New Waves
The Research Newsletter of the Texas Water Resources Institute
Volume 4, Number 1, March 1991

Water for Texas Conference Participants Discuss Solutions to Non-Point Source Pollution

More than 100 researchers, agricultural chemical representatives, policy makers, and State and Federal agency personnel gathered in Lubbock in December for the Texas Water Resources Institute's 23rd Water for Texas conference.

The Conference focused on the theme of "Solutions to Non-Point Source (NPS) Pollution." Presentations that were given at the conference by Jeanne Brisken, Norman Bade, Andrew Klein and Hal Schramm are highlighted in the abstracts section of this issue of *New Waves*. Other papers will be described in future issues. TWRI will also publish a proceedings from the conference.

Some of the highlights from the Conference include the following:

- Jeanne Brisken of the EPA detailed results from the National Pesticide Survey which estimates that roughly 10% of the nation's community drinking water wells contain delevels of pesticides.
- Andrew Klein of Monsanto described results of his company's recent survey of alachlor and other pesticides in groundwater wells. Only 0.1 % of the wells showed pesticides that were greater than EPA MCLs (Maximum Contaminant Levels).
- Norman Bade of the Soil Conservation Service described a new methodology that agency will use to assess the vulnerability of groundwater systems to point and non-point source pollution.
- Hal Schramm of the Range and Wildlife Management Dept. of Texas Tech University described efforts to manage playa lakes in the Lubbock area for multiple purposes including stormwater detention, wildlife enhancement, recreation, and water supply enhancement.
- Pat Hartigan of the Lower Colorado River Authority discussed urban NPS control programs in the Austin area that are based on performance standards to remove target levels of pollutants.

Other speakers spoke of the impact of new Federal regulations on pesticide availability and use; nitrogen levels in groundwater systems; the impact of agricultural practices on ground and surface water NPS; and many others.

The Proceedings are expected to be ready later this year. At that time, ordering information will be presented in a future issue of *New Waves.*

For more information on the Conference, contact: TWRI, Texas A&M University, College Station, TX 77843 or call 409-845-1851.

New Water for Texas *Plan Emphasizes Conservation*

Water conservation and reuse are being given more attention in Texas, according to a new report by the Texas Water Development Board (TWDB).

The report, titled Water for *Texas: Today and Tomorrow, includes* TWDB water supply and demand projections and will guide water use and water development throughout the State.

The study indicates that water demand may exceed supplies by the year 2030 in some areas of Texas unless conservation programs are implemented. As a result, strategies for increasing water conservation, recycling, and wastewater reuse are included.

Some significant findings follow:

- Potential water savings due to increased conservation are roughly equivalent to 75% of the surface water expected to be developed by 2040. Without conservation, twice as much surface water would be needed.
- Water conservation programs could reduce demand by 1 trillion gallons annually by the year 2040.
- Water reuse and use of return flows should increase by 300% by 2040.
- Irrigation efficiency is projected to increase by 20% per acre by the year 2040. Conservation and other factors may reduce irrigation use from 1980 levels of 4 trillion gallons to 2.2 trillion gallons by 2000 and to 1.9 trillion gallons by 2040.
- Use of 1.6 gallon per flush lowflow toilets could save 200 million gallons.

Details are available from: Texas Water Development Board, Box 13231, Capitol Station, Austin, TX 78711 or by calling 512-463-7834.

Pesticide and Fertilizer Use in the Upper Trinity River Watershed

Researchers : B.L. Harris, Rodney Holloway and H. Dale Pennington, Texas Agricultural Extension Service, College Station, TX.

Problem: There are concerns that agricultural crop production may be resulting in increased levels of nitrate and pesticides in surface and groundwater. However, little information exists on the actual amount of nitrogen and pesticides applied in Texas and their impacts on the environment.

Objectives: To determine actual application rates of nitrogen and fertilizers in the Upper Trinity River watershed and to project potential impacts of usage of these chemicals on water pollution.

Methodology: The amount of nitrogen applied to soils in agronomic production areas was obtained by surveys of fertilizer dealers. Calculations were made to determine the amount of nitrogen removed by plants from the soil based on nitrogen content of grain or lint and crop yields. County Extension agents and specialists, in conjunction with chemical dealers and others, developed estimates of the types and amounts of pesticides that were used to produce individual crops for counties and hydrologic units. Corn was selected as an example of a major crop for this watershed.

Results: In most cases, the amount of nitrogen applied for crop production was roughly equal to the amount taken up by individual crops. This was especially true when farmers had tested their soils to determine how much nitrogen was in the soil and how much needed to be applied. For example, 1.9 Ibs. of nitrogen were typically applied to produce a bushel of wheat, while 2 Ibs. of nitrogen per bushel were removed by plant growth processes. Similar results were shown for cotton (30 pounds of nitrogen applied to produce a bale and 40 pounds removed). It should be noted that when droughts, floods, or other disasters occur and crops fail, little nitrogen removal occurs. Crops like corn and grain sorghum did not remove as much nitrogen as was applied. There was an excess of 0.8 pounds per bushel of corn produced, and 1.6 pounds per hundred weight of grain sorghum grown. This is because stalks and other vegetative parts that contain nitrogen are left in the field after harvest. Crop rotations can utilize excess nitrogen so that pollution risks are minimized. The amount of pesticides typically used each year to produce corn in the Upper Trinity River watershed include 46,000 Ibs. of Bicep (metolachlor+atrazine), 45,000 Ibs. of Aatrex (atrazine), 33,000 Ibs. of Counter (terbufos), and 25,600 Ibs. of Lasso (alachlor). These are within the application rates recommended by manufacturers.

Note: This paper was presented at the Symposium titled "How Healthy is the Upper Trinity" Oct. 2, 1990 at Fort Worth, and will be published by TWRI as part of the Proceedings. Individual copies of the paper can be obtained from TWRI.

A Method to Evaluate the Potential for Nitrate and Nutrient Leaching to Groundwaters

Researchers: Norman Bade, U.S. Department of Agriculture/ Soil Conservation Service, Temple, TX.

Problem: Nitrogen is commonly the most limiting and widely used plant nutrient in crop and forage production. However, if not carefully managed, nitrogen and nitrate can pollute surface and ground water supplies. Management strategies need to be developed and utilized to assess risks to specific soils and crop production areas from nitrogen pollution.

Objectives: To develop and utilize an easily implemented method to determine the potential for nitrogen and nutrient leaching to groundwater. This method can be used in planning efforts and as a preliminary screening tool.

Methodology: The Leaching Index (LI) is used to determine the degree to which water can percolate below the root zone in specific soils. The LI uses average annual rainfall,

precipitation from October to March, and hydrologic soils groupings to determine potential leaching risks. Soils are classified into four groups: A (high infiltration rates even when thoroughly wet), B (moderate rates of infiltration and water transmission), C (slow infiltration rates), and D (very slow infiltration rates). This information is tabulated into a LI score which reflects the vulnerability to pollution. If the LI shows that a high potential for leaching exists, follow- up studies can be conducted to develop management strategies that can lessen pollution risks. The LI was applied in test cases for Lubbock, Bexar and Leon counties.

Results: Application of LI technologies suggest that little or no potential for nitrogen or nutrient leaching exists in Lubbock County when irrigation is not utilized. If water is applied in excess of plant needs, leaching could occur. Bexar County is more susceptible to leaching, especially in A and B soil types. All soil types in Leon County have a potential for nitrogen and nutrients to leach into groundwater supplies. Note: This paper was presented at the 1990 Water for Texas Conference in Lubbock and will be published by TWRI as part of the Proceedings. Individual copies of the paper can be obtained from the Institute.

Results from The EPA National Pesticide in Groundwater Survey

Researcher: Jeanne Briskin, Director, National Pesticide Survey, Office of Pesticides and Toxic Substances, EPA, Washington, DC.

Problem: More than 38,000 community water systems (CWS) with roughly 94,600 wells and as many as 10.5 million rural domestic wells tap groundwater supplies for drinking water and other uses. Despite this, groundwater quality data are lacking, especially regarding the amount of pesticides and nitrate. Both pesticides and nitrate can cause human health problems. Knowledge about existing and potential problems needs to be developed to assess what regulations and other measures are needed to minimize health risks.

Objectives: To test groundwater quality of CWS and rural domestic wells in selected wells for pesticides and nitrate, and to use this data to estimate pesticide and nitrate levels nationally.

Methodology: Development of the statistical design for the Survey began in 1984 and pilot studies were conducted in California, Minnesota and Mississippi in 1987. Sampling for the full survey was conducted between April 1988 and February 1990. Wells were randomly selected according to rankings of agricultural pesticide use and assessments of groundwater vulnerability. EPA collected samples from 566 CWS wells and 783 rural domestic wells. Water quality samples were analyzed for 101 pesticides, 25 pesticide degradates, and nitrate.

Results: Nitrate was the most commonly detected contaminant. EPA estimates that nitrate levels are above 0.15 mg/L in roughly 52% of CWS wells and 57% of rural domestic wells nationwide. About 1.2% of CWS wells (1,130) and 2.4% of rural domestic wells (254,000) are estimated to exceed the maximum contaminant level for

nitrate of 10 parts per billion. Pesticides and pesticide residues were detected much less frequently than nitrate, although EPA estimates that roughly 10% of CWS wells and 4% of rural domestic wells contain pesticides or pesticide residues above the minimum reporting limits used in the Survey. The two most commonly detected pesticides and pesticide residues were DCPA acid metabolites (DCPA is used extensively on home lawns, golf courses, and farms to control annual grasses and broadleaf weeds) and atrazine (used to control broadleaf weeds and grasses on cropped lands). Six pesticides (atrazine, DCPA, ETU, EDP, lindane, and alachlor) were detected in rural domestic wells at amounts greater than maximum contaminant levels.

Related Publications: *National Pesticide Survey: Project Summary,* Office of Pesticides and Toxic Substances, EPA, Washington, DC, 1990.

Note: To receive a copy of the Summary, contact: EPA Office of Pesticide Programs, 401 M St. SW, Washington, DC 20460.

The National Alachlor Well Water Survey (NAWWS)

Researcher: Andrew Klein, Regulatory Affairs Manager, Monsanto Agricultural Chemicals, St. Louis, MO.

Problem: Alachlor is the active ingredient in Lasso herbicide and a variety of other herbicides to control annual grasses and certain broadleaf weeds in corn and soybeans. EPA required that Monsanto estimate the occurrence of alachor in all rural wells in counties where the chemical is used to determine if groundwater pollution is evident as part of the reregistration process.

Objectives: To estimate, with specified precision, the proportion of private rural wells with detectable levels of alachor in areas where the chemical is used.

Methodology: The NAWWS took more than 4 years to design, conduct and report. Actual water well sampling took place between June 1988 and May 1989. A complex probability sampling design was used to select wells so that unbiased estimates of alachlor occurrence could be obtained. The survey deliberately oversampled wells in areas where higher levels of alachlor might be expected. Samples were taken from 1430 wells in 89 counties in 26 states. In addition to alachlor, nitrate and four other herbicides (metoachlor, atrazine, cyanazine, and simazine) were also sampled. Information was also gathered on well construction, hydrogeologic features, farming practices, climate conditions (including drought) and pesticide usage.

Results: More than half of the rural wells in the alachlor use area are expected to contain detectable levels of nitrate. The Survey estimates that 5% of the rural wells will exceed health based standards for nitrate. Atrazine was the most commonly detected pesticide in the Survey and occurred in about 12% of the rural wells. Simazine is expected to be present in about 1.5% of the rural wells. Metolachor is expected to be found in about 1 % of the rural wells. Alachlor is expected to be found in 0.8% of the rural wells and only 0.03% of those wells are expected to exceed levels of 1 microgram per liter. Only 0.02%

of the private wells are expected to exceed the maximum contaminant level (MCL) for alachlor. Drinking water with pollutants at or below the MCL is considered safe for human consumption by the EPA. Cyanazine is estimated to occur in only 0.028% of rural wells nationally.

Note: This paper was presented at the 1990 Water for Texas conference in Lubbock, and will be published by TWRI as part of the Proceedings. Copies of the Summary can be obtained from: Monsanto Agricultural Chemicals, 800 N. Lindbergh Blvd., St. Louis, MO 63167.

A Water Quality and Ecological Survey of the Trinity River

Researchers: Ken Dickson, William Waller, and James Kennedy, Institute of Applied Science, University of North Texas, Denton, TX; Ray Arnold, Exxon Biomedical Sciences, East Millstone, NJ, and Jerry Hall, Texaco Research Laboratories, Port Arthur, TX.

Problem: Although the Upper Trinity River has historically been plagued by pollution and fish kills, recent improvements in wastewater treatment have increased dissolved oxygen levels and have lowered biochemical oxygen demand (BOD), suspended solids and ammonia loadings. Now, several new issues are emerging including determining potential uses for the river (should the river be made safe for swimming and fishing, for example), control of nonpoint source pollutants, and the use of biological monitoring to gauge water quality. Comprehensive assessments of the water quality and biology of the river are needed to make such decisions.

Objectives: To document the spatial and temporal distribution of fish and benthic macroinvertebrates, to characterize the chemistry and biology of sediments, and to assess the toxicity of water and sediments in the Upper Trinity River. Also, to develop a data base which can be used to better understand relationships between point and nonpoint loadings to the river and fish kills which have occurred.

Methodology: The survey was conducted by the University of North Texas and the University of Texas at Dallas from August 1987 to December 1988. Twelve sampling stations were established on the Trinity River and its Elm and East Forks from above Ft. Worth to Lake Livingston. Tests to analyze water quality, sediments, fish tissues, and ambient toxicity were taken on a quarterly basis. Fish populations were collected quarterly using seines, electroshocks, and gill nets.

Results: A diverse number of fish and benthic invertebrate species were present in the river, especially upstream of Fort Worth and on the Elm Fork. The number of fish and benthic invertebrate species declined immediately downstream of wastewater treatment plant discharges and recovered somewhat further downstream. Results of biomonitoring studies using daphnia suggest that the ability of these species to reproduce and survive is also most limited immediately downstream of wastewater treatment plants. The greatest toxicity was exhibited during low flow periods. Sediments of the river were generally found to be non- toxic. Regression analysis of selected biological and chemical

parameters suggests that the diversity of fish species is likely to be low when levels of municipal effluents are high.

Related Publications: Dickson, Ken, et al., A *Water Quality and Ecological Survey of the Trinity River*, Institute of Applied Sciences, University of North Texas,1989.

Note: This paper was presented at the 1990 Symposium titled "How Healthy is the Upper Trinity River" that was held at Texas Christian University in Fort Worth Oct. 2, 1990, and will be published by TWRI as part of the Proceedings.

Incorporating Wildlife, Fishing and Recreation into Lubbock's Management of Playa Lakes

Researchers: Harold Schramm, and Loren Smith, Dept. of Range and Wildlife Management, Texas Tech University, Lubbock, TX; Tony Mollhagen, R. Heyward Ramsey, and Lloyd Urban, Water Resources Center and Civil Engineering Dept., Texas Tech University, Lubbock, TX and Russell Black, Parks and Recreation Dept., City of Lubbock, TX.

Introduction: In 1977, the City of Lubbock created a series of four small lakes in Yellowhouse Canyon called the Canyon Lakes that capture runoff to reduce flooding. In addition, Lubbock also pumps groundwater from a site where wastewater irrigation is practiced to provide supplemental water for the lakes. Lubbock also contains numerous naturally occurring playa lakes which would normally help contain stormwaters. However, urbanization has increased the amount of impervious cover and has increased the volume of stormwater runoff. Modification of urban playas has also reduced their capacity to hold stormwaters and has led to rising groundwater tables. It has also been proposed that excess water be pumped from beneath urban playas to the Canyon Lakes. While managing both the Canyon Lakes and the playas to reduce flooding risks is essential, efforts have also been made to improve conditions for fisheries, waterfowl, and recreation.

Objectives: To improve management of Canyon and playa lakes to reduce flooding as well as to improve conditions for aquatic waterfowl, fisheries, and recreation.

Current and Past Studies: Numerous water quality studies have been conducted on such issues as the quality of Lubbock's urban stormwater, the impact of pumping groundwater from the wastewater irrigation site, and others. Since 1987, researchers from Texas Tech have worked with the City of Lubbock and the Texas Parks and Wildlife Department to initiate a Fisheries Improvement Program (FIP) to create better recreational fishing opportunities in the Canyon Lakes and 15 urban playas. Efforts of the FIP have included improvements of warm water fisheries, stocking of rainbow trout, education programs and other activities. Research efforts are now underway to develop management strategies to improve conditions for aquatic waterfowl and recreation.

Results: Catfish were the species most preferred by Lubbock fishermen, and fingerlings have been stocked at rates of 100 to 200 fish per acre into all the lakes during the past 3

years. Fisheries for large mouth bass (the second most preferred species) are now being established in 12 lakes by stocking fingerlings. Catchable size (8 to 11 inches) rainbow trout are stocked in lakes from November to January. These fish are caught until April. Because of the stocking programs, the amount and rate of catfish and rainbow trout caught has increased. However, the improvements of the large mouth bass fishery are less evident. Most waterfowl utilize Lubbock's lakes during fall, winter and spring. Studies suggest that ducks and geese can benefit if some vegetation is maintained on the shores of playas, if islands are built, and if artificial nesting structures are provided. Although swimming is not allowed in any of the lakes, activities such as wind surfing have been promoted on one playa lake.

Note: This paper was presented at the 1990 Water for Texas Conference and will be published as part of the Proceedings. Individual copies are available from TWRI.

Brazos River Authority Working to Stabilize Dam That Slipped 4 Inches Downstream

When the Morris Sheppard Dam moved 4 1/2 inches downstream, it created the need for a series of major repairs. The Brazos River Authority first learned of the shift during a routine dam safety inspection in 1987.

The dam, located west of Fort Worth at Possum Kingdom Lake, is the largest flat slab buttress dam in the U.S. The technology uses the weight of the dam and the force of impounded water to stabilize the structure.

A crack developed that was 200 feet long but only 2 inches wide in an upstream cutoff wall. The cracks allowed water to enter portions of the shale foundation of the dam and made the dam more vulnerable to sliding.

To repair the dam, lake levels first had to be lowered by 13 feet. Workers then had to drill 8foot diameter holes through the dam's 9- foot 5 thick hollow concrete buttresses. It took five days of around the clock work to drill through each one. That provided an opening for workers to place 72,000 cubic yards of concrete and 66,000 cubic yards of crushed rock inside the dam to add ballast and reduce slippage. 87,000 cubic yards of concrete still need to be added. In addition, 144 wells were drilled below the dam to reduce water pressure. The $34 million repair job (nearly four times the original cost of building the dam) is scheduled for completion this year.

Tough Controls for Non-Point Source Pollution, Sedimentation, Proposed for Austin

Austin is proposing some of the strictest measures in Texas to control non- point source pollution, runoff and sedimentation problems which now plague regional lakes and rivers.

The City of Austin is considering a "zero degradation" policy which would prevent non-point source pollution from areas that provide recharge to Barton Springs. The draft proposals would require developers to demonstrate that they would not increase rainfall runoff pollutants over existing levels, and would limit the amount of land which could be paved to 18 to 30% in individual developments. The proposed restrictions could also apply to golf courses and could result in the application of "xeriscape" concepts (use of more resource efficient plants and lesser amounts of pesticides). Last year, the Lower Colorado River Authority (LCRA) enacted tough performance- based standards to control runoff and sediment transport.

The need to control NPS pollutants and sedimentation is no more apparent than in the Highland Lakes, just north of Austin. Recent reports suggest that silt formed islands and sand bars continue to strangle parts of Lake LBJ and Lake Buchanan. In some parts of Lake Buchanan, water that was 10 feet deep a few years ago is only 1 1/2 feet deep now, the depth of the lake has been reduced by up to 40 feet, and many boat docks are now unusable. It will take up to $6.8 million to dredge portions of the lakes and make them navigable. Traps and other silt blocking structures could cost an extra $4 million.

Beaumont, Whitney, to Use Wetlands, Marshes to Treat Wastewater, Improve Wildlife Habitat

The use of aquatic plants to treat wastewater seems to be an idea that is catching on in many areas of Texas. For example, Beaumont and Whitney are just two of the cities that are considering using wetlands to improve their wastewater treatment.

In Beaumont, wetlands and marshes are being used to improve the quality of wastewaters. Cattails and bulrushes will be placed in 600 acres of holding ponds to increase the amount of dissolved oxygen and to reduce ammonia levels. The effluent will then flow to a 300-acre natural marsh and swamp for additional treatment. That area will also serve as a wildlife preserve that will be open to the public. This system also helps Beaumont satisfy Federal regulations that prohibit net losses of wetlands acreage.

In Whitney, just outside of Waco, a new facility is being built that will use aquatic plants and microbes to treat wastewater. Sewage will run through three 860-by-128 feet lagoons where wastes will be consumed by microorganisms that will be added to the water. As the water leaves the last lagoon, it will pass through a rock and gravel filter. There, roots of reed plants penetrating the filter will trap and feed on organic matter in the water. This system is based on NASA research in Mississippi and has been successfully used in Louisiana.

Effluents will be discharged to a nearby creek. The project will cost roughly $1 million but a government grant will pay for a fourth of the cost. Operating costs of the system are expected to be low because it will use no electricity.

Coastal Creek Showing Slight Signs of Recovery Despite Brine Discharges, TWC Says

For more than 50 years, oilfield brine 50 times more saline than natural in-stream conditions, has been discharged into Petronilla Creek which feeds into Baffin Bay. When the pollution was stopped in 1987, it provided an excellent case study to see how quickly ecosystems can recover following such long- term damage. Frank Shipley, now the Director of the Galveston Bay National Estuary Program at the University of Houston at Clear Lake, conducted the study for the Texas Water Commission. The brines altered the ecosystem by introducing toxic and cancer- causing chemicals and made much of the stream more, saline than ocean waters. These impacts reduced and eliminated many freshwater species. As a result, only brackish- and salt- tolerant species such as sheepshead minnows, gulf killifish, and sailfin mollies inhabited the saltimpacted areas in any appreciable numbers. The saline water also introduced species into the stream which usually live in estuaries.

Now that the brine discharges have ceased, some improvements have been noted in a limited part of the stream. The diversity of aquatic species has increased, in particular in areas where salinities have decreased and dissolved oxygen and pH levels have increased. Two thirds of the stream are still plagued by problems associated with saline water.

An article on the study, "Oil Field Brines in a Coastal Stream" was featured in Vol. 43, No.1 (1991) of the *Texas Journal of Science.* For details, contact: Frank Shipley at the Galveston Bay National Estuary Program at 713-283-3950.

Recharge Dams Could Boost Recharge to Edwards Aquifer; Management Plan Outlined by TWC

Constructing recharge dams along the western edge of the Edwards Aquifer could significantly increase groundwater supplies, according to a new study.

The study evaluated 19 potential sites for recharge dams in the Nueces River Basin. Two types of dams were considered. Type 1 dams are "catch and release" structures that are located upstream of the recharge zone and release water downstream. Type 2 dams are located within the recharge zone and usually will store water for up to a month before releasing it. When all existing water rights were honored, recharge could be increased by an average of 85,000 acre feet (AF) per year if 7 Type 1 dams were built, and by an average of 62,500 AF annually if 12 Type 2 dams were constructed, the study said. The Nueces River Authority, the City of Corpus Christi, the Edwards Underground Water District (EUWD), the South Texas Water Authority and the Texas Water Development Board participated in the study.

Meanwhile, the Texas Legislature's Special Committee on the Edwards Aquifer has produced a draft management plan for the region. This report suggests that best way to manage the Aquifer may be to implement a regional planning council. The Council would guide the planning, development, and management of the Edwards Aquifer, the

Nueces, San Antonio and Guadalupe rivers, and associated bays and estuaries. Members of the planning council would be appointed by the Governor. Sub-units of the council would conduct the day-to-day management of the region's water supplies including agricultural, bay and estuary, municipal, and spring and downstream flow issues. If approved, the Council would also take over many of the management functions of existing river authorities and water districts in the region. As a result, it has generated opposition from many of those groups. The Committee was cochaired by Senator Cyndi Krier and Representative Terral Smith.

A few other issues also need to be briefly noted.

The Lone Star Chapter of the Sierra Club has said it plans to file a lawsuit to force federal management of the Aquifer. The Club charges the U.S. Fish and Wildlife Service (USFWS) is neglecting its duty to protect endangered species in Comal and San Marcos Springs.

Meanwhile, the Bexar Metropolitan Water District is now negotiating to purchase excess water from Medina Lake. The EUWD had earlier tried to purchase as much as 30,000 AF of Lake water on an annual basis.

Finally, the USFWS is requesting that another environmental study of the impact of Applewhite Reservoir needs to be conducted to determine if freshwater flows to bays and estuaries could be damaged by the dam. USFWS had earlier sought a study on the impact of the reservoir on spring ecosystems.

Fort Worth Goes Into Storm Drains to Stop Non-Point Source Pollution

One of the most frustrating aspects of combatting urban non-point source pollution is trying to isolate the specific sources of contaminants. The City of Fort Worth has come up with a unique and successful solution-- they're sending workers into storm drains to ferret out the contaminants.

The program works like this. Storm drain discharges are monitored monthly for the presence of "undesirable features" such as sewage bacteria, changes in water color, fish kills, water clarity, pH, surface scum and the presence of oil and grease. The monitoring is used as a screening tool to determine if more in-depth studies are needed. In many cases, that involves entering the storm drains with a video camera and representatives of the polluting companies to see first hand where problems exist.

The program is showing signs of success. The number of undesirable features detected each month has dropped from 60 in 1985 to less than 10 currently. Significant reductions have been noted in odor, color, oil and grease, and ammonia levels. Since 1985, more than 572 sources of nonpoint source pollution have been corrected.

Fort Worth has developed a video and a handbook with details about the program. For information, contact Gene Rattan with the Fort Worth Health Dept. at 817-870-7281.

Cumulative Index to New Waves *Now Available*

Finding articles which have appeared in previous issues of New Waves will now be a little easier. The Texas Water Resources Institute has compiled a subject and author index to the first three volumes of New Waves. The subject index, for example, contains 51 categories including such diverse topics as acid rain, agriculture, wastewater reuse, legal and policy issues, hazardous wastes, pesticides, and many others. In the future, the index will be updated quarterly.

To receive a free copy, contact: Ric Jensen, Editor, *New Waves,* Texas Water Resources Institute, Texas A&M, College Station, TX 77843-2118 or call 409-845-8571.

Need for Coastal Management Plan Outlined in Texas A&M, General Land Office Reports

Policy recommendations that could lead to the creation of a Texas Coastal Management Plan are detailed in new reports by the Office for Strategic Studies at Texas A&M University and the Texas General Land Office (GLO).

Texas is one of the few coastal states without a management plan. Creation of such a plan could provide for additional Federal funding for shoreline protection and rehabilitation programs.

The recommendations include increasing the use of dredged materials and revegetation programs to replenish eroded areas; requiring that new dams built in coastal areas be equipped with sediment bypassing systems; preparing a statewide wetland conservation plan; and developing a trust fund to purchase environmentally sensitive beaches and coastal areas.

Many of the recommendations were developed with the help of Tom Bonnicksen of the Parks and Recreation Department of Texas A&M University.

Bonnicksen has developed a method called the Alternative Futures Assessment (AFA) process to help participants develop natural resource policy recommendations. The AFA process uses workshops in which diverse groups identify future trends and evaluate strategies to deal with those trends. An expert system simulates the consequences of those policies.

The recommendations and the AFA Process are described in three reports titled *Strategies for Managing Shoreline Erosion and Dune Protection, Strategies for Managing Wetlands,* and *Strategies for Managing Beach Access.* Single copies can be obtained by calling Bonnicksen at 409- 845- 6098.

Many recommendations from the AFA Process were adopted by the GLO after public hearings. Those policies are outlined in a new report titled *The Texas Coastal Management Plan.* Details on this report are available by contacting the GLO at 512-463- 5001.

Updated National Survey of Water, Wastewater Rates Is Now Available

A handy guide that compares water and sewer rates, billing structures, onetime connection fees, and additional charges and discounts across the U.S. is now available.

The report, 1990 *National Water and Wastewater Rate Survey*, includes information from Dallas, Houston, Austin, San Antonio, Corpus Christi, El Paso, Fort Worth, and Beaumont as well as numerous other major cities. The report shows, for example, that monthly water charges range from a low of $18 for 3,000 cubic feet of residential water in Dallas to a high of $53 for that same amount of water in Ft. Worth. Industrial water supplies are least expensive in San Antonio and most costly in Austin.

Individual copies of the report are available free from: Ernst and Young, 1100 Independence Ctr., Charlotte, NC 28246 or by calling 704-372-6300.

Survey Details Texas Groundwater Districts

Detailed information on Texas groundwater districts is contained in a new book from the Texas Groundwater Conservation Districts Association.

A Survey of District Activities includes information on financing methods, rate structures, well permitting and spacing, the statutory authority that created the district, whether water quality testing and monitoring is being conducted; local regulations to control nonpoint source pollution, and other data. Maps of the service area for each district are also provided.

To order, contact: Bill Couch, Barton Springs-Edwards Aquifer Water Conservation District, 1124-A Regal Row, Austin. TX 78748 or call 512-282-8441.

Baylor, SW Texas State Researchers Contribute to Reservoir Limnology

Reservoir Limnology - Ecological Perspectives offers an analysis of reservoirs as aquatic ecosystems that share many basic similarities with natural lakes, but still differ in a number of important ways.

Two of the nine chapters were written by Texas researchers.

Herbert Hannan of the Aquatic Station at Southwest Texas State University coauthored a chapter on dissolved oxygen dynamics.

Owen Lind of the Baylor University Biology Department co-wrote a chapter discussing reservoir primary production.

Other topics addressed in the book include reservoir transport processes, nutrient dynamics, perspectives on fish populations, and sedimentary processes.

To order, contact: John Wiley & Sons at 201-469-4400.

Geological Survey Reports Cover Edwards Aquifer, El Paso Recharge Project

A number of new reports are available from the U.S. Geological Survey.

Potentiometric Surface of the Edwards Trinity Aquifer System and Contiguous Hydraulically Connected Units by Eve Kuniansky (WRI 89-4208) describes groundwater flow patterns and includes a map of potentiometric flow patterns in the region. *Summary of Data from a Pilot Study and Operations the Hueco Bolson Recharge Project* (OF 90175) by Don White and Gail Sladek describes El Paso's efforts to supplement groundwater supplies through recharging treated wastewater into the Hueco Bolson Aquifer. *Guidelines for Collection and Field Analysis of Water Quality Samples from Streams in Texas* (OF 90127) was written by Frank Wells, Willard Gibbons, and Michael Dorsey. It contains standardized procedures for field analysis and water quality data collection. *Salt Dome Locations in the Gulf Coastal Plains in the South Central* U.S. was written by Jeff Beckman and Alex Williamson (WRI 90-4060) identifies the properties of numerous salt domes and assesses their impact on the salinity of groundwater supplies in many areas of Texas.

To order any of these reports, contact: U.S. Geological Survey, 8011 Cameron Rd., Bldg. 1, Austin, TX 78753 or call 512-873-3020.

Water Protection Needs Outlined in Outdoor Recreation Assessment

A number of policies that could be implemented to prevent the degradation of recreational waters and coastal resources, as well as strategies to improve river based recreation, are included in the *Texas Outdoor Recreation Assessment and Policy Plan.* The plan was produced by the Texas Parks and Wildlife Dept.

The Plan recommends, for example, that increased emphasis be placed on water quality monitoring and research to protect water resources and that a coastal management plan be developed to guard against erosion on beaches and coastal areas. Some of the strongest proposals come in the area of river management. The Plan recommends that comprehensive assessments of river resources be performed that include water quality and water supplies, wildlife species, natural areas, development status, and other factors. That information could be used to help determine which river segments need to be protected or left undeveloped.

For details, contact: Comprehensive Planning Branch, Parks Division, Texas Parks & Wildlife Dept., Austin, TX, 78744, or call (512) 389- 4900.

Texas A&M Geologist Co-Authors Physical and Chemical Hydrogeology

Texas A&M Geology Professor Patrick A. Domenico and Franklin Schwartz of Ohio State University have co-authored *Physical and Chemical Hydrogeology.* Published by John Wiley & Sons, this 824-page book covers numerous topics, including groundwater

flow patterns, contaminant hydrogeology, the role of groundwater in the hydrologic cycle, and remediation techniques to clean up polluted aquifers.

Individual chapters focus on models; methods and applications of hydraulic testing; solute and particle transport; aqueous geochemistry and other topics.

To order, contact: John Wiley & Sons, 605 Third Ave., NY, NY, 101580012 or call 201-469-4400.

Corps of Engineers Study Describes Impact of 1990 Floods on Texas

Last spring's floods, especially on the Trinity and Red rivers, were some of the worst in Texas in recent memory. Now the U.S. Army Corps of Engineers, the Federal agency that is primarily responsible for flood control, has summarized its findings in a new publication titled *Report on Flooding: April-May 1990*.

Chapters estimate flood losses by county and document damages prevented by Corps of Engineers reservoirs and other flood control projects. Several graphs and charts detail rainfall patterns, river flows, and flood damages.

For details, contact the U.S. Army Corps of Engineers, 819 Taylor St., Fort Worth, TX, 76102 or call 817-334-2196.

TWC Publications Deal With Urban Water Losses, Flood Hazard Guidelines

Several new publications are now available from the Texas Water Commission.

A Guidebook for Reducing Unaccounted-for Water outlines recordkeeping, leak detection, and meter testing and selection. The book includes worksheets to monitor leak detection and costs of operating such programs. *Flood Hazard Evaluation Guidelines for Texas State Agencies* (LP 90-07) includes floodplain construction standards established by the Federal Emergency Management Agency. Evaluation of dissolved oxygen impacts is the subject of *Waste Load Evaluation for the Sulphur/South Sulphur, North Sulphur, and Upper South Sulphur Rivers in the Sulphur River Basin* (WLE 90-05). The purpose of the evaluation is to define wastewater treatment levels and effluent limitations that will help receiving waters meet dissolved oxygen criteria through the year 2000. *Relationships Between Toxicity Test Results and In-Stream Biological and Physiochemcial Impacts for a South Texas Coastal Stream Receiving Chemical Plant Wastes* (Report 90-01) characterizes impacts on receiving streams from a single point source industrial discharge. The report suggests in-stream ecological studies can be used as an initial determination of whether pollution exists, and as a rationale to decide if toxicity testing is required.

To order any of these publications, contact The Texas Water Commission, P.O. Box 13087, Austin, TX, 78711-3087 or call 512-463-7834.

Edwards Aquifer Data, Sampling Manual, Available from TWDB

A new report on the Edwards Aquifer and a field manual for groundwater testing are among the new reports available from the Texas Water Development Board (TWDB).

Test Well Drilling Investigation to Delineate the Downdip Limits of Usable Quality Ground Water in the Edwards Aquifer in the Austin Region (Report 325) quantifies the Edwards aquifer in the Austin region. The study also evaluated TWDB's new geophysical sonic tool and its ability to interpret formation porosity in a carbonate aquifer.

A Field Manual for Ground Water Sampling (UM-51) was prepared to standardize TWDB's sampling program. The guide describes the groundwater sample collection and chemical characterization procedures to be followed during field sampling events by TWDB personnel and others.

TWDB has also produced *The Texas Water Education Network Directory,* which lists information sources about water issues that teachers can use.

For details, contact the Texas Water Development Board, P.O. Box 13231, Capitol Station, Austin, TX, 78711-3231 or call 512-463-7834.

SMU Monitoring Shows Acid Rain, Air Pollution, Getting Worse in Dallas

A long- term monitoring study at Southern Methodist University shows that acid rain and air pollution are both getting worse.

George Crawford of SMU's Physics Dept. has headed the Acid Deposition Project since 1984. The project measures air pollution and the acidity of Dallas- area rainfall since 1984.

Results show that the amount of rainfall with a pH of 4.6 or less jumped from 11 % in 1985 to 52% in 1990.

A number of factors may be behind the increase. The amount of sulfur dioxides (SO2) in Dallas' air has increased 155% since 1983 and 123% just since last year, Crawford's data show. Sulfur compounds are major contributors to acid rain. Many of the more acidic rains may be coming from industries and coal burning power plants south and southeast of Dallas. These air masses can also bring in acid forming molecules during dry periods.

Crawford thinks more accurate acid rain data needs to be generated. He recommends that sites to measure acid rain levels be established in urban and other highly polluted areas of Texas. For details, contact: George Crawford at SMU at call 214-692-2498.

Raw, Undercooked Shellfish May Pose Health Threat Despite Monitoring Efforts, According to UT-MB Study

Even though the Texas Department of Health monitors clams and oysters for the presence of fecal coliforms, consuming these shellfish raw or uncooked may still make you sick, according to researchers at the University of Texas Medical Branch (UTMB) at Galveston.

Charles Gray and Norman Trieff of UTMB's Dept. of Preventative Medicine and Community Health are investigating the problem. The problem, the researchers say, is that the absence of fecal coliforms does not guarantee that growing waters and harvested shellfish have not been contaminated by pathogens such as *Vibrio,* heavy metals or other disease causing substances. Improper handling of shellfish by wholesalers and retailers can also create disease problems.

Until tests to detect other diseasecausing agents can be developed and implemented, the best advice may be to avoid raw and undercooked oysters and clams. An article on the subject, "Biological Monitoring of the Texas Shellfish Industry," was featured in Vol. 42, No. 4 of the *Texas Journal of Science.* For more details, contact: Charles Gray at UT-MB at 713- 761- 2551.

Texas' Hot Water May Keep Zebra Mussels Away, UT-Arlington Researcher Says

Since it was introduced to the U.S. in 1985, the zebra mussel has been wreaking havoc at water treatment plants, power plants, and distribution systems in the Great Lakes. The freshwater bivalve and its larva attach themselves onto hard surfaces such as intake structures, cooling towers, heat exchangers, and fire protection systems. The zebra mussel reduces flows and increases corrosion and sedimentation.

Many utilities are now trying to cope with and control the mussel by a variety of means. In some cases the mussels have to be scraped and removed from pipes, either manually, with high pressure water jets, or through high-tech robots. Other ways to get rid of the mussels include toxic biocides, use of chlorine, exposure to high voltage electrical fields, and others. Any way you look at it, dealing with the mussels is expensive and time consuming.

Fortunately, Texas may get to avoid the problems the zebra mussels are causing, according to Robert McMahon, a professor of Biology at the University of Texas at Arlington (UT-A). McMahon also heads the Center for Biological Macrofouling Research at UT-A.

He said the zebra mussels do not tolerate high temperatures and cannot reproduce when water temperatures are as high as 79- 81 deg. F. He doubts the mussels can survive in areas like Texas where summer water temperatures climb as high 90deg. F. McMahon has also evaluated the use of different chemical agents and other methods to control zebra mussel populations.

For more details, contact: Robert McMahon, Biology Dept., UT- Arlington, Arlington, TX 76019 or call 817-273-2412.

Galveston Bay Studies Emphasize Point, Non-Point Source Pollution, Economic Impacts

Galveston Bay is one of Texas' most vital and vulnerable aquatic resources. Now researchers from Texas universities are getting an opportunity to investigate many aspects of the bay ecosystem through the Galveston Bay National Estuary Program (GBNEP) . The GBNEP is a joint venture of the Texas Water Commission and the Environmental Protection Agency and is headquartered at the University of Houston at Clear Lake.

Examples of recent projects funded by the GBNEP include a study of point sources of pollution by the University of Texas at Austin and a study of nonpoint source pollution by Rice University.

The UT study is headed by Neal Armstrong of the Civil Engineering Dept. and George Ward of the Center for Research in Water Resources. They are compiling existing information, calculating pollution loads, and isolating the amount of pollution generated in each bay segment by individual dischargers. The goal is to develop a long-term data base and to determine if gaps in the data exist. This information will help identify emerging trends on point source pollution loads and assess potential problem areas.

Meanwhile, non-point source (NPS) pollution is the focus of a study by Phil Bedient and Hanadi Rifai of the Environmental Sciences and Engineering Dept. at Rice University and Charles Newell of Groundwater Services Inc. This project will use Geographic Information Systems to assess the location and relative contribution of various NPS pollutants entering the bay. The study area includes most of the Galveston Bay watersheds, but does not include the areas draining into Lake Houston and Lake Livingston. Runoff estimates will be generated using loading rates from the EPA National Urban Runoff Program and other models developed by Rice for Houston watersheds. The impact of two different levels of storm events will also be simulated.

Economic and sociological studies are also under way. Roger Durand and Richard Allison of the School of Business and Public Administration at the University of Houston at Clear Lake are gauging the economic value of bay activities, the amount that certain user groups depend on the Bay, and demographic trends such as increased urbanization which could put increased pressure on the Bay. Durand and Allison previously conducted a study for the GBNEP in which they characterized public attitudes and perceptions about the Bay.

For more details on any of these projects, contact: Galveston Bay National Estuary Program, University of Houston at Clear Lake, 2700 Bay Area Blvd., Houston, TX 77058 or call 713-283-3950.

TAES-Dallas Facility Will Measure Runoff from Urban Landscapes

Scientists and regulatory agencies are focusing increased attention on rural and urban non-point source (NPS) pollution, but there's been scant data on how much urban landscapes are contributing to pollutants in runoff.

A new facility at the Texas A&M University Research and Extension Center at Dallas is designed to shed some light on these processes. Twenty landscapes, each comprised of two-thirds turfgrasses and one-third shrubs, have been constructed at the Center. Each of the 150-square-foot plots will be instrumented to measure runoff and water quality from irrigation or rainfall events.

Billy Hipp of Texas Agricultural Experiment Station is working closely with the system. He says the facility may improve our understanding of the contributions of urban landscapes to NPS pollution and may aid in developing management strategies to reduce runoff.

For details, contact: Billy Hipp at the Texas A&M Center at 214-231-5362.

GIS Method May Make It Easier to Rank Sites for Stormwater Detention Basins

Stormwater detention basins are a technique to control non- point source pollution and runoff, but identifying the best sites for them has always been time consuming and difficult.

However, by using Geographic Information Systems (GIS) and remotely sensed images, the process can be simplified and more accurate results can be obtained, according to research at the University of North Texas (UNT).

Sam Atkinson of UNT's Institute for Applied Sciences conducted the studies on the Upper Trinity River flood plain in the Dallas- Fort Worth area. Information on land uses and flood plain profiles were input from aerial photography. Criteria were then established for optimal sites for the basins. They had to be within the standard project flood plain, but outside the 25-year flood plain (maintenance costs would be too high if the area flooded too often). The basins also had to be within a 1/2 mile of a tributary and no more than 4 miles from where the stream met the Trinity River. Finally, residential, transportation and commercial lands were removed from consideration. Each of the criteria was individually applied for each tributary in the study area.

The results were encouraging. Although 21 watersheds drain into the Trinity, only seven had no obvious limitations that could prevent a stormwater detention basin from being located there. This type of study could be used in the future, Atkinson says, in other areas as a screening tool.

For additional details, contact: Sam Atkinson at 817-565-2694.

Learning More About Wells Along "Bad Water Line" is Goal of Abilene Christian University Study

The Edwards Aquifer's "bad water zone" is a much studied hydrogeological no-man's land. Generally speaking, water quality is excellent north of the zone. South of the zone levels of total dissolved solids increase markedly and water quality deteriorates.

The bad water zone has been extensively studied previously because there are fears that more areas could be threatened by poor quality water if the aquifer falls to dangerously low levels.

Despite the fact that many studies have been undertaken on the bad water zone and its characteristics, the data still needs to be integrated and interpreted.

Hughbert Collier, a researcher in the Geology Dept. at Abilene Christian University, is now working on such a study for the Edwards Underground Water District.

Collier's project involves examining transects of the bad water line at six wells in San Antonio, New Braunfels and San Marcos. The work will focus on understanding factors that control porosity, hydraulic conductivity, and well yields. The research will involve making thin sections of rock cuttings from each well. The sections will be studied under a petrographic microscope and photographed and analyzed for porosity and other factors.

Wireline logs will be normalized, processed, and integrated with other data. Pump tests will be used to interpret the logs and the cuttings.

For details, contact: Hughbert Collier, Geology Dept., Abilene Christian University, Abilene, TX or call (915)674-2736.

Institutional Barriers to Use of Novel Hazardous Waste Treatment Techniques Investigated by UH

New and innovative approaches to treat pollutants and hazardous wastes are being investigated by many scientists. But, once these novel technologies are developed in the laboratory, can they be put into practice? That's the issue being addressed by a University of Houston study.

Sanford Gaines and David Duncan of the Law Center and Jack Matson and Beth Ayer of the Environmental Engineering Department are leading the research. The project will analyze existing laws and regulations which discourage and encourage the use of new treatment technologies. Two recent Texas proposals to dispose of hazardous wastes in caverns mined from salt domes will be examined as case studies.

For details, contact: Sanford Gaines at 713-749-1393.

On-Site Wastewater Treatment Council Funds 2 Projects; Now Accepting Proposals

The On-Site Wastewater Treatment Council receives funding whenever septic tanks are installed. Those monies are then made available to fund research, technology transfer, and demonstration projects at Texas universities.

Only university scientists are eligible to apply and no matching funds are required. Unsolicited proposals are now being accepted and reviewed on a regular basis.

Recently, the Council announced that it will fund its first two projects. Anthony Tarquin of the Civil Engineering Dept. at the University of Texas at El Paso is investigating a project titled "Effectiveness of an On-Site Filter for Treating Household and Other Small Waste Flows." The study will monitor drainfields from four houses with different septic tank designs. Howard Liljestrand of the Civil Engineering Dept. at the University of Texas at Austin is carrying out a study titled "Analyses and Evaluation of Caliche Soils for On-Site Wastewater Treatment Capabilities." That project will involve determining how well wastewaters percolate into caliche and whether clogging develops.

For details about the Council, contact: Yusuf Farran, Texas Dept. of Health,1100 W. 49th, Austin, TX 78756 or call 512-458-7243.

TWRI Offers New Institute Fellowship Program

The Texas Water Resources Institute is now accepting applications for its new Fellowship program. The program is open to Ph.D. candidates who are entering Texas A&M University for the first time. All water-related disciplines are eligible.

Fellowships will be awarded on a competitive basis and Institute Fellows will receive a stipend of $4,000 per year plus $1,000 for research support for a total of 3 years. Those funds are contingent upon students maintaining high academic standards and conducting appropriate research.

Applicants must have an entering GPR of 3.30 and a GRE score of at least 1250. Texas A&M University graduate advisors should forward copies of the application to the Institute with a statement that the department will offer the applicant a half-time assistantship and a description of research to address a priority water problem of the State. Selections will be made by an intercollegiate committee of faculty. Applications will be accepted at any time, but will receive most favorable consideration if received as soon as possible. Applicants must be citizens or permanent residents of the U.S.

For details, contact: Wayne Jordan, Director, Texas Water Resources Institute, Texas A&M University, College Station, TX 77843-2118. The phone number is 409-845-1851.

North Texas Limnologists Forming New Organization

Biologists at the University of Texas at Arlington and Texas Christian University are now attempting to form the North Texas Limnological Society.

The society's mission is to increase interaction among aquatic scientists in North Texas who work at different universities. This could lead to cooperative studies, facilitate greater information sharing, and provide students with greater exposure to various aspects of aquatic research.

Plans have been made to have an organizational meeting this spring at the U.S. Army Corps of Engineers' Lewisville Lake Aquatic Plant Research Facility.

Interested persons should contact: Tom Sterner, Biology Dept., University of Texas at Arlington, Arlington, TX 76019 or call 817-273-2424.

USGS Offers Co-Op Jobs With Trinity River Project

The U.S. Geological Survey (USGS) is now conducting the National Water Quality Assessment (NAWQA) program in the Upper Trinity River watershed. As a result, there are opportunities for college students pursuing degrees in hydrology to work with the USGS on a temporary basis as part of University Co-Op programs.

Students will typically be working with a team of hydrologists and technicians to collect data; make field and laboratory measurements; and compile, compute, and analyze records of streamflows, water levels, pumpage, sediment transport, and other data. Other duties include helping write reports and preparing maps.

Details including the academic requirements needed to take part in the program, salaries, and other information can be obtained from local university co-op of ices or from: Larry Land, USGS, 8011 Cameron Rd., Building 1, Austin, TX 78753 or call 512-832-5791.