to have it back now at 10%). Fun is fun, but many of these shortages are reaching crisis proportions and cannot be ignored.

A third is the youth rebellion, with all it implies. The effective rebels of course are not the louts, but the working leaders like Nader and Yannacone who have learned how to mobilize idealism and move mountains.

Fourth is this Committee. Much of the trouble rests in the organization of Congress. It is clear you are trying to do something about it. I'll cheer for you and, in the old fashioned deprecatory sense, pray for your enemies.

Fifth is the wilderness conservation movement, spearheaded by the dedoubtable Sierra Club and its new, taxable lobbying incarnation. They may be True Believers. But if we must choose—and we must—between them and the excesses they fight, they are clearly the better choice.

And so I think there is some hope of reform. Accordingly, pursuing the instructions of Mr. Haveman I will suggest what seem to me desirable policies for Congress.

III. POLICY RECOMMENDATIONS

Congress obviously suffers from certain problems of internal organization. I will not presume to comment on these before men who know them better than I. Rather I will tell you what if I were King I should try to accomplish.

A. Congress needs a superior substitute for logrolling. Trading votes is essentially the way one region pays another for a share of the common wealth—basically a reasonable concept. A problem is that often the only coin in which payment can be made is another water project, when a hospital is needed more; or a project of any kind, when reduced taxes are needed more. Another problem is that all jurisdictions have equal bargaining strength, while capital is much more productive in some than others.

So how else may the beneficiaries of public works compensate other Americans? By paying more taxes. It's surprisingly simple. The whole wretched, corrupting business of lobbying for and horse-trading Federal largesse, which seems so intractable that many observers and citizens lose hope in Congress and lean more and more towards a strong executive—this whole business has a solution. Lincoln Steffens observed that the troublemaker in Eden was not Eve, nor yet the Serpent. It was the Apple! Taxing the beneficiaries of Federal works should serve wonderously to dehydrate the apples of discord on Capitol Hill.

The beneficiaries of public water works are surprisingly easy to identify. The works service certain defined lands. The landowners gain. Other local beneficiaries are subject to competition from immigrants. Land cannot immigrate; it appreciates instead.

But Federal income taxation virtually exempts land appreciation. (See Appendix.) If you work for a living you pay the full tax rate on ordinary income. If you improve land under Federal works and match the Federal enterprise with private enterprise, your land income is mostly "ordinary" and taxed at full rates. But if you can influence public officials to improve your land while you do nothing, your income is almost all your own.

And so it pays landowners to commit great effort to drumming for Federal aid. This has always been a problem, but has worsened in our times because of the cumulative perversion of the Federal income tax into a payroll tax. Another problem is the declining role of the property tax, which used to socialize a good

share of land value increments. The latter long decline is in a short-run reversal. The former is in the hand of Congress. As you labor in the vineyard of tax reform, you have an opportunity to prune the apple tree of discord with the same strokes.

B. Congress should charge market prices or rents for Federal property. It should encourage the States to do likewise with State property, as a condition of Federal aid. No State should get away with giving away its valuable resources to local influentials and then pleading poverty in Washington. Congress should assert Federal property rights aggressively when they are paramount, and convey them unequivocally and explicitly when it releases them, not to the end of grabbing everything in sight but of creating a certain and workable tenure system.

It should certainly not do this in one stroke, without detailed analysis. Hydrology and water law are complicated. It should immediately commission a group to return recommendations for clarifying Federal water rights. The difference between this and previous and ongoing efforts would be the posture of the U.S. as a great landlord seeking to maximize income from its domain. Economic analysis will show this is also the way to maximize general welfare.

The benefits are the converse of the problems cited under I.A (Giving away public resources). There is more pressure to put resources to the highest use. Premature pre-emptive appropriation is stopped. Distribution is better. Allocation is better. Waste is reduced.

An important added gain from asserting public property rights is to solve the "pollution conundrum" of who should pay whom for doing or not doing what. To some people it is self-evident that polluters are no better than louts who would nuisance on the public streets, and should control themselves at their own cost and be grateful if they are not jailed for past obscenities. To others it is equally clear that people who want a clean environment should pay polluters not to pollute. The latter school is waxing mighty in the learned journals. Although I have never understood how they would limit the number of those who must be paid not to pollute, they have managed to lend respectability to those who would love to be paid a good price to relinquish the waste-removing capacity of the common water which they have appropriated in the past.

Assertion of public ownership resolves the conundrum. Neither beneficiary of water pays the other. Rather, both pay the government: the ones an effluent charge for unavoidable waste disposal; the others a variety of user or standby charges, depending on their terms of access to the water.

As part of this effort, Congress should assume great responsibility to use its unique powers in resolving interstate water conflicts. It should abandon such economic monstrosities as the Colorado River Compact, which rigidly divides water among political states regardless of demand, and find a formula that recognizes productivity and requires repayment.

Another function uniquely tractable to Federal powers is that of pooling and integrating local projects. Power pooling is a fact over wide areas. Pooling of water supply, storage, power generation and flood control are much more limited. Conjunctive use of surface and ground storage is barely begun. The obstacles of law, institutions, and local-vested interests are formidable. The Federal might is often the most potent available engine of reform.

C. Congress should move towards full-funding of a few projects at once, and away from yearly appropriations for more projects than available funds can complete in a reasonable time. A "reasonable time" depends on the interest rate. Money doubles in a number of years equal to 72 divided by the interest rate. At 7.2%, for example, money doubles every ten years, and quadruples every twenty. If a construction job is stretched out to 20 years the early costs are quadrupled by the delay. Obviously, the delays we learned to accept at low interest rates are no longer reasonable.

Once the logrolling logjams are broken by tax reform and beneficiary charges, endless possibilities open up for rationalizing the timing of works, and ranking projects by priority. This requires use of a reawakening subdiscipline of economics known as "capital theory." Congress should commission expert studies on this topic to develop criteria for priorities.

Now, some development is postmature. Probably more is premature. In general, priority should go to projects yielding the greatest surplus per dollar of cost, as of now, on a present-value basis. But this needs to be tempered by holding off on-sites that are ripening very fast to still higher uses. Capital theory needs to teach us how to make this trade-off.

D. Congress should scratch "regional development" as a benefit from any project. All projects are regional. The concept is either meaningless, or else a thin cover for vote-swapping, maintenance of obsolete congressional districts, and sinking the Nation's dwindling treasure into submarginal projects.

Congressmen who are tempted to go on piling concrete into every narrow gorge with a strident lobby could do worse than to review the history of a previous boom in water works, the canal boom that busted in 1836. They went wild, simply wild over regional development. Some States have outlawed State bond issues ever since.

Another pressure to resist is that of designating the Corps of Engineers and the S.C.S. as "anti-poverty" agencies. A dollar invested in any hamburger stand does more to fight poverty than ten spent by the Corps, which has demonstrated beyond misunderstanding its eagerness to serve the very, very, very rich by servicing their lands, free. It is an "arrangement" of long standing, a scarlet affair beside which the novel of the same name pales into the brilliance of a soiled sheet.

Not only does the hamburger stand employ more people per dollar of capital, it feeds them as well, and it does both things many times a year as each dollar turns over and over. If we aim to deploy our capital to fight poverty we need channel more of it into small, labor-using businesses that produce useful goods. The Corps of Engineers does not recover its capital outlays for decades, if ever, either directly or from increased tax collections. Each new project requires new capital, so that over the years the sum of capital invested for every job created is greater than in any private industry except tombstones. Monumental engineering works are the tombstones of civilizations. Pharoah had his pyramids; Caesar had his aqueducts; and Uncle Sam . . . may profit by their example.

(Supplemental information, subsequently supplied by Mr. Gaffney, appears on p. 384 at the conclusion of today's proceedings.)

Chairman PROXMIRE. Our next witness is Dr. Allen Kneese, who will present a statement on Federal pollution policy. Dr. Kneese received his B.S. in economics from Southwest Texas College in San Marcos, Tex.; his master's degree in economics from the University of Colorado at Boulder, and his Ph. D. from the University of Indiana at Bloomington.

Dr. Kneese has served as assistant professor of economics at the University of New Mexico; as research associate at the Federal Reserve Bank in Kansas City; and as visiting associate professor of economics at Stanford University.

Since 1967, he has been director of the Quality of the Environment Program for Resources for the Future, Inc.

Dr. Kneese has served as a consultant to several organizations and has authored several articles and books, some of which are "Managing Water Quality," "Quality of the Environment," and "Water Pollution."

Dr. Kneese, you may go right ahead.

STATEMENT OF ALLEN V. KNEESE, DIRECTOR, THE QUALITY OF THE ENVIRONMENT PROGRAM FOR RESOURCES FOR THE FUTURE, INC.

Mr. KNEESE. Thank you very much, Senator. It is a great pleasure for me to have been asked to comment on this very important matter of strategies for pollution control in the United States. If it is suitable, I would like to submit for the record a couple of chapters from a book, which will reinforce some of the points I will make in my short written statement.

Chairman PROXMIRE. We are delighted to have them. (See p. 349.) Mr. KNEESE. In commenting on the strategies for water pollution

control in the United States, I would like first of all to characterize very briefly what I think our present strategy is. I believe that strategy is based on two central elements. The first is a policy of Federal subsidies for the construction of waste treatment plants and the second is an enforcement policy on the part of the Federal Government directed against individual waste dischargers. I think those are the most essential elements of the policy and I would like to comment briefly on them.

The financial support for waste treatment plant construction was first introduced in the Water Pollution Control Act of 1956 and the authorization of funds for such subsidies has increased since then. In the 1966 Water Pollution Control Act, \$3.4 billion were authorized for municipal sewage plant construction grants over the period of 1968 to 1971. Under the act, it is possible for a municipality to cover up to 55 percent of the cost of constructing treatment plants.

The other element of the current Federal Government strategy is an enforcement policy on the part of the Federal Water Pollution Control Administration, which has been supplemented in the last several years by a technique which should make the enforcement a bit easier than it was in the past. Under the Water Pollution Control Act of 1965, the States were required to set standards on their interstate and boundary waters. These standards were to be reviewed by the Secretary of the Interior and approved by him by the middle of 1967. Understandably, there have been quite a few delays, but by this time, for the most part, those standards have been established and approved.

As I say, this is a supplement to the enforcement aspect of our present strategy for pollution control. The Federal Government has had the authority to bring enforcement actions against interstate polluters for some period of time. Comparatively few such actions have been brought and it is perhaps not completely clear what the reasons for that are, but probably, they involve such things as the fact that it is expensive and difficult to bring actions against individual polluters and possibly also the fact that there is a great deal of power, economic and political power, which resides in the large industrial polluters.

I think that without in any way criticizing people like Senator Muskie, for example, who did a wonderful job of bringing pollution control legislation about, I think it is nevertheless fair to say that many people are disappointed in the progress that has been made under the present strategy of pollution control. Municipal treatment plant construction has been lagging far behind the schedules that people hoped it would meet.

One of the reasons has been that the actual appropriation of funds for subsidies, grants to the municipalities, has lagged far behind the authorization. For example, the authorization for 1970 is \$1 billion and the Nixon administration has asked an appropriation of \$214 million. Many people believe that the municipalities are simply standing pat, waiting for the Federal funds to become available to them which in principle are available but not in fact, at the present time.

I have already mentioned that the other aspect of the strategy has not seemed to work terribly well—that is, the enforcement action against the individual polluter.

As part of this what I have called subsidy enforcement strategy, a lot of bills have been introduced into Congress to provide Federal subsidies for the construction of waste treatment plants by industry. So far, these proposals have not been successful, which I feel from the point of view of trying to achieve an efficient pollution control policy is quite a good thing. In general, the subsidies that would have been made available by these bills have been hinged to the construction of waste treatment plants. Many studies of individual industries have shown that the treatment of waste at the end of the pipe is an inefficient way to control industrial pollution. It is very often much more efficient to practice internal controls and waste reduction through recycling and byproduct recovery, neither of which would be encouraged by the kinds of bills that have been proposed.

The tax reform bill that is currently in Congress has a provision, according to testimony before this committee by Stanley Surrey, which would provide for a 5-year tax amortization of pollution control facilities investment by industry. This, I think, is a particularly weak approach, because the rapid amortization can't help those marginal plants that are often the excuse for providing subsidies in the first place, since it is necessary for them to have profits to write off against—

Chairman PROXMIRE. You say this provision of the tax reform bill, in the judgment of Mr. Surrey, would cost \$400 million in forgone revenue. Is that for 1 year? Is that the annual loss?

Mr. KNEESE. I think not. I think that is over a period of 5 years; yes.

Chairman PROXMIRE. Thank you.

Mr. KNEESE. Well, anyway, so much for our present strategy which is based on the subsidy enforcement approach. Several years ago, I proposed an alternative strategy for dealing with our water pollution problems in this country, and I think that that strategy in general has the support of those professional economists who have studied the matter. I also believe that had it been implemented, we would be much further along the road to effective and efficient control of water pollution.

This strategy is also based on, I would say, two main elements. I would characterize those briefly again by saying that one of them, the first one of them, is an effluent charges technique. The second is encouragement to regional agencies for planning and managing water quality on a regional basis. I would like to comment just briefly on those two possibilities.

The first, the effluent charges portion of the proposed strategy, is really very closely related to some of the things that Professor Gaffney was saying. Just to back off for a moment and made a sort of broad comment about the question, it seems to me that we are faced more and more in managing our economic affairs with excessive use of what one might call the common property resources—such things as the water, such things as the air mantle, such things as space, which are quite different from the more traditional sorts of resource in the sense that they are owned or held in common and thereby, really not owned by anyone. What we have done in the past is to treat them as though they were free goods. But in fact, they are becoming more and more valuable, and I think this is presenting us with a very broad problem of economic strategy in this country.

One element of that is to try to price the waste-assimilated capacity of water courses, which has up until now carried a zero price. I had advocated under this strategy that the Federal Government institute a national system of effluent charges, which would mean actual prices being placed on the discharge of effluent to water courses. The reasoning is that the common property resources are just as valuable as the traditional types of resources, it is just that we do not have institutional methods for paying for use of that property and this would be a step in that direction.

Of course, such a scheme would yield a certain amount of revenue. This might be considered a social rent, in a sense, on a resource which is held in common.

One thing that could be done with this social rent is to distribute it to the governments of general jurisdiction and thereby let it substitute for other taxes which have distortion effects rather than favorable effects on the allocation of resources. An effluent tax would have a favorable effect.

Another element of this is it would really focus on what is put into the water course so it would leave the individual waste discharger to seek out the most efficient ways of reducing this waste discharge, which would include not only the building of waste treatment plants, but also internal waste generation pollution controls which I mentioned earlier. This leads to another aspect of our present policy, which does emphasize the construction of plants and not their operation. That is, the subsidies that are now available are simply for construction of plants, with very little, if any, monitoring of what goes on afterwards. The difference here would be that the effluent charge is made contingent on what goes into the water and, therefore, would provide an incentive for efficient operation of existing facilities as well as construction of new facilities. Many experts in the water pollution field contend that the existing facilities are operated very inefficiently.

The other aspect of the policy which I suggested several years ago would be for the Federal Government to encourage the formation of regional water quality management agencies. We have now had quite a lot of economic and related research on the question of how one would manage water quality most efficiently in particular areas. All of the studies that I am familiar with and they are studies of the Delaware, of the Potomac, of the San Francisco Bay, of the Miami Basin in Ohio, have all come to the same conclusion. That is that a system which is planned on a regional basis and operated in a closely integrated and articulated manner, can achieve major economies over the present technique of setting a plant on outfalls all over the basin. Such a management plan would incorporate not only treatment devices, but it would incorporate such things as the regulation of river flow for water quality improvement, the actual mechanical or artificial introduction of oxygen or air into the water courses, short-term treatment or chemical treatment of waste during circumstances that are adverse, meteorological or hydrological circumstances that are adverse, and so on.

These studies, and I could, if it is desired, supply reports on some of them, have all come to the conclusion that there are not just marginal economies to be achieved in this manner, but major economies, in some cases almost order of magnitude economies. So I feel we would be well

advised to encourage the development of institutions which could take this kind of regional approach to the problem. I feel the implementation of an effluent charge on a national basis would be a very great step in that direction, for it would hold an umbrella, so to speak, over the regional agencies, and even State agencies, who would like to institute such a procedure but who are afraid because of threats by industry to move out and other kinds of local pressures. Also, it would provide a built-in source of financing for such regional agencies, because the administration of such a charge system could be turned over to the agency if it met certain criteria which would be established by the Federal Government.

As I mentioned earlier, I feel if we had embarked on this route several years ago, we would be much further along the road toward effective and efficient management of our water quality. I feel that this approach still merits a very serious consideration even today.

Thank you.

(The prepared statement of Mr. Kneese follows:)

PREPARED STATEMENT OF ALLEN V. KNEESE

STRATEGIES FOR WATER POLLUTION CONTROL IN THE UNITED STATES

Senator Proxmire and members of the Subcommittee on Economy in Government, I am very pleased to have been asked to appear before you to comment on the important matter of strategies for water pollution control in the United States. I will present my own individual views which do not reflect any official position of my employer Resources for the Future, Incorporated. I am submitting for the record two chapters of a book by Blair Bower and myself, called *Managing Water Quality: Economics, Technology, Institutions*, which amplify some of the points I will make in my oral testimony. (See p. 349, following Mr. Kneese's prepared statement.)

I would like to start by characterizing briefly what I take to be the present strategy of the Federal Government for achieving water pollution control in the United States. It seems to me this strategy is based on two main elements. The first is financial support for municipal waste treatment plant construction. Such support started with the Federal Water Pollution Control Act of 1956 and has continued at higher levels of authorization since then. The 1966 Act authorized \$3.4 billion for municipal sewage plant construction grants over the period 1968-71. Under the Act it is possible for municipalities to cover up to 55 percent of the costs of waste treatment plant construction from Federal grants.

The second element in our pollution control strategy was instituted by the Water Pollution Control Act of 1965 which required that all States set water quality standards on their interstate and boundary waters. These standards were to be completed and reviewed by the Secretary of the Interior by mid-1967. Understandably enough, there were some delays but the required standards are now for the most part in existence. The standards were to be accompanied by a proposed program for achieving them which could then be used as a benchmark against which to judge the need for Federal enforcement actions. Actually, while the Federal Government has had authority to bring enforcement proceedings against interstate polluters in the past, this program has been used only to a very limited extent.

Without in any way denigrating the great and sustained efforts made by Senator Muskie and others to provide us with effective pollution control legislation, I think it is fair to say that the results of our pollution control strategy up to this point have been disappointing to many. Municipal treatment plant construction has been lagging partly because federal appropriations for treatment plant construction are falling far behind authorizations (the authorization for 1970 is \$1 billion and the Nixon Administration has requested \$214 million) and many people assert that municipalities are holding up construction until Federal funds become available. It is hard to say why Federal enforcement powers have not been more effective, but possibly it is because of the difficulty and cost of mounting effective enforcement proceedings, as well as the political power of the larger industries.

As part of our subsidy-enforcement strategy, many bills have been introduced in Congress to provide Federal subsidies for the construction of industrial waste treatment plants. These proposals have so far not been successful. From the point of view of trying to achieve an efficient as well as an effective pollution control policy, this may be regarded as fortunate. For reasons that I hope will become clear in my further testimony, subsidies for industrial waste treatment would tend to be less efficient than incentives to adopt other waste reduction procedures, such as recycle and by-product recovery. The tax reform bill currently in Congress would provide for 5 year tax amortization of pollution control facilities and would, according to the testimony of Stanley Surrey, cost the Government \$400 million in foregone revenue. In addition to the points already made about the inefficiencies of subsidies, a weakness of rapid tax amortization is that it cannot help those marginal firms which often serve as the excuse for subsidy arrangements.

Several years ago, I proposed an alternative strategy for dealing with our national water pollution problems which, I think, has the support of those professional economists who have studied the matter. I believe if this strategy had been adopted, our efforts to improve the quality of our national waters would be further advanced than they now are, and we would be moving into a position to achieve justifiable or desirable levels of water quality at the least cost to society. This proposed strategy was also based on two main elements. The first rests on the concept that the waste discharger should bear the costs his waste disposal activities impose on society, and the second recognizes that in many of our highly developed basins, where pollution problems are concentrated, great savings in costs can be obtained by the implementation of a systematic and well-integrated water quality management plan on a regional basis. The latter would contain elements other than just the treatment of waste waters.

I would like to elaborate briefly on these points and suggest some ways in which the Federal Government might contribute to the development of the sort of strategy I have in mind. With respect to the first element, I think we must devise ways of reflecting the costs of using resources that are the common property of everyone, like our watercourses, directly in the decisionmaking of industries and local government. The waste assimilative capacity of our rivers is a valuable asset, and these rivers have alternative uses which conflict directly with waste disposal. Because our property institutions cannot adequately be applied to resources like watercourses, and for that matter the air and space, they are essentially unpriced and treated as free goods, even though they are in fact resources of great and increasing value in the contemporary world. It seems to me that this unfortunate situation cannot be remedied unless we move toward the implementation of publicly administered prices for waste discharge to watercourses and for the use of other common-property resources. Accordingly, one element of my proposed strategy for water quality management is a system of what I have termed "effluent charges". The proceeds from such charges would yield a rent on a scarce resource to society which could be used in various ways, including further measures to improve water quality, as discussed below. Also, and perhaps even more important, the effluent charge would provide an incentive to conserve in the use of the watercourses for waste discharge. Careful industry studies have shown that industries can often reduce waste discharges enormously, usually at low cost, if they are given a proper incentive to do so.

In many instances the most effective means for reducing waste discharges is internal process change and recovery and recycle of materials that would otherwise be lost. Similarly, under our present property institutions, municipalities are paying only part of the social costs of disposing waste to streams and what they pay is rather capriciously distributed depending on whether or not they happen to have implemented treatment plants. The effluent charges system would give these municipalities an incentive to proceed expeditiously in the treatment of waste. Another point of some importance is that our present policies put heavy emphasis on the construction of plants with little or no follow-through on operations. Many experts have pointed out that most treatment plans are operated far below their capabilities. The effluent charges system focuses on what is put in the stream and thereby offers an incentive for effective operations of existing facilities.

It should be clearly recognized that the present and proposed subsidy arrangements are quite different and, most economists would feel, less desirable in their impacts than the effluent charges system.

First, the system of effluent charges is based on the concept that efficiency and equity require payment for the use of valuable resources whether they happen to be privately or collectively owned.

Second, subsidies for treatment plant construction do not, by themselves, provide an incentive to take action to control waste discharges. Even if an industry is paid a major proportion of the cost of waste treatment plant construction, it is still cheaper, from the point of view of the industry, to dump untreated waste into the river. Thus the subsidy arrangement cannot work unless accompanied by enforcement or other pressures on the waste discharger.

Third, to the extent that the subsidy system works it tends to bias the choice of techniques in an inefficient direction. It would provide an incentive to construct treatment plants with Federal subsidy even though internal controls would be cheaper.

Finally, the effluent charges system yields revenues rather than further straining an already overextended tax system. This revenue can be put to useful public purposes including improvements in the quality of our environment.

Most economists who have studied the matter have concluded that there are compelling reasons for favoring the effluent charges system as one of the cornerstones of effective and efficient regional water quality management. But it may be difficult for particular States and regions to pioneer such a substantial departure from previous practice. The Federal Government's greater insulation from powerful local interests provide an opportunity for leadership. One approach would be for the Federal Government to levy a national effluent charge on all waste dischargers above some minimum amount. The charge could be based on a formula similar to those that are used in the Ruhr area of West Germany or one of those used by certain U.S. municipalities in levying sewer service charges upon industry. This charge could be considered a minimum which could at their discretion be exceeded by a State or regional agency having responsibility for water quality management. Revenues obtained by the Federal Government could be made available for purposes of financing the Federal program with the excess turned over to other governments of general jurisdiction or, and I think preferably, the revenues could be used to establish regional water quality management agencies which are the other element in my proposed strategy.

Research on water quality management over the past several years has clearly shown that major efficiencies can be obtained by the implementation of water quality management systems on a regional basis. In addition to the standard treatment of waste waters, such management systems could include a number of other alternatives closely articulated in planning and operation. These could include riverflow regulation, putting air directly into streams, brief periods of high-level chemical treatment during adverse conditions, and others. Studies of the Potomac, of the Miami, of the Delaware, of the San Francisco Bay region, and of other areas have shown beyond question the economies to be realized by this kind of regional approach. It appears that such an approach can only be effectively implemented by a regional river basin agency having the authority to plan, construct, and operate the necessary facilities. Again, there is a role for Federal leadership in the establishments of such agencies. So far, tendencies to support such an approach at the Federal level have been minimal.

The Federal Government could, of course, take direct action. It could set up regional water quality management agencies or regional water resource management agencies. These could be separate entities, such as TVA, or regional units of Federal agencies, such as proposed by the first Hoover Commission. There has been so much opposition to arrangements of this nature that it is questionable whether the Federal Government would be willing to move in this fashion. An alternative would be for the Federal Government to establish incentives and guidelines for the organization and operation of regional management agencies, either under State law or through interstate compacts. An agency with adequate authority to plan and implement a regional water quality management system would be eligible for a grant of funds to support a portion of its budget to help staff the agency and to make the first data collections, analyses, and formulation of specific measures for water quality management. If the Federal Government is satisfied that the proposed program and the plan for its implementation satisfy criteria for its efficient operation, the agency might be eligible for a grant to assist it with actual construction and operating expenses. Such a system might appropriately be limited to the early implementation—say five years. During this period, it would be necessary to work out longer-term arrangements for financing

the agency. Clearly, the proposed effluent charges system could play a major role in this. Presumably, administration of the effluent charges system would be turned over to the regional agencies with the Federal level of charges continuing to be regarded as a baseline. In this manner, regional scale measures would be financed while at the same time providing appropriate incentives to waste dischargers to cut back on their emissions. A system similar to this has had an interesting history of operation in the Ruhr area of West Germany.

I have no doubt that Federal leadership toward implementation of an effluent charges system and the creation of regional water quality management agencies can put us on the path to continuing effective and efficient management of the quality of our waters. I believe that this approach merits serious consideration as a strategy for dealing with our serious national water pollution problem.

(The following chapters are taken from Allen V. Kneese's and Blair T. Bower's book entitled "Managing Water Quality: Economics, Technology, Institutions," Baltimore: The Johns Hopkins Press, 1968:)

Chapter 9

POLICY ALTERNATIVES FOR INFLUENCING INDIVIDUAL WASTE DISCHARGES

Before broadening our discussion of managing water quality to include collective measures of various types, we review the merits of alternative policies for influencing decisions at individual discharge points.

The conclusion from our analysis is that, despite some shortcomings and problems, the effluent charges approach is the one most likely to result in efficient and equitable arrangements. In addition, the proceeds from effluent charges constitute a source of net revenue to the agency levying them, and this revenue could be used to develop and improve the water resource or for other public purposes. If a certain amount of waste can be put into a watercourse without producing damage, part of the return from a properly levied effluent charge, i.e., one that reflects marginal damage, will be a pure rental return on the naturally occurring assimilative capacity of the watercourse.

The revenue yield of the effluent charge may itself achieve a wider efficiency benefit. Economists have long argued that excise taxes are generally undesirable because they impose an excess burden by distorting the allocation of resources. By placing a wedge between marginal cost and price for certain commodities, the excise tax tends to have an effect analogous to that of monopoly, that is, it restricts production even though consumers would be willing to pay more than the cost of producing additional units of the goods. When taxes affect the production of some goods and services but not others, there is a distortion or misallocation in resources use. Even the income tax, generally favored as the best of the major taxes, may impose an excess burden by distorting choices between work and leisure.¹

This line of reasoning suggests that taxation systems such as effluent charges, which bear upon activities producing an external cost, can yield an excess benefit. They improve the allocation of resources in two ways: directly, by providing an incentive to waste dischargers to control their waste discharges; and, indirectly, by providing revenues, and so reducing the need to impose taxes to finance the public provision of goods and services. Since most taxes levied by governments are deemed to be more or less undesirable on efficiency grounds, improvements in efficiency resulting from the revenue aspects of an effluent charge or tax system are likely.² As we have said, the revenue-yielding aspects of effluent charges will command more of our attention in the next part where we consider further opportunities to improve water quality through collective action. At this point we simply note that the revenue-yielding capability of effluent charges as compared with other means of reducing waste discharges is a desirable characteristic.

¹ For an excellent discussion of these matters and extensive citations to a rather copious literature, see R. E. Musgrave, *The Theory of Public Finance* (McGraw-Hill, 1959), Chapter 7.

² As far as we know, the first person to make this point was Gordon Tullock. In an unpublished paper on excess benefit, Tullock suggests that a systematic effort should be made to find instances where activities creating external costs could be taxed in order to realize both the direct and excess benefits of such taxation.

In the past few years effluent charges or effluent taxes have received a good deal of attention in the political arena. One of the main recommendations of the Environmental Pollution Panel of the President's Science Advisory Committee in November 1965 was,

... that careful study be given to tax-like systems in which all polluters would be subject to "effluent charges" in proportion to their contribution to pollution. Federal and local efforts to reduce pollution of air, soil, and water have traditionally rested upon a mixture of prohibitory regulation and persuasion. The public interest can often be served by reducing pollution below the levels where these means are appropriate and effective. Effluent charges have enhanced effects because individual polluters always have a prospect of financial gain from further reductions in their contribution to pollution.³

The annual report of the Council of Economic Advisers, issued in January 1966, contained the following statement:

Although it must assist in eliminating the large backlog of capital requirements, the federal government cannot and should not finance local waste treatment indefinitely. In the long run, localities should collect revenues from the polluters adequate to sustain the system and to expand it in line with normal growth. Charges based on use of treatment facilities provide long-run incentives for the abatement of pollution. *Effluent charges* on polluters in sections on the river where there is no municipal treatment could have a similar effect; when waste discharge is costing industrial firms a certain amount for every pound discharged, the volume of waste will be reduced and the revenue collected will help to pay for collective treatment.⁴

During 1966, the House Committee on Government Operations polled the state governors on various incentive devices including effluent charges. Eight of the governors expressed qualified approval of a federal policy requiring effluent charges, five suggested that the idea needed more study, and three were opposed to federal effluent charges but felt that charges established by the state might be more desirable. The attitude toward effluent charges seems remarkably favorable considering that the idea is highly unconventional, that it hit most governors "cold," and that the alternatives involved reduction in federal taxes.⁵

Finally, over the last few years a working group of the President's Task Force on Pollution Abatement consisting of representatives from the Bureau of the Budget, the Council of Economic Advisers, the Department of Commerce, the Department of the Interior, and the Treasury Department evaluated economic incentives for industrial pollution control and came forward with a strong recommendation favoring effluent charges. There has also been considerable interest in this technique at regional and state levels. During 1966, for example, Wisconsin passed a far-reaching new water quality control law which specifies that an inquiry should be made into the feasibility of effluent charges as an aid in the implementation of water quality control programs.

Despite the interest in effluent charges, political attention and support have centered on techniques that involve subsidies such as rapid tax write-offs and tax credits. Numerous bills have been introduced into the Congress over the past several years proposing such devices.⁶ A number of states have passed such legislation and many more are currently considering it. In addition, the federal government and some state governments have programs of direct grants to municipalities for either or both capital and operation and maintenance expenses relating to municipal waste treatment plants. When these plants serve industrial users—as they often do—the grants provide an indirect subsidy for industrial waste treatment.

Support for these techniques continues despite what seem to us to be compelling arguments against them from the point of view of the broader social interest. Some of the most important deficiencies of these devices are reviewed below.

³ *Restoring the Quality of Our Environment*, Report of the Environmental Pollution Panel, President's Science Advisory Committee (1965), p. 17.

⁴ *Economic Report of the President*, H. Doc. 348, 89 Cong. 2 sess. (1966), p. 124, emphasis added.

⁵ *Views of the Governors on Tax Incentives and Effluent Charges*, House Committee on Government Operations, 89 Cong. 2 sess. (1966).

⁶ For a detailed description of these devices see H. W. Mantel, *Industrial Incentives for Water Pollution Abatement* (New York: Institute of Public Administration, 1965).

During the twenty years since 1945, on an average, three bills a year were introduced into Congress proposing various forms of tax incentives for industrial waste treatment. During the first session of the 89th Congress (1965), there were 19 such bills; in the first six months of the second session (1966), there were 24 bills. League of Women Voters of the U.S., *Current Review of Water Resources*, No. 3 (August 1966).

First, each of these devices involves a reduction in federal revenues or an additional expenditure from the federal treasury. This means that an already overburdened tax base must be hit even harder to finance these outlays. Further use must be made of taxes which already involve "excess burdens" in order to provide replacement revenue. Should the tax credit or accelerated depreciation devices turn out to be successful in inducing substantial outlays for industrial waste treatment facilities, their cost to the federal treasury could be large (approximate costs as calculated by the working group of the President's Task Force on Pollution Abatement are shown in Table 9). Accelerated depreciation is equivalent to an interest-free loan, and the cost to the government takes the form of waiving a longer period of time for tax payments. This proposal would allow capital expenditures to be depreciated more rapidly than is permitted under existing laws and the rate would not be consistent with the functional life of the waste treatment facilities. An investment credit might operate like the investment credit for machinery and equipment which exists under present tax laws. Credits reduce the net cost to the taxpayer for such investments, but they do not alter the basis for depreciation.

TABLE 9.—COMPARATIVE GAINS BY INDUSTRY THROUGH ALTERNATIVE FORMS OF FEDERAL ASSISTANCE FOR WASTE TREATMENT PLANT CONSTRUCTION

(Dollar amounts in millions)

Type of assistance	Percentage	Per \$1,000,000,000 of capital in- vestment
Accelerated depreciation:		
5 years.....	8.5	\$85
3 years.....	14.7	147
1 year.....	18.3	183
Tax credits: ¹		
Existing 7 percent.....	7.0	70
14 percent.....	14.0	140
20 percent.....	20.0	200
Accelerated depreciation and tax credit combined:		
14 percent tax credit and 3-year accelerated depreciation.....	28.7	287
20 percent tax credit and 1-year accelerated depreciation.....	38.3	383
Reduced interest loans: ²		
6 percent.....	6.0	60
3 percent.....	12.0	120

¹ Assume 48-percent effective tax rate, 15-year functional life (straight line) for waste treatment facilities and 9-percent discount rate; accelerated depreciation now available in existing tax laws, e.g., sum of digits, excluded.

² 15 years, straight reduction loan.

Source: Jack W. Carlson, Council of Economic Advisers.

The second point is one that is often overlooked. Devices like accelerated depreciation and tax credits, or even grants to meet part of the construction cost of facilities, do not provide a net incentive to waste load reduction. They merely reduce losses on waste treatment equipment but by no means make the equipment profitable. In other words, no firm acting rationally would provide any treatment solely on the basis of this kind of incentive. This means that these devices might be effective only if they were combined with a program of enforcement. The result of laws providing tax breaks for industry, if not combined with a systematic enforcement effort, would be most unpredictable.⁷

Third, all proposals for tax breaks that have come to our attention specify that the incentive is for the installation of *treatment* equipment, although many

⁷ An account of experience in North Carolina is interesting in this regard:

"A North Carolina statute exempts industrial waste treatment and water pollution abatement plants and equipment from ad valorem property taxation and provides a free five-year amortization allowance for income tax purposes in lieu of depreciation. . . .

"Approximately 12 firms have applied for and received certificates permitting them to amortize their anti-pollution facilities over a 60 month period. This is a small per cent of those firms eligible to receive certificates by making application. . . .

"It appears questionable whether the statute confers a significant benefit on the companies eligible to receive certificates as evidenced by the very small number making application and of the action by some to amortize over a longer period even with the certificate. The conclusion must be that the statute as related to rapid amortization has had little significance in the attainment of pollution control objectives."

W. R. Walker, *Industrial Water Use in North Carolina*, University of North Carolina Water Resource Papers, Number 18 (September 1964).

industries can reduce their waste loads most efficiently—at least over a considerable range—by altering production processes and/or recovering materials and producing by-products. By providing no incentive for process and related changes, these proposals would tend to distort the investment decision toward treatment of waste after generation, i.e., at the “end of the pipe.” Even when compared with the narrow efficiency standard of minimizing the cost of producing a given reduction in waste loads at specific outfalls, these proposals do not pass muster. If efforts were made to widen the scope of these incentives, administration would become extremely complex, and because of the intimate relationship between over-all production processes and wastes produced the incentive might amount to a general subsidy for technological improvement. Without careful policing of individual plants, it would be virtually impossible to distinguish costs incurred to reduce waste loads from costs incurred to increase profitability of industrial processes. In numerous instances, process changes (use of savealls in paper production, black liquor recovery in pulp production, syrup recovery in canning, etc.) result in both waste load reduction and recovery of valuable materials.⁸

Finally, tax write-offs and credits would be of little or no benefit to firms that are on the margin of profitability and that might have to close down if effective effluent controls were imposed. Research suggests that few firms are likely to be threatened in this way, but society may have a real interest in protecting some of those that are, especially if they constitute the primary local employment base—a cannery or beet sugar factory in a small midwestern town, or a pulp mill in a small New England town, for example. Special policies are required to deal with situations of this kind, and we suggest some in the final chapter.

In summary: tax breaks are blunt instruments for water quality management; they are potentially costly to the taxpayer; and they are very likely to induce inefficient means of control.⁹

Our study leads us to the conclusion that the nation should give serious consideration to reorienting its policies towards effluent charges as a component of broader systems of regional water quality management and in turn as a component of over-all water resources management. We feel that the empirical evidence presented in the previous chapter, as well as the knowledge of the way in which managerial decisions are made, demonstrates the validity of the predicted response to effluent charges. This evidence does not bear out the idea held by some that effluent charges would not reduce the wastes discharged into the nation's watercourses. We do not propose that other approaches be abandoned immediately, or even completely in the future. There is a continuing role for effluent standards as a supplement to the charges system. In the final chapter, after we have developed a good deal of background on the potential benefits from regional systems incorporating large-scale measures and reviewed some institutional arrangements which might be used to implement them, we suggest a new initiative in federal and state policies which we believe can lead toward an effective and efficient program for dealing with the increasingly difficult water quality problems we face. Among the instruments we feel will be important in this effort is the effluent charge. But now let us drop the assumption that the only way to deal with water quality problems is to reduce or limit waste discharges at individual outfalls.

Chapter 14

A POLICY FOR THE FUTURE

The fundamental task with respect to water quality improvement is how best to accomplish it. But it is also true that the task itself needs to be clearly defined. The job is not simply to “clean up” the nations' water bodies; rather, it is to manage continuously the quality of these waters over time in the dynamic context of a growing and affluent urban-industrial society. This dynamic context requires flexibility in adapting to changing circumstances if efficient manage-

⁸ The bills introduced into Congress normally specify that tax credits and accelerated depreciation are not to be allowed on any equipment that contributes or adds to a company's profits. This provision virtually forecloses in-plant changes.

⁹ D. F. Bramhall and E. S. Mills made much the same points in their recommendations to the State of Maryland in a study sponsored by the Maryland State Planning Department. See, “Alternative Methods of Improving Stream Quality: An Economic and Policy Analysis,” *Water Resources Research*, Vol. II (3rd Quarter 1966), p. 355.

ment is to be achieved, which in turn has implications for the nature of the institutions needed for water quality management.¹

In the following pages we outline an economic optimization approach to water quality management on a regional basis—an approach that reflects our interpretation of research over the past several years and that seems likely to provide a firm foundation for efficient progress. It is a distinct departure from the usual approach, which tends to see waste treatment as an end in itself and lays heavy emphasis upon enforcement actions against individual waste dischargers, perhaps supplemented by subsidies for selected means of reducing waste discharges.

As population grows, economic development proceeds, and interactions among uses and users of the country's water resources become ever more complex, the gain from such an economic systems approach will be even larger. A new initiative in policy appears needed at all governmental levels, but especially at the federal level, to permit the regional approach to evolve in an orderly way. New, broad-ranging, and responsible institutions will be needed for water quality management, but they must be consistent with the legitimate roles of our governments of general jurisdiction—local, state, and federal.

We believe that agencies should be established with powers to plan and implement management programs for an entire region, usually a river basin. These regional agencies would be responsible for planning, for the day-to-day operation of quality management systems, for the design and construction of appropriate management facilities and controls, and for data collection and research. With this combination of powers and geographical jurisdiction, the agencies should be able to:

1. Progress toward more systematic methods for reflecting the external costs associated with waste discharge in the waste disposal decisions of municipalities and the production and waste disposal decisions of private enterprises;
2. Search for, define, evaluate, and implement collective measures to reduce waste discharges, to reduce the adverse effects of waste discharges, and/or to improve or make better use of the assimilative capacity of watercourses;
3. Open the way for more efficient operation of reservoirs, treatment plants, and other components of a water quality management system through regionwide integration;
4. Adapt new knowledge and technology to the specific regional environment and incorporate them into a continuous management system at an optimal rate, because of their *continuous* responsibility for water quality management;
5. Give explicit consideration to the impacts of the spatial pattern of economic activities on water quality management and of the inter-relationships between other aspects of environmental quality and water quality management.

Much of the discharge of water-borne wastes in this country is concentrated in a few river basins and bay and estuary areas. Most of these regions are sufficiently developed to support the expert staff and facilities a management agency requires.² Many other basins would benefit from collective measures such as flow regulation and in-stream aeration and from more systematic use of treatment and other measures, but they are not large enough or populous enough to support a separate management agency. Basins of this kind might be managed by the agency in charge of a contiguous river basin. Or a state might act as the regional management agency if the basin lies within the state. The latter approach would require a substantial strengthening of the capabilities of the states in regard to water quality management—a matter to which we return subsequently.

In the following sections, we first state the criteria which research on water quality management suggests efficient regional management agencies (river basin or state) should meet. Then we describe what we feel are appropriate water quality management functions for the governments of general jurisdiction. They will still have an important role and without their leadership thoroughgoing regional water quality management cannot become a reality.

¹ Portions of this chapter build upon material developed by a panel of the National Academy of Sciences of which one of the authors was Chairman. The contributions of Irving Fox and David Smith to the panel report deserve special notice. See *Waste Management and Control*, Publication 1400 (Washington: National Academy of Sciences—National Research Council, 1968), App. 6 and 7.

² A number of "River Basin Commissions" have already been approved under the Water Resources Planning Act of 1965. These are not management agencies, since they have no construction or operating powers. Rather, they are planning and co-ordinating bodies which usually cover large areas (for example, one such commission covers the New England States). The planning activities of these commissions could be helpful in defining appropriate areas for water quality management.

The final section addresses the question of the best means for internalizing the external costs imposed by the waste disposal activities of private enterprises and local governments. We conclude that an effluent charges system has major advantages over potential alternatives such as effluent standards and payments to reduce waste discharges, and at the same time it provides a needed source of funds to the regional management agency.

CRITERIA FOR REGIONAL WATER QUALITY MANAGEMENT AGENCIES

Given our broad definition of management, and assuming that the general goal of the regional agency is to foster the efficient use of resources, we suggest some criteria which regional agencies should meet. These criteria are based on technological and economic characteristics of efficient water quality management which we call determinants (see Table 16).

Table 16. Determinants and Criteria for Regional Water Quality Management Agencies

Determinants	Criteria
Existence of externalities.	Regional agency should be able to internalize the major externalities associated with waste discharges.
Economics of scale in various measures to handle wastes and to improve assimilative capacity of watercourses.	Regional agency should be able to implement measures of all types to improve water quality.
Inseparability of water quality from water quantity, interrelationships between water quality management and other outputs from water systems.	Regional agency should be able to take adequate account of the interrelationship between water quality and other aspects of water systems.
Interrelationship between spatial location of economic activities and water quality management.	Regional agency should be able to take into account through specific communication channels the interrelationship between water quality management and land use management.
Interrelationships between water quality management and impacts on other aspects of environmental quality, i.e., air, solid wastes disposal.	Regional agency should be able to take into account through specific communication channels the interrelationships between water and other activities having impacts on environmental quality.
Many of the benefits and costs associated with water quality are difficult to quantify in a generally acceptable manner.	Regional agency should: (a) delineate the wide range of choice possible—costs and consequences of different combinations of measures and of different levels of quality; (b) reflect or consider adequately the views of those affected by water quality management activities.

1. *The regional agency should internalize the major externalities associated with waste discharges to the watercourses of a region.* This does not necessarily mean that all external costs must occur within the territory under direct jurisdiction of the agency but that the major ones do and that any residual external costs which occur outside the area must be taken appropriately into account. Normally, the latter would occur through the activities of a higher unit of government. For example, an intensive management unit as large as the Mississippi Basin would probably be far from optimal in regard to administrative efficiency and the ability to involve the relevant publics in the decision-making process. Perhaps even the basin of the Ohio River with all its tributaries would be too large a unit for detailed water quality management, let alone over-all water resources management. But an Ohio Basin authority which controlled the quality of water from the tributaries by standards or charges at the points of confluence could articulate the interest of the larger region with intensive management of water quality by tributary agencies.³

³ This idea was proposed by the staff of the Ohio River Valley Water Sanitation Commission. See Edward J. Cleary, *The ORSANCO Story* (The Johns Hopkins Press, for RFF, 1967), pp. 276-77.

In many instances the states are in a good position to foster appropriate regional associations for watersheds or river basins within their jurisdictions. In a number of cases, conservancy districts and water authorities could be adapted to this purpose.⁴ In these instances the state government should see that the river basin agencies consider the full costs associated with waste disposal in their regions. This could be done by means of effluent standards or charges at the points where rivers discharge from such regions.

For interstate waters such as the Delaware, Hudson, and Potomac, interstate or interstate-federal agencies might well assume full and detailed water quality management functions. Under the program for federal initiative detailed below, the federal government would foster such organizations and insure that interstate and coastal effects of residual waste discharges are not overlooked.

2. *The regional agency should be able to implement all relevant measures to improve water quality.* Efficiency gains can often be achieved by implementing such collective measures as flow regulation, regional treatment plants, ground water recharge, effluent redistribution, and various measures to improve the waste assimilative capacity of watercourses. Accordingly, the regional agency should have the authority to see that such measures are implemented where economically justified. But the agency should also have the authority to acquire and operate more conventional treatment works where efficiency gains can be demonstrated. In some instances, the complexities of rather intricate system operation or the gains from more efficient use of technical and laboratory personnel may justify having the regional agency operate all treatment works in a region—even conventional ones at individual outfalls.⁵

3. *The regional agency should be able to take adequate account of the inter-relationship between water quality and other aspects of water resource development and use.* The efficient use of watercourses for residual waste disposal cannot be disassociated from the development of water resources for other uses. Waste discharge imposes cost upon other water uses, and water quality may be improved or impaired by the way water bodies are managed for a variety of purposes. Controlled releases of stored water for hydroelectric power or navigation purposes may improve quality by augmenting low streamflows, thereby increasing the capacity of a stream to assimilate wastes. An irrigation development, on the other hand, is likely to have an adverse effect on water quality by reducing the flow of a stream and by contributing a return flow with a high concentration of dissolved solids. Thus water quality management is inextricably related to the total management of the hydrologic unit. Yet, it is generally treated as a separate activity.

How can water quality management be integrated with the over-all development and efficient use of an area's water resources? From an administrative standpoint, the simplest procedure would be to assign the responsibility for all aspects of water management to a single public regional agency. The Delaware River Basin Commission has such broad authority. This is also the approach used in the Ruhr area and contemplated under the water laws in France and England. This arrangement has much merit, but, again, experimentation would appear to be in order. For the most part in the United States, water quality responsibilities are now separated from other water development responsibilities at both the federal and state levels of government. And, in fact, water quality responsibility is itself divided among two or more agencies in many states.

An alternative to the integrated or broad regional agency is a separate regional water quality management agency that would buy services, such as the maintenance of minimum flow conditions, from the general water development agencies and charge other agencies whose activities have adverse effects on water quality. Such an arrangement would not be as simple to administer as the single agency, but in some instances it might be more practicable of attainment.⁶

⁴ For example, "Proposed Procedure for Establishing and Financing the Miami Conservancy District as the Regional Water Resource Agency in the Great Miami River Basin (Preliminary)," The Miami Conservancy District, Dayton, Ohio (April 19, 1967).

⁵ A proposal to do this has recently been put forward in the state of Maryland. ["A Program for Water Pollution Control in Maryland," by a Study Commission to Investigate the Problems of Water Pollution Control, mimeo. (February 1967). [Experience in the Ruhr area and in Ontario, Canada, suggests that major gains may accrue from centralized operations. We have no doubt that experimentation with this approach is merited elsewhere.

⁶ In this connection, an ORSANCO staff memorandum may again be cited. The staff considered both the alternative of an entirely new compact to administer all aspects of water use and development, and the alternative of restructuring the existing compact to establish a regional authority for water quality management, roughly in accordance with the criteria here outlined. The staff favored and recommended the second alternative as offering more practical promise for political attainment. See Cleary, *op. cit.*

4. *The regional agency should be able to take adequate account of the inter-relationship between water quality management and land use management.* The location of an economic activity has a bearing on the costs of water quality management. The costs imposed by a major industrial operation with a potentially large residual waste discharge may be much larger in one location than in another. The economics of centralized waste treatment cannot be realized when development is scattered and waste collection costs are high. Furthermore, water-based recreation will not benefit from improved water quality unless the pattern of land use on areas adjacent to the water body facilitates the recreational activities.

The interrelationships between water quality management and land use management are perhaps less direction than those between water quality management and other outputs of water resources systems. Thus there is less reason for proposing that a single regional agency have jurisdiction over both water quality and land use management. What is essential, however, is that the water quality management agency have an explicit and formal relationship with the regional and local agencies responsible for planning and regulating land use, so that it will have ample opportunity to indicate how land use decisions would affect water quality management. That opportunity should occur in the early phase of the land use planning process. (At the same time, it is essential that the activities of the regional water quality agency be reviewed with a view to their consistency with over-all land use planning.)

5. *The regional agency should be able to take adequate account of the inter-relationship between water quality management and impacts on other aspects of environmental quality.* Removing waste materials from water streams does not destroy the wastes, it merely changes their form or location or both. Solid or gaseous waste materials may re-enter the productive cycle,⁷ or they may present waste disposal problems of their own. Numerous examples could be cited. The kraft pulping process produces less waterborne waste than the sulphite process but it results in deterioration of air quality; if solids are removed from a waste-water stream and incinerated, gases and particulate matter are released to the air; disposing of sewage sludge as swampland fill reduces wildlife habitat; in one instance, underground disposal of a particularly difficult to treat waste stream is thought to have caused earthquakes.⁸ Such environmental inter-relationships are of sufficient importance that the regional jurisdiction and/or special agencies having responsibility with respect to other environmental quality problems must be involved in the process of decision making. There should be close working relationships between the staffs of the regional water quality management agencies and the agencies with responsibility for other aspects of environmental quality. Formal review procedures are also needed, and ways should be developed for the agencies to exchange funds to compensate for external benefits or costs conferred or imposed by one upon the other. These "market-like" devices can often allow much greater flexibility than the binary decision implicit in a permit.

6. *The regional agency should provide an opportunity for affected parties to have a voice in decisions.* The discussion of the Potomac and Delaware estuaries (Chapter 11) indicated the importance of benefits which are as yet difficult to quantify in monetary terms. This problem has two implications with respect to governmental organization for water quality management. First, the agency should delineate not only different ways of achieving a specified physical target but also alternative targets (including degree of certainty of achievement).

Second, those affected by water quality management activities should have a voice in decisions. Various techniques have been devised to meet this second problem. They range from the Delaware River Basin approach where only governments of general jurisdiction have direct voting power to the *Genossenschaften* of the Ruhr area where industrial representatives as well as governments are afforded voting rights on the governing board. As explained in Chapter 13, we can offer no hard criteria as to the appropriate arrangement.

One of the least understood questions in regard to water quality and over-all water resources management is how the agency's political structure can be

⁷ As it becomes possible and necessary to weigh all the external costs associated with waste disposal—be it in liquid, gaseous, or solid form—techniques for holding materials in the productive cycle rather than "disposing" of them will become of greater significance relative to treatment.

⁸ See Walter Sullivan, "How to Start an Earthquake," *New York Times*, March 27, 1966, p. 6E; D. M. Evans, "Man-Made Earthquakes—A Progress Report," *Geotimes*, Vol. 12, No. 6 (1967), pp. 19-20.

arranged so that it is conducive to efficiency and equity. This is an area in which research is exceedingly difficult but badly needed.

We now turn to outlining a pattern of activities which we would regard as constructive initiative by the various levels of government to establish efficient systems of regional water quality management.

THE ROLE OF GOVERNMENTS OF GENERAL JURISDICTION

Establishing an optimizing system for water quality management in any region would involve essentially the following steps. The first—a political-legal one—would be to set up a new agency or restructure an established one with authority such that the criteria enumerated above are met. This could be done under state law for an intrastate region, under federal law for interstate regions, or through the mechanism of an interstate or interstate-federal compact. The second step would be to assemble a staff. This would include various kinds of engineers and natural scientists, and economists and other social scientists. The third step would be data collection and analysis—to illuminate alternatives available and to assess the benefits and costs associated with them. The studies of the Potomac and Delaware estuary areas reported in Chapter 11 are illustrative of this phase. The fourth step would involve formulating systems of physical measures and other control devices and policies (such as standards and charges) for water quality management in the region. The final step would be to construct and operate the first units of the agreed-upon system. Operation and further planning would then become a continuous process, with the system adapting to changing circumstances and the development of new information.

Federal Government

Water quality management is largely the province of state and local governments, and state governments are in a good position to encourage the establishment of appropriate management institutions in tributary basins that lie within an individual state. Federal leadership could be particularly important in dealing with interstate waters—with main-stem conditions on the larger river systems and with large groundwater basins. In such instances, interstate compacts establishing effective agencies are difficult to negotiate.⁹ Also it might assist in various ways in the implementation of regional approaches in the smaller, intrastate basins.

The federal government could, of course, take direct action. It could set up regional water quality management agencies or regional water resource management agencies. These agencies could be separate entities such as TVA or regional units of a federal agency such as proposed by the First Hoover Commission. There has been so much opposition to arrangements of this nature, that it is questionable whether the federal government would be willing to move in this fashion.

An alternative would be for the federal government to establish incentives and guidelines for the organization and operation of regional management agencies either under state law or through interstate compact. An agency with adequate authority to plan and implement an optimizing system would be eligible for a grant of funds to support a portion of its budget (or expenditures) to help staff the agency and make the first data collection, analyses, and formulation of specific measures for water quality management. If the federal government is satisfied that the proposed program would meet reasonable optimizing objectives, the agency might be eligible for a grant to assist it with its actual construction and operating expenses. Such assistance might appropriately be limited to the early implementation period—say, five years. During this period, it would be necessary to work out longer-term arrangements for financing the agency, a point to which we return later.

The federal government might wish to approach the water quality management problem in the broader context of water resources development and management. In that event, the federal government could provide support of the type described above to regional water resources agencies having general water management responsibilities including quality management. In addition, the federal government could provide support through the regional agency for flood

⁹ It is perhaps less difficult than in earlier years because: (a) the Federal Water Quality Act simplifies obtaining consent of Congress for states to negotiate; (b) a fund of experience in writing compacts is now available; and (c) state legislatures have come to regard compacts as desirable means for co-operative action.

damage reduction, navigation, irrigation, power, and recreation on whatever terms such support is, or may be, provided for these purposes through federal agencies. Unless this were done, regional agencies would operate at a serious financial disadvantage, and it is doubtful that regions would willingly impose such disadvantages on themselves. A partial or complete alternative to the extension of subsidy arrangements to regional agencies would be a more complete financing of federal water programs through user charges, which would produce greater efficiency in water resources use.¹⁰

Even with a regional agency as the primary device for effective and efficient water quality management, the federal government would have an important continuing role to play.

First, it should be prepared to intervene—in terms of data collection, analysis, and enforcement—if instances exist where it has not been possible to establish a duly constituted organization or state action, in significant interstate problem situations.

Second, the Federal Water Pollution Control Administration has begun to assemble teams of planners—scientists, engineers, and a few social scientists—to carry out its comprehensive surveys program. “Headquarters” teams of this kind could be retained to aid the regional and state agencies in their continuing planning and implementation functions. Joint studies by federal teams and local agencies, such as the study contemplated in the Houston-Galveston Bay area, might be undertaken. The federal teams should be in a position to bring a wider range of experience and expertise to bear on the regional problem than regional and state personnel.

Third, the federal government should expand its network of water quality monitoring stations, with respect to both surface and ground waters. Data from short-run sampling stations for specific investigations could then be related to the data from the base network.

Finally, the federal government should maintain a strong program of research on various aspects of water quality management, and make arrangements for the results to be passed on to the regional and state agencies. The headquarters planning teams might be particularly useful in this regard.

The advanced Waste Treatment Research Program is an example of the type of research effort which can be extremely valuable. But the present research program should be strengthened in several directions:

1. More emphasis should be given to research on quality improvement measures such as re-aeration of watercourses, flow regulation, groundwater recharge, regulated discharge of effluents, design of water and waste treatment plants for high-level intermittent treatment, and industrial waste reduction via process change, materials recovery, and byproduct production. In the past, federal programs have focused on *treatment facilities* as independent entities rather than as potential components of a regional water quality management program.

2. More emphasis is needed on research in techniques of system planning, design, and evaluation, and on system operation.

3. More emphasis should be placed on research directed to defining water quality damage or loss functions.

4. Research on the interrelationships among liquid, solid, and gaseous wastes is badly needed and could logically be supported and stimulated at the federal level.

5. Continuous appraisal is needed of the technological changes in the major water-using industries and their effects on the generation, handling, treatment, and disposal of wastes. This would provide valuable information for regional water quality management.

The States

The states must establish much stronger organizations if the benefits of efficient regional water quality management are to be realized. A major function of the state governments should be to facilitate the organization of adequately financed regional management agencies of appropriate size and authority within their areas of jurisdiction. Probably most such organizations would be the creatures of state law. States must therefore assume a primary responsibility as governments of general jurisdiction to see that the previously stated criteria relating to regional agencies are met. In addition, the states should

¹⁰ For good discussions, see Otto Eckstein, *Water Resources Development: The Economics of Project Evaluation* (Harvard University Press, 1958); and John V. Krutilla, “Is Public Intervention in Water Resources Development Conducive to Economic Efficiency?” *Natural Resources Journal* (January 1966).

be in a position to offer technical advice and possibly financial aid to regional agencies, in much the same manner as proposed for the federal government vis-à-vis the states.

Furthermore, the states should be prepared to conduct appropriate water quality management programs in areas that have neither the size nor the development to justify a regional agency. A program of this kind has been proposed in Maryland.

In performing these functions, fragmentation of responsibility in state governments (as at other levels of government) may be a severe problem. Responsibilities for water quality and water resources management are, to various degrees, lodged in a variety of agencies in most states. A few states are almost in a position to perform the needed water quality management supporting functions, but most are very far from it.¹¹

Local Governments

The role of local governments in regional water quality management is a complex one primarily because the general government of metropolitan areas is itself often greatly fractionated. Nevertheless, these governments have extremely important functions in regional water quality management. They generally have the legal authority to regulate land use and, as the case study of the Delaware indicated, the pattern of land use and associated waste disposal can have an important bearing on the cost of regional water quality management programs.

Environmental problems are most apparent in the metropolitan areas; consequently metropolitan planning agencies must co-ordinate and integrate the activities of environmental agencies within their jurisdictions. It should also be their responsibility to see that proposed land-use patterns take adequate account of the environmental quality problems, including water quality, which may be associated with them.¹²

Local governmental units can influence regional water quality management through their water and waste disposal charges. Also, local governments can achieve major economies by organizing collective treatment and distribution works. This might be done with the help of the regional agency where the latter does not assume direct responsibility for instituting such works.¹³

Governments of General Jurisdiction and the Regional Agency

We have already noted the need for considerable flexibility and experimentation with respect to the composition of regional agency governing boards. In all instances, however, the governments of general jurisdiction in the region involved should be represented on the governing board.

CONTROLLING WASTE DISCHARGES AND FINANCING THE REGIONAL AGENCY

Research has demonstrated that regional agencies capable of directly implementing collective facilities for regional water quality management could achieve major efficiencies. But equally important functions of management are to optimally control waste discharges from individual municipalities and industries and to appropriately influence industrial location decisions. These problems will confront regional agencies to differing degrees but will always be present.

At one extreme, an agency may do no more than induce the individual industrial plant or municipality to reduce its waste discharge to an appropriate degree, and not construct to operate waste handling facilities itself. In that case, it has only to decide how best to induce control of the waste discharges.

¹¹ The contention is often made that the states are financially incapable of carrying out their responsibilities along the lines suggested here. Such a contention is equally valid for many state activities in addition to water quality management, and results from the inadequate fiscal resources of the states in general. We believe that federal revenue-sharing plans of the type proposed by Walter Heller (formerly Chairman of the President's Council of Economic Advisers), and others, could materially aid the states in realizing their potential in this and other areas. (A good brief discussion of this concept is found in Walter Heller, "A Sympathetic Reappraisal of Revenue Sharing," in Harvey S. Perloff and Richard P. Nathan (ed.), *Revenue Sharing and the City* (The Johns Hopkins Press, for RFF, 1968).)

¹² For a preliminary effort to analyze this connection, see *Waste Management* (Regional Plan Association, New York, March 1968). The report was prepared by B. T. Bower, G. P. Larson, Abraham Michaels, and W. M. Phillips.

¹³ As indicated in Chapter 11, present federal grant arrangements provide an added incentive for metropolitan, area-wide collection and treatment systems. In several instances—Pittsburgh, Seattle, and St. Louis, for example—metro systems were installed or planned prior to the federal incentives program.

Near the other extreme is the approach used in the Ruhr area where the management agency provides both conventional treatment works and regional-scale facilities. Even there, however, industrial operations are encouraged to conserve the waste assimilative capacity of the stream via process changes, materials recovery, and specialized industrial waste treatment methods. Effluent charges are levied on industries discharging to the waste handling system and on those discharging directly to watercourses.

An intermediate case would be a regional agency that provided only facilities affecting the assimilative capacity of watercourses (reservoirs for flow regulation and facilities for stream reaeration, for example). Here, too, an appropriate means must be found to reflect the external costs¹⁴ associated with waste discharges in the decisions which remain in the hands of industries and local units of government.

Direct regulation, payments, and charges are the terms used here to refer to the techniques for achieving this result. The alternatives are outlined below in general terms. Payments and charges, which were grouped in the analysis in Chapter 6 because they are in theory closely related, are treated separately here because they are very different in terms of administrative and institutional considerations. Furthermore, each of the techniques has different financial effects on the regional agency and on the amount of funds which would have to be obtained from taxes to support the activities of the regional agency.

Direct Regulation

This system would rely primarily upon direct public regulation of waste discharges by means of standards established in accord with laws and administrative orders. These standards would apply to discharges at individual (industrial and municipal) outfalls and to discharges from regional agency treatment plants. Such a system would constitute an extension or elaboration of existing policies and practices.

To be capable of optimizing under the regulatory system, the operating agency would have to be able to estimate not only the external costs associated with waste discharges but also the costs associated with incremental reductions in waste discharges¹⁵ by cities and firms through alternative means. It should be capable of taking into account possibilities for residual materials recovery and process changes, as well as conventional treatment.

Ideally, the standards would be varied to take into account the differing waste-assimilation capacity of the watercourse under varying flow conditions, the differing capacity at various locations, differing levels of demand upon the watercourse, and the differing incremental costs of waste reduction at various outfalls. This would mean different standards for different locations and for the same location at different times. The effluent standards would not only control the amount of existing discharges but, since they would vary geographically, would play a role in determining the location of industrial and municipal outfalls, and perhaps the location of industrial and even municipal activities. Optimum effluent standards might result in greatly different levels of required waste reduction at different outfalls, perhaps even at outfalls located close together.¹⁶ This result raises major problems of equity which were explored in some detail in Chapters 7 and 8.

The success of a system of this kind would depend in large measure upon the ability of an agency to develop reliable data on the physical and economic effects of alternative waste reduction programs and then to enforce effluent standards that minimize waste management costs to society. The funds for establishing and operating such a system would presumably come from taxes because no prices or charges would be built into the system. This in itself presents a serious problem, since most taxes are not without distorting effects upon the allocation of resources.

Payments

This system would rely primarily on selective payments to waste dischargers to motivate them to restrict waste discharges to an optimum degree. A payment would be made for each unit of waste withheld. This arrangement would con-

¹⁴ Perhaps as represented by a stream standard surrogate; see the discussion in Chapter 7.

¹⁵ Or to establish a stream standard surrogate for a damage function. See Chapter 7, Chapter 11, and the Appendix to Chapter 10.

¹⁶ This was shown by the empirical investigation of effluent charges as they might apply to the Delaware Estuary area, as reported in Chapter 8.

stitute a departure from existing policy and practice and would entail a major change in the kinds of subsidies already provided and proposed.¹⁷

On the basis of its estimate of the external costs, or of the incentive to achieve the stream standard surrogate, the operating agency would institute a schedule of payments for waste reduction to induce cities and firms to reduce their waste contribution to an optimum level. These payments should in principle be equivalent to the downstream costs imposed by increments of waste discharge. Payments would vary with water availability and with outfall locations, as well as with the quantity and quality of the effluent. Where the incremental costs associated with waste disposal can be reduced more efficiently by large-scale facilities than by payments, the agency would provide such facilities and reduce payments to reflect the efficiency gain. If the agency provided treatment plants and adhered to the payment scheme, it would pay industrial users to reduce discharge at least to the point where the marginal cost of a further reduction by internal measures began to exceed the marginal cost of treatment in agency plants.

No doubt some minimum direct regulatory measures would also be useful. For example, where a waterway is used for domestic water supplies and also has recreational and aesthetic values, it might be best simply to prohibit the discharge of toxic chemicals and/or particularly unsightly and odorous materials.

This system would require the expenditure of much larger sums, presumably raised through taxes, than the system utilizing effluent standards.

Charges

This system would rely heavily upon effluent charges to motivate firms and cities to cut back on discharges in such a way as to optimize waste discharge, (or to achieve a desired water quality level). The elements of such a system would be identical with the payments system except that instead of making payments to waste contributors to reduce effluent discharges to optimum levels (or setting standards to achieve the same purpose), charges would be levied on each unit of waste discharged. The schedule of charges would be based upon the external costs associated with increments of effluent discharge (or the agency's estimate of the incentive needed to achieve the stream standard surrogate). The charges system would take hydrologic variability into consideration. As with the system of payments, large-scale measures would be undertaken to the extent that their incremental costs were lower than the incremental individual, outfall waste reduction costs and residual damages avoided by the measures.

Funds to finance the agency would be derived from the charges imposed on the waste dischargers.

Advantages and Disadvantages

Each of the three systems—direct regulation, payments, and charges—has certain advantages and disadvantages. The regulatory system, which in some ways is closest to present policy and practice, has proved reasonably effective in dealing with the grossest forms of water quality impairment. But it does not lend itself to balancing incremental costs and gains in a relatively precise manner. Moreover, it does not provide funds for the construction and operation of measures of regional scope, should these prove economical.

The payment and charge systems are in effect an application of the pricing system—on which our economic institutions rely so heavily to secure an appropriate allocation of resources—to the waste disposal field. But the payment system suffers from several major handicaps. The concept of paying a waste discharger for reducing the costs he imposes upon others is contrary to the popular concept of fairness—even if such a practice would assure greater economic efficiency. In addition, there would be the task of raising substantial funds through increased taxation. With so many urgent demands being placed upon government and the difficulty of framing taxes which themselves do not distort resources use, there are serious problems in obtaining the amounts required. Also, to be fully effective, payments must continue even after research produces lower-cost means of reducing effluent, or if a firm ceases manufacturing altogether in order to reduce its effluent contribution to the extent warranted by the payments. Even more of a problem is the matter of paying firms that would locate in a basin were it not for the social cost of waste disposal which they would impose; these firms would require payment even though they never locate in the basin.

¹⁷ Variants of this system completely incapable of achieving optimum results but with considerable current political support have been discussed in Chapter 9.

These amount to almost insuperable informational and administrative obstacles to a fully effective system of subsidies.

The charges system does not suffer from these handicaps, and it has the merit of providing funds to finance the construction and operation of quality management measures on a regional scale. If optimally applied, the charges system might be self-sustaining (see Appendix to Chapter 10).

The charges system might be opposed by waste dischargers who now avoid the external costs which they impose. However, the industry and regional examples reported in Chapters 4 and 8 have shown that for an individual firm the cost of an efficient waste reduction program—over realistic ranges—is not large compared with other costs of industrial production. Thus for the vast majority of industrial plants effective waste discharge control would hardly be a determining factor in the decision whether to operate the plant or not.

In a few instances, mostly in already depressed areas, plants may be capable of continuing operation only because they are able to shift all or most of that portion of production costs associated with waste disposal to other economic units. When this situation is coupled with one in which the plant is a major part of the employment base of a community, society may have an interest in assisting the plant to stay in business, while at the same time controlling the external costs it is imposing. This, however, does not suggest across-the-board subsidy for industrial waste control, but rather selective aid where a community might be seriously disadvantaged by the closing of a plant. Such aid might take the form of direct assistance to the plant for installing waste reduction equipment, or support to the community—retraining and preference in government contracts, for example.

LEADERSHIP IN INITIATION OF A CHARGES SYSTEM

There appear to be compelling reasons for favoring the effluent charges system as one of the cornerstones of regional water quality management.¹⁸ But it may be difficult for particular states and regions to pioneer such a substantial departure from previous practice. The federal government's greater insulation from powerful local interests provides another opportunity for leadership. One approach would be for the federal government to levy a national effluent charge on all waste discharges above some minimum amount. The charge could be based on a formula similar to one of those used in the Ruhr area or one of those used by certain U.S. municipalities in levying sewer service charges upon industry. The charge might be set at a level which would approximately meet the cost of the federal program. Collection would depend on voluntary reporting and spot checks. The merits of this approach would be: (1) it would finance an important national program by means of a tax which would tend to improve the allocation of resources; and (2) it would hold an umbrella over regional agencies who wished to use the device for management and financial reasons. Once a regional agency was duly established, the authority and responsibility for levying the charges could be turned over to it. The agency could then refine the system of charges as a tool of management. The agency would be permitted to raise the charge above the federal level but not lower it. It would be permitted to use the proceeds to operate and finance a regional water quality management system to the extent justified. Excess revenues, if any, would be made available for purposes of financing the federal program or turned over to other governments of general jurisdiction.

By taking this initiative and those discussed in earlier parts of this chapter, the federal government could lay the groundwork for effective and viable institutions for regional water quality management in the framework of overall water resources management.

¹⁸ We have emphasized the role of effluent charges because of the importance of water quality in water management currently and in the future. However, as has been indicated numerous times previously, water quality management is but part of over-all water resources management. In order to achieve optimal allocation of resources, it is essential to consider not only effluent charges but, where relevant, charges in relation to other components of water utilization. For example, another component of water utilization which a management agency must consider in the context of over-all water resources management is net depletion or consumptive use. Because different production processes (as well as different methods of waste treatment) may result in significantly different amounts of consumptive use, wherever water is relatively scarce it is relevant to consider possible incentives for the reduction in net depletion or consumptive use. In principle, charges should reflect the incremental external cost which a user imposes on the whole water resource system. Blair Bower has referred to such charges as "water utilization charges." See B. T. Bower, "The Economics of Industrial Water Utilization," in *Kneese and Smith* (ed.), *Water Research* (The Johns Hopkins Press, for RFF, 1966).

(Supplemental information, subsequently supplied by Mr. Kneese, appears on p. 419 at the conclusion of today's proceedings.)

Chairman PROXMIRE. Thank you, Dr. Kneese, for another very fine paper.

Our last witness is Dr. Lee Preston, who will testify on the Federal helium program. He received his BA at Vanderbilt University; his MA at Harvard, and his Ph. D. from the same institution. His background includes service on the staff of the President's Council of Economic Advisers, consultant at the Rand Corp. and Texaco, Inc., and associate professor in the school of business administration at the University of California at Berkeley. Currently he is the Melvin H. Baker professor of American enterprise at the State University of New York at Buffalo.

He is the author of several important articles dealing with the exploration for nonferrous metals, as well as an important study entitled "The Size Structure of the Largest Industrial Firms, 1909-58."

Dr. Preston, we are delighted to have you. You certainly are the outstanding expert in this helium matter which I think does, as you say in your paper, lend itself to a good appraisal of the efficacy of economic analysis, as well as being very interesting in itself.

Go right ahead.

**STATEMENT OF LEE E. PRESTON, MELVIN H. BAKER PROFESSOR
OF AMERICAN ENTERPRISE, SCHOOL OF MANAGEMENT, STATE
UNIVERSITY OF NEW YORK AT BUFFALO**

Mr. PRESTON. Thank you, Senator Proxmire. The helium program seems small and simple in comparison to the large and complex programs that have been discussed by the previous speakers. However, I do think it merits consideration as an example of the possibility of comparing costs and benefits in a Federal or any other governmental project.

As you know, the helium program does essentially two things: The Bureau of Mines produces and sells to other Federal agencies helium for their current use. In addition, the Bureau purchases from four private contractors helium in a less purified form for storage underground in vacated natural gas chambers for future use at some date when it would be needed. The rationale for this storage program is that the helium going into storage would otherwise be dissipated. It is in deposits of hydrocarbon natural gas, and this natural gas is privately owned and is being subjected to current exploitation. The gas being extracted and consumed. The helium will go up into the atmosphere in the process of consumption if it is not extracted and stored at this time.

The conservation aspects of this program originated in 1960 and was embodied in the Helium Amendments of 1960. It was developed in response to a fear that helium use would increase very rapidly and that our supplies of helium would not be sufficient for the uses that were anticipated. This idea, of course, developed during the 1950's in the cold war period, when stockpiling became a national concern and a great many stockpiles of various kinds were constructed. This helium stockpile was one of these.

The situation has changed a great deal since that time. There is now a substantial private industry producing and selling helium to the private economy. This private industry, which consists of seven plants at the present time, is selling at a lower price than the Federal Government has set on its helium, and thus has taken all the private market and the market of the Government contractors—the private firms that use helium to perform activities under contract with the Federal Government. Therefore, the only market remaining for the Federal helium activity is the Federal Government itself—that is, direct sales to other Federal Government agencies. This market is reserved by law to the Bureau of Mines, and accounts for about 60 percent of the total helium consumption.

This development has had a very powerful effect on the whole program, because the program was set up on a payout principle. The price of helium was more than doubled—it was raised from \$15.50 to \$35 per thousand cubic feet—in 1960 at the time the conservation program was established. The idea of this price increase was to recover the cost of purchasing and storing the helium for future use over the period of the storage program. This payout scheme was unsound to begin with, because the price was set so high as to restrict uses of helium when, in fact, the helium was available and its use should have been encouraged for any application that was worth more than its economic cost—not this artificial \$35.

Chairman PROXMIRE. The economic cost being—

Mr. PRESTON. Whatever it cost the Government to get the helium.

Chairman PROXMIRE. Which was approximately \$15 to \$20—

Mr. PRESTON. Well, it might have been \$10 or \$12. Say, \$10 would be a good cost figure.

So the \$35 was a very high price, and it was set in order to recover the cost of this big storage program. The stored helium would, of course, be sold or used or something at some future date. But those future values were not taken into account in the pricing. The idea was to price the present helium so as to recover the cost of storing the helium for the future. Then in the future, in effect, the helium would be "free." That is, it would be free in the accounting sense that the program would have paid for itself, and we still have the helium in storage. This scheme has been invalidated by the fact that the private industry has grown up and taken away the substantial part of the market. So that now, the current sales of helium from the Bureau of Mines are not running at the projected rate, and even in this accounting sense, the program will not fulfill its original plan.

In addition, two other things have happened. One is on the demand side. Not only has the Government lost this substantial part of the market, about 40 percent, to the private industry, but the total use of helium has not increased at quite the rate that was anticipated when the storage program was initiated. It has increased and it will continue to increase no doubt. But it has not increased at as great a rate as was expected.

The third development, on the supply side of the equation, is that substantial changes have come about in our knowledge of how much helium there is. One specific large deposit of helium in a noncombustible gas, a sulfurous gas, has been discovered. In addition, we know more about leaner deposits of helium, both in hydrocarbon gas

and in other gases, that are below present recovery levels but might be recovered under some other recovery conditions. So there is reason now to think that the available resources of helium are perhaps greater and available on more favorable terms than we had thought earlier.

Thus, it is obvious that the whole program really should be re-examined. This is not to say that it was a mistake to begin with, but the question is whether going on with the program for the rest of its planned life is a wise choice. To make this examination, we have to look at the demand side and the supply side.

As I have said, I think it is clear that the demand is not growing as rapidly as was anticipated. On the other hand, it will probably continue to grow, and for substantially the kind of uses we are now making of helium—purging and pressurizing, controlled environments, et cetera. There are very important research uses of helium that are of very high value. However, the big volume of use is in the type of uses I have just listed.

On the supply side, it looks as if we can anticipate production from current hydrocarbon gas resources for quite a number of years. In addition, we can anticipate production from one nonhydrocarbon deposit, the Tip Top deposit in Wyoming, which is supposed to contain 20 billion cubic feet of helium, at some future date. We have 18 billion cubic feet of helium already in storage in the Bureau of Mines storage facility. If we project anything sensible in the way of the rate of use, these combinations of resources should get us well up into the next century, sometime after, say, the year 2010 or so, before we would need to start using helium that might be stored after the present time. So the question is, does it pay to store any more helium?

We are currently paying private contractors \$12 per thousand cubic feet for the helium that is going into storage. Thus, our cost figure, from the Government's viewpoint, is this \$12 accumulated at whatever interest rate we might choose up until the time that we use the helium. This gives us the relevant cost of the future helium—the cost that we pay for it now plus the interest on that money. The interest charge, of course, reflects the value of alternative uses of that money, or those resources, overtime until we would use the helium.

In my statement, I noted down the accumulated value of \$12 at various interest rates over 40 years. I think that is a useful period to suggest, since we are thinking about storage in 1970, and use after 2010. Thus, 40 years is a relevant period. I put down several interest rates because I know the committee is familiar with the problem for selecting appropriate interest rates for this kind of period. I do not want to get into that argument too much. But if one takes a low rate, which would be about 5 percent, you get \$84.48, or about \$85 per cubic foot over 40 years; if you take a 10-percent interest rate, then you have \$540.

Now, the question is, is it likely that we would be able to get helium on comparable or better terms than these after the year 2010? Of course, no one can know the answer to that, for certain. But it does appear that the present costs are very far below this—something like \$10 or so per thousand cubic feet. Thus, even at the lowest rate of interest, costs would have to go up eight times for the storage program to present an economic alternative. Yet the whole trend of natural resource extraction costs for the last hundred years has been a reduc-

tion in extraction costs. So it is hard to believe that these costs would go up eight times, if we have available sources from which to extract the helium.

On the other hand, if we had to go to air recovery, recovery of the helium from the atmosphere, present costs are certainly in the thousand dollar or more range. However, if we anticipate any technological improvement in atmospheric recovery of gases, then we might well anticipate that this figure would come down. Indeed, if we anticipated technological improvements at 2 percent per year, which is a sort of long-term average figure one might use in such a calculation, we would get those costs down to less than \$500 in 40 years.

One can take all kinds of combinations of recovery sources and interest rates to figure out any combination of cost comparisons that one might think relevant. But my general conclusion from this analysis is that it seems quite unlikely that the values of stored helium in the next century will be sufficient to justify continued expenditures for this purpose now. The 18 billion cubic feet that are already in storage constitute a very important and significant reserve against any kind of contingencies. That is a 20-year supply in itself at current usage rates. In addition, the current production of hydrocarbon natural gas will produce all the helium that we can anticipate needing on a current basis for about 20 years or so from now, even at a conservative estimate. So the likelihood that it will pay us to store more helium seems very small indeed.

Thank you.

(The prepared statement of Mr. Preston follows:)

PREPARED STATEMENT OF LEE E. PRESTON

THE FEDERAL HELIUM PROGRAM

The Federal Helium Program is a small and highly specialized unit within the huge expanse of Federal Government activity. It involves the expenditure of about \$50 million per year, something less than half of which is covered by revenues from sales of its own output on a current basis. It has no substantial economic side-effects, no pervasive social or environmental impact. One may therefore question whether this minor Program merits even brief discussion within the context of these Hearings.

In my view, however, the inclusion of the Helium Program within this survey of Government activities is well-justified. In the first place, the Program itself is relatively simple. It has a single purpose—producing and storing helium gas for current and future use. It involves few localities, few supplier companies, few customers and few competitors. Its costs may be readily estimated, and its benefits are entirely tangible. Therefore, the Program should present a classic case for the straight-forward application of analytical techniques and decision criteria. Further, the application of an analytical approach in this context should serve to test and demonstrate the value of the method itself, and thereby stimulate and validate its application to other and more complex problems. Finally, although the actual amount of resources misallocated in this, or any one, Federal program alone may be relatively small, the accumulated total of such misallocations may be quite substantial. Thus, by improving Federal practices in this area, we may contribute to substantial improvements overall.

BACKGROUND

Helium gas is a natural resource of unique character and rarity, and the Federal Helium Program is correspondingly unusual in both its economic status and its operating characteristics. The Program originated during World War I, when the use of lighter-than-air craft in military operations stimulated interest in large-scale production of helium as a nonflammable substitute for hydrogen. The Federal Government contracted with three companies to construct and

operate experimental helium production plants under the direction of the Bureau of Mines. The first full-scale plant actually came into operation in 1921, and was operated by Linde until 1925, when all Government helium activity was placed directly under the Bureau. With minor exceptions, all subsequent helium production in the U.S. down to 1961 was conducted in Government-owned facilities or under direct Government contract. Throughout the period the Federal Government has been the primary helium user, both in direct application and through private contractors. Until 1955 the largest single use of helium was in Navy airships. Private commercial use, primarily in shielded-arc welding and the creation of controlled atmosphere, has risen to about 20% of total U.S. helium consumption in recent years.

The idea that helium should be extracted and stored for future use first appeared in the Program in 1945. A major new helium production facility (the Exell plant) came into production in that year. This plant had as its source of supply a large reserve of privately-owned hydrocarbon gas, the helium component of which would be dissipated if it were not extracted as the gas emerged from the ground. Therefore, a plan was adopted to extract the helium as the gas emerged and store it underground in vacated natural gas chambers. The helium thus stored was referred to as a "mobilization stockpile" in documents of the period.

Expanding demand for helium in military, space, other Government uses, and commercial uses in the 1950's was met by the reactivation of all existing plants, sales from storage, expansion of the Exell plant, and construction of a major new plant (Keyes) in 1959. This last development almost doubled the Bureau's production capacity, pushing it well beyond current consumption levels, and once again making long-term storage possible. At the same time, it appeared that very substantial increases in military and non-military demand for helium would occur over time. In response to this situation, the present Helium Conservation Program was established by the Helium Act Amendments of 1960.

The Helium Conservation Program is a large-scale effort to recover helium from hydrocarbon gas, which is in the process of being extracted and consumed, and store it in the ground for future use. As eventually established, the Program contemplated that 62.5 billion cubic feet of helium would be purchased, at \$12 per Mcf, from four private contract producers over the period 1961-83. The cost of this program was to be borne in part by revenues from current helium sales and in part by loans from the U.S. Treasury. These loans were to be repaid with interest when the stored helium was withdrawn and sold to final users. A price of \$35 per Mcf was set covering all helium sales by the Government. Given this price, and given the assumed cost and demand conditions, the program was to be self-liquidating no later than 1995.

CURRENT SITUATION

The dual program of (1) helium production for current sale and for storage in Bureau of Mines plants, and (2) purchase of helium from private contract producers for underground conservation storage, has continued to the present time. More than 22 billion cubic feet of helium are now in storage; more than \$150 million in indebtedness to the Treasury has been incurred; and very substantial sums are currently due the private contractors for helium already stored but not yet paid for.

However, the situation contemplated in 1960 has changed in several important respects:

(1) Private commercial production of helium from natural gas deposits was begun by Kerr-McGee Industries in 1962, and six additional commercial plants have subsequently come into operation. As a result, private helium production capacity (735 MMcf/yr) is almost equal to that of the Bureau of Mines (860 MMcf/yr.) Actual private production is running at more than half the capacity level. The commercial producers are selling to private users and to Federal contractors, with the result that the Bureau of Mines has now lost about 40% of the total helium market. Commercial sales are being made at prices \$10 to \$15 per Mcf below the Bureau price (\$35), and on attractive terms with respect to form (i.e., liquid) and delivery. The Bureau has reserved for itself the Federal direct purchase market, and has brought suit to compel Federal contractors to purchase from it their requirements as well. This matter is currently in litigation.

(2) Helium consumption, although continuing to expand, has not grown at the rates anticipated in the initial planning of the Conservation Program.

As a result of this slackening of total demand, plus the loss of sales to the private sector, the storage program has expanded more rapidly than was initially contemplated; and it would be possible, if desirable, to store a considerably larger amount of helium than had been originally planned.

(3) Supply conditions have changed in a variety of ways, both to increase the volume of known helium reserves and to reduce the anticipated costs of recovery from known sources. A major new natural reserve, the Tip Top field in Wyoming, in which helium is combined with noncombustible (sulfur) gas, was discovered in 1961. Further, the estimated costs of helium recovery from lean sources have been reduced by technological and scientific developments.

In the light of all these developments it is evident that the whole status of the helium program must be reconsidered. The original pay-out financing plan has been undermined by the loss of 40% of the market, and the fundamental rationale of the program has been shaken by changes in supply and demand conditions. A new appraisal is required.¹

A REAPPRAISAL

The two critical elements required to appraise the current situation and available alternatives with respect to the Helium Program are:

- (1) The anticipated demand for helium, present and future, and the value of helium in the various uses for which it is demanded;
- (2) The anticipated supply of helium, present and future, and the costs involved in obtaining it at various times from various sources.

THE PAY-OUT PRINCIPLE

The Helium Conservation Program was based on assumptions of rapidly expanding demand, sharply limited reserve supplies suitable for extraction under current conditions, and extremely high recovery costs from other sources (or resort to high-cost substitutes). Under these assumptions, the purchase of helium for storage and future use could be readily justified. However, one significant aspect—the \$35 Mcf price—of the original program cannot be justified, even on its own terms. The pay-out principle underlying this pricing scheme would be sound if the price were to be set equal to the alternative cost of obtaining helium, or a substitute, from some other source. This is the situation that would prevail if the selling and buying agencies were entirely independent of each other, and the buyer chose to purchase only if the seller at least met the conditions offered by the next best alternative.

Thus, for example, if alternative supplies of helium could be made available at some future date for \$100 Mcf, and the Helium Program could make similar quantities available at the same time for \$50 Mcf (including both purchase and interest cost), then it would be economically sound to purchase and store helium for this purpose. However, the accounting price at which the helium is eventually transferred from the Helium Program to using agencies is only an arbitrary detail in the entire scheme. If the price were set equal to the Program's own costs, then (a) it would rise each year, to reflect the accumulation of additional interest costs on the stored helium; and (b) the Program would be shown to break-even on its operations over time. Any excess of benefits over costs would be reflected in the performance of the using agencies. On the other hand, if the benefits of use substantially exceeded the costs of purchase and storage, then

¹ This is not the first reappraisal of the Helium Program since these new developments began to emerge. My own connection with this subject arose in 1964 when Dr. David B. Brooks, then of Resources for the Future and now Chief Economist for the Bureau of Mines, and I were asked by the Bureau of the Budget and Council of Economic Advisors to make an independent appraisal of the Program in connection with a proposed expansion of its borrowing authority. Our conclusion was that the artificial price structure established as part of the Conservation Program could not be justified on either financial or economic grounds, and was doomed in any event by the development of private commercial production. However, the demand and supply projections available to us at that time, and the relatively low interest rate (4%) used in our calculations, lead us to recommend an expanded storage program along with a price reduction. Neither of these recommendations was, in the end, acted upon. And with the benefit of hindsight it appears that the recommended storage expansion would have been an error. It is important, however, to note that the source of the error lay in the specific numerical estimates and projections provided to us. The analytical model relating costs to benefits remains the appropriate form for considering the problem, and the logical structure of the analysis makes it possible to examine any number of alternative numerical values and situations and to evaluate their impact on expenditure and investment decisions. The basic framework of the Preston-Brooks study is used again in this statement.

a higher transfer price could be set and the Helium Program could be made to show a profit. The essential point is that the transfer price among Government agencies, and also between the Government and Government contractors whose costs are covered by their respective contracting agencies, has no bearing at all on the economic validity of the program. Only the sales price to purely private customers would serve as a test of economic validity.

And this test, as we have noted, yields a negative result, since the private buyers have taken their business elsewhere. For this reason—and because Government uses account for the great preponderance of helium consumption in any event—the pay-out question can be set aside; and our analysis can be cast entirely in terms of basic economic alternatives. If the Program is economically sound, it can be so structured as to pay-out in any pattern that might be thought desirable for internal administrative and accounting purposes. If it is unsound, no arbitrary pay-out calculation will make it acceptable.²

DEMAND

Detailed estimates of the demand for helium, and of its value in various consumption uses, are not required for purposes of this analysis. There are some research and national security uses of helium that might be termed literally priceless, but fortunately the present known reserves, the volume of helium already in storage, and the current rates of production and capacity make it clear that these extremely high-value uses can be satisfied into the indefinite future. The principal elements both in current consumption and in estimates of future demand are the types of uses for which commercial users are currently paying \$20–25, and Federal agencies \$35, Mcf—i.e., purging, pressurizing, welding, controlled atmospheres and cryogenics. Total helium consumption is now running just under 1 billion cubic feet per year; and the initial plans for the Conservation Program anticipated consumption rates of 2 billion cubic feet per year by the end of the century. It now seems somewhat unlikely that these levels will, in fact, be reached; certainly there is no reason to think they will be exceeded. In sum: It is likely that nominal-value uses will consume relatively large and steadily increasing quantities of helium into the indefinite future. It is not likely that either (a) there will be almost no demand for helium, or (b) the major part of demand will be accounted for by very high-value uses. Therefore, we may take a trend projection of present demand conditions as our best guess for planning purposes.

SUPPLY AND COST

The key to the problem therefore lies on the supply side. How much helium will be available from known types of sources, and at what costs. What are the true costs of purchasing and storing helium in the present for use in the future? How do these two methods of providing helium for future use compare?

The analysis is somewhat simplified by the fact that the principal cost elements in the storage program are simply the price of helium purchased for storage—\$12 Mcf—and the accumulated interest costs between the time of purchase and the time of use. The problem of choosing an appropriate interest or discount rate for this type of calculation is a familiar one, and has been discussed at length in the contribution of Professor Baumol to the *Compendium of Papers* already published by this Committee.³ It is not necessary to repeat his analysis. However, it is necessary to emphasize that the choice of an appropriate rate is absolutely critical to the decision problem at hand. This is true because the interest rate reflects the value of the alternative uses to which the resources—in this instance, capital funds—might have been put if they had not been invested in helium for storage purposes.

² A particularly ludicrous aspect of the pay-out approach is the current attempt by the Bureau of Mines to compel Government contractors to purchase from it at the artificial price of \$35 Mcf. Evidently, even the other Government agencies involved are interested enough in stretching their budget dollars to encourage their contractors to purchase from the cheapest available source. In effect, the Bureau's legal action is intended to require other Government agencies to transfer to it additional portions of their own budgets so that the Bureau can show less of a deficit on its helium operations. This, of course, is precisely the result that the Bureau accomplishes by reserving to itself the Federal direct-purchase market.

³ William J. Baumol, "On the Discount Rate for Public Projects," in *The Analysis and Evaluation of Public Expenditures: The PPB System*, Vol. 1, Washington, 1969, pp. 489–503.

Thus, for example, if the funds invested in helium had no alternative use whatsoever—neither the public nor the private sector of the economy had a single investment project that would yield returns in excess of its costs—then no interest costs should be accumulated, and the total cost of helium released from storage at any future date would simply be \$12 Mcf. However, if there are alternative investment projects available, and some of these must be foregone in order to release funds to be invested in helium for storage, then the rates of return available on these projects must be considered as costs (i.e., opportunity costs) associated with the use of the funds for purchasing helium. Only if the values obtained from the Helium Program exceed the sum of the purchase costs *plus* these interest costs is the program economically justified. This is an appropriate principle, whether the Federal Government itself is forced to borrow money to finance the program or whether it is able to provide investment funds from a current operating surplus. However, the need to resort to the private capital market for financing emphasizes the relationships involved. Surely Federal projects should yield returns *at least* as great as the interest charges incurred in funding them. The more general analysis presented by Baumol argues that minimum returns should be as great as returns available in the private economy, from which funds have been withdrawn for the Federal purpose. Rather than debate at length which of the several possible discount rates should be appropriately chosen, I have computed results for a number of rates that might be considered in the following analysis.

How long will helium currently being purchased under the Conservation Program be likely to remain in storage? Known in-ground reserves of helium in the U.S. are estimated as follows:

In combustible natural gas reserves: 153 billion cubic feet, 0.3% or more concentration; 135 billion cubic feet, less than 0.3% concentration, not now considered commercially feasible.

In non-combustible gas reserves: 20 billion cubic feet.

In appraising these figures, it is important to note that no systematic exploration for helium has ever been attempted in the U.S., and gas well samples containing helium, sometimes in relatively high concentrations, have been recorded in many different parts of the country. It is also important to note that technological improvements can be expected to push down the minimum concentration level at which extraction is feasible over time. Thus, it is quite likely that the total volume of in-ground helium reserves is considerably larger, and can be recovered under considerably more favorable conditions, than present knowledge indicates.

Even if annual helium usage rates should increase very sharply from their current levels, it would appear that simultaneous production and use of helium from known deposits of combustible gases would meet all demands until 1990 or beyond, and at costs not very different from current levels, taking no account of inflation.* These gas deposits themselves are likely to be exhausted soon after 1990, whether the helium has been recovered or not. A combination of the helium already in Bureau of Mines storage, privately stored helium, and extraction from non-combustible gases not now being exploited (and which could be purchased and stored *in situ* for conservation purposes, if necessary) may be expected to meet demand for an additional 20 years or more. This pushes the earliest date for the removal of additional helium stored in, say, 1970 forward to the year 2010 and beyond. The accumulated value of a \$12 principal after 40 years at each of several interest rates is as follows:

Percent:	
5	----- \$84.48
6	----- 123.43
7	----- 179.60
8	----- 260.69
9	----- 376.91
10	----- 543.11

How likely is it that any of these cost figures would present favorable economic alternatives to other sources of helium available in the twenty-first century?

We do not have an accurate estimate of the current private production cost of helium. However, we know that private contractors have been quite willing

*Note that if we take significant inflation in account on the cost side, then we must also take it into account in selecting the interest rate.

to extract helium and sell it to the Bureau of Mines for \$12 Mcf; and there is some evidence that actual production costs may be close to half that figure. Certainly \$10 Mcf would be a generous estimate. At the other extreme, it has been estimated that the cost of helium recovery from the atmosphere might be \$1000 Mcf or more at the present time. Now, if we presume that underground gas deposits containing at least lean reserves of helium will continue to be available well into the twenty-first century, the lowest of the above accumulated cost figures (approximately \$85) would represent an economically attractive alternative only if production costs increased more than 8-fold from their present levels. After a century of progress in reducing the costs of natural resource recovery from decreasingly rich deposits, such a turnabout in the trend of extraction costs appears most unlikely. At the other extreme, if even relatively lean in-ground sources were simply unavailable, the highest accumulated cost figure above (\$543) is about one-half the \$1000 estimated cost of atmospheric recovery. If we can anticipate technological improvement in this area comparable to the trend of the economy as a whole, then an annual rate of improvement of 2% over 40 years would be expected to reduce these latter costs by something more than one-half, or at least to a level comparable to the accumulated cost of stored helium at a 10% interest rate.

One may prefer to select a rate somewhere in the middle, and various combinations of availability and cost conditions, for more detailed analysis. It must be recalled, however, that the greater part of any additional helium stored after 1970 might not come into use until well into the twenty-first century, with correspondingly lengthened periods both for interest compounding and for favorable technological change. Although the entire problem begins to take on a futuristic cast that literally boggles the mind, a balance of factors makes it appear unlikely that helium purchased for storage after 1970 can yield benefits that will be commensurate with its costs. Hence, a systematic analysis of the costs and benefits involved in the Helium Conservation Program suggests that additional purchases for storage should cease as soon as possible and the economic resources that might have been used for these purposes diverted to other more productive activities.

(Supplemental information, subsequently supplied by Mr. Preston, appears on p. 420 at the conclusion of today's proceedings.)

Chairman PROXMIRE. Thank you, Dr. Preston.

These are all very stimulating and interesting papers.

Mr. Gaffney, I am intrigued by your assertion that these unproductive public works contribute to inflation. It is a thesis I have had for some time. We would like you to explain to us just how this happens and how much this Government practice contributes to our current inflation, in your opinion.

Mr. GAFFNEY. Why they contribute to inflation? If we assume that the money which is invested in public works is taken from alternative investments in the private sector, there is no difference there. If we assume, however, that these alternative investments in the private sector would result in useful goods coming on the market in a few months or even 10 years, whereas the public investment sector does not produce useful goods for a much longer period, you have a reduction in the amount of consumer goods coming to the end of the pipeline. That is where the contribution to inflation is, in my opinion.

Now, in an earlier era, people would have said that the Government investment was a net increase in investment and did not reduce private investment. If that is true, that would add further to inflation. I do not believe that today, because obviously, this money is coming right out of the housing industry and others. But one can conceive of conditions in which you can add that point, too.

Chairman PROXMIRE. Would you agree that the wasteful unproductive expenditure of billions of dollars in military procurement would have the same impact?

Mr. GAFFNEY. Well, certainly, if it's wasteful, yes.

Chairman PROXMIRE. Supposing it is not wasteful? Would it not still have the same impact?

Let me just say, would you not concur that any type of military expenditure—after all, you expend the money, you expend the dollars. They go into the spending stream and you do not increase the supply of economic goods. There is no corresponding increase in the supply of goods. If you are building houses, you are spending money on the houses. That has an inflationary impact, but you increase the supply of houses, and that tends to somewhat moderate the cost of housing.

Mr. GAFFNEY. Yes. Your point is quite true, of course, if we assume that the alternative is not a military disaster in which the enemy would come and take our groceries away from us, and I am inclined to agree with you that it would not be.

Chairman PROXMIRE. How about the space program? You can make the same argument on the space program. NASA, in reply to a letter I wrote them asking what benefits we are going to get out of nine more man-on-the-moon flights, said two. One is human fulfillment. The other is that we are going to discover more about the origin of the earth, the moon and the sun, which is fine, but whether we have to have that in the next 3 years, whether it is worth \$1.7 billion a year to get it is another question. At any rate, why is this not a completely inflationary program?

Mr. GAFFNEY. It is. I think the only consumer goods produced is whatever pleasure people get out of watching television and reading the headlines in the paper and a certain contribution to the advertising industry.

Chairman PROXMIRE. Dr. Kneese, of all the disturbing testimony this subcommittee has heard, yours is probably the most disturbing because, if I interpret your remarks correctly, what you are really saying is that Federal attempts to control water pollution have so far been an almost total failure. Of course, commonsense tells us the same thing. Most of us know our waterways are polluted and we have had a strong suspicion that things are not getting any better. For our benefit, however, I wonder if you would elaborate on why Federal programs have been inadequate. For example, recognizing the fact that Congress has not appropriated enough money, what has been done with the money that has been appropriated?

Mr. KNEESE. As far as I know, it has gone into its intended purpose. The reason that certain people who have looked at the matter would give for the slowdown is that there were intentions on the part of local governments to build treatment plants in many instances. But obviously, if you have a program which will provide a subsidy for such an activity, then it is highly desirable from the local point of view to obtain that subsidy. What has been happening is that the subsidy is available in principal, and even a very large subsidy, but in fact, the funds have not been forthcoming.

Chairman PROXMIRE. So the worst thing you can do is hold out the prospect that you can get a subsidy if you do not pollute, but not actually provide it, and that is what we have been doing?

Mr. KNEESE. That is right.

Chairman PROXMIRE. Even if you did provide it, your argument is that this is an inefficient way to do it?

Mr. KNEESE. Yes; it is. For one thing, it is frequently argued or at least implied that a subsidy will itself lead to pollution control. This clearly is not true, because even if the subsidy were 95 percent for the building of a treatment plant, it would still be cheaper to put the waste into the water course so it is not in itself a control of pollution. A private industry, for example, would never have the incentive to establish a treatment plant solely because there is a subsidy available, unless it is also under the gun of enforcement or other pressures are put on it not to use the zero-priced resource as though it were free. The subsidy can only be a part of the overall approach. That is why I linked subsidy to enforcement. This is the only sensible way.

Then, of course, I think the efforts to extend the subsidies to industrial waste treatment plant construction are particularly pernicious. We know a good deal about a number of industries. I personally have studied the beet sugar industry, for example, which was and in some instances still is a major source of industrial pollution. We know in those particular industries that if one were to devise the most efficient means of cutting down our waste discharges, it would seldom be a conventional waste treatment plant put at the end of the pipe. In the beet sugar industry at the present time there are plants that discharge waste equivalent, say, to a city of a quarter of a million people and there are other plants that discharge virtually none. The difference is not accounted for by treatment; it is the internal design of these plants. If you establish a Federal subsidy program which links the construction of the subsidy to the treatment plant, then you set up something to do it inefficiently. This is why I feel that the approach that I have suggested here of actually putting a price on what's discharged to this common property resource has the proper incentive effects to efficiently control not only by treatment, but control the generation of wastes.

Chairman PROXMIRE. Has there been an engineering analysis or a professional analysis to indicate that this is a feasible, practical way to measure the amount of pollution effluent discharge in such a way that you could price it and charge the polluter?

Mr. KNEESE. Yes. As a matter of fact, there is a long and, I think, very interesting history of the use of such a technique in the Ruhr area of Western Germany, where the effluents are in fact regularly priced.

Chairman PROXMIRE. What has been the reaction to that by industry?

Mr. KNEESE. Well, in the early days, there were a good many complaints against the assessment of such charges and there were appeals against the technique. But in the course of time; it has become pretty well accepted and the kind of appeals that are brought by industry no longer question the legitimacy of the technique but really concern details of measurement and such matters.

Chairman PROXMIRE. What is the cost element? Is it a big cost?

Mr. KNEESE. In most instances, not. We have one study that was done in the United States on the Delaware estuary. The basic data collection and analysis was done by the Federal Water Pollution Control Administration in a comprehensive study of the estuary area. Then an additional analysis was done by Edwin Johnson, who is with the Federal Water Pollution Control Administration, but this was done—I think this is correct—at the request of the President's

Task Force on Pollution Control. It was 2 or 3 years ago. That study suggested that the costs to industry would be very small, on the order of 1 or 2 percent of value added in the worst instances, and much less than that in most other instances for an effluent charge—

Chairman PROXMIRE. Of course, 1 or 2 percent of value added can be a pretty big charge. Profit can be, maybe, 2 or 3 percent of value added.

Mr. KNEESE. This is true. But of course, if the charge were to be levied on the rather wide-scale basis that I was suggesting, some of it would be passed forward in price. Of course, this would not be a complete impact on the profit position. And of course, that passing forward in price would be useful from an economic point of view, because then the price of these goods would more clearly reflect the special cost of producing than it now does.

Chairman PROXMIRE. What hard evidence is there that the larger industries have used their influence to defeat the enforcement of water quality standards? Can you cite any specific examples?

Mr. KNEESE. I do not think it would be possible to cite specific examples. It would be possible to dig back into the testimony on water pollution laws when they were up for hearing and review the positions taken by industry. The industries have regularly argued up until very recently that the implementation of effective pollution control would be impossibly expensive, which appears not to be true. They have, in a number of ways, by repeated calls for further research and such things, tended to delay the implementation of effective programs and to use their power in that fashion. I think it would require much more careful study to point to a particular industry and make it stick.

Chairman PROXMIRE. Dr. Preston, your helium study, I think, is most interesting, not only because it is, after all, a substantial amount of money and the Government has the direct responsibility—it can act—but what does all this tell us, in your view, about the benefit-cost study and its usefulness? Is this particular example—can you give us, do you think, a clearcut example of how a benefit-cost study can be used effectively to give us answers in this area?

Mr. PRESTON. Yes, Senator, I do. I think if the original justification of the program had been structured more appropriately so that it was clearly justified to begin with on the grounds of the costs and the expected benefits over the time period, then, when the conditions changed, the significance of the changes would have been much more obvious.

Chairman PROXMIRE. Now, lurking in the back of my mind, and I know very, very little about this, is that helium conceivably could have an essential military use, and that whereas we can determine costs all we want and indicate this is an expensive program, there is only significant cost in terms of benefits and the benefit in significant military value to us sometime in the future may be great. Is it possible that that is a consideration that has to be separately analyzed?

Mr. PRESTON. I think that is very true. There is also the priceless scientific use—literally priceless in the same sense that military use is priceless.

Chairman PROXMIRE. I understand you are proposing we abandon the present helium program?

Mr. PRESTON. I think that further storage does not look justified to me, buying additional helium for storage. It would seem to me it would

be up to anyone who wants to justify that to show some reasonable expectation that the future value of the stored helium would exceed its cost. If they could show it, then one would be for it.

Chairman PROXMIRE. I am not so worried about exceeding its cost. I think you have made a devastating case that it is most unlikely. But is there a possibility that, absent continued storage or continued production and storage by the Federal Government, we might not have access to this resource at all?

Mr. PRESTON. Well, sir, we have 18 billion cubic feet in storage now. As I noted, that is 20 years or so of use at current rates.

Chairman PROXMIRE. Right.

Mr. PRESTON. And it will be at least 20 years before we have to use any of that. So it does not seem likely that, within any time horizon that we could think of, there would be no helium at all, or even a very small amount. In fact, it seems that there will be a large amount for substantially as long a time horizon as we could imagine.

Chairman PROXMIRE. I understood you to make the point that the Federal Government requires its agencies to buy helium from the Federal Government, although the price is much higher than it would be if they were to buy it privately, and therefore it increases the cost to the taxpayer in this way.

Mr. PRESTON. The taxpayer has incurred the cost already by buying the helium and storing it in the ground, so it is really an accounting question.

But the observation you make is true.

Chairman PROXMIRE. To the extent that we could continue to produce and the Federal Government continues to produce and store additional sums of helium and then justifies the sale to the Government on the ground that the taxpayer has already expended the money, you would have an additional and unnecessary cost to the taxpayer, right?

Mr. PRESTON. Yes; but the additional and unnecessary cost is the additional storage, not the transfer of money among the Government agencies.

Chairman PROXMIRE. What Government agencies are the primary purchasers of the helium, for what purposes?

Mr. PRESTON. NASA and various Department of Defense agencies, and then, of course, scientific agencies also purchase it.

Chairman PROXMIRE. What proportion is NASA's purchases, roughly?

Mr. PRESTON. About one-half.

Chairman PROXMIRE. I am not surprised, in view of the way NASA operates.

Mr. PRESTON. It is interesting to note that until fairly recently—well, until the NASA era—the largest use of helium was to float Navy airships. That was still our old notion of helium, as something to float things around in the air. That was in fact the primary use. In the NASA era, that is not true.

Chairman PROXMIRE. What proportion of the Bureau of Mines' sales of helium are accounted for by Government contractors?

Mr. PRESTON. It is all to Government agencies.

Chairman PROXMIRE. Does not this mean that in any year, say 1969, the U.S. taxpayers have been paying for both that part of the helium purchase which is not covered by sales, plus the high price of Government helium paid by Government agencies?

Mr. PRESTON. The second item there is just a transfer within the Government.

Chairman PROXMIRE. That is right, you point that out.

Mr. GAFFNEY, you speak of the Government giving away water rights. What do you mean by this, giving away water rights?

Mr. GAFFNEY. Senator, as long as you have given away the floor, may I comment first on your point about the military?

Chairman PROXMIRE. Yes.

Mr. GAFFNEY. I think if we are drawing an analogy, there is an even closer tie-in. Of the \$2,192,000,000 spent in 1966 on water by Federal agencies, \$1.3 billion was spent by the Army Corps of Engineers. This is four times more than spent by the Bureau of Reclamation and much more than spent by HEW on water purification. The Engineers are part of the Military Establishment. There is not much doubt in my mind but what the power, the political clout, if you will, thus generated can be used to tie in with what you might call wasteful military expenditures.

Chairman PROXMIRE. Well, the political clout, though, does not really come from the military and those reclamation projects and others, it comes from Congress, does it not, very largely? This system we have of logrolling and backscratching and running for office on the grounds that we will get a dam may not be necessary, or get a Trinity River project of \$750 million to connect Dallas-Forth Worth to the Gulf of Mexico, even though the benefit-cost ratio is very low and with any kind of an adequate discount factor would be very strongly negative—you get it because the Texas people had great influence a year or so ago.

Mr. GAFFNEY. But the Corps of Engineers evaluating those projects and telling you what they recommend—

Chairman PROXMIRE. Congress gives them such rules that it is ridiculous how they approve projects that we know have no realistic discount a competent accountant would recommend as adequate. I think it ought to be 12 percent. Say you have one of 7 or 8 percent. Many of these projects which show a benefit-cost ratio of 1.1, 1.2 or 1.3 to one would have a clearly negative ratio. This is true, certainly, of the Trinity River project, it is true of the Cross-Florida Barge Canal, it is true of a number of others.

Mr. GAFFNEY. Well, on your other question about the giveaway of water, it is a very simple matter that water is an extremely valuable natural resource. In the Western States, it is frequently more valuable than the land that might be irrigated by it, and no charge is levied, either by the State government or the Federal Government.

Chairman PROXMIRE. Can you give some example of the kind of people or groups to whom these rights are given?

Mr. GAFFNEY. Every project is an example. Power companies, of course, use power drops. They have to be licensed by the Federal Power Commission. It has a latent power to charge a price for this, but this is not exercised in any meaningful way.

When the Bureau of Reclamation generates water on the San Joaquin River and delivers it to landowners in the Friant-Kern Canal, there is no charge in the accounting for the basic water right itself which is being appropriated by the beneficiaries, who are turning Heaven and earth to have these water rights made appurtenant to their

lands in perpetuity, which means there never will be any charge of or any possibility of reallocation.

Chairman PROXMIRE. You state, and this is a quote, that "the very, very, very rich benefit."

Mr. GAFFNEY. Yes.

Chairman PROXMIRE. Can you elaborate on this adverse income redistribution effect?

Mr. GAFFNEY. Many studies have been made of landownership patterns in the San Joaquin Valley over the years. I might mention specifically the Southern Pacific Railroad has large holdings in benefited areas. The J. G. Boswell Co. has something between 100,000 and 200,000 acres in the Tulare Lake basin which receives flood control benefits from Pine Flat Dam on the Kings River. You could probably name 10 corporations and individuals which hold over 50 percent of the land in the west side and center of the southern San Joaquin Valley.

Chairman PROXMIRE. Let me ask you, Mr. Kneese, one of your major points and the keystone, certainly, of your recommendations for legislation is that the waste discharger has succeeded in shifting the costs of his waste disposal activities to the public. The public pays, first, in having its water waste polluted and secondly, it pays by subsidizing to have the polluter clean up his own mess. Do Federal policymakers in the executive branch and the Congress understand this fact, in your judgment, or is it being ignored? Do you think the public fully understands it is being taken advantage of?

Mr. KNEESE. I do not think either of those groups fully understands what's happening in the misallocation of resources and distribution effects and so on. However, there have been a number of opportunities for the people in the executive branch, particularly, to get good information on the sort of alternative that I was mentioning. I mentioned the President's Task Force, which I think is not operative at the present time, but which was operating under President Johnson. This had economists, representatives from various agencies that are involved in water matters and the chairman of it was a man from the Council of Economic Advisers' staff. They did several studies—

Chairman PROXMIRE. The chairman was a man from the Council of Economic Advisers' staff, or he was a—

Mr. KNEESE. He was a staff man, not a member of the Council. They issued reports after really extensive periods of study and one of the kinds of inputs was one I mentioned earlier, this effluent charge study on the Delaware, which was made for them. They repeatedly recommended that a system of effluent charges be implemented by the Federal Government. I would certainly suppose that those members in the executive branch who have an interest in the policy as well as the people in Congress who have an interest in policy had an opportunity to see those reports and learn from them.

I think in the case of the public, what has been happening is that they are more aware now of the fact that there is pollution and that it has adverse and widespread effects. The communications media have taken on an increased interest in this. There has been mention of the system that is used in the Ruhr area in a number of relatively popular articles in such places as Time and Fortune and Newsweek.

Chairman PROXMIER. I would agree with you that there is a very, very widespread understanding of this. My colleague, Senator Nelson, last year won the most remarkable personal victory that anybody, in my view, has won in Wisconsin in years. He was the only Wisconsin Democrat elected. Every other Democrat lost, but he won by an overwhelming landslide. He had two or three issues that were very effective, but one of the principal issues was this issue, pollution. He has tried very hard to come up with programs to overcome it and he has proposed a number of programs and he has fought hard on it. I think that the reaction of the public to his position was very positive and strong. They are aware of it. Especially in the Great Lakes area, those who live on Lake Erie or Lake Michigan. But I think it is true all over the country; we do not have a major river that is not polluted or about to be polluted.

So I think there is consciousness of that, but there is very, very little, unfortunately, awareness of this constructive suggestion you have made this morning of an effluent charge and the experience Germany had with the Ruhr, which I think is a very strong practical argument in favor of it.

It has worked there. I am wondering what we can do to get this administration interested. It is very hard, by and large, for Members of Congress in some areas to espouse or even support this kind of legislation, because the industrial people are very conscious of increased costs to them. To say that they ought to pay something that you say in some cases could be 1 percent of their value added is a very substantial, 1 or 2 percent could be a very substantial diminution in their profits, even though they undoubtedly would eventually be able to push that on to the consumer. So it is a tough one.

I would like to know what we can do to advance this cause. You have advanced it this morning by appearing here, I am sure. We will do our best to get it around. If you have any other ideas, we would certainly welcome them.

Mr. KNEESE. I really do not. I think it is largely an educational matter and I think one of the central points is to change the frame of mind with which many people approach common property resources. I would like again to repeat that I think there is a much broader kind of problem that confronts us here.

As we get more congested, as our production and consumption activities generate greater and greater amounts of residuals which go into the air and water and which consume urban space and so on, we simply have to move away from the old concept that air and water are free goods in some sense, or that they are different than an iron ore input or labor input. I think everybody thinks they should pay for the labor they use or the iron ore they use. To my way of thinking, these resources present the same kind of allocation problem. It is just that our institutions are not well designed to cope with them. We have to move, I think, much more in the direction of publicly administered prices.

Chairman PROXMIER. I wonder if there is some other alternative. You state that studies have shown that industries often can reduce waste discharges, usually at low cost, if they are given proper incentives. Can you give us examples of the successful efforts by industries and what kind of incentives are employed? Obviously one way you

have pointed to is the Ruhr system. What are the others that might be worthwhile?

Mr. KNEESE. Well, it would be a mistake to argue that there has been no reduction in industrial waste discharges. I think in many cases it has not been the result of such specific enforcement proceedings or such specific incentives as one might like to see, but rather a kind of perception that pressures were building to do something.

To comment on the Ruhr for a minute, there is a large steel plant, the Dortman Westphalen-hutte, which has entirely enclosed its water system to the extent that it discharges no waste whatsoever and therefore does not pay an effluent charge.

I would like to refer again to an industry that I myself have studied because I know some details about it. In the case of the beet sugar industry, which in 1950 was estimated to be generating something like 14 or 15 percent of all of the organic pollution coming from industry, there have been some really spectacular reductions in waste discharge. These have usually come as equipment has been replaced and as the industry felt a certain amount of pressure to try to reduce its waste discharges. But it is literally true that a new beet sugar plant can be designed so that it does not discharge any waste whatsoever to the outside.

Chairman PROXMIRE. I like very much this idea of having a charge on the effluent discharge, because then there is not any question that the polluter would choose the most efficient means. It may be, for example, that you can do the same thing, perhaps a little more complicated, maybe, with air pollution. There have been some suggestions that we have a provision in the tax laws to provide a credit for the purchase of equipment which would reduce air pollution.

On the other hand, experts say the most efficient way in some kinds of plants to do it would be to use a low sulfur fuel. If you put this incentive in the tax laws, they buy equipment and do it in an inefficient way, rather than rely on the more efficient system of using a fuel that is less of a polluter. But if you charge them for their air pollution, as you are suggesting you charge for water pollution, then they would take the more efficient method, because it would serve their interest to do so.

Mr. KNEESE. Yes, and I might just reiterate that I consider tax credits and rapid amortization to be particularly bad devices. One of the arguments that is made for subsidizing industry in connection with these problems is that it is the marginal firms that people are really worried about.

Chairman PROXMIRE. You are so right. The difficulty is that they are so politically attractive. Everybody likes to have their taxes reduced and if you say you the doing it for a public purpose, getting clean air, reducing taxes, what could be better? On the other hand, if you make a charge, people do not like to pay more.

Mr. Preston, you stated that in 1960, the helium program was expected to pay its cost plus interest. What interest rate was assumed in making this estimate?

Mr. PRESTON. Three and seven-eighths percent.

Chairman PROXMIRE. You stated in your appraisal of the economics of the program in 1964, you used an interest rate of 4 percent and recommended a continuation of the program.

Mr. PRESTON. That is right.

Chairman PROXMIRE. Would you have found the program to be efficient at that time if you had used a more appropriate interest rate of 7 or 8 percent?

Mr. PRESTON. No, I don't think we would have.

Chairman PROXMIRE. This is really the heart of the benefit-cost analysis, isn't it, getting an interest rate which is realistic and appropriate?

Mr. PRESTON. That is right.

Chairman PROXMIRE. You can justify anything if you take a low enough interest rate, no matter how wasteful it is.

Mr. PRESTON. That is certainly true.

Also, however, I think we were more pessimistic than we should have been about future supplies even in 1964. Now I think we are a little more aware of some of the supplies of helium below the present extraction level so that the future supplies looked more favorable.

I might add that there has never been any systematic exploration for helium in the United States. We have never gone out to look for it specifically and there may be substantial supplies that we do not know about at all. There are traces of helium found in gases all over the country and there has not been a serious effort to really develop helium supplies for their own sake.

Chairman PROXMIRE. Of course, what this helium story really raises—it raises a lot of interesting things. You have presented them very well. One of the things it raises to me is how we can act more promptly when conditions do change.

Mr. PRESTON. Yes.

Chairman PROXMIRE. This is the real story, it seems to me, on helium. You have had a dramatic change in the situation. It is very hard because of the inertia of Government to make a change when we should.

Mr. PRESTON. That is correct.

Chairman PROXMIRE. We find that in military procurement with a vengeance. We go on buying battleships long after we need them. I think the aircraft carrier is obsolete, also the manned bomber. But we are going to appropriate fantastic sums to buy what's obsolete. Whether they are or not, only hindsight will tell us. In this case of helium, however, it is very clear.

Mr. PRESTON. It will take legislation to arrest it, you see, because it was established by legislation to proceed in this way.

However, I think that is one of the key arguments for the whole PPB system or any other kind of systematic, rational system of decisionmaking and planning and programing within any kind of large organization. If you have the right kind of analytical system, then changes in the data going into the system will show you the different answer. But if you have the wrong kind of analytical system, if your analytical system does not show you the things you really should be interested in, then it is that much harder to take account of changing circumstances.

Chairman PROXMIRE. Well, apropos of that, it seems to me that one of the reasons why this inefficient program has come to light is precisely because it incorporates a user or beneficiary charge. The purchasers of helium from the Bureau of Mines have to pay a price to get it. If this recovered helium had been given away, like the outputs of

public works investment, for example, there would be no clear signal something is wrong, that the benefits were not covering costs. Would you agree with this interpretation, even though the price at which helium is sold is an artificial price?

Mr. PRESTON. Yes, certainly. You see, the test of it is that private industry has come into the field offering an alternative, and everybody who has a choice has gone to private industry to buy the helium, because it is cheaper.

Chairman PROXMIRE. In a way, this relates to Dr. Kneese's argument, that you can put a price on the cost of effluent in polluting and destroying the water resources, then you would have a signal that would be useful to us.

Mr. PRESTON. That is correct.

Chairman PROXMIRE. A little different, but it is somewhat similar.

Mr. PRESTON. That is correct.

Chairman PROXMIRE. And with Mr. Gaffney, there is also the absence of this kind of a clear signal that we have with regard to the helium program because agencies have to pay for it and pay an uneconomical price compared to what they could get if they just could rely on the private industry.

Could you describe for us, the basis for the Bureau of Mines' lawsuit to compel Government contractors to buy higher cost helium from it rather than from the private producer?

Mr. PRESTON. It is my understanding that the Bureau feels quite rightly that this is a Federal procurement. It is indirect, but it is for a Federal purpose. But since the Bureau is assured of the Federal market, they feel that this assurance should extend to the private contractor part of the Federal market. Since it is not, however, a direct procurement, the private contractors have felt that they are buying helium as private firms, and they sell only the results of their activity to the Federal Government, so that they have felt that the law does not bind them. It is my understanding that this is in litigation now and is not decided finally.

Chairman PROXMIRE. Mr. Gaffney, you cite in your prepared statement a recent USDA study which shows that two-thirds of the 66,000 largest U.S. farms reported net losses from farming. How do you account for this result?

Mr. GAFFNEY. Tax shelter, primarily.

Chairman PROXMIRE. Would you submit the study for the record?

Mr. GAFFNEY. I would be delighted. It is a U.S. Government study, made by Mr. Edward Reinsel.

(The study referred to, and additional supplementary information furnished subsequently by Mr. Gaffney appears on p. 415 at the conclusion of today's proceedings.)

Chairman PROXMIRE. Do you feel, on the basis of your study of this and analysis of this, that the figures that you get, the Internal Revenue Service gets, are true, fair, accurate, honest figures? What's wrong here? You point to the difference. You say that the Internal Revenue Service indicates what was it, a \$2 billion or \$3 billion net income, whereas the statistics that we get from the Department of Agriculture indicate a net income of \$12 billion?

Mr. GAFFNEY. That is right. This was brought out by Professor Houthakker of the CEA.

There are several problems involved. One is undoubtedly sheer sloppy bookkeeping and tax evasion. The Governor of Wisconsin once stated in my hearing that as a small town tax lawyer, he was of the opinion that farmers simply did not pay their taxes.

Chairman PROXMIRE. Which Governor was that?

Mr. GAFFNEY. The present one.

Chairman PROXMIRE. That is good to know. I will remember that. He is a possible opponent of mine in 1970.

Mr. GAFFNEY. I should say that he did not say this to me in confidence. Otherwise, I would not be relating it here.

Chairman PROXMIRE. Well, now it is on the record.

Mr. GAFFNEY. Probably more important than this are the built-in avoidance mechanisms. These relate particularly to soil conservation investments, water conservation investments, and livestock. By building up a herd, one can write off the costs currently, even though it is really a capital investment which is subject to later capital gains treatment at reduced rates, of course. Primarily, though, what we have here is a mystery, as I indicated in my paper. This has not been adequately explained. People have started to look into it and have come out shaking their heads.

There are instances, many instances, of wealthy men building up horseracing stables.

Chairman PROXMIRE. This would not account for two-thirds, though, of the biggest farms?

Mr. GAFFNEY. Not by itself.

Chairman PROXMIRE. In our State, for example, I do not think 10 percent of the farms are owned by the big farmers. It may be quite different in some other States. Ours is a dairy farming State where you are bound to lose an awful lot of money unless the family itself does the work and you have the children work as well as the wife and husband.

Mr. GAFFNEY. Wisconsin, on the whole, is not a State which benefits from these provisions, although dairy cattle do receive the important tax privilege of being expensible when they probably should not be. But this is—

Chairman PROXMIRE. I disagree with you.

Mr. GAFFNEY (continuing). But this in minor relative to what's happening in Texas. As Professor Houthakker found, the primary cases of States where zero net farm income was being reported, to be cattle States and specifically those in the Dallas, those that were subject to the Dallas office. That was his last word on the subject, as far as I know.

Chairman PROXMIRE. Let me just ask you, you and Mr. Kneese, one more question, then I will be through.

Mr. Gaffney, you argue that imposing charges on the beneficiaries of projects would do much to correct the major inefficiencies in U.S. water policy. So I guess we do have a common thread right through all three of your testimonies. I did not realize that I had missed that point. A number of witnesses in our hearings have cited user or beneficiary charges as means of eliminating inefficiencies in the programs which they were discussing. Would you try industry first a set of procedures whereby these charges might be levied on the beneficiaries of public works projects, and second, the benefits in terms of resource allocation which they would have?

Mr. GAFFNEY. I can begin to. As you would imagine, this is a very complicated subject. One could go into hours of detail.

In a general way, if a charge is levied by the U.S. Government on something like the appraised value of, let us say, the Kings River, which arises on Federal land, this, then, would be passed on through two or three layers of agencies, some Federal and some State and some local. In a particular case—well, let me move over to the San Joaquin River. That water is handled first by the Bureau of Reclamation, then it is passed on to irrigation districts organized under State law. I would suggest first of all that the Federal landlord charge the Bureau of Reclamation for the water.

Secondly, that the Bureau of Reclamation charge the irrigation district. Let's take the Madeira Irrigation District, which already does pay a price for water, but not a high enough price.

The district then would levy a charge on the individual farmers who receive the water. This charge comes in two forms. One is a user charge based on the amount of water taken. A second part is a land tax based on the area serviced. The optimal combination of these two charges depends on a number of specific factors.

This is the basic structure that I would envision being set up.

Chairman PROXMIRE. I would like to ask, finally, Mr. Kneese, since you mention the resistance to creation of regional water control authority, what are the objections to regional control?

Mr. KNEESE. Well, I think that the primary thing I had in mind was that it might be very difficult for a regional agency to initiate an effluent charges technique. The reason is that, as you have pointed out earlier, there is likely to be considerable resistance, especially on the part of industry and the industrialized areas to going along with such a procedure. Of course, If you try to implement a system of this kind on a limited basis, the industry has a very powerful argument usually, or at least it is very persuasive to local people, to the effect that if you do this thing, they are going to leave. This is why I felt it would be very useful for the Federal Government to lead in initiating this system on a nationwide basis so that the principle gets firmly established and so that each of the regional agencies which would implement regional programs of water quality management would not have to fight that fight in their own regions. They might still have a fight on their hands in terms of getting the effluent charge set at a proper level, but at least they would not have to fight the principle of the effluent charge. I think first of all that has to be done at the Federal level. This is what I had in mind in my statement.

Chairman PROXMIRE. Thank you very much, gentlemen. This has been most useful. I would like to ask you to answer some questions for the record that some members have. Those questions will be addressed to you when you correct your remarks. I would very much appreciate it if you would give them some thought.

Tomorrow we will hear in this room some testimony from Leonard Rapping and James R. Nelson on Federal highway and navigation policy, and Gary Fromm on aviation policy.

The committee stands in recess until 11 o'clock tomorrow.

(Whereupon the hearing was recessed until Wednesday, September 24, 1969, at 11 a.m.)

(The following materials were subsequently submitted for inclusion in the record by Mason Gaffney who testified at the September 23 session:)

REPLIES TO QUESTIONS SUBMITTED TO MASON GAFFNEY ON BEHALF OF A MEMBER OF THE ECONOMY IN GOVERNMENT SUBCOMMITTEE OF THE JOINT ECONOMIC COMMITTEE—SEPTEMBER 23, 1969

Question 1. Are you aware that the water rights in the West are granted by the State and that the so-called "right" is a permit to use the water only so long as it is used beneficially?

Answer. The truth is more subtle than you suggest. The requirement of "beneficial" use is vague, and in practice is elastic. Practice varies between drowning rice with 15 acre feet per acre per year, and saving orange groves that need 1½ just to stay alive. Each to the law is a "beneficial" use.

It is commonly observed by crop specialists and extension agents that many farmers with superior water rights would be better off to use less water. That is worse than waste. Think what that means. They could release surplus water to service lands now dry, and also raise more crops on lands presently irrigated. Yet the law calls this sloshing on soggy ground a "beneficial" use just because something is growing on the land.

Question 2. The Reclamation Fund now receives \$185 million a year in revenues, reserved in the Treasury to help finance the Reclamation program. Since the annual revenues are far in excess of the cost of program features allocated to irrigation—the only interest-free aspect of the Reclamation program—then why is it an "outstanding outrage" that no interest is charged to such projects in the West where the fund originates?

Answer. I think you are saying that reclamation should be locally financed: Idaho pay for Idaho projects. Or perhaps it is a little broader: a new Confederate States of Inter-mountain America. That is all right if you are willing to let New York tax money be spent 100% in New York, and so on. That would mean an end to the Bureau of Reclamation as we know it today. Is that really what you want?

The western attitude on this was framed around an idea that federal lands in western states really should be given to the states. The Reclamation Fund was a device toward this end. I used to believe there might be some sense in that, but later I thought about it. It makes no more sense than letting Kentucky have Fort Knox. National property is national property, be it land or gold bullion.

If there were just 20 citizens in, say, Oregon, it would be clear as crystal that the nation had no obligation to cede its resources to the control of those who happened to get there first, or to own the private fee simple land in Oregon. When there are a million, it is easier to get confused as more variables enter the picture, but the basic principle holds true.

Now you make a second point, that when there is a surplus in an earmarked fund then it should be invested without interest. Any economist would then reply that the earmarking was folly.

But let me suggest an easy way out. If the U.S. Congress is really bound by past mistakes so that it cannot release funds that have been trapped in unproductive blind alleys, then hold the unspent surplus as long as you can. Only invest it during the interim in mortgages to finance the housing the American people really need. Or invest it in anything that yields a high return—there are plenty of outlets today. Or just hold idle cash, if you want. That will not earn anything for the government, but at least it will avoid wasting real resources. In effect it will constitute a diffused loan to everyone who has cash, extended through the medium of reduced inflation. Almost anything is better than wasting real resources.

Remember, we have left the era when economists would smile on any investment because it stirred up idle money and had alleged multiple benefits. That notion is as dead as the 4½% mortgage. The economy is gasping for disposable capital. You cannot recover the frozen concrete of yesteryear, but you do not have to go on making the same mistakes year after year. Congress can and must find ways to marshal disposable capital to meet the crisis of today.

Question 3. Few single-purpose irrigation projects are authorized today, and recreation is one of the multiple-purposes for which Reclamation projects are built today. Nevertheless, you seem to assume, on page 2, that these alternative purposes are not taken into account. Would you please comment on this?

Answer. Yes, many multi-purpose projects include recreation among their benefits. If my statement gave the other impression, I thank you for clarifying it. I have enjoyed boating on some lovely little jewels of lakes behind power dams; and I am not one who regards such "artificial" recreations as inherently inferior to natural wilderness experience. It gets down to cases. Which is worth more to more people?

Today there is a growing number of cases where the destruction of the scenic natural canyon is a large cost relative to the other values involved. The Pelton Dam case, for example, is one where the economic issue was pretty clearly one of the Izaak Walton League vs. the Portland General Electric. The upper Colorado dams have exercised the Sierra Club as you know better than I; the growing membership of that club suggests the share of the population devoted to wilderness recreation will rise in the future. The AEC is catching the devil, as you know. Open space, environmental quality, ecology—these are all popular catchwords today. That is why I chose the example of "Canyon X".

I do not object to including recreational benefits among project benefits. I would object to excluding them. My point here is that the destruction of natural recreational and amenity values should be included among costs. That includes the full cost of environmental deterioration. When we consider how sensitive people everywhere have become to this issue, I probably understated it.

Question 4. In an area that has annual precipitation of only a few inches of moisture a year—and that normally in the non-growing season—do you regard efforts to develop an assured water supply as "premature" or "pre-emptive"?

Answer. They could be, yes. It all gets down to cases. New York City tapped the Delaware River prematurely, in a humid area. San Francisco grabbed the Tuolumne River about 50 years too soon, in a more arid climate. Los Angeles grabbed the Feather River—or thought it did—somewhat less prematurely.

But you understand these premature pre-emptions were not necessarily so from the viewpoint of the actors involved. San Francisco was just greedy, but Los Angeles has to grab water prematurely because if they do not someone else will. They should have gotten more of the Colorado River or the Kern, or the Kings, but these were spoken for. The problem is that the water is not priced, and so the licensees on these nearer rivers are under no pressure to release water needed by others. On the contrary, the more they use, the stronger their rights become.

Question 5. Are you aware of the century-old Western water laws based on the right to appropriate surplus streamflows? In view of this established legal doctrine, what is your advice to States in the semi-arid zone which are located on the headwaters of major river systems, where much of the streamflow originates? Is it to let all the water flow downstream, where it can be put to use only by downstream areas, thereby pre-empting future use by the watershed areas of origin?

Answer. Our subject here is Federal policy. But your question brings out the motives that our century-old western law forces on all agencies below the Federal level, namely grab everything in sight before someone else does. Looters in riot areas are merely replaying on a small scale what the law advises water appropriators to do on a grand scale. I do not condemn the individual actors in this mob scene; I do not praise them, either. Greed is human, but not admirable. Enlightened public policy takes account of human greed; but leadership rises above it. What we need now is leadership to reconcile interstate rivalry on a much higher level than in the past.

My advice to the states is to get together and change the rules by which water is allocated among states. The guiding principle should be to maximize the joint net benefits over time; and to distribute the gains equitably. Economists have outlined the mechanics of such plans. When the idea catches fire, as it will, you will find a good start on the basic thinking already exists.

There are several ways by which states can get together. The best way is through the Congress of the United States. Unfortunately, deliberations here have long been dominated by efforts to have Congress abandon residual Federal property rights. This has blinded everyone to the constructive role Federal power might play in helping maximize national benefits from interstate waters.

Question 6. What is inherently uneconomical about building upstream storage works to store water that otherwise would waste to the sea in the snowmelt runoff and thus provide available water for use in water-short areas for all purposes in storage and distribution systems that will last for many generations?

Answer. Nothing. It is a question of when, where, how much, and so on. Please do not tag me as an enemy of water conservation. The whole process fascinates me, and my emotions are on the side of storing and playing with every drop. The point is, don't spend the last dollar to save the last nickel's worth of water.

Question 7. Are you aware of the fact that Reclamation projects are individually authorized; that this program in the water-short West has a backlog of \$5 billion in authorized projects?

Answer. That is what I mean by overcommitment. This authorized backlog means that Congress has been promising things it cannot deliver. Spreading promises around thin leads to spreading capital around thin, starting more than we can finish in a reasonable time.

Question 8. Did you know that much of the so-called "waste water" from irrigation returns to the river system or to underground aquifers and is re-used by other water users?

Answer. That is basic, of course. Few uses are 100% consumptive. I surmise you are suggesting that upstream users should get some credit or preference on this account, since their return flows are available below them. Sometimes that is right. In the Kaweah case, upstream relocation was (and is) the overreaching need, and a side-benefit was greater reuse of return flows.

The law has always had a special slot for "non-consumptive" uses. The law is 100 years behind the practical problems of today, alas. The corpus of water is not the only attribute of water that is involved. Power generation consumes elevation, control of timing, reservoir storage space, and so on. What we need is a much more sophisticated law that can tune in on what is relevant.

If you try to defend all waste on the basis of return flows and deep percolation, however, you cannot do it. The best initial use of virgin water is as likely to yield good return flows as the ones we have today. It is a matter of the individual case. Even the upstream use is not always better. If return flows are heavily salted or polluted, the use can be worse than 100% consumptive, it can ruin the water not withdrawn. Return flows and percolation from the Fresno Irrigation District ruined a great area beneath it by saturating it, and drainage problems are common below irrigated land.

Question 9. You have mentioned that dear water from Federal projects would encourage economy not just of water but of land. Is it your idea to charge more for the water than the cost of the water projects, making farming prohibitive so that you could build hamburger stands in the desert instead of water supply systems?

Answer. It is a good idea to earn a profit or economic rent from developing desert water, yes. The cost of importing northern water to Los Angeles exceeds \$100 per acre foot. Water occurring naturally down there costing \$2 per acre foot to develop obviously can yield a high rent.

It is obvious to most economists that it should, as well, so it will not be wasted.

You suggest that farming cannot survive free competition for its water. Many economists have encouraged that idea. I think it is overdrawn. Sloppy farming cannot survive competition. It should not. But it does not need to go on being sloppy. And there are millions of acres of farm land where water would be very productive if only it could be pried loose from the sloppy farmers.

This whole farm vs. city bit is a red herring. Plenty of cities are wasting water. San Francisco is a notorious water hog which has withheld a big share of the Tuolumne River from more productive agricultural alternatives for 60 years.

On the whole, the legitimate needs of cities are small relative to farm needs, and the farmers' fear that they cannot compete is exaggerated. Putting market prices on water would as its main effect promote much more efficient farm use of water.

The worst thing farmers could do to themselves would be to choke the growth of cities, which complement them.

Question 10. Most people and particularly those of southern California recognize the economic contributions of the Boulder Canyon Project which ended a massive flood threat to the Imperial Valley, stabilized some of the world's best agricultural areas, provided power and municipal water which made possible the tremendous growth that has occurred in southern California during the past quarter century. Is this national asset an example of what you have referred to as one of the "tombstones of civilization"?

Answer. The economist does not say "If one project is bad, all are bad," or "If some is good, then more is better." The point of economics is to break down decisions into components and dimensions and increments, to keep waste from hiding behind the skirts of productivity. So Boulder Canyon could be a good project without its justifying others. But it is not above examination.

I will not try in a few words to evaluate this complex project. It has been some years since I studied it. I suggest, though, that you are describing it uncritically.

One of the things that interested Los Angeles in the Colorado River was the precarious standing of their claim on it. There are sources nearer home, and totally intrastate, which would have supported the area's growth. The Colorado was irresistible because Los Angeles saw a last chance to convert a precarious claim into a firm right, as against six other states and the Imperial Valley. As a result the project was probably premature, if nothing else. And now look at the colossal waste inspired as the other states claim Federal aid to tap the Colorado, each in its own costly way.

If there is so basic a fault in this jewel of Federal dams, what does that suggest of the others?

Question 11. What has been your experience with water resource development in the West and reclamation and irrigation projects in general?

Answer. Several years of research, primarily, and a number of published studies. I enjoy an unfair advantage over many others in the field in that I have no vested interest in the matter other than as citizen and member of a profession whose job it is to develop and apply criteria of the public interest.

ANSWERS GIVEN BY MASON GAFFNEY TO WRITTEN QUESTIONS SUBMITTED BY SENATOR PROXMIER RELATING TO THE SEPTEMBER 23, 1969, HEARINGS ON ECONOMIC ANALYSIS AND THE EFFICIENCY OF GOVERNMENT

1. Because of their complexity and importance, there are a number of assertions in your statement which I would like you to elaborate on:

(a) At the bottom of page 1, you assert: "The use of zero-interest for all costs that ingenuity can allocate to 'irrigation' benefits of a project is an outstanding outrage. The use of zero rent on public sites and waters is equally outstanding." Could you develop this point for me using an example of what you mean?

Nearly every Federal project exemplifies the point. The projects serve to allocate public resources to a limited number of private beneficiaries, below cost. The public's perception that something of value has been given away is low even when the something is easy to understand, like construction cost. It is lower yet when the thing is less tangible, like an interest subsidy. It is lowest of all when the thing involves no cash outlay of any kind, and no visible price tag. That is the way with public waters and sites. I have never seen them entered as cost items in project studies, even though they are the basic input.

The matter is glossed over partly by the long-standing and continuing confusion over who "owns" raw water. The welter of conflicting claims and self-serving assertions and indecisive judicial equivocation is a mare's nest that lets everyone indulge his conceits. The conceit favored by local landowners is that they "own" water within striking distance, and should not pay to get it (even though they do not want to own a clear fee, for that would be locally taxable as real property). Their political clout, and the ignorance of socially minded groups, lets them get away with it.

There is also great unresolved confusion over state and federal claims. It is often unclear which sovereign would have the right to sell or rent water or damsites. This confusion aids those who aim to appropriate the resources to their private gain.

My paper develops the point by listing five social damages that result from giveaways:

- abatement of pressure to put resources to their best use
- creation of pressure to develop water prematurely, pre-emptively
- creation of a privileged class
- misallocation of water
- underpricing and waste of water

Let me mention some examples.

Most of California's water allocation from the Colorado River goes not to Los

Angeles but through a Federal project to Imperial Valley where it is lavished extravagantly. Giving the Federal project the benefit of the doubt, grant it shows a benefit: cost ratio above one. Now let us add to its cost the cost premium that Los Angeles is planning to lay out to secure water from the costliest alternative source — say the Eel River, or desalinization. I.e., let us make Imperial Valley pay for its water what the raw water is worth, and add that to the denominator of the benefit: cost ratio. Then the ratio falls far below one, and the "favorable" project turns out to be submarginal.

The Kaweah River collects runoff from Sequoia National Park and waters certain lands in Tulare and Kings Counties, California. Terminus Dam, Federally financed, now regulates the flow. The Kaweah exemplifies every diseconomy that flows from giving away public resources free of charge. The waters are allocated in a clumsy, uneven, uneconomical way to which a few words can hardly do justice. I submit a close study of the Kaweah example as an exhibit:

(b) On page 2, you state that because of government policy of "giving away damsites" (presumably to power companies) and water rights, huge capital investments are undertaken prematurely. Would you elaborate on the reasoning behind this assertion? What are the costs to society of "premature development"? You state that our income tax law encourages this premature development. Could you describe this process, perhaps by using an example?

With rising population and exploding demands, wastes once deemed remote or high-cost look better all the time. This is a continuous process. Everyone today is familiar with it.

Everyone has learned, too, that if you wait until you need the water, someone else will be in it. He won't have needed it yet either, but knowing how greedy others can be he will have exercised prudent precautionary foresight and sound judgment to protect his legitimate interests.

The appropriation doctrine will not let you just hold raw water. You must develop it, however uneconomically. When the prospect of its future values has a present discounted value equal to or greater than your cost for some development which the law will accept as preemptive, you lay out that cost, even though the water is submarginal for current use.

The cost to society is that scarce capital is invested unproductively. Housing is tight; buyers are paying 10% to finance houses; and we are freezing national capital into concrete yielding 3%, 1%, 0%, and negative returns. California has become the half-finished state, having started more universities than it can finish, more BART, more Feather River Project, more new communities — yet people keep allocating capital to more new starts, not for productive use but to preempt water from their fellows.

Let me refer you to the appendix I am submitting on taxes. The basic idea here is that land does not depreciate, so cost of buying land should not be depreciable, much less expensible. The costs incurred to preempt premature water are essentially costs of land acquisition. The appropriative law and custom say, in effect, "Spend money to develop this water now and you may enjoy its future benefits just as though you owned it." But the private developer can expense current operating losses and depreciate capital costs. Thus he writes off costs of acquiring a water resource which does not depreciate. In fact it appreciates.

If a state or local government is the preemptive developer, its taxpayers deduct the necessary increased taxes from current taxable income, even including taxes used to build capital improvements. The benefits come in the form of enhanced land values, lightly taxed.

(c) On page 6, you state that development of water facilities proceeds faster than development on the land can accommodate the water development, hence making the water development "sterile". You go on to state that Federal tax law encourages this by making "water conservation" investments "expensible". Would you elaborate on the economic effects of this process?

Some detailed effects of unbalanced development have been treated at length in the Kaweah River study which I am submitting as an appendix.

To elaborate on this on a broad canvass could involve surveying 200 years of westward expansion in U.S. history. In 1836 the canals got far ahead of private land settlement. Trunks tended to get ahead of feeders. Marginal areas got ahead of central areas. Then when the whole grand fabric of a new society was just beginning to emerge, our great-great-grandfathers ran out of capital. They could neither continue the canals nor improve the land they tapped. They had started more than they could finish, and the system collapsed in a credit crisis. Their descendants did it again with railroads, in 1857, 1873, and 1893. Our fathers did it with roads and city streets and water works and utilities in 1929. We are pretty

far down the same route in 1969. We are having to slow down and stretch out program after program. "Overcommitment" is the word of the day. We do not have the capital to finish what we have already begun, and 1969 interest rates reflect the greatest capital shortage of the 20th century.

DISECONOMIES INHERENT IN WESTERN WATER LAWS: A CALIFORNIA CASE STUDY

(By Mason Gaffney, University of Missouri)

A paper read before the Western Agricultural Economics Research Council at Tucson, Ariz., on January 23, 1961, as published in *Economic Analysis of Multiple Use*, Report No. 9 in the series *Water and Range Resources and Economic Development of the West*. Proceedings of Western Agricultural Economics Research Council, Range and Water Section, Tucson, Ariz., January 23-24, 1961, pp. 55-82.

I. INTRODUCTION

Is our system of water law compatible with economic use of the resource? This old question came again to the fore as the postwar cycle of resource development brought renewed pressures on limited water resources. For a time the negative answer seemed ascendant, at least in the intellectual world (it made somewhat less headway with the holders of superior water rights.) More recently the positive has been accentuated by Professors S. V. Wantrup,¹ Stephen Smith,² George Tolley,³ V. S. Hastings,⁴ and others. Even Professor S. T. Harding, who once might have been regarded as a sharp critic of the system⁵ (especially its riparian components), has recently risen to its defense.⁶

While it is hazardous to summarize so many authors, they seem to share the view that water law in its entirety does not work out in practice in nearly the absurd ways that one might expect from a *a priori* analysis of the enunciated principles; that in fact it would be hard to improve on the allocation achieved in the field; and critics should be required to show how allocation might be improved.

This allegation shifts the emphasis of the debate from the analysis of principles to the observation of practice. For this purpose I have selected the Kaweah River system, which is in the southeastern San Joaquin Valley, largely in Tulare County. This system, like all local situations, is unusual in some particulars, but contains diseconomies of kinds and in degrees that in my observation prevail throughout the Valley and the State.

The Kaweah system makes a good study area for the following reasons:

A. Unusually complete data on diversions are available. The stream has long been administered by a water master, and his 1920-55 records of daily flows in the ditches of some 21 water user organizations are published in California Division of Water Resources Bulletins 49, 49A and 49B.⁷

B. As the Kaweah River emerges from the foothills it fans out over an alluvial cone, in such wise that water may be shifted among the rival claimants through existing channels with minimal transfer costs. There is, therefore, no appreciable transportation cost barrier amount the separate water users to complicate the analysis.

C. There is no great problem of water quality to complicate the analysis.

D. The unit is small enough for analysis in some depth yet its institutions are complex and varied enough to present in microcosm many basic problems of water law.

E. The river is located where water is clearly the limiting factor on economic expansion. A high scarcity value imputes to Kaweah River water, so there are compelling economic reasons for allocating it to its best uses.

¹ Wantrup, S. V., "Concepts Used as Economic Criteria for a System of Water Rights," 32 *Land Economics* (4) 295-312, November, 1956.

² Smith, Stephen, "Legal and Institutional Control in Water Allocation," 42 *JFE* (5) 1345-58, December, 1960.

³ Tolley, George, and Hastings, V. S., "Optimal Water Allocation for the North Platte River," dittoed MS, nd, (c. 1957).

⁴ Harding, Sidney T., *Water Rights for Irrigation*. (Stanford: Stanford University Press, 1936).

⁵ Harding, Sidney T., *Water in California*, (Palo Alto: N-P Publications, 1960), pp. 59-60, 211-12. Professor Harding is specifically contrasting the established diligence principle favorably against the exemption from diligence of fillings by the State. But his language and evident purport become much more general.

⁶ State of California, Department of Public Works, Division of Water Resources, *Kaweah River Flows, Diversions and Service Areas*, Bulletins Nos. 49, 49A, and 49B (Sacramento: State Printing Office, 1940, 1950, and 1956).

F. The area is important for its own sake. It was the alleged crisis of this area that originally triggered off the Central Valley Project in the 'twenties, and it remains the major payoff area for that project. It is the major State and national producer of navel oranges and plums, and an important producer of clings and freestones. In respect to water law, the Kaweah is the locale of at least two leading cases, *Tulare Irrigation District vs. Lindsay-Strathmore Irrigation District*,^{6a} and *Ivanhoe Irrigation District and the State of California vs. McCracken, et al.*^{6b}

G. Toward the end of the period of study the area received a large imported water supply from the completed Central Valley Project. Observation of the reactions of the local water economy to this increment has brought out a number of significant points that are obscured in a static situation.

II. DISECONOMIES IN THE KAWEAH RIVER DISTRIBUTARY SYSTEM

A. *Indications of wide dispersion of marginal revenue productivities of water within the system.*—It is a weakness of much grand-scale project planning to assume implicitly that there is an operative local market mechanism which has succeeded in equating the marginal productivities of water among different users. Thus, one hears statements of the order "Down in Tulare County they pay \$15 an acre-foot for water." In fact, in the Kaweah system, the marginal productivity of water varies from less than zero in some areas (where it is applied in such excess as to damage crops and soil) to an upper figure that I hesitate to specify. To save a heavy citrus crop worth \$1,000 an acre on the tree, and to save the trees themselves, a marginal acre-foot at the critical moment assumes a short-run value many times greater than the maxima we ordinary discuss. Within the area there have been citrus groves in just such straits at the very moment that water was wasting elsewhere.

So great is the range of marginal productivities obtaining in the system that it is possible, without pretending to fine accuracy, to establish the contrast beyond cavil. These contrasts have persisted over several decades because, as we shall see, the system's evolution has been almost completely arrested since before 1920.

Each of over twenty water user groups has its own insulated supply-demand balance, hence its own marginal productivity. Lands without surface water using pumped wells of greatly divergent lifts have still more separate marginal productivities. This paper focuses on what is probably the most extreme divergence, that between the "thermal" areas, the "coves" and benchlands above about 350' elevation, and the lower Kaweah delta of cold nights and alkali-damaged soils. The thermal zone is adapted for citriculture; the lower delta at best for alfalfa and cotton, at worst for barley and pasture. These areas are in direct competition for the same water deliverable by gravity to either area through existing channels.

There are several means by which the outside observer can estimate the marginal productivity of water. In the larger study from which this paper is drawn many of these means were essayed. While some of them eventuate in only crude estimates, plus or minus considerable margins of doubt, they are adequate to the present purpose which is simply to establish the contrast between the lowest and the highest marginal productivities. Possible uncertainty attaching to single methods of estimate was resolved by the fact that the different methods consistently pointed to the same conclusion. The methods of estimate and their results are listed and described below.

1. *Water conservation expenses*

There is some index to the marginal value of water in the pains that water users take to conserve it. Let us take the Lindsay-Strathmore Irrigation District, extending east from Lindsay and Strathmore to the foothills, as the prototype of citrus water organizations. The following description applies to the period before its acute water shortage was relieved by the *deus ex machina* of the Central Valley Project.

This district pumps water up over 200 feet from the river to the top of its system (a cost, as we shall see, imposed not by nature but by water law). It distributes water in steel pipe under pressure throughout its area, so that sprinklers may be used. It operates a surface and an underground reservoir and has the necessary excess distributive capacity to serve water on demand so that operators need apply only when the trees require it. It has withal one of the most elaborate water conservation systems of any Irrigation District in the State, a fact reflected

^{6a} 3 Calif. (2d) 489, 45 Pac. (2d) 972 (1935).

^{6b} 357 U.S. 275 (1958).

in persistently high tax rates and water tolls: in 1949, \$6.79 per assessed acre and \$8.14 per delivered acre-foot.⁷

By contrast, the Tulare Irrigation District (around Tulare in the southwestern Kaweah Delta) loses some 50% of the water it diverts through a long unlined ditch.⁸ When it finally reached the District, "... the use of water is very uniform and generally wasteful" observed Frank Adams in 1915.⁹ William Horn, in studies preliminary to the 1955 Bulletin 2,¹⁰ assigned this District the low overall "irrigation efficiency" of .39.¹¹ Let me emphasize that neither Mr. Horn, Mr. Adams nor I are necessarily levelling any criticism at the management of this Irrigation District. Its behavior may be perfectly rational within the framework of water law. It is rather that framework itself which is under examination here.¹²

The Tulare Irrigation District is not the worst example. Indeed it is, among our twenty-odd water users, one of those more pressed for water. There is only one lined canal in the entire Kaweah system (Foothill Ditch in the thermal zone). Wasteful rotation systems of water distribution are the rule.

2. Marginal costs of lifting ground water

The marginal cost of lifting ground water in individual pumped wells is an excellent guide to marginal productivity, since individuals are in a position of complete control wherein they can pursue the natural tendency to equate private marginal cost and marginal revenue product.

The Lindsay-Strathmore Irrigation District, like much of the thermal citrus zone, is underlain by very poor aquifers. Lifts had increased to over 150 feet before 1920,¹³ and costs were higher even than that would suggest because the underlying rock imposed high drilling costs and low yields per well.¹⁴ From about 1913, many wells struck connate brines with boron, toxic to citrus.¹⁵

By contrast, along the lower reaches of the St. Johns River. (the northern distributary of the Kaweah,) between Goshen and Traver, ground water has damaged the soil by intermittently evaporating from the surface, and is not far down today.¹⁶

Despite this accessible water table, there is little pumping, due to poor soils.¹⁷ A large amount of Kaweah water is nonetheless consigned to the area each year, under vested rights in surface diversion and channel seepage. In most of the Kaweah delta area over the period of study, pump lifts averaged less than 25'. Only in the southwestern delta were lifts much greater.¹⁸

3. Water applied per acre

Lindsay-Strathmore Irrigation District was forced by unfavorable court judgments to subsist for many years on 1.76 acre-feet per acre.¹⁹ Even to achieve this depth it had to halve its acreage.²⁰

⁷ Computed from State of California, Dept. of Public Works, Division of Water Resources, *Irrigation Districts in California, 1944-1950*, Bul. No. 21-P (Sacramento: State Printing Office, nd). In 1929 the District charged \$24.50 per acre and \$10 per acre-foot. State of California, Dept. of Public Works, Div. of Water Resources, *Permissible Annual Charges for Irrigation Water in the Upper San Joaquin Valley*, Bulletin No. 34 (Sacramento: State Printing Office, 1930), p. 65, Table 39.

⁸ Adams, Frank, *Irrigation Districts in California*, State of California, Dept. of Public Works, Division of Engineering and Irrigation, Bulletin No. 21 (Sacramento: State Printing Office, 1929), p. 247.

⁹ State of California, Dept. of Engineering, *Irrigation Districts in California, 1881-1915*, Bulletin No. 2 (Sacramento: State Printing Office, c. 1916), p. 88.

¹⁰ State of California, Water Resources Board, *Water Utilization and Requirements of California*, Bul. No. 2, Vol. 1. (Sacramento: State Printing Office, 1955).

¹¹ Correspondence in writer's files.

¹² Messrs. Horn and Adams are not implicated, of course.

¹³ State of California, Dept. of Public Works, Division of Engineering and Irrigation, *Water Resources of Tulare County and their Utilization*, Bulletin No. 3 (Sacramento: State Printing Office, 1922), Map No. 1.

¹⁴ *Hearings on S. 912 before Senate Public Lands Subcommittee*, 80th Congress, 1st Session, 1947, p. 636.

¹⁵ *Ibid.*, p. 400.

¹⁶ Althouse, Irvin H., "Water Requirements of Tulare County," Report to Tulare County Board of Supervisors, January, 1942 (mimeo.), p. 13.

¹⁷ Weir, Walter W., *Transactions of the American Geophysical Union*, 1941, cited in U.S. Dept. of Agri., Bureau of Agri. Econ., "San Joaquin Valley Water Investigations, Agricultural Aspects," (Berkeley, 1944), p. 149.

¹⁸ U.S. Department of Agriculture, Bureau of Agricultural Economics Division of Land Economics, Water Utilization Section, "Area Proposal, Kaweah-Tule Area, California," September, 1941, p. 7.

¹⁹ Note 13, *supra*; and U.S. Bureau of Reclamation, *Central Valley Basin*, Senate Document 113, 81st Congress, 1st Session, 1949, Plates 4-6 facing p. 104.

²⁰ Statement of Donald Burr, Manager, Lindsay-Strathmore I.D., 1958.

²¹ Kerr, S. A., in *Hearings on S. 912*. . . . *supra* (Note 14), p. 390.

As the other extreme, the Consolidated Peoples' Ditch Company mean annual diversion over 36 years has been about 7 acre-feet per acre.²¹ plus whatever may be lifted by private pumps from shallow wells after July when the river usually runs dry.

Let me repeat that it is physically possible to shift water from Consolidated Peoples' Ditch Company to Lindsay-Strathmore Irrigation District without cost, simply by changing the point of diversion. The only barrier is legal. Lindsay-Strathmore Irrigation District was prepared to make the shift in 1928, having bought shares in Consolidated Peoples' Ditch Company and an easement in Foothill Ditch, and was stopped only by injunction.²²

4. Value of output per acre-foot.

We all know of course that the average revenue product per acre-foot is not the marginal revenue product. But it is a near relative, so that differences as great as those recorded here, especially in conjunction with the other data, are worth noting. In fact, the use of average products understates the contrast of marginal productivities, probably a good deal, since thirstier areas are nearer the stage of increasing average returns to water, and some are in that stage.

The Lindsay-Strathmore Irrigation District, before the advent of Central Valley Project water, grossed something like \$5,000,000 per year²³ from 16,400 acre-feet per year, or about \$300 per acre-foot. Consolidated Peoples' Ditch Company, I would estimate, (exact figures are not compiled) grossed in the rough neighborhood of \$2,000,000 from its 66,000 acre-feet, or little more than 10% as much per acre-foot.

If we go by crops instead of area, we can deduct current variable costs (i.e. cultural and harvest costs) and arrive at a more significant figure. Costs are higher for navels, of course, and that reduces their advantage, but leaves it still impressive. The average net product of water applied to navels, at current levels of prices and costs, would run from \$200-\$500 and acre-foot compared to around \$40 for cotton, \$20 for alfalfa, \$20 for barley, and \$10 for pasture.²⁴

In the long run the advantage of navels would be still less because of their long development period and heavy fixed costs. But for our present purpose the short run difference is relevant. For in the Kaweah area it was not just raw citrus land that was denied water for the benefit of downstream barley and pasture. It was also established citrus groves, with fixed costs already sunk. The economic pressure that water law has withstood is the full difference in the short run values of water between citrus and pasture.

Contrasting to the high yields and low water requirements of citrus, irrigated pasture grasses in the lower delta are little more than domesticated phreatophytes. Irrigated pasture uses about five acre-feet per acre. Michael Brewer has recently tabulated water cost as a percentage of variable costs in pasture operation.²⁵ He finds it to be 23%, a good deal more than for cotton at 5%, Emperors at 2.7%, and even rice at 14.9%.

But this contrast, striking as it is, understates the full economic contrast a good deal because only explicit outlays are considered. No opportunity cost value is assigned to the water itself, even though this may be the predominant social cost of water use. If, in the Kaweah area, we were to charge against irrigated pasture and opportunity cost of about \$15 per acre-foot, there would remain no net return at all to other variable inputs, the operator or the equity. There would remain precious little return to growers of barley and alfalfa. These crops can be grown here only because water law insulates their growers from feeling the social cost of water as a personal cost.

5. Production response to increased water supply

From 1952, the Central Valley Project brought a prodigious increment to the area's water supply. According to Tulare County Agriculture Commissioner reports, the response of navel output was immediate and continuing. Tulare Coun-

²¹ Computed from *Kaweah River Flows . . . supra* (Note 6). Table 8. Cf. *Permissible Annual Charges . . . supra* (Note 7), p. 81, on the lavish use of water by irrigators in the Kaweah Delta.

²² *Consolidated Peoples' Ditch Company v. Foothill Ditch Company*, 205 Calif. 54, 269 Pac. 915 (1928).

²³ Adapted from data compiled under supervision of Wm. Taggart, U.S. Bureau of Reclamation, Sacramento; from Annual Reports of Tulare County Agricultural Commissioner; and several contributing sources.

²⁴ Cost data supplied by Tulare County Farm Advisers.

²⁵ Brewer, Michael, "Water Pricing and Allocation with Particular Reference to California Irrigation Districts", Giannini Foundation Mimeographed Report No. 235, 1960, p. 84.

ty navel yields for 1952-58 are about double those for 1943-51, and the division between 1951 and 1952 is clean and sharp. By way of a control, in neighboring Fresno County, where navels received no new Central Valley Project water, there was no significant change in yields between the two periods.

Crops grown in the middle and lower delta—plums, alfalfa and walnuts—show no increased yields after 1952 (cotton is not used as an example because its intermittent acreage control program overshadowed other factors influencing yields).

6. Land-value response to increased water supply

In the thermal citrus zone, access to a reliable water supply today is worth something in the neighborhood of \$500-\$800 an acre. This is the difference in the price of raw land with and without water. Dry land, of which there is ample, would bring some \$50-\$100 an acre based on grazing income. Water raises this to \$500-\$900. Access to water is not free, but entails annual land taxes and water tolls of some \$30 an acre, and the land value increment is based on expected income net of these charges.²⁵

This index is inflated by today's high land prices, based in part on speculative anticipations that may be unwarranted.²⁶ Still it contrasts sharply with the lower delta, where it is difficult to find evidence of any land value increment related to increased water supply, and for our present purpose it is the contrast, not the absolute quantity, that is important.

7. Willingness to pay for water and water rights

Lindsay-Strathmore Irrigation District before 1935 had bought, and downstream interests had sold shares in most of the Ditch Companies in the Kaweah Delta, despite the high risk (which came to pass) that Lindsay-Strathmore Irrigation Districts could never use them. Consistently thwarted in her quest for water, Lindsay-Strathmore Irrigation District just as consistently put up whatever money seemed necessary to get it some other way.

In 1949 when the Irrigation Districts' Association sought to maintain a united front in bargaining with the Bureau of Reclamation, it was Lindsay-Strathmore Irrigation District which first broke ranks and consented to a contract with several unpopular features. By contrast the lower delta ditch companies have never even organized as Irrigation Districts to contract for Bureau water. The Kaweah Delta Water Conservation District, representing the whole delta, is unwilling to pay the Bureau's prices.

8. Competent appraisals of soils and climate

The excellence of the benchlands in soils and climate is documented in sources cited in the appended footnote.²⁷ Parts of the lower delta also have excellent soils, but the thermal qualities of the benchlands suit them for much more productive uses of water.

9. Size of farms

In Lindsay-Strathmore Irrigation District almost all the land is in unusually small an intensive farms, averaging about 15 acres.²⁸ At that size clearly the operator is in sore need to spread his overhead over as much output per acre as possible. He is likely to have on hand underutilized indivisible input items to make the fullest use of marginal water at the least marginal associated cost.

Nowhere else in the delta are farms nearly so small.²⁹

B. Unreliability of water supply.—A common rationalization for rigidity of water allocations, and unresponsiveness to demands, is that this is simply the price we must pay for security and stability of supply. But this argument will

²⁵ Interviews with local realtors and water officials, 1958. See also *Hearings on S. 912* . . . *supra* (Note 14), pp. 654-55.

²⁶ See Section IV, *infra*.

²⁷ USDA Bureau of Agr. Economics, "San Joaquin Valley Water Investigations, Agricultural Aspects" (Berkeley: 1944), Mimeo. A Report to the War Dept. U.S. Engineers Office, Sacramento District [made of public record by introduction by Paul Johnstone in testimony at *Hearings on S. 912* . . . , *supra* (Note 14), p. 842], Table 19, p. 44; Table 24, p. 60; Table 39, pp. 108-09.

USDA Bureau of Agricultural Economics, "Area Proposal, Kaweah-Tule Area, California", *supra* (Note 17), pp. 7 ff.

Althouse, Irvin H., *op. cit.* (Note 16), pp. 12, 96-97.

U.S. Dept. of Interior, Bureau of Reclamation, "Factual Report, Tulare Irrigation District" (Fresno: 1949), mimeo.

²⁸ U.S. Dept. of Interior, Bureau of Reclamation, "Factual Report, Lindsay-Strathmore I.D." (Fresno: 1949), mimeo.

²⁹ Clawson, Marlon, and Wilson, Edwin E., "Agricultural Land Ownership and Operation in the Southern San Joaquin Valley", USDA Bureau of Ag. Econ. (Berkeley: 1945), Mimeo.

not bear much weight in the Kaweah River situation, since the division of waters is such as to increase materially the system's aggregate variability over what it might be; and the allocation of the burden of variability among different users is such as to deprive a needlessly large share of the diverted water of much of its value, as will be shown directly.

It is natural to think that irregularity of irrigation water supply must reflect irregularity of demand, but such is not the case in the Kaweah system. Demand plays no part in timing deliveries. Diversions are regulated by an iron-bound schedule based exclusively on rates of flow in the river. Demand must adjust to the supply so determined.

1. Aggregate variability in the system: Nature imposes a certain variability on water supply, which man can reduce only by physical means, *i.e.* storage. But he can increase it, when dividing the supply among many claimants, by the counter-movement of diversions. That is, if one diversion rises as another falls there is new variability introduced in the system. Or if the diversions change disproportionately (even though perfectly correlated) there is a sort of increased variability introduced, if we define and measure "variability" in such a way (as I think we should) that deviations are weighted in step with their magnitudes (*e.g.* by squaring them).

For this purpose the variance divided by the mean makes an appropriate measure. For annual flows from 1920-55 this figure for the sum of all diversions was 63,016 acre-feet. This represents the variability which nature imposed on that portion of the river which man diverted. But the sum of the corresponding figures for the individual diversions was 98,050 acre-feet, or 56% more.³⁰ Thus, man's division of the water added, by this measure, 56% to the burdens imposed by nature.³¹

Three user-organizations actually received supplies which were less steady than wasted flood waters, *i.e.* Kaweah River flows in excess of diversions. This hardship is clearly unnecessary, and is imposed by the system on junior appropriators to the benefit of no one.

2. Distribution of variability among water-users: System variability is very unequally distributed. The steady portion of the flow, which is of course much the more valuable share, goes to a few. In general, these are the same which get the heavier per acre mean annual supplies.

The result is that few acres receive water supplies that are adequate in both quantity and reliability. To give some quantitative measure of this I have improvised a "coefficient of reliability" defined as $.1 \div [.1 + (\text{coefficient of variation})^2]$. This is not the best such coefficient that human ingenuity might devise, but is frankly a Rube Goldberg gadget which simply corresponds to my intuitive evaluation of the importance of steadiness in water supply. I will rise to defend it against simple misunderstanding or sandbagging, but gladly abandon it to a better alternative.

After adjusting mean annual supplies with this coefficient the acres getting adequate water supply are seen to be much less than they could be.

89,500 acres get some Kaweah surface water. Mean annual flows could supply them nearly four acre-feet per acre. Multiplying by the coefficient of reliability for the River this becomes 1.13 adjusted acre-feet per acre. But, due to the unequal distribution of water and steadiness, the acreage receiving that good a supply or better is only 29,000. These acres receive very good supplies indeed. But they are only 32% of the acres (89,500) that might receive that good a supply.

When we consider further that the 29,000 acres for whose benefit the others are deprived do not include the best combinations of soil and climate, we have a notion of the undeveloped potential in the Kaweah River.

C. Excess diversion capacity.—A third important diseconomy in the system is excessive diversion capacity. One would expect this form the excessive aggregate variability discussed above, but there is more excess than that accounts for. With few exceptions, ditch diversion capacity far exceeds all recorded diversions except perhaps one—one day in 36 years—and that one diversion apparently undertaken in the hope of stretching and/or nailing down a claim to water.

³⁰ Computed from *Kaweah River Flows . . . , supra* (Note 6)

³¹ The percentage increase is greater in the summer months, which are by far the more important ones. Exact figures on this, however, have been derailed in a vacuum tube deep in the bowels of our computer and could not be located in time for this meeting.

The sum of all diversion capacities is 4740 second-feet,³² or 2.2 times the peak of the sum of all diversions reached on June 4, 1952,³³ and 11.5 times the mean diversion.

D. Excess canal mileage.—Excess of canal mileage is one of the more conspicuous diseconomies in the Kaweah system. Probably over two-thirds of it could be dispensed with in a compact integrated system. I have not tried to demonstrate this directly. The indirect evidence happens to be easier to marshal, and it suffices.

1. Scattered service area: The 89,500 acre Kaweah service area is strewn over about 440,000 acres, or five times as much land, which is contained within the perimeter of service.³⁴ Some of the bypassed lands are poor, but some are very good, and better than those getting service, and in general the scatter cannot be rationalized as an effort to apply limited water to better soils. Neither is it an effort to bring surface water where underground water is costly, for there is clearly no such pattern. It is a heedless, haphazard scatter reflecting random historical forces now frozen tight.

2. Overlapping service areas: Shares of the separate ditch companies have traded freely over the area and reached the sort of *reductio ad absurdum* that might be lampooned in an elementary text to dramatize the inevitability of monopoly in public utilities, but which one hardly expects to meet face to face.

Only 12,000 acres are actually served by two or more companies, but the company service areas are scattered among each other most intricately, so that there is much overlapping of the areas within service perimeters. The sum of the areas within the service perimeters of the separate companies is 356,000 acres, or four times the net area served (89,500 acres). One company, the Wutchumna Water Company, is so scattered that it serves only 11% of the lands within its perimeter. Five other companies operate within this same area.³⁵

3. Unintegrated ditches and cross-hauling: Many ditches in this system cross one another, some of them two or three times. A most conspicuous waste are the parallel ditches which work at cross purposes, carrying water in opposite directions, or at least with significant contrary vector components. For example, by long standing tradition (and court order) the River must be split 50-50 at McKay Point between the St. Johns, or northern distributary, and the "Kaweah Branch", or southern distributary. This division has behind it no rationale that I have discovered deeper than that there is a ring of rough and ready justice to "fifty-fifty". The productivity of and demand for water are greater in the south. And so the Ketchum Ditch and Packwood Canal have been built to carry St. Johns' water from below McKay Point back to the southern branch. The Tulare Irrigation District canal goes even farther north to tap the Wutchumna Ditch, whence it crosses both branches (with the most sanitary precaution against intermingling) and proceeds many miles southwest to lands which could be served from one of the natural distributaries of the south branch, Cameron Creek. From this same Wutchumna Ditch the Lindsay-Strathmore pipeline carries water not only back southeast whence it came, but back up hill to lands that the water could reach by gravity *via* an existing aqueduct, Foothill Ditch.

E. Conveyance losses.—The problem has at least two important dimensions.

1. Loss of elevation: From about elevations 650 feet down to 250 feet the Kaweah River falls freely. This drop could hardly be used to generate power, but it could be used to move water southeast at high elevations. The gradient of marginal productivity rises rapidly to the southeast, and uphill, so this would be a very productive use of the elevation. This valuable elevation is completely dissipated in the process of moving water through the present system to low lands that could be served by imported northern waters—if waters must be imported—much more cheaply than the higher and more southerly lands.

2. Channel seepage: Both the natural and artificial channels pass over porous materials and lose large fractions of their flow to the underground. Much of this water is later pumped and used, but it still represents significant loss.

First, much of it percolates in the wrong places, *e.g.* the lower St. Johns channel, where ground water is too high already and the marginal productivity is zero. And once it has sunk it becomes subject to the paramount rights of overlying landowners and is very difficult to export.

³² Computed from *Kaweah River Flows . . . , supra*, (Note 6).

³³ June 4, 1952, is not necessarily the all-time peak of the sum of diversions. The task of computing this series daily for 36 years was beyond my resources. But this was certainly near all-time peak, and far above the normal annual peak.

³⁴ Computed from *Kaweah River Flows . . . , supra* (Note 6), map in back pocket.

³⁵ *Ibid.*

Second, much of it percolates at the wrong time, that is in summer when pumps are busy lifting water from the ground reservoir and surface delivery of this seepage water would save a needless round trip.

F. Inadequate use of the ground reservoir.—

1. Storage use: Below the surface of the Kaweah delta lies a resource that is comparable in value to the river itself, *viz.* a large underground storage reservoir in coarse gravel that is notable for ease of recharge and withdrawal, especially toward the apex of the cone. Like the river the reservoir has high location value, because in this area storage, like water, is scarce. Neither the Kaweah nor the neighboring Tule has a large and economical site for surface storage, and ground storage south and especially southeast from the Kaweah delta is poor.⁵⁶ Clearly this ground storage should be filled in spring and drawn down in summer to regulate the flow.

But many overlying landowners have strong rights in surface water, so hardly need the ground water. And the reservoir cannot be used for the benefit of other lands. California law allows only "surplus" waters to be exported from a ground water basin, and in this area exports have been enjoined. Even if the "foreign" land holder supplies his own water by artificial recharge, wishing only to use the reservoir, he cannot, because the natural and artificial waters commingle underground. When he withdrew the equivalent of what he had "deposited" in this bank it would include some natural water, thereby threatening to establish a prescriptive right which overlying owners would be bound to enjoin.

The Lindsay-Strathmore Irrigation District did, it is true, operate a well-field in this area for several years up to 1952, but was forced finally to discontinue. It had only enough bargaining power to get consent to continue its use until Central Valley Project water became available. Even this well-field used only a small fraction of the underground reservoir capacity.

2. Permanent recharge: In some areas in recent years, recharge of aquifers would have been desirable. One of the most productive uses of water often is to submerge it permanently to support the water table and reduce pump lifts. In aquifers of 10% water-holding capacity, for example, one acre-foot per acre should raise pump lifts 10 feet, worth about \$1.50 a year if three acre-feet per acre are pumped. A dollar and a half a year at 5% would be worth \$30, an exceedingly rough figure, but suggestive of the order of values involved.^{56a}

Recharge has not proceeded as fast as it should. The Tulare Irrigation District, interested in recharge, could not or did not pick up enough water from other organizations. The Kaweah Delta Water Conservation District, whose primary physical function is recharge, has acquired no water rights of its own whatever.

A prime cause is the scattering of irrigated farms among dry farms in the area. Not only are organizational service areas scattered, as described above, but pump-irrigated land is similarly interspersed with dry-farmed land over a wide area.⁵⁷ This pattern of course multiplies the volume of water that must be sunk underground to support water tables beneath the irrigated acreage, and no doubt helps to make uneconomical an operation that would, with compact development of irrigation, often be feasible.

Corresponding to inadequate recharge is the problem of excessive withdrawal. The individual pumper feels no constraint to economize on ground water and accordingly treats it as a free good.

*G. Inadequate reuse of water.—*The early diversions from the Kaweah, which today have fixed priorities based on historical use as well as privileged riparian status, were largely made at lower elevations, toward the bottom of the system. Water so applied drains out of the system with less reuse than if it were applied initially on the higher bench lands.

*H. Segregation of the Kaweah from small local streams.—*There are several small intermittent streams nearby the Kaweah, whose flows aggregate some 20% of the Kaweah's. Generally, the smaller a stream the less reliable its flow, so these waters are largely unusable.

It is interesting to note, however, that these intermittent waters could be made usable by integration with the Kaweah, materially augmenting the area's usable water supply. They rise from much lower watersheds than the Kaweah, so their patterns of flow are different, tending to offset each other and the

⁵⁶ Gardner, Wm., testimony at *Hearings on S. 912 . . . supra*, (Note 15), p. 417.

^{56a} Preliminary studies by Edward Renshaw at the Giannini Foundation appear to yield comparable figures.

⁵⁷ *Water Resources of Tulare County . . . supra*, (Note 13), Map 1; Althouse, Irvin H., *supra* (Note 16), map in back pocket.

Kaweah. When all the flows are aggregated, in fact, the coefficient of variation of the combined flows is little greater than for the Kaweah alone.³⁸ This benefit would flow simply from applying the principle of pooling offsetting risks. However, it has not been done. Rather, as we have seen in II, B, the contrary: the Kaweah itself is unpooled, split up in such a way as to create more risk, regressing from Nature rather than improving on her.

I. Segregation of the Kaweah from the Kings River.—Integration of the Kaweah with its larger northern neighbor, the Kings, has been recommended by most students of the area of an engineering or economic orientation. These include Irvin Althouse,³⁹ a leading engineer of Tulare County; the California Division of Water Resources in its original plans for the Central Valley;⁴⁰ and more recently the Bureau of Reclamation.⁴¹ Some of the advantages would be:

1. The Kings River has abundant cheap surface storage (at Pine Flat), which could be used to firm up the Kaweah, thus indirectly helping to regulate the latter.

2. The Kings has a *relative* water surplus, and its present service area is much cheaper to reach from the north if more supplies are to be imported.

3. The Kings could serve much of the Kaweah delta by gravity, releasing Kaweah water for export southeastward at high elevations into the zone of highest marginal productivity. The Friant-Kern canal could have been shortened into a "Kaweah-south" canal and its cross-section could have been reduced by utilizing some elevation to increase the very low gradient, presently just six inches per mile. These measures would have greatly reduced its high cost, which was incurred by maintaining elevation through the rough foothills between the San Joaquin and the Kings.⁴²

III. THE ROLE OF WATER LAW IN IMPOSING AND PERPETUATING DISECONOMIES^{42a}

I have several times already alluded to the role of water law in the diseconomies described. The present section spells out this relationship more systematically.

A. Productivity not the initial basis of water rights.—

The State has never allocated its valuable waters by putting a rental on their use, neither has it ever sold licenses or titles to the highest bidder. Rather it has followed a mixture of methods whose rationale bears little apparent relationship to marginal productivity.

1. **Riparian rights:** Riparian rights are limited, as we all know, to lands fronting on natural channels. The Kaweah delta with its many distributaries is endowed with more than the usual quota of riparian lands. The Kaweah channels are unusually shallow, as well as absorptive. Ground water gradients, therefore, slope down away from the channels, so that riparian lands in general have the easiest pump lifts and the least need of surface water. Thus riparian rights attach surface waters to the lands that need them least.

These net gains waited upon getting some flexibility into water allocations. They still wait. Not only was local enterprise blocked, but even when outside benefactors, the State and the Nation, offered to cover most of the expenses, the obstacles of water law proved insurmountable.

2. **Appropriative rights:** Appropriative rights, as we all also know, are based on priority of use and ranked by seniority. Rights become appurtenant to lands in the order that they are developed for irrigation.

Now the supersession of lands from less to more intensive uses in our society has almost never proceeded orderly-wise, in compact increments, and irrigation use is no exception. The more diligent early irrigators are sprinkled among dry farmers, and their appropriative rights the same, so that conveyance costs are excessive.

Early appropriative rights are not necessarily biased toward better soils, since dry-farmers on these are under less pressure than those on poor soils to augment their incomes, and are more typically holdouts against innovations like irrigation. Early rights are biased, however, toward soils and locations

³⁸ .52 for the Kaweah and .54 for the combined flows. The coefficients of variation for the small streams taken individually run around .75-.80. Computed from data for 1890-1940 in Althouse, Irvin H., *op cit. supra* (Note 16).

³⁹ *op. cit. supra* (Note 16), p. 97.

⁴⁰ Bailey, Paul. *Water Resources of California*. State of California, Dept. of Public Works, Division of Engineering and Irrigation, Bul. No. 9 (Sacramento: State Printing Office, 1925). Plate IV facing p. 10.

⁴¹ *Central Valley Basin, supra* (Note 18), p. 132.

⁴² Boke, Richard, testimony at *Hearings on S. 912 . . . supra* (Note 14), p. 661.

^{42a} I am indebted to Thomas Crocker for assistance in research for this section, and to Professor Fred Mann for tolerant legal counsel.

better suited to quick-development crops, uses like hay or grain. The slower evolving uses with high per-acre capital requirements, like orchards, tend to join the race too late to get good water, even though they ultimately develop higher marginal productivities than the fast starters. Thus it is that the citrus zone has such inadequate water rights. Not only is land development slow, but extension of ditches to serve these higher lands requires more capital and a longer development period. The earliest pioneers were short on the capital and organization for such projects.

Worst of all, the appropriative system puts a premium on excessive and wasteful diversions. Even before that the "doctrine of relation", which bases priorities on the date the first claim rather than first use, puts a premium on premature and inflated claims, which are a source of enervating uncertainty. But when the chips are down, the courts have generally fallen back on histories of diversion as the ultimate basis for prorating scarce waters. The individual's incentive is, therefore, to divert water whether he needs it or not. It is the accepted means of staking a claim for the future.

Thereby a cost to society—withdrawing water—is made a revenue to the appropriator. Where water was superabundant this may once have served some useful function in accelerating development. Now when water has become scarce it would be hard to contrive a more perverse arrangement.

3. Correlative rights: In California rights to percolating ground water are called "Correlative". They have no statutory basis but are based on court traditions and judgements. Land overlying an aquifer is treated analogously to land riparian to a stream, and correlative rights are limited to these overlying lands. "Surplus" waters may be exported, but the meaning of "surplus" is for a court to decide in each case and on the Kaweah, despite the situations described in II, A, above, the courts have denied permission to export ground water from acres of low to high marginal revenue productivity.

As mentioned above (II, F, 1) the prohibition on exporting ground water also stops "foreign" land holders from using underground reservoirs.

B. *The initial pattern is frozen.*—The initial pattern would be of limited concern if it could be altered to meet changing demands. But under prevailing water laws, water users are insulated from social opportunity costs. The State charges no economic rental for the use of its waters, or indeed any rental at all. The counties hardly tax water rights (unless held by rich outside cities). Nor is there much appreciable implicit opportunity cost felt by the individual because he cannot easily sell surplus waters even if he wants to. The last point bears elaboration.

1. Allegations of transferability: It is generally recognized that riparian and correlative rights are not transferable, but several writers have alleged that appropriative rights are. S. T. Harding in 1936, seemingly in a glow of optimism over *Peabody vs. Vallejo*,^{42a} could write that "economic pressure will eventually result in the available water supplies' being used where the greatest return will be secured",⁴³ but this was little more than an expression of faith and hope. Several other allegations of transferability ultimately trace back to a citation in Wells Hutchins⁴⁴ wherein he discusses some of the possibilities of and obstacles to transfer in various states. But the discussion is purely legalistic with no purport of economic analysis or quantitative evaluation, and certainly should not be asked to bear much weight as a demonstration that any significant volume of our water resources are effectively transferable in response to ordinary economic pressures. To my knowledge there is no such general demonstration, but only a belief in some quarters that one exists.

2. Kinds of transfers achieved on the Kaweah. Certain limited kinds of water transfers actually have been effected in the Kaweah system. The most common kind is the sale of shares in Mutual Water Companies. There has been an active and continuing market in these shares, among individuals and areas. In general, the movement has been in economical directions, from north to south. Big buyers have been the Irrigation Districts: The Lindsay-Strathmore, Tulare and Corcoran. Biggest sellers have been shareholders in the Wutchumna Water Company, which had an undoubted surplus.

^{42a} 2 Calif. (2d) 351, 40 Pac. (2d) 486 (1935)

⁴³ Harding, Sidney T., *Water Rights for Irrigation*, *supra* (Note 4), p. 46.

⁴⁴ Hutchins, Wells, *Selected Problems in the Law of Water Rights in the West*, USDA Misc. Publication No. 418 (Washington: Government Printing Office, 1942) pp. 378 ff.

3. Uneconomic aspects of these transfers: Transfer of water company shares has bemused several water economists recently as a means toward that workable water market most of us would postulate as an ultimate goal.⁴⁵ Unfortunately, these are drawbacks to this type of transfer which severely narrow its potentiality.

(a) Fixed point of diversion. The buyer of Mutual Water Company shares in California must use the selling company's diversion works, however inconvenient. In 1928, Lindsay-Strathmore Irrigation District, having bought shares in several downstream Mutual Water Companies, sought to divert its share of their waters by gravity through Foothill Ditch from a higher diversion point. The courts enjoined this,⁴⁶ requiring Lindsay-Strathmore to let the water flow freely downhill to the Mutual Water Companies' diversion works, tap onto the individual ditches below their heads, regather the waters and then pump them back uphill. These requirements precluded most of the transfers, and imposed extra costs which consumed much of the net benefits from the one such transfer that was consummated (from Wutchumna Water Company).

Tulare Irrigation District, which lies below Wutchumna Water Company, in order to divert its share has had to build the long canal previously described, paralleling the Kaweah Branch and crossing both branches to tap the Wutchumna Ditch near Woodlake.

Thus the Kaweah water distribution system has had to grow physically in a manner analogous to the law itself, with one principle hanging on another back to the ancient and ultimate fountainheads of authority. It is questionable whether circuitous transfers of this sort are desirable at all, even if each individual operation shows a net gain. For as one ditch is tacked on to another, more and more interests become vested in an increasingly absurd tangle, and the hope of rationalization recedes even further into the realm of unattainable visions.

(b) Short run inflexibility. The flexibility achieved by sale of shares is largely long run. Within some areas there is some leasing, but between companies it would usually be necessary to extend a ditch to effect a transfer. There is lacking a planned excess ditch capacity such as is necessary to allow much flexibility. The process of transfer is slow and sticky, whereas demands fluctuate continually and to a degree unpredictably.

(c) Deconsolidation of service areas. Individuals selling shares give little heed to the overall effect on distribution costs, so the company service areas are shot full of holes, resulting in the pattern of scattered and overlapping service areas noted above. (II, D).

(d) Limited area of transfer. The transferability of Mutual Water Company shares is limited to the Kaweah delta area. Areas of high marginal productivity outside the delta cannot get Kaweah water this way (or any other way). This point was decisively settled by the out-of-court treaty closing the "17-years war" against Lindsay-Strathmore. While this one persistent district was finally vouchsafed an interim supply until Central Valley Project water should arrive, there was clearly no hope for other citrus lands, none of whose owners have since found the temerity to try to tap the Kaweah.

4. Kinds of transfers blocked: Other types of voluntary transfer have been blocked almost completely.

(a) Riparian rights. Riparian rights in California are "part and parcel" of land and transferable only by extinction. The same holds for Mutual Water Company shares based on riparian rights.

Riparian rights are not good for storage. If a riparian claimant wants to store water he can do so only by filing as a junior appropriator and taking his place at the end of the line. Since the Kaweah is all "claimed up" this would avail him nought, and if he sought to put water at the end of the line by abandoning his riparian claim he would find this water completely swallowed up in the inflated claims of prior applicants.

A riparian, therefore, has little choice but to insist on maintenance of the natural flows he claim and use them without any storage regulation. Transfer of these waters to storage is legally impossible, in the normal course of events.

(b) Correlative rights. Like riparian rights these are completely nontransferable.

⁴⁵ Anderson, Raymond L., "Operation of the Water Rental Market in the South Platte Basin", 42 JFE (5): 1501-03 (December, 1960).

⁴⁶ "The Irrigation Water Rental Market: a Case Study." *Agricultural Economics Research* 13 (2): 54-58 (April, 1961).

⁴⁶ *Consolidated Peoples' Ditch, Co. v. Foothill Ditch Co.*, 205 Calif. 54, 269 Pac. 915 (1928).

(c) Appropriative rights. The basic legal presumption is that appropriative rights are transferable, and sometimes they have been transferred. But there are many hurdles to cross which, in their cumulative effect in the Kaweah area, have the effect of complete prohibition.

(1) Uncertainty of tenure. An appropriator does not not "own" a water right. He has a permit or a license to use the State's water. Appropriators would like to have these licenses regarded as firm property rights, and in part they have succeeded, but only in part. The law is equivocal, now asserting the State's ownership, now deferring to the licensees' "property" rights, and in the last analysis will no doubt, like Mr. Dooley's Supreme Court, follow the election returns. Meantime appropriative rights are left hanging in a tenuous limbo, the judicial reflection of public schizophrenia.

The appropriators' position rests on a kind of mystic philosophy that value is entirely created by use, a *mystique* that will not bear analysis and so must deny much of the rationalism associated with the commercial revolution. This *mystique* is roughly violated, and the acquiescent public outraged, by the spectacle of licensees "trafficking" in their privileges and measuring them in the balance with something so profane as money.

Some of this attitude rubs off on the licensees themselves, many of whom put water rights in a class with family heirlooms and heap social disapproval on any of their number who would sell, the more so because publicity attending sales at high prices might weaken the already shaky position of licensees generally, expose them to regulation, taxation, or royalty charges, and rouse opposition to their receiving subsidized reservoir services from Federal agencies. And so there is a strong bias against commerce in appropriative rights. By its nature the relative strength of this factor is impossible to quantify, but in my observation and judgment it is appreciable.⁴⁷ It has some measure in the zeal with which landholders agitate to have Federally developed and delivered waters made "appurtenant" to their lands.

(2) Marginal adjustments. Ordinarily an appropriator with surplus water would not want to sell his entire supply, but only the surplus, that is the part whose marginal productivity falls below its opportunity cost. It is doubtful if a licensee could guarantee the buyer a good title in such a transfer, however, because the validity of the license rests on historical beneficial use, and sale of surplus water could and doubtless would be seized upon by thirsty junior appropriators as evidence that the water never had been used "beneficially" and should revert to them.

Thus a licensee cannot sell something as good as what he has because the process of sale weakens the license. A strong bias against change inheres in the system.

3. Rights held by water-users' organizations. Additional difficulties beset transfers of water rights when these are held by Mutual Water Companies or Irrigation Districts. Since most water rights on the Kaweah and in California are so held, these special hurdles are of prime importance in any discussion of water-right transfers. Curiously, however, I have found little such discussion, so that what follows must be partly the conjecture of a guardhouse lawyer. If it is seriously misleading, I hope it will at least irritate some real lawyer into publishing a definitive correction.

Mutual Water Companies and Irrigation Districts hold property and water rights as trustees for the beneficial owners, the served landholders. The landholder is more than an ordinary shareholder in a Mutual, or a voter in a District: he is the beneficiary of a trust. The law presumes that the trustees will continue the customary service to the customary beneficiaries in the absence of some new condition which a judge finds compelling and persuasive.

Just what a judge might deem compelling and persuasive is sometimes hard for an economist to fathom. I have found no clear-cut decision authorizing a

⁴⁷ The "Chicago School" approach of Drs. Hirshleifer, De Haven and Millman is doomed to frustration, I believe, for failure to acknowledge this aspect of the problem. They argue most persuasively the benefits to flow from removing barriers to transfer of water, their means being to strengthen absolute private property control over water. (*Water Supply* [Chicago: University of Chicago Press, 1960], pp. 222-54). But to convert a conditional into an absolute "Giveaway" is to clarify the issue of distributive equity to the degree that the public will become aware of it. So long as the licensees are ascendant they are unlikely to tolerate market transfers that risk arousing the public; while if the public were ascendant, it would not likely abandon all interest in its waters without exacting some *quid pro quo*. We are not likely to achieve the benefits of market allocation of water rights without an unequivocal resolution of this incertitude: the licensees gain full control of the water by buying or (I think preferably) leasing it from the State.

Mutual or District to sell water rights. Nor have I found any instance where one has done so, save to another organization serving the same lands.

But there are several instances of conveyances' through sale or foreclosure being enjoined.⁴⁹ Since there are scores of Districts and Mutuals with surplus appropriated water they should but do not sell, it seems that judicial interpretation of the trustee relationship has virtually prohibited sale.

The would-be seller is pinched between the devil and the deep, for on one hand he must satisfy the courts that he is not depriving any litigious trust beneficiary of something of much value, and on the other hand that the District or Mutual has a valid appropriation to convey, based on beneficial use. An economist might feel he could resolve such a dilemma to the mutual benefit of all parties, but economic concepts are not to be presumed as among the intellectual equipment of jurists, especially in the lower courts. So the trustees play it safe by hanging on to all the water they can for such future use as it may have to them. It is effectively withdrawn from commerce in a *mortmain* grip as deadly as that fastened on the lands of medieval Europe.

4. Point of diversion. In transferring an appropriate right one may shift the point of diversion only if no one is damaged. The most economical transfers in the Kaweah area would entail shifting points of diversion, as we have noted. But today one cannot shift any point of diversion without damaging or at least discommoding someone else.⁵⁰ One could seek an agreement from him not to press his claim, but his ransom is not necessarily limited to actual damages. No point of diversion has been changed on the Kaweah during the period this study covers most intensively, that is back to 1919; and the general patterns of uneconomic diversions still extant go back at least to 1880, when they were roundly condemned by the California State Engineer.⁵¹

IV. THE DYNAMIC EVOLUTION SHAPED BY WATER LAW

Professor Wantrup has remarked that a system of water law should be judged over time,⁵² and the point is well taken. But if this is to imply that the judgment will thereupon become more favorable, it is not.

The effect of water law on economic development is to reinforce other economic and political pressures working toward premature over-development of new lands, a process already past the point of no return today. Let me expand on this perhaps startling asseveration.

A. *Marginal vs. monumental adjustments.*—Legal perception of economic values is too crude, as we have seen, to effect or even to permit of marginal adjustments among local water-users. Yet Justice is not entirely blind. It is more to be likened to the near-sighted Mr. Magoo who does respond, however inappropriately, to the major outlines of things. After the water-seeker has ranged far enough from home, and crossed several underused streams, he ultimately reaches one in which the courts will acknowledge the existence of a "surplus".

He finds the courts little concerned with any monetary comparison of productivity F.O.B. the source. Such comparisons might leave him with a negative or very low net product, after deducting his high conveyance costs. But the law is disposed to count that in his favor as a mark of sincere purpose and acute thirst.

Panglossian philosophers may point to this as evidence that water law is, after all, dynamic. On the Kaweah, it is true water law has attained to a nearly perfect degree of stagnation which the law contemplates with equanimity. But this has not stopped, indeed it has materially accelerated great inter-regional transfers of dimensions that dwarf the Kaweah.

⁴⁹ Copeland *et al. v. Fairview Land and Water Co. et al.*, 165 Cal. 89 (1913); Bent v. Second Extension Water Co. *et al.* 51 C.A. 648 (1921); Hutchins, Wells, *Mutual Water Companies in California* and Utah, Farm Credit Administration, Cooperative Division, Bulletin No. 8 (Washington: Gov't. Printing Office, 1936), pp. 87-91, 137-38; Tulare Irrigation District v. Collins, 154 Cal. 440 (1908). "An Irrigation District owns no lands in a proprietary sense, and its property is owned by the State and is held only for governmental purposes".—Allen v. Hussey, 225 Pac. 2d 674, (1950); 101 C.A. 2d 457 (1951).

⁵⁰ On the neighboring Kings River a few changes have been possible, but only downstream.—Clarence Smith, Kings River Water Master, in interview, 1958. The General need, however, is for upstream shifts, and these are blocked by intervening land holders with interests in channel seepage.

⁵¹ Hall, Wm. H. *Report of the State Engineer to the Legislature of California*, Session of 1880, Part I (1880), pp. 33, 35, 36, 105-17 *et passim*. Hall's observations applied specifically to the Kings, Tule, and Kern, which border on and overlap the Kaweah service area.

⁵² Wantrup, S. V., "Conceptual Problems in Projecting the Demand for Land and Water", Giannini Foundation Paper No. 176 (Berkeley: 1959) mimeo., p. 14.

Thus the water law as a whole does not simply resist change. Inexpensive little local economies on the Kaweah meet a stone wall of judicial disapproval, but water law opens up wide avenues for monumental projects to effect grand interregional transfers.^{51a} Rather than block development, it biases development toward remote sources. This is the dynamic growth pattern imposed by water law. If we wish to criticize the law, it must be on grounds that the type of change it promotes is less desirable than the alternatives.

B. Drawbacks of monumental projects.— Monumental interregional transfer projects have captured the imaginations of the State's voters and politicians to the extent that they now dominate water development. It is my thesis that this type of development is leading to overexpansion.

1. Size of increment. A remote import must usually be a large one for several reasons. First, to be economical at all it must realize scale economies springing from the fact that canal cross sections increase out of proportion to their cost. Second, it requires strong political support, to secure both water rights and State or Federal financing, and for these purposes it must have a large service area. Third, this service area typically has scattered irrigation developments, and to keep project distribution costs within bounds it must plan to serve the included dry lands as well. Likewise, in recharging underground reservoirs, it must import enough to recharge the entire area over which irrigation is scattered. Fourth, the political conjuncture which permits the region to import water is an opportunity to be fully exploited, and the beneficiaries will try to stake claim to as much water as possible.

So a remote import is likely to be a large one, an indivisibility in economic development, in contrast to the continual fine adjustments that would be possible under a more flexible system of water law. In the Kaweah area the increment from the Central Valley Project is in fact several times the local supply. The Friant-Kern Canal with 4,000 second-feet capacity can import most of the San Joaquin River, whose mean annual flow of nearly two million acre-feet is about four times the combined means of the Kaweah and Tule Rivers. More, this is regulated water from Millerton Lake. Almost one million acre-feet is to be Class I water delivered on demand. The increment to summer water is much greater than 400%.

The potential impact of this increment has been concealed, among other ways, by the belief that much of it would go to overcome overdraft. But the annual overdraft is of a much smaller order than the San Joaquin imports. Equally important, there is no basis for assuming that irrigated land development will cease when water equilibrium shall have been attained. There are no controls on pumping and nothing (except market collapse) to stop development short of another overdraft. But in fact, before this becomes an issue there will be a question of how to dispose of the waters now used for recharge and soon to be available for other uses as that operation is completed.⁵²

In terms of acreage, size of the increment has been concealed by most of its having gone into alfalfa, pasture, and cotton, whereby the impact is absorbed by nationwide markets or government storage. But these uses could never justify the cost of the Central Valley Project. They are lower uses in an area of excellent soils and superlative climate suited for horticulture and winter vegetables. It is only a question of time before these slower-developing, higher-yielding farm enterprises lay claim to much of the new water.

But here the impact will be overwhelming. Three local products of which California produces most of the nations' supply are plums, freestone peaches, and navel oranges. These supplies come from the following acreages: plums, 21,000; freestones, 36,000; navels, 65,000.⁵³ In the last five years, new non-bearing acres of these (and other) tree fruits have turned up sharply, reversing long declines. The potential acreage increments of 10% or 20% have aroused consider-

^{51a} For a more general criticism of monumental transfer project see Hirshleifer *et al.*, *op. cit.* (Note 47).

⁵² In their commendable zeal to maintain the Government's bargaining position in drawing up water contracts, Bureau of Reclamation officials have understandably tended to minimize this eventuality. See for example, *Hearings on S. 912 . . . supra* (Note 14), pp. 710 *et passim*. Whether their prognostications of continued high demand are correct is a question of fact which I am content to leave to the verdict of events. The current drought forestalls the emergence of a surplus, but on the other hand helps stimulate more new water supply developments that in the long run may aggravate the over-supply.

⁵³ Dean, Gerald W., and McCorkle, Chester O., *Trends for Major California Fruit Crops*, California A.E.S. Extension Service Circular 448, 1960.

Sherwood W. Shear of the Giannini Foundation has been more than gracious in supplying acreage and production data. Neither of the above is implicated in the use of the data here.

able anxiety, as well they might, the moreso because they are more intensively planted than the old with better stock. But they are as nothing compared to the eligible acres now newly supplied with water from Friant-Kern. The increment of almost one million acre-feet per year of Class I water, and additional Class II of variable water, could support 300,000 or 400,000 new acres, far more than markets could absorb in the foreseeable future. This one project has brought water supply to so much potential fruit land that fruit land as such is hardly any longer a scarce economic good. Scarcity today attaches only to producing groves, and tomorrow perhaps not even to them. Only this relationship is not yet reflected in land prices, whose inflated levels lend a specious plausibility to the Project still.

2. Slow response to changing demands. Another serious drawback of remote imports is the long lag between stimulus and response. Lindsay-Strathmore's wells began striking boron in 1913. Friant-Kern water reached them in 1951, 38 years later. Meantime the area's high potential citrus development was arrested completely, and other regions filled the gap. The scale economies of monumental projects are to be considerable discounted on account of their ponderous immutability. They are slow-a-building, and once built they are slower to liquidate. They cannot be rolled up when obsolete, and they pay out slowly if at all.

3. A cycle of over development. A response which is both slow and excessive is the basic element in a cycle of over development along the lines of the classic cobweb theorem (corn-hog cycle). Only with land and water development the period is much longer, the mistakes irreversible, and the excesses much greater for several reasons I will mention.

(a) Lag of private land improvement behind public works. To increase public water supplies rarely results in commensurate increases in the products of irrigated land until long after, because private improvement of the lands made irrigable lags many years, decades in fact, behind the public works.⁵⁴ Thus, the price effects and capital requirements of the incremental land supply are deferred and concealed until the project and its several features are committed past the point of no return. The long developmental period of tree fruits lends itself to its own cycle of overexpansion anyway. When this is combined with the lag in building large water supply systems the lags and accompanying perils of overexpansion are multiplied.

(b) Incitement of other projects.

1. The price umbrella. Lagging private development of project-served lands holds a price umbrella that entices more starts than markets can ultimately absorb and for which capital can be found at feasible cost. The high prices bring on competitive starts of several kinds. Private lands in older irrigated areas are intensified, for which the sloppy developments of the past leave considerable scope—in fact, if lands served by pre-Central Valley Project water supplies were developed to capacity, there would be little need for new public water supplies. Lands in the new project area are planted at high standards of intensity based on high land values that do not accurately reflect the impending abundance of raw land.

Most striking of all, entirely new water supply projects are begun. To a degree this is simply analogous to what has happened in land cycles of every kind throughout our history. But water law is responsible for amplifying the cycle in ways besides those already mentioned.

2. Racing for water rights. When one region goes foraging about the whole State for "surplus" waters, this naturally awakens anxieties in others lest they lose out. They seek to nail down claims that others cannot jump. The surest means to this end is to begin developing waters to establish a history of use. It takes little imagination to anticipate the result, which today one observes throughout California: premature interest in developing water ahead of need.

3. Logrolling. Monumental interregional transfers are usually too costly for local finances. They are undertaken with State and Federal subsidies. This incurs political debts to be repaid in kind, less on a basis of economic productivity than of political bargaining power. There must be something for everyone, or at least for enough legislators to constitute a working majority. And most projects need to be started before any is completed, lest late starters lose their bargaining

⁵⁴ Teale, Ray P., *The Economics of Land Reclamation*, (Chicago: A. W. Shaw Co., 1927), pp. 99–100.

⁵⁵ *Land Reclamation Policies in the United States*, U.S. Dept. of Agri. Bulletin No. 1257 (Washington: Government Printing Office, 1924), p. 15.

⁵⁶ Huffman, Roy, *Irrigation Development & Public Water Policy*, (New York: The Ronald Press, 1953), pp. 61–62, 81.

power. This process clearly lends itself to the cycle of overexpansion, too: the impact of the first project is suppressed by non-completion until the later ones are well underway. This is the sort of process by which Indiana went bankrupt in another kind of canal boom that busted in 1836.

C. Current overexpansion of water supply projects.—J. K. Galbraith has won wide support for his thesis that we put too small a portion of our resources into the public sector. While this may be true in comparing tail fins vs. school rooms, it can be very misleading in comparative private vs. public contributions to land and water development. Public water supply works stand ready to serve far more land than private capital has improved to use the water.

This is not a new phenomenon. David Weeks & Charles West documented it extensively in 1927 in their classic *The Problem of Securing Closer Relationship Between Agricultural Development and Irrigation Construction*.⁵⁵ They noted that capital flowed into public water supply works much easier than into corresponding private farm improvement, with a resulting lag, serious imbalance, and ultimate overdevelopment of irrigated land. Their judgment was abundantly confirmed in the ensuing collapse of land values.

The premature excessive public works they observed were the product of local enterprise almost entirely. To redress the balance would seem to have called for diversion of capital from public works to individual land improvement. Yet instead the last 25 years have witnessed the opposite, and on a scale hitherto undreamed of.

First, the value of the tax-exempt feature of local bonds has risen along with personal income tax rates. In the 1920's these bonds often sold at big discounts: today at handsome premia.

Second, local water enterprises receive new State and Federal subsidies, under the Small Projects Act, the Davis-Grunsky Act, and interest-free loans from the Bureau of Reclamation.

Third, Irrigation Districts and private power companies have cemented an effective working alliance whereby the power company borrows the Irrigation Districts' immunity from local property taxes and pays for it with free water. This is a big factor in the estimated one billion dollars worth of local projects now under way in California.⁵⁶

Fourth, the Army Engineers have gotten into water supply under guise of flood control, especially since the Flood Control Act of 1944, and are planting Federal projects in hitherto neglected sites all over the State, including Terminus on the Kaweah, and Success and Pine Flat on its neighbors the Tule and Kings.

Fifth, the Bureau of Reclamation, once a negligible force in California, has contributed the Central Valley Project and its slowly proliferating appendages.

Sixth, if all this were not enough, we add now the Feather River Project, whose \$1.75 billion bond issue is conceived as only a beginning on an overall California Water Plan.

Finally, seventh, Secretary of Interior Udall announces that the U.S. has shirked its duties and will increase its contributions to water supply development.

There has been no commensurate stimulus to the flow of capital into improving private farm lands. On the contrary, higher personal income tax rates, in conjunction with the various capital gains loopholes, have encouraged much more land buying to reap price increments without land improvement, a type of behavior that has previously played a central role in creating this problem even without such added stimulus. Indeed it is only in the last five years or so that bearing acreages of most of California's distinctive speciality crops have ceased contracting.⁵⁷ Here is the bottleneck that has held back output and sustained the prices on which the whole mammoth structure of public works is premised. Modest increases of a few thousand bearing acres, soon finally to be forthcoming, are adequate to meet the market demands that ultimately must justify investments in water supply.

Irrigation is new enough in American history that it has figured in only two major land collapses, 1893 and 1929. But in those two it figured prominently, through excessive expansion of water supply works for undeveloped lands. "Too much, too late" has characterized the *dénouement* of each cycle. There is evidence that we have moved too far on the same course again.

⁵⁵ Univ. of Calif. College of Agriculture, Agri. Expt. Sta., Bulletin 435 (Berkeley: Univ. of Calif. Printing Office, 1927).

⁵⁶ *Western Water News*, October, 1960.

⁵⁷ Dean and McCorkle, *op. cit.* (Note 53).

In this cycle water law, while not solely responsible, plays an important role. It is water law that blocks the economical use of the best waters, compelling recourse to marginal sources, gigantic projects, and State and Federal financing with consequent log rolling. It is water law that sets region racing against region, and agency against agency to establish use rights ahead of need.

And so when we view water law in the dynamics of development the view is more illuminating, but not more complimentary. How serious the defects, again I am willing to leave the verdict of events.

V. CONCLUSION

In this paper I have sought to expound the conclusion I have reached from observation of water use in the Kaweah area, that water use is grossly uneconomical. I have laid the blame where I believe it belongs, on the doorstep of water law. I have gone on to show how water law contributes to the cycle of overexpansion which has run so far along today.

I have not suggested, save by indirection, alternative policies, nor will I impose further on your patience by doing so now. But assuredly, if it be established that present policies are intolerable, the moulding of new is the greatest challenge facing our profession.

EXCERPT FROM "COORDINATING TAX INCENTIVES AND PUBLIC POLICY : THE TREATMENT OF LAND INCOME"

(Mason Gaffney—Presented at The Brookings Institution, May 1969)

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A. INTRODUCTION : TAX REFORM AND PUBLIC GOALS

In the last few months the demand for tax reform has suddenly loomed into a towering force that will be served. Fixed postures of either satisfaction or fatalism have become ludicrous; old bastions indefensible. Here we stand, bewildered and unprepared as usual, as the opportunity of a generation passes before us.

This paper is an effort to pull together a systematic outline of one set of accumulated tax outrages, those bearing on land. I follow press releases, and scholarly and treasury and commission and task force releases on the subject with a growing impression of incompleteness, of a tendency to settle on one or two points as the major abuses to be remedied. These make it altogether too easy, and seriously underestimate the diligence and ingenuity of tax-avoiders, who have gone far towards converting the income tax into essentially a payroll tax, and who will not be put squarely in the income tax base with a few simple strokes. Nothing less than a thoroughgoing shakeup of the tax treatment of land income will avail. And this is exactly the time when such a project, hitherto a pipe dream, may be seriously entertained.

Distributive equity is one purpose; allocative efficiency another; employment and growth a third; international standing a fourth. We are not just interested in taxing property income, but in creating a good incentive pattern that respects the market and harmonizes with a host of public policies. Some major policies to be served are these:

1. Timely urban renewal. "Timely" implies an optimum, neither post- nor pre-mature.
2. Create employment opportunities, especially where needed most.
3. Economize on capital. This is an era of sharply limited disposable capital with urgent competing demands.
4. Counter inflation. This means encouragement of investment with short pipelines to consumer markets and quick supply impact. A counterpart of 3.
5. Contain urban sprawl. Again consistent with 3, for sprawl wastes capital.
6. Ample housing. This is where more capital should go, with quick supply impact.
7. Encourage small business, combat concentration of economic power.
8. Distributive equity. Most loopholes are tailored to the needs of those with large net worth and are regressive.
9. Clean air and water.
10. Decentralize detailed planning.

By local officials, subject to state and national needs.

By the market. Tax policy should if possible lubricate sticky markets; and certainly not gum them up. It should make them respond to local planning powers.

11. Strengthen balance of payments. Consistent with 4, but also requires maintenance of competitive after-tax rates of return to investors with migratory (non-land) assets.

B. TAX TREATMENT OF LAND

1. The income tax.

Favors to investors in new capital goods, such as accelerated depreciation, expensing, and the 7% investment credit, have positive macro-economic and balance-of-payments effects and may be necessary in spite of possible regressivity. Favors to land, on the other hand, have no macro-economic or allocative virtues to offset their distributive vices. It is not that economic land supply is altogether "fixed"; but the growth that occurs is not primarily a function of the private landowner as such. Rather, public spending plus the spillover benefits from the enterprise of neighboring land users enhance the potential service flow of land. It is these, rather than the landowner as such, whose motivation needs to be the concern of the framers of functional institutions.

It is possible to retain many tax advantages now essential to motivate private investment in real estate, and still collect as much or more taxes from real estate, by bearing down on the loopholes specific to non-functional land income. The following analysis seeks to identify these.

My explicit reference, unless otherwise noted, will be to the Federal personal income tax. Most of my points, however, apply as well to the Federal corporate tax, and the various state personal and corporate taxes.

I begin with an outline, a sort of Mendeljev Periodic Table which may help us find new devices as well as order the old.

- (a) Covert write-off of undepreciated and appreciated land value.
- (b) Exemptions.
 - i. Imputed income.
 - ii. Unrealized appreciation.
 - iii. Capital gains at death.
 - iv. Bequests.
 - v. Capital gains of exempt owners.
- (c) Deferral of tax on realized appreciation.
- (d) Capital gains rate on appreciation, ordinary offset on losses and carrying costs.
- (e) Deferral of tax beyond date of sale.
 - i. Sale of residence.
 - ii. Barter.
 - iii. Installment sale.
 - iv. Prorating of principal and interest.
 - v. Profit participation by seller.
 - vi. Condemnation.
- (f) Deferral of land-use income where there is intertemporal dependence of income.
 - i. Sacrificing early rents for higher later rents: "implicit expensing" of capital investment.
 - ii. Explicit expensing of early operating losses to appropriate position.
 - iii. Explicit expensing of capital outlays by "farmers."

(a) Covert write-off undepreciated and appreciated land value.

Land is non-depreciable for tax purposes, in deference to its physical indestructibility. If a non-depreciating asset were to be written off, its income would achieve complete tax exemption, as follows. Let t be the income tax rate. When the tax payer writes off the asset, he reduces his tax liability by that amount, and his tax payments by $t\%$ of that amount. Now the Treasury has put up $t\%$ of the value of the asset. It also receives $t\%$ of the income of the asset. Thus the Treasury simply receives a return on its investment. As for the owner, he has now invested only $(1-t)\%$ of the value; and he gets $(1-t)\%$ of the income. On his equity ¹ he would earn a tax-free income in perpetuity.

¹ I assume 100% equity financing, for expository simplicity. Actually the game is leverage, and the mortgaged landowner who writes off land could easily end up receiving income on no equity at all.

The way to write off land is to buy it with an old building or orchard, etc., and allocate most of the cost to the capital, which is depreciable—and if its remaining life is short, rapidly depreciable, especially if the owner avoids repairs and maintenance. The IRS has no well-organized defense against this. Harold Groves reports cases of taxpayers even depreciating adjoining vacant lots! IRS invites taxpayers, if challenged, to use the land: building allocation reported by the local tax assessors as evidence supporting their allocation. In my research I have found these allocations consistently understate the land component by a very large factor. IRS lets owners use very short tax lives—10 years is about par—on slums and old farm buildings.

Covert write-off of land is a factor above and beyond the multiple write-off of buildings. This latter is a more or less intended consequence of accelerated building depreciation which reduces book value of the depreciable asset to below its remaining resale value. Land depreciation occurs when the buyer of an old building allocates less value to the land than it had originally, even though it has not declined; or allocates the same, even though it has risen.

There might seem to be recapture of land write-off when one sells and pays a tax on the excess of sale price over book value. But this tax is twice diluted. First, it is deferred until sale, whereas write-off came earlier. Second, it is at capital gains rates: write-off was from ordinary income. If the owner never sells there is never an occasion to recapture.

But actually taxpayers can do better by selling. For the buyer starts writing off both land and building all over again—never mind how many times it was done before. Thus land, which the law says is not supposed to be depreciated at all, is written off several times. The only proviso is that it must remain under an old building.

Were it not for this device, the income tax might serve to promote urban and rural renewal. Once the initial cost of a building was completely written off, accelerated or not, its current cash flow would be fully taxable.³ Because it would be pure ground rent, a non-depreciating income source. Thus in the year after the last allowable write-off, the owner would suddenly face a much higher tax bill. If he wanted a tax shelter in real estate, he could get it only by actually building; not by redepreciating old capital.

But under present practice the surest way to lose the privilege of depreciating land is clear it and erect a new building. For then the IRS, seeing through a glass darkly, finally perceives that what you bought—if you just bought—was not the depreciable building but the non-depreciable site underneath it. It denies write-off. Even demolition cost is non-depreciable. Or, if there was no recent purchase, they let one depreciate only the cost of building, not the land. The net effect: you can depreciate land so long as you do not improve it.

Thus the tax law biases owners of older buildings to delay renewal, to milk the last drop of tax shelter out of old buildings before releasing the land for new. It raises the "defender" value of land—the capitalized value of the extant building—relative to the "challenger" or renewal value of the cleared site in the best succeeding use. Thus it increases the renewal gap (defender value less challenger value) that must be met by subsidy. Renewal subsidies are soaked up by land write-down, leaving less for the constructive employment-generating investment in rebuilding and actually supplying housing.

(b) Exemptions.

i. Exemption of imputed income.

Durable goods use for the owner's consumption yield an income "in kind" that is not taxed. The price of land is more affected by this than is that of other assets because the service flow from land is 100% income—no wearing out. The price of appreciating land is even more affected. The untaxed service flow is supplemented by an untaxed growth of value each year stemming from progressive increments to the tax-free service flow. A depreciable durable good, on the other hand, must be of about 40 years life before the income flow equals the flow representing recovery of capital.

The availability of land that builders might use is reduced in urban fringes by the high propensity of the affluent to "reside" over considerable acreage. Teamed with large-lot zoning (which holds down assessed values and property taxes), expensing of taxes and interest, expensing of "conservation" investments, capital gains on breeding stock, indefinite deferral of tax on sale of "residence," and a

³ Indeed, if a building underwent locational obsolescence due to land appreciation, write-off should end before the life originally contemplated, as soon as the "challenger" land value equalled the "defender" value of land cum old building.

host of favors to deferred land increments (all to be treated later), this exemption of imputed income serves greatly to fortify the holdout power of landowners of the "mink and manure" set that surrounds every city. Nearer in, the imputed income of elderly widows is likewise enhanced by its exemption from taxation.³

It is true, of course, that buyers of new homes on this same land would also enjoy the exemption of imputed land income, partially neutralizing the bias. But there is normally a tax bracket differential—appreciating suburban land gravitates to the strongest hands. Higher prices mean higher credit barriers all around, screening out the poor. Where the new use is an apartment there is no offset at all⁴—that is, there is a total and unmitigated bias against renters, a factor hitting low-income people with differential severity because of their low net worth. Finally, open space as a consumer good is clearly a superior one—indeed, throughout history it has been the ultimate luxury, the highest mark of status—and its tax exemption is worth much more to those who have risen farthest above subsistence. Those who would normally consume more open space anyway do so tax free while they contemplate with supplemental pleasure the untaxed appreciation of their net worth.

ii. Exemption of unrealized appreciation.

The form of income known as capital gains is not taxed until realized by sale [*Eisener v. Macomber* (1920) 252 U.S. 189, 40 S. Ct. 189].

If the land is never sold, there is no tax. Some landowners therefore prefer to lease ripe land rather than sell—prominent examples are the Irvine Ranch of Orange County, California, and the Big Five of Oahu. Others prefer to buy many years in advance of their own anticipated needs, even very conjectural ones. When and if the needs materialize, they have on tap needed land, now of high value, acquired at a low value. The difference is tax-exempt income. The motive is strengthened by, and mutually strengthens, the motive to acquire advance reserves of a raw material whose supply is jeopardized by the absence of a vigorous free market. The combination magnifies the area of idle reserves which individuals and firms find it advantageous to hold. Thus it raises the holdout price of land.

iii. Capital gains at death.

Capital gains taxes on appreciated assets are forgiven at death. There are death taxes to pay instead, but these would also be due on whatever asset was substituted for appreciated land. It is therefore folly for individuals to sell appreciated land during a period of several years before death. Elderly owners in their declining years are obviously below average in enterprise, so their land is often just held off the market, "locked-in".

iv. Bequests.

Eleemosynary bequests of appreciated land enjoy exemption from capital gains tax; yet they are fully deductible at appraised value, and their carrying costs are expensible. Thus the taxpayer can deduct a value which he has accumulated tax free, in addition to enjoying the prestige and satisfaction of supporting his favorite church, college, tract society, or foundation. This adds to the motives to hold land for appreciation. The same is true for the factitious book capital gain created by having written off land (or having depreciated buildings too fast).⁵

Another aspect is the gift with life estate. Under this arrangement, the taxpayer deducts the appraised value at time of bequest, but enjoys use of the home and grounds for life (no tax on the imputed income either, of course). During this period he cannot sell and the land is frozen.

v. Capital gains of exempt owners.

Churches and other tax-exempt owners are normally not allowed exemption on business-type, profit-making activities. The exception is gain on land sales. The central city church that goes suburban takes its full selling price along with it. Thus initiated, it is altogether likely to select a large site with ample grounds and parking space, with one eye to future tax-free gains.

³ It is evident that tax reform must come to grips with varieties of institutionalized sentimentality. However, consider that it is only the widow of means who can afford to value her feelings above the pecuniary blandishments of 'hopeful builders'; and a high proportion of the national wealth is controlled by longevous widows. If we wish to subsidize widows let us help the needy through the welfare system; not the propertied through the tax system.

⁴ There are other offsets, through fast write-off of income property, not treated here.

Cemetery associations are especially large land speculators to benefit from this provision. Cemeteries in Milwaukee County pre-empt more land than all industry—not a negligible item.

These speculators usually couple their income tax exemption with exemption from local property tax. In addition, interest on their bonds is exempt from income tax, an advantage to them as they borrow at very low interest rates.

(c) Deferral of tax on realized appreciation.

The most transcendent of tax loopholes is the least well understood. That is because it entails no specific "gimmick" that might serve as a handle to identify and popularize it, such as depletion allowance, capital gains rates, accelerated write-off, or forgiveness at death. Also, a rigorous demonstration that the loophole really is a loophole involves the use of some mathematics. However, the basic reasoning may be readily grasped.

Money in the bank doubles every 10 years at 7% compound interest. It follows that present dollars are worth more than future dollars, and a great deal more than remote future dollars. For example, at 7% one dollar today is worth \$32 in 50 years ($2^5 \times 32$), so one dollar due in 50 years is worth 3¢ now. Therefore taxes deferred are taxes denied. Early tax payment to reduce later tax payment by an equal amount is an investment that yields no interest.

Suppose a piece of unused fringe land is ripening toward urbanization, the target date for sale at urban prices being certain—say 20 years hence. Or suppose a piece of wetland is ripening toward the higher use made possible by a federal flood-control dam. In a reasonably free market it would appreciate like a bank deposit, at compound interest. Consider what compound interest means: it means that the appreciation accrued in each year goes right back to work for the investor, earning income for him in all future years. Accrued appreciation is therefore income constructively received at the time of appreciation, just like interest paid by a bank and credited to one's account. Note the timing: appreciation is income in the year accrued, not the later year of "realization" by sale.

Now consider the contrast in time of tax liability between bank deposits and appreciating land. Interest is taxable each year as it accrues in your account. Appreciation is not taxed until "realized" by sale. With each passing year, the landowner defers taxes, not just on the value accruing currently, but also on the value accrued in all prior years.

The 16th Amendment authorizes taxation of "income from whatever source derived." The realization doctrine is not part of the Amendment. It rests on the shaky case of *Eisen v. Macomber* (1920).⁵ As a result of this decision and its implementation, appreciating land affords a sovereign tax loophole. The landowner constructively receives income at the time it goes to work earning more income for him. But he is not taxed until much later. He has contrived to receive income and plow it back without being taxed. He can even turn this accrued income into cash by mortgaging appreciated land, without tax liability—and deduct the interest payments to boot.

Appreciating land is like a corporation that does not distribute profits, to avoid taxation of dividends, but plows them back into capital and lets the shareholders realize the income at their tax convenience in the form of appreciated stock values at capital gains tax rates. This loophole for corporations has been recognized and somewhat compensated by the double taxation inherent in the corporate income tax. In the case of appreciating land, however, there is no such compensating device. There are rather a number of fortifying loopholes, discussed elsewhere.

Holding land for appreciation, therefore, is much favored. The extraordinarily favorable tax treatment encourages speculators to buy and hold land, and retards their releasing it to developers and builders, whose income is fully taxable at ordinary rates when produced.

The desire of landholders to defer taxes on gains is often colloquially described as the "locked-in" effect. To show the force of the locked-in effect and its tendency to defer sale, I have worked out a formula for computing the land speculator's rate of return after taxes for different holding periods, and from it constructed Table 1 showing how after-tax rates of return increase with holding periods.

⁵ 252 U.S. 189, 40 S. Ct. 189.

The formula is based on supposing unused fringe land's selling price rises yearly at an assumed market rate of interest, i . A tax rate, t , is applied to the excess of sales price in any year, $(l+i)^x$, over cost of \$1 at time zero. The landowner's rate of return after tax is r .

$$(1) \quad (l+r)^x = (l+i)^x (l-t) + t$$

Using any set of interest tables, it is easy to give numerical examples of how r rises with x , the year of sale. Table 1 is such an example.

TABLE 1.—After-tax rate of return (r) to land speculator for different holding periods when the rate of appreciation before tax (i) is constant at 8 percent, tax rate (t) is 50 percent, and acquisition cost of \$1 is deductible in year of sale (x).

[Based on the equation: $(l+r)^x = (l+i)^x (l-t) + t = 1.08^x \cdot 1/2 + 11/2$]

Percent	1.08 ^x	(l+r) ^x	r
1.....	1.080	1.04	0.040
5.....	1.469	1.24	.043
10.....	2.159	1.58	.047
15.....	3.172	2.09	.050
20.....	4.661	2.83	.053
25.....	6.848	3.92	.056
50.....	46.902	23.95	.065
100.....	2,199.798	1,100.40	.072
∞.....			.080

The speculator who sells in one year bears the full effective tax rate—his rate of return is halved, as the nominal tax rate of 50% contemplates. The speculator who sells in 20 years bears less than $\frac{3}{4}$ of the nominal tax rate. The old settler who waited 50 years bears less than half.

A heuristic proof of the generality of this result is possible by rearranging the form of Equation (1)

$$(1A) \quad (l+r)^x [l - t(l+r)^{-x}] = (l+i)^x (l-t)$$

$$(l+r)^x = (l+i)^x \frac{l-t}{l-t(l+r)^{-x}}$$

As x grows very large, $(l+r)^{-x} \rightarrow 0$, so the fraction on the right side $\rightarrow 1$, and $x \rightarrow i$

A rigorous proof is available on request. It is for the mathematicians. Most readers will find it more drawn out than the residual doubt warrants, and less helpful quantitatively than Table 1.

It is easy to prove rigorously, however, that a tax has no locked-in effect—is intertemporally neutral—if its base is the yearly increment of value. It even makes sense: the tax cannot be deferred or changed by deferring sale; therefore it has no effect on time of sale.

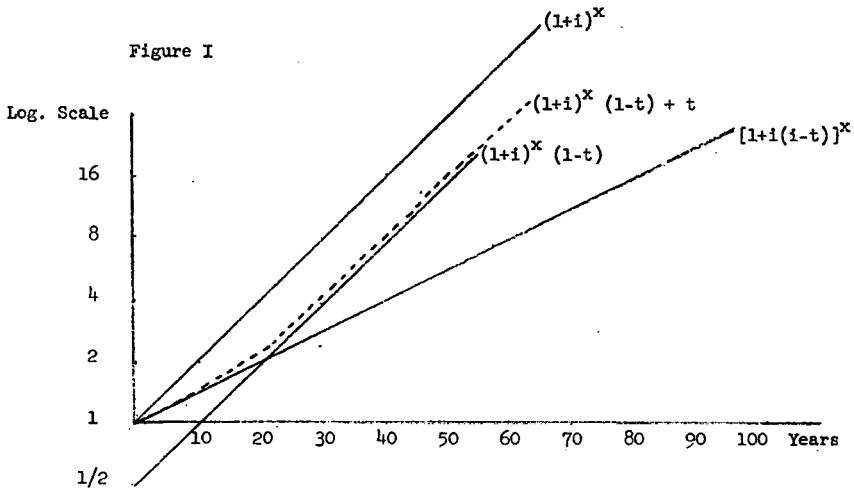
Assuming as before that value grows at compound interest, the value at the end of any year x is $(l+i)^x$; the accrual of value is $i \cdot (l+i)^{x-1}$; and the tax is $t \cdot i \cdot (l+i)^{x-1}$. r , the after tax rate of return, is now that discount rate which makes the present value of selling price less tax costs equal the cost of \$1.

$$(2) \quad \$1 = \frac{-it}{l+r} - \frac{i(l+i) \cdot t}{(l+r)^2} - \dots - \frac{i(l+i)^{x-1}t}{(l+r)^x} + \frac{(l+i)^x}{(l+r)r}$$

$$1 - \left(\frac{1+i}{1+r} \right)^x = \frac{-it}{r-i} \left[1 - \left(\frac{1+i}{1+r} \right)^x \right]$$

$$r-i = -it$$

$$r = i(l-t)$$



Growth of taxpayer realized cash after taxes under different tax assumptions:

- $(1+i)^x$ —no tax
 $(1+i)^x(1-t)$ —gross tax, no deduction of cost
 $(1+i)^x(i-t) + t$ —income tax on gain when realized
 $[1+i(i-t)]^x$ —neutral tax

Under this tax, r is reduced below i by the full tax rate (t) impartially for all holding periods (x). There is no bias—no locked-in effect, no partial tax exemption, no encouragement to land speculation.

The difference between this tax on accrued income, which is intertemporally neutral, and the cash-basis tax policy now employed, gives an idea of how the Eisner v. Macomber rule biases investors to buy and hold appreciating land.

It is of some policy interest to note that the local property tax based on capital value tends to operate like this neutral tax. Because each takes a fixed percentage of the capital value each year.

At the same time that investors seek to defer tax liabilities they seek to advance deductions. The land speculator receives favorable treatment in this particular also. For he deducts his holding costs as he spends the money—i.e., he “expenses” local land taxes, and interest on borrowed money, even though the increment of land value which they finance will not be taxable for many years to come, if ever. He may also succeed in writing off part of the initial cost of land, if he buys land under an old orchard or building and allocates too little of this cost to the land. He may write this off through depreciation. In the alternative, he might demolish the building midway in his holding period and claim a loss. It is not hard to imagine how an ingenious taxpayer may become a non-taxpayer by combining these devices. By reducing his real cost basis and deferring his tax he may end up with a rate of return after taxes higher than the rate before taxes.

(d) Capital gains rate on income, ordinary offset on losses, and carrying costs.

The sale of land for a gain, if the seller has avoided “dealer” classification, qualifies for capital gains rates. This of course encourages tax avoiders in high brackets to buy and hold appreciating land. The uncertainty about how to avoid “dealer” classification causes all landowners to avoid rapid sales, development, large sales, consistent selling, etc. The result is more land tied up. One must be either a passive investor, or use the land in a business other than real estate, a business such as a golf course, farm, nursery, drive-in, parking lot, junk yard, or what have you. One is encouraged to hold land in these lower uses and defer allocating it to its highest use.

Losses on land sales (up to \$1,000) are deductible from ordinary taxable income, so long as one observes the elementary precaution of realizing losses in years of no realized gains. If the loser lacks taxable income, he can often

merge with a winner before realizing losses. Both winner and loser are locked in while courting each other.

The costs of holding land—interest and local land taxes—enjoy ordinary offset. So does covert depreciation of land cost, where that is accomplished. After-tax rates of return may be much higher than before-tax rates of return.

(c) Deferral of tax beyond date of sale.

i. Sale of residence.

If it is a "residence" one sells, the tax is deferred so long as one buys another residence within a year. Under large lot zoning, five or ten acres of grounds would probably qualify as part of the "residence", although local administrative practice varies.

ii. Deferral of tax by barter.

If the grounds qualify as a "farm" one can barter it, tax free, for a larger "like property". The new owner has a higher basis—the appraised value at time of barter—and can subdivide and sell off without tax on the pre-barter increment. Or he can hold for further appreciation, the tax on which he too can defer in the same manner. Section 1031 of the Internal Revenue Code provides: "No gain or loss shall be recognized if property held for productive use in trade or business or for investment (not including stock, etc.) is exchanged solely for property of a like kind to be held either for productive use in trade or business or for investment." There is a good deal of "tailoring" of transactions to fit the letter of 1031. An investor whose intent is to buy a suburban farm for cash will first buy a rural farm, satisfactory to the prospective seller, and then barter farms with him. Or he might buy other suburban land for barter.

The other land of "like kind" might also be a golf course, dump, drive-in, airport, nursery, etc.

A network of brokers' clubs has developed to arrange such bartering. Thus a ready avenue is open to suburban land speculators to defer income taxation of capital gains.

The 1031 is not an unmixed evil. It unlocks some locked-in investors by letting them release their land to commerce without tax penalty on the transaction. On the other hand, it makes land speculating more attractive and brings in more speculative money, inflating the general level of land prices. The seller, too, is still locked into his "like property", which may be a rural farm—a big factor inflating farm land prices—but may also be another suburban farm.

iii. Deferral by installment sale.

The affluent seller who is in no hurry for cash, or whose strong credit lets him monetize his illiquid assets by banking them, may defer tax on land sale by the installment device. He must be the mortgagee. He must not take a down payment of more than 30% of the selling price.

An important incidental benefit of this method of sale is that a large share of the interest on the deferred payments may be treated as part of the contract price and receive capital gains rates. Only a 4% rate must be treated as interest, at *simple* interest rates. Mortgage interest rates today are about double that, at *compound* interest, so contract prices are inflated to reflect the buyer's benefit from borrowing at 4% simple interest from the seller; and the seller takes his interest above 4% at capital gains rates.

The longer the installment period the greater the differences between simple and compound interest. So sellers who can wait a very long time for cash can get capital gains treatment on all compound interest above 2% or 3%, depending on the time involved. I have not worked out details on this, but the possibilities of deferred payment of inflated contract prices are evident. Farm economists have published a good deal on the subject.

A variant of installment sale is the "land contract". The seller, instead of conveying title and taking a mortgage, retains title until payments are completed. If payments come in slowly this is not too different from rental, but with the tax benefit of capital gains treatment for all payments on principal representing taxable gains to the seller, and all interest payments above 4% simple. Thus a good deal of ordinary rent income receives capital gains rates.

iv. Simple prorating of installment payments between interest and principal.

Whenever a debt is paid off in level installments, the true proportion which is interest is a maximum in the first year, when the unpaid balance is a maximum, and falls nearly to zero in the last installment. The necessary sinking

fund tables to find the true proportion are the common property of bankers, and no deep mystery. Simple prorating of level installments between interest and principal therefore constitutes a deferral of tax liability relative to an accurate accounting—another benefit from installment sales.

v. Contract price contingent on buyer's profits: "profit participation".

If the contract price is contingent on the buyer's profit from the land, the seller need not prorate early payments between interest and recovery. He treats all payments as non-taxable recovery of principal until he has recovered his full basis; and only then does he begin to pay taxes on his cash receipts.

vi. Condemnation.

If land is condemned, as for highways or urban renewal, the tax on gains is deferred if the unwilling seller reinvests in like property within a year. If a lessor is forced to convey title to his lessee under something like the "Maryland land law," now law in Hawaii, he receives the same privilege or better.

(f) Deferral of income from land use, where there is intertemporal dependence of income.

i. Sacrificing early rents for higher later rents. "Implicit expensing" of foregone income.

There is often an intertemporal dependence of land rents. Sacrificing early rents to get higher later ones is a form of investment, and basically quite legitimate. However, the income tax biases landowners toward an excess of this kind of investment, because the foregone early rent is plowed back without ever having been received and taxed.

The effect is the same as though the early foregone rent were received in cash and then reinvested, and granted the valuable tax privilege of being expensed. This is "implicit expensing". Expensing of capital investments is tantamount to 100% exemption from income tax.

An example of how implicit expensing causes land to be unavailable to builders is the following. As a district or neighborhood fills in, the early builders establish a pattern of use. The more of the land is developed, the more certain become the specifics of the highest use of the remaining undeveloped land. Thus certainty improves over time. This has always supplied a certain rationale for deferral of land development, even before income tax rates were significant. But now the early foregone rent—the investment in greater certainty—is expensible: implicitly, that is. This encourages individuals to withhold land to achieve greater certainty. Since the individuals gain of certainty is achieved by imposing uncertainty on other landowners, there is no net social gain to justify a subsidy to this kind of withholding.

Another familiar example is the effort of large developers to attract the highest wealthy buyers are thought to tune up a subdivision and enhance later sales possible stratum of the market, at the expense of some waiting. Early sales to prices, if not volume. Thus a bias toward high pricing and slow sales results. The income tax exaggerates it. The loss of potential income from idle land is "implicitly expensed". Implicit expensing is involved not merely in the year-to-year management but in the original decision to cater to higher tastes than the broadest and most frustrated stratum of the market can now afford.

A third example is the California zoning device whereby large landowners can have their development density measured as a whole. They can raise density in parts of their land if they keep the average down to the required level. Their response, as described by Eichler and Kaplan, is to begin at densities below the average, building up zoning "credits" to apply later to apartments after the integrated development has become established. The unrepaid rents of the unused land, meantime, are implicitly expensed.

A fourth example, of some generality, is where a large owner avoids subdividing, at a time when that would be optimal, in order to preserve a large tract intact for future integrated development.

ii. Explicit expensing of early operating losses to establish position.

It is possible in several ways to appropriate control over territory by establishing an early position. An example is the effort of retailers to establish an early position in growing suburban territory. Here the bias is toward premature development—but not of housing, as a rule. How does this work?

Knut Wicksell, astute Swedish economist who anticipated many of the ideas that have stirred the world since his time, once observed: "because of the local

character of the firm and its market, . . . the large enterprise has an actual monopoly simply because it comes first on the scene, and this monopoly may be as good as a monopoly which is legally established." Competition by a second firm "would only lead to the ruin of both." (*Lectures*, Vol. I, p. 131)

Now observe retailers establishing new positions around every growing city. Where there is room for only one store, or shopping center, or only a few gas stations, to be there first is to establish a species of franchise over the trade area, at least for several years. The early losses are expensible; the taxable income is deferred, and might even be taken as capital gain by sale of land.

Today, it is also of value to establish a zoning position. The more offensive a land use is to its residential neighbors, who will ultimately dominate zoning, the more important for a firm to establish an early history of noise, traffic, signs, smoke and other nuisances. Likewise, if tight future zoning of some monopoly value is anticipated, it is good to establish one's future grandfatherhood today.

Thus, areas best suited for residential use are subject to premature invasion by commerce, a higher use. The "floating value" that results, diffused over wide areas, inflates values above the residential level, without, however, raising them enough to stop the commercial demand. This drives residential builders farther out, where high density residential use establishes a floating value over areas best suited for low density—and so on and on in a succession of centrifugal shock waves.

The appropriative doctrine of water law is a grand vehicle for expensing land acquisition. Under the doctrine, control of water is established by prior use: "first in time, first in right." The country is full of water sources currently sub-marginal but potentially rent-yielding. The only way to secure the future rents is to develop the water now, before a rival. The doctrine is pernicious enough without tax considerations, but on top of everything else, early operating losses are expensible. They actually should not even be depreciable, for they are the price paid to acquire land.

The natural resource field overflows with parallel examples, wherever a rule of capture applies. Expensing of exploration outlays and intangible drilling costs are among the largest of these.

One of the greatest urban land speculations in history is the current race for gasoline station sites by the largest collection of corporate wealth in the world, the international major oil companies and the several lesser ones, loaded with untaxed cash from depletion allowances. The early losses are expensible; the tax liability of income is deferred, and the land value increment is never taxed so long as there is no sale. The accumulated economic power behind the oil companies is impossible for home buyers and builders and most other retailers to match. Not stopping with station sites, some companies have gone into land speculation as a major enterprise. The tax relations between their retail outlets and their other land would make an interesting study. Meantime, the home buyer and small retailer know they must overcome the most powerful competition in the quest for land. The "implicit expensing" of early foregone rents, and the explicit expensing of operating losses of premature retail outlets, add to the power of the competition.

A subtle form of expensing is that resulting from pay-as-you-go municipal financing of capital improvements. The property taxpayer expenses his taxes; the money is used for public capital improvements of the most durable kind, whose payoff is in enhanced service flow to land.

iii. Explicit expensing of capital outlays by "farmers".

While the homesite seeker is pressed from above by the higher use of commerce, he is ground against the nether millstone of "farming", which also enjoys extraordinary privileges. "Farmers" may expense many capital investments in soil and water "conservation." The gentleman farmer and his horsey family, who thus sink money in farms, have become proverbial; the proverb is now documented by a recent U.S.D.A. study, based on 1963 tax returns, showing that most wealthy taxpayers who own farms report farming losses. Of 3.2 million individuals who file tax returns including farm income, 66,000 reported combined farm and non-farm incomes over \$25,000. Of this top group two-thirds reported farm losses! Their alleged tax losses are only current. They are expensed from ordinary income, usually urban, to be recouped later at capital gains rates by sale of a greatly improved farm. Improved for what? Not for sale to lower income home

buyers as a rule. Soil and water conservation are likely to hold the land in agriculture until the tax-motivated farm improvements have been used for farming.

The cost of establishing orchards also is expensable, and the unrealized rent of the land used for orchard's early nursery years enjoys implicit expensing. The competitive strength of horticulture against housing is thus enhanced.

The combined result of factors a. through f. is that the income imputable to land is largely exempt from income taxes. This helps explain why landowners in high brackets hold out for higher prices than can be met by low-income workers whose wages are fully taxable.⁶ It helps explain the paradox of high and rising land prices in the face of a vast surplus of vacant and underutilized land, and the twin paradox that islands of hyperintensive, high-density land use, appropriate to high land values, arise in oceans of empty space with which they have little complementary linkage. It helps explain why the land market is not nearly as responsive to consumer demands as a market has to be to be functional in a complex modern economy.

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STUDY SHOWS LOSSES BY WEALTHY FARMERS

Washington, D.C.—Most wealthy taxpayers who own farms lose money on their farming operations, an agriculture department study indicated.

The study was based on 1963 income tax returns. It may provide new ammunition for lawmakers and farm leaders campaigning for a ban on deduction of farming losses from big nonfarm income tax returns.

Under existing law, some high income taxpayers can reap substantial tax savings by deducting farm losses from other income subject to high bracket tax rates.

The agriculture department study noted that 3.2 million individuals filed tax returns which included farm income in 1963. Economists, dividing the list into five groups ranging from "poor" to "wealthy," put only 66,000 taxpayers into the top group.

"The 66,000 wealthy individuals who reported farm income in 1963 can hardly be thought of as farmers although they generally reported income from sizable farming operations," the report said.

"Their farm business receipts averaged \$40,130—far larger than receipts of the other four income groups. Nevertheless, more than two-thirds (of the wealthy group) reported farm losses."

The wealthy classification included taxpayers who reported farm income and had combined farm and nonfarm incomes of more than \$25,000 a year.

The report showed profits reported by 87% of the "poor" farm taxpayers.

U.S. FARM ACREAGE

There are nearly 2.3 billion acres of land in the United States and farms cover a little more than one billion of them, the agriculture department has reported.

Twice a year the department makes a survey of land sales and prices. The next report is due in October.

Last Mar. 1, the value of all farm land in the United States was \$193.7 billion, the department said, or a national average of \$178 an acre.

LIVING STANDARDS

Most of the nation's poorest nonwhite farm families live in counties with the lowest standard of living, a new report by the agriculture department shows.

Only 8% of all persons living in farm households are nonwhite, the report said. But 57% of these lived in counties ranked in the lowest living standard category.

About 93% of the counties in the lowest index category are in the south, the report said.

⁶ More than fully taxable when you consider that the base is the gross wage before withholding wage taxes.

[From the Challenge, January-February 1967, vol. 15, No. 3]

THE GREAT FARM TAX MYSTERY

(By Henry Houthakker)

If we believe the United States Department of Agriculture, Texas farmers had a net income of \$824 million in 1964. The Commerce Department, which is responsible for the national income accounts, put the figure at \$844 million. But the Texas farmers themselves tell a different story, at least on their tax returns. According to the Internal Revenue Service, these same farmers did not earn a penny; in fact, they lost \$60 million among them. Whom should we believe?

Nobody knows how accurate the Agriculture and Commerce Department estimates of farm income are, but there can be no doubt that they are in the right ballpark.

In 1964 Texas had some 200,000 people who made their living wholly or partly from agriculture, and many of them did pretty well. The 10 million cattle and calves that roam the endless plains are not there merely for decoration. In addition, Texas produces more than one-half of the nation's cotton crop and a sizable percentage of its grains. To say that all this activity resulted in a net loss of \$60 million is clearly preposterous.

Of course, it has long been known that farmers generally are not among the more enthusiastic taxpayers. Even in the Midwest, where compliance among farmers appears to be highest, the income declared by individuals on their federal tax returns is only between one-third and one-half the estimates by the Agriculture or Commerce Departments.

For the country as a whole, farm income in 1964 was \$13 billion according to the Agriculture Department, and \$12 billion according to the Commerce Department; yet only \$2.6 billion was declared by individuals. Evidently, Texas is not the only state where there are large discrepancies between tax returns and other estimates of farm income.

In California, the number one farm state, farm income exceeds \$1 billion, according to the Agriculture and Commerce estimates, yet only \$42 million appeared on individual tax returns. And this is not because farmers do not file tax returns at all. Except in a few Southeastern states where there are many poor farmers, the number of farm returns filed agrees closely with the number of farms estimated by the Agriculture Department. The difficulty must be in what farmers put down on their tax returns.

It is true that there are some conceptual differences between the Internal Revenue Service and the other official estimates. The most important difference is probably that the IRS figures do not include partnerships and corporation for which no recent data are available. This omission does not explain a great deal, however. In 1962, the latest year for which figures have been published, partnerships and corporations reported only about \$1 billion in farm income, and it is likely that their reporting is more accurate than that of individual farmers.

Apart from this, the only important conceptual differences refer to revenues from breeding cattle and from standing timber, both of which may be reported as capital gains. The treatment of other components of farm revenues and expenditures is essentially uniform.

Despite the conceptual similarity, it is very hard to pin down the reasons for the large discrepancy between the two estimates, known in the trade as "the farm income gap." In fact, there is no major discrepancy between the money receipts reported on tax returns and the money receipts estimated by the Agriculture Department.

In 1963, the last year for which this comparison can be made, money receipts of farmers (including both receipts from sales and government payments) amounted to \$39.1 billion according to the Agriculture Department, while "business receipts" reported on farm tax returns (including partnerships and corporations) amounted to \$37.1 billion. In addition, farm income should include about \$1 billion for food produced and consumed on farms and \$2 billion for the rental value of farm dwellings. It is likely that very little of this is reported on tax returns, although, in principle, it is taxable.

Together, these factors on the receipt side account for little more than \$5 billion of the farm income gap, which amounted to somewhat less than \$10 billion in 1963. The remaining \$4.5 billion must therefore be on the expense side, but there again it is difficult to point to any major source of discrepancy.

The farm income gap is not only large; it seems to be growing larger. In 1962 the Internal Revenue Service figure for individuals was 27 per cent of the Agriculture Department figure; in 1963 it had dropped to 22 per cent, and in 1964 to 20 per cent. It had been as high as 32 per cent in 1957 and 30 per cent in 1958. Here again the case of Texas is especially significant.

In 1962 Texas farm taxpayers reported an income of \$184 million; the next year they reported an income of \$9 million; in 1964, as mentioned already, they reported a net loss of \$60 million. In two years the farm income reported on tax returns therefore dropped by nearly a quarter of a billion dollars, yet the Agriculture Department figure for Texas fell only slightly between 1962 and 1964.

It is also interesting that the same thing happened on a smaller scale in three adjoining states. In Oklahoma, declared farm income dropped from \$35 million in 1962 to virtually zero in 1964, and New Mexico went from an income of \$29 million to a net loss of \$14 million during the same period. Louisiana also went from a gain to a loss. In none of these states does the Agriculture Department estimate reveal any drastic change in agriculture's profitability.

Although we have no direct information that may account for these strange developments, there is a clue in the figures for metropolitan areas, which are available only for 1963. In fact, it was by looking at these figures that my attention was first drawn to the present subject.

It struck me as odd that the taxpayers of the Dallas metropolitan area reported a net loss of \$44 million from farming, although this area does not include much farm land. Such urban farm losses are also found in a few other metropolitan areas, among which Houston, San Antonio and Oklahoma City may be mentioned. Dallas, however, exceeds all the others by a wide margin; even much larger cities such as Los Angeles and New York come nowhere near it.

Now Dallas is known, among other things, for its relatively large number of taxpayers with very high incomes. For such taxpayers there is a loophole in the tax laws which is especially interesting in a cattle-raising state such as Texas. As mentioned previously, the proceeds from the sale of breeding cattle may be treated as long-term capital gains, which means that they are subject to no more than 25 per cent income tax.

On the other hand, the expenses incurred in raising these cattle (including depreciation) may be deducted from ordinary income, the marginal tax rate on which was as high as 91 per cent prior to the 1964 tax cut which brought it down to 70 per cent.

To the wealthy, cattle raising, therefore, offers splendid opportunities for converting ordinary income into capital gains. A number of examples of this were published some years ago by the Treasury Department.

Thus one manufacturer of chain link fences, who in 1960 declared an income of over \$4 million, deducted some \$246,000 as a loss on the raising of cattle and had a capital gain of about \$65,000 on the sale of cattle. Since this man must have been in a marginal tax bracket of about 90 per cent, the loss on cattle, after taxes, was only about \$25,000, while he could keep about \$48,000 of the capital gain from sales. Although he lost about \$180,000 before taxes, after taxes he was ahead by nearly \$25,000.

Actually, this taxpayer may not even have had the best professional advice. It is apparently quite legal to take the deduction for cattle losses without declaring any capital gains on sales at all. The owner of a herd of cattle kept for breeding apparently only has to declare his gains when the whole herd is sold. Since a herd may last indefinitely, there is nothing to stop him from postponing the liquidation until his death, when the capital gains tax ceases to apply.

Treasury also mentioned the case of a "musician-conductor" who in two years deducted about \$130,000 in losses on cattle without declaring any gains at all.

How widespread is the use of this loophole? The most recent data on this point refer to 1963, when farm losses still occurred only on a modest scale. Of the 351 taxpayers with incomes over \$1 million, for instance, only 69 reported farm losses, but they "lost" an average of \$70,000 each. In this select group there were only 14 taxpayers with positive farm income.

For the same year it can also be calculated that taxpayers in marginal tax brackets of 50 per cent and over deducted a total farm loss of about \$116 million, by which they saved about \$78 million in taxes.

We do not yet know what the picture was after 1963, but the 1964 data quoted earlier indicate that, at least in Texas and adjoining states, the use of farm losses for tax avoidance has increased considerably. In fact, the Treasury itself may have unintentionally stimulated this practice.

In 1963 it proposed an amendment to the Internal Revenue Code that would have curtailed the use of the cattle-raising loophole. Congress refused to go along, but the resulting publicity on this angle was probably not lost on the tax accountants who cater to the very rich. It will be interesting to see more recent data on farm losses.

Pending the release of more detailed and recent statistics, we cannot say, with any certainty, that it is the cattle deduction that is responsible for the sharp drop in declared farm income in the Southwest. There may be other reasons.

It is certainly curious that the four states where the decline in declared farm income has been worst are all in the same Internal Revenue Service region, and that the headquarters of this region is in Dallas itself. If the Service ever decided to investigate the matter, Dallas would be a good place to start.

This does not necessarily mean that there is anything wrong with the way the Service enforces the tax laws; it may also be that the "cattle research" firms, which specialize in this type of operation, are particularly active in Dallas, and that the tax rulings from which the profit have gradually become known in other parts of the region.

The tax laws, in fact, are quite lenient on this point. The capital gains treatment of "livestock held for breeding, draft or dairy purposes" is an extension of a more general rule concerning "property used in business." If a retailer sells his used delivery truck, he has a capital gain on any profit made on the sale. The original idea appears to have been that if a farmer sold a bull that had passed its prime, he would be in a position similar to the retailer. A dealer in used trucks, however, does not get capital gains treatment; but a cattle breeder does.

This favored treatment of the livestock industry was no doubt intended to help agriculture, a sector for which Congress traditionally has a soft heart, though not always a hard head. Unfortunately, agriculture covers a multitude of sins. It is doubtful, in fact, if the capital gains treatment of livestock is of much help to the genuine farmers, who are rarely in high tax brackets.

On the contrary, by bringing pseudo-farmers with high nonfarm income into cattle breeding, it sets up unfair competition for those whose livelihood depends on it.

The further question thus raised is: Who is a farmer? This question has often come before the courts, and the upshot of all the litigation appears to be that everybody can be treated as a farmer provided he is not overly fond of farming. The tax laws are designed to prevent so-called "hobby farmers" from claiming a deduction for farm losses, but it is easy to escape this classification by asserting some hope of ultimate profit.

The mere fact of losing money year after year is not considered to make a taxpayer a hobby-farmer, but one rich old lady was put into this category (after at least 15 years of unbroken farm losses) when a misguided friend testified that she "just loved farming."

If the tax laws are to be effective in this area, a more sophisticated definition of farmers is needed, or, alternatively, the offsetting of farm losses against other income should be restricted. But this restriction has to be introduced with due regard to the interests of genuine farmers.

The best possibility would be to limit the farm loss deduction to, say, \$10,000 in any one year, with provisions to carry larger losses backward or forward to be offset against earlier or later farm profits, but not against nonfarm income. In 1962 the taxpayers who claimed over \$10,000 in farm losses had an average nonfarm income of about \$50,000.

Another possibility would be to treat as farmers only those who have derived a specified fraction of their income from farming during the past five years.

Still another (similar to the Treasury proposal of 1963 which was rejected by Congress) would be to allow capital gains treatment only for the amount by which sales exceed deductions for farm losses in prior years. This proposal, however, would not deter those who do not take capital gains at all.

Unless something is done, it is likely that the livestock loophole is going to cost more and more tax revenue without any visible economic benefit. Of course, this loophole is only one element (and probably a small element) of the farm tax mystery. More analysis is needed to determine what the other elements are.

Analysis requires data, and, unfortunately, the data published by the Internal Revenue Service, though voluminous and accurate, leave much to be desired. Not only are they very slow in coming (the last year for which complete figures have been published is 1962), but they are not coordinated with other statistics, such as the National Income Accounts. It is, therefore, difficult to determine how good a job the Internal Revenue Service is really doing.

It is well-known that it collects a vast amount of money at a comparatively small cost (about 50 cents for every \$100 collected), but this may testify as much to the law-abiding nature of the American people as to the efficiency of the Service. The data on farm taxation suggest this is one area where compliance could be considerably improved.

But if this sacred cow is to be finally eliminated, the Internal Revenue Service may need some help from Congress.

(The following materials were subsequently submitted by Allen V. Kneese of Resources for the Future who testified at the September 23 session of the hearings:)

Answers given by Allen V. Kneese to written questions submitted by Senator Proxmire relating to the September 23, 1969, hearings on Economic Analysis and the Efficiency of Government.

Question 1. What powers do local governments have to prevent water pollution by polluters within their jurisdictions? Forgetting for a moment that municipalities are often polluters themselves, what could a local government do if a company within its city limits was discharging waste into a body of water? Have local governments done anything about this problem?

Answer. Traditionally, the primary rights and responsibilities for controlling water pollution rest with the states. This results from the police power vested in the states by the Constitution so that the states may protect the health safety and welfare of their inhabitants. So far as I know, the states have delegated little or none of this power to local governments, which, as you know, can exercise only those powers given to them by the states. Accordingly, local governments have not played any significant general role in the control of water pollution. One respect in which some municipalities have succeeded in reducing industrial waste generation is, however, interesting. A number of cities have imposed surcharges on industrial wastes discharged to their sewers and treatment plants. This has resulted in dramatic reductions in industrial waste discharge. Examples are Oswego (Michigan), Springfield (Missouri), and the Greater Winnipeg Sanitary District. The similarity of the surcharge to an effluent charge should be noted. The latter extends the concept of levying a charge on waste discharges to the entire river system.¹

Question 2. You state that studies have shown that industries can often reduce waste discharges, usually at low cost, if they are given proper incentives. Can you give us some examples of successful efforts by industries? What kinds of incentives were employed?

Answer. An example of an industry which has achieved a dramatic reduction in the waste it generates and discharges is the beet sugar industry. This has been the result of recycle and process changes rather than conventional treatment. It has resulted from replacement of old equipment by newer, more efficient equipment and has, at least in part, been a response to pressures from the communities and authorities to reduce waste discharges. Beet sugar plants are often located where little or no dilution water is available and the effects of their huge waste discharges on the environment can easily be imagined.²

Question 3. Other witnesses have recommended user charges to preserve the public interest and achieve greater economy in government. Could you give us some idea of how your concept of "effluent charges" would operate and how much revenue could be obtained in this manner? Also, do you have figures that can be submitted to the Subcommittee showing the amounts of government funds that have been spent so far, and the amounts that would be needed to clean up our major rivers and lakes?

Answer. Formulas for gauging the "strength" of effluents have been devised in the Ruhr area of Germany and in connection with the surcharges discussed in the answer to Question 1. A very crude calculation (the details of which I will supply if desired) suggests that if discharges were unaffected by the levying of an effluent charge, the yield from a national system of charges might be about \$3

¹ A further discussion of sewer surcharges can be found in Allen V. Kneese and Blair T. Bower, *Managing Water Quality: Economics, Technology, Institutions* (Baltimore: The Johns Hopkins Press, 1968).

² A detailed discussion of waste reduction in this industry and the costs of further waste reduction can be found in Lof and Kneese, *The Economics of Water Utilization in the Beet Sugar Industry* (Baltimore: The Johns Hopkins Press, 1968). Discussion of other industries is found in the previous reference.

billion annually. Since, however, one may reasonably assume that discharges would respond strongly, the yield might drop to \$1 billion or so. Effluent charges systems have recently been put in operation in Czechoslovakia and France. Estimates of the kind requested in the last sentence have been made by the Federal Water Pollution Control Administration. I have no independent estimates to submit to the Subcommittee.

Question 4. Can you give us any explanation for the fact, as you point out, that most treatment plants are operated far below their capacities? Why would a company or a municipality build a facility and not use it?

Answer. We have tended to judge progress in reducing water pollution by the construction of treatment plants. Presumably, this is because federal subsidies have been linked to such construction. The plants have often been operated by poorly trained personnel and have been undermanned at that. Since operating a plant costs money and there has been no systematic monitoring of performance, there is a natural tendency to stint on operation.

Answer given by Allen V. Kneese to written question asked by Minority Members of the Joint Economic Committee in relating to the September 23, 1969, hearings on Economic Analysis and the Efficiency of Government:

Question 1. We are interested in your recommendation of effluent charges, for these charges carry far-reaching legal and financial implications. Specifically, they would amount to a declaration by the Government that river flow is a public resource, and that the Government's function is to maintain the water constituting such flow at a reasonable level of purity.

The effluent charge furthermore implies that the polluter must pay the cost to society of polluted waters. We are not quite sure from your statement, however, whether this cost to society is a function of the economic damage done by pollution, or the estimated cost of cleaning up our waters. Certainly if you believe the latter to be the case, the problem of ascertaining proper effluent charges is made immensely simpler. The resulting system of charges would also be very amenable to the trust fund concept (i.e., a Clean Water Trust Fund, financed through effluent charges, and devoted to Federal Anti-pollution programs). Would you please comment on the way you believe these charges should be assessed, and on the adaptability of your proposal to the trust fund concept?

Answer. In principle, the proper basis for levying charges is the damage resulting from the waste discharge. In practice, it would probably be necessary (at least for the time being) to key charges to standards of water quality in streams, lakes, and estuaries. For the federal charge, this might be done on the basis of rough estimates. The regional authorities discussed in the testimony before the Subcommittee would presumably refine the charges (but with the federal charge continuing to be a minimum) as well as implement regional water quality management programs. The trust fund concept is not very appealing on theoretical grounds because of the inflexibilities in budgeting it produces and because trust fund revenues may not comport very well with the optimal level of expenditures on a program. In practice, however, it does provide a means of assuring that a worthwhile program will receive financing at some significant level. I think the idea of a water quality trust fund based on effluent charges should be seriously considered.

(Questions submitted to Mr. Lee E. Preston, State University of New York, by Senator Proxmire to be answered for the record, September 23, 1969, and Mr. Preston's subsequent answers follow:)

Question 1. On page 4, you state that since 1962, 6 new privately-owned helium production plants have come into existence and have taken about 40 percent of the total helium market.

Was this lower-cost private-sector alternative not foreseen when the program was established in 1960?

Answer 1. The alternative of private production was apparently not foreseen in the mid-1950's, at the time the initial plans for the helium storage program began to form. However, by the time the Helium Amendments of 1960 were adopted, the Kerr-McGee project was well under way and its existence was

widely known. It appears that the Bureau of Mines simply went ahead with its plans, in spite of changing circumstances. However, it would have been difficult to anticipate at that time the full scale of the private program that has in fact developed. Of course, one reason for this extensive development has been the artificially high price of Government helium. If Government helium had remained around \$15 Mcf then the private expansion might have been much less extensive.

Question 2. You state that with the current supply and demand outlook for helium, the helium that we would store in 1970 would not be removed for 40 years. Then you state that at a 10 percent interest rate, the price of recovering helium in the year 2010 would have to rise from \$12 today to about \$550 to make the programs worthwhile.

In your judgment, what is the probability that the costs of recovering helium would increase by this 50-fold amount over the next 40 years?

Is there any substantial probability that recovery costs will rise by 8 times in the next forty years—the amount of increase required to justify the program at the very low interest rate of 5 percent?

Answer 2. The only circumstance under which a 50-fold increase would be likely would be the necessity of helium recovery from the atmosphere. For recovery from in-ground sources, one might anticipate some cost increase, but not more than double or triple present levels. Of course, any statements about these distant future cost conditions are strictly "guesstimates".

Question 3. Can the government extricate itself from this program with no serious economic costs or disruptions?

Can you see any reason why it should not abandon this program?

Answer 3. The contracts between the Bureau of Mines and the private contractors who supply helium for storage contain escape clauses. If my analysis of the situation is correct, it would appear that the Bureau should take advantage of these clauses and discontinue purchases for the storage program as quickly as possible. Of course, there is no reason for it to release from storage any of the presently stored helium. This constitutes an important long-term strategic and conservation reserve, and the cost (other than accumulating interest) are all sunk by now.

Question 4. As you know, the helium program is only one of many Federal stockpile programs. Do you know whether the kinds of problems you have discussed exist in any of the other stockpile programs? Which ones?

Answer. 4. No, I do not know whether similar problems exist with respect to other stockpiling operations. I am not aware that we are continuing to purchase many other materials for stockpiling at the present time.

Question 5. Would you agree that our stockpile programs are essentially for Defense-Space purposes? Did most of them originate during the Cold War period?

Answer 5. Present stockpiling programs exist both for defense-space purposes and for price support purposes in agriculture. Most of the former programs were initiated during and after World War II, although some are of earlier origin. The notion that minimum reserves of strategic resources should be maintained for critical national uses—where use values may be literally priceless—is widely accepted. This notion does not imply, however, that indefinitely large reserves should be accumulated, nor that stockpiling programs should be allowed to have a continuing impact on regular economic activities.

(Questions submitted to Mr. Lee E. Preston, State University of New York, by the minority members of the Joint Economic Committee, to be answered for the record, September 23, 1969, and Mr. Preston's subsequent answers follow:)

Question 1. I understand that the Court of Appeals recently upheld the judgment of the District Court against the government in the litigation to which you refer on Page 4 of your statement. I would gather that this only aggravates the conditions about which you were speaking in your testimony.

Could you explain what the implications of this development are?

Answer 1. The court decision holding that Government contractors are not compelled by law to purchase their helium requirements from the Bureau of Mines simply preserves the status quo. However, it does mean that Federal

agencies can stretch their budgets by contracting-out helium using activities to private contractors, rather than purchasing helium from the Bureau for in-house operations. To the extent that this happens, the present financial plight of the Helium Program will be worsened.

Question 2. Reading between the lines of your testimony, I get the feeling that if the Federal Helium Program had originally been planned so as to make sales at, say, \$19 or \$20 per thousand cubic feet, this might have prevented the development of competitors in private industry. On the other hand, the \$35 price was probably the greatest single stimulus to the development of what is now a healthy helium industry. Considering that one of the functions of government is to do precisely this type of thing, don't you believe that the cost of the helium program is worth the "benefit" of an indigenous helium industry?

I note that in 1960 there was no private helium production in the United States; today there are several privately owned helium production plants capable of supplying 70 percent of the total market. In 1960, no one had ever recovered helium from gases containing less than .9 percent helium. These private contractors extended the technology so that now helium in far leaner concentrations can be recovered. Since the contracts with the government for the sale of helium were supply contracts only, these private contractors took the risk of developing their production process.

Answer 2. If it should become public policy to stimulate private industry in helium, the Bureau of Mines could abandon its activities in this area completely and leave the entire market to private firms. A combination of remaining in the market but posting an artificially high price seems a peculiar method of accomplishing such a goal.

Question 3. The Stanford Research Institute has recently issued a report indicating that the demand for helium will rise to 5 billion cubic feet per year, or higher, by 1985. If this should prove to be true, how would this affect your position?

Answer 3. I have not seen the Stanford Research Institute report referred to in the question. However, if demand were to increase at the rate indicated, then it would certainly pay private firms to start producing and storing helium now in preparation for this unprecedented increase in sales. Fortunately, there will be ample reserves of helium in the ground in hydrocarbon gas deposits throughout the 1980's (and probably well beyond), so that it should be possible to produce any helium needed on a current basis if demand justifies. It should be recalled that the current production capacity of the entire industry—Bureau of Mines, supply-contract plants, and independent private firms—is in excess of 5 billion cubic feet per year, and all of this output could come into current consumption if demand conditions warranted. (Helium from the supply-contract plants would, of course, have to undergo an additional purification process before coming into use.)

(The following letter and statement were furnished by Mr. Preston to supplement his testimony:)

STATE UNIVERSITY OF NEW YORK AT BUFFALO,
SCHOOL OF BUSINESS ADMINISTRATION,
FACULTY OF SOCIAL SCIENCES AND ADMINISTRATION,
September 25, 1969.

Senator WILLIAM PROXMIRE,
Chairman, Subcommittee on Economy in Government,
New Senate Office Building,
Washington, D.C.

DEAR SENATOR PROXMIRE: I am returning herewith a corrected transcript of my testimony before the Subcommittee on Economy in Government, September 23, 1969. I am also enclosing a copy of a statement presented by Mr. Harold W. Lipper, Acting Assistant Director for Helium of the Bureau of Mines, which he presented to the Subcommittee on Mines and Mining of the House Committee on Interior and Insular Affairs, September 15-16, 1969. Mr. Lipper's statement and the accompanying charts serve to bring up to date the data in my own statement. This material also dramatizes the financial plight of the Program. Mr. Lipper's picture of the dilemma confronting the Bureau of Mines ties in directly with the more substantive economic analysis contained in my own

paper. If the Program had been appropriately based on real economic terms to begin with, it would not have required this unrealistic financial structure. Hopefully, therefore, it would have been able to adapt its operations before becoming overwhelmed by circumstances, as it is at present.

As an additional amendment to my statement with particular reference to your question concerning the contractor market for helium, I am now informed that the legal action has been finally resolved in favor of the contractors. That is, they are not required to purchase helium from the Bureau of Mines.

A copy of my own prepared statement containing a few typographical and other corrections is also enclosed.

Sincerely,

LEE E. PRESTON, *Professor.*

Enclosure.

STATEMENT OF HAROLD W. LIPPER, ACTING ASSISTANT DIRECTOR—HELIUM,
BUREAU OF MINES

Thank you. Before getting into specifics, I should review briefly how the helium conservation program began and how it operates.

Under conditions prevailing in 1960, the helium conservation program as authorized was a prudent and financially sound way to assure a continuing low-cost supply of a material that is vital to missions of the Department of Defense, the Atomic Energy Commission, the National Aeronautics and Space Administration, other Federal agencies, scientific laboratories, and industry. In 1960, helium demand for these purposes was increasing rapidly. Billions of cubic feet of helium in the relatively rich helium-bearing natural gas from the Hugoton Field of Kansas, Oklahoma, and Texas were being wasted and lost each year when the natural gas went to fuel markets. After helium could no longer be obtained from this large rich source, extraction from the air, at a very high cost, was considered the only alternative source of future helium supply. There was no private industry production of helium and the Government used about 90% of the helium produced. It was against this background that the Helium Act Amendments of 1960 became law, so that a part of the wasting helium resource could be saved and stored for future use.

The 1960 Act authorized long-term helium purchase contracts, for not to exceed 25 years, and required the Secretary of the Interior to sell helium at prices which would recover all costs, together with interest at prevailing rates, within 25-35 years. The present \$47.5 million a year contracting authority was established in the first appropriation act following the enabling legislation. Federal agencies were required to buy their major helium requirements from the Secretary. Borrowing from the Treasury was authorized to supplement income from helium sales for the purpose of financing the program. The amounts of borrowing are authorized each year by appropriation acts. The 1960 Act also expressed the sense of the Congress that it was in the national interest to foster and encourage individual enterprise in the development and distribution of helium supplies.

During 1961, the Department of the Interior entered into four, 22-year, fixed-price, take-or-pay, supply-type contracts with private industry, which obligated all of the \$47.5 million a year contracting authority. This represents about 85% of the total operating budget of the helium program.

Let us now call attention to our charts—

Our first chart shows the maximum annual obligation of each contract, the estimated volumes of helium to be delivered each year, and over the life of the contracts. By 1963, the contractors had financed, designed, and built their extraction plants and had begun delivering helium into the Government's pipeline gathering system which transports helium to the underground storage field near Amarillo, Texas. At the end of FY 1969, about 22 billion cubic feet of helium was in underground storage. Under the present contracts, it is expected that an additional 38-40 billion cubic feet of helium will be delivered and stored before the contracts expire in 1983.

As has been mentioned earlier, until about three years ago, the program operated generally as planned and as it was presented to the Congress in 1960. Then changes began to take place which led the program into its present financial difficulties.

CONTRACTS WITH INDUSTRY FOR THE ACQUISITION OF HELIUM

COMPANY	INITIAL UNIT PRICE (FOR 1,000 CUBIC FEET)	MAXIMUM ANNUAL OBLIGATION (MILLION DOLLARS)	ESTIMATED HELIUM VOLUME (MILLION CUBIC FEET)	
			ANNUAL AVERAGE	LIFE OF CONTRACT
NORTHERN HELEX CO.	\$11.24	\$9.5	675	13,500
CITIES SERVICE HELEX, INC.	\$11.78	\$9.1	610	12,200
NATIONAL HELIUM CORP.	\$11.78	\$15.2	1,053	21,060
PHILLIPS PETROLEUM CO.	\$10.30	<u>\$13.7</u>	<u>788</u>	<u>15,766</u>
WEIGHTED AVERAGE	\$11.29			
TOTAL		\$47.5	3,126	62,526

CHART 1.

One of the most recent and unanticipated changes is the effect of increased interest rates, as shown on our second chart, "Unit Cost of Stored Helium." Under the 1960 Act, compound interest rates on amounts borrowed from the Treasury are calculated by the Secretary of the Treasury as of the time of each borrowing on the basis of the current average market yields of outstanding marketable obligations of the United States. When the program was planned, the cost of borrowed money was assumed to be four percent over the life of the program. At that interest rate, a thousand cubic feet of helium put in storage at a cost of \$12 and held there for 30 years would grow to a cost of about \$40 at time of withdrawal. The most recent borrowing from the Treasury was at the rate of 6¼ percent. However, in evaluating new programs, the Bureau of the Budget now requests that a 10% rate be applied as a test of a new program's desirability. If, for example, helium costing \$12 should be held in storage for 30 years at the 10% rate, the cost of helium at the time of withdrawal would be about \$200 a thousand cubic feet. Here is another problem we face in the helium program. When commodities cost more, less are used. If a commodity is held in storage long enough, its cost at the time of use may exceed the price that users are willing to pay.

UNIT COST OF STORED HELIUM

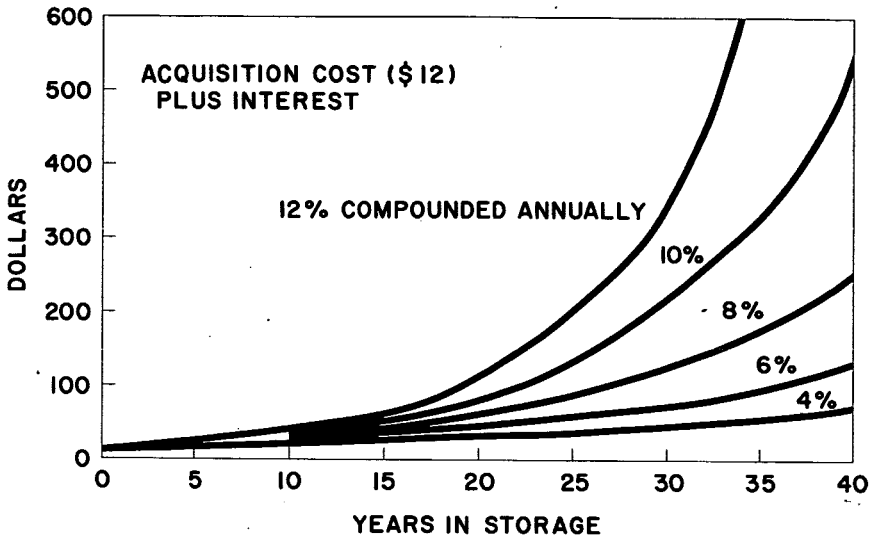


CHART 2.

Another factor which affects the program is the change in the helium supply-demand picture. Our third chart shows that picture as it was presented to this committee in 1960. In 1960, no consideration was given to obtaining helium from natural gas containing less than 0.3 percent helium because there was no technology at that time for extracting helium from such low-grade sources. Extracting helium from gas containing 0.3 percent helium posed some questions of technology since no one in this country had ever processed natural gas containing less than about 0.9 percent helium. As things then appeared, it seemed likely that, by 1985 or 1990, helium demand would exceed the quantity available from remaining known helium resources containing more than 0.3 percent helium. In 1960, total recoverable helium in natural gas containing more than 0.3 percent helium and being transported to fuel markets was estimated to be 154 billion cubic feet. By 1985, the remaining helium resources from such relatively rich natural gas was expected to be reduced to about 35 billion cubic feet. Annual availability of helium was expected at that time to be less than annual demand. In 1960, the only considered alternative to helium conservation was extraction from the air at costs estimated to be between \$1,000 and \$2,000 a thousand cubic feet. Since then, because of new technology, we have taken a new look at the leaner helium resources in natural gas outside the Hugoton area. This is shown on the next chart.

HELIUM SUPPLY DEMAND PICTURE 1960

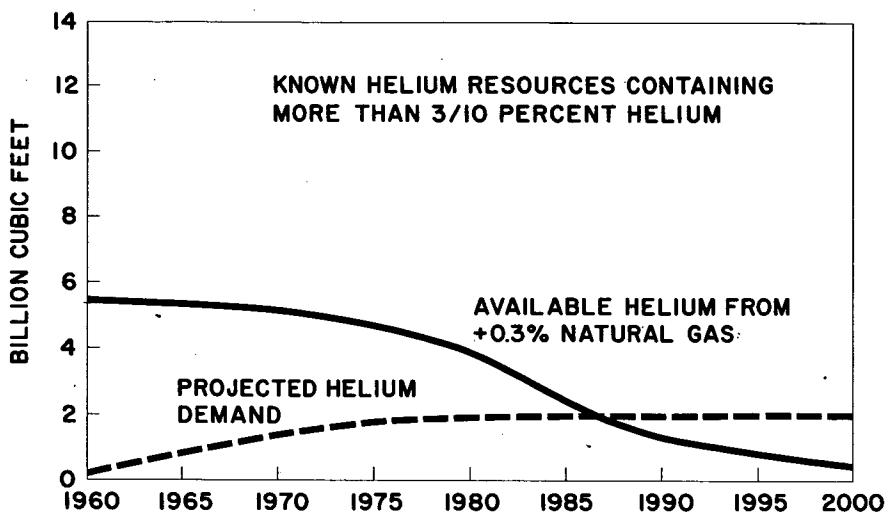


CHART 3.

Evaluation of known and prospective natural gas supplies containing less than 0.3 percent helium suggests that helium may be obtained in the future at costs which may not exceed the cost of holding helium in storage for long periods at high interest rates. It is now feasible to consider these low helium content natural gases as a future supply of helium because of the extension of helium extraction technology made by the helium conservation contractors. Gas streams containing as little as 0.4 percent helium are now being processed at a price of \$12 per thousand cubic feet for the helium extracted. Recovery of helium from lower helium content sources (about 0.076 percent or less) would likely cost in the range of \$200 to \$500 a thousand cubic feet with present technology. These reserves are also being depleted to supply fuel markets. Nevertheless, there are good prospects that additional reserves of natural gas will be discovered in this country. If no more higher helium content natural gas is found and the helium content of yet to be discovered natural gas should be low, there should be large volumes of helium available at a price much less than the cost of extraction from air and at a price which is not likely to exceed the cost of holding helium in storage for long periods of time. These features were not considered when the helium program was presented in 1960.

HELIUM SUPPLY DEMAND PICTURE 1969

HELIUM FROM NATURAL GAS OF VARYING HELIUM CONTENT

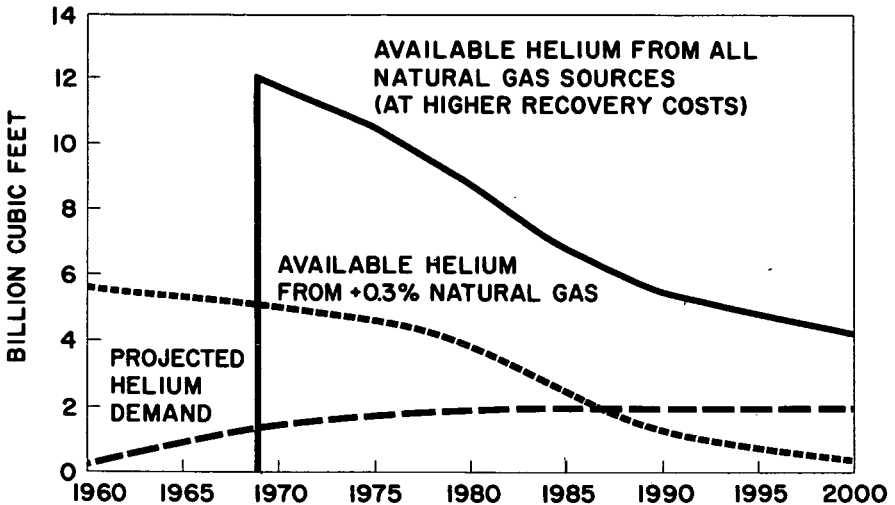


CHART 4.

On the next chart we see the helium demand which was projected from the experience between 1950 and 1959, and which was presented to this committee in 1960 in support of the need for conservation. For several years, actual sales ran close to projected sales, but, for each of the last two years, total demand has been from 20 to 30 percent less than anticipated when the program was authorized. A large part of past helium demand has been generated by, and is related to, the space program. A principal reason for the lower demand during the past two years is the completion of major development phases in the planned program to land men on the moon before 1970.

ESTIMATED TOTAL HELIUM DEMAND FY 1950-1985

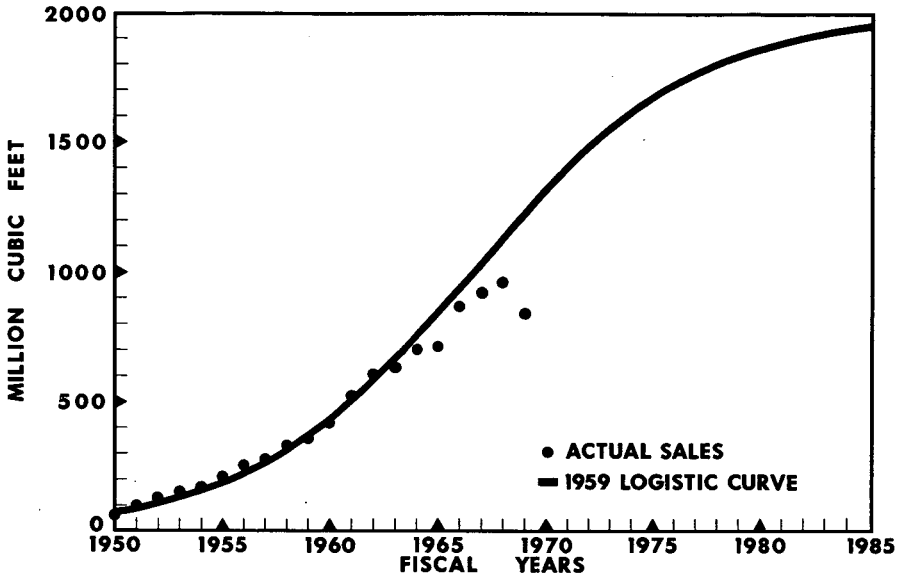


CHART 5.

Our chart of helium uses in 1969 shows that most of the current helium demand is for pressurizing rocket fuel systems, with welding and cryogenics or low temperature uses of helium the next largest categories.

HELIUM USES

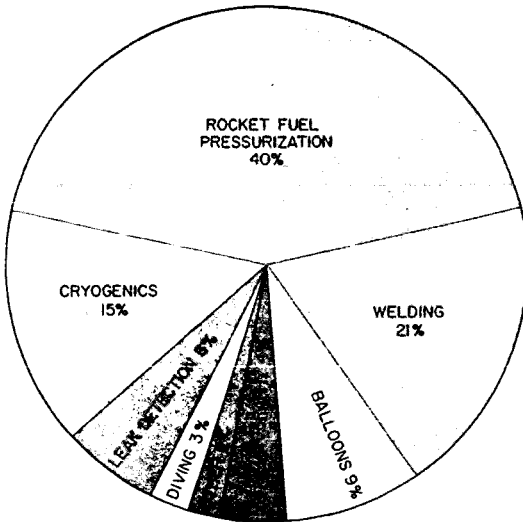


CHART 6.

The dependence of present helium demand on the needs of the space program is shown with greater emphasis in our chart of helium users in 1969. It seems clear that, unless some large and new helium-using programs soon develop, helium demand is not likely to grow as rapidly in the near future as it has in the immediate past.

HELIUM USERS 1969

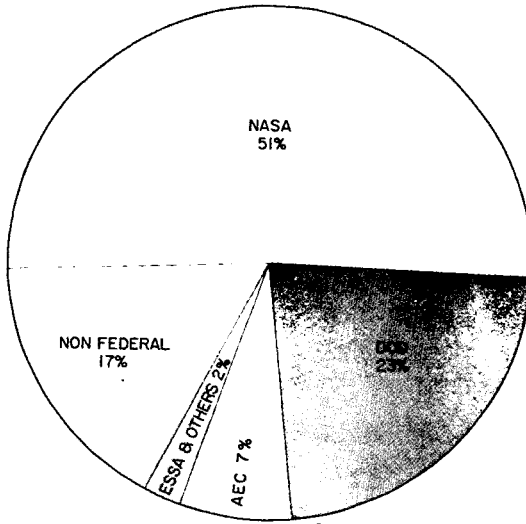


CHART 7.

Although the Government is still the dominant helium user, it now supplies a little over half the total helium demands, as seen on the next chart. The growth of the private helium industry began when the helium conservation program got into operation. At that time, the price of helium was increased from a former high of \$19 a thousand cubic feet to \$35 a thousand cubic feet. The purpose of the increase was to generate revenue to liquidate costs of the program, and the \$35 price was calculated to do this under the assumptions made at that time. The higher price also created an attractive price umbrella which accelerated the entrance of private industry into helium production.

It might be asked why the Government does not reduce the price of helium to be competitive with private marketers. The answer is that even if the Government reduced the price to a point below that at which the private producers could survive, thus taking 100% of the market, the total market is too small to meet the payout requirement of the Act with revenues from sales at lower prices. Conversely, the Government would be reluctant to raise the price to Federal agencies, thus creating an even greater disparity in price with the private marketers, and adding this additional burden on the budgets of the using agencies.

This picture of helium sales in the United States shows how private industry sales have diverted income from support of the helium conservation program.

HELIUM SUPPLIERS 1969

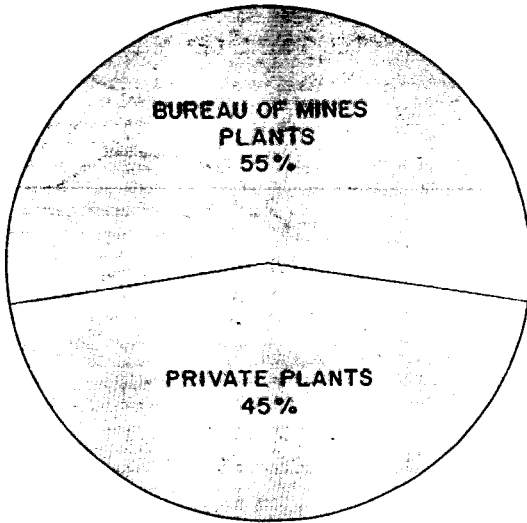


CHART b.

The loss of income to the Government from sales, coupled with a reduced level of total demand, has brought about a drastic change in the financial outlook of the program. Because of competition among themselves, private producers undersell the Government by about \$10 a thousand cubic feet and have thus taken over all of the purely private market. They also have encroached on much of that part of the "Federal market" represented by contractors and subcontractors doing work for Federal agencies.

The extent to which a private helium industry would develop was not foreseen in 1960. With the exception of one small helium plant, which began operating in 1961, no new helium plants appeared until 1966. By the end of 1968, a total of seven private plants had entered the market. In addition, three of the four conservation contractors became able to produce more helium than the Government could purchase for storage under the dollar ceilings of the contracts. Consequently, this excess helium was also available for sale.

For the purposes of payout, section 6(a) of the Helium Act reserves the "Federal market" to the Secretary. The Bureau of Mines has been of the view from the outset that this reserved market includes contractors and subcontractors doing business with Federal agencies. While this position was made known by the Bureau to private producers and distributors, it became clear that the latter were, to an increasing extent, marketing to Federal contractors and their subcontractors. Accordingly, after consultations with the helium-using Federal agencies, the Secretary issued regulations in October 1968, which, in effect, would require contractors and subcontractors to purchase their major requirements of helium from the Secretary. Before these regulations became effective, three of the private producers filed an action in court to enjoin the Secretary from making them effective. In December 1968, the U.S. District Court for the District of Columbia issued a permanent injunction. The Government has appealed this decision to the U.S. Court of Appeals for the District of Columbia Circuit, and a decision is expected at any time. Since issuance of the injunction, strong appeals have also been made to the Department of Defense, AEC, and NASA, urging these agencies to adopt procurement policies which would require their contractors and subcontractors to purchase their major requirements of helium from the Secretary, unless such helium is furnished by the agencies.

HELIUM SALES IN UNITED STATES

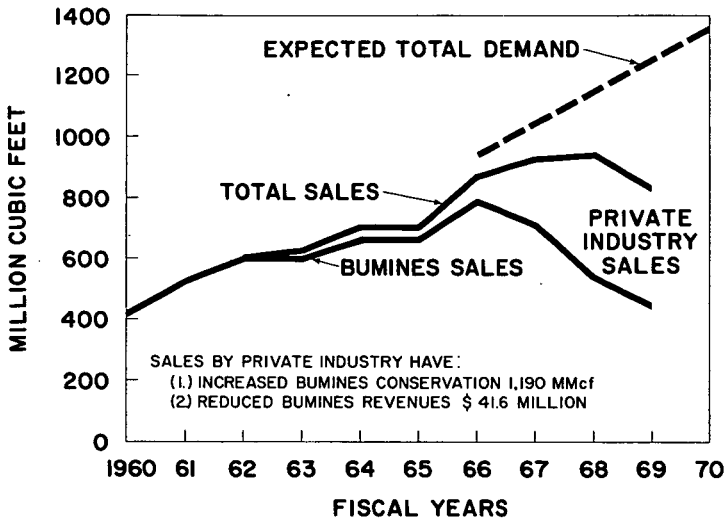


CHART 9.

As illustrated on our next chart, the helium program was expected to payout within the minimum time provided in the Helium Act. Borrowing from the Treasury would not have been required beyond about 1970 and repayments would begin thereafter.

EXPECTED PAYOUT-HELIUM PROGRAM

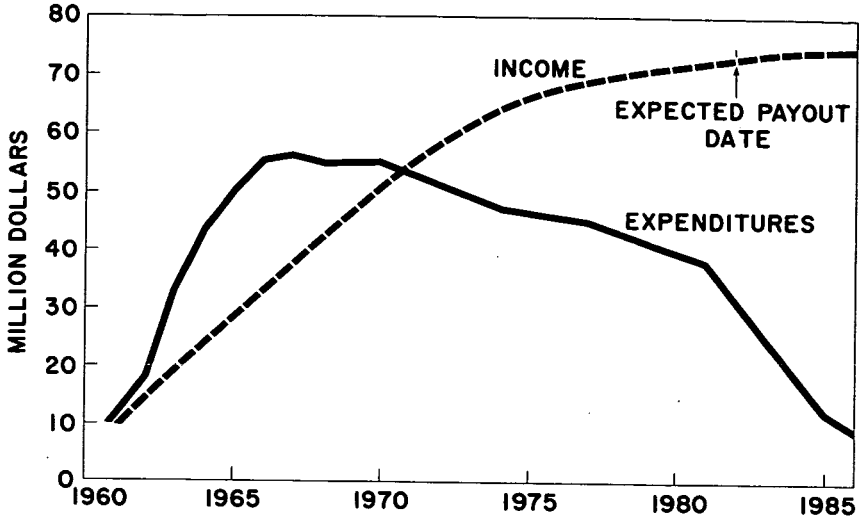


CHART 10.

Our next chart of the actual picture of helium program payout shows that the program cannot now meet the payout requirement of the Act at the current level of income. This situation came about from the loss of market which was reserved to the program by the Helium Act. Some of these features are shown on the next chart.

HELIUM PROGRAM PAYOUT PICTURE 1969

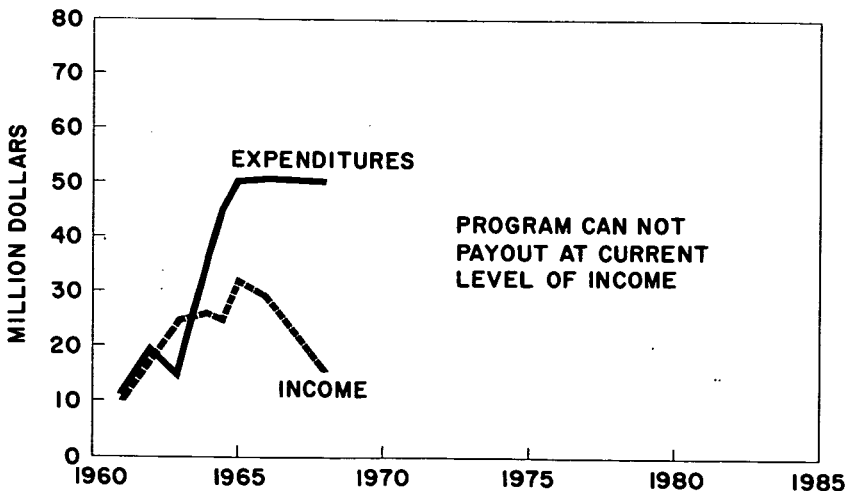
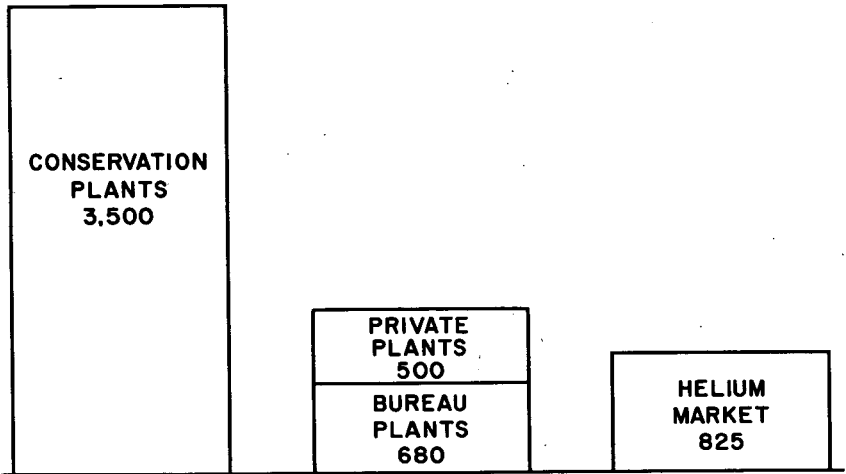


CHART 11.

Because of the helium conservation program, the total helium recovery capacity existing today is about five and one-half times larger than the present total market for helium. Without drawing on stored helium, Bureau of Mines plants cannot supply the total market from gas supplies available to them. The private plants, operating outside the helium conservation program, cannot supply the total market from gas supplies available to them. Under the helium conservation contracts, the conservation plants' production is purchased for storage by the Government. If it were not for the present contractual arrangement, any one of the four conservation contractors would have the capacity to supply the entire market—and probably at prices lower than the lowest prices being charged today.

HELIUM RECOVERY CAPACITY vs. MARKET 1969 **(MILLION CUBIC FEET)**



HELIUM RECOVERY CAPACITY

36-125 888

CHART 12.

Finally, this chart of helium program costs and financing for 1970 is typical of the situation in 1969 and is what can be expected in 1971 unless some changes are made. Our continuing efforts to regain the Federal contractor helium market will likely have little effect on the financial picture in 1970. Some relief may materialize during 1971. If we are successful in regaining the Federal contractor market, and if the regained market should turn out to be about 200 million cubic feet a year, as anticipated, the additional revenue available to the program, at the present \$35 price, would be about \$7 million a year.

HELIUM PROGRAM-COSTS AND FINANCING FY 1970

(MILLION DOLLARS)

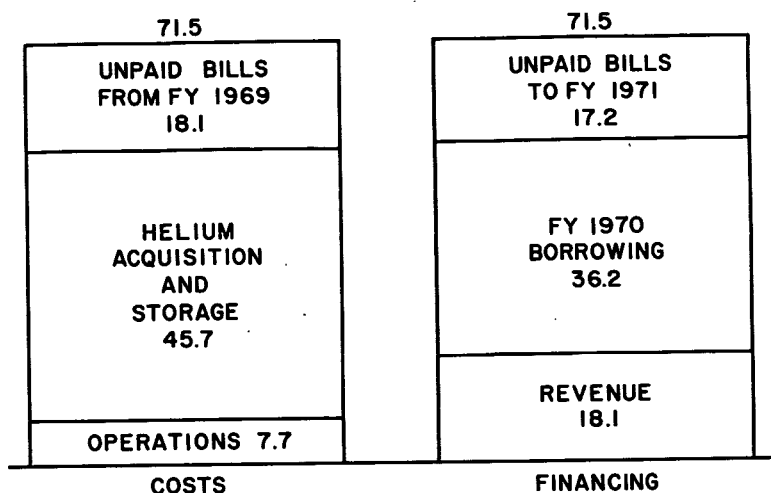


CHART 13.

In summary—Important and unforeseen changes have occurred since 1960 which affect seriously the financing of the helium conservation program. Total helium demand has been lower than anticipated when the program was authorized. A sizable part of the "Federal market" has been lost. In addition to lower total demand, emergence of a vigorous private helium industry, operating under a Government price umbrella, has come into being. Higher interest rates for borrowed money are burdening the program beyond the point that it can be liquidated through future revenues. These combined factors make it impossible for the program to continue at its present level if it is to meet the payout requirements of the Act. Improvements in helium recovery technology, as a direct result of the conservation program, suggest that larger helium resources may be available in the future than was thought possible when the program was authorized. This concludes my description of the problems we face with the helium program.

**FARM
AND OFF-FARM
INCOME REPORTED
ON FEDERAL
TAX RETURNS**

farm profits and losses
wages and salaries
dividends
interest
nonfarm business
capital gains

CONTENTS

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SUMMARY

1. Individual proprietors accounted for nearly 96 percent of the more than 3 million farm tax returns filed for 1965, and reported more than three-fourths of the farm business receipts. Partnerships accounted for fewer than 4 percent of the tax returns, but reported about 11 percent of the total farm receipts. Farm corporations, representing only 0.6 percent of the returns, reported 12 percent of the receipts.
2. Many individuals report small farm receipts and relatively few report large receipts. It is significant that those with small receipts often could not expect to live solely by farming. The semiretired, individuals with full-time off-farm jobs, and landlords with small holdings account for some of those with small farm receipts.
3. This study is based on "Statistics of Income" published by the Internal Revenue Service (IRS). The study departs from the concept of a farm and relates income to individuals. A picture emerges of a farm economy in which most individuals receive some off-farm income and many receive most of their income from off-farm sources. Several individuals or families may share the income from a farm.
4. Individuals with farm income often report little or no profit on their farm tax returns. In 1964, more than one-third reported losses and another two-fifths reported profits of less than \$2,000. However, farm profits and losses, as reported on tax returns, need to be interpreted with a clear understanding of IRS rules and definitions.
5. Data from tax returns show the important interrelationship between farm and off-farm income. This relationship is significant in understanding the farm economy. Farm income alone often does not fully measure an individual's income.
6. Wages and salaries totaling \$7.1 billion in 1963, reported by 70 percent of those with farm losses and 40 percent of those with profits, were the most important kind of off-farm income. Large farm profits and large wage and salary earnings were not usually received by the same people. Wage and salary income was relatively more important to individuals whose reported farm profits and losses were small. However, many with small profits or losses did not have off-farm work.
7. Dividends, the most unequally distributed of the various off-farm income sources, were reported most often and were largest for individuals with the largest farm losses. Dividends were also associated with large off-farm incomes.
8. Income from interest was reported by 40 percent of the individuals with farm income in 1963. Interest averaged largest for those reporting large losses. Individuals reporting losses reported interest only slightly more often than those with profits.
9. More than one-tenth of the individuals with farm income reported income from nonfarm businesses. About half of those with nonfarm businesses reported farm losses.
10. When classified by amount of taxable income from all sources, about a million individuals with farm income were classed as poor, 1.9 million were in the middle income groups, and more than 0.3 million were termed well off or wealthy. Individuals at higher income levels were generally those with large off-farm incomes.

FARM AND OFF-FARM INCOME REPORTED
ON FEDERAL TAX RETURNS

by

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INTRODUCTION

Farm economic analysis has traditionally been associated with the farm operating unit. The concept of a farm has been built around a set of physical resources--a tract of land, a set of buildings, machinery, livestock, and labor. This operating unit or farm firm has served as the basis for microstudies concerned with efficient use of limited resources and maximization of farm income. Because farm statistics are collected with the farm operating unit in mind, macroeconomic studies and farm policies are also often implicitly tied to the farm firm. The notion of a farm has so dominated thinking about agriculture that alternative units of observation have seldom been considered.

In the past it was reasonable to believe that farmers were people who lived on farms, tilled the soil with their labor and equipment, and cared for their own farm animals. Farmers received the fruits of their labor and management and a return on their investment--farm income. It was generally assumed that the farm operation was separate from and influenced relatively little by nonfarm occupations or nonfarm business and investment interests of the farm operator. Farm production units were taken to correspond with family income-earning and spending units.

Farming today is mixed with nonfarm pursuits, but little is known about how individual incomes are affected.^{1/} Farms and farmers are no longer as easily identifiable as they once were. Off-farm income such as wages and that from nonfarm businesses and investments is a major part of the income of people with farm earnings, especially those who own farmland but are not directly engaged in farming. In fact, most individuals with farm income receive some off-farm income, and many receive most of their income from off-farm sources. Individuals often receive income from farming although they neither live on a farm nor participate directly in farm operations. Moreover, some farm operators do not live on farms. For some people, farming is a sideline; for others, a hobby.^{2/}

^{1/} About four-fifths of the 1964 census farm operator households reported some off-farm income. Average off-farm income reported was \$3,900.

^{2/} It should be noted that developments such as vertical integration have also decreased the usefulness of the concept of a farm for some types of studies, and have strengthened the need for a shift toward other analytic units.

This report focuses on the income of individuals. Analysis of individual incomes can provide new insights from an alternative vantage point, and is potentially valuable because it is unique. Not only are there few studies of the income sources of those involved in farming but there are few data which would allow this kind of analysis.

Understanding the income situation of people with farm incomes is crucial to enlightened farm policy decisions. Policymakers need to know for which groups and to what degree income problems exist before more effective solutions can be developed. Farm operators may have lower farm earnings than indicated by the income of the farm they operate because landlords or others may share this income. Also, some of those with low farm incomes may have little need for direct farm income support because of substantial off-farm incomes.

The development of new sources of information for individuals may help in understanding the flow of funds into and out of farming. If the off-farm income of individuals associated with farming is large, it may be an important source of farm investment funds. Nonoperator landowners and other investors in agriculture may also rely on credit sources generally thought to have little influence on farming. Money and credit available for farming from nonfarm sources may increase pressure on farmland prices, increase farm output, and tend to lower the prices of some farm products.

Objectives

The specific objective of this study is to determine the amount of income from various sources received by individuals who derive some of their income from farming. The emphasis is on the income of individuals rather than the income of farm firms. A secondary but important objective is to evaluate farm tax returns as a source of data for studies of income from farming.

Federal Income Tax Returns as a Source of Data

This is a study of gross farm receipts, farm profits or losses, and the off-farm income of those reporting farm income on Federal income tax returns.^{3/} Data are for individuals, including farm operators, landlords, and others with a business interest in farming.^{4/} Income data are also included for partnerships and corporations whose major source of receipts is farming.

^{3/} The data come largely from "Statistics of Income, U.S. Business Tax Returns" and "Statistics of Income, Individual Income Tax Returns," Internal Revenue Service, U.S. Treasury. For a description of the sample and sampling procedures, see these annual reports. In 1962, the sample included about 50,000 individual farm proprietors, 6,000 farm partnerships and about 1,000 farm corporations. The report includes data for 1945-65, but emphasizes 1962 and 1963. It was sometimes necessary to show tables for different sets of years because tabulations of the IRS differ from year to year.

^{4/} For tax purposes, individual proprietors are farm operators (including tenants), landlords, and others, such as informal partners not using the partnership return, with income from farming and gross income from all sources of \$600 or more (\$1,200 for individuals 65 years old and over). Self-employed individuals must also file a return and pay self-employment taxes for social security purposes if their net earnings from self-employment are \$400 or more. Individual returns (tabulated from Form 1040) and individual proprietor returns (tabulated from the farm and business schedules) are essentially the same and are treated alike in this report. The number of individual returns in 1964 was about 0.6 percent smaller than the number of individual proprietors. About 80

Farm receipts on tax returns include sales of market livestock, livestock products, and crops. Receipts also include Federal agricultural program payments, patronage dividends of cooperatives, income tax refunds, Federal gasoline tax refunds, and ordinary gain or loss on sales of farm real estate and personal property. Sales of livestock held 12 months or longer by individuals or partners for draft, breeding, or dairy purposes are not counted as farm receipts, but are treated as sales of capital assets. Capital gains and losses are included with the farm income of corporations.

Farm profit or loss for tax purposes is the difference between farm receipts and farm business deductions. Business deductions include hired labor, materials, taxes, and depreciation. Some land development costs, such as the cost of land clearing, are also treated as deductible expenses. Wages and salaries paid to the owners of a partnership and payments by a corporation to its managers are deductible. Individual proprietors cannot deduct wages for themselves.

Social security benefits, welfare payments, and interest on State or local bonds are not taxable and are thus not reported. The value of home-consumed farm products is not taxable, and the cost of producing them is not a deductible expense.

Off-farm income reported on farm tax returns includes wages and salaries, dividends, interest, income from nonfarm businesses, rents, royalties, pensions and annuities, and other miscellaneous income.

The total amount of farm receipts from tax returns compares favorably with the amount of cash receipts estimated by the Economic and Statistical Analysis Division, Economic Research Service, USDA. Net farm income from the two sources, however, differs greatly. It is important to keep in mind that estimates by USDA and those from IRS are developed under different definitions from separate sources. Data have not been adequate to fully reconcile these differences.^{5/}

Farms and Farm Tax Returns

Data from tax returns will be more easily understood if the differences between persons who file farm returns and farm operators are clear. The total number of farms is about the same as the total number of tax returns, but farm operators and persons who file farm tax returns are not identical populations. Most farm operators file a return, but some are not required to do so because their income is below the taxable minimum. For some farms, there are two or more tax returns because landlords or informal partners share the income. Sharing income under landlord-tenant arrangements on low income farms increases the probability that no one will receive sufficient taxable income to file a return.

percent of individual returns are joint returns of husbands and wives. A small number of individuals with more than one farm are counted more than once when treated as individual proprietors, but are counted only once when treated as individuals.

Farm partnerships file information returns, but no income tax is paid with these returns. Each member of the partnership transfers his share of the partnership income to his individual return and, when due, taxes are paid on the individual return. These individual returns from farm partners are not tabulated with other individual returns. Data for farm partnerships are from the partnership information return. Many informal farm partnerships do not file information returns; the partners file separately and are counted as individual proprietors.

^{5/} For a discussion of differences in income reported, see the appendix.

The relationship between persons who file farm tax returns and farm operators is illustrated by two overlapping circles (fig. 1). The area AB represents all farm operators; area BC represents all individuals and businesses reporting farm income on tax returns. Area A represents farm operators not filing a return because they receive less than the minimum taxable income. The shaded area B, common to both circles, can be thought of as representing farm operators receiving more than the minimum gross taxable income and filing a return. Farm landlords, informal partners, and other nonoperators with business interests in farming receiving more than the minimum gross taxable income are included in area C.

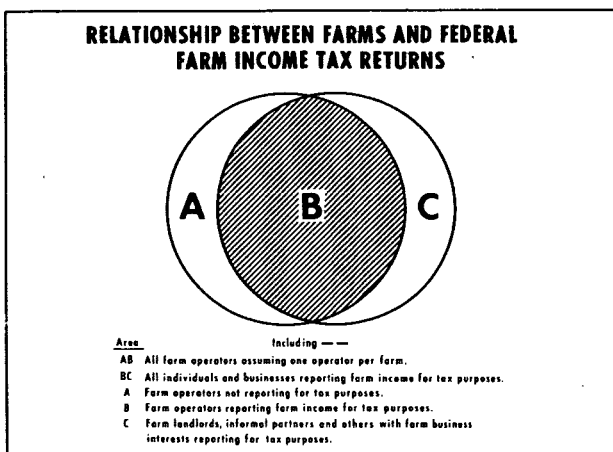


Figure 1

Data by States show that the number of farms and the number of farm tax returns do not correspond on a one-to-one basis. In 1963, 22 States had more Federal farm income tax returns than farms (fig. 2). These States were mainly in areas known to have relatively high farm incomes, especially where there were many part-owners and tenants. Tenants and part-owners are important since each has at least one landlord who may also file a farm return. There were fewer than 80 percent as many tax returns as farms in 15 States in the Appalachian, Southeast, Delta, and Northeast Regions.

When U.S. farms and farm tax returns are classified by size of receipts, the distributions are similar (table 1).^{6/} Although the similarity is partly coincidental, approximately three-fifths of the farms and tax returns showed receipts of less than \$5,000, and about a fourth of each reported \$10,000 or more.

^{6/} The distribution of farms by value of sales, as estimated by the USDA, is compared with a distribution of tax returns by farm business receipts.

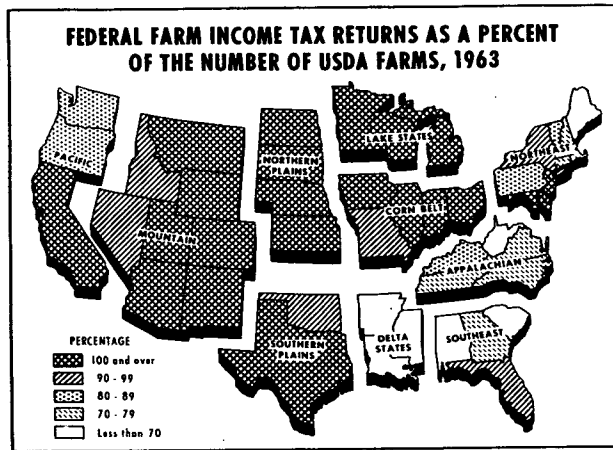


Figure 2

Table 1.—Number of farms and Federal farm income tax returns
by amount of farm receipts, 1962

Farm receipts (value of sales)	Farm tax returns 1/		Farms 2/	
	Number	Number as per- centage of total	Number	Number as per- centage of total
	Thousands	Percent	Thousands	Percent
\$10,000 or more-----	862	25	894	24
\$5,000 to \$9,999-----	633	18	583	16
Less than \$5,000-----	1,962	57	2,211	60
Total-----	3,457	100	3,688	100

1/ U.S. Business Tax Returns, 1962. Includes returns of individual proprietorships, partnerships, and corporations. The distribution of the 15,000 farm corporations by receipts was estimated by the author from the distribution of 22,000 agriculture, forestry, and fishery corporations. Data are for the 50 States, Puerto Rico, and the Virgin Islands.

2/ U.S. Department of Agriculture, Economic Research Service. Farm Income Situation, July 1967. Data include the 48 conterminous States.

There were a few more farms than tax returns with receipts greater than \$10,000. This is probably because taxpayers sometimes shared income from a farm, and each reported only his share of the receipts. Income sharing on larger farms also helps explain the slightly greater number of tax returns than farms in the class with receipts of \$5,000 to \$9,999. For example, the income of a farm with receipts of \$18,000 might be shared by two individuals, each reporting \$9,000 in receipts. Although no one would receive more than \$10,000, two individuals would report receipts of \$5,000 to \$9,999.

The 10 percent fewer tax returns than farms with receipts of less than \$5,000 suggest that a return was not filed for some farms where no one received the minimum taxable income. Many of those not reporting probably had no income tax to pay.^{7/} They may live mainly on social security or other nontaxable income. Apparently relatively few who receive the minimum gross taxable income fail to report.

FARM INCOME

Income tax returns include two measures of income from farming: (1) farm business receipts, and (2) farm profits or losses. Business receipts help establish the relative importance of each type of business organization--individual proprietors, partnerships, and corporations--in the total farm mix.^{8/} Receipts also serve as a measure of the size of farm business, except when receipts from a farm are shared by two or more individuals or businesses. While farm receipts alone are an unsatisfactory measure of an individual's income, the amount of farm receipts sets an upper bound on farm profits.

Profits or losses are, of course, generally preferable to receipts in measuring an individual's farm income. Also, because expenses have been deducted, farm profits or losses of individuals can be combined with taxable income from other sources to arrive at a more complete income picture.

Trends in Reporting Farm Income for Tax Purposes

In 1965, some 3.2 million Federal income tax returns included farm income, 10 percent fewer than the number in 1955 (appendix table 13). This decline is probably due to the decreasing number of farms. Individual proprietors and partnerships with profits have decreased in number, but those with reported losses have in general increased in recent years. One-fourth of the individual proprietors reported losses in 1953; one-third reported them in 1965.

^{7/} The 1964 census data suggest that about 600,000 farm operators sold less than 600 dollars worth of farm products. Often these operators and others over 65 with less than \$1,200 in farm receipts and little or no taxable off-farm income would not have been required to report income. About half the farms reported in the census with receipts of less than \$600 were in 12 Appalachian, Southeastern, and Delta States where there were the fewest tax returns in relation to the number of farms estimated by USDA.

^{8/} The receipts picture is complicated by partnerships and corporations that are engaged in activities other than farming, since the industry classification is based on the major source of receipts.

An increase in Federal farm income tax returns between 1953 and 1955 seemed to reflect the extension of social security coverage to farmers in 1955. Qualifying for social security coverage may have increased the total number of individuals filing farm tax returns by as much as 10 percent. Some of those reporting under the gross income option available to low income farm taxpayers would not have filed a tax return otherwise. Optional reporting for social security probably also contributed to the greater number reporting net farm losses for Federal income tax purposes.

Farm business receipts reported for 1965 were more than double those reported in 1945. But individual proprietors accounted for a somewhat smaller percentage of the total farm receipts than in 1945 because of a more rapid increase in receipts of partnerships and corporations. Partnerships just maintained their relative position; corporations increased their share of receipts (appendix table 14).

Farming was the major source of receipts for slightly more than 18,500 corporations in 1965. These corporations, representing less than 0.6 percent of the number of farm returns, reported business receipts of \$4.9 billion--about 12 percent of the total reported farm receipts. Farm corporations represented 67 percent of the number and a similar share of the business receipts of all agriculture, forestry, and fishery corporations as classified by IRS.

The number of agriculture, forestry, and fishery corporations more than quadrupled between 1945 and 1965. Nearly one-third of the increase after 1957 can be explained by tax legislation that favored small family-type corporations.

Business Receipts in the Farm Economy

Individual proprietors--mainly farm operators, landlords, and informal partners--dominate the farm economy (tables 13 and 14). In 1965, these proprietors reported receipts of \$29.9 billion, averaging \$9,760 each. They accounted for 96 percent of all returns and reported three-fourth of total farm receipts.

Many individuals report small farm receipts; relatively few report large receipts. In 1962, about 58 percent of the individual proprietors reported receipts of less than \$5,000, 19 percent reported \$5,000 to \$9,999, and 23 percent reported \$10,000 or more (table 2). Receipts averaged 14 percent more in 1965 than in 1962.

It is not surprising that some individuals who are not full-time farmers report little farm income. The semiretired, those with full-time off-farm jobs, and landlords with small holdings account for some of the small receipts. Of course, there are also full-time farm operators reporting small receipts.

Many individuals who have farm receipts can not expect to live solely on income from farming. Prospects for a satisfactory living from farming are remote for all individuals with receipts of less than \$5,000, and most of those with receipts of less than \$10,000 can expect only moderate net incomes from farming.

Partnerships accounted for fewer than 4 percent of the 1965 farm tax returns, but reported more than 10 percent of total farm receipts. The average partnership (2.5 partners) received \$35,220, about 3.6 times the average for individual proprietors. The most recent distribution of partnership receipts for 1962 indicates that

Table 2.--Farm proprietorships, partnerships, and corporations
by amount of farm receipts, 1962 ^{1/}

Type of business	Number of businesses	Percentage with receipts of--				
		Less	\$5,000	\$10,000	\$25,000	\$50,000
		than	to	to	to	or
		\$5,000	\$9,999	\$24,999	\$49,999	more
	Thousands	Percent	Percent	Percent	Percent	Percent
Individual proprietor-						
ships-----	3,319	58	19	17	4	2
With profits-----	2,302	49	22	22	5	2
With losses ^{2/} -----	1,017	78	11	8	2	1
Partnerships-----	123	27	15	26	16	16
With profits-----	94	20	16	28	18	18
With losses ^{2/} -----	29	49	12	17	11	11
Corporations ^{3/} -----	15	9	9	11	14	57
All businesses-----	3,457	57	18	18	5	2

^{1/} U.S. Business Tax Returns, 1962. Data are for the 50 States, Puerto Rico, the Virgin Islands, other U.S. possessions, and foreign areas.

^{2/} Including returns with receipts equal to deductions.

^{3/} Farm corporations were assumed to include 70 percent of the agriculture, forestry, and fishery corporations as they did when tabulated separately for 1963. The percentage distribution by amount of receipts was estimated from the distribution of corporations classified as agriculture, forestry, and fishery. Because there are relatively few farm corporations, the distribution for all farm businesses together is not changed significantly if corporate returns are excluded.

more than 40 percent of these partnerships reported less than \$10,000. However, nearly one-third reported receipts of \$25,000 or more, and half of these reported receipts of \$50,000 or more (table 2).

Available data from agriculture, forestry, and fishery corporations for 1964 indicated that more than half of the farm corporations had receipts of \$50,000 or more; nearly one-fifth reported receipts of less than \$10,000. Receipts of all corporations averaged about \$230,000.

Producing areas. About half of the farm produce in the United States in 1963, measured by reported farm receipts of individual proprietors and partnerships, was concentrated in 12 North Central States (fig. 3). Five Corn Belt States alone accounted for about one-fourth of the total; the Northern Plains and Lake States accounted for another fourth. The Pacific and Southern Plains Regions each accounted for somewhat less than one-tenth of all production:

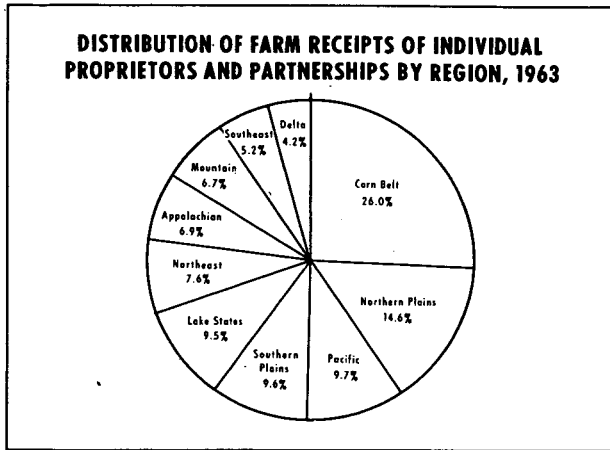


Figure 3

Farm Profits or Losses

Tax returns are unique in that they provide distributions of proprietorships and partnerships by amount of farm profit or loss. However, these data need to be interpreted with a clear understanding of the reporting rules and definitions used by IRS. Also, because income tax returns are filed mainly by individuals rather than for farm operating units, the notion of a farm is not particularly useful in analyzing the data.

Many individuals with farm income report little or no profit on their farm tax returns. In 1964, about 41 percent reported profits of less than \$2,000 and another 36 percent reported losses (table 3). Fewer than 8 percent reported profits of \$5,000 or more.

Farm partnerships generally reported larger profits than sole proprietors, but in 1964, 29 percent of the partnerships reported losses and another 20 percent reported profits of less than \$2,000.

About 82 percent of all individuals in the Northern Plains with farm income reported profits in 1962, the highest proportion reporting for any region (table 4). The percentages were also relatively high in the Corn Belt, Appalachian, and Lake States--76 percent, 74 percent, and 71 percent, respectively. Comparatively few, 52 percent, reported farm profits in the Pacific Region. The percentage of individuals reporting profits was often different among States within these regions (fig. 4).

Regions where profits were most frequent were not always those with large average farm receipts nor those where farming risks are low. For example, the Appalachian Region had the smallest average receipts in the Nation, but the proportion of persons that reported profits was above the U.S. average. Many from the Appalachian

Table 3.--Farm proprietorships and partnerships by amount of profit, 1964 ^{1/}

Farm profit	Proprietorships		Partnerships	
	Number	Number as per- centage of total	Number	Number as per- centage of total
	Thousands	Percent	Thousands	Percent
Less than \$2,000-----	1,267	40.5	23	19.5
\$2,000 to \$4,999-----	507	16.2	23	19.5
\$5,000 to \$9,999-----	180	5.7	18	15.3
\$10,000 to \$24,999-----	51	1.6	15	12.7
\$25,000 or more-----	6	.2	5	4.2
Businesses with profits--	2,011	64.2	84	71.2
Businesses with losses ^{2/}	1,119	35.8	34	28.8
Total, all businesses---	3,130	100.0	118	100.0

^{1/} U.S. Business Tax Returns, 1964.^{2/} Including returns with receipts equal to deductions.Table 4.--Individuals with farm profits and losses, and average receipts, by region, 1962 ^{1/}

Region	All individuals			Individuals with farm profits		Individuals with farm losses	
	Number	Average farm receipts	Percent- age with farm profits	Number	Average farm receipts	Number	Average farm receipts
	Thou- sands	Dollars	Percent	Thou- sands	Dollars	Thou- sands	Dollars
Northeast-----	229	9,460	61	139	11,450	90	6,400
Lake States-----	391	7,240	71	279	8,440	112	4,220
Corn Belt-----	843	8,660	76	638	10,110	205	4,120
Northern Plains--	348	11,650	82	284	12,430	64	8,250
Appalachian-----	476	4,460	74	353	4,780	123	3,530
Southeast-----	206	7,080	60	123	8,770	83	4,590
Delta States-----	145	7,860	61	89	10,220	56	4,100
Southern Plains--	316	8,540	58	183	11,240	133	4,820
Mountain-----	155	12,590	65	101	14,660	54	8,770
Pacific-----	182	13,820	52	95	19,500	87	7,570
United States ^{2/} --	3,296	8,580	69	2,287	10,060	1,009	5,210

^{1/} U.S. Business Tax Returns, 1962.^{2/} U.S. totals include Alaska, Hawaii, and other areas not included in the regions.

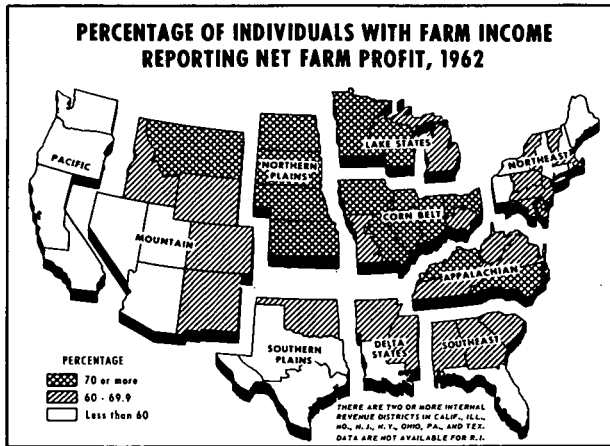


Figure 4

and other low-income regions probably do not report small farm losses. This reduces the total number of returns and tends to increase the percentage showing profits. The percentage of individuals with profits was lowest in the Pacific Region, despite relatively large farm receipts. The Northern Plains, often thought to be a high-risk region, had both high average receipts and a large proportion of individuals reporting profits.

The importance of off-farm income appears to be closely associated with reported farm profits or losses. Losses of those with income solely from farming can often be attributed to weather, crop or livestock diseases, insects, low farm prices, or ill health of the farm operator. But to understand why others show farm losses, it is useful to consider how off-farm income may affect reported farm income.

Some low-income farmers who have recently begun to earn taxable nonfarm income may find it more advantageous to report their farm losses now than in earlier years when they had no taxable nonfarm income. The withholding tax system also tends to increase the number of returns with farm losses. Income taxes are generally withheld from nonfarm wages and salaries even though no taxes may be due when the individual files his tax return. When filing for a refund, the taxpayer may also report small amounts of farm income and small farm losses that he might not be required to report if he had no off-farm income.

Farm operators and landlords with off-farm income sometimes subsidize their farm operations. While this is sometimes done only during a period of development or expansion, it may become a mode of operation. In these instances, the farm business can show losses for several years, or it may never become profitable. Farm operators without off-farm income ordinarily cannot survive losses over an extended period of years.

Individuals with large off-farm incomes sometimes attempt to farm in grand style, hopefully for a profit. Even when earning profits is the objective, these ventures frequently result in farm losses. Others, including "hobby farmers" with little interest in earning farm profits, are even more likely to have farm losses. Expenses of operating a farm for recreation or pleasure are not allowable business deductions when the farm results in a continual loss from year to year.

OFF-FARM INCOME^{9/}

The relationship between farm and off-farm income is probably more significant than has generally been recognized in understanding the U.S. farm economy. In 1963, individuals with farm income also reported off-farm income of \$10.9 billion and capital gains of \$1.2 billion. Wages and salaries totaling \$7.1 billion represented the most important off-farm income. Dividends and interest totaled \$1.5 billion. Nonfarm business income was also nearly \$1.5 billion. Other miscellaneous income such as that from rents, royalties, pensions, and annuities amounted to \$0.8 billion.

Mixing farm and off-farm income results partly from efforts of farm people to increase or stabilize their incomes. Off-farm income is frequently received by individuals who continue to farm but also earn wages or salaries or have other off-farm interests. For some of these people, farm earnings dominate the income picture; however, farm earnings are often overshadowed by off-farm income.

Some of those who have left farms during recent decades for better nonfarm opportunities have retained or inherited a financial interest in farming, such as through ownership of farmland or farm business investments. In addition to those with a farm background, others who have few ties with agriculture may own farmland or invest in farming.

Individuals whose incomes appeared to be inadequate when only farm profits and losses were considered often had the largest combined farm and off-farm incomes. In fact, the greater the reported farm losses, the larger the average income from all sources combined and apparently the less likely that the individual made his living by farming (tables 5 and 6). After subtracting farm losses, those with losses in 1963 averaged \$5,250 from combined farm and off-farm income. This was about one-fifth greater than the \$4,340 combined income reported by individuals with farm profits. It is clear that reported farm profits and losses alone are a poor indicator of the income situation of individuals.

In 1963, off-farm income and capital gains averaged only 36 percent as much for individuals with farm profits as for those with losses. However, they accounted for about half of the combined income of those with farm profits and were more important than farm profits for 38 percent of those reporting profits. One-fifth of the individuals with farm profits reported that 80 percent or more of their combined income consisted of off-farm income or capital gains.^{10/} Among individuals reporting profits, off-farm income averaged highest for those with the largest farm profits but accounted for a larger share of the combined income of individuals with small profits.

^{9/} Farm and nonfarm capital gains are also discussed in this section.

^{10/} For further detail on farm profits of individuals as a percentage of their combined farm and off-farm income, see table 10, Individual Income Tax Returns, 1963, Internal Revenue Service, U.S. Treasury Department.

Table 5.--Percentage of individuals with farm income reporting off-farm income from specified sources,
by amount of farm profit or loss, 1963 ^{1/}

Farm profit or loss	Number	Average farm receipts	Percentage: any off-farm or other income	Percentage reporting off-farm income from--					
				Wages and salaries ^{2/}	Dividends	Interest	Nonfarm sole pro- prietor- ships	Partner- ships	Other sources ^{3/}
	Thousands	Dollars	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Farm profit:									
\$10,000 or more--	50	60,450	88	24	30	62	6	10	76
\$5,000-\$9,999----	167	26,660	85	27	19	50	6	4	74
\$1,200-\$4,999----	854	11,820	79	33	11	39	6	3	64
\$400-\$1,199-----	584	5,100	75	41	7	35	8	3	54
\$100-\$399-----	337	3,270	86	55	9	37	12	3	60
Less than \$100--	111	2,660	92	65	10	39	14	4	66
Farm Loss:									
Less than \$100--	96	2,690	95	69	9	37	16	4	68
\$100-\$399-----	241	2,840	95	71	10	40	12	4	67
\$400-\$1,199-----	381	3,390	96	74	10	40	14	4	70
\$1,200-\$4,999----	310	6,540	97	70	16	43	16	7	75
\$5,000-\$9,999----	40	16,190	96	51	30	53	26	18	84
\$10,000 or more--	26	55,220	94	42	46	64	30	24	87
Individuals with farm profits-----	2,103	10,440	80	40	11	39	8	3	62
Individuals with farm losses-----	1,094	5,790	96	70	13	42	15	6	71
All individuals:	3,197	8,850	86	50	12	40	10	4	65

^{1/} U.S. Business Tax Returns, 1963.

^{2/} For additional detail, see table 7.

^{3/} Including sales of farm and nonfarm capital assets, rents, royalties, pensions and annuities, ordinary gain from sales of depreciable property, estates and trusts, sales of property other than capital assets, and other miscellaneous items. See table 10 for number of individuals reporting and amounts reported.

Table 6.--Average farm and off-farm income of individuals, by amount of farm profit or loss, 1963 ^{1/}

Farm profit' or loss	Combined farm and off-farm income 2/	Farm profit or loss	All off-farm and other income 3/	Off-farm income from--3/					
				Wages and salaries	Dividends	Interest	Nonfarm sole proprietorships	Partnerships	Other sources 4/
-----Dollars-----									
Farm profit:									
\$10,000 or more----	20,120	16,150	4,520	2,640	2,880	1,130	(180)	1,610	2,190
\$5,000-\$9,999-----	8,500	6,670	2,150	2,030	990	640	1,360	2,070	810
\$1,200-\$4,999-----	4,170	2,570	2,020	2,360	730	460	2,000	1,860	580
\$400-\$1,199-----	2,790	770	2,720	3,250	820	390	1,960	2,250	500
\$100-\$399-----	3,180	260	3,410	3,760	860	400	2,060	3,130	530
Less than \$100----	3,970	50	4,260	4,460	830	450	2,040	3,010	520
Farm loss:									
Less than \$100----	4,160	(56)	4,440	4,540	1,000	420	2,080	4,850	500
\$100-\$399-----	4,540	(240)	5,050	5,100	1,100	420	2,610	3,870	600
\$400-\$1,199-----	4,700	(740)	5,660	5,480	1,280	440	3,060	4,910	660
\$1,200-\$4,999-----	5,140	(2,260)	7,670	6,480	2,300	660	5,310	5,020	1,320
\$5,000-\$9,999-----	7,720	(6,910)	15,260	9,030	7,590	1,450	7,750	7,450	4,290
\$10,000 or more----	21,700	(22,750)	47,100	19,300	27,500	2,930	9,740	8,490	19,320
Individuals with farm profits-----	4,340	2,220	2,650	3,090	950	480	1,930	2,210	620
Individuals with farm losses-----	5,250	(1,740)	7,310	5,890	4,290	640	4,170	5,410	1,520
All individuals----	4,650	860	4,430	4,430	2,240	540	3,040	3,800	960

^{1/} U.S. Business Tax Returns, 1963.^{2/} Combined farm and off-farm income is referred to as "adjusted gross income" by the Internal Revenue Service.^{3/} Average amounts are for those reporting. See table 5 for percentage reporting.^{4/} See footnote 3, table 5.

Wages and Salaries. Wages and salaries represented the main off-farm income of those with farm income in 1963. About half of the returns, including joint returns of husbands and wives, showed wages or salaries averaging \$4,430 (tables 5 and 6). Wages and salaries totaled \$7.1 billion and accounted for 65 percent of the total off-farm income. The importance of wages and salaries demonstrates that many individuals with farm income will accept off-farm employment when it is available. For many, combining off-farm employment with farming is a more attractive alternative than either full-time farming or wage work alone.

Large farm profits and large wage and salary earnings were not usually received by the same people, probably because those with large farm businesses have little time for off-farm work. Slightly more than one-fourth of the 217,000 individuals reporting farm profits of \$5,000 or more reported wage or salary earnings. Seven out of 10 of these wage and salary earners received less than \$2,000 (table 7). Thus, because they were mainly full-time farmers, most earned little from off-farm work.

One-third of the 854,000 individuals with farm profits of \$1,200 to \$4,999 reported wages and salaries, and about 40 percent of these reported wages and salaries of \$2,000 or more. Wages were more important in relation to total income for this group than for individuals with larger farm profits, but not as important as

Table 7.—Percentage of individuals with farm income reporting wages or salaries of specified amounts, by amount of farm profit or loss, 1963 ^{1/}

Farm profit or loss	Number	Percentage earning wages or salaries of--					
		Less than \$2,000	\$2,000- \$4,999	\$5,000- \$9,999	\$10,000- \$24,999	\$25,000 or more	
	Thousands	Percent	Percent	Percent	Percent	Percent	
Farm profit:							
\$10,000 or more-----	12	71.1	15.5	7.4	4.5	1.5	
\$5,000-\$9,999-----	45	71.6	17.1	8.2	2.7	.4	
\$2,000-\$4,999-----	162	67.9	19.6	10.3	1.9	.3	
\$1,000-\$1,999-----	166	53.7	28.4	14.6	3.1	.2	
Less than \$1,000-----	454	38.4	33.5	23.7	4.2	.2	
Farm loss:							
Less than \$1,000-----	462	18.5	34.4	40.1	6.6	.4	
\$1,000-\$4,999-----	269	13.9	28.1	44.5	12.4	1.1	
\$5,000-\$9,999-----	20	24.2	24.2	22.1	21.8	7.7	
\$10,000 or more-----	11	21.4	10.8	20.2	22.3	25.3	
Individuals with farm profits-----	839	49.4	28.7	18.2	3.5	.2	
Individuals with farm losses-----	762	17.0	31.6	40.9	9.3	1.2	
All individuals-----	1,601	34.0	30.0	29.0	6.3	.7	

^{1/} Individual Income Tax Returns, 1963.

for those with smaller farm profits or losses. Wages alone accounted for nearly half of the off-farm and capital gains income of this group. For the group as a whole, including some farmers with marginally adequate incomes, farm profits exceeded off-farm income, but farm profits alone, averaging \$2,570, would have often been too low for a satisfactory level of living. With average farm receipts of \$11,820, some of these individuals may have had farms that were large enough in the past but scarcely adequate today.

Wage and salary income was particularly important to individuals whose reported farm profits were less than \$1,200 and whose farm losses did not exceed \$1,200. This group, heavily dependent on off-farm income, received more than 70 percent of its off-farm income from wages and salaries. While it is difficult to identify a dominant characteristic, the group probably included many part-time farmers and some farm landlords. Many seemed to supplement reasonably adequate nonfarm wage work with a bit of farm income. Others were subsidizing their limited farm operations with their own or their wives' off-farm income.

Although more than a million individuals with farm profits and losses of less than \$1,200 benefited from off-farm employment, about 734,000 at this income level had no wages or salaries. Many of those without off-farm jobs are probably older people with little prospect for improved incomes through wage work, or they may live where off-farm employment opportunities are inadequate.

Individuals with farm losses of \$1,200 to \$4,999 include many who combine farming with full-time wage work or small nonfarm businesses. This group of 310,000 individuals had larger farm receipts and more off-farm income than those with smaller losses, but the sources of income for both groups were generally similar. Wages and salaries averaging \$6,480 per individual, enough to indicate that most had full-time off-farm work, were reported by 70 percent of those in this group and accounted for 60 percent of their off-farm and capital gains income.

Individuals with farm losses greater than \$5,000 earned wages and salaries less often than those with smaller farm losses, but they reported each of the other types of off-farm income more frequently. The average amount of wage and salary income received suggests that many earned salaries in managerial positions.

As a group, those with farm losses of \$10,000 or more averaged farm receipts of \$55,220 and farm losses of \$22,750. About 94 percent had off-farm income or capital gains; this income averaged \$47,100. Clearly, most were not farmers under usual definitions.

Large salary earnings were particularly evident for about 11,000 individuals from the group reporting farm losses of \$10,000 or more (table 7). Two-thirds reported wage or salary earnings of \$5,000 or more. Nearly half reported \$10,000 or more and one-fourth reported \$25,000 or more. It is unlikely that many of these individuals supplied a significant amount of farm labor, although they often owned or had interests in sizable farm businesses.

More than one-third of those with wage or salary earnings, 561,000 individuals, did not have any other taxable off-farm income. They depended almost entirely on wages and salaries which averaged about \$3,800. Farm profits of these individuals (including those with farm losses) averaged only \$171.

In 1962, wages and salaries were reported most often and were highest in the Pacific Region, where 57 percent of the individuals reported an average of \$5,760 (tables 8 and 9). Wage and salary earnings were lowest and were reported by the smallest percentage of persons--38 percent--in the Northern Plains. In that region, where there are relatively few off-farm employment opportunities, wage and salary income averaged only \$2,820--less than half as much as in the Pacific Region.

In each production region, a smaller percentage of individuals with farm profits than with losses reported wages and salaries. There were substantial differences among regions in the average amounts of wages and salaries reported. However, the differences in amounts reported by persons with farm profits and those with losses were greater than the differences among regions.

Dividends. About 12 percent of the individuals with farm income in 1963 reported dividends totaling \$825 million--8 percent of the reported off-farm earnings of individuals. Individuals with dividends averaged about \$2,240 from this source in 1963, but dividends were less equally distributed than other types of income. About 86 percent of all dividends were reported by fewer than 4 percent of the individuals, those with dividends and income from all sources of \$10,000 or more.

Dividends were reported most frequently by and were largest for individuals with farm losses; those with the largest farm losses reported the largest dividends (tables 5 and 6). Too, the greater the income from all sources combined, the larger the reported dividends.

The association of dividends with large off-farm incomes and farm losses suggests that most of those with large dividends do not farm for a living. Nevertheless, the amount of dividends and the frequency with which they are reported have important implications. Individuals with both farm income and large dividends clearly have large nonfarm financial assets and often have relatively large farm operations, measured in terms of farm receipts and expenditures. It is apparent that they are often not engaged in farming for farm profits alone, though the farm income produced may go to nonfarm people. Wealthy individuals with farm investments--particularly those with large farm losses--may have little interest in farm profits or they may seek tax advantages by combining farm and nonfarm investments.

In 1962, a year for which regional data were available, dividends were particularly important in the Northeast where 17 percent of the individuals reported an average of \$6,650 in dividends. Individuals with farm losses and dividends averaged about \$12,470 from dividends; those with profits averaged about \$1,470 (tables 8 and 9).

Interest. Income from interest, totaling about \$680 million and averaging \$540 per individual, was reported on 40 percent of the 1963 individual farm income tax returns. This source of income accounted for about 7 percent of all off-farm income. Like dividends, reported interest averaged more for those with large losses. However, interest was more widely distributed. Not only was it reported more often than dividends at all levels of farm profit but there was less variation by level of farm profit in percentages reporting and in amounts reported. Individuals with losses reported interest only slightly more frequently than those with profits (tables 5 and 6).

Regional data for 1962 indicate that interest was more common and averaged more in the Pacific Region, where just under half of the individuals with either farm

Table 8.--Percentage of individuals with farm profits or losses reporting off-farm income from specified sources, by region, 1962 ^{1/}

Region	Percentage reporting income from--					
	Wages and salaries	Dividends	Interest	Nonfarm sole pro- prietor- ships	Partner- ships	Other sources 2/
Percent						
Individuals with farm profits:						
Northeast-----	42	14	36	9	2	42
Lake States-----	34	9	30	5	1	53
Corn Belt-----	38	10	32	8	3	53
Northern Plains-----	34	8	25	6	2	57
Appalachian-----	40	5	18	10	3	24
Southeast-----	42	8	22	13	5	27
Delta States-----	35	5	14	8	3	26
Southern Plains-----	43	8	26	9	5	51
Mountain-----	47	10	31	7	4	50
Pacific-----	45	14	46	9	5	49
United States 3/-----	39	9	28	8	3	45
Individuals with farm losses:						
Northeast-----	70	19	38	14	4	50
Lake States-----	71	7	29	11	2	49
Corn Belt-----	70	10	30	15	7	52
Northern Plains-----	56	9	24	13	6	61
Appalachian-----	75	10	27	17	7	40
Southeast-----	75	12	29	20	6	42
Delta States-----	78	9	19	15	5	35
Southern Plains-----	71	10	29	19	9	57
Mountain-----	69	8	32	14	10	54
Pacific-----	71	16	47	17	9	54
United States 3/-----	71	11	31	16	6	50
All individuals:						
Northeast-----	53	17	37	11	3	45
Lake States-----	47	8	30	7	2	52
Corn Belt-----	46	10	32	10	4	52
Northern Plains-----	38	8	25	7	3	57
Appalachian-----	49	7	20	12	4	28
Southeast-----	55	10	25	15	5	33
Delta States-----	52	7	16	11	4	30
Southern Plains-----	55	9	27	13	7	53
Mountain-----	55	9	31	9	5	51
Pacific-----	57	15	47	13	7	51
United States 3/-----	49	10	29	10	4	47

^{1/} U.S. Business Tax Returns, 1962.^{2/} See footnote 3, table 5.^{3/} U.S. totals include Alaska, Hawaii, and other areas not included in the regions.

Table 9.--Average farm profits or losses of individuals and average off-farm income from specified sources, by region, 1962 ^{1/}

Region	Off-farm income from-- ^{2/}						
	Farm profit or loss	Wages or and sala- ries	Divi- dends	Interest	Nonfarm sole proprie- torships	Partner- ships	Other sources 3/
Dollars							
Individuals with farm profits:							
Northeast-----	1,780	3,580	1,470	540	1,520	4,540	760
Lake States-----	1,780	2,820	620	430	1,920	2,020	520
Corn Belt-----	2,310	3,280	990	520	2,150	2,650	680
Northern Plains-----	2,810	2,390	480	440	1,610	2,560	670
Appalachian-----	1,280	2,790	1,210	410	1,750	2,670	770
Southeast-----	1,530	3,300	1,140	700	1,600	3,020	1,160
Delta States-----	1,920	2,650	1,040	660	1,750	4,010	920
Southern Plains-----	2,500	3,100	900	580	1,570	1,760	1,210
Mountain-----	3,041	2,740	700	670	1,500	1,850	940
Pacific-----	3,690	4,110	1,660	880	2,080	2,210	1,480
United States ^{4/} -----	2,170	3,050	990	540	1,830	2,550	790
Individuals with farm losses:							
Northeast-----	(1,760)	6,640	12,470	840	3,720	9,280	2,560
Lake States-----	(1,020)	5,540	3,150	510	3,760	4,080	1,010
Corn Belt-----	(1,240)	5,970	4,100	600	4,000	6,030	1,210
Northern Plains-----	(1,400)	3,990	1,590	560	3,390	5,200	1,590
Appalachian-----	(1,290)	5,560	4,590	590	4,500	4,780	1,820
Southeast-----	(1,810)	6,100	3,630	1,140	4,680	5,620	2,460
Delta States-----	(1,450)	5,170	2,240	690	3,720	6,720	2,530
Southern Plains-----	(1,950)	5,840	4,010	880	3,300	5,440	3,070
Mountain-----	(2,320)	5,200	4,360	930	3,550	5,960	2,280
Pacific-----	(2,260)	6,910	3,990	1,160	6,000	6,280	2,930
United States ^{4/} -----	(1,580)	5,820	5,200	790	4,100	5,810	2,060
All individuals:							
Northeast-----	---	5,180	6,650	660	2,680	7,420	1,540
Lake States-----	---	4,320	1,270	450	2,740	2,820	650
Corn Belt-----	---	4,270	1,750	540	2,860	4,200	800
Northern Plains-----	---	2,820	670	470	2,220	3,420	850
Appalachian-----	---	3,880	2,610	470	2,800	3,660	1,160
Southeast-----	---	4,820	2,430	900	3,180	4,360	1,820
Delta States-----	---	4,120	1,660	680	2,790	5,490	1,660
Southern Plains-----	---	4,600	2,310	720	2,620	3,820	2,040
Mountain-----	---	3,860	1,890	760	2,560	3,610	1,440
Pacific-----	---	5,760	2,860	1,020	4,560	4,660	2,210
United States ^{4/} -----	---	4,280	2,470	620	2,880	4,150	1,200

^{1/} U.S. Business Tax Returns, 1962.^{2/} Average amounts are for those reporting. See table 8 for percentages reporting.^{3/} See footnote 3, table 5.^{4/} U.S. totals include Alaska, Hawaii, and other areas not included in the regions.

profits or losses reported receiving interest. Interest was reported least frequently in the Delta Region (tables 8 and 9).

Nonfarm businesses. Individuals with income from farming are often also engaged in nonfarm businesses. About one out of 10 of those with farm income in 1963 reported nonfarm sole proprietorship income; one out of 25 reported partnership income. Together, income from these sources amounted to nearly \$1.5 billion and accounted for 14 percent of total off-farm income. Seventy percent of this income was from nonfarm sole proprietorships; 30 percent was from partnerships. Individuals with farm losses reported nonfarm business income nearly twice as often as those with farm profits, and their nonfarm business income averaged more than twice that of persons with farm profits. Nonfarm business income was reported most frequently by those with the largest farm losses. Thirty percent of the individuals reporting farm losses of \$10,000 or more reported nonfarm sole proprietorship income averaging \$9,740; about one-fourth reported partnership income that averaged nearly \$8,500.

Combinations of farm and nonfarm sole proprietorships seem to be particularly important in the Southeast (tables 8 and 9). Both those with farm profits and those with farm losses in 1962 had larger percentages reporting such income in the Southeast than in any other region. Average dollar income in the Southeast from nonfarm sole proprietorships was \$3,180. This was exceeded only by the \$4,560 reported in the Pacific Region. Partnership income was reported by a greater percentage of individuals in the Southern Plains and Pacific Regions, but income from partnerships averaged more in the Northeast.

Other income, including capital gains. About two-thirds of all individuals with farm income in 1963 also reported other income totaling nearly \$2 billion. This includes net gains or losses from the sale of farm and nonfarm capital assets, rents, royalties, pensions and annuities, ordinary gain from the sale of depreciable property, income from estates and trust funds and from the sale of property other than capital assets (table 10).

"Other" income was distributed among individuals at the various farm profit or loss levels in somewhat the same way as dividends, although it averaged less than half as much (tables 5 and 6). Average amounts reported were more for individuals with the largest farm losses.

About 61 percent of the other income reported in 1963, an estimated \$1.2 billion, was net gain from the sale of farm and nonfarm capital assets. An estimated \$428 million of these net capital gains were from the sale of livestock; \$294 million were from farmland sales.^{11/} It is significant that for individuals with farm income, 55 percent of the net gains from the sale of capital assets accrued to 121,000 individuals with income of \$10,000 or more from all sources.

^{11/} Net capital gains from sales of livestock and farmland were estimated from data in "Statistics of Income . . . 1962, Sales of Capital Assets Reported on Individual Income Tax Returns, Internal Revenue Service, U.S. Treasury Department, 1966.

Table 10.--Number and percentage of individuals with farm income reporting income from other sources, and amount of other income reported, 1963 ^{1/}

Other sources of income ^{2/}	Individuals reporting income from other sources		Amount of income reported from other sources
	Number	Percentage	
	Thousands	Percent	1,000 dollars
Sales of capital assets-----	1,051	33	1,215
Rents-----	532	17	376
Royalties-----	114	4	174
Pensions and annuities-----	46	1	71
Ordinary gain from sale of depreciable property-----	56	2	56
Estates and trusts-----	31	1	49
Sales of property other than capital assets-----	83	3	-36
Miscellaneous-----	82	3	82

^{1/} Individual Income Tax Returns, 1963.

^{2/} Income items listed in this table are included as other income on tables 5, 6, 8, 9, 11, and 12.

Reported by more than half a million individuals with farm income and second in importance in the "other" income category, rents amounted to \$376 million. Royalties reported by about 114,000 individuals amounted to \$174 million. Each of the remaining income sources accounted for less than 5 percent of other income.

THE FINANCIAL SITUATION OF INDIVIDUALS

All individuals reporting farm income in 1963 were classified in one of five groups. These groups, based on farm profits or losses and taxable income from all sources, are indicators of the financial situation of individuals. A better measure would consider income received over several years. Also, these income groups reflect wealth only insofar as it produces taxable income. The following chart shows how individuals were classified for this study.

Income from all sources	Individuals with farm profits	Individuals with farm losses of--				
		Less than \$400	\$400-\$1,199	\$1,200-\$4,999	\$5,000-\$9,999	\$10,000 or more
\$25,000 or more----	wealthy	wealthy	wealthy	wealthy	wealthy	wealthy
\$10,000-\$24,999----	well off	well off	well off	well off	well off	wealthy
\$5,000-\$9,999-----	high middle	high middle	high middle	high middle	well off	wealthy
\$2,500-\$4,999-----	low middle	low middle	low middle	high middle	well off	wealthy
Less than \$2,500----	poor	poor	low middle	high middle	well off	wealthy

Individuals with farm profits were classified on the basis of their taxable income from all sources. For example, those with farm profits and taxable income of \$5,000 to \$9,999 were classified in the high-middle group. Individuals with farm losses were classified according to the size of their losses as well as by amount of taxable income. This was done on the hypothesis that large farm losses generally must be offset by substantial nonfarm income or wealth, regardless of reported taxable income. For example, an individual was classed as wealthy if he had either \$25,000 of taxable income or reported \$10,000 or more in farm losses. This method of classification may have resulted in the misclassification of a relatively small number of individuals who had large farm losses that were not offset by off-farm income, capital gains, or wealth.

The poor. More than a million individuals, 32 percent of those with farm income, were classed as poor. They were poor not only because their farm income was low but also because they earned little taxable off-farm income (tables 11 and 12). While farm receipts of the poor averaged only \$5,590, about 87 percent reported farm profits. Wages and salaries, like all other off-farm income, were reported less often and were smaller for the poor than for all other groups. Only about one-fourth reported any wage or salary income; that of those reporting averaged about \$830, suggesting that most had only part-time wage work.

It seems unlikely that many of those classed as poor have much prospect of becoming full-time farm operators with an adequate income. Some are apparently part-time farmers with part-time farms but no off-farm jobs. Social security payments, pensions, welfare, or other nontaxable income may make up for part of the apparent income gap, but within this poor class many may be in need of income support.

The middle income groups. The main difference between the upper-middle and lower-middle income groups was that off-farm income was more important to the upper-middle group. The two groups, including 58 percent of the individuals reporting farm income, were about equal in size. Average farm receipts were \$8,830 for the upper-middle group and \$8,030 for the lower-middle group. Off-farm income was less than half as great for the lower-middle group as for the upper-middle group. Though they were less likely to report profits, both farm profits and combined farm and off-farm income averaged more for the upper-middle group.

Table 11.--Percentage of individuals with farm income reporting farm profits and off-farm income from specified sources, by classification of taxpayer, 1963 ^{1/}

Classification of taxpayer	Individuals with farm income		Percentage reporting--							
	Number	Average farm receipts	Farm profits	Any off-farm or other income	Off-farm income from--					
					Wages and salaries	Dividends	Interest	Nonfarm sole proprietorships	Partnerships	Other sources ^{2/}
	Thou- sands	Dollars	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Wealthy-----	66	40,130	31	97	48	60	77	31	30	91
Well off-----	251	17,090	56	97	61	32	66	19	13	83
Upper middle-----	926	8,830	48	96	71	13	46	11	4	74
Lower middle-----	925	8,030	65	91	54	8	36	10	3	68
Poor-----	1,029	5,590	87	68	26	5	29	7	1	49
All individuals, total or average-----	3,197	8,850	66	86	50	11	40	10	4	65

^{1/} U.S. Business Tax Returns, 1963.

^{2/} See footnote 3, table 5.

Table 12.--Average farm and off-farm income of individuals, by classification of farm taxpayer, 1963 ^{1/}

Classification of farm taxpayer	Combined farm and off-farm income 2/	Net farm profit 3/	Net farm loss 3/	All off- farm and other income 3/	Off-farm income from--3/					
					Wages and salaries	Dividends	Interest	Nonfarm sole proprie- torships	Partner- ships	Other sources 4/
					-----Dollars-----					
Wealthy-----	37,280	13,270	14,110	44,150	20,650	15,850	2,790	16,860	12,080	13,780
Well off-----	12,000	6,210	3,080	10,210	9,030	1,370	900	6,300	4,490	1,890
Upper middle-----	5,610	3,190	1,480	5,040	5,400	510	440	2,250	2,010	580
Lower middle-----	3,220	2,150	590	2,240	2,630	340	370	1,250	1,020	420
Poor-----	1,210	900	180	1,740	830	180	270	310	350	250
All individuals-----	4,650	8,850	860	4,430	4,430	2,240	540	3,040	3,800	960

^{1/} U.S. Business Tax Returns, 1963.^{2/} Combined farm and off-farm income is referred to as "adjusted gross income" by the Internal Revenue Service.^{3/} Average amounts are for those reporting. See table 11 for percentage reporting.^{4/} See footnote 3, table 5.

The upper-middle group, with 71 percent reporting wages or salaries averaging about \$5,400, appears to include many part-time farmers with relatively higher incomes. Often their wages alone were large enough to place them in this income group. For them, farming seems to be a relatively minor source of income. Slightly fewer than half reported farm profits.

The well off. About a quarter of a million individuals were classified as well off. Averaging \$12,000 from all sources and with farm business receipts of \$17,090, this group had more than twice the income reported by the upper-middle group. Included were some 40,000 individuals who were truly well off in terms of farm income. They reported average farm receipts of nearly \$52,000 and farm profits of \$10,000 or more. Although comparatively few in number, they accounted for 80 percent of those reporting farm profits of \$10,000 or more; the remaining 20 percent were classified mainly as wealthy.

Nearly 150,000 individuals, three-fifths of those in the income group, were well off not because of their high farm incomes but in spite of their low farm profits or farm losses. About 111,000 reported farm losses and more than 38,000 reported farm profits of less than \$1,200.

A somewhat smaller percentage of the well-off individuals reported wages or salaries than persons in the upper-middle income group, but those reporting averaged two-thirds more income from these sources--about \$9,030. This appears reasonable since few of those classified as well off would be expected to be wage workers. They are apparently often salaried individuals and persons with investment incomes or non-farm businesses.

While nonfarm investment and business income was important to some individuals in the upper-middle income group, it was relatively more important to the well-off group. Nearly one-third of the well off reported dividends averaging \$1,370; almost two-thirds reported receiving interest which averaged \$900. Nearly one-fifth of the well off reported income from nonfarm sole proprietorships; one-eighth reported partnership income. Average amounts reported were \$6,300 and \$4,490, respectively.

The wealthy. The 66,000 wealthy individuals who reported farm income in 1963 can hardly be thought of as farmers, yet they generally reported income from sizable farm operations. Their farm business receipts averaged \$40,130, far larger than the receipts of the other four income groups. Nevertheless, more than two-thirds reported farm losses. Wealthy individuals with farm profits averaged \$52,770 in receipts and \$13,270 in profits. Those with losses averaged \$34,420 in receipts, but because their farm business deductions averaged about \$48,530, they reported average losses of \$14,110.

Most of the wealthy have prospered in nonfarm pursuits. They were more likely to have income from nonfarm businesses and investments, and it was greater than that of those at lower income levels. Significantly, individuals classified as wealthy reported wages and salaries less frequently than those in the well-off and middle income groups, though their average salary earnings were higher.

IMPLICATIONS

An important implication of this study is that it is unrealistic to tie farm income policies to the income level or income-producing capacity of farm production units alone. Public policies aimed at increasing human welfare need to be divorced from the earnings of farms and related directly to the income situation of individuals. Because they control few farm resources, many people with small farm earnings live largely from their off-farm income. Thus, not all those with low farm incomes are in need of special income assistance. Some with little farm income have relatively large incomes from all sources combined. Also, because current farm programs are essentially farm resource based, individuals with low incomes and few resources may benefit little under these programs.

Recent discussions have shown considerable dissatisfaction with the economic classification of farms by value of sales. No substitute measure of size of business has been found to be generally acceptable, however. An implication of this study is that for many uses, a more appropriate classification for both commercial and non-commercial agriculture should be based on the individual or the family spending unit--especially for income studies.

In planning for future farm capital and credit needs, it may be that greater recognition should be given to the role of individuals who neither live nor work on farms. Some individuals retain a financial interest in farming after they leave agriculture. Others may invest in farming for financial or personal reasons. Those with nonfarm interests may also have access to credit sources not used by most farmers.

Formal models that attempt to explain or predict farm supply response must rely on assumptions about the organization of the farm economy. To be realistic and produce significant results, such models may need to recognize that the farm operator often shares decisionmaking with others who have a business interest in his farm operation. Also, nonfarm interests of farm families may affect many farm decisions. Firm growth and financial management studies will also need to consider both farm and off-farm income sources of individuals.

This study suggests that a new class of specialists may be replacing farmers who provide the land, labor, and most of the capital used in their farm businesses. Farm entrepreneurs may be becoming specialists in combining resources owned by others and less dependent on resource ownership. Thus, entrepreneurship is the new area of specialization; resource ownership may increasingly be left to others. Farm resource ownership by nonfarmers also helps explain the importance of off-farm income.

A further implication of this study is that farm tax returns offer a new, relatively inexpensive source of information on the farm economy. Although tabulations from farm tax returns have until recently been fragmentary and relatively unknown, data are now available in considerable detail. Further exploration of these data as a source of detailed information on both farm and off-farm income of individuals should be valuable. Users will need to recognize differences between these data and other more familiar sources.

APPENDIX

Tax Returns as a Source of Income Data

In this report, tax returns serve as a source of information on incomes. Evidence was presented to show that farms and farm tax returns do not correspond on a one-to-one basis. Nevertheless, since farm income reported by taxpayers is mainly from crop, livestock, and livestock product sales, and from Government payments--the main sources of income estimated by the U.S. Department of Agriculture--it seems reasonable to expect the income estimates to be somewhat comparable.

Gross Farm Income

Although there are several differences in income concepts and in the way the data are collected, gross farm receipts reported to the Internal Revenue Service and the gross cash farm income estimates of the USDA are surprisingly close (appendix table 16). There is little to suggest that large amounts of farm receipts are intentionally excluded from farm returns.^{12/} Some of the conceptual differences between the two estimates tend to narrow the spread between the two receipt figures; others increase the differences. The following discussion should be recognized as only a partial reconciliation of differences. While desirable, a complete reconciliation is outside the scope of this report.

An important difference in the gross cash income concepts is intrastate livestock sales to other farmers. These sales, estimated at about \$1.8 billion in 1963, are not included in USDA estimates, but are reported for tax purposes. Since farmers who purchase livestock can deduct their purchases, this difference cancels out in the net income figures.

About \$1.0 billion should be added to the business receipts estimated by IRS to account for gross sales of livestock reported on tax returns as sales of capital assets.^{13/} These sales are included as receipts in USDA estimates.

A substantial amount, perhaps as much as \$1 billion in 1963, was probably excluded from farm receipts reported on tax returns because some crop share tenants report only their own share of the farm receipts, and their landlords report their income as rent. The landlord's income may thus not be identified and tabulated as farm income.

Farm receipts on tax returns from the sale of products such as milk, livestock, cotton, and grain may sometimes exclude marketing costs such as transportation and commissions and reflect only the amount received by farmers. This probably reduced the total receipts estimated by IRS by \$0.6 billion in 1963. USDA estimates should

^{12/} See: Stocker, Frederick D. and John C. Ellickson, "How Fully Do Farmers Report Their Incomes?" *National Tax Journal*, Vol. XII, No. 2, June 1959.

^{13/} The actual value of livestock treated as sales of capital assets is substantially greater than reported capital gains. The tax rate on net long-term gains is limited to 25 percent.

Capital gains (or losses) = $\frac{1}{2}$ (long-term gains - long-term losses)
+ (short-term gains - short-term losses)

include the full value of these farm products. Since marketing costs are subtracted in computing net income for USDA estimates, the omission of marketing costs on tax returns would not affect the comparability of the net income figures.

Receipts reported on farm tax returns include items such as machine work; gasoline tax and lubricating oil tax credits; sales of soil, sand, and gravel; and crop insurance indemnities. These items are not included in the marketings reported by USDA. Together, they are estimated at about \$0.6 billion for 1963. Another item included in the figures reported by IRS but not included in USDA estimates is patronage dividends of cooperatives. The 1962 data of IRS indicate that a reasonable allowance is \$0.2 billion.

Amounts reported by corporations include some receipts from foreign areas. Also, the farm receipts of corporations and partnerships that are mainly nonfarm businesses are excluded, and some nonfarm income of farm businesses is included. For example, the farm income of corporations that both produce and process farm products will generally not be tabulated as farm income when processing is more important than production. A net adjustment of \$0.8 billion is included to account for these differences in reporting concepts for corporate receipts and for other miscellaneous items.

Differences between the gross income estimates appear to be greater in low-income areas and for those with small receipts. Part of this difference may be accounted for by individuals who report small amounts of farm income but do not properly identify it on their tax returns. A small amount of farm income received by those with less than the taxable minimum is not reported.

Tax returns are tabulated in the districts where they are filed. This obviously does not always coincide with the district in which the income was earned. These reporting districts may have a relatively minor effect on regional and State income estimates.

Capital gains on farmland sales are not reported as farm receipts but are included in table 10. Amounts reported are probably lower than actual capital gains on such sales because gains from land sales are often spread over several years through sales agreements and land contracts. Also, some sales of farmland may be excluded from sales of farm capital assets because the sale is not identified as farm property by the taxpayer.

Net Farm Income

Net cash farm income estimated by USDA and net farm profits reported on farm tax returns differ greatly. Amounts reported for 1964 and 1965 are shown in the following tabulation.

	<u>1964 (bil. dol.)</u>	<u>1965 (bil. dol.)</u> ^{1/}
<u>USDA net farm income</u>		
Realized net farm income	13.1	13.9
Noncash income	<u>3.2</u>	<u>3.2</u>
Net cash income ^{2/}	9.9	10.7
<u>IRS net farm profits</u>		
Sole proprietors	2.6	3.4
Partnerships	.5	.6
Corporations	<u>.1</u>	<u>.2</u>
Total farm profits	3.2	4.2

^{1/} Preliminary.

^{2/} Derived from official USDA estimates of cash receipts, Government payments, and total production expenses.

Data are inadequate for a full understanding of these differences in net income. However, since the gross income estimates are reasonably close, an important part of the differences in net income is probably due to the differences in concepts used in accounting for expenses.

It is clear that accounting for differences in the gross cash income estimates will aid in reconciling the net income figures. For example, net farm income estimates of the Internal Revenue Service would be greater if livestock sales reported as sales of capital assets were not excluded from net profits.

Some individuals and partnerships, particularly those with relatively large incomes from all sources, and many farm corporations show extremely large business deductions. Further work is needed to understand how expenses reported by these taxpayers differ in concept and amount from those included in USDA estimates.

Table 13.--Number of Federal farm income tax returns filed by individual proprietorships, partnerships, and corporations, 1945-65 ^{1/}

Year	Total (excluding corpora- tions)	Individual proprietorships			Partnerships 2/			Corpora- tions 4/
		Total	With profits	With losses 3/	Total	With profits	With losses 3/	
		-----Thousands-----						
1945-----	2,756	2,659	2,280	379	97	87	10	---
1947-----	3,018	2,904	2,542	362	114	101	13	---
1949-----	---	2,987	2,511	476	---	---	---	---
1951-----	---	3,139	2,538	601	---	---	---	---
1953-----	3,261	3,126	2,356	770	135	106	29	---
1955-----	5/3,553	3,417	2,424	993	5/136	---	---	---
1957-----	3,480	3,343	2,436	907	137	106	31	---
1958-----	3,509	3,374	2,526	848	135	105	30	---
1959-----	3,519	3,387	2,331	1,056	132	100	32	---
1960-----	3,485	3,359	2,295	1,064	126	96	30	---
1961-----	3,489	3,362	2,360	1,002	127	97	30	---
1962-----	3,442	3,319	2,302	1,017	123	94	29	---
1963-----	3,328	3,208	2,110	1,098	120	88	32	16
1964-----	3,248	3,130	2,011	1,119	118	84	34	6/18
1965 7/-----	3,180	3,064	2,013	1,051	116	84	32	6/19

^{1/} U.S. Business Tax Returns, Internal Revenue Service, U.S. Treasury Department.^{2/} Including only businesses whose major source of receipts was from farming. Informal partnerships are included under individual proprietorships. Partnerships averaged about 2.4 partners each in years when number of partners was reported.^{3/} Including returns with receipts equal to deductions.^{4/} Including only corporations whose major source of receipts was from farming.^{5/} The number of partnership tax returns was interpolated by the author for 1955.^{6/} About half of the farm corporations reported profits in 1964; 56 percent reported profits in 1965.^{7/} Preliminary.

Table 14.--Farm business receipts of individual proprietorships, partnerships, and corporations as reported on Federal income tax returns, 1945-65. ^{1/}

Year	Total (excluding corpora- tions) 2/	Individual proprietorships			Partnerships 2/			Corpora- tions 4/
		Total	With profits	With losses 3/	Total	With profits	With losses 3/	
----- Million dollars -----								
1945-----	15,940	14,227	12,872	1,355	1,713	1,595	118	---
1947-----	20,963	18,381	16,894	1,487	2,582	2,394	188	---
1949-----	---	18,993	16,735	2,258	---	---	---	---
1951-----	---	22,093	19,211	2,882	---	---	---	---
1953-----	24,150	21,317	17,887	3,430	2,833	2,340	493	---
1955-----	---	20,779	16,660	4,119	---	---	---	---
1957-----	25,843	22,416	18,509	3,907	3,427	2,895	532	---
1958-----	28,144	24,674	20,744	3,930	3,470	2,835	635	---
1959-----	29,855	26,279	21,063	5,216	3,576	2,936	640	---
1960-----	29,161	25,529	20,725	4,804	3,632	2,943	689	---
1961-----	30,179	26,291	21,600	4,691	3,888	3,196	692	---
1962-----	32,390	28,311	23,131	5,180	4,079	3,398	681	---
1963-----	32,078	28,285	21,950	6,335	3,793	3,082	711	5,354
1964-----	31,761	27,746	21,786	5,960	4,015	3,187	828	4,038
1965 5/-----	34,005	29,908	24,381	5,527	4,097	3,411	686	4,877

^{1/} U.S. Business Tax Returns, Internal Revenue Service, U.S. Treasury Department.^{2/} Including only the business receipts of partnerships whose major source of receipts was from farming. See footnote 2, table 13.^{3/} Including returns with receipts equal to deductions.^{4/} Including only corporations whose major source of receipts was from farming.^{5/} Preliminary.

Table 15.--Estimated number of farm corporations, 1945 to 1965 ^{1/}

Year	Number of tax returns from agriculture, forestry, and fishery corporations ^{2/}	Number of farm corporations ^{2/}	Estimated number of farm corporations
1945-----	6,152	---	4,306
1947-----	7,329	---	5,130
1949-----	8,006	---	5,604
1951-----	8,734	---	6,114
1953-----	9,405	---	6,584
1955-----	10,303	---	7,212
1957-----	11,833	---	8,283
1958-----	13,945	---	9,762
1959-----	15,603	---	10,922
1960-----	17,139	---	11,997
1961-----	18,981	---	13,287
1962-----	22,130	---	15,491
1963-----	23,270	16,227	16,289
1964-----	25,933	17,578	18,153
1965 ^{3/} -----	27,582	18,526	19,307

^{1/} These estimates are extrapolated from Internal Revenue Service data for agriculture, forestry, and fishery corporations, 1945-65, and for farm corporations, 1963-65. In making these estimates (column 3), the author assumed that 70 percent of the agriculture, forestry, and fishery corporations were farm corporations. Farm corporations actually accounted for 70 percent of the agriculture, forestry, and fishery corporations in 1963, 68 percent in 1964, and 67 percent in 1965.

^{2/} U.S. Business Tax Returns, Internal Revenue Service, U.S. Treasury Department.

^{3/} Preliminary.

Table 16.--Partial reconciliation of estimates of farm receipts as reported by the Internal Revenue Service and the U.S. Department of Agriculture, 1955 and 1963

Item	1955 ^{1/}	1963
	<u>Billion dollars</u>	<u>Billion dollars</u>
<u>U.S. Department of Agriculture</u>		
Cash marketings-----	29.9	2/37.4
Government payments-----	.2	2/1.7
Adjustment:		
Intrastate livestock sales-----	+ .9	3/+1.8
Total (including adjustments)-----	31.0	40.9
<u>Internal Revenue Service</u>		
Business receipts-----	25.8	4/37.4
Adjustments:		
Livestock sales reported as capital gains-----	+1.0	5/+1.0
Share rent-----	+ .7	6/+1.0
Marketing costs-----	+ .6	7/+ .6
Machine work, other services, crop insurance indemnities-----	- .5	7/- .6
Patronage dividends-----	- .2	8/- .2
Other-----	- .6	9/- .8
Total (including adjustments)-----	26.8	38.4

^{1/} Estimates by Frederick D. Stocker and John C. Ellickson, "How Fully Do Farmers Report Their Income?", National Tax Journal, Vol. XII, No. 2, June 1959, pp. 116-126.

^{2/} Farm Income, State Estimates, 1949-1966, Supplement to the July 1967 Farm Income Situation, Economic Research Service, U.S. Department of Agriculture.

^{3/} Based on livestock expenses reported in the 1964 Census of Agriculture, Vol. II, Chapter 6, Table 15, p. 648 and livestock purchases excluding intrastate purchases reported in the Farm Income Situation, Economic Research Service, U.S. Department of Agriculture, July 1967, Table 13 H, p. 56.

^{4/} Statistics of Income--U.S. Business Tax Returns 1963, Internal Revenue Service, U.S. Treasury, Table 1, p. 30.

^{5/} Based on Statistics of Income--1962, Sales of Capital Assets, Internal Revenue Service, U.S. Treasury, Table 1, p. 24.

^{6/} Based on unpublished data, Economic and Statistical Analysis Division, Economic Research Service, U.S. Department of Agriculture and rent deducted on farm income tax returns as reported in Statistics of Income-1963, U.S. Business Tax Returns, Table 1, p. 30.

^{7/} Based on unpublished production expense estimates, Economic and Statistical Analysis Division, Economic Research Service, U.S. Department of Agriculture.

^{8/} Statistics of Income 1963, U.S. Business Tax Returns, Table 9, p. 79.

^{9/} Including an adjustment for corporate receipts from foreign areas.