Lower Raritan/ Middlesex County 208 Water Quality Management Planning Program

EVALUATION OF WATER QUALITY MANAGEMENT PLAN ALTERNATIVES

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EVALUATION OF WATER QUALITY MANAGEMENT PLAN ALTERNATIVES

INTRODUCTION

This summary evaluation is presented to provide the reader with a basis for comparison of alternatives and control measures. This report is a companion volume for the report entitled Water Quality Management Plan Alternatives. Material in the section of this report entitled "Evaluation of Technical Measures" was prepared by the Middlesex 208 Joint Venture; the section entitled "Evaluation of Institutional Options" was prepared by the staff of the Middlesex County Planning Board. The evaluation presented here should in no way be taken as a recommendation by either the Joint Venture consultants or the Middlesex County Planning Board, nor as fulfillment of the final evaluation, which is to be performed with consideration of the results of discussions with involved parties, the deliberations of the Policy Advisory Committee, and the Public Hearings. Rather it is a summary of the issues and an identification of the most obvious advantages and disadvantages of individual technical measures that will have to be addressed by the community and the Policy Advisory Committee as they continue with the plan selection process.

In many cases further detailed engineering and planning studies, conducted after the approval of the initial plan, will be required to determine more accurately the cost and effectiveness of some possible technical solutions. Technical measures summarized here correspond to those discussed throughout the main report, and particularly Chapters V through VII. Institutional options for implementing the measures are discussed in Chapter III.

In the next phase of the process, citizens of the LR/MC region and their representatives are to evaluate three long-range plans for the solution of water quality problems. These water quality management plans were developed after almost two years of effort on the part of the PAC, the project staff, and the consultants. Details of the three alternatives are discussed at length in the main report. The philosophy and principal

characteristics of the plans are summarized below. The alternative plans reflect the choices available to the region to achieve water quality objectives ranging from continuation of existing practices to the maximum change in existing regulations.

PLAN I, THE PASSIVE ALTERNATIVE

relies on existing local, state, and federal agencies to continue established techniques to deal with water quality problems. (See Chapter V)

PLAN II, THE REMEDIAL ALTERNATIVE

assumes that future development will proceed guided by the "Trend Development Profile" as in the Passive Alternative. Controlling pollution to achieve water quality standards through land use regulation is minimized, while structural approaches and capital-intensive solutions are emphasized and would be applied only as deterioration in the area's water resources actually occurred. (See Chapter VI)

PLAN III, THE PREVENTIVE ALTERNATIVE

assumes the adoption of land use controls to achieve the "Plan Development Profile". In addition, the approach calls for the increased use of other regulatory measures while de-emphasizing capital-intensive projects. Controlling problems before they occur, by establishment and enforcement of controls and restrictive use of environmentally sensitive areas, rather than potentially more expensive solutions to control problems after they occur, are other characteristics of this alternative. (See Chapter VII)

This report provides guidance on the comparison of alternative plans leading to the selection of a single water quality plan at the completion of the 208 process. Alternative plans are to be compared in terms of the program criteria of technical feasibility, cost-effectiveness, plan implementability, and public acceptability.

No rigorous analytical method exists which will readily identify the best plan for the LR/MC 208 region. Many factors must be interrelated and considered in comparing the alternatives. While some of the factors, in particular technical data and structural cost assessments, can be quantified, others can only be assessed qualitatively based upon the best available knowledge in the field and the view of the public. Plan assessment involves the comparison of all key factors deemed pertinent for reliable decision making, in light of technical evaluation and public preferences.

Representatives from all affected groups should be involved in the assessment of the alternative proposals. The plan approval and implementation process will be more effective if the people and their representatives responsible for carrying out the plan's proposals fully understand the issues and contribute to the assessment and recommendations of alternatives.

The summary comparison of alternatives draws together information dealt with in more detail in appropriate sections of the main report and evaluations already completed in other tasks. A summary of proposed control measures by issue area and alternative is presented in the next section. The final plan may be determined by selecting a given alternative; selecting and mixing appropriate individual solutions from different alternatives; devising a strategy which lies between the stated alternatives; or choosing a solution which lies outside the conceptual boundaries of the proposed alternatives.

Citizen input will be derived from 208 decision making meetings to be held within each of the individual planning areas and with major industries and sewerage agencies. Cooperation and compromise will be required to reach agreement on decisions affecting the region's future water quality. Participants will be required to make tradeoffs and decisions between different plan alternatives, and reach agreement on what a final water quality plan is to be. A summary of proposed control measures by issue area and alternative is presented in the Table on the following page.

It should be recognized before hand that consensus will not be found on all of the elements of the plan, and that different interests will continue to have differing points of view. It should also be recognized that the plan, once adopted, will continue to be improved and modified with input through citizens participation.

SUMMARY OF PROPOSED CONTROL MEASURES BY ISSUE AREA AND ALTERNATIVE: PASSIVE, REMEDIAL, AND PREVENTIVE

PASSIVE

LAND USE

1. Maintain existing land use controls
   a. Prevent development in designated flood plains (N.J. Flood Prevention and Control Act).
   b. No specific protection of critical ground water recharge areas
   c. No prohibition on development of prime agriculture lands.
   d. Prevent development on wetlands (N.J. Wetlands Act)
   e. Continue to enforce existing municipal sewering policies.

LAKES, PONDS AND TRIBUTARY STREAMS

2. Dredging of impoundments, where done, occurs only after loss of use.
3. Occasional weed cutting performed.
4. Storm drainage from new development - NA.
5. Copper sulfate not normally administered to control algal blooms.
6. Continue present N.J. Soil Erosion & Sediment Control Act (ESCA) limitation to private development disturbing 5,000 sq. ft. or more.
7. Occasional requirement for developer to provide storm water detention basins.
8. No buffer zones for objective of stream habitat protection.
9. Continue present lack of public education regarding fertilizer impacts on water quality.

REMEDIAL

LAND USE

1. Same as Passive Alternative

LAKES, PONDS, AND TRIBUTARY STREAMS

2. Dredge to 12.5 feet or selective dredging for each of the eight impoundments.
3. Occasional weed cutting performed.
4. Storm drainage from new development - NA.
5. Administer copper sulfate to control algal blooms.
6. Expand Soil Erosion & Sediment Control Act to include public construction with administration by the Soil Conservation District.
7. Construct regional storm/sediment basins.
8. Acquire buffer zone (100 ft. for lakes; 50 ft. for streams) in critical areas.
9. Provide educational program for domestic fertilizer control.

PREVENTIVE

LAND USE

1. Control development to protect water quality
   a. Prevent development in designated flood plains
   b. Protect critical ground-water recharge areas.
   c. Prohibit development of prime agricultural lands.
   d. Prevent development on wetlands.
   e. Require sewering for all new development.

LAKES, PONDS, AND TRIBUTARY STREAMS

2. Dredge to 9 feet or provide for selective dredging of each of the eight impoundments.
3. Implement an annual weed cutting program.
4. Prevent storm drainage from new developments from entering water supply lakes.
5. Administer copper sulfate to control algal blooms.
6. Expand Soil Erosion and Sediment Control Act to cover public construction with administration by the County Planning Board.
7. Require storm/sediment basins for new development $\geq$ 5 acres.
8. Require buffer zones for all new development (100 ft. for lakes and 50 ft. for streams) and existing development where practical.
9. Require the labeling of fertilizer containers to instruct domestic users on proper application rates and the potential adverse water quality effect of excess amounts of fertilizer.

SUMMARY OF PROPOSED CONTROL MEASURES BY ISSUE AREA AND ALTERNATIVE: PASSIVE, REMEDIAL, AND PREVENTIVE

PASSIVE	REMEDIAL	PREVENTIVE
GROUND WATER	GROUND WATER	GROUND WATER
10. Ground water developed without regard for safe yield or natural limitations of aquifers in South River basin.	10. Continue pumping as under Passive Alternative, but plan to supplement supply with surface water or intra-basin ground-water transfer.	10. Rely on existing ground water resource in the South River Basin. Pump 50 MGD from the Old Bridge aquifer and 5 MGD from the Farrington aquifer.
11. Continue present well pumping practices that induce salt water intrusion.	11. Construct injection wells as barrier to salt water movement into Farrington aquifer.	11. Modification of pumping patterns in the Farrington aquifer within the above limits
12. Develop proposed Deep Run reservoir and continue fragmented programs to support recharge from all relevant facilities.	12. Dredge Tennent and Duhernal Impoundments (see item 2); repair on an as-required basis.	12. Monitor recharge rate and existing facilities, dredge and maintain to restore required rate.
13. Continue existing regulation of land fills and lagoons.	13. Collect and treat leachate from existing landfills and lagoons; contain leachate (liners).	13. Remove existing waste lagoons and close existing landfills in critical areas and contain leachate from closed facilities, if necessary.
14. Continue to have DEP and local health departments deal with problems after they occur. EPA will regulate storage of toxic and hazardous wastes (regulations not yet promulgated).	14. Enclose industrial product storage areas.	14. Remove existing product storage areas from critical areas and/or take corrective action.
15. Continue current practice of contingency plans for oil and hazardous spills only.	15. Require contingency plans for spills and leaks of all industrial products.	15. Same as Remedial Alternative.
16. Continue present N.J. PL199 septic system permit requirements depending on functioning only, with some problem areas eliminated by present sewer plans under 201.	16. Require advanced on-site disposal in critical areas; establish monitoring wells, regular inspection and maintenance program.	16. Prohibit location of septic tanks within critical areas.
17. Sewer exfiltration rarely considered as cause for repair.	17. Require all new sewer construction to be watertight; inspect suspected leakage by direct method; repair existing leaks.	17. Same as Remedial Alternative.
18. Continue present extent of environmental controls for locating pipelines in ground water areas.	18. Require watertight construction for all pipelines.	18. Prohibit the location of all pipelines from critical areas.
19. Continue fragmented county program with local action for solid waste management.	19. Increase monitoring of local solid waste facilities and organize local pressure group for increased State action.	19. Assist in the establishment of a regional solid waste management system.
20. Continue lack of pollution control fund.	20. Establish a State pollution control fund to finance remedial actions in solid waste management.	20. Same as Remedial Alternative.
21. Continue Administration of Regulations of N.J. Solid Waste Act.	21. Alter existing administrative regulation of the N.J. Solid Waste Act with regard to permits, EIS requirement, clarified definitions, closure plans, etc.	21. Same as Remedial Alternative.

SUMMARY OF PROPOSED CONTROL MEASURES BY ISSUE AREA AND ALTERNATIVE: PASSIVE, REMEDIAL, AND PREVENTIVE

PASSIVE	REMEDIAL	PREVENTIVE
MUNICIPAL AND INDUSTRIAL DISCHARGES	MUNICIPAL AND INDUSTRIAL DISCHARGES	MUNICIPAL AND INDUSTRIAL DISCHARGES
22. 201 Planning: Upgrade municipal discharges to meet DO standards.	22. 208 Agency reviews 201 planning for conformance with 208 planning.	22. Designate the proposed 208 agency as the 201 agency for the entire region.
23. Provide NPDES effluent control program under NJDEP (conversion from EPA to NJDEP in progress).	23. 208 Agency conducts stream surveys, effluent monitoring, water quality assessments where necessary, and makes recommendations for NPDES compliance.	23. Same as Remedial Alternative.
24. Continue combined sewers as in facilities plans.	24. Separate all combined sewers.	24. Separate combined sewers in critical water quality areas (Carteret and Perth Amboy), to be determined by the New York City Harbor model. Conduct a special investigation of combined sewers in New Brunswick.
25. Expand sewered areas as desired.	25. Same as Passive Alternative.	25. Limit sewering in critical areas with limitations imposed under item 16.
26. Apply forthcoming final EPA regulations for industrial pretreatment.	26. Minimal pretreatment by industry; accomodate additional treatment in publicly owned wastewater system.	26. Require stringent industrial pretreatment regulations; provide incentive programs (tax reductions or grants) for good treatment practices; foster cooperative arrangements for combined pretreatment.
27. Augmentation of low flows - NA.	27. Augment low flows in Millstone River with reservoir water.	27. Augmentation of low flows - NA.
28. Mechanical reaeration - NA.	28. Mechanically aerate segments of Millstone River.	28. Mechanical reaeration - NA.
29. Continue current practices regarding water conservation.	29. Education program for voluntary water conservation in all development.	29. Mandate water conservation devices in new development and implement an intensive educational program to promote water conservation in existing development.
30. Occasional industrial and commercial water re-use.	30. Encourage industrial water re-use and scheduling.	30. Require industrial plants using in excess of 0.1 MGD to submit a water conservation plan.
31. Industrial treatment strategy - NA.	31. Upgrade industrial treatment to meet water quality standards.	31. Reduce contaminant loss from industrial process to meet water quality standards.
32. Continue monitoring and surveillance as it is now conducted.	32. Increase scope of monitoring and surveillance to include all relevant water quality parameters and to support remedial measures.	32. Increase scope of monitoring and surveillance to include all relevant water quality parameters and to support preventive measures.

EVALUATION OF TECHNICAL MEASURES

1. Land Use

The development and use of land are critically important issues affecting water quality. Control over the use of land is employed in the Preventive Alternative as a technical measure for water quality management. Neither the Passive nor the Remedial Alternatives attempt to alter current development policies or rates of development.

The primary impact of the Preventive Alternative is a slower rate of growth leading to 12 percent less total developed land and about 18 percent less population in the year 2000 compared to that of the Passive and Remedial Alternatives. In the period between now and the year 2000, the Preventive Alternative includes 52% less development and 40% less population growth than the Passive and Remedial Alternatives. The difference is most striking in the South River and Lawrence Brook/Upper Millstone planning areas. This impact is felt less in the already more built-up areas north of the Raritan River--Green Brook basin and Northeast County.

In general, the control of land use development is an effective method of water quality control. LR/MC 208 analyses show that in most areas sewage flows and non-point phosphorus, sediment, BOD, and lead are lower under the Preventive Alternative. Pollutants, for which there was no analysis in the LR/MC 208 sampling program, will follow a similar pattern. Increases in peak flows leading to deterioration of tributary stream habitat is also reduced with lower levels of development.

In considering direct costs, development under the Preventive Alternative would be preferable to that of the Passive and Remedial Alternatives. Because fewer acres are developed, the public service costs would be lower. A good example is installation of new sewers. Estimates of sewer construction and ancillary costs show the Preventive Alternative at $190 million and the Passive/Remedial distribution at $329 million. Costs

of several Remedial measures, such as regional multi-purpose detention basins and provision of water supply, would be lower with the Preventive Alternative land use distribution.

Secondary costs are more difficult to assess. If some land, which would otherwise be developed, is removed from the market by ordinance, it's market value would decline resulting in a loss to the owner. (Agricultural areas are most likely to be affected, since they contain large tracts of cleared land suitable for development.) From an areawide point of view, this loss tends to be offset by the increase in value of developable land. However, because the total development allocated under the Preventive Alternative is less than the baseline projections of development, the net of individual "profits" and "losses" may be on the debit side.

Still, the situation is not clear-cut. For instance, any increases in the cost of the services - water supply, sewers, etc. - that are required to support development will also depress land values. A development pattern which is environmentally sound and which controls the cost of services will tend to support real estate values.

Another example is open space. The Preventive Alternative fulfills the PAC objective of protecting other elements of environmental quality such as terrestrial habitat and forests. Land adjacent to or near open tracts has an environmental ambiance that may be reflected in increased value. Such areas would benefit from the Preventive Alternative land use pattern.

Although these examples add to the benefit side of the comparison, these mitigating factors would not completely compensate for the net monetary loss from lower growth rates.

To the extent that water quality is improved in general, all study area residents will benefit. However, it is clear that some areas would be more greatly affected than others in the region. Whether this is perceived as good or bad depends on one's sense of regional benefit and the objectives

of each locality. Some localities seek new development; others prefer to preserve a more rural character. The Preventive and Passive/Remedial land use patterns will be further evaluated in terms of local zoning and development plans.

Impacts on identified interest groups may be summarized as follows:

Municipal Officials. Implementation of the Preventive development pattern will require changes in local land use objectives. While it is not likely that the zoning prerogative held by municipalities will be preempted, still, this represents some loss of local control. Municipalities as a group would have to agree to zoning changes (Institutional Option 1: Water Resources Association) or would be directed to comply (Institutional Option 2: Water Resources Authority).

Water quality objectives in land use planning often appear to conflict with other objectives -- in particular economic objectives, which promote non-residential development. Municipal officials would have to resolve this conflict before agreeing to the Preventive development pattern.

Environmental and Civic Groups. In general, interest groups with environmental and civic concerns could be expected to favor the orientation of the Preventive land use pattern. With less overall development and open space preserved, this pattern would benefit all aspects of the environment, thereby fulfilling objectives of this group.

Business and Industry. An alteration in land use patterns that results in less commercial and industrial development is not likely to be preferred by business and industrial interests. The Preventive pattern may be seen as having a dampening effect on economic growth potential. This view would be expected to be shared by labor interests, too. On the other hand, business and industry, as individual dischargers, may see a benefit in the pattern that produces lower domestic sewage flows and waste loads, because their own treatment requirements might be less rigorous.

Developers. The Preventive land use policies would result in fewer opportunities for real estate development in the 208 area. How this would affect developers is difficult to assess. Because their territory is not defined by 208 area boundaries they may seek and find opportunities in neighboring counties. However, while developers as a group might theoretically be neutral as to the differences within the 208 area, local developers in particular, and developers in general, probably would seek the continuation of existing land use patterns as opposed to the Preventive pattern. Any developer who has already purchased land and made other investments in a development which would not be possible under the Preventive Alternative would certainly oppose this Alternative.

General Public as Taxpayers. Impacts on local taxes from a change in land use policy will vary between municipalities. In general, though, local tax ratables under the Remedial Alternative would be expected to reflect higher expenditure rates than under the Preventive Alternative. Lower tax ratables under the Preventive pattern would correspond to lower expenditures necessary to provide public services.

2. Dredging

Under the Passive Alternative, dredging of impoundments would be performed only after the primary use of the impoundment has been lost. This philosophy follows that observed in the past, where dredging has been very infrequent, and done only to correct already existing serious problems.

Two options (major and minor) for dredging are proposed under both the Remedial and Preventive Alternatives. The Remedial proposes major dredging of eight problem lakes to 12.5 feet, assuming that they would be redredged no more than once in 40 years. With this type of dredging, no upstream controls for sediment would be required, other than those mandated in the N.J. Erosion and Sediment Control Act or contained elsewhere in the Remedial Alternative.

Approximate costs for dredging would be as follows:

Planning Areas	Costs (in Millions)
South River	$ 7.3
Lawrence Brook/Upper Millstone	14.4
Green Brook	1.0

Except for privately-owned lakes the responsibility for dredging would rest with a public agency. Some costs might be recovered through recreational user charges but most of the expenses probably will be paid for out of general public funds.

Major dredging under the Preventive Alternative is to 9 feet. This assumes the need for upstream sediment controls in order to meet the redredging criteria of more than once in 40 years.

Public costs are much less than the Remedial Alternative; approximate costs are as follows (not including costs of upstream controls):

Planning Areas	Costs (in Millions)
South River	$ 3.6
Lawrence Brook/Upper Millstone	6.4
Green Brook	about 1/2 Remedial

While the public costs for dredging are less, the costs of upstream controls would be borne in part by developers and passed on to buyers and renters.

The "minor" dredging proposed under both alternatives would be selective -- deliberately leaving weed growth in sections of the lake and dredging the remainder. Advantages are that the weeds act as traps for sediment and actually filter sediment-associated phosphorus entering the lake from upstream. Such actions would have to be carefully coordinated with upstream controls. In this case, the Remedial Alternative may be the

more effective, because regional multi-purpose basins can be applied to more than simply new development and will supplement selective dredging more effectively. In fact, the Preventive Alternative may need selective dredging in addition to the program for major dredging, thus increasing the costs indicated above.

The activity of dredging will stir up sediment, remove organisms living in the bottom sediments and in general temporarily disturb the aquatic environment. The major dredging options will have greater initial impacts but offer a far longer recovery period (more than 40 years) than minor dredging, which will have to be repeated every five years or so.

Both alternatives also face the physical and environmental problem of dredge spoil disposal. Here selective dredging has the advantage, because spoil can be disposed of in other parts of the dredged lake, although, further habitat destruction would be associated with in-lake disposal of spoil. For major dredging, a lower volume of material is disposed of under the Preventive Alternative, and impacts are proportionally less. However, for both alternatives the major dredging program's success or failure will, in part, be determined by locating environmentally sound disposal sites for the spoils that would be both publicly acceptable and reflect reasonable cost.

3. Removal of Weeds

Of the three alternatives, the Remedial is least likely to require major weed cutting programs because of the effectiveness of major dredging. Annual weed harvesting will be required sooner under the Preventive Alternative than for the Remedial. Estimated costs are as follows:

Planning Area	Costs
South River	$ 8,000/yr.
Lawrence Brook/Upper Millstone	$10,000/yr.

Costs in the Green Brook basin may be in conjunction with other programs; costs in the Lower Millstone/Lower Raritan/Northeast County will be minor for the small impoundments.

The Passive Alternative assumes that aquatic vegetation would continue to flourish until the use of a given lake was threatened. It is not clear what steps would be taken at that point, but weed harvesting, if done, would be expected to cost at least as much as in the Preventive Alternative.

4. Prevent Storm Drainage from Entering Water Supply Lakes

Under the Passive Alternative, the existing practice of discharging storm water to the closest available waterbody would continue; therefore, there would be no measures to prevent storm discharge from entering the water supply lakes.

Storm drains entering two study area water supply lakes -- Farrington and Westons Mill Pond -- appear to be discharging a number of pollutants at irregular intervals. Diversion of existing drains was investigated under the Remedial Alternative and found to have extremely high costs (greater than $5 million for Westons Mill Pond alone). Since the exact pollutant contributions from storm drains have not been documented at this time, and since such a diversion would also reduce the water supply capabilities of the system, this expenditure has not been justified. However, monitoring as part of ongoing planning is recommended. Diversion of storm drainage from the lake may be warranted in the future if further study indicates that both water quality will improve and the water supply capabilities of this system could be maintained.

The Preventive Alternative could prohibit any new storm drains from entering a water supply lake, or the property owner could be made responsible for the quality of storm water discharges. Although this measure also poses problems that may limit its implementability, it was deemend feasible enough for consideration.

As with the Remedial Alternative, it would not now be possible to eliminate storm water from an upstream lake, e.g., Farrington, by diversion downstream of the waterbody. This would pass the problem on down the line. Therefore, other means would have to be employed, such as groundwater recharge, in appropriate areas only, or diversion to another stream system (very costly with serious environmental impacts).

Treating before discharge is more practical given a waterbody's inability to absorb additional contaminants. This may be possible to achieve through a multi-purpose detention basin (see Measure 7), which can be the equivalent of primary treatment (sedimentation aspects only). Of course, such treatment is not as effective for contaminant removal diversion.

It is also noted that the lakes themselves can be regarded, to a certain extent, as large sedimentation basins, more efficient as such than either the regional multi-purpose basins of the Remedial Alternative or the smaller, more numerous multi-purpose basins of the Preventive Alternative. From the point of view of water supply, therefore, these basins may not provide much additional protection, assuming that contaminants settled in the water supply lake are not released from the sediments to the overlying water. Contaminated sediments are, however, a water quality problem for the eco-system of the lake, water supply protection aside.

In any event, development costs would be increased, and then would be expected to be passed on to the new property owner or tenant. In extreme cases, development may be discouraged altogether.

5. Administer Copper Sulfate to Control Algal Blooms

Under the Passive Alternative algal problems are not now generally controlled with chemicals. However, the analysis conducted for the LR/MC 208 showed that phosphorus loads from all sources are significantly high such that algae will continue to be a problem. Thus, an annual program to administer copper sulfate has been recommended in both the Remedial and

Preventive Alternatives. Costs, which are the responsibility of a public agency, are as follows:

Planning Area	Costs
South River	$ 5,000/yr.
Lawrence Brook/Upper Millstone	$14,000/yr.
Green Brook	$ 1,000/yr.

The costs in the Lower Millstone/Lower Raritan/Northeast County basins will be minor for the small impoundments.

There is some concern over introducing copper, a potentially toxic contaminant, into the water supply. The recommended dosage of copper sulfate (5.4 lbs./ acre of surface water/to 2-ft. depth) would result in a conservatively estimated concentration of .09 mg/l. The New York State Class AA drinking water standard for copper (N.J. has none) at the present time is set at 0.2 mg/l more than twice the concentration predicted for this measure. Furthermore, USEPA "Quality Criteria for Water" suggest a level of 1.0 mg/l for domestic water supply in order to protect the public welfare. While there is no record of serious problems from accidental spillage in areas employing this technical measure, every precaution must be taken to prevent such occurrence, especially for those water supply sources being treated. The recommended dosage levels will also protect fish life from toxic effects.

6. Expand N.J. Erosion and Sediment Control Act to Include Public Construction

Under the Passive Alternative, the NJESCA would be implemented in its present form. Based on case histories of areas with similar controls, the NJESCA is estimated to reduce soil loss from construction sites by 80 percent (100 tons/acre/yr. to 20 tons/acre/year). These controls only apply to private development requiring a building permit. Although much public construction is subject to environmental regulation, a significant amount is not. Private activities not requiring a building permit, such as parking

lots, are also not subject to the NJESCA. Therefore, both the Remedial and Preventive Alternatives propose amending the law to include public and other construction not presently requiring building permits.

An estimated 5 percent of annual study-area construction is in this category. With these proposed controls, erosion from construction sites would approach a net of 15 tons/acre/year. Costs for erosion controls would be borne by the public agencies and private interests involved.

7. Storm/Sediment Basins

A number of traditional runoff control measures were considered for control of non-point sources of pollution. These included: roof-top and parking lot storage, porous pavements, storm detention basins, etc. The preliminary screening process found that, while these techniques produced various degrees of effectiveness in controlling storm water flows, they had little effect on water quality. While peak flows were reduced, the water was not detained in a manner suitable for allowing sediment and related pollutants to settle out. An analysis of the available literature on street sweeping as a control measure showed that the effectiveness of this cannot be estimated at present, but is probably low.

One measure seemed most promising: the detention basin. Further analysis showed that, when properly designed to detain sediment in addition to its traditional function as a flood control device, this technique would be quite effective.

The Passive Alternative would continue current practices of requiring installation of storm water detention basins in large developments to limit peak storm water runoff from the developed site. In Middlesex County, the determination as to which developments will need these facilities is currently made by the local municipal engineer who considers the severity of potential downstream flooding (only) on a case by case

basis. As these facilities are designed, scouring of sediment from the basins is encouraged, and therefore little pollution control is provided.

By contrast, a multi-purpose basin which would detain flows but also promote sedimentation of storm water would have average pollutant removal efficiencies for sediment, BOD, phosphorus and lead of about 50%, 25%, 20% and 40-60% respectively. This reduction makes this measure appropriate for lakes, ponds and tributary stream management as well as river management. They can be used in suitable areas to promote recharge as well.

Under the Preventive Alternative this type of facility (described in detail in an Appendix) would be required in all new developments of greater than five acres. A requirement for all developments to be serviced with storm water detention/sedimentation facilities was investigated but was found to require the construction of twice as many basins, with the small benefit of controlling only 5 to 10 percent more of the land undergoing development. Thus, the five-acre minimum size was selected to provide a possible cut-off point for the drafting of a runoff control ordinance. Further refinement would of course reflect differences in land use undergoing development.

As this program has been initially conceived, the construction costs would be financed by developers (and passed along to new home buyers, industrial tenants, etc.) and the yearly maintenance costs would be raised by a public agency under the selected institutional arrangement. The reason for establishing public control of the facilities is that hundreds of basins would be built by the year 2000 and the only economical program for maintenance would be that achieved through a full-time staff.

For most sizes of development, construction costs will be approximately $800 per acre of development (which is approximately 10 to 15 percent higher than the unit cost for achieving stormwater detention alone) and the annual maintenance cost will be somewhat less than $20 per acre of

development. Equivalent annual costs to each planning area of this measure under the Preventive Alternative are:

EQUIVALENT ANNUAL COST
OF STORM/SEDIMENT BASINS IN
NEW DEVELOPMENTS ≥ 5 ACRES

South River	$ 239,713
Lawrence Brook/Upper Millstone	$ 312,729
Lower Millstone/Lower Raritan/Northeast	$ 561,208
Green Brook	$ 386,266
Total:	$1,481,916
Say:	$1,500,000

A major problem associated with this measure is that the construction of hundreds of small basins may create a maintenance and aesthetic problem for local municipalities if the management agency does not take strong control of the situation. Additionally, many individual variances from the detention requirement would be needed as dictated by local topographic constraints. Therefore, under the Remedial Alternative, a regional approach to storm water runoff detention/sedimentation was investigated. A regional storm water facility servicing 500 acres of land would substitute for over 20 individual basins. Additionally, this regional approach would treat runoff from the smaller developments under five acres not affected by the storm water control ordinance under the Preventive Alternative.

In addition to replacing the need for many smaller facilities, a regional multi-purpose basin would offer certain economies, not only in the relative size of the project, but also as a result of the difference in design loadings to the facility.

Although estimation of the costs of regional facilities is risky without detailed site information, a rough approximation would be in the range of $400 to $600 per acre of tributary basin area or two-thirds the unit cost

of individual basins if the tributary area were fully developed. The pollutant removals of the regional facilities are conservatively estimated to be the same as the individual ones. However, there is reason to believe that the operational efficiencies may allow significantly higher removals.

With regard to effectiveness, a major advantage of the regional alternative is the ability to provide relief from runoff pollution from existing development. Additionally, where flood control is not an issue, regional basins could be designed to provide sedimentation only, at an estimated cost of $200 per acre of tributary basin.

However, as an alternative to controlling new development with individual basins, problems arise. Programming the construction of facilities to meet the requirements of development is difficult because (1) regional sites will have to be acquired well in advance of actual need, (2) the decision concerning construction schedule must be made in relation to the timing of the percent of infilling of the tributary area, and (3) it is not always certain that development will actually occur in land tributary to designated facility sites.

Clearly, overall effectiveness of this measure under the Remedial or Preventive Alternative depends on anticipated development. In more rural areas, where development will increase substantially over the next two decades, the Preventive approach, which only controls increase in contamination, will have a significant effect. However, in built-up areas, like Green Brook and Northeast County, the regional multi-purpose basins would be more effective. Sites would be difficult to find, and if concrete structures were required, costs per acre would be much higher than the average stated above.

8. Provide Buffer Zones for Lakes and Streams

Buffer zones, as conceived under the Remedial and Preventive Alternatives, exist only as byproducts, if at all, under the Passive Alternative.

Current flood plain legislation applies only to structures in flood prone areas.

Lakes, ponds and tributary streams are subject to various effects from stormwater runoff which have detrimental impacts on water quality and stream bank habitat. Runoff and its erosive power discharges sediments, phosphorus, lead, ammonia and other pollutants to the tributary system which reduce the quality of the water. In addition, erosion of stream banks removes vegetative cover which is necessary to filter and divert runoff, and to shade streams from the thermal effects of the sun. The most obvious impact of runoff to stream channels and banks is flooding. Although the agencies involved with water quality control are aware of all the existing problems, the fragmentation of authority and lack of sufficient manpower results in attempts to solve only the most critical problems. As noted earlier in this report, most of the current and proposed stream and drainage improvements are limited to correcting major flooding problems, usually those which are most visible, such as along streets and highways after high intensity storms.

Actions recommended in the Passive Alternative do not expand the scope of current policy and technical measures to protect water quality. On an areawide basis, incremental steps would be taken by the County Engineer to correct only the most critical flooding and drainage problems. Incidental improvements would be made to streams and lakes by the Mosquito Commission in conjunction with its mosquito control program.

More comprehensive efforts to control flooding problems are being implemented by NJDEP under the New Jersey Flood Plains Control Act. However, these regulations apply to new construction or to repair and renovation of existing structures. While the restrictions are adequate to control flood plain development, they fail to protect important natural features of stream habitat. Even the alternative plans for flood protection in Green Brook proposed by the Corps of Engineers do not deal with the necessity to

save the natural vegetation which serve as a very vital resource for runoff control. Thus, while the measures proposed in the Passive Alternative are necessary, they are not extensive enough to provide the water quality control and habitat protection that are urgently required.

Both the Remedial and the Preventive Alternative recommend a system of buffer zones which would create an area of protection 50 feet wide on each side of streams and 100 feet wide around lakes. The Remedial Alternative is designed to protect those stream segments delineated as having the most critical erosion and habitat problems by direct acquisition of the problem area. Therefore, it would create buffer zones along fewer aggregate linear miles or acres than the Preventive Alternative.

The acquisition would be costly. Preliminary investigations have delineated 17.1 linear miles in Green Brook, 7.6 linear miles in South River, 7.9 linear miles in Lawrence Brook/Upper Millstone and 7.7 linear miles in Lower Millstone/Lower Raritan as critical areas. The total cost for purchasing the buffer zones within the 208 study area is estimated to range between $19.5 million and $34.1 million, based on an estimate of the price of prime developed residential property. Further study is required to delineate specific areas for acquisition. In conjunction with field research and a fact-finding program, priorities should be established to determine the problems and areas in greatest need of attention.

In areas where there are extensive storm drains passing under the buffer zone, the considerable force of flood level waters entering the stream (and thereby causing increased scour, sedimentation, and turbidity) would not be reduced. Also, the high phosphorus and BOD loading of storm waters would continue as if there were no buffer zone. Stormwaters would pass directly through the storm drains into the stream without being "filtered" in the buffer zone. Therefore it would be best to continue the buffer zone program in such areas with the regional multi-purpose basin program if possible.

Potential funding sources for acquisition should also be thoroughly investigated. Because some of the buffer zones may provide an ideal location for strip parks and nature areas, the New Jersey Green Acres Program or the Department of the Interior, Bureau of Outdoor Recreation should be considered as possible funding sources. In addition to acquisition costs, there will also be costs to implement the necessary technical improvements to the stream banks or channels, and ongoing costs to maintain the buffer strips.

The net result of the acquisition on tax revenue is unknown at this time. It is possible that the taking of land may reduce the assessed value of the abutting property, but the creation of permanent open space and recreational areas and aesthetic improvements may maintain or increase the assessed value.

Although the acquisition of the buffer strip is costly, if offers the advantage of complete public control and use of critical areas. It provides the right-of-way to make the necessary channel and habitat improvements and the potential to develop new parks for passive recreation.

The Preventive Alternative recommends the creation of buffer zones along all streams and lakes where new development would occur and, where practical, in areas of existing development. In this alternative, however, the buffer zone would be implemented through regulation of the use of land rather than acquisition. The objective of the buffer is the same as in the Remedial Alternative, i.e., to stabilize bank vegetation in order to filter sediment and phosphorus and disperse the erosive force of runoff. It is estimated that as much as two-thirds of the phosphorus load could be removed from overland runoff passing through a 100-foot vegetated zone. In addition to the regulations on "new" development in the flood plain, the Preventive Alternative would prohibit the removal of existing natural vegetation. As with the Remedial Alternative, the buffer zone program would be in addition to the multi-purpose basin program.

Implementation of these controls could be accomplished by expanding existing flood plain or sediment control legislation, thus creating a buffer zone without the public costs of acquiring the land. Direct public costs would be limited to regulation or policing of the buffer zone. The loss of developable land would represent a cost to the developer or owner. As in the Remedial Alternative, there would be unknown indirect costs associated with a possible loss in assessed or market value of residential property, but these losses would be greater in the Preventive Alternative since more streams would be covered. Restrictions on the removal of natural vegetation would prohibit the property owner from adding improvements such as swimming pools, tool sheds, garages, etc. While such restrictions could lower the market value of a house, there could also be an increase in value as a result of its proximity to open space and scenic natural features.

The Preventive Alternative, like the Remedial, provides the opportunity to develop strip parks but without public acquisition costs. As an additional measure to protect the more critical stream segments, the Preventive Alternative encourages the use of cluster zoning to obtain buffer zones. Using this form of land use control, a developer with property abutting a stream or lake would dedicate or cede land to a municipality as a buffer strip in return for zoning variances. The cluster zoning concept would mitigate the loss of income to the developer, since cluster zoning increases open space for a given number of housing units. This variation would only require that the open space be along stream channels or impoundment shores.

In summary, the Preventive Alternative can provide the necessary buffer zone protection of natural vegatation and stream habitat without the high public costs of the Remedial Alternative. It also offers the potential to develop strip parks.

On the whole, the Preventive Alternative for buffer zones is more comprehensive and, if properly regulated, would have a more effective impact on water quality and stream habitat. However, it is unclear that the

Preventive Alternative would be less costly. Problems of implementation would be similar to solution number 1 above.

9. Fertilizer Control

No specific fertilizer control measures would be required under the Passive Alternative.

The difference between the Remedial Alternative and the Preventive Alternative with regard to control of domestic fertilizer is one of emphasis and degree of regulation. The Remedial Alternative would provide for an educational program for domestic fertilizer control. The Preventive would require fertilizer containers to be labeled with instructions for application rates and warnings regarding potential adverse effects on water quality. In either case the costs would be primarily institutional, and the effectiveness uncertain - dependent upon public cooperation and participation. The cost would principally educational for the Remedial Alternative and principally regulatory (requiring New Jersey State Legislative action) for the Preventive Alternative.

10. Groundwater Pumping Practices

If present pumping practices are continued (Passive Alternative), eventually the groundwater will become so depleted and degraded that it will no longer be a practical source of supply. This may well occur before the year 2000 in several locations within the study area, particularly South River Basin.

Under the Remedial Alternative, responsibility for water supply would rest with the 208 agency, a move away from fragmented control of the resource. While pumping locations would not be controlled, water supply management could be made more efficient, relieving somewhat the depletion problem. However, this would be only partially effective, and costly remedial measures would be required as well. Injection wells, needed as a barrier to saltwater intrusion would be required (Measure 11).

The Remedial approach will also require eventual transfers of surface or groundwater from neighboring sub-basins to supplement the depleted supply in the South River. These are also quite expensive: an estimated $12 million to bring surface water from Rond Valley-Spruce Run Reservoir and $1 to $5 million for groundwater transferred from the Upper Millstone basin. Public investment would be recovered through water use rate increases.

This measure carries with it adverse environmental impacts. Major new pipeline construction is akin to roadway construction, with its attendant disruption. Further, removal of water from one sub-basin to another has permanent impact on the hydrology of both basins. In the Upper Millstone, where low base flows limit the capacity of the river system to assimilate pollutants, actions that might further decrease the base streamflows would be somewhat deleterious to water quality in those areas.

It may also be necessary to acquire areas near pumping centers to protect the underlying aquifer from surface pollutants. While it is not possible to know now how much land would be acquired (it depends on future as well as present pumping practices and development patterns) the unit cost would be commensurate with those described in Measure 8 above. These costs would be borne by the general public, although they could be supplemented by "Green Acre" funds and other state and federal programs.

The Preventive Alternative poses a completely different approach to the area's groundwater problems. Using this approach, careful control of pumping location and rates would yield enough potable water to meet the year 2000 demand -- assuming that water use conservation is also undertaken (see Measure 29). (The Preventive Alternative water conservation practices would also be of benefit in implementing the Remedial Alternative pumping practices).

By taking advantage of the more abundant Old Bridge aquifer and restricting pumpage from the Farrington, water levels in the latter aquifer would begin

to recover to normal levels, and the saltwater front would stabilize in its present position.

This proposal would not be costly to implement. Because the Old Bridge overlays the Farrington in existing major pumping centers, it would be possible to transfer withdrawal from one aquifer to the other with little construction or change in the distribution system. However, because the Old Bridge is near the surface and therefore subject to intrusion of surface pollutants and contains iron, more treatment prior to distribution would be required. While this may appear to add expenses initially, over the long term it will be far less than the water supply costs generated under the Passive and Remedial Alternatives.

Vulnerability of the Old Bridge to pollution from the surface makes protection of its recharge vital. The Preventive Alternative, therefore, establishes a "critical" area around pumping centers and strictly limits permissible activities within it. This poses some problems of equity, because those who would suffer losses (land owners in the restricted area) are but a fraction of those who would benefit (all groundwater users). Further discussions of losses and benefits associated with land use controls are found in Measure 1 at the beginning of this chapter.

Although the Preventive approach has the greatest potential for effective groundwater management, it will be difficult to implement. A broad-based solution such as this one calls for broad-based implementation. The kind of institutional arrangements required can be provided by either a Water Resources Association or Water Resources Authority. However, the change from current fragmented control to areawide management is a major one and it can be expected to take a long time. In contrast, a Remedial measure such as intra-basin water transfer, though much more expensive, will be easier to implement if the water supply is threatened.

11. Control of Saltwater Intrusion

Control of saltwater intrusion is directly connected with the pumping rates for groundwater (Measure 10). The Remedial Alternative would require costly corrective measures because of the rate of Farrington sands groundwater development. Injection wells, needed as a barrier to saltwater intrusion would cost over $10 million and because the technology is new, the effectiveness of the measure is uncertain. Recent experiments at Bay Park on Long Island have shown the system to be complicated and expensive. However, it is likely that federal funding would be available to defray local expenses. (The Bay Park project is cosponsored by the U.S. Geological Survey). The modification of pumping patterns in the Preventive Alternative as developed in Measure 10 would stabilize the Farrington aquifer and prevent further saltwater intrusion.

12. Maintain Recharge

Under the Passive Alternative the study area will gradually lose its natural recharge surfaces, and its recharge basins will assume more importance for maintenance of groundwater. At the same time these basins will not be maintained reliably and their estimated 10 MGD of recharge will decrease.

Further, the recharge ponds will be more and more subject to quality degradation from surface runoff and the abuse that accompanies urbanization. At the present time the City of Perth Amboy has been directed to remove filter backwash and other wastes from water treatment processes that were dumped in the Tennent Pond recharge facility. If the utmost care is not taken, the corrective dredging may stir up sediments that could release toxic materials into the lake water and thence into the ground.

The Remedial Alternative offers some effective measures for promoting recharge. Dredging is one. The evaluation of this action is similar to that of Measure 2, except that dredging a recharge pond poses potential dangers to the groundwater supply, as demonstrated by the Tennent Pond

example. Therefore, bottom sampling would have to be done and special precautions taken to avoid accidental release of toxic materials into the groundwater. This would increase costs of the recreation-oriented dredging program somewhat, but probably not significantly.

The regional multi-purpose basins proposed as Measure 7 would be helpful in maintaining the quality of recharge waters (see above). In-stream sediment traps upstream of recharge impoundments should also be considered.

Under the Preventive Alternative, recharge is part of the overall approach, as described in Measures 10 and 11. In addition, this Alternative would require infiltration, rather than drainage to surface waters, to handle stormwater in new development. Options for infiltration are sumps, dry wells, porous pavements, etc. Multi-purpose basins, required for surface water quality control could serve a recharge purpose at no additional cost, depending on soil conditions. In general, though, the infiltration approach to flood water control is more costly to construct and maintain than the more traditional method.

The same equity problems as in Measures 10 and 11 would apply. Costs would be passed on by developers to new homeowners and industrial tenants, but benefits would accrue to a much larger group.

13. Control Pollution from Landfills and Lagoons

The Passive Alternative, which responds only to obvious problems caused by landfills and lagoons would be ineffective. Since contamination occurrances in the past can be expected to continue into the future, contamination of ground and surface waters from these sources can be expected.

Under the Remedial Alternative, which does not limit groundwater pumping centers, and therefore critical recharge areas, to specific locations, protection must be areawide. This means that all facilities may be subject

remedial action, such as removal of landfill leachates by scavenger wells, which costs $5,000 per acre of landfill, or closure. The Preventive Alternative is similar, but radical actions would be confined to fewer specific critical areas, thus saving some expense. Further, new sources would be excluded from the critical recharge areas, eliminating future problems.

Both Alternatives must treat and/or dispose of leachate and sludge which adds to the cost and is a major environmental problem by itself. The two alternatives are also similar in that they mandate complete leachate containment in few facilities.

Costs would be the responsibility of facility owners and, given the expense involved and scope of this measure, it would be difficult to implement. Were it possible to carry out the basic groundwater management premises of the Preventive Alternative, then control of landfill and lagoons would be more efficient; knowing the critical areas would help the 208 agency to focus intense corrective efforts in more limited areas.

14. Control of Pollution from Product Storage

Currently, control of pollution from product storage is similar to landfills and lagoons: only major problems are addressed as they arise. These practices would continue under the Passive Alternative. EPA will promulgate regulations covering storage of toxic and hazardous wastes but the effectiveness of this program is as yet unknown.

The Remedial and Preventive Alternative are alike in that they require containment of runoff and seepage from product storage areas. Since the methods to achieve this objective vary from simple containers to elaborate structures, costs cannot be estimated now. Individual industries would be responsible for carrying out the necessary construction and maintenance.

As with landfills and lagoons, because the Preventive approach defines critical recharge areas in advance, this Alternative will be the more effective. Further, this Alternative will be able to prohibit entirely storage of certain products in critical areas, and to prevent new product storage areas from locating there. The latter restriction is a land use control, with impacts similar to those discussed under Measure 1.

15. Control of Pollution from Spills, Leaks and Other Accidents

Under the Passive Alternative, response to pollution-producing accidents would be, as it is now, a tidying up process. Under the 208 water quality management agency both the Remedial and Preventive Alternatives would require a more comprehensive spill contingency program - including fail-safe designs (e.g. cut-off valves, liners under storage areas), and effective equipment for clean-up and trained personnel to operate the equipment.

Public agencies as well as industries would be responsible for the contingency plans. The management agency would follow up with investigations of longer-term impacts and take appropriate action. Although random events cannot be completely controlled, this measure would be quite effective in controlling the effects of accidents. It should not encounter any serious implementation problems, either.

16. Septic Systems

Under the Passive Alternative, septic systems would be developed as they are now, i.e. with consideration mainly to the local soil's ability to leach water, and not to broader concerns such as groundwater quality.

The existing septic system permit requirements would be modified for critical areas within the Remedial Alternative and would be prohibited for critical areas within the Preventive Alternative. The Remedial approach would require advanced disposal systems and would necessitate regular monitoring, inspection, and maintenance.

Critical areas would be defined by the following: if the waste disposal system were on the same site as a water supply well; if there were 2 or more SCS classification limitations (slope, depth to water table, etc); if the lot size were less than or equal to one-half acre; or if the facilities are located in the vicinity of public supply wells.

The Remedial Alternative would entail capital, operational, and maintenance costs to impacted individuals or companies. Public sector costs would involve institutional and monitoring costs. The regulating method in the Preventive Alternative would be generally less expensive to the public sector and significantly more expensive in terms of lost opportunity to the affected private sector. The results of the prohibitive regulatory approach are somewhat more defined and uncertain.

17. Sewer Exfiltration

The existing situation with regard to leaky sewers would be modified under both the Remedial and Preventive Alternatives. Using existing circumstances (which would be continued in the Passive Alternative), sewer exfiltration is rarely considered as a condition necessitating repair. The Remedial and Preventive approaches would require all new sewer construction in critical groundwater areas (see Measure 16) to be watertight, and would require the existing system to be inspected by direct method (e.e., T.V.) and leaks repaired. The additional cost for watertight construction is approximately 5-15 percent; monitoring and maintenance costs under both the Remedial and Preventive Alternatives would also be increased.

18. Product Transfer Pipeline Location and Construction

The type of construction for such pipelines in critical groundwater recharge areas would be modified in the Remedial Alternative, while the locational decisions for these pipelines would be modified in the Preventive Alternative. Leak-proof construction is required in the Remedial Alternative.

In general, this type of construction would increase the cost of construction in affected areas. Pipelines under the Preventive Alternative would be prohibited from critical groundwater areas. The costs would be primarily opportunity costs to the private and semi-private sectors. Because it is prohibitive in character, the Preventive Alternative has substantially greater effectiveness than the Remedial Alternative with regard to accidents and other random events.

19. System of Solid Waste Management

Currently, Middlesex County is attempting to develop a resource recovery system to handle the county solid waste while Union and Somerset counties are just beginning to develop alternative solid waste disposal plans. Under the Remedial Alternative these efforts would be supplemented by the increased monitoring of sanitary landfills and the encouragement of public pressure for increased state enforcement action. The probability of success of this type of "political action" is questionable since it would put the management agency directly in the path of the forces seeking to maintain the status quo with respect to the quality of state enforcement. Also, the cost of the additional landfill monitoring can be expected to be quite high.

Under the Preventive Alternative, action would focus on establishing a regional solid waste management system with an emphasis on resource recovery. The major efforts on behalf of this would be undertaken by the Middlesex Solid Waste Management District with the 208 agency providing technical assistance with respect to water quality concerns. The cost of this alternative could also be quite high until new capital facilities are amortized and a stable secondary materials market is developed. Some remedial action may still be necessary to deal with pollution problems from improperly closed landfills. Also, considerable political opposition to this proposal may develop among landfill owners who are unwilling or unable to convert their existing facilities.

20. Pollution Control Fund

Under the Passive Alternative, the N.J. Solid Waste Administration (NJSWM) does not have the legal authority or financial capacity to remove or to order the removal of pollutants that have entered the state's waters from landfills. The Remedial and Preventive Alternatives both propose the creation of a Pollution Control Fund which is patterned after the existing Spill Compensation Fund to deal with pollutants from operating landfills which are polluting potable waters and to deal with those landfills which have been closed and/or abandoned by their owners. Opposition to the Fund from landfill owners should be minimal since they will be able to pass on the costs. General opposition, however, can be expected from some municipalities who ultimately would have to bear the added disposal cost. The strength of this opposition is unknown at this time. However, as the Fund will have an upper limit, the added disposal cost should be minimal.

21. Regulation of Solid Waste Disposal

While the Passive Alternative would continue the existing regulations of the New Jersey Solid Waste Act (NJSWA), both the Remedial and Preventive Alternative would alter the administrative regulations of the Act. The effect of these changes would be to streamline and strengthen the procedures of NJSWA. They would cause little additional cost to the government but the private sector would have to bear the cost of providing additional information. In addition, the altered regulations may require additional capital facilities. Intense opposition can be expected from landfill owners to these changes, especially those relating to the qualifications of facility owners.

22. Upgrade Municipal Discharges

The Passive Alternative simply accepts the 201 planning process as the means for carrying out the upgrading of municipal discharges to meet dissolved

oxygen standards. This approach has the inherent disadvantage of not providing a vehicle for local coordination among municipalities. The Remedial approach which calls for review of 201 plans by the areawide 208 agency offers continuity and coordination in the planning process. Such local coordination is appropriate inasmuch as the Remedial Alternative calls for water quality monitoring that will guide both the long-range 208 plans and the 201 plans.

The recommendation, in the Preventive Alternative, that the proposed areawide 208 agency assume responsibility for the 201 process for the entire region is theoretically the best of the three approaches. It would overcome the objection that the 208 agency's responsibilities in the Remedial approach include only review and not overall direction of wastewater management. The only drawback in the Preventive approach is that it will no doubt encounter strong resistance from the existing 201 agencies -- mainly the Middlesex County Sewerage Authority (MCSA) but also others -- as it will absorb their functions. Implementation of this portion of the Preventive Alternative will therefore be difficult.

However, it must be noted that the majority of the existing or new municipal point sources that are programmed to continue into the future lie just outside the study area. As such, these effluents directly impact the study area waters. Therefore, it is recommended that under both the Remedial and Preventive Alternatives the proposed areawide 208 agency establish a mechanism to review the activities of these municipal point sources.

23. Effluent Control

Both the Remedial and Preventive Alternatives contain identical recommendations for stream surveys, effluent monitoring and water quality assessments where necessary. These activities would be carried out under the direction of an areawide 208 agency that would make recommendations for National Pollution Discharge Elimination System (NPDES) compliance.

This approach offers a number of advantages over the Passive Alternative which would place the NPDES effluent control program under the direction of the New Jersey Department of Environmental Protection (NJDEP). The U.S. Environmental Protection Agency currently oversees this program but is in the process of handing over the responsibility to the NJDEP.

In all likelihood, the program for effluent control would be pursued with greater attention to water quality details if directed by an areawide agency than if it continues to be a state or federal responsibility. This greater emphasis on water quality should, theoretically, yield a more cost-effective approach. Effluent controls based on this detailed analysis of local water resources should also produce a better understanding of the possible tradeoffs in controlling point or non-point sources of pollutants. Although such tradeoffs are not generally applicable in the study area, two areas where there may be an opportunity for improving the quality of receiving waters by controlling non-point rather than point sources are in the Matchaponix/Upper Millstone and in the Raritan. The first example illustrates the possibilities for substituting controls on phosphorus input -- a constituent of storm water runoff from fertilized farms and lawns -- for treatment of effluents (point sources). In the second example, it may prove more cost-effective to control urban runoff biochemical oxygen demand (BOD) than to adjust the DO/BOD complex in the Raritan through point source controls.

One disadvantage of the Remedial/Preventive Alternative is that the areawide 208 agency might not have the resources to ensure adequate quality control in any toxicity testing program that they would undertake. Nor is it probable that NJDEP would turn over all its existing responsibilities for water quality monitoring and surveillance to a local agency.

24. Combined Sewers

The Remedial Alternative calls for separation of all combined sanitary/stormwater sewers, while the Passive Alternative continues the use of

combined sewers. By exercising this control over combined sewers, the problem of sewer overflow during storms can be totally eliminated. The disadvangate of this approach is that it would not be cost-effective and therefore would not be eligible for federal funding under existing funding arrangements. Without federal funding, local costs might be an excessive burden to support, and consequently the program may not be possible to implement.

The Preventive approach would recommend separation of storm and sanitary sewers where necessary for water quality purposes such as Carteret and Perth Amboy, if the New York City Harbor model supports the effectiveness of the procedure. The Preventive Alternative also calls for a special investigation of separation of a combined sewer in New Brunswick. The advantage of this approach is that a limited program demonstrating a significant improvement in water quality will have a far better chance of being funded by the EPA. However, this limited approach will also mean a higher concentration of pollutants entering the receiving waters. Also, the analysis necessary to justify the program may not accurately identify the real problems in the receiving waters; all such analyses are limited in precision.

25. Sewering

Both the Passive and Remedial Alternatives allow expansion of sewered areas in response to growth in the region. No controls would be placed on sewering. This approach is designed both to avoid a possible constraint to development and to decrease dependence in the area on septic systems. With such a policy, by removing this possible development constraint, population in the area will increase between now and the year 2000 more than in the Preventive Alternative. Such a population increase and increase in sewage and industrial discharges will cause point source problems with attendant control costs.

Construction related sediment loads would also be greater than with the Preventive Alternative (see Measures 6 and 7). The increased development

of the area encouraged by an unlimited sewering policy will also cause non-point source pollution even after construction. This will be a function of the increase in impervious surfaces (i.e. greater and faster runoff) and an increase in pollutants contained in that runoff.

26. Industrial Pretreatment

The Passive Alternative (Measure 26) would supply the forthcoming final EPA regulations for industrial pretreatment. The method of enforcement has yet to be decided upon. However, four options have been proposed. The first three involve local agency (sewage authority or local government) enforcement of: (1) technology standards; (2) technology standards or water quality variances; (3) toxic technology standards. The fourth option would have federal and state enforcement of technology standards. The status of the decision process is currently in a state of flux and modifications to the proposed options may be forthcoming. If a local choice were available the Passive Alternative would chose option 1.

The Remedial and Preventive approaches to industrial pretreatment of wastewater differ in that the former calls for minimal pretreatment and an accommodation of industrial wastes in a publicly owned wastewater system, while the latter calls for stringent industrial pretreatment prior to discharge into the area's sewerage system. The Preventive Alternative also recommends incentives in the form of tax reductions and grants for good treatment practices. Cooperative pretreatment arrangements among industrial dischargers would also be encouraged.

The chief advantage of the remedial approach is that centralizing additional treatment offers economies of scale especially if the pollutants being removed are widespread rather than a product of only a single discharger. Further, the cost of additional treatment would be spread over the entire area. At the same time, this approach requires common treatment of both contaminated and uncontaminated water; it also fails to attack the problem

at the source - the industrial discharger. Removal efficiencies may not be high because treatment is not pollutant-specific. Therefore the Remedial approach, in addition to not assigning the cost of additional treatment to the discharger responsible for water quality degradation, it is not likely to be cost-effective.

The Preventive approach would be more beneficial for water quality by removing pollutants at the source. Because it treats pollution at the industrial source where they are most concentrated, the Preventive Alternative is also probably the most cost-effective. This cost-effectiveness might be somewhat reduced by removing pollutants at the source without regard to the capacity of specific receiving waters to absorb some of the pollution. While clearly assigning the cost of treatment directly to the industrial process that causes the problem, the Preventive solution will present a difficult administrative problem. Another disadvantage of industrial pretreatment of wastewaters is that control over the environmental effects of residuals will be more complicated the more decentralized the source of the residuals.

27. Augmentation of Low Flows

Only the Remedial Alternative contains a recommendation for the augmentation of low flows, and there only in the Lower Millstone River. Water, most probably from the Delaware and Raritan Canal, would be used to increase the water level and so dilute the higher concentrations of contaminants that appear at low flow. Such a procedure will probably be a cost-effective means of meeting water quality standards in the Millstone in comparison to requiring further wastewater treatment. It might also produce some small benefit by contributing to solution of the dissolved oxygen problem in the Raritan River. However, it should be pointed out that this remedial approach does not seek to correct the cause of the problem, it merely dilutes it. Neither does it produce the ancillary benefits of toxics removal that could be achieved by further treatment.

Once again, however, it does dilute the toxic contaminants and therefore renders the water more acceptable in terms of the toxic concentration standards.

Implementation of a low flow augmentation program may be a serious problem in a water-short state such as New Jersey. Under the circumstances there would not be much support for anything but using available water resources for the highest possible purposes. Besides, the price of such water would not reflect the higher future value of the water. Another disadvantage of low flow augmentation is that a higher capacity of water flow would be required to support the short-term low flow augmentation program. Most of this capacity would be underutilized most of the time. A more specific, though related problem, is that the D&R Canal probably does not have the capacity to support an effective low flow augmentation program. The cost of low flow augmentation would be borne by the Stony Brook Regional Sewerage Authority (SBRSA).

28. Mechanical Reaeration

The Remedial Alternative calls for mechanical reaeration of segments of the Lower Millstone River in order to meet the dissolved oxygen standards set for that waterbody. Neither of the Passive nor Preventive Alternatives include reaeration in their water quality programs. Unlike the low flow augmentation procedure in Measure 27, reaeration capacity can be supplied incrementally, avoiding the problem of under utilization of capacity. It is probably the most cost-effective means of meeting dissolved oxygen standards. Implementation of this solution is probably simpler than either low flow augmentation or additional treatment of wastewaters.

The chief disadvantage of this solution is that it does not go to the root of the problem. Dissolved oxygen shortages are partly an indication of water quality problems; the actual pollutants are reduced in neither mass nor concentration. Mechanical reaeration is probably also more power consumptive than low flow augmentation as a remedial solution to low DO

levels. It would also have a more local effect and be of little benefit as a solution to dissolved oxygen shortages in the Raritan River. It would also have an adverse aesthetic impact on the Millstone in comparison to either low flow augmentation or treatment. As with low flow augmentation, the cost of in-stream aeration would be borne by SBRSA.

29. Water Conservation

The Passive Alternative (Measure 29) would continue the current practices regarding water use conservation. However, since the current practices are felt to be ineffective in promoting any substantial savings in water consumption the effectiveness of the Passive approach would be low at cost.

The Remedial Alternative recommends a public education program to encourage voluntary water conservation. Although this approach is not likely to be very effective in controlling water consumption, it is inexpensive and relatively easy to implement. Unfortunately the program could not realistically be expected to offer any overall dollar savings to the consumer since the water utilities would be forced to raise their rates if there were a drop in water demand. This is because most of their expenses are fixed and they would have to replace any lost income due to lower consumption. Further, the utilities' perception of the effectiveness of this solution is likely to be so low that they would not plan and construct their facilities for lower consumption. Thus, even if a substantial reduction in water use were to occur as a result of a conservation education program, the cost of the additional, underutilized facilities would still be borne by the consumer.

The Preventive Alternative provides much stronger conservation measures in the form of mandatory conservation devices in new developments and a more intensive public education program for the already developed areas. This approach is likely to be cost-effective in terms of reducing both water consumption and point source discharges resulting from increased sewering for new developments. In addition to the direct cost savings, this would

allow the utilities to plan more effectively and so reduce overall system requirements (construction of new facilities). All of these savings could then be passed on to the consumer.

Although clearly more effective than the Remedial Alternative, a mandatory program would also be difficult to put into effect. Also, once again the benefits of this program are dependent on the utilities and the consumer accurately perceiving the usefulness of the conservation devices and their effectiveness.

30. Industrial Water Conservation and Reuse

Currently there is only occasional industrial and commercial reuse of water. The Passive Alternative assumes a continuation of current practices. The Remedial Alternative would simply encourage greater industrial and commercial water conservation, reuse, and scheduling of discharges. While inexpensive and relatively easy to implement, this approach would not be as effective as the Preventive Alternative which would require industrial plants that use more than 0.1 MGD to submit a water conservation plan to the 208 agency for review and approval. This would stimulate industrial users to examine the cost-effectiveness of alternative conservation strategies in order to reduce the cost of water and wastewater treatment. Thus disadvantage of the Preventive approach lies in the additional expense of planning and administering the program that is not directly related to conservation. It might also prove to be an onerous burden to industry.

31. Industrial Treatment

The Passive Alternative includes no specific strategy under this heading. The Remedial Alternative would require an upgraded industrial treatment program to meet water quality standards whereas the Preventive Alternative would seek to reduce contaminant losses from the industrial process itself. Either approach, if pursued alone, could fail to be cost-effective since neither solution recognizes the specific industrial process. Some

processes might yield excellent water quality results at low cost through in-house process changes; others would not. Those in-house reductions in pollutant generation could also produce ancillary improvements in effluent quality. This approach would also be generally better in terms of preserving the nations' resources in the long run. The recommended approach is therefore to combine the two alternative solutions so that industrial dischargers would seek the most cost-effective solution to their particular discharge problem.

32. Monitoring and Surveillance

The Passive Alternative (Measure 22) would continue the existing level of monitoring and surveillance of point sources within the study area. The Interstate Sanitation Commission (ISC) and NJDEP conduct effluent sampling on a periodic basis. Both NJDEP and EPA have the capability to "spot check" problem dischargers. All individual dischargers are required to submit self-monitoring reports for specifically identified parameters on a regular basis to both NJDEP and EPA for NPDES compliance purposes. Continuation of this condition may not provide the level of detail, responsiveness, or reliability that would be required to ensure areawide water quality standards being met.

Under both the Remedial and Preventive Alternatives the scope of monitoring and surveillance would be measured to include all relevant water quality parameters consistant with the goals of the particular alternative.

The areawide water quality agency would review all current activities and offer recommendations to the other responsible agencies as to the most cost-effective means of obtaining compliance monitoring and surveillance information. This may entail the areawide agency assuming some of the work. The above proposed approach would be for superior, in concept, than continuation of the existing situation under the Passive Alternative.

The success of both the Remedial and Preventive Alternatives will be dependent upon the degree of cooperation the water quality agency can obtain from the other affected governmental agencies. However, the overriding factor to the success of this increased effort will depend upon the level of funding required to support a significant increase in these activities. In addition, sources of funding will have to be identified, as well as, allocation of these resources between the various agencies.

The LR/MC 208 included some sampling and analysis programs to support both the modeling of the BOD/DO interceptors at low flows, and to determine the relationships between land use and specific contaminants in storm water runoff. The discussion of the Alternatives, most importantly the River Management sections, recommend further monitoring to define more exactly some of the potential problem areas, such as non-point BOD/DO problems in the Matchaponix and Raritan Rivers, and potential non-point load levels in Green Brook. It should be recognized that the LR/MC 208 did not have the financial resources to define completely several issues that are worthy of further analysis. Among these are:

1. Definition of land use/potential relationships. Because of the limitations in the present study, these relationships would be defined for only broad categories of land use, i.e., developed, open and crop land. Continued 208 sampling and analysis may result in a more definitive categorization of land uses as pollutant sources, and therefore assist more detailed land use planning.

2. Expansion of Pollutants Analyzed. The LR/MC 208 included no analysis of oils and greases, which can have direct water quality impacts on other hydrocarbons which can become toxic when chlorinated at a water supply source. Future monitoring should include both these contaminants.

3. Heavy Metals Interactions. The LR/MC 208 program samples runoff water, and concluded that, of four heavy metals analyzed, only lead is present

in measurable concentrations. It should be noted, however, that studies in other areas have found dangerous concentrations of other metals, e.g. copper, in urban runoff, and these may therefore be streams in the study area, not sampled by LR/MC 208, where such metals are a problem. Furthermore, it is possible that the metals may not be in the flowing water in problem concentrations, but are causing damage to the eco-system via sediments in the streams. Such problems would be most likely in the highly urbanized streams. Further analysis along these lines would define the role of sediment-bound metals in the aquatic eco-system, including their release directly to overlying waters and their passage through the food chain.

With many of the basins in the study area highly developed, but still maintaining an adequate physical habitat for aquatic life, and many basins expected to change from a relatively undeveloped nature to a very urbanized character, these programs are of direct value to continued 208 planning. Data and interpretation analyses on these topics will be of greatest value to the study area if performed by, or under the auspices of, the 208 management agency.

EVALUATION OF INSTITUTIONAL OPTIONS

Under the Passive Alternative, the current institutional arrangement for water quality control would continue in its present structure. As this arrangement is hampered by manpower deficiencies and organizational problems at the state level and a coordinating mechanism at the local level, it cannot adequately address the problems of water quality management.

In addition to making specific recommendations concerning state (NJDEP) operations, both institutional options attempt to create a system with the capability to provide local government with an adequate capacity to make decisions concerning water resources in the region, to implement many of the 208 recommendations, and to protect the regions' competitive social and economic position within the state.

Institutional Option 1, the Water Resources Association, is one means of organizing local governments and providing them with this capability. The major advantage of the Association is that it minimizes the disruption to municipal home rule. The Association would be formed by all of the affected municipalities and special purpose agencies in the region. It would only be able to undertake those activities agreed to by its members and it would always be held accountable to its members. Although municipalities sacrifice some of their operating powers to the Association, home rule remains intact since they remain in control of the Association. In the area of land use, for example, the Association would only coordinate municipal actions. The final powers with respect to land use would remain in municipal hands.

This arrangement also has the advantage of being highly flexible. Since it is composed mostly of general purpose governments, it would have the ability, without additional authorization, to shift emphasis and alter activities in response to changing problems and attitudes. A further advantage is that, being made up of a number of governments, the Association is most likely to maintain a broad orientation to problem solving which would enable it to respond to several objectives at once and thus consider many alternative solutions to problems.

However, this option contains disadvantages as well. In its attempt to preserve home rule to the greatest extent possible, the Association is susceptible to having its actions frustrated or negated by uncooperative members. Further, incentives for some municipalities, particularly those without major water quality problems, to join may not be readily apparent. This will be particularly true where the short-term distribution of benefits are not equal. In addition, the procedures for cost allocation must be determined as well.

Institutional Option 2, a Water Resources Authority, provides an alternative means of organizing local government. This approach eliminates the frustrations and built-in inefficiencies of the Association but does so at the cost of municipal home rule. It actually solves the regional/local conflict by creating a new governmental unit, outside the existing structure, and effectively eliminates local jurisdiction over water quality management. As a corporate body it will be administratively independent of the "parent" government and would be able to fund and efficiently implement any projects that it chooses to undertake within its basic mandate.

However, the independence that allows an Authority to function efficiently creates other disadvantages. The agency would not be accountable to the local covenants which created it. While this promotes technical competence by shielding the Authority from the vicissitudes of the political world, it also insulates it from the realities of that world. The implications of this "independence" are particularly apparent with respect to land use. Unlike Option 1, the Authority would be able to review and approve all municipal land use decisions as they affect water quality. Municipalities would retain the ability to make land use diversions but limits would be placed on their powers. In effect, the independence of the Authority in this as well as other areas would come at a direct cost to municipal independence. Also, with its insulating, staffing and operating practices, and its carefully delineated authorization, this institutional option would be less flexible and less responsive to changing times than the Water

Resources Association. The financing arrangements have the same insulating effects. The Authority is responsible for its "bottom line" to bond holders and investment banks more than to the people it serves. This not only makes the agency less accountable to the public, it may even set up competing agency objectives in the sense that the Authority would refrain from undertaking projects in which the financial risk was high, lest it antagonize its bondholders.

In summary, both options provide the region with an implementation capability but the Association offers greater accountability and flexibility in water quality management while the Authority provides greater operating efficiency and more reliable funding.