



U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III

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Office
of the
Regional
Administrator
Edward W. Furia

December 22, 1972


Lt. Col. Robert E. Ayers
District Engineer
Norfolk District
Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

Dear Colonel Ayers:

Enclosed are the comments prepared by EPA on the Impact Statement for the Gathright project. Briefly, we find that the older evaluation of the value of water quality storage embodied in the Design Memorandum No. 4 can no longer be accepted as valid. We advise that no non-zero value can be assigned to water quality storage until EPA has determined the need for, the value of, and the impact of such storage, and until the necessity of such storage has been affirmatively demonstrated. Furthermore, we feel that a significant loss of economic efficiency and social well-being will occur unless provision is made for reimbursement by private industrial firms, notably Westvaco, for costs allocated to benefits which accrue to them. We regard the water quality storage benefits as accruing primarily to such firms in the form of reduced treatment costs. Water quality standards will be met in any case. Finally, we find the environmental costs associated with this project to be severe and its economic benefits subject to recalculation to significantly smaller values than those stated heretofore. We recommend that the possibility of restoring the area affected by construction activities to date be investigated and cost estimates prepared.

Because of the need for development of further data and for project modification, we have classified the impact statement for this project in EPA Category 3. We recommend that no further construction be initiated until questions of water quality storage benefits and cost reimbursement have been resolved. We hope that you will feel free to contact us for further discussion and clarification of these comments.

Sincerely yours,

A handwritten signature in dark ink, appearing to read 'Edward W. Furia', with a long horizontal flourish extending to the right.

Edward W. Furia
Regional Administrator

Enclosure

cc: Council on Environmental Quality

Comments by EPA Region III
on the
Draft Environmental Impact Statement for
Gathright Lake, Virginia
prepared by the
U.S. Army Corps of Engineers, Norfolk District
June, 1972

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Introduction

Gathright Dam is a Corps of Engineers project on the upper Jackson River which is intended to benefit water quality and provide flood control and recreation. It is presently about 29% completed. The amendments to the Federal Water Pollution Control Act recently enacted into law impose on EPA the duty of evaluating "the need for, the value of, and the impact of storage for water quality control." For that reason, we felt compelled to analyze the project with great care in commenting on its Impact Statement, focusing on the Corps' Statement itself but bringing our own knowledge and viewpoint to bear. We rapidly became convinced that the economic justification of the project hinges on the water quality benefits - this is true even allowing for the substantial investment which has already occurred. Thus the "impact of" water quality storage is nothing less than the impact of the project as a whole. That impact is analyzed in section 1 and found to be quite severe. The "need for" and "value of" water quality storage are studied in section 2. The conclusion is reached that the desired water quality benefits can be achieved by a higher level of treatment without flow augmentation. In the context of the amended law, treatment proves to be the less expensive alternative by a substantial margin. A procedure by which the need and value questions can be resolved is suggested.

Proponents of water quality storage will be required to establish its necessity.

Furthermore, we regard the benefits of water quality storage as accruing to the affected waste dischargers. Flow augmentation will permit them to meet water standards with a lesser level of treatment. We believe that stream standards will have to be met regardless; high water quality is not itself contingent on the project. The flood control and recreation benefits will have to be foregone if a higher treatment level is employed to meet standards and the dam is not completed. These benefits are analyzed in sections 3 and 4. The question of whether environmental benefits might accrue to abandonment of the project is considered in section 6, and our recommendations are summarized in the final section.

1. Environmental Impact

The Gathright Project entails a severe environmental impact. It is notable that this is so even though all three project purposes - water quality, flood control and recreation - are related to environmental quality. The basic environmental effect of the Gathright Project is to replace a unique and highly valuable resource, protected by public ownership, by a resource which is not in short supply and is distinctly less valuable on environmental grounds. We make no claims to special insight into these environmental effects. However, because of the project's relation to water quality storage, it is necessary for us to consider such questions and to evaluate for ourselves their merit

The uniqueness and value of the area to be flooded by Gathright reservoir stems from the presence in one and the same publicly owned tract of land and water of: (1) a highly scenic stream which supports an unusually productive warm and cold water fishery and is also uniquely suitable for recreational canoeing, (2) the juxtaposition of scenic mountains, gorges and river bottom lands, and (3) unusually productive gamelands which can probably not be duplicated elsewhere in the state. The range of people who find these lands unusually appealing and important is impressive. It ranges from the Corps itself, to professional fish and game managers, and recreationists of many sorts. The following excerpts from evaluations by others, representing both official and private concerns, will illustrate these points:

"The entire area is picturesque, isolated, and has a rugged semi-wilderness character." (Corps, EIS P. 2-5)

"The Jackson River above the Gorge [damsite] is considered 'an unusually beautiful whitewater trip' for canoeists." (Corps, EIS P. 2-16)

"The Bureau of Outdoor Recreation states that there is no substitute for a whitewater stream - a lake is not comparable in any way - and because of the paucity of opportunity for this recreational pursuit in this region, there is no known area which might mitigate this loss." (Corps, Design Memorandum No. 4, P. 19 - See Reference (1) below)

"The portion of the Jackson River to be destroyed is the only free-flowing river of comparable size and quality in public ownership within many miles. There is no comparable recreational or aesthetic resource in the Commonwealth of Virginia. The nearest comparable resource...is the Chatoga. on South Carolina's northwest border with Georgia. It is 300 miles as the crow flies from the Gathright area and considerably further from the populous eastern part of Virginia." (R. H. Skeppstrom, Reference (3) below, P. 3)

"The Jackson River above Covington supports a quality stream fishery which features such indigenous sport fish as smallmouth bass, sunfish, pickerel, catfish, fallfish and sucker. In addition, the river above the Gathright dam site is stocked annually with catchable size rainbow and brook trout to maintain a high quality put-and-take trout fishery. Since this important Jackson River fishery is located within the Gathright Wildlife Management Area, public access is assured. This tends to magnify the universal appeal of trout and smallmouth bass as sport fish." (Corps, EIS P. 2-12)

"The aesthetic appeal and high natural productivity of these streams combine to afford sport fishing opportunities of significant value." (Corps, Design Memorandum No. 4, P. 20)

"The esthetic appeal of white water, unrestricted access, high angling success, and good natural stream productivity all combine to afford sport fishing of outstanding value." (Bureau of Sports Fishery and Wildlife, Design Memorandum No. 4, Appendix D, P. D-20)

"The T. M. Gathright Wildlife Management Area (18,392 acres) is regarded by State Wildlife officials as probably one of the best such management areas in Virginia. The highly productive wildlife area is essentially the result of a diversity of habitat together with good management." (Corps EIS P. 2-12)

"The importance of the wildlife area as wild turkey range is considerable, more than any other State-managed area, since Gathright serves as a pool whereby trapped birds are utilized to stock other regions in Virginia." (Corps, EIS P. 3-31)

"The area affected by the Gathright Project comprises an important portion of the Gathright Wildlife Management Area...The juxtaposition of agricultural crops in the fertile bottomland and wooded uplands combines with topography and water courses to provide excellent habitat for a variety of wildlife species. In addition to sustaining a high annual wildlife harvest, the wildlife productivity of the area is sufficiently great to yield substantial numbers of wild-trapped turkeys for transplanting to other locations in the State." (Corps, Design Memorandum No. 4, P. 22)

"The unusually high wildlife productivity of the Gathright area is a result of diversity and juxtaposition of these four habitat types. The game production of the four types managed as a single unit is much greater than the total production of the same habitat types if they were isolated and managed as separate entities." (BSFW, Design Memorandum 4, P. D-22)

"The exceptionally high populations of wild turkeys and favorable trapping conditions found on the Gathright unit make it an invaluable source of wild birds for restocking other areas. ...The success of such a restoration program is dependant on a source of wild birds since artificially reared birds have proved unsuitable for this purpose. At present, the Gathright area is the only source from which wild turkeys are being obtained for Virginia's restoration program." (BSFW, Design Memorandum No. 4, P. D-23)

Virtually all of the uniquely valuable features would be destroyed by the reservoir. The white water canoeing would certainly be eliminated, together with the outstanding fishing which exists at present. Attempts to mitigate the loss through flow regulation of the stream segment downstream of the dam site cannot reproduce the outstanding quality of the existing resource. Loss of the fertile bottom lands will drastically reduce the carrying capacity of the surrounding game lands as well as eliminating the nucleus of the wildlife preserve. The Bureau of Sports Fishery and Wildlife concludes "the existing source of wild turkeys for the State's long-range turkey restoration program will be virtually eliminated," (Design Memorandum No. 4, P. D-6) with incalculable effects on the program itself. The State Commission of Game and Inland Fisheries has repeatedly expressed firm opposition to the project. (Design Memorandum No. 4, P. D-7).

The attempt to mitigate the loss of the T.M. Gathright Wildlife Management Area as a major wildlife resource of the Commonwealth of Virginia has apparently broken down or been abandoned. The status of this effort should be described by the Corps in the EIS. There is a need to: (1) identify a tract of land capable of replacing the wildlife production potential of the Gathright Area - if indeed any such alternative exists anywhere in the State; (2) determine its cost and make provision to secure it for the State. In meetings held to discuss such mitigation involving the Corps, the State Game and Inland Fisheries Commission and the Bureau of Sport Fishery and Wildlife, it was initially recognized that Gathright could not be replaced on an acre by acre basis, and that as much as 20,000 acres might be required to make up for its loss. (see Design Memorandum No. 4, Appendix D). This insight seems to have been eroded, however, since the Corps

has paid only "fair market price" \$620,000 for the 5415.5 acres actually required for project use. This sum is almost certain to prove far too small to provide for replacement, especially since replacement lands may well be more costly than those given up. Furthermore, since Federal funds under the Pittman-Robertson Act were among those employed to acquire the Gathright unit, it must be replaced, otherwise State eligibility to receive such funds will be lost. Regulations of the Federal Department of Interior provide that when gameland acquired with Federal aid under the Pittman-Robertson Act is diverted to other uses, eligibility to receive further such aid is withheld until "a property of equal value at current market price and with commensurate benefits to fish and wildlife is acquired with non-Federal funds to replace it." The State is thus in the unenviable position of either losing all Federal aid to acquire and develop game resources or else spending perhaps several million dollars of its own funds to replace the game management resources lost.

The flooded segment of the Jackson River and the associated gamelands would, of course, be replaced by an open water expanse. This would provide Covington area residents with convenient access to broad water recreational pursuits. The Corps states that there are no other such reservoirs within 50 miles of Gathright. This is a rather misleading observation. Smith Mountain Reservoir and Summit Lake are each approximately 50 miles from Covington - the nearest population center to the proposed reservoir. Other lakes and reservoirs lie at distances of approximately 65, 70, 70, 80 and 80 miles from Covington in virtually every compass direction. Furthermore, the proposed Hipes reservoir would be approximately as close to Covington as Gathright - but in the opposite direction. Major regional population centers such as Roanoke and Lynchburg already have reservoirs and other recreational water surfaces much closer to them than Gathright would be. Furthermore, Gathright Reservoir would represent basically a "State Park" type of development. Other State Parks exist in the immediate area. Opportunities to develop public recreational facilities for swimming could be found much closer to Covington if desired.

Other adverse effects which would result from the Gathright Project, as presently formulated, are mentioned in the sections on Water Quality and Flood Control. These include loss of national economic welfare and violation of standards of social equity; possibly, perpetuation of flood risk through unwise use of the flood plains; and encouragement of environmentally harmful "external" effects of the pulp and paper industry such as air pollution, aggravation of the solid waste problem and promotion of single purpose use of the nation's forests.

2. Water Quality

A major purpose of the Gathright Project is improvement of water quality in the Jackson and James River Basins. EPA has a specific responsibility in this area. The justification for inclusion of water quality storage in the project formulation was originally provided by a study carried out by the Corps in collaboration with EPA's predecessor agency in the Public Health Service.⁽¹⁾ Furthermore, the Federal Water Pollution Control Act Amendments of 1972 provide that: "The need for, the value of, and the impact of, storage for water quality control shall be determined by the Administrator, and his views on these matters shall be set forth in any report or presentation to Congress proposing authorization or construction of any reservoir including such storage." This determination is a heavy responsibility since, as discussed in Sections 1 and 5, the environmental impact of this project is quite severe and the project is not economically justifiable - even 29% completed - without substantial water quality benefits. This conclusion holds both in economic theory and in the real, political world. On the other hand, there undoubtedly exist real water quality problems in the Jackson and James River Basins. The questions which must be answered hinge on the feasibility of achieving good water quality by treatment of polluting discharges at their sources without the aid of flow augmentation, the economics of the alternative strategies, and their relative compatibility with EPA's goals and legislative mandates, including the Federal Water Pollution Control Act Amendments of 1972.

A. Water Quality Problems in the Jackson and James River Basins

The Gathright Project is intended to assist in overcoming several specific water quality problems. These are identified in the Impact Statement and in the project document, Design Memorandum No. 4, especially Appendix C. This latter work, prepared with the aid of the Public Health Service, is cited in the Impact Statement as defining the water quality problems to be addressed. The major water quality problem which Gathright will substantially affect is the poor stream quality produced in the 10-15 mile reach below Covington by discharges from the Westvaco Pulp and Paper Mill at Covington. Covington is 19 miles below the Gathright damsite, and the low values of dissolved oxygen (DO) found in this stream segment were the critical factor in determining the amount of water quality storage to be provided. Furthermore, it is only the streamflows in this segment which could not be augmented equally well by releases from other reservoirs on other tributaries of the

(1) Water Supply and Water Quality Control Study, Gathright Reservoir, James River Basin, Virginia, by the Norfolk District, COE and the Public Health Service, Charlottesville, Virginia, May, 1965. This study appears as Appendix C in the Design Memorandum No. 4 for the Gathright Reservoir.

James. Thus, for example, flows at Lynchburg or Richmond would also be augmented by releases from the proposed Hipes reservoir.

EPA has refined its water quality model of the James and Jackson Rivers. Recent work confirms that the stream segment below Covington is the critical reach affected by the Gathright Project, and that flow augmentation or improved waste treatment will be required to meet stream standards.

Another water quality problem which was identified in the earlier work and in the EIS is found slightly above Lynchburg below the Owens-Illinois Pulp and Paper Mill discharge at Big Island Dam, and extends down to the Lynchburg Dam. This was stated to be due to power generation at the intervening Reusen Dam, which results in storage of river flows and "results in a virtually dry stream bed for a 2-3 mile stretch, causing nuisance conditions and sporadic fish kills."

The problem in this reach is clarified by EPA's more recent stream quality modeling. Model results, which describe only steady state conditions, show low dissolved oxygen levels in this stream reach, primarily behind Coleman's Falls Dam above Reusens Dam. The above problem is believed to be caused by the retention of waste laden waters behind this dam and may also be affected by slow aeration rates through the slack water surface. Intermittent streamflow is not depicted by the model. Such interruptions in the flow are undesirable on environmental grounds and may well cause fish kills or other nuisance conditions in their own right. In contrast, the proposed combined discharge of municipal wastes and paper mill wastes below Lynchburg is not expected to cause violation of stream quality standards for dissolved oxygen, assuming that secondary treatment provides at least 85% removal of BOD₅.

Additional problems exist at Richmond. Three have been suggested: (1) Low flows above Richmond permit algae blooms to occur in the river pools and cause taste and odor problems in the Richmond municipal water supply; (2) Flows of up to 900 cfs are diverted through the Kanawha canal at Richmond leaving "little or no flow in the natural channel from Bosher Dam to 14th Street Bridge," (EIS, P. 2-10). This is stated to lead to "nuisance conditions," (Ref. 1, P. 4); (3) The estuary below Richmond in the Richmond-Hopewell area suffers from low dissolved oxygen. Increased freshwater inflow would benefit water quality to some extent. However, no such benefits are asserted in the Impact Statement, and in the Design Memorandum it states explicitly that, "the flow from the reservoir is such a small portion of the estuary volume that the benefits in this portion of the river are unmeasurable."

EPA has improved its capability of modeling estuarine water quality. The level of treatment required of dischargers can now be specified as a function of freshwater inflow to the estuary. (The chemical industry in the Hopewell area is the controlling waste source.) The total flow augmentation necessary to reduce the required treatment level by a significant amount is quite large - roughly 11 times the amount supplied by Gathright. (Different strategies could be employed. The figure refers to the one which requires least total water quality storage.) The contribution of Gathright alone would be too insignificant to permit relaxed treatment standards. Furthermore, construction of an effective system of reservoirs would almost certainly take 15 to 20 years at a minimum. Nor is it likely that such a system could be easily justified at this time, since as discussed in the text, requirement of "best available treatment" will revolutionize the water quality situation within a distinctly shorter time frame than this. Thus, although a relatively small but non-zero value could be attributed to releases from Gathright as they affect estuarine water quality, we believe the Corps is wise not to claim such benefits for this project. We shall follow their example here and not attribute any monetary benefits to Gathright for estuarine water quality improvement.

B. Technological Options for Meeting Water Quality Standards with Little or no Flow Augmentation

(1) Westvaco-Covington. Secondary treatment of municipal wastes from Covington will effectively eliminate such wastes as a factor in the water quality problem in the affected stream segment. The question is then, what waste discharge by Westvaco is compatible with stream quality standards and to what extent is it economically feasible to reduce discharges to that level? Attention has focused on the dissolved oxygen in the stream segment extending 10-15 miles below the plant. Virginia standards specify an average DO of 5 mg/l and a minimum of 4. These conditions are not met at present during much of the year. EPA has studied water quality in this stream reach with the aid of a water quality model. The model parameters were determined by field observations. The amount of waste loading which is compatible with attaining stream standards in the absence of flow augmentation can be specified with sufficient precision to meet all practical needs. The precise value depends on the temperature and DO of the discharge itself. Assuming that thermal standards are met (barely) and the DO of the discharge is 5 mg/l, the stream can assimilate 8970 pounds per day of ultimate BOD. This increases to 9270 pounds if the effluent DO is 6 mg/l. These numbers are derived on the basis of the assumption that BOD_1 is 3 times BOD_5 , the more commonly measured quantity, and assuming both a maximum stream temperature, 26°C, and a minimum flow, 87 cfs. This flow represents the 7 day average flow recurring on the average once in 10 years. However, the 7 day-10year low flow will typically occur in September, when stream temperatures are likely to average no more than 22°C rather than 26°C. On the other hand, maximum stream temperatures are likely to occur in July and August. The 10-year minimum of the 7 day average flow for these months exceeds that of September by at least 15 cfs. The critical conditions occurring, on the

average, once in 10 years then represent the low flow encountered during August and are compatible with a loading of about 10,200 lbs. per day of BOD_u at an effluent DO of 5 mg/l.

It is adequate for purposes of discussion to suppose that a gross loading of 10,000 lbs./day of BOD_u by Westvaco would meet stream standards for DO without flow augmentation. The permissible BOD₅ discharge would be about 1/3 of this BOD_u loading. From the discharge permit application, we determine that present discharges average about 14,000 lbs./day of BOD₅. Of this, about 10,000 lbs./day are discharged from the treatment plant proper. (These average values are believed to be the most relevant quantities in considering the summer low flow conditions.) These discharges are too high to attain stream standards even with Gathright. The limiting conditions with Gathright correspond to a summer flow of about 280 cfs, which allows a discharge of about 26,300 lbs./day of BOD_u or 8800 lbs./day of BOD₅. Thus, reduction of the BOD discharged by about 1/3 of the present amount can be taken as the "baseline condition" required even if flow augmentation from Gathright is provided. (Westvaco proposed to the Virginia State Water Control Board a schedule to meet all stream standards by July 1, 1978. The proposal was rejected as entailing excessive delay.)

An EPA in-house investigation of the technology of the pulp and paper industry has indicated, on general grounds, that plant discharges could be reduced to around 10,000 lbs./day BOD₅ by mainly in-plant changes of relatively modest cost and without a major effort to upgrade the present biological treatment facilities. These latter have a treatment efficiency of about 85%, were constructed many years ago, and are typical of facilities possessed by a substantial fraction of existing pulp mills. Water quality standards without Gathright would then be met by upgrading the treatment works to remove 95% of the BOD. (These efficiencies are usually expressed in terms of BOD₅. Here we assume that the ratio of BOD_u to BOD₅ remains constant at 3:1.) Thus the "treatment" alternative to Gathright may be taken to consist of upgrading the sewage treatment plant from 85% to 95% efficiency. This is conservative, since a limited upgrading or other method of further reducing discharges would be required even in the presence of Gathright - that is, the 10,000 lbs./day BOD₅ assumed for the discharge level without upgrading still exceeds the 8800 lbs./day required to meet the stream standards.

Section 102.b.1 of the Federal Water Pollution Control Act as amended in 1972 forbids provision of flow augmentation "as a substitute for adequate treatment or other methods of controlling waste at the source." The level of treatment considered "adequate" has often been taken to include the highest level which is technically feasible and not prohibitively expensive. Certainly the questions of feasibility and cost are fundamental to comparing the trade-off of higher treatment levels for flow augmentation. There is good reason to believe that the 95% treatment efficiency contemplated for Westvaco is technically feasible. We can cite as evidence of this claim:

1) Other pulp mills have treatment efficiencies as high as 95% and even considerably higher; 2) The standard reference, "The Cost of Clean Water, Volume III," indicates that as of its publication date, five years ago, up to 95% removal of BOD₅ was "state of the art" for an activated sludge treatment facility. This is the type possessed by Westvaco; 3) The technology employed to treat pulp mill wastes is fundamentally the same as that used in treating municipal wastes. Methods of upgrading municipal treatment plants are well developed and permit much better even than 95% BOD removal. 4) It is the professional opinion of the appropriate technical expert at EPA-Region III that upgrading the treatment facilities to 95% removal is feasible. The required capital investment cost is estimated to amount to 50% of the value of the existing treatment facilities and operating costs are expected to double.

This last observation permits the economics of the contemplated treatment alternative to be addressed. Using standard figures for capital and operating costs of treatment plants in the pulp and paper industry (2), the estimate provided amounts to a capital investment of about \$3 million and increased operating costs of about \$1 million per year. (1971 price levels are employed throughout to facilitate comparison with the latest available figures on reservoir construction costs.) Converting the operating costs to a capitalized present value using a 10% interest rate, which represents the typical rate of return on private capital investment and approximates that appropriate to the pulp and paper industry, leads to a total present value cost of about \$13.2 million. (The "present value" incorporates the operating costs as an equivalent capital sum whose earnings would just pay these costs.) This present value cost represents the savings to Westvaco resulting from water releases from Gathright. Together with the analogously defined quantity for Owens-Illinois, the other principal beneficiary of this project function, it can be compared directly to the capital value assigned by the Corps to such benefits, \$26.9.*

- (2) R. V. Thomann, Systems Analysis and Water Quality Management, 1972. See, especially, Tables 9.2 and 9.6.

*After this work was completed, based on "state of the art" estimates, additional data was obtained from Westvaco. Discharges of BOD₅ from the treatment plant have been reduced to about 8,700 lbs./day average at a treatment efficiency of about 87.5%. Total present value of capital invested in the plant was \$3.5 million in 1971, less than the conservative estimate we employed, and operating costs are slightly less than the \$1 million which we allowed. Fourteen men are employed full time in pollution abatement, including four whose duties relate to both air and water pollution. We wish to express our thanks to the Westvaco Corporation for providing this information.

However, the \$13.2M (Million) figure derived in this manner seriously overestimates the net cost of meeting water quality standards by enhanced treatment without flow augmentation. The Federal Water Pollution Control Act Amendments of 1972 require that all industrial dischargers employ, "the best available technology economically achievable," to abate polluting discharges by July 1, 1983. There can be little doubt that the reduction contemplated in the present context to meet water quality standards is readily "available" even at today's level of technology, much less that of 1983. This point was documented in the last paragraph. Even higher treatment levels may well be readily attainable. Sand filtration could presumably be used--as in the analogous case of treating municipal wastes--to remove another few percent BOD₅* overall. Lime clarification, which is discussed further below, can increase the efficiency of a subsequent treatment process, as well as removing 30% or more of the BOD₅* in its own right. Thus, in requiring 95% removal of BOD₅*, we would at most be advancing by a few years measures which will have to be undertaken in any case. Suppose the abatement schedule required of Westvaco specified 1977 instead of 1983 as the deadline for instituting these measures. The five-year delay in making the contemplated expenditures would have a present value (in 1977) to Westvaco of \$4.9 million. It is this figure which will contribute about 90% of the total which has to be compared to the cost of flow augmentation, \$26.9 million for a single-purpose reservoir. (As discussed below, the allocated cost for the multi-purpose project gives a very similar figure.)

A great deal of attention has been focused on the dissolved oxygen problem downstream from Westvaco. However, there are several other respects in which Westvaco is in apparent violation of stream standards which are amenable only to treatment and are not eliminated by dilution. These include discharges of colored substances and toxic compounds. Virginia water quality standards forbid for all waters and all times "...substances attributable to...industrial wastes...which...interfere directly or indirectly with beneficial uses of such waters." Uses of the upper Jackson are defined to include "secondary contact recreation, propagation of fish and other aquatic life, and other beneficial uses." The effect of the Westvaco Mill on the color of the Jackson River has been described in the following terms, "The Jackson River enters one side of the plant crystal clear, sparkling, and colorless and emerges from the other side a black, foaming abomination." (3) Photographs of the river have conveyed to us the appropriateness of this description. A biological survey

* Removal efficiency is stated in terms of BOD₅, which is the quantity usually measured. However, BOD_u is actually the more relevant quantity. We are implicitly assuming that at the treatment levels under consideration, the ratio of BOD_u to BOD₅ remains nearly constant.

(3) R. H. Skeppstrom, Comments on the Draft 102 Statement on the Gathright Project, prepared for Citizens Against Pollution, Inc.

of the affected stream reaches by VMI Research Laboratories, Inc. presents the same picture.(4) The color itself has a strong impact on recreational and scenic enjoyment of the river. It also can be expected to adversely affect primary production by algae and periphyton.

- (4) The following summarizes observations by this group immediately above and below the Westvaco outfall:

"Station #2 - Jackson River at the riffle approximately 100 yards upstream from the Covington, Virginia, Water Filtration Plant

Numerous smallmouth bass and darters were observed in the clear water at this station. A small group of children were seen swimming downstream from the water filtration plant. High water quality was again indicated by the 38 kinds (genera) of bottom organisms which included such clean-water forms as mayflies (eight genera), caddisflies (eight genera), stoneflies (one genera), riffle beetles (two genera), and hellgrammites. A total of 426 bottom organisms were collected in the square foot sample which included 95 mayflies, 51 caddisflies, and 94 riffle beetle larvae. Clean-water organisms made up 56 percent of the total in the quantitative sample. High diversification and numerous clean-water forms indicated excellent water quality.

"Station #3 - Jackson River at the Covington, Virginia, Playground Park

This station was located approximately 0.7 of a mile downstream from the pulp and paper company and adjacent to the Covington Municipal Playground. Virtually all of the rocks were coated with a heavy, black slime believed to be Sphaerotilus sp. The water was a dark, coffee color at this station.

The water temperature was elevated, and foam was observed. In addition, a strong odor characteristic of a mill operation was noted. The air-breathing snail Physa was present in fair numbers, but these snails were all at the waterline and on the rocks. For this reason, a quantitative sample was not taken. Only a few sludgeworms and another bristle-worm (Nais sp.) were found in addition to the Physa snails. Severe biological degradation is indicated at this station when compared with the upstream station. The enormous drop in genera from 38 (upstream station) to three at this station, plus the complete absence of clean-water forms, indicated heavy industrial pollution. All three kinds of bottom organisms found at this station were pollution-tolerant forms. The low dissolved oxygen and high water temperatures found by VMI sampling during this period further substantiate the poor biological conditions."

Westvaco's treatment plant discharges about 37 cfs with a color intensity of 1500 ppm color units. The natural color in the stream is quite low, of the order of 15 ppm. Reduction of the color of the discharge to that of the stream would require a dilution factor of about 100. The dilutions actually available with and without Gathright under various flow conditions are tabulated below:

	<u>With</u>		<u>Without</u>	
	<u>Flow</u>	<u>Dilution</u>	<u>Flow</u>	<u>Dilution</u>
7-day - 10-year minimum	160*	4	83*	2
7-day "annual" minimum	280	7.5	115	3
Mean discharge	600	16	600	16

* The minimum "without" occurs during the late summer or fall, the minimum "with" occurs during winter.

Evidently Gathright produces about a factor of two increase in dilution under low flow conditions, but nowhere near enough to avoid the very dramatic and obvious "color pollution" described above. Under more typical flow conditions, the presence of Gathright has no effect at all, as the final row illustrates.

Color can be substantially reduced by lime clarification. This process has been demonstrated as being economically feasible in full scale operation (5). It has operated consistently at 90% color removal and better. This is the equivalent of a "dilution" factor of 10. The effect of such treatment is thus equivalent to multiplying the factors tabulated above by 10. Clearly flow augmentation is far less effective than treatment in reducing color levels. It can be safely assumed that color removal will be required within a few years when the technology has been more fully demonstrated. It is also reasonably clear that color removal could be required even today. This is exactly what was done for the International Paper Company Mill in Riceboro, Georgia, described in Reference 5.

Lignins, which are responsible for the color of the wastes, are also the cause of its tendency to foam. The foam is eliminated by the lime clarification together with the color. Just as with color, the effect of treatment on foaming is greater than the effect of flow augmentation, and the advantage is especially pronounced under typical flow conditions, as contrasted to unusual ones. As mentioned above, removal of the lignins by lime clarification improves the efficiency of biological treatment. Removal of these surface active agents can also be expected to increase the re-aeration rate in the Jackson River (6). This could assist in meeting stream standards for dissolved oxygen.

- (5) "Color Removal from Kraft Pulping Effluent by Lime Addition," prepared for EPA by Interstate Paper Corporation, Riceboro, Georgia, Water Pollution Control Research Series 12040ENC12/71
- (6) M. Waldichuk, "Some Water Pollution Problems Connected with the Disposal of Pulp Mill Wastes," The Canadian Fish Culturist, No. 31, Oct. 1962, PP. 3-34

Pulp Mill wastes are known to contain toxic constituents which are harmful to fish. (6) Among these are probably, "resin and fatty acid soaps" (6) and terpenes (7). These compounds are very stable in the aquatic environment and would be expected to persist for a period of many weeks or even months as the water proceeds downstream. Demonstrated effects on fish include decreased ability to utilize food resources for growth (7) and increased requirements of oxygen for respiration and survival in the presence of stabilized Kraft effluent. (8) The increased oxygen requirement amounted to a factor of two increase (from 2 mg/l to 4 mg/l) on introducing 6% Kraft effluent. (8) This low a concentration would require a dilution factor of 18. The decreased growth caused by Kraft effluent is especially interesting because: (1) the effect was primarily encountered during the colder seasons of the year--the period during which flow augmentation actually decreases the flows; (2) the effect was detected at a concentration of 1% stabilized Kraft effluent and was prominent at a concentration of 4%, corresponding to dilution factors of 100 and 25, respectively; (3) the effect was evidently due in large part to terpenes; and (4) addition of a terpene recovery system to the mill in question markedly reduced the toxicity of the effluent. Evidently flow augmentation as provided by Gathright is largely irrelevant to toxic effects from any such constituents of the Westvaco effluent, and recovery of them might well be economically feasible at the present time.

No toxic effects on human beings from stabilized Kraft effluent have been established. However, no systematic effort has been made to screen the constituents of stabilized Kraft effluent for possible toxic effects which could result from low doses over a long period of time. Note that flow augmentation leading to dilution of wastes by a typical 160 cfs at Covington would increase the dilution at Richmond by only about 10% (median low flow.) (Richmond is the only major town on the James which obtains its municipal supply directly from the river.) In contrast, a comparable decrease in concentration at Covington produced by treatment would lead to a twofold (100%) decrease in concentration of the toxic substance at Richmond. This proportional reduction, moreover, would continue in force throughout the year, whereas that from flow augmentation would be nonexistent for much of the time and would only develop its full potential during low flows.

(2) Owens-Illinois at Big Island-Lynchburg. Discharges from the Owens-Illinois Pulp and Paper Mill at Big Island are responsible for low DO conditions found behind Coleman's Falls Dam. In contrast to earlier impression the water quality problem is highly localized and is almost confined to this pool. By a combination of in-plant changes and primary treatment, Owens-Illinois has evidently reduced its discharges to about 16,000 lbs/day of BOD₅. (9) EPA's water quality model indicates that meeting water quality standards above Coleman's Falls Dam requires a waste loading of only 2200 lbs/day of ultimate BOD without Gathright and only 5800 lbs/day with Gathright. Assuming that the present treatment level amounts to 50% BOD₅ removal and postulating a 3 to 1 ratio of BOD_u to BOD₅, the required treatment level is 97.7% without and 94% with Gathright. In the course of studying water quality conditions in this reach, we have become convinced that retention

- (7) "Laboratory and Controlled Experimental Stream Studies of the Effects of Kraft Effluents on Growth and Production of Fish," Stream Improvement Technical Bulletin No. 259, Oct. 1972 of the National Council of the Paper Industry for Air and Stream Improvement, Inc.
- (8) D. F. Alderdice and J. R. Brett, 1957. "Some Effects of Kraft Mill Effluent on Young Pacific Salmon," Fish, Res. Bd. Canada, XIV(5), PP. 783-795, cited by Waldichuk, Ref. (6)
- (9) "Clean Water: Affluence, Influence, Effluents," ed. by Albert E. Millar, Jr., 1971. Report of a Summer Program Sponsored by ASEE-NASA Langley Research Center and Old Dominion University Research Foundation.

of flows behind the Coleman's Falls Dam is largely responsible for the intractable character of this problem. We ~~guesstimate~~ ^{estimate} that if the flows were passed directly through this reach, the permissible loadings would be about 9000 lbs/day without and perhaps 14,000 lbs/day ultimate BOD with Gathright. These loadings correspond to treatment efficiencies of 91% and 85%, respectively. We conclude that removal of this dam or its modification to preclude storage and retention of flows during low flow periods is certainly a part of the most efficient method of meeting stream standards in this reach. That such removal or modification is eminently practical is clear from the fact that this dam has been abandoned and unused for about 25 years and that it has been purchased within the past year by Owens-Illinois itself.

Assuming that the Coleman's Falls Dam is demolished or modified, the incremental treatment costs associated with foregoing the increased flow provided by Gathright can be calculated approximately. We assume (1) the capital cost of installing a secondary treatment plant having 85% efficiency is \$1.73 million (9); (2) the capital cost of operating the plant is about \$400,000 per year; (3) the fractional increase in capital and operating costs to reach 95% efficiency resemble those estimated earlier for Westvaco; and (4) in interpolating costs to intermediate treatment levels, the geometric ratios of BOD fractions remaining should be employed. The estimated costs for reaching the higher treatment level are then \$290,000 for the capital investment and \$120,000 per year for operating costs. The present value cost of achieving the higher level five years earlier than would otherwise be required is \$.56 million. This is about 10% of the comparable value calculated for Westvaco.

The EPA water quality model does not depict the fact that flows are intermittent in the reaches near Lynchburg, which results from use of the hydroelectric dams for peaking. These intermittent flows cause fish kills in their own right (Ref. (1), P. 4). The requirement that conservation releases be maintained through the hydro-dams at all times would eliminate this condition of nearly dry stream segments and resulting "nuisance" conditions, including fish kills. In preparing these comments on the Gathright EIS, EPA contacted the staff of the Federal Power Commission to determine the status of the affected dams and the nature of regulatory authority over them. Proceeding downstream, five dams are involved as follows:

<u>NAME</u>	<u>OWNER</u>	<u>STATUS</u>
Big Island	Owens-Illinois	Unlicensed, but presumably subject to FPC regulation
Colemans Falls	Owens-Illinois	No hydro-electric generators-- No FPC authority
Holcombs Rock	Owens-Illinois	Unlicensed, but presumably subject to FPC regulation
Reusens	Appalachian Power Company	Under FPC License
Lynchburg	Glamorgan Pipe and Foundry Company	No hydro-electric generators-- No FPC authority

The following standard provisions of the licensing agreement apply to the Reusens Dam and potentially to licenses to operate the Big Island and Holcombs Rock Dams' generating facilities: "Article 6...the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as...the Commission may prescribe for the protection of life, health and, property, and in the interest of the fullest practicable conservation and utilization of such waters for power and for other beneficial public uses, including recreational purposes;" and "Article 15. The Licensee shall, for the conservation, and development of fish and wildlife resources, construct, maintain, and operate...and comply with such reasonable modifications of the project structures and operation as may be ordered by the Commission..." In cases such as the Lynchburg Dam in which no generating facilities are present, the FPC has no regulatory authority. In this case, however, the existence of the structure in a navigable river ~~may make it subject to regulation~~ by the Corps of Engineers. In either case, it is quite likely that the U. S. Federal Government retains adequate authority to require necessary conservation releases or other modifications of the structures and their operation which might be necessary to maintain satisfactory water quality and conditions for aquatic life. We recommend that the FPC and Corps of Engineers look into this situation and exercise their regulatory authority.

(3) Richmond. Taste and odor problems at Richmond are at present combated on an as needed basis with additional water treatment. In 1965, the added treatment cost 5 to 6 thousand dollars per year.⁽¹⁾ It should be emphasized that taste and odor problems associated with algae blooms can be corrected completely by proper treatment of the drinking water supply with activated charcoal, which is the method employed at Richmond. It is stated that no taste and odor problems exist when the flow at Richmond exceeds 900 cfs. The question, however, is not really one of taste and odor problems or their absence but of treatment costs since an effect comparable to flow augmentation could be obtained by routinely giving extra treatment to the water supply when the flow in the James falls below 900 cfs. Furthermore, it has been claimed that algae blooms are associated with river pools which are unexpectedly flushed under low flow conditions by flow irregularities thus leading to taste and odor incidents. If this is so, the conservation releases from the dams in the Lynchburg area and the de-emphasis of the present prevalence of peaking releases-intended to benefit water quality upstream-might well aid in correcting the taste and odor problem at (above) Richmond. Finally, it seems clear that this taste and odor problem would rightly be called a problem of water supply since the presence of algae is a natural phenomenon which is apparently not in the present case associated with harmful conditions for aquatic life or degradation of the aquatic environment. Therefore, if such benefits are to be counted toward project justification, they should be represented as "water supply benefits." As such, they are re-imbursable. Project reauthorization would have to be obtained to permit reimbursement for such benefits by the city of Richmond.

The nuisance conditions below the Boshier Dam site could clearly be avoided by providing conservation releases through the dam. This could presumably be required by the Corps of Engineers under their authority to regulate navigable waterways. Low flows at Richmond are adequate to meet projected municipal and industrial needs to 2020 while still providing substantial conservation releases. We recommend that the Corps investigate the possibility of requiring such releases.

C. Policy Considerations Involved in Water Quality Issue

EPA has not yet formulated policy guidelines to govern its new responsibility to determine, "the need for, the value of, and the impact of, storage for water quality control." It must balance an appraisal of the technology available for waste treatment against the requirements of the law that, "[flow regulation] storage and water releases shall not be provided as a substitute for adequate treatment or other methods of controlling waste at the source." (FWPCAA-1972, Section 102.b.1). Furthermore, adequacy must now be considered in the light of the Congressional declaration that, "it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985" (FWPCAA-1972, Section 101.a.1.) and the specific requirement that the, "best available technology be employed by 1983. The thrust of these developments is that flow augmentation, except under very unusual circumstances, will probably be at most an interim measure.

In the absence of policy guidelines, it is not now possible to assign a value to flow augmentation for water quality improvement. Earlier assignments of value, such as that embodied in the work of the Public Health Service in 1965⁽¹⁾, can no longer be accepted as valid.

In the present case, . (1) EPA withholds endorsement of the project and does not at this time assign a non-zero value to water quality storage; (2) in the present case, the question of the value of water quality storage cannot be severed from those of the economic feasibility of the project as a whole and of the desirability of proceeding with construction; (3) therefore, proponents of water quality storage will be required to establish by .. substantial evidence the necessity of such storage. This must be in the context of the current law which forbids such storage as a substitute for control of pollution at its source.

Questions of economics, equity and "external" costs and benefits of alternative strategies should also be thoroughly explored. These questions have policy implications in their own right.

(1) Economics: Efficiency and Equity. As discussed in Part B, above, it is quite feasible to meet water quality standards without benefit of flow augmentation. Meeting such standards is required by law and the environmental quality benefit of higher water quality is not a consequence of the Gathright Project. Rather, the monetary savings enjoyed by Westvaco and perhaps, Owens-Illinois are the true benefits accruing from water quality storage in this project. The Federal Water Pollution Control Act Amendments of 1972 require that the beneficiaries of water quality storage be identified and provides that, "if the benefits are widespread or national in scope, the costs of such features shall be non-reimbursable." By implication, if these conditions are not met, the costs allocated to water quality storage are reimbursable. In the present case, by far the largest part of such benefits would accrue to one--perhaps two--private firms. Reimbursement should be required. The failure to require such reimbursement would have serious adverse effects on economic efficiency and on equity.

As determined above, treatment costs are only a fraction of water storage costs. To provide flow augmentation in the amount and manner presently proposed would be economically inefficient from a national point of view, and would be, "paid for," by a net decrease in National Economic Development.⁽¹¹⁾ However, only the treatment costs are paid for by the private firm, while the water storage costs are traditionally assumed by the public. Thus, it cannot be expected that the firm will seek the most efficient combination when flow augmentation comes free of charge. The conclusion that subsidized flow augmentation leads to increased cost and decreased public welfare is not new or unique to the present case. The following material from a recent economic analysis of the value of dilution water can be taken to illustrate the point: "[Davis] made the important observation that where Federal subsidies are provided, the local cost of augmentation can be zero; therefore, regional decision makers might argue strongly in favor of this method even though its total cost in achieving a desired water quality were many times that of the lowest cost alternative. From the standpoint of national welfare, the choice of low flow augmentation in these circumstances would of course be incorrect."⁽¹²⁾ This problem is eliminated by requiring reimbursement (provided that an interest rate comparable to the typical rate of return on investment by the industry in question is employed in setting annual charges.) This would then permit the industry in question to make use of the knowledge which it alone possesses as to the cost of the least expensive technological options for treatment or process change, and to balance that ^{cost} against the cost of water quality storage, allowing for any advantages implicit in multiple purpose project formulation, to arrive at the most economically efficient means of reaching the water quality objective.

(11) See the proposed Principles and Standards of the Water Resources Council for a discussion of this concept.

(12) L. B. Merritt and B. W. Mar, "Marginal Values of Dilution Waters," Water Resources Research 5, 1186 (1969).

If reimbursement is not required equity--fairness--is sacrificed as well as efficiency. Why should the people of the United States subsidize the profits of the shareholders in these firms? (If Westvaco were likely to close down its Covington Mill as an alternative to making the required expenditures, the well-being of its employees would obviously have to be considered in depth. Even in this case, it would be more efficient from a national point of view to subsidize treatment than to augment streamflows. It is worth noting in this context that the largest part of the treatment costs are for "operation and maintenance." Part of this cost is for labor. This means jobs for Covington. The "treatment" option may well provide a more lasting contribution to "Area Redevelopment" than short-term expenditures for public works construction.) Citizens who perceive that such a project as Gathright provides a very substantial subsidy from the public treasury to a profit-making enterprise typically and quite justifiably react with shock and outrage. (3) Such subsidies are not compatible with our social goals and sense of justice. This is a point which should be recognized by decisionmakers in Federal agencies and other public servants.

(2) Externalities: Certain industries are deliberately subsidized because it is felt that increasing their output is in the national interest. No doubt inexpensive paper contributes to our standard of living. The possibility of a "paper shortage" is sometimes raised. Furthermore, Covington is on the fringes of Appalachia. Expansion of its major industry might be considered worthy of encouragement even though the Covington area is not as depressed as other parts of this region. However, it is very important that these arguments be analyzed with care instead of being accepted uncritically.

The U.S. paper industry has recently been suffering from excess capacity and over-production. Profit margins have suffered in consequence (13). A "Shortage" is not likely in such a competitive market. At worst prices would rise. Production of paper entails significant environmental costs which have not been reflected in the market cost. Even aside from air and water pollution, paper is a major constituent of the solid waste problem which plagues American cities. Excess capacity has led paper manufacturers to attempt to promote new disposable products, which would tend to further exacerbate this solid waste problem. Furthermore, excessive paper consumption places a heavy burden on our nation's forests. Clearcutting and other intensive management measures are necessitated, and the replacement of mixed aged forests by even-aged plantations is encouraged. The latter are typically less productive of wildlife, less attractive and less ecologically stable, so that increased pesticide applications are required. Thus higher paper prices which led to reduced use and waste of this commodity might on balance be a desirable result.

(13) "The Water Lords," James M. Fallows, 1971

3. Flood Control

Flood control is a major function of the Gathright project. Yet no systematic program is described which would preclude project induced stimulation of flood plain occupancy, leading in turn to increased flood hazard. Past experience has shown that this is the typical result of reliance on structural flood protection without simultaneous enactment of effective land use controls. Abundant literature exists to document this observation.⁽¹⁵⁾ Structural flood protection, such as that provided by Gathright, is almost never totally effective. Below the mouth of Dunlap Creek in Covington, just 19 miles below Gathright, only 45 percent of the peak discharge would be controlled.⁽¹⁾ The significance of "partial flood protection" was grimly illustrated by the Rapid City disaster in South Dakota. In that case, 261 people were killed in Rapid City just 14 miles downstream from a modern, multipurpose flood control reservoir, Pactola Reservoir. The reason was that the rain fell on the watershed downstream of the reservoir.⁽¹⁶⁾

Because of the danger of increased flood hazard resulting from over-confidence in the degree of flood protection accorded by an upstream reservoir, we believe that construction of such a project should not take place until all affected downstream county or municipal bodies have undertaken definite programs to regulate flood plain use. Ideally these should include qualification for Federal Flood Insurance.⁽¹⁷⁾ Following Hurricane Agnes, there has developed considerable interest in the affected area in flood plain zoning.⁽¹⁸⁾ The Corps has been providing assistance by mapping the

¹⁵ See, for example, L. B. Leopold and T. Maddox, Jr., The Flood Control Controversy, 1954; Tennessee Valley Authority, A Program for Reducing the National Flood Damage Potential, 1959; and Task Force on Federal Flood Control Policy, A Unified Program for Managing Flood Losses, 1966.

¹⁶ Flood Control - A Field Investigation, Environmental Defence Fund, 1972.

¹⁷ 42 U.S.C. 4001 "The Federal Insurance Administration (HUD) requires a community to adopt certain land use and control measures in order to qualify for flood insurance coverage." Ref. (16). See this reference for additional information.

¹⁸ Robert M. Shannon, Executive Director, Fifth Planning District Commission. Botetourt and Roanoke Counties have already adopted flood plain zoning regulations.

flood hazard zones. The Corps should employ this favorable opportunity to secure definite commitments to institute flood plain land use controls. It would be desirable to hold further construction on Gathright in abeyance till these commitments are obtained. No less would be fully consistent with the directive to Federal agencies embodied in Executive Order No. 11296, August 10, 1966: "...the heads of the executive agencies shall provide leadership in encouraging a broad and unified effort to prevent uneconomic use and development of the Nation's flood plains (.)"

In the absence of Gathright, one may anticipate that the local progress toward flood plain zoning will continue. Thus in the absence of Gathright, a gradual decline in the value of structures in the flood plain should be anticipated as non-conforming structures depreciate and are not replaced. If Federal Flood Insurance were widely adopted, then costs of flood damage would be borne in part by the Nation as a whole--in complete analogy to public financing of a structure to prevent such individual losses. Each "alternative," structure or insurance, distributes the burden of financing flood losses onto the Nation as a whole. Each should be supplemented with a warning system to prevent loss of life, since flash floods remain a possibility in either case. One important virtue of the flood insurance program is its educational aspect. It has been shown that the people inhabiting the highest risk areas of the flood hazard zone are often those least aware of the danger involved.⁽¹⁹⁾ Another virtue is that it is "self-liquidating." Ultimately, structures are removed from the hazard zone except those for which high economic returns justify location there. Thus, personal danger and property loss are eliminated. A major potential adverse effect of structural flood control measures is simply that they tend to discourage this much more effective, desirable, and permanent long-term solution. Every effort should be made to avoid this consequence.

In contrast to occupancy by individuals and small businesses, major industrial plants locate in flood hazard areas knowingly for the sake of the economic advantage which such locations may confer. They thus accept the periodic flood losses for the sake of economic gains. The cost of doing business in the flood plain should not be subsidized by the public at large. Criteria both of social equity and of economic efficiency would be violated by such a subsidy to the detriment of public welfare. Therefore, costs of providing Federal flood protection to WESTVACO, in particular, should be passed on to this corporation. The flood control benefits to this one plant represent almost half, 40%, of the total project flood control benefits. The corresponding fraction of project cost allocated to flood control should be reimbursed by WESTVACO. Annual costs to be reimbursed should be calculated using the rate of return on private capital investment, 10%, to properly reflect the cost to the Nation and WESTVACO's gain. The amount of this payment, as calculated below in the "economics" section, is \$300,000 annually.

¹⁹ D. L. James, E. A. Laurent, D. W. Hill "The Flood Plain as a Residential Choice," Atlanta Institute of Technology, 1971.

4. Recreation

EPA has no special responsibility for evaluating benefits. However, they are closely related to the environmental impact of the project, which we must consider in evaluating the impact of water quality storage. Moreover, these are among the "benefits" which the project is designed to provide and which must be foregone if a higher level of treatment is employed to meet water quality goals in place of flow augmentation.

We feel that the recreation benefits claimed for the Gathright project are not credible. The methods usually employed by government agencies appear to systematically overstate the value of high-density recreation. If recreational values were accurately reflected by the calculational tools employed, National Parks and Wildlife Refuges would not be worth their cost to the American people. Through the political process, it has been made abundantly clear that such resources are valued by the public--enough to preclude other apparently more remunerative economic uses. That such values are not reflected in calculated "benefits" and "costs" impeaches the accounting procedures employed.

A possible conceptual alternative to the scheme usually employed is the following: the public at large, in this case the people of Virginia, receive a value each year from the existence and preservation of a major, unique natural resource such as the upper Jackson and the Gathright Wildlife Management Area. The mere existence of such areas and the knowledge that they exist and can be enjoyed at some time in the future, enhances the scope of the affected person's existence and provides real and valuable rewards. Because many people are affected, this benefit is a major factor even though the returns to individuals may be small. If the average value of the typical return was \$1.00 per year and accrued to several million people, it would dramatically change the relative value of the recreation resource with and without the project. In view of the widespread opposition to the Gathright project such an estimate does not seem unrealistic.

Even within the confines of the traditional accounting scheme, the value of recreation without the project appears to be underestimated in comparison to that with the project. Thus, although total man-days of trout fishing are about 20,000 per year in each case (thanks to the inclusion of mitigation measures), the superior access, more "outstanding" fishing, and scenic surroundings under the existing, no project circumstances have been neglected. If these factors serve to double the enjoyment of the fishermen, they might represent a value of \$120,000 each year. Similarly, though only half of the annual 20,000 man-days of hunting are lost as a result of project implementation, because of the unusual productivity of Gathright, the hunting which goes on today is of higher value per man-day than that which would remain after construction of the dam. If the extra value associated with greater hunter success is assigned a value \$5.00 per man-day, this project induced cost would amount to an additional \$100,000 per year. In a similar fashion, the potential value of white-water canoeing without the project--a potential which is by no means fully developed today--can be reasonably assigned a value of \$50,000 per annum (10 parties per day of 10 individuals each - 5 canoes - over a recreational season of 50 days, effective length. The actual total length of the season would be longer but the use non-uniform). Together these neglected or underestimated recreational

dis-benefits would decrease the net recreational benefits attributable to the project from \$381,000 to \$111,000 per annum. The possibility of compatible development of opportunities to sight-see, birdwatch, or indulge in other outdoor activities at the Gathright area in the absence of the dam would add further value to the "without" total recreational benefits and further decrease the net yield from project implementation.

The possibility has been suggested (3) that provision of public swimming in the Gathright reservoir would result in swimmers contracting acute primary amoebic meningoencephalitis (PAM). This is a disease which is contracted through swimming and is invariably fatal. There is no known cure. The disease is endemic in several recreational lakes in the Richmond area. A review of the available data conducted with the aid of Dr. S. L. Chang of EPA's Cincinnati Laboratory, one of the leading authorities on this disease, leads to the following conclusions: (1) The disease seems to be endemic in some, but not all, apparently comparable recreational lakes in various areas; (2) The disease is definitely present in parts of Virginia; because of the unfamiliarity of the disease to most physicians, it may be more widespread than is presently recognized; and (3) The causal factors which make the disease endemic to some lakes and not to others are not known. "The natural reservoir of *N. Fowleri* [the tentatively identified pathogenic organism] has not been defined. It may well be that some animal could act as a reservoir or vector..."(20) We conclude that there is a possibility that the unknown causal factors would lead to acute PAM becoming endemic to Gathright Lake. The probability of a given swimmer contracting the disease is very small, however. A study of PAM in the Richmond area cited in reference (20) diagnosed 16 cases (retrospectively) extending over a 15-year period. Presumably not all cases were found. We may postulate the rate of incidence in this area to be 4 per year. Total swimming in the Richmond-Lynchburg central James area has been estimated at 8,000,000 man-days per year.(9) If half was in bodies of water in which PAM might occur, the incidence of the disease would be about 1 case per million man-days of swimming activity. For a lake in which the disease was known to be endemic, the incidence rate would be much higher. If the Gathright reservoir were neither more nor less likely to harbor PAM than the central Virginia waters for which the data is available, one case of PAM would result every 10 years, assuming that one in four man-days of recreation involved swimming. It must be recognized that people are quite willing to run risks for the sake of enjoyment or convenience; the risk involved in traveling to and from the reservoir would certainly exceed that involved in swimming in it. However, it would be desirable, if PAM turned out to be endemic in Gathright, to insure that prospective swimmers were fully informed as to the potential danger. This would probably tend to decrease their enjoyment of the experience. It might be worthwhile to attempt to further elucidate causal factors involved in transmission of this disease before further promoting extensive participation in swimming in recreational water bodies.

(20) R. J. Duma, "Primary Amoebic Meningoencephalitis," CRC Critical Reviews in Clinical Laboratory Sciences, June 1972, pp. 163-192.

5. Economics of Benefits and Costs

It is a primary function of the Impact Statement to explain not only what environmental costs are incurred but why they are necessary to meet valuable social or economic goals. This means that the project purposes, including their economic returns, should be carefully discussed in the Impact Statement. This information was not provided in the Impact Statement. Furthermore, EPA had great difficulty securing needed information which would permit us to address such questions, notably data concerning current benefits assigned to individual project purposes. These were eventually located in Congressional hearing records. (22) Average Annual Benefits are given as follows:

Flood Control	\$ 720,000
Water Quality Control	\$ 884,000
Recreation	\$ 381,000
Area Redevelopment	\$ 226,000
TOTAL	\$2,211,000

The importance of such data is that it provides a quantitative description of the formulation of the project. We, as reviewers, need it to quantitatively comment on our own reassessment of the project. Witness the fact that every one of these numbers is employed for some purpose in these comments.

The EIS states that the project is 29 percent completed, and that its total cost is \$39.4 million. Major cost increases of 20 and 30 percent have occurred during each of the last two fiscal years. The benefit/cost ratio is said to be 1.2 calculated using an interest rate of 3 1/8% and a project life of 100 years.

Benefits from specific project functions have been presented in the sections on those functions. It remains to study the benefit/cost ratio and the costs allocated to water quality under different alternative assumptions.

A. The B/C Ratio Used In Project Authorization

If EPA finds the assignment of non-zero water quality benefits incompatible with its interpretation of the requirements of the Federal Water Pollution Control Act Amendments of 1972, the benefit/cost ratio for the project as a whole would drop to .72. Furthermore, when Area Redevelopment benefits are excluded as being not National Economic Development benefits, the ratio drops to .61. Even with 29% of project costs omitted, completion of the project has a benefit/cost ratio of .86 in the latter case and 1.01 in the former, using the Corps' estimates of the other benefits and costs. Furthermore, with water quality storage needs eliminated, it is obvious that less storage would be needed to meet remaining project functions at least cost. This means that there is a less expensive alternative which provides the same benefits. By the rules under which the Corps operates, the B/C ratio is then (cost of completing reduced storage project)/(cost of completing presently authorized project), which would be markedly less than unity.

(22) Public Works Appropriations Hearings Record, Fiscal 1973, 92nd Congress, Second Session, Part 1, Volume 1.

It is our understanding that this situation would require re-authorization of the project. This authorization would presumably employ the current interest rate, 5.5%. Under these circumstances, the B/C ratio is calculated at $\$1.33 \text{ M} / \$1.96 \text{ M} = 0.68$. The saving resulting from the permissible lowering of the conservation pool has been taken into account using the data in Table 11 of DM4.

We conclude that Gathright is not economically feasible without water quality storage benefits. Therefore, EPA must accept a moral responsibility for the environmental impact of the project as a whole.

B. True National Benefits and Costs

As discussed in the proposed Principles and Standards of the Water Resources Council, the effect of public investment on National economic development is properly calculated by use of an interest rate which represents the rate of return on private capital investment. This interest rate approximates 10%. Since the major part of the project functions of Gathright can be achieved by alternative means which amount to private capital investment for private returns, it is clear that the use of the rate of return on private capital investment will permit the comparison of alternative social strategies on the basis of their economic efficiencies without distortions produced by regulated interest rates, transfer payments or outdated public investment criteria.

1. Corps of Engineers' Benefit Stream. Let us first calculate the benefit/cost ratio based on the Corps' values of the benefits, including that for water quality. These last are calculated as the cost of an alternative single purpose reservoir which would provide the same flow augmentation. This alternative reservoir would cost \$26.9M. When the interest rate is changed, the benefits for such an alternative capital investment change in parallel to those of the authorized project. The new water quality benefits have annual value of \$2.69M. The annual national economic development benefits and costs are then, respectively, \$3.791M and \$3.94M. Note that annual returns are \$150,000 less valuable than expenditures. The regional benefits have annualized value, according to the Corps, of \$226,000.* From this should be subtracted the incremental wages paid out according to the alternative plan. Recall that this involves relatively high "operating and maintenance" costs, a major share of which is wages. It is likely that these wages would come close to equaling the figure \$226,000 per year. For this reason, the Corps "Area Redevelopment" benefits will be dropped from the discussion, since they will probably not much exceed the Area Redevelopment benefits of the "no-action" alternative. Thus, even with the Corps' large benefits, the benefit/cost ratio is less than one when analyzed with regard to true economic costs and returns. It is useful to calculate the costs allocated to the different project functions using the separable costs (as fractions of total project cost) given in Table 11 of DM4. The separable cost of

* Use of a low interest rate is appropriate in calculating the value to individuals of wages as opposed to a capital sum, since the earnings on their savings will be low in real terms. In short, to the individual wage earner continued long-term employment is much more valuable than a short-term bonanza.

the recreation function turns out to exceed recreation benefits by a substantial margin. However, this does not mean that recreation can be deleted as a project function since in part it represents mitigation for the loss of existing recreation resources. Assigning an allocated cost to recreation equal to its numerical benefits, we then calculate the following allocated annual costs.

Water Quality	\$2.81M
Flood Control	\$.75M
Recreation	\$.38M

The water quality costs and at least 40% of the flood control costs should be reimbursed to the government--as discussed above. These charges would apply primarily to Westvaco.

2. Re-estimated Benefits. Let us calculate the benefit/cost ratio derived from the benefits for water quality and recreation re-estimated above. The annualized benefits for water quality are then at most \$.55M. Total national economic benefits then become \$1.41M using recalculated recreation benefits of \$110,000 per year. (The very large correction for the value of the unique scenic and recreational resource lost--discussed in the Recreation Section above--has not been included. It might easily cut the total project benefits in half.) The national costs are \$3.94M. Thus the benefit/cost ratio is 0.36. Even when the fact that 29% of project expenditures have already occurred is taken into account, the ratio is still only 0.51.

6. Alternative

Alternative strategies to achieve the individual project functions were discussed in detail in earlier sections. It has also been established that even 29% completed, the project is still economically a poor investment. The question remains, to what extent have the scenic values of the project area been adversely affected by construction to date? Is there anything worth saving left? The answer is definitely yes in our opinion. The major impact to date has been localized in the Kincaid Gorge region where the dam itself would be located. The major scenic impact results from stripping the overburden from the area where the embankment will rest. We have seen photographs of this area and believe that with or without human assistance the area will recover its natural appearance in time and will have a reasonably naturalistic appearance in a few years. The other major construction effects, building the concrete intake tower and the outlet tunnel, could readily be demolished and concealed. The Corps should develop a program for scenic restoration, and should give cost estimates in the Impact Statement.

7. Conclusions

We find the impact of this project to be severe. An essentially unique and very valuable resource would be lost. The resulting reservoir would be one of many within the general area. Its economic returns, moreover, would be less than its costs, even taking into account the fact that 29% of the total cost has already been spent.

We recommend that the following actions be taken:

1. No non-zero value can be assigned to water quality storage until proponents of such storage have established its necessity. This should include proof that water quality storage will not be provided "as a substitute for adequate treatment or other methods of controlling waste at the source." (FWPCAA-1972, Section 102.b.1)

2. Private firms, notably Westvaco, should reimburse the Federal government for the allocated costs of water quality and flood control benefits which accrue to them. True national costs should be reflected in the charges. Modification of project authorization should be sought from Congress if that is necessary to secure such reimbursement.

3. The Corps is requested to investigate how the disturbed area at the dam site may best be restored and the cost of such restoration.

4. Further construction or administrative action leading thereto is inadvisable until the need for, the value of, and the impact of storage for water quality control have been established the Federal Water Pollution Control Act as amended and until provision has been made for reimbursement, and commitments to pay secured from the beneficiaries. In particular, further commitment of funds which would tend to preclude termination of the project should be avoided.

5. The Federal Power Commission and the Corps of Engineers should examine the feasibility and desirability of requiring conservation releases through the various dams on the main stem of the James. Such releases should be used to avoid depleting downstream flows to the point where harm is done to aesthetic values and the maintenance of fish and wildlife.