

COMPLETION REPORT

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INFORMATION DISSEMINATION FOR A BETTER
UNDERSTANDING OF LOUISIANA'S WATER RESOURCES

By

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For

Office of Water Policy
United States Department of the Interior
Washington, D. C. 20240

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Project Completion Report
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Disclaimer

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Abstract

This project involved the assessment of Louisiana citizens' needs for water resources information, and the identification, preparation, and dissemination of the information available through the Louisiana Water Resources Research Institute to meet these needs.

During the needs assessment phase, it was found that a need for information on most aspects of water resources exists in Louisiana. One topic of major concern for the State, coastal zone water problems, has been addressed by Institute-supported research, and the results of this research was used to develop educational materials for the public on these problems. A brochure was prepared to explain the complex, interrelated nature of coastal water and water-related problems. This material was prepared for distribution to the libraries and local governments of the communities affected by the problems addressed as well as to appropriate state government offices.

This project, through the evaluation of the Institute's ability to satisfy the State's needs for water information through existing Institute information, revealed gaps between needs for information and existing information. An updating of the Institute's research priorities was, therefore, proposed as a means of helping fill the gap between information needs for the State and information available through the Institute. Those topics not previously addressed by the Institute were recommended for incorporation into the Institute's water research priorities listing.

Purpose and Objectives

Significant research into Louisiana's water resources problems has been effectively addressed by the Louisiana Water Resources Research Institute, providing an abundance of information available on crucial topics of interest to the State and the nation. The purpose of this project was to synthesize this information, and begin a process of transferring this valuable information in a useable form to the citizens of the State who stand to gain from knowledge of this information. Specific objectives were to assess the citizen's needs for water resources information, and to identify, prepare, and distribute the information available through the Louisiana Water Resources Research Institute to meet these needs.

Related Activities

The Louisiana Water Resources Study Commission, organized to develop a comprehensive state water resources management plan, has conducted recent evaluations of the current and anticipated water resources problems for the State of Louisiana. The primary thrust of the Commission's work was the assessment of the availability and quality of public drinking water supplies, with the results of the work published in the Commission's 1984 report (1,2). Findings indicate drinking water shortages already exist or will be a major future concern for several communities in the State. Shortages of both surface and groundwater supplies exist with seasonal shortages prevalent in coastal Louisiana. In addition to the water quantity concerns, water quality problems pose a threat to water availability for public drinking water supplies. The primary quality problems found are due to salt water intrusion into groundwater aquifer sources, and the existence or threat of industrial pollution of surface and groundwater sources alike. A comprehensive listing of the water problems documented by the Study Commission, along with the accompanying policy statement recommended to the State legislature, is given in Appendix A.

The five year research plan (3) prepared by the Louisiana Water Resources Research Institute (LWRRI) documents the concerns of the State in 1980, and serves as a basis for comparing the current with previous needs. The 1980 - 85 research plan identified thirteen water research areas relevant to Louisiana. These areas were:

1. Effects of surface wastewater disposal,
2. Deep well waste disposal,
3. Water conservation research,
4. Desalting research & development,
5. Water reuse research & development,
6. Energy-related water research,
7. Groundwater research,
8. Aquifer management,
9. Urban water research,
10. Environmental protection research,
11. Rural water research,

12. Water law research, and
13. Subsidence.

These represent a wide range of water resources problems, including problems that are peculiar to Louisiana. Appendix B gives a summary of this plan. In addition to these priorities, Dr. Elvin J. Dantin, former director of the Institute, proposed the inclusion of contingency planning for water emergencies on the priorities list stating the topic to be a critical water resources problem for Louisiana (4).

A 1983 water resources symposium, "Louisiana: Priorities For The Future," held in Covington, Louisiana brought together water resources professionals from throughout the state to discuss future water problems. Through presentations, panel discussions and workshops, the attendees collectively formulated research priorities for Louisiana. These priorities, published in the final report of the symposium (5), cover seven broad topics with very specific needs within each category itemized. The topics presented were public awareness, public drinking water supply, agriculture, transportation, industry, state government, and wildlife, fisheries & recreation.

Methods and Procedures

A five-phase procedure was identified as necessary for the completion of this project. Each phase is briefly explained below.

Phase 1: Determination of the Need for Information

A search for already existing information on citizen's awareness levels and information needs was the first step of this phase of the project. Documentation of current needs was found to exist through state government and miscellaneous reports (1,2,3,4,5). The reports provided an up-to-date and fairly comprehensive view of information and/or research needs for Louisiana, therefore additional efforts as the citizens opinion survey, previously proposed, was considered unnecessary. The data from these reports were merged and organized into a composite listing of information and/or research needs.

Phase 2: Assessment of Louisiana Water Resources Research Institute Technical Information Available

Information, research results, and publications resulting from Louisiana Water Resources Research Institute's 18 years of research activities in water resources were identified and classified according to broad interest categories. Twenty-two categories were used in the classification, and are the same as used in the LWRRI Library to classify all literature and information available. The categories are given in Table 1. Wherever appropriate, publications are cross-referenced to better represent the nature of the research involved. For the specific listing of the publications of the Institute and their classification, see Appendix C.

Table 1. Distribution of Louisiana Water Resources Research Institute Research Projects Among Water Resource Categories

Category	Category Name	Number of LWRI Funded Projects*
1	Agriculture	4
2	Annual Reports	+
3	Aquatic Biology	9
4	Bibliography and Data	
5	Conference Proceedings	
6	Conservation	
7	Energy	1
8	Flood Control	
9	Groundwater	18
10	Great Lakes	
11	Hydrology	15
12	Limnology	10
13	Management and Planning	3
14	Miscellaneous	1
15	Mississippi River	3
16	Social - Economic - Legal	4
17	Streams and Rivers	6
18	Waste Water	4
19	Water Quality	11
20	Water Reuse	
21	Water Treatment Technology	8
22	Wetlands/Coastal Environments	6

*Individual projects have been listed in more than one category when appropriate. Thirty-one projects have been multi-listed.

+ Not Determined.

Phase 3: Comparison of Needs Versus Available Technical Information

The results of phases 1 and 2 were compared with a determination made as to whether needed information was available through the Louisiana Water Resources Research Institute. Areas where there was a match between needs and information available were indicated as possible topics for the development of educational materials. When a need could not be matched with existing information, those needs were considered as warranting new or additional attention from the research community. In other words, two possible products could result from phase 3, a listing of possible information transfer topics and a listing of research priorities.

Phase 4: Preparation of Documents for Dissemination

From phase 3, areas were identified where an information need existed that could be met by the Institute's existing materials. This phase involved the translation of the technical information into a non-technical language. To present this information in an easy-to-read format, the brochure format was chosen as the method most suitable for dissemination to the non-technical audiences.

Phase 5: Dissemination of Information

Dissemination of information through the distribution of brochures or other materials was the planned approach. Parish and state libraries in the communities most affected by the specific water problem addressed as well as local and state government offices were selected as distribution points for the brochure. This approach was thought to be the most cost effective and efficient means of reaching the greatest number of people in the target area(s).

Principle Findings

This project involved close examination of the past and present works of the Louisiana Water Resources Research Institute (LWRRI). In the Institute's history, sixty-seven research projects have been funded. These projects addressed topics contained within fourteen of the twenty-two categories used in the information classification. Findings indicate the categories of ground water, hydrology, and water quality as having received the most attention. Research in three categories - conservation, flooding, and water reuse - has not been performed by the Institute. Table 1 shows the distribution of projects among the water resources categories. While some work has been performed in a majority of the categories, significant problem areas within each category were found to be unaddressed.

The evaluation of current information and research needs was completed based on information obtained from various sources, including state government, Louisiana State University, and other state organizations. The information needs listings obtained from the sources considered were merged to eliminate duplication. This examination revealed twenty-seven topics or problem areas needing more attention.

Table 2 provides the composite listing of the needs identified through this procedure. These problem areas were found within the general areas of water resources management, public water supply, agriculture, water transportation, wildlife-fisheries-recreation, and industry.

Phase 3 findings resulting from the comparison of information/research needs versus the information available through LWRRI revealed many problem areas that were not being addressed. These problem areas are summarized in Table 3, but in general, water resources management, public supply and transportation are the most notable areas not being addressed by the Institute.

Final activities for this project involved the translation of technical information into readily understandable information for non-technical audiences. The selection of a problem area to be addressed by a brochure was made based on:

1. an existing need for the information, and
2. the availability of the information through the Institute.

Four problem areas appearing on the needs list have been addressed by the LWRRI research program. The topics are subsidence, impact of various activities on water, drainage and agriculture, and water supply and quality as related to wildlife, fisheries and recreation.

The topic selected to be addressed in Phase 3 was Louisiana's coastal water and water related problems. This issue is a complex one, and includes water supply and quality problems, land subsidence, flooding, and beach erosion. A 1980 project of the Institute (6) dealt with this problem area. In this technical report, the types and extent of water resources and related problems were documented. A brochure is being developed to translate the results of this work into a more understandable form for the public. This brochure will help the non-technical public better understand and be more aware of the unique coastal problems of Louisiana. Once printed, the brochure will be distributed to local governments, to libraries in the twenty parishes affected by these problems, and to appropriate state government officials.

Conclusions

The scope and output of this project was altered slightly as a result of the Phase 3 findings. While it was initially felt that an abundance of information existed that could help the governments and citizens of Louisiana understand and deal with current water resources problems, the contrary was found. While some of the state's critical problem areas are discussed in the Institute's Five-Year Plan priorities, these areas have not been addressed by the research community. From this, one concludes that the research priorities are not being effectively communicated to the research community, or that the expertise to address these specific problems do not exist within

Table 2. Water Resources Needs Of Louisiana
That Can Be Met By State Universities

Management

1. Conservation
2. Water reuse
3. Ground water management
4. Emergency/Contingency planning
5. Subsidence
6. Comprehensive planning & management
7. Flooding
8. Health impacts of water pollution problems
9. Coastal zone
10. Water law and regulations
11. Public awareness of water resources and potential future development

Public Supply

1. Impact of various activities on water (through modeling and forecasting) - community and industrial development
2. Financing maintenance and upgrading of local water supply systems
3. Resolve public concern about New Orleans water supply
4. Monitoring Mississippi River water quality
5. Seasonal shortages of drinking water supplies

Agriculture

1. Salt water intrusion in coastal areas - agriculture
2. Drainage and agriculture

Transportation

1. Port planning-coordination
2. Technological, marketing, operational, and planning assistance for small ports
3. Navigation

Wildlife, Fisheries, Recreation

1. Water supply and quality as related to W.F.R.
2. Upgrading sewage facilities
3. Interaction of fresh, brackish and saline waters as it affects fisheries

Industry

1. Lack of information or inadequate information on pollution problems
2. Hazardous Wastes
3. Waste Disposal

Table 3. Problem Areas and Informational Needs
for Louisiana Needing More Attention

Areas Never Addressed by LWRI

1. Water Resources Management
 - a. Water conservation or reuse
 - b. Contingency planning
 - c. Comprehensive planning & management
(between surface and ground water supplies)
 - d. Human health impacts of water pollution
 - e. Water Law - clarification and regulations needed for water rights and in-state and intra-state water movement or transport
 - f. Upgrading sewage facilities
2. Public Supply
 - a. Problems of maintenance and upgrading water supply systems - particularly financing
 - b. Water quality monitoring - particularly the Mississippi River
 - c. Seasonal shortages of drinking water supplies
3. Agriculture
 - a. Impacts of salt water intrusion on agricultural crops
4. Transportation
 - a. Port planning and coordination
 - b. Technical, marketing, operational, and planning assistance
 - c. Navigation

Areas Needing Additional Work

1. Water Resources Management
 - a. Flooding
 - b. Public awareness of water resources
2. Industry
 - a. Hazardous wastes

the state's academic communities.

In addition, the findings of Phase 3 also suggest that the Institute's research priorities need updating to reflect the current needs of the state. The current research priorities for the Louisiana Water Resources Research Institute should include selected topics in:

1. Water Resources Management,
2. Public Drinking Water Supply,
3. Water Quality Impacts on Louisiana's Agriculture,
4. Water and Transportation, and
5. Ground Water Protection from Hazardous Wastes,

with the greatest emphasis on the various water resources management topics itemized in Table 3. Category 4, "Water and Transportation" is currently being addressed by the Louisiana State University's Ports and Waterways Center. For this category, interaction between LWRRI and this center is recommended.

The findings of this project reaffirm the need for continued, yet redirected, water resources research. The appearance of public awareness of water resources issues as a critical need of the state emphasizes the need for the subsequent transfer of research results to the state governmental offices and the citizens and local governments of the affected communities.

Publications

Publication of a brochure on Louisiana's coastal water problems will result from this project. Publication and distribution is anticipated by December, 1984.

REFERENCES

1. Water Resources Study Commission Interim Report to 1983 Legislature. Office of Public Works, Louisiana Department of Transportation and Development, 1983.
2. "A Summary of Water Problems with Suggested Water Policy Statements." Revised, Water Resources Study Commission, February 29, 1984.
3. Five-Year Plan: 1980-1985" Louisiana Water Resources Research Institute, October, 1980.
4. "Critical Water Resources Problems in Louisiana." E. J. Dantin, Louisiana Water Resources Research Institute.
5. Louisiana: Priorities For the Future, Water Resources Symposium - Final Report. May 14, 1983.
6. Water Related Problems in the Coastal Zone of Louisiana. Ronald F. Malone, Marty E. Tittlebaum, Stephen M. Crane, Nona S. Sanders, and Sarah R. Alston. Louisiana Water Resources Research Institute, Technical Report No. 7, Nov., 1980.
7. Louisiana's Water Resources. Office of Public Works, Louisiana Department of Transportation and Development, January, 1978.

APPENDIX A

A Summary of Water Problems with
Suggested Water Policy Statements

A SUMMARY OF WATER PROBLEMS WITH SUGGESTED WATER
POLICY STATEMENTS

<u>Water Problem or Issue</u>	<u>Suggested Policy Statement</u>
<u>General</u>	
1. Water is essential to human life.	Public drinking water supply shall be considered the use of first priority. The quantity and quality of drinking water shall be monitored and protected for the public health and welfare.
2. Water resources are one of the principal renewable resources available to Louisiana.	It is recognized that the water resources of Louisiana are an endowment of national significance and shall be used and managed to provide present and future health, economic, social and quality-of-life benefits to Louisiana citizens.
3. Ground and surface water are generally managed separately by state agencies.	Ground and surface water are part of the same hydrologic cycle and shall be considered together by the various state agencies in planning, management and laws.
4. The waste assimilation capacity of water is affected by the quantity of water available.	Quantity and quality of water are interdependent; therefore, agencies shall coordinate with respect to their water resources activities.
5. The general public is not adequately informed on the importance of water issues in Louisiana.	Public education and involvement in water resources matters in Louisiana shall be encouraged.
6. Water has been considered an unlimited resource in Louisiana and has been used inefficiently in many cases.	Conservation of the state's water resources shall be encouraged and practices which encourage waste shall be eliminated.

Water Problem or IssueSuggested Policy StatementWater Law

1. Current water law is vague and contradictory, leaving court action the only means of resolving water use conflicts.
2. State authority to protect ground and surface water remains unclear.
3. The state does not have a contingency plan for dealing with drought and other natural and man-made disasters.
4. To some extent jurisdiction over water supply and water quality is fragmented among several agencies including DOTD, DNR, and DHHR with the potential for agencies working at cross purposes.

The state shall provide adequate and clear water laws to protect the rights of surface and groundwater users.

The primary authority for protection of ground and surface water shall be vested in the state, although it may delegate authority to local or regional governmental bodies.

It is the policy of the state to lessen the impacts of severe droughts and other natural and man-made disasters which affect water quantity and/or quality through the development of a drought contingency plan.

Through the expression and implementation of the water policies of the state and through formal interagency coordination mechanisms, the water resources agencies of the state shall work together towards common goals with respect to the use and protection of Louisiana's water resources.

Surface Water

1. In most areas of the state municipal and domestic sewage treatment is inadequate to protect the quality of receiving water-bodies.
2. Pollution from non-point sources such as sediment pesticides, fertilizers and municipal storm-water runoff is responsible for significant stream and lake pollution.

Municipal and domestic sewage shall be properly treated before entering state waters.

Non-point sources of pollution shall be managed to the maximum practical extent. The state shall provide assistance in non-point sources pollution management through research and financial assistance.

Water Problem or IssueSuggested Policy StatementSurface Water (cont'd)

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| <p>3. Industrial waste water treatment in some areas is inadequate to protect the water quality of receiving waterbodies.</p> | <p>Industrial waste waters shall be properly treated before entering state waters.</p> |
| <p>4. Fisheries value of streams continue to be degraded due to point and non-point source pollution.</p> | <p>Louisiana fisheries are of economic and social value and efforts will be made to preserve and enhance the water quality for fisheries production.</p> |
| <p>5. The Louisiana Coastline and Coastal Zone are undergoing deterioration in the form of barrier island erosion, land loss, water pollution and saltwater intrusion with implications on the official coastline boundary, fisheries production and water supplies</p> | <p>The state recognizes the unique nature and importance of the Louisiana coastline and Coastal Zone to maintaining official state territorial waters, fish and wildlife production, and hurricane protection, and shall undertake a coordinated effort to maintain the current coastline configuration and stem the current land loss and saltwater intrusion problems.</p> |
| <p>6. The Mississippi River is a vital water supply source serving 1.5 million people in Louisiana, but public concern exists over the health effects of drinking treated Mississippi River water.</p> | <p>The state recognizes the importance of the Mississippi River as a water supply source as well as the public concern over the health effects of drinking Mississippi River water and shall conduct the necessary reserach to assure the quality of treated Mississippi River water or identify alternative sources if necessary.</p> |
| <p>7. High chloride levels in the Red River from out-of-state sources generally preclude the use of Red River water for municipal, industrial and agricultural purposes in Louisiana.</p> | <p>The state of Louisiana shall take an active role in protecting and improving the quality of interstate streams in Louisiana through interstate compacts and coordination.</p> |
| <p>8. The quality of streams such as the Mississippi, Red, Sabine, Ouachita, and Pearl rivers is significantly affected by out-of-state activities.</p> | |

Water Problem or Issue

Suggested Policy Statement

Surface Water (cont'd)

- 9. The production of fish and wildlife is reduced in some streams because maintenance of a flow for fish and wildlife is not a water quality standard.
- 10. Navigation is crucial to the economy of Louisiana but in-stream needs are not protected.
- 11. Replacement or supplementation of existing water supply for the Shreveport region is needed.
- 12. Supply of water in bayous Pierre Macon, Lafourche and Boeuf is inadequate for current irrigation demands.
- 13. Saltwater intrusion into drinking water supplies is a problem in lower Plaquemines Parish, the city of Houma and Vermilion Parish.
- 14. The existing drinking water supply of Grand Isle is inadequate to meet existing needs.
- 15. Testing of water quality at public recreation sites is inadequate to properly monitor contact recreation water quality.
- 16. Coordination between agencies responsible for or affected by surface water quality is inadequate.
- 17. Water resources data and terminology is not uniform and not generally available for use by other agencies.

The state shall determine minimum stream flows state-wide and adopt measures to maintain flows and/or volumes at adequate levels to support in-stream needs such as navigation, recreation and fish and wildlife.

An adequate and healthful water supply is essential to the health and economic growth of Louisiana, and the state shall provide assistance to ensure that water needs are met.

The state shall adequately monitor water quality at contact water recreation sites to ensure that the public health and safety is protected.

Coordination between state agencies which are involved in or affected by water resources activities shall be achieved through a formal arrangement or mechanism.

Water data collection, storage and retrieval should be comprehensive and current, and shall be shared by public agencies. The data shall be made available from a centralized location.

Water Problem or IssueSuggested Policy StatementSurface Water (cont'd)

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>18. Much of Louisiana is subject to flooding from local precipitation, hurricanes, and interstate streams. In addition flood control projects and programs have widespread effects on other water-related activities.</p> <p>19. Scenic and natural streams and surrounding areas are under increasing pressures to be altered or developed.</p> <p>20. Existing Louisiana laws pertaining to dam construction provide only for safety consideration, and afford inadequate protection to the water rights of downstream users or in-stream needs.</p> | <p>Protection of the life and property of Louisiana citizens from flooding is crucial to the continued health and development of this state and in a coordinated statewide manner to ensure the state's flood control efforts are effective and that the impacts of flood control measures on other water needs are minimized.</p> <p>Unique and scenic streams of the state shall be preserved and protected in order to provide recreational opportunities for present and future Louisiana citizens.</p> <p>The state shall ensure that laws governing the construction of surface water diversion facilities adequately protect the water supplies of downstream users and other downstream needs.</p> |
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Water Problem or IssueSuggested Policy StatementGroundwater

1. The potential for contamination of our groundwater resources exists through: existing and abandoned water wells, waste injection wells, surface and underground storage of liquids and materials, boreholes and pumpage induced saltwater encroachment.
2. Free-flowing wells and "open" groundwater source heat pumps waste valuable groundwater.
3. Construction regulations for water wells apply only to public supply wells, not irrigation wells, private wells, etc.
4. Integrity testing is inadequate for Class II, III, and V injection wells.
5. Septic tanks are basically unregulated and their effectiveness and effect on aquifers is not well known.
6. The quantity and quality of water available in aquifers such as the Sparta Sand in North Louisiana and the Miocene Sands of the Florida Parishes are affected by out-of-state activities.
7. Aquifer outcrop areas are particularly important to replenishing groundwater resources and are susceptible to pollution, but currently receive no special protection.
8. Control over the movement or transport of water in Louisiana needs to be a matter of state control.

It is the policy of the state to protect our abundant and valuable groundwater resources from being wasted via free-flowing wells. Protection is also needed from contamination via existing and improperly abandoned wells, improper waste disposal, septic tanks, bore holes and storage of materials.

The state recognizes that groundwater quantity and quality are affected by out-of-state activities and the state shall work with other states to protect groundwater in common systems.

The state shall identify and take special measures to ensure that important aquifer outcrop areas are not subject to contamination or alteration which adversely affects recharge.

Transport of water between basins or political units shall be a matter of state control.

Water Problem or IssueSuggested Policy StatementGroundwater (cont'd)

9. Louisiana is inadequately protected against diversion of water out-of-state.

The state shall take the necessary measures to ensure that the waters of the state are not diverted to out-of-state users without the permission of the state of Louisiana.

APPENDIX B

Louisiana Water Resources Research Institute
Five-Year Plan (80-85)
October 1980

Water-related problems are high on the Nation's problem-solving agenda. These problems stem from the need for accelerated energy development, past and present waste disposal practices, increased food production, industrial expansion, environmental protection, and safe and orderly urban and rural development. They are intensified by population growth and compounded by climatic and hydrologic fluctuations (droughts and floods) and the complexity and interdependence of the political, economic, social, technological, and natural systems that are involved in the use and management of water and the environment. Water resources research plays an important role in providing the nation with an adequate supply of high-quality water for many competing uses and with a "healthy" drinking water. In addition to the expansion and intensification of existing effort, a detailed elaboration on some of these priority research areas in which the Institute will be involved is as follows:

1. Effects of Surface Wastewater Disposal

A preliminary appraisal of the impact of surface landfill and the movement of leachates on surface water and groundwater quality is needed. A state-wide identification procedure must be developed based on field data collected by surveying and sampling disposal sites throughout the State of Louisiana. Research is needed to study where or what volume of wastes have been accumulated at various land surface sites in Louisiana; which sites are potential sources of groundwater contamination; and where groundwater is actually being contaminated. To do this, clay hydrology models are needed to predict the "fate of the waste."

2. Deep Well Waste Disposal

A study of deep well disposal utilizing the latest findings in the field of miscible displacement to design such systems is needed. Cognizance would be taken of EPA's proposed regulations and the feasibility of meeting such standards on a timely and economic basis. Modeling is needed so the applicant and regulatory agency can make a decision.

3. Water Conservation Research

Apparently, excessive water consumption by municipalities, industries, and agriculture is occurring throughout the country. Research efforts are needed to conserve usage of water and thus save energy. Recommendations may include: a) water demand forecasting and improved methodologies for pricing and rate structures; b) code and specification revisions, metering practices and public education; c) reduction of residential water use by means of recycling devices; and d) development of methods for improving irrigation efficiency.

4. Desalting Research and Development

The desalting technology which has been developed over the past few years not only has potential for enhancing water supplies for the cities in coastal areas and inland areas having access to brackish water supplies, but also has application to the control of industrial pollutants and for water reuse. Research and development should continue on developing new and improved membranes, freezing, and other promising or potential desalting technology. Also, the research and development effort should continue with respect to the development of large desalting plants and multi-purpose desalting plants for site specific applications. (OWRT has approved a desalting demonstration plant at Grand Isle, La. which will involve research by the Institute.)

5. Water Reuse Research and Development

Reuse of municipal and industrial wastewaters provides a potential method for conserving the Nation's water resources. At present, less than three percent (3%) of the approximately 7,500 billion gallons of municipal waste water discharged annually is being reused. Industrial wastewater discharges are about double the municipal quantities. The research and development program in water reuse should lead to the removal of trace organics and heavy metals, in organic chemical and dissolved solids, pathogenic organisms, and various industrial contaminants now hindering major reuse of wastewater resources. Also, research should continue on water reuse planning and management, cost effectiveness, methods of pollutant detection, analysis, and monitoring.

6. Energy-Related Water Research

Increased development of the Nation's fossil energy resources will have an additional impact on local and regional water resources. Already surface and subsurface mining has created water quality problems in many areas. Streams have been so polluted by runoff and leachates that they are no longer useful for fish, recreation, or water supply. Research should aim at developing methodologies to minimize any adverse water-related consequences--social, economic, and environmental--resulting from fossil fuel development.

7. Groundwater Research

Substantial achievements in the analysis of aquifer properties important to predicting of the future response of aquifers to alternate pumping and recharge decisions have been made. Major research challenges remain. Some of these are: groundwater quality modelling, regional predictational capacity, prediction of water use, analysis of institutional adaptation for groundwater management, use of aquifers for storage of waste heat through injection of heated water, use of aquifers to store compressed air, and new uses for resources previously thought unusable for quality or cost reasons, i.e., storage of fresh water in saline aquifers.

8. Aquifer Management

The framework for establishing property rights in groundwater has not yet been established in Louisiana. Recharge districts to salvage the seasonal surplus of water cannot, yet, be formed. The lack of a proper management framework is causing increasing pumping lifts in some areas and increased use of power for water supplies.

9. Urban Water Research

A shifting of the population from rural to urban society has resulted in approximately 75 percent of the Nation's population living on approximately two percent of the land. The principal problems associated with this shift include: 1) municipal and industrial waste generation, 2) water pollution associated with urban runoff, 3) effects of urbanization on local climate and hydrological processes, 4) flood damage protection, and 5) provision of adequate municipal and industrial water supplies. Examples of continuing research to solve these problems include: 1) research and development of procedures for detecting, measuring and predicting nonpoint sources of pollution and 2) research to provide solutions for the ultimate discharge of treatment plant effluents and the disposal of the tremendous volumes of sludge that are generated by the treatment process. A further goal of research is to develop integrated management for water supply, wastewater collection and disposal, and storm water management.

10. Environmental Protection Research

The environmental quality of the Nation must be maintained and enhanced consistent with other national goals. Research is required to establish the scientific base for environmental standards, regulations and practices. Research should continue on: 1) environmental loading and contamination associated with human activities and natural sources (including radionuclides); 2) environmental processes that result in pollutant transformation, transport and removal; 3) pollutant identification, characterization and measurement; 4) determination of health and ecological effects and; 5) development of alternate control technologies for environmental enhancement and restoration.

11. Rural Water Research

A major portion of the population of the United States in rural or semi-rural areas is not served by a central water supply and wastewater disposal systems. Research is required to improve local practices in waste disposal to develop economically feasible water treatment and storage facilities; methods of water source protection; effective individual on-site treatment and disposal systems in poorly drained soils; and institutional arrangements for financing, operating, and maintaining rural community systems.

The use of water cistern systems to alleviate the incoming demands for water should be reviewed.

12. Water Law Research

The identification of responsibilities of various governmental offices and the water rights of individuals is needed.

13. Subsidence

Land subsidence due to groundwater off-take has been observed in Baton Rouge and New Orleans. Similar subsidence has undoubtedly occurred in the Lake Charles area. Definitive studies are needed to determine rates of subsidence, and the type and costs of measures to halt subsidence.

APPENDIX C

Publications of the Louisiana
Water Resources Research Institute

PUBLICATIONS OF THE LOUISIANA
WATER RESOURCES RESEARCH INSTITUTE

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9	Fresh Water Storage in Saline Aquifers (Multi-year project)	1964
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3	PHASE B - The Effect of 2-4-dichloro-phenoxyacetic acid and its derivatives, upon the growth of planktonic freshwater algae and its persistence in surface waters	1965
9	Measures to Accomplish Protection of Ground Water Supply of Baton Rouge Area From Degradation Due to Intrusion of Saline Water Into Area of Offtake (Multi-year project)	1965
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