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CONTENTS

DEM REPORT OUTLINES CHOWAN/ALBEMARLE ACTION PLAN

A recently released document produced by the Division of Environmental Management (DEM) details a plan for restoring the water quality of the Albemarle Basin.

The action plan concludes that nutrient enrichment, both nitrogen and phosphorus, is the major cause of water quality problems in the Chowan/Albemarle Basin and that these problems can be effectively mitigated with a reduction of those nutrients. The report emphasizes the need to focus nutrient reduction efforts in the Chowan River Basin. Reduction of nutrients in the Chowan would serve to reduce the algal bloom problem and also reduce nutrient inputs to Albemarle Sound.

The well-documented report includes among its recommendations that a 30-40 percent reduction in total phosphorus inputs is required to significantly reduce the frequency and magnitude of algal blooms on the lower Chowan River. A 15 to 25 percent reduction in total nitrogen is needed to a) increase the effectiveness of P reductions, b) maintain a balanced algal community, c) decrease the magnitude of the spring bloom. The report also recommends that a phosphate detergent ban be adopted in the Chowan/Albemarle Basin and a strong educational program be encouraged to implement best management practices for agriculture to reduce nitrogen and phosphorus inputs.

The DEM plan is in response to special legislation and a study commission. Concern over water quality in the Chowan/Albemarle region prompted the 1981 General Assembly of North Carolina to pass House Bill 747. The bill created a legislative commission to study water pollution problems and water resources needs of the Chowan River Basin and the Albemarle Sound Basin. The bill also appropriated funds to the Department of Natural Resources and Community Development to assist in Chowan River restoration efforts and initiate studies leading to an Albemarle Basin Restoration Project. The Division of Environmental Management had lead responsibility for these efforts.

Limited copies of the Chowan/Albemarle Action Plan are available from the NRCD Division of Environmental Management, P.O. Box 27687, Raleigh, NC 27611.

VIRGINIA BEACH'S LAKE GASTON PROPOSAL PART OF LARGER PICTURE

Virginia Beach, long in need of a permanent water supply, announced in November its choice of Lake Gaston on the North Carolina-Virginia border as a desired water source. The proposed withdrawal of up to 60 mgd would be via a $105 million, 86-mile pipeline. The Lake Gaston pipeline was one of three alternative sources being considered by the town.

The water needs of the Tidewater Virginia area and the planned Lake Gaston pipeline are part of a larger scenario of issues (involving both water quantity and quality) faced by the two states and figure prominently in negotiations by the N.C.-Va. Water Management Committee.

There are three main issues involved. One is the surface water withdrawals by southeast Virginia from rivers that flow into North Carolina. Another is heavy ground water demands on the aquifer that supplies water to both

northeastern North Carolina and southeastern Virginia. A third issue is pollution in North Carolina's Chowan River, whose drainage basin lies largely in Virginia.

The bi-state committee is working on an agreement that would consider each of these issues and be suitable for the needs of both states.

The Lake Gaston pipeline faces a number of obstacles before it can become a reality, including opposition from Lake area residents, who fear that lowered water levels would threaten future economic growth.

MAJOR AGRICULTURAL EROSION EFFORT IN SELECTED PIEDMONT COUNTIES OF NORTH CAROLINA AND VIRGINIA — A USDA Soil Conservation Service-led project seeks to use a systems approach to control erosion in 13 counties in North Carolina and 14 counties in Virginia. The selected counties, in what is called the Piedmont Bright Leaf Erosion Control Area, are characterized by small farms with corn, soybeans, tobacco, and small grains being the major crops. Tobacco accounts for 80 percent of the crop income.

According to a SCS publication describing the project the cropland erosion in the targeted area has an average soil loss of 18 tons per acre or over twice the state average and is three and one-half times greater than the soil loss tolerance for the soils common in the area.

Counties in the project are Alamance, Caswell, Durham, Franklin, Granville, Guilford, Northampton, Orange, Person, Rockingham, Stokes, Vance and Warren Counties in North Carolina; and Amelia, Brunswick, Campbell, Charlotte, Dinwiddie, Franklin, Greenville, Halifax, Henry, Lunenburg, Mecklenburg, Nottoway, Pittsylvania, and Prince Edward in Virginia. The project is an intensive 10-year effort to reduce erosion, improve irrigation water management, increase soil productivity, reduce water pollution and improve farm income. Emphasis in the project is given to using all of the available practices rather than single-shot practices for soil and water management. Among the practices to receive special attention include contouring, stripcropping, fescue rotations, diversions, waterways and field borders on tobacco land. For the corn and soybean land, conservation tillage systems will be encouraged.

Over 1,200,000 acres in the targeted area need additional conservation treatment. With accelerated technical assistance, cost-sharing and educational efforts it is expected that landowners will install conservation practices and other best management practices on 425,000 acres during the 10-year project period. Currently, approximately 30 percent of cropland with potential erosion problems is considered to be adequately protected from erosion. SCS in North Carolina and Virginia will coordinate the program with assistance from other USDA agencies and other farm related organizations.

According to Mitch Clary, Assistant State Conservationist, additional resources for the accelerated program have been made available in FY 83 for technical assistance by SCS and for cost sharing by ASCS. In the 13 North Carolina counties some 19 technical people have been employed to work intensively with farmers and ASCS has received $225,000 for additional cost-sharing funds.

WAKE FARM PROJECT SHOWING BMP EFFECTIVENESS — Preliminary results of Best Management Practices monitoring on two Wake County farms are showing that it is possible to achieve both efficient agricultural production and clean water when the BMPs are used.

The preliminary findings for 1982 show pronounced differences in pollutant losses from one farm, where recommended BMPs are in use and the other, a control site, with minimal BMPs. The study is part of an educational effort by the N.C. Agricultural Task Force, with the NCSU Agricultural Extension Service serving as the lead agency. Both farms are privately owned and located north of Raleigh.

The well-managed site in Hillcrest Farms, owned by Huel Choplin and his son Connie. Their main product is swine in a farrow-to-finish operation, with grain grown on 100 acres for feed. On the control site, cropping consists of continuous soybeans straight up and down the slopes.

BMPs used on the Choplin farm include conservation practices such as parallel terraces, grassed waterways, field borders, winter cover crops, and no-till. Three ponds store runoff for seasonal irrigation needs. Soils are tested annually to assess nutrient and liming needs. Swine waste is stored in a liquid slurry pit, and it is tested to assess its nutrient value prior to land application via a traveling big gun irrigation system. Irrigation scheduling is based on crop and soil moisture conditions.

Loss of water, sediment, nutrients, and organic matter from each farm were measured in 1982. Preliminary estimates allow comparison of pollutant losses from the Choplin farm, with its BMP system, to the control farm.

- Water runoff reduced by 64% from 210,000 gal/ac to 76,300 gal/ac
- Sediment loss reduced by 99% from 17.7 ton/ac to 0.05 ton/ac
- Loss of organic material reduced by 96% from 1800 lb/ac to 72 lb/ac
- Total nitrogen loss reduced by 92% from 65 lb/ac to 5.3 lb/ac
- Total phosphorus loss reduced by 90% from 18.1 lb/ac to 1.8 lb/ac

This integrated BMP approach has also worked very well for the Choplins from a production standpoint. From 1978 to 1981, the Choplins have been Wake County corn champions, and during 1981 were fourth in the state with a top yield of approximately 214 bushels/acre. Also, as a result of soil conservation, soil and manure testing, and optimal manure utilization, their annual fertilizer bill has been reduced from $10,000 to $2,000 (from 1981 to 1982).

Final results of the BMP monitoring are expected in February. For more information on the study or on the use of agricultural BMPs, contact James Blake Atkins of the NCSU Agricultural Extension Service at (919) 737-2675. Atkins is the educational coordinator for the N.C. Agricultural Task Force.

POLL SHOWS PUBLIC FAVORS STRONG CLEAN WATER ACT — The American public strongly favors tough clean water standards in spite of costs involved, according to a recent poll by Louis Harris and Associates.

The poll was conducted for the Natural Resources Council of America, and the results were presented by Harris at a hearing of the Senate Environment and Public Works Subcommittee on Environmental Pollution in December.

The 2,503 adults polled in the 1982 survey expressed opinions on such matters as the adequacy of existing federal water standards, wetlands protection, and Best Available Technology (BAT) requirements for industry. Those surveyed said by a 94-3 percent margin that the Clean Water Act should remain as it is or be made stricter. Sixty-nine percent favored more protection of wetlands under the Section 404 program. On the question of BAT requirements for industry, 65 percent of the respondents favor use of the BAT, even if the number of jobs would be reduced.

GROUND WATER CONFERENCE HELD IN RALEIGH

Ground Water Availability in the Piedmont was the topic of a conference held December 8 in Raleigh. The conference was attended by community officials, well-drillers, water suppliers, and others interested in learning more about ground water. Triangle J. Council of Governments and the Water Resources Research Institute sponsored the session, which explored many aspects of ground water, from the basic facts about its occurrence to current scientific research.

Ground water serves the water needs of two-thirds of North Carolina's citizens, yet there remain a number of misconceptions and a lack of knowledge on the subject. Former USGS District Chief Ralph Heath, the conference's opening speaker, dispelled several persistent myths about ground water in the Piedmont. For example, he said, many misconceptions exist about how ground water actually occurs and moves. It is contained in open spaces of two distinct layers of rock that underlie Piedmont soil: the top layer is saprolite, a granular, weathered material with water ccntained in the pores. Underneath is the more solid bedrock, where water is contained in sheet-like fractures of the rock. Heath went on to explain the relationship between topography and ground water, noting that well yields on hills are much lower than in valleys.

Charles Daniel of the USGS discussed the many aspects of well site selection and the site selection and well drilling work done as part of a joint USGS-Town of Cary ground water development project (see separate NEWS article on the Cary project.)

Other speakers addressed such topics as planning and political considerations relating to ground water development and management, common problems encountered in well drilling, and ground water pollution.

Several speakers noted that for municipalities or anyone considering ground water development, a wealth of information is available from government agencies as well as private consultants. Allan Dietemann of the N.C. Office of Water Resources pointed out that communities do not embark on surface reservoir development without consulting a trained hydrologist, yet often they proceed with ground water decisions without the services of a specialist. Help for communities is available from several sources.

Dietemann offered several steps a town might take to begin ground water development. Town officials must be genuinely interested in pursuing the project, he said. First, they would consult the State or another government agency for general information on ground water. The State can provide general suitability criteria and assistance in identifying good possibilities for further evaluation as well as relating the experiences of other communities nearby. The State also has ground water records for North Carolina and information about regulatory requirements.

A next step would be for the town to contact a private consultant, a specialist with time to evaluate promising alternatives in detail, perform specific studies and calculations, and assist with such things as drilling contracts and regulatory permits.

Dietemann also outlined several options for funding ground water supply projects, such as a guaranteed-yield contract (expensive, but guarantees a certain yield or the town pays nothing) or the ground water development packages offered by large national firms (also expensive, but can ultimately save money by developing ground water resources efficiently). He emphasized the importance of seeking out professional services--being aware of those that are free, and exploring the possibilities of using private consultants.

One purpose of the conference was to increase communication among those interested in ground water development and to encourage further discussion on the topic. The Institute is looking at ground water research needs and is setting up meetings and work sessions to assess voids in research in this area.

CARY, USGS BENEFIT FROM JOINT GROUND WATER PROGRAM

A joint ground water research project by the U.S. Geological Survey, the N.C. Department of Natural Resources and Community Development, and the Town of Cary is benefiting all parties involved. The USGS has gained valuable information on ground water in the Piedmont, and Cary is gaining much-needed additional water supplies.

At the recent ground water conference in Raleigh, Bill Hardin of William G. Daniels and Associates, engineering consultants to Cary, described the development of that town's ground water resources. Through the consulting firm, Hardin has worked with Cary to identify alternate sources to supplement the town's main water supply, which it buys from Raleigh. Contact with USGS and NRCD officials led to the idea for the joint ground water project, and arrangements were completed in January 1981.

While the fast-growing town needed water, having required temporary emergency allocations to meet peak summer demands in recent years, the USGS wanted to validate and refine concepts concerning ground water characteristics in the Piedmont. Much ground water information had been gathered for the Mountains and Coastal Plain, but little for the Piedmont. "The whole project has been a learning experience for everyone involved," Hardin said.

Sites were selected and 13 wells were drilled; 10 have proved acceptable. Wells constructed as part of the project should provide Cary with an additional 1 mgd.

Cost to bring one of Cary's wells on line has been almost $36,000. However, Hardin emphasized that because of the knowledge and experience gained, similar systems in the Piedmont could be developed by municipalities in the future at much lower costs--probably about $18,000-$25,000 per well. Owing to the research nature of the project, engineering costs per well were high, averaging about $6,000 each. Also, Cary is building well houses that exceed minimum requirements. Each structure costs

about $7,300, with an additional $2,000 for internal piping and equipment. New water lines to connect the wells to existing water distribution systems cost about $7,000 per well, and well sites and access easements have been about $8,000 per site. Drilling costs have been about $6,000 per well. The average cost of water brought on line in Cary is within the competitive range of 50 to 65 cents per 1,000 gallons, said Hardin. Manifolding wells together where possible was found to greatly reduce O&M costs as well as initial capital investments.

Drilling for the Cary wells generally stopped at 300 feet. Over 80 percent of the ground water was encountered in the first 200 feet, usually between 125-180 feet.

The N.C. Division of Health Services has provided the benefit of their field experience during the project to help prevent maintenance and operation problems.

Hardin added, "We feel that Cary's ground water program has been successful for each of the participants. The experience gained should benefit other municipalities in the Piedmont. A great deal has been done to advance the conjunctive use concept in the Piedmont. In addition, we've seen steady improvement between all government agencies involved in ground water development."

STUDY FOR EPA EXAMINES THE USE OF WETLANDS FOR WATER POLLUTION CONTROL

An EPA-supported investigation was made of the use of wetlands as treatment mechanisms for urban stormwater runoff. Findings from this study indicate that application of municipal wastewaters and polluted urban runoff to wetlands may potentially provide low-cost water quality protection for many communities. Through the cost of conventional treatment facilities may be difficult to support, development of wetlands for runoff treatment is easy to justify because it meets many community needs (recreation, wildlife and fishery enhancement, recharge of ground water, and water quality renovation, for example).

A summary report of the research states that wetlands such as marshes, swamps and artificial wetlands, have been shown to remove selected pollutants from urban stormwater runoff and treated municipal wastewaters. Wetlands have produced reduction in BOD, pathogens, and some hydrocarbons, and they excel in nitrogen removal. They have been reported to act as sinks for trace metals, phosphorus, and suspended solids.

Physical/chemical pollutant removal mechanisms in wetlands include sedimentation, coagulation, chemical filtration, volatilization, adsorption, and chelation. Vegetative mechanisms include filtration, adsorption through roots, stems, and leaves, and chemical transformations in the plants. Chemical transformations of some waterborne pollutants also occur in the sediment layers or the water column as a result of anaerobic or aerobic conditions, the presence of catalysts and reactive substances, and microbial action.

The conclusions of the study are as follows:

(1) Most wetlands studies were able to receive treated municipal wastewater and/or stormwater runoff, remove certain pollutants, and produce satisfactory plant growth. Pollutants removed or decreased included organic wastes (as measured by BOD), nutrients, suspended and volatile solids, and trace metals.

(2) The application of hydraulic controls and vegetation management has the potential for improving wetlands removal or pollutants.

(3) Wetlands remove waterborne pollutants principally through physical and chemical processes that are substantially augmented by biological processes associated with wetland vegetation.

(4) Wetland system stress was reported only in laboratory studies and certain field studies below municipal and industrial discharges where plants were exposed to excessive pollutant concentrations. Abatement or reduction of pollutant loadings usually led to recovery of wetland vegetation.

(5) Further research should be directed at improving our understanding of how wetland systems assimilate pollutants after initial removal.

The full report was submitted in fulfillment of Grant No. R-806357 by the Association of Bay Area Governments and RAMLIT Associates under the sponsorship of the U.S. Environmental Protection Agency. The complete report, entitled "The Use of Wetlands for Water Pollution Control," (Order No. PB 83-107 466; Cost: $23.50, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

The EPA Project Officer, Richard Field, can be contacted at:

Storm & Combined Sewer Section
Municipal Environmental Research Laboratory - Cincinnati
U.S. Environmental Protection Agency
Edison, NJ 08837

TVA BEGINS BATTLE WITH HYDRILLA

Hydrilla, the rapidly spreading exotic weed that has caused extensive damage to the aquatic environment in a number of states, was discovered in August in the Tennessee Valley, and control measures were quickly begun. It is the first known occurrence of the weed in a TVA reservoir.

Hydrilla was found during routine TVA sampling on August 19, and its identity later confirmed, at the Sublett Ferry Slough on Guntersville Reservoir in northeast Alabama. Colonies of the weed were later found downstream along the reservoir's main bank.

The hydrilla invasion in the Valley was not unexpected. TVA officials, aware of hydrilla's existence in surrounding watersheds and the ease with which it spreads, had prepared a contingency plan for dealing with the weed. The plan involved measures directed at preventing infestation for as long as possible, early detection, and control mechanisms.

Aerial photography and boat surveys are being used to keep track of hydrilla's spread. Chemical treatment was begun using the herbicide endothal, with polymers added to ensure accurate placement. Also, water level drawdowns are planned, along with experiments on the use of an herbivorous fish, the white amur.

NEW INSTITUTE PUBLICATION

Use of Geologic and Water Yield Data From Ground Water Based Community Water Systems as a Guide for Ground Water Planning and Management, by Charles W. Welby and Thomas M. Wilson.

Estimates of the occurrence and availability of ground water on a geographic basis can be valuable in planning the development of ground water resources. Furthermore, probability information is useful in decisions relating water needs to a drilling program and its costs.

In this study Community Well System (CWS) well yield data from 214 wells was used to outline patterns of favorable and less favorable areas for ground water development in Wake County. Conjunctive use of ground water with surface water requires an understanding of an inventory of the ground water and an understanding of under what circumstances ground water may become unavailable or be in limited supply.

A two-media model was recognized, consisting of saprolite and the underlying crystalline rocks. The well data provided well yield information which was tested against various geologic and non-geologic parameters. Major areas where ground water yields have historically been low (less than 10 gallons per minute) and areas where yields appear consistently higher are outlined in the report. Pumping test data and their interpretation led to use of a fracture coefficient which proved to be correlatable with lithology, field joint and fracture measurements, and specific capacity of wells. Average values of fracture coefficients grouped by rock type decreased in the same rock type order as average well depths grouped by rock type increased.

Probability curves provide a means of estimating yields for a given rock type and a means of guiding a decision on whether to deepen a well beyond about 250 ft or to drill a new well for a given project. The probability of location of high yield wells (greater than 50 gallons per minute) is improved by application of lineament analyses. Fractures and joints appear in greater abundance where the rocks are the more intensely folded, and water well yields are generally higher in these areas.

Low stream flow calculations (7-day, 10-year; 7-day, 1-year) were utilized to estimate usable recharge for various parts of the county. Information about well failures indicates that roughly 25 percent of the CWS wells eventually cease to be productive for one reason or another. It is estimated that about half of the failures can be attributed to geologic factors.

From a land-use planning viewpoint the study suggests that development needing a water usage exceeding that required by a single-family residential density of one unit/acre should be concentrated in those areas where governmental planning proposes extension of water and sewer services.

A copy of this report may be obtained free from the UNC WRRI, NCSU, 124 Riddick Bldg., Raleigh, NC 27650-5999, telephone (919)737-2815. A fee of $8 prepaid is charged for out-of-state requests. Report number is 184.

N.C. OUTDOORS SCHEDULED MARCH 24-27

This March, how would you like to go panning for gold in a mountainside mine? Or take a hike along one of North Carolina's scenic trails? Or get a first-hand look at the underwater creatures that inhabit the State's seas and inland waterways?

You can do this and more, and all within the space of a single day, at the 1983 Outdoors North Carolina Expo. Beginning on Thursday, March 24 and running through Sunday, March 27, the '83 Expo will be the largest exhibition on the outdoors in the Southeast.

For four days, North Carolina's great outdoors will be on display indoors, at the Raleigh Civic Center.

The Department of Natural Resources and Community Development is sponsoring the expo in cooperation with the Raleigh Civic Center, state and federal agencies, citizens groups and the outdoors industry.

WORKSHOPS, CONFERENCES, AND SHORT COURSES

Annual ALI-ABA Course of Study Environmental Law. Course will be held February 17-19, 1983, at the Westin St. Francis Hotel in San Francisco. The course is cosponsored by ELI and The Smithsonian Institution.

This year's program will include plenary sessions on the following subjects: hazardous wastes and toxic substances developments under RCRA, TOSCA, and other laws; Clean Air Act and Clean Water Act developments; environmental litigation; current developments under NEPA and state "little NEPAs"; and public lands and energy resource development. Keynote addresses by distinguished speakers also are planned.

For further information write Donald M. Maclay, Director, Courses of Study, ALI-ABA, 4025 Chestnut Street, Philadelphia, PA 19104, or telephone (215) 243-1630.

Environmental Permitting. This seminar will be conducted February 8-9, 1983, at the Jane S. McKimmon Center of Extension and Continuing Education, N. C. State University, Raleigh, NC. The seminar is sponsored by NCSU School of Engineering, Industrial Extension Service, and Division of Continuing Education.

Objectives of the seminar are to assist participants in:

- Understanding current and developing environmental regulations;
- Obtaining environmental permits;
- Planning future environmental policy; and
- Eliminating unnecessary costs of compliance.

For registration details call Woody Fairbrother or Michelle Howell at (919) 737-2261. For details on technical content call Jeffrey L. Shumaker, TRW Inc. at (919) 541-9100.

POSITION AVAILABLE

The Office of the Assistant Secretary of the Army (Civil Works) is seeking applications for an economist for the position of Scientific Advisor for the academic year beginning July (or September) 1983.

Economists interested in being considered for the Scientific Advisor position should have training in microeconomics and have research interests related to application of economic analysis to natural resources management and development, or water transportation. Examples of policy issues of concern to the Army Secretariat currently include revenue-bond financing of water development projects, project formulation with cost recovery for vendible outputs, practical pricing policies for recreation and other outputs of single purpose and multiple purpose water projects, cost recovery and compensation policies for reallocation of existing reservoir storage. Research and publications in these or related areas will be weighted heavily in the evaluation of candidates.

Interested applicants should submit a completed Standard Form 171 (Personal Qualifications Statement) to:

Honorable William R. Gianelli
Assistant Secretary of the Army
(Civil Works)
Room 2E570, The Pentagon
Washington, D. C. 20310

WATER RESOURCES CONDITIONS IN NORTH CAROLINA

Statewide, most streams had above normal to excessive flows because of widespread rainfall throughout the month. Flows varied from 54% above normal conditions in the French Broad River at Asheville (Buncombe County), to 25% above normal in the South Yadkin River near Mocksville (Rowan County). Minor flooding of lowlands occurred along scattered Piedmont and Coastal Plain streams as a result of locally heavy showers on the 5th and 15th.

Ground-water levels in shallow wells rose slightly throughout the State. During December, water levels were 1 1/2 to 3 feet above normal but were 3 to 6 feet higher than levels recorded during December 1981.

. . . *U. S. Geological Survey*

NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

(Residents of North Carolina may borrow these from the Institute for a two-week period. Where individual copies are desired, readers are encouraged to request copies from the organization issuing the publication. The addresses are provided by the *News* for this purpose.)

Water Resources Planning

"Stormwater Management in Urbanizing Areas," 1983, by W. Whipple, et al., avail. from Prentice-Hall, Inc., Englewood Cliffs, NJ 07632. (HB)

"Metropolitan Water Management," 1981, by J. G. Milliken, et al., avail. from American Geophysical Union, 2000 Florida Ave., NW, Washington, DC 20009. (03)

Water Quality Management

"Chowan/Albemarle Action Plan, Agriculture-Industry-Municipalities," 12/82, by DEM, NRCD, PO Box 27687, Raleigh, NC 27611. (Chowan)

"Design and Installation of Low-Pressure Pipe Waste Treatment Systems," 5/82, by C. Cogger, et al., avail. from UNC Sea Grant College Program, 105 1911 bldg., NCSU, Raleigh, NC 27650. (05D)

Water Quantity Management

"Altered Hydrology of the Missouri River and Its Effects on Floodplain Forest Ecosystems," 11/82, by W. C. Johnson, et al., WRRC, VPI & SU, 617 N. Main St., Blacksburg, VA 24060-3397. (04A)

Miscellaneous

The following papers by the Australian Water Resources Council are avail. from the Australian Government Publishing Service, Canberra, Australia. (Foreign)

"Guidelines for the Use of Reclaimed Water for Aquifer Recharge," (WM#2), 1982, by Working Group on Aquifer Recharge with Reclaimed Water.

"The Performance of Tertiary Treatment Ponds and the Role of Algae, Macrophytes, and Zooplankton in the Waste Treatment Process," (#3), 1982, by B. D. Mitchell, et al.

"Proceedings of the Floodplain Management Conference," (#4), 5/7-10/80.

"Papers of the Groundwater in Fractured Rock Conference 1982," (#5), 8/31-9/3/82.

"Proceedings of the Workshop on Spillway Design," (#6), 10/7-9/81.

"Hydrogeochemical Study of Groundwater from an Unconfined Aquifer in the Vicinity of Perth, W.A.," (#67), 1982, by R. E. Martin, et al.

"The Ecology of a Polluted Urban Creek," (#68), 1982, by A. H. Arthington, et al.

"Management of Conjunctively Used Water Resource Systems in an Alluvial Valley," (#69), 1982, by R. B. Gates, et al.

"A Study of Regional Evapotranspiration Using Remotely Sensed and Meteorological Data--Contrasts Between Forest and Grassland," (#70), 1982, by J. N. Churchill, et al.

"Groundwater Recharge with Secondary Sewage Effluent," (#71), 1982, by K. Mathew, et al.

SPECIAL

A Shift from Water Development to Water Management: The Trend in Federal Involvement*

Warren Viessman, Jr., Senior Specialist, Congressional Research Service

The early years of the twentieth century were building years for water projects and programs. But since the 1960's, the pattern has shifted and an antagonism toward water resources development has settled in. Perception of water problems, acceptance of ways for dealing with them, political maneuvering to get water projects, definition of benficial uses of water and administrative procedures for dealing with water supply and wastewater disposal have all undergone rapid change. Furthermore, it is interesting to observe the disproportionate share of blame for inefficiency, "pork barreling," and environmental destructiveness that has been laid on water projects and programs. For when measured in dollars, the total expenditures on these constitute only about one percent of the federal budget.

The environmental movement ushered in bold new legislation on water quality control, and concurrently, citizens began looking more critically at the trade offs between water programs and those related to education, crime, and social services. The once powerful political blocks of western congressmen were weakened under the fire of eastern coalitions, which felt that they were not being fairly treated regarding location and type of water resource investments. And the list continues. In fact, during all of this time, the only constant has been the resource itself. Floods, droughts, and pollution have marched on as always. What did change radically was the focus. It shifted from the technical issues of hydrologic systems -- physical, biological, and chemical factors of water bodies -- to issues of human behavior, those associated with the presence of man and his activities.

Today the need for objective planning and management is compelling. The question is how to pull it off. It is not a matter of technology, it is a matter of human...agency...government...interest-group interrelationships. And, it is symptomatic of the pervasive institutional problem that is at the bottom of all water issues. The fragmented power systems that must be dealt with -- state, federal, local -- legislative, executive, judicial -- present more of a challenge than most care to accept.

Isolationalism in dealing with water resources issues, influences of laws and regulations, political boundaries, agency missions, financial barriers, social customs, and the belief that water is free for the taking have all interacted to create a "water crisis" aura. It is unfortunate that these human aspects of water management are so sensitive that politicians and others avoid addressing them, with the hope that if left alone, they will go away. Instead, as the refinements and evaluation procedures are argued about because they generate controversy of little scale and can be made the scapegoat for indecision and inaction.

Now there are problems of water shortage and water quality degradation, and there is a powerful technical role to be played. But the point I want to make is that in many cases, water is physically available, but locked out of use by laws, regulations, traditions, imperceptions, and other institutional mechanisms. The challenge is to take on these dragons and bring them to bay. If this is not done, local water shortages will be widespread and their correction will be costly and time-consuming.

The institutional elements of water management all have a common human thread which is emotion. It is this feature with which we must contend if we are going to use our know-how effectively. Our levels of technological understanding are sufficient to allow us to present viable alternatives for handling the tough issue; our shortcoming is in our inability to implement the solutions suggested. The voices of those who strongly oppose water development must be reckoned with and listened to. These militant groups press for curtailment of water use, emphasize nonstructural approaches, play on the selfishness of local constituencies, and are masters at creating negativism and delay. The trouble is that an organized and informed counterforce to bring the dimension of objectivity into the arena is usually lacking. The intensity of opposition to water resources programs has created an era in which both the layman and the professional rush to postponement difficult decisions in their desire to achieve short-run objectives. But someday the "piper will have to paid." Our tendency to avoid or minimize issues now will exact a substantial price.

We as a nation are technologically rich, and our level of accomplishment is high and sophisticated. But we as a human system are floundering at an elementary level, with perplexing interpersonal, intergovernmental, interagency, and related problems that drive and mold our decisions and that seem at times to eliminate all options for achievement, except those created in a scene of crisis. This is not an easy society to live in. The rate of change in its technological dimensions has been swift and mind boggling, and these changes are accelerating. Many of the institutional elements, on the other hand, are old, have not kept pace with other shifts, and are tied to policies of days gone by. The tug of war this creates is intense and debilitating. It must be resolved, however, if our future is not to be one of shortage and suffering. We know what to do, but unfortunately are too often inhibited in our actions out of fear of the short-run consequences.

Furthermore, it seems to me that we have generally been approaching the problems we face in the wrong way, or at least in a way that minimizes our chances of success. For years it was recognized that some type of regional planning was needed to bring about a cohesive type of development. Unfortunately, the failures of regional organizations that were created to do this job are legion. The lesson is that needed changes are not

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*Presented at the 11th Annual ENR Conference, Springfield, Illinois. September 21, 1982. The views expressed are those of the author and do not necessarily reflect those of the Library of Congress or any member of Congress.

going to occur unless there is strong incentive for them. Most reforms will require compromise at best, and loss for some of these involved at worst. Few panels will ever recommend a course of action that is detrimental to any of its members. What is needed, is a mechanism by which objectivity can be brought into decision-making processes on a sustained basis. Scientists and engineers have always taken pride in their objectivity in attacking problems, and that is what is needed now. Unfortunately, this objectivity has been undermined by political and social pressures. An easy route has been taken, but it is one with potentially grave consequence for the future.

The planners and managers of tomorrow must be of a new breed. Being well grounded in technology is not enough. The strict technologist looks for the best technical way out of a problem; he does not always stop to determine if that particular approach goes counter to local traditions, cannot be accommodated within a prevailing legal system, or would negate some other desired activity. To be effective, we must learn to design, manage, and plan within the context of existing physical and institutional dimensions. Otherwise, our proposals will fare poorly, and we will risk the loss of even a step-wise solution. On the other hand, we must take every opportunity to show the gains that might be achieved by lifting some or all of the constraining influences. Information of this type, laid out in simple terms, is sorely needed. If it is presented often enough, and done well, it will eventually be listened to. Given the pressures to provide water for an expanding population, increased industrial activity, energy development, food and fiber production fish and wildlife preservation, recreation, and other purposes, and given that there are strong social pressures to do all of this with minimal structural undertakings, and in a way unlike that before, an exciting opportunity exists for imaginative management, operating outside of the narrow perspectives of agencies, interest groups, and others. The tools of diagnosis and evaluation at our disposal permit prompt, in-depth evaluations of many courses of action. It is time we started to objectively examine systems already in place to see if they can be operated more efficiently, and if so, what changes would be needed to bring this about. For example, analysts have found a way to forestall the need for additional water storage facilities in the Potomac River Basin until well into the next century by optimizing the releases from existing reservoirs. Imaginative studies such as this have great promise for taking on problems all over the U.S. But to implement such findings, we must consider the total dimensions of the systems being dealt with -- physical and institutional.

Particularly troublesome are the institutional problems. They include: the conflicting purposes of state and federal water laws; the proliferation of water agencies; and the ill-defined roles of federal, state, and local governments that must be dealt with. The enormous body of environmental laws and regulations that have been produced in recent years is also troublesome. The sometimes inconsistent interpretation of these laws and regulations by federal agencies and the courts has, for example, foreclosed the construction of beneficial water projects. Furthermore, various laws and regulations have sometimes been used inappropriately as tools to derail or delay water and other types of development.

Roles of Federal, State, and Local Governments

In its 1973 report Water Policies for the Future, the National Water Commission stated that "development, management, and protection of water resources should be controlled by that level of government nearest the problems and most capable of effectively representing the vital interests involved" (1). The commission envisioned a continuing federal role in planning and financing, but believed it should gradually diminish. The report also proposed that "regional and state entities, as well as local units of government, should assume increasing roles in the control of water resource use and preservation."

President Carter's water policy reforms of 1978 included emphasis on an increasing role for the states (2). He said that his proposals were designed " . . . to enhance the role of the states, where the primary responsibilities for water policy must lie." In 1980, at the annual meeting of the National Governors Association in Denver, Governor Snelling of Vermont prescribed elimination of excessive regulation by federal agencies and greater involvement by the states in federal programs. In fact, the major theme of that meeting was the need for reassessment of the relationship between the federal, state, and local governments.

The Reagan administration has also gone on record as supporting a much strengthened role for the states in managing and developing their water resources. Unfortunately, there has been little evidence to indicate how some of the states might be able to take on added burdens such as this with their own fiscal problems. and sometimes limited technical cadres. If a successful transfer of authority is to be made, some federal guidance and technical support will certainly be required and financing options may have to be provided to permit some of the less-well-to-do states to carry on a determined effort. Conceptualizing a governmental role is easier than putting it into operation.

While much attention has been focused on the states becoming more dominant in the field of water resources, there has been much more rhetoric than manifestation at both state and federal levels of government. The states tend to blame the federal government for the lack of action, while a reverse opinion seems to flow from Washington. In truth, both share the blame and this is due in large measure to the fact that practical designs for mutual cooperation are hard to find. The issue is important, however, and if the talked about transition of authority from the federal to the state and local levels becomes a reality, significant changes in philosophy on water resources management and development will likely be the outcome.

State Water Law, Federal Reserved, and Tribal Water Rights

Many of the laws that share in allocating the nation's waters were born out of local disputes and, at the time of their design, were adequate for the task to which they were committed. Today, however, many of these have outlived their usefulness and act more as barriers than facilitators of good water management.

State Water Law. Water law can best serve those holding water rights if these rights can be defined and quantified, if the extent of third party interests can be specified, and if water rights can be transferred through the payment of compensation (3). This is easier said than done, however. The trouble is that there are no mechanisms to facilitate the sale, lease, or transfer of water rights in many states. In the East, common law water rights doctrines often forbid the transfer of groundwater from overlying land and states that regulate water by means of permit systems generally prohibit transfers. In theory, many western states can accommodate water rights transfers, but these are sometimes difficult to effect in practice (3). Adding to the difficulty is the uncertainty about possible adverse effects on third parties, which often inhibits water rights transfers even when they are legal. A mechanism to foster needed changes could be a thorough comparison of existing state laws. Such an analysis might be sponsored by the federal government to facilitate action by the states.

Federal Reserved Water Rights. Few water issues have caused more friction in state-federal relations than that of the "federal reserved right." This instrument clouds state law respecting the acquisition, control and distribution of water and permits the federal government to circumvent the states' appropriation procedures (4). The issue of these federal reserved water rights is especially important in the public land states because large quantities of water originate or flow through national forests and parks. Integrating federal reserved water rights into existing state water rights systems should be considered. Thereafter, these rights could be subject to court decrees, interstate compacts, or other institutional developments affecting the source of water involved.

Tribal Water Rights. The competition between Indian and non-Indian water rights also poses some extraordinary problems (1). Most Indian reservations predate extensive water development projects in the western United States, although the use of water in significant quantities by Indians has mostly developed in recent years.

A factor of great importance is that resource potentials of Indian reservations are often large. In the northern Great Plains, for example, most Indian lands are underlain with extensive reserves of coal and other valuable minerals, many have outstanding recreation features, and many contain large areas suitable for agricultural development (4). The tribes are concerned that water used for energy and other non-Indian purposes will adversely affect their water rights and lead to depletions of supplies critical for sustaining future economic developments on their reservations. They seek assurances that their water requirements will be properly considered in all planning scenarios.

Rational water planning is dependent upon a knowledge of existing and proposed water uses. And although current studies of water uses in the western United States have addressed the issue of Indian water requirements to greater or lesser degrees, the fact remains that the quantities involved are often unknown or in dispute.

Water Quality

According to the President's Council on Environmental Quality (CEQ), the nation's water continues to be damaged by pollution and misuse (5). CEQ cites water problems throughout the country and notes that improvements in water quality and supply are lagging due to a combination of sewer overflows, urban and agricultural runoff, overloaded sewage treatment plants, and toxic waste disposal. CEQ noted that nationwide measurements of key pollutants have showed little overall change in their levels since about 1975. In particular, CEO criticized the slow progress being made by the municipal construction grants program.

Another problem is that most water quality efforts have been directed to point sources and particular pollutants (3). The scale of the nonpoint problem is such, however, that little new progress in cleaning up our streams can be attained unless a major effort in controlling these diffuse source is mounted. The CEQ reported, for example, that sediment flows from nonpoint sources were 360 times greater than those from municipal and industrial outlets. A complicating factor is that significant amounts of sediment and other pollutants are produced naturally as well as from man's endeavors. For example, well-stocked, undisturbed southern pine forests of the Coastal Plain may be expected to yield 200 to 300 tons of sediment per square mile per year (6).

Unfortunately, the trend in water quality management in this country has been toward centralization and the imposition of uniform rules nationwide (3). Although there was a brief effort made in the Water Quality Act Amendments of 1965 to understand the nation's water courses and to relate water quality to that understanding, that approach was abandoned in favor of today's massive technologic-fix program. The time for rethinking that policy and considering the development of comprehensive approaches that can come to grips with the real issues is at hand.

Careful reexamination of the Clean Water Act is in order (4). What should our clean water goals be? How can the high cost of sewage treatment works be reduced? What is the proper role of advanced waste treatment? How can innovative options, including land applications of effluents and wastewater reuse, be encouraged and more widely implemented? What is the proper role of federal, state, and local governments and private industry?

How can realistic water quality goals be achieved other than by the present P.L. 92-500 technologic-fix restrictions and without bankrupting the nation?

Groundwater Management

Augmenting the nation's surface waters are about 50 billion acre-feet of economically accessible groundwater. Only a fraction of this is available on a continuing basis, however, and most of it is located in humid regions. It is alarming that much of the nonrenewable groundwater in the arid West is being exhausted at a rate that will cause significant reductions in total groundwater availability by the year 2000 (3). For example, the Ogallala aquifer, which supplies much needed water to the agriculturally significant states from Texas to South Dakota, is being depleted much faster than it is being replenished. Unfortunately, good groundwater management is impeded by conflicting and out-of-date laws, spotty regulations, lack of data, political sensitivity, and developmental programs oblivious to groundwater-surface water interrelationships.

There are many who believe that a national groundwater policy is needed to provide an integrating framework for decisions at all levels of government. State representatives are strong in their belief, however, that basic responsibility for groundwater use, management, and water rights determination should rest with them as it does for surface water. It has also been suggested that federal groundwater policies should be flexible so that individual basin idiosyncrasies can be accommodated efficiently.

Questions requiring answers include: How can incentives and/or penalties be used effectively to facilitate good groundwater management and encourage conjunctive use of surface and groundwater supplies? What are the principal constraints on wise use of groundwater resources? How can these be shifted? What are the nation's groundwater needs to the year 2000? What are the major threats to groundwater quality and what type of monitoring systems are needed to identify them? What legal authorities exist to address the problem and what role should EPA play? Are present institutional arrangements sufficient to meet the challenge or are new or modified structures necessary?

Urban Water Supply

A 1980 Intergovernmental Task Force on Water Policy found that about 20 percent of the nation's urban water systems might experience capital investment shortfalls by the year 2000. They noted that the capital expenditure needs for these systems could reach $110 billion, including $50 to $80 billion for replacement and rehabilitation of worn out system elements.

While there is considerable debate as to the wisdom of the federal government entering the realm of direct funding for construction and/or rehabilitation of urban water systems, escalation of interest rates, in combination with weakening tax bases in many cities, gives this problem an urgent dimension. Historically, localities have paid for their own water supplies. Can they continue to do so? This issue is not a technical one, but an institutional one involving the means to repair and maintain existing municipal water supply system elements and to finance the construction, operation, and maintenance of system expansion.

Amid general dissatisfaction with past federal policies that have nonuniformly distributed funds around the nation, there appears to be a mounting initiative to make some changes in the way that urban water resources issues are dealt with. Some recommendations being considered include:

-- Establishment of a federal policy that distributes funds more equitably, bases disbursement on need, is committed to rehabilitating existing urban water infrastructures, and is less oriented to new development.

-- Creation of a federal reconstruction bank or a water bank to issue low-interest, long-term loans to water suppliers.

-- Continuation of federal construction grants to those water treatment projects whose designs have already been approved by the EPA.

-- Making public works funds available to maintain urban infrastructures.

-- Providing federal grants for local water projects. Eligibility would be based on the merits of each case.

-- Creating a national capital budget.

-- Examining the possibility of using tax credits and leasing systems to finance infrastructure investments.

-- Allowing some federal and state intrusion into local operations of water systems. Greater efficiency, independence, creativity, and initiative might result.

-- Integrating planning and management programs for water quality and quantity.

Water Allocation

The drought of 1976-77 underscored the problems of allocating scarce water supplies for environmental enhancement, recreation, food and energy production, municipal and industrial water uses and for other competing purposes. Well known avenues of relief include additional water supply development, reduction in the quantities of water use, and better water management, but institutional constraints make it difficult to implement many of these options (8).

It must be admitted that regions that are still experiencing growth are going to need additional supplies of water. While present sources can be stretched by implementing conservation strategies, in the long run and contrary to some popular belief, growth cannot be sustained by conservation alone (9). More efficient water use practices will only reduce incrementally, not eliminate, tomorrow's water supply requirements (4).

Conservation's role in federally supported water resources programs should be determined on a case-by-case basis. It should also be considered in context with other problem-solving alternatives and not become a mechanism to delay or discourage other remedies for water problems that may be more efficient. Fortunately, specification of national or regional technical standards has not been made and, hopefully, can be avoided. Such decisions should be left to the discretion of state, local, and regional water authorities who can determine what is best for them. A uniform-fix, such as that mandated for water quality control by P.L. 92-500, could be very counter-productive (9).

These and other issues, including the coordination of water programs, water policy assessment, cost-sharing and financing of water projects,coal slurry transport, reclamation reform, and determining adequate drinking water standards are currently being considered by the Reagan administration and the Congress. What the future holds is hard to say, but it seems clear that the emphasis will be more on water management and less on the construction of new facilities. In the final analysis, the severity of water and other crises we face as a nation will depend heavily upon our ability to be "society wise" as well as "technology wise." Only then can our creativity, imagination, and technical underpinning unlock the constraining mechanisms that force us to operate far beneath the level of efficiency for which we are capable. This is the challenge. If it is not accepted, the frequently referred to "water crisis" will become a reality.

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ITEMS OF INTEREST:

AND MORE . . .

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