

**Maryland
Department
of
Natural
Resources**

**Annual
Activities
Report**

1991



Table of Contents

Office of the Secretary	Page 1
Boating Administration	Page 2
Chesapeake Bay Trust	Page 9
Maryland Environmental Service	Page 10
Maryland Geological Survey	Page 17
Public Lands	Page 26
Resource Conservation	Page 31
Natural Resources Police	Page 43
Tidewater Administration	Page 47
Water Resources Administration	Page 69

In a Natural Resources Emergency or for assistance, telephone (301) 267-7740, (410) 974-3181 or 1-800-628-9944 twenty-four hours a day.

The facilities and services of the Department of Natural Resources are available to all with out regard to race, religion, color, sex, age, national origin, physical or mental disability.

Office of the Secretary

The Maryland Department of Natural Resources has a mission to protect, renew and wisely manage the natural resources of Maryland for the greatest benefit to the state and its citizens. The department directs activities affecting water resources, fisheries, forests, parks, wildlife, geology, waste and energy management as well as land acquisition and management, and historic preservation.

The Department-wide work force includes biologists for fisheries and wildlife, recreation specialists, computer specialists, graphic artists, construction specialists, law enforcement officers, foresters, park rangers, public affairs officers, engineers, accountants, planners and administrators.

DNR employees are actively involved in the management and enhancement of the Chesapeake Bay watershed through forestry management, waterway improvement, enforcement of waterway and land use, research, restoration of fish stocks and preservation of endangered plants and animals.

Within this work force, DNR employees manage state parks, forests, natural environment areas and natural resource management areas ranging in size from four acres to 42,800 acres for a total of 244,557 acres. In FY 1991 over 8,000,000 visited these public lands.

With public understanding and support we will continue to protect and enhance Maryland's natural resources and to so manage our facilities that they remain a source of recreation, enjoyment and education for all citizens.

The number one priority of DNR is to improve its services to the public, to offer more programs for citizens and volunteers, and to better tell the public what we offer to them and what we do for natural resources.

The Office of the Secretary is responsible for providing complete program overview and coordination plus the following administrative functions:

- Legal
- Fiscal and Supportive Services
- Management Information Services
- Licensing and Watercraft Registration
- Personnel
- Human Resource and Staff Development
- Public Affairs

Boating Administration

The Boating Administration was formed in 1988 to foster the protection, safe enjoyment, enhancement, and balanced use of Maryland's waterways for the boating public. The agency was originally comprised of four major programs: General Administration, Waterway Improvement, Operations, and Planning and Policy. As a result of the DNR Reorganization in July, 1991, the Shore Erosion Control Program (SECP) was added to the agency.

GENERAL ADMINISTRATION

This program is responsible for the overall direction, supervision and coordination of the administrative activities of the Boating Administration. Support is provided in the areas of budget, personnel management, contract management, procurement, vehicle fleet management, training, data processing and legal services.

Program review and evaluation activities are also undertaken to insure maximum effectiveness of the overall organization.

WATERWAY IMPROVEMENT

The Waterway Improvement Program is responsible for activities attendant to the improvement of Maryland's waterways for the general boating public through the Waterway Improvement Fund pursuant to the State Boat Act. The program encompasses four primary divisions: Hydrographic Operations, Dredging, Project Planning and Development, and Marine Services and Grants. The main office of the Waterway Improvement Program is in the Tawes State Office Building in Annapolis with field locations at Matapeake, Cambridge and Crisfield Terminals. Since the program's inception in 1961, the program has completed over 1,500 waterway improvement projects at a construction cost of \$60,213,643.

Hydrographic Operations Division

The Hydrographic Operations Division is responsible for providing hydrographic engineering services for the Department of Natural Resources. This includes establishing, maintaining, and charting regulatory buoys/aids to navigation;

surveying and charting the location of pound nets, oyster seed, shell plantings and private oyster leases in state waterways; assisting the Potomac River Fisheries Commission; and providing ice breaking services during winter months for commercial shellfish operations.

Of the vessels assigned to the division to complete these duties, three are of a sufficient size and tonnage to provide ice breaking/buoy tending services in deep and shallow water areas as well as act as support vessels for special events and activities. These steel-hulled vessels include the *M/V J.M. Tawes* (100-foot, 145 tons), the *M/V A.V. Sandusky* (80-foot, 120 tons), and the *M/V J.C. Widener* (73-foot, 78 tons).

In an effort to enhance the division's charting responsibilities, during FY 1991, the division entered into a multi-year contract with Frostburg State University to develop a Geographic Information System (GIS) for charting natural oyster bars and acquired a Global Positioning System (GPS) which will be used to establish and upgrade horizontal controls for locating navigation/regulatory aids within Maryland's waterways.

The total number of buoys/regulatory aids placed in state waterways and other duties completed by the division in FY 1991 is as follows:

Regulatory/Navigation Aids	2,285
Special Markers	425
Survey Corners of Private Oyster Leases	700
Pound Net Locations	20
Construction of New Triangulation Stations	45
Court Appearances (Expert Witness)	26
Resurvey/Aid in Construction of Potomac River	42
Fisheries Commission Markers	

Due to the mild winter, the division did not receive any requests for ice breaking in FY 1991. However, in addition to routine maintenance, each of the vessel's sanitation systems were modified for zero discharge. This means that all waste water generated on board is placed in holding tanks located on the vessels which is then pumped-out at approved upland discharge sites. This retrofitting is part of an overall effort to support the eventual delineation

of the Chesapeake Bay as a no-discharge zone for boat-generated sewage.

Dredging Division

The Dredging Division is responsible for state waterway projects involving the dredging and protection of harbors and channels that are not maintained by the US Army Corps of Engineers. Activities include the development of hydrographic and topographic surveys at proposed channel areas, determining the need for protective structures at project sites, reviewing the design of all state-funded dredging/breakwater projects and conducting bathymetric surveys of previously completed and proposed channel dredging sites.

In FY 1991, the Dredging Division completed twenty-one (21) projects at a total cost of \$1,324,697. The division currently has 43 active funded projects in various stages of development with an estimated construction value of \$6,977,400.

Project Planning and Development Division

The Project Planning and Development Division is responsible for state-related recreational development of the Chesapeake Bay with particular emphasis on projects and activities directly related to the general boating public. Specific activities include financing and coordinating the planning and construction of public marine facilities on state lands. All projects are financed through Waterway Improvement Funds pursuant to the State Boat Act.

During FY 1991, the division continued its planning efforts for the development of facilities at Jennings Randolph Lake, Ocean City Boathouse, and Marshall Hall. In addition, engineering was completed for regional boating facilities at Deep Creek Lake, Big Run, New Germany, Sandy Point and Hart Miller Island State Parks. Work continues on various phases of construction at Fort Washington Marina, Dundee Creek Marina, Deep Creek Lake State Park, and Hart Miller Island. Various construction projects were completed at Hallowing Point, Point Lookout and Elk Neck State Parks, Somers Cove and Sweden Point Marinas.

Major accomplishments in FY 1991 included beginning the final phase of construction at Fort

Washington Marina (Prince George's County) which consists of completing a new multi-service marina building, razing the existing marina services building, installing the remaining piers, utilities, and stormwater management structures as well as completing the final grading of the parking areas. With regard to other public facilities, marine sewage pumpout stations were installed at eight state parks throughout Maryland as part of the Chesapeake Bay clean-up effort. Furthermore, the second phase of construction at Hart Miller Island (Baltimore County) commenced, the scope of which includes constructing a ranger station/ multi-services building and several boardwalk/road nature trails as part of implementing the Department's recreational master plan for the facility.

In addition to the above, the Project Planning and Development division moved forward in planning the development of a recreational boating facility at Jennings Randolph Lake in cooperation with the US Army Corps of Engineers and Garrett County. The purpose of this project is to provide public access from the Maryland side of the lake. Currently, the only public access to the lake is from the West Virginia side. Engineering for the project is underway and construction is scheduled to begin in FY 1992. Furthermore, the Division provided extensive graphic presentations for public displays set up at numerous boat shows, programs, and activities.

In FY 1991, the Project Planning and Development Division completed 15 projects at a total construction cost of \$9,656,513. Currently, the division has 15 projects in various stages of development with an estimated construction value of \$4,849,150.

Marine Services and Grants Division

The Marine Services and Grants Division provides support to the Department and local jurisdictions to maintain channels, harbors, and public boating facilities within state waterways not under the jurisdiction of the US Army Corps of Engineers.

Specific activities completed by this division include providing technical and financial assistance in the form of grants to local jurisdictions to design and construct boating facilities on public lands. In FY 1991, 92 grant projects were completed at a total construction cost of \$1,482,609. Currently, the Division has 123 grant projects in various

stages of development with an estimated construction value of \$6,168,000.

In addition to supplying grants, the Marine Services and Grants Division also provides services through the Marine Services Construction Crew for projects located on state and local public lands. This crew has a complete array of equipment including barges, support vessels, crane, bulldozer, excavator, trucks, and other equipment required to complete a variety of marine construction projects. Such projects include dredging channels and harbors, removing abandoned boats and debris from state waterways, constructing piers, bulkheads, jetties/breakwaters, boat ramps and parking lots.

Major accomplishments in FY 1991 include the expanded use of the Marine Services Crew to remove abandoned boats and debris. One project, which involved a cooperative effort with the US Army Reserve and Baltimore and Anne Arundel Counties, resulted in the removal of 64 abandoned vessels from the Chesapeake Bay and its tributaries. The crew also constructed a 540-foot floating pier at Point Lookout State Park and made modifications at the Hallowing Point public boat ramp designed to reduce sand accretion at the ramp.

In addition to the above, the Marine Services Crew assisted the City of Cambridge in Dorchester County by installing the piles for a new 290-foot bulkhead. The crew also completed the annual haul out of their tug, the *Big Lou*, and their barges at the Cambridge Marine Terminal as well as assisted in the construction of a fishing reef, the completion of an oyster shell coring project, and redecking the primary pier located at the Matapeake Marine Terminal.

OPERATIONS PROGRAM

This program operates and maintains facilities used to promote the economic, environmental and recreational importance of the Chesapeake Bay to Maryland.

At present, the most prominent state-owned facility is Somers Cove Marina in Crisfield. In addition to providing the boating public with 500 wet slips, the marina houses the Tawes Museum and a Charter Sportfishing Facility. The Marina also hosts a number of events including the National Hard Crab Derby and Fair, the Watermen's Festival, the Pro-Am Fishing Tournament, and the J. M. Tawes

Crab and Clam Bake, sponsored by Budweiser and the Crisfield Chamber of Commerce. Proceeds from these events help fund the activities of the local Chamber of Commerce and the Tawes Foundation. These activities and those of the marina are designed to help promote and stimulate the economic and community development of the City of Crisfield.

Under construction on Piscataway Creek off the Potomac River is the Fort Washington Marina. Once completed, this 292-slip public boat ramp facility is expected to significantly contribute to the boating public's enjoyment of the Potomac River. Fort Washington will be a full service marina offering hauling and launching, dry storage, major boat repairs, boat maintenance, food service, a ship's store and a complete inventory of marine supplies. These services and more will be made available as construction progresses. It is expected that by the spring of 1992, the marina will be 100 percent operational, at which time it will be turned over to a private concessionaire to operate under the direction and control of the state.

Also under the direction of the Operations Program is the state flagship, the *Maryland Independence*. In addition to providing the governor and other state officials with an informal facility for the conduct of state business, it is used to lobby and promote Maryland to foreign dignitaries and business leaders who have occasion to visit the state.

Included in the fleet of vessels operated by the Operations Program is the *H.J. Elser*, a 48-foot steel hulled demonstration vessel equipped as a marine sewage pumpout facility. The vessel's mission during boating season is to acquaint the boating public with marine sewage pumpout stations at marinas throughout the state. Maryland is the first state to own and operate its own mobile marine pumpout station.

The *Declaration* also joins the *H.J. Elser* in providing DNR scientists with the vessels needed to continue their studies and reviews of the Chesapeake Bay and execute management plans as they relate to the Bay's restoration. The *Declaration*, a 45-foot Hatteras confiscated for illegal use in drug trafficking, is now being put to use by the state in support of its Bay programs.

The *Anna McGarvey*, the state's official skipjack, is on display at the Tawes Museum located in Crisfield. The vessel, upon completion of restoration, will be taken around the Bay to various water-oriented events. It will be used to educate the public on the historical importance of the Chesapeake Bay's role in developing Maryland's commerce highlighting oyster dredging and Maryland's maritime industries.

PLANNING AND POLICY PROGRAM

This program is responsible for planning the wise and safe use of Maryland's waterways; developing river systems management plans; identifying the location of marine-related facilities; administering grant programs for the installation and operation of marine sewage pumpout facilities; promulgating regulations for administering the state Boat Act; and providing liaison with the boating industry, other state agencies and federal and local governments. This program works closely with the Boat Act Advisory Committee and the Boat Dealer Advisory Council, testifying on legislation pertaining to boating matters; and establishing policies and regulations in order to protect and enhance the public safety, welfare and recreational interests on the waters of the state.

Boat Act Advisory Committee

All regulations affecting the operation and equipment required on vessels, which the Department proposes, are submitted to the Boat Act Advisory Committee (BAAC) for advice and opinions. During FY 1991, the Boat Act Advisory Committee reviewed individual petitions for speed limits on waterways and participated in preliminary planning for river management plans for the South and Magothy Rivers and the Ocean City/Coastal Bays area. Committee activities often include site visits to areas under review.

Boat Dealers Advisory Council

The Boat Dealers Advisory Council (BDAC) is an ad hoc council whose members are appointed by Secretary Brown to provide counsel on boating industry matters. The Council reviews departmental legislation that affects the boating industry and prepares recommendations for legislation and departmental regulations.

Marine Sewage Pumpout Grants

The Planning and Policy Program administers grants for the construction of marine sewage pumpout stations around the Bay. These grants are made from the Waterway Improvement Fund and offered to public and private marinas in an effort to aid in the Bay clean-up. The goal is to ensure that Maryland will eventually have sufficient pumpout facilities to enable the state to petition the Environmental Protection Agency to declare substantial portions, if not all, of the Bay as a "no discharge zone." The Sensitive Area report, completed in FY 1991, will be used to establish priority areas for installation of pumpout facilities.

In FY 1991, grant applications were received from 26 marinas. Sixteen facilities completed installation and were reimbursed for a total expenditure of \$126,662. Since the program's inception, 42 pumpout stations have been installed at marinas at a total cost of \$308,732. There are currently 73 grant applications outstanding.

An extensive **Pump Don't Dump** campaign including signs, brochures, posters and bumper stickers was continued. Maryland's pumpout symbol appears on signs at pumpout facilities throughout Maryland's waters and a number of other states have expressed an interest in using the symbol in their own efforts to reduce recreational vessel pollution.

Guide to Cruising Maryland Waters

The 16th (1990-1991) edition of the **Guide to Cruising Maryland Waters** was published in March 1990. The Guide is a biennial publication containing reproductions of the National Oceanic and Atmospheric Administration (NOAA) nautical charts of the Maryland portion of the Chesapeake Bay. These charts have been updated with the new and proposed buoy changes through February 1990. It is one of the few Maryland publications available with the Coast Guard buoy changes marking the new 50-foot channel. The publication notes on the chart the location of marine sewage pumpout facilities as well as the nesting areas of protected birds. The 1992-1993 edition is expected to be available in March 1992 with updated charts and a more comprehensive marina listing.

Resource Planning and Utilization Division

The Resource Planning and Utilization Division is responsible for developing comprehensive vessel management plans for Maryland waterways to accommodate the various recreational boating activities in state waters, protect sensitive environmental resources, and promote public safety on increasingly congested waterways.

In FY 1991, the Resource Planning and Utilization Division undertook the development of management plans for the South and Magothy Rivers. The proximity of the South and Magothy Rivers to Annapolis, Baltimore and Washington, DC has characterized both rivers as some of the most heavily used waterways for recreational boating in Maryland. The planning process was designed to involve numerous federal, state and local government agencies, and place high emphasis on public participation. Public participation efforts included "Notice to Boaters Buoys," written and oral correspondence, a user survey, a public workshop and public meetings. Representatives from recreational user groups, boating safety organizations, community associations, marine trades groups and private citizens took part in the process. Regulations for both plans are scheduled to become effective April 13, 1992. An education campaign describing the regulations and highlights of the South and Magothy River Plans will include brochures, public meetings and news articles.

Staff continued to monitor the effectiveness of the Severn River Comprehensive Vessel Management Plan that went into effect May 24, 1990. A brochure describing the plan was developed and widely distributed during the boating season.

An analysis of boating activities on the Coastal Bays of Maryland was undertaken in 1991. The focus of this project is to identify areas of critical concern for public safety and natural resources, and to coordinate protection measures with federal, state and local government agencies. This three-year project coincides with a multi-faceted water resources study of the coastal bays to be prepared by the US Army Corps of Engineers.

The search for an inland site suitable for a slalom water ski course continued. Staff worked cooperatively with representatives of the Maryland Water

Ski Federation to identify and evaluate several sites and the Maryland Department of the Environment assisted with water quality analysis.

In 1991, funding was provided to the University of Maryland-Center for Environmental and Estuarine Studies for a study of the effects of high-speed boat activities on water quality and submerged aquatic vegetation in Maynadier Creek on the Severn River.

Recreational Boating Area Management Division

The Recreational Boating Area Management Division (RBAM) is responsible for administering the mooring registration required by COMAR; drafting and promulgating regulations related to boating; monitoring police citations to locate "trouble spots" and exploring ways to address the problems of boaters. RBAM staff serve as the initial point of contact between many of the user groups of Maryland waters and DNR, directing boaters to other sources of information when issues arise which are outside the scope of the administration. Division personnel attend functions such as homeowner association meetings, special user group organizations, etc. and host public meetings to explain DNR boating issues.

This division is responsible for surveys of each area for which a petition is received to limit or increase use of Maryland waterways. Overflights of many of Maryland's waterways have been completed and a photographic library is being developed which will assist in determining boater use patterns. The majority of the unit's effort in surveying during FY 1991 was devoted to accumulating data used in developing the Magothy and South River comprehensive management plans and preliminary planning for the Coastal Bays Area in Ocean City.

Recreational area management personnel review applications for wetland licenses and permits, and waterway construction permits, for possible impact on boating interests. A consistent pattern of response related solely to boater use and safety is developed for each area of the state.

In FY 1991, the division also sponsored a study of recreational gauging and an information system to alert Potomac River users of dangerous water

levels and was active in planning and participating in the Potomac River Appreciation Day and Boating FunFest.

SHORE EROSION CONTROL PROGRAM

The Shore Erosion Control Program (SECP), established in 1969, is charged with the following responsibilities:

- to educate the public on the causes of beach and streambank erosion along the state's shorelines
- to assess and make recommendations on the overall erosion problem in Chesapeake Bay and tributaries
- to provide technical assistance to property owners, communities and counties experiencing shore erosion problems
- to evaluate the effectiveness of new materials and methods developed to control erosion
- to prepare budget requests for the design and construction of shore erosion control projects on private and public land
- to administer the Shore Erosion Control Revolving Loan Fund which provides interest-free loans to design and construct projects for qualified applicants
- to provide matching grants for the design and construction of non-structural shore erosion control projects
- to provide design supervision and construction management
- to design and construct shore erosion control projects, funded by the capital budget on state lands
- to manage the Ocean City Beach Replenishment and Hurricane Protection Project
- and to periodically inspect completed projects for the purpose of recommending preventive and corrective maintenance to the property owner.

The activities of SECP extend across more than 4,300 miles of shoreline along the Maryland portion of the Chesapeake Bay and its rivers, and the 31 miles of Maryland's Atlantic Ocean coastal beaches.

Ocean City Beach Replenishment & Hurricane Protection Project

Phase I of the "Ocean City Beach Replenishment and Hurricane Protection Project," implemented by DNR's Shore Erosion Control Program and completed in cooperation with Worcester County and the Town of Ocean City at a cost of \$14.2 million, provided the foundation for the second phase of the project. Over 2.2 million cubic yards of sand, dredged from two miles offshore, were spread along 8.3 miles of Ocean City's Atlantic Ocean shoreline between 3rd Street and the Maryland/Delaware state line.

Phase II is a \$30.6 million federal cost-shared project between the State of Maryland, acting as the local sponsor in cooperation with Worcester County and the Town of Ocean City, and the US Army Corps of Engineers. This phase of the project provides hurricane protection and includes construction of a steel bulkhead from 4th Street to 27th Street, placement of 3.4 million cubic yards of sand for additional beach fill from 3rd Street north to the Maryland/Delaware state line, and dune construction from 27th Street north to the state line. Sixty-five acres of dunes are vegetated with American beachgrass and American panic grass and 28.6 miles of sand fence plus 210 beach access cross-overs were installed.

The project will be dedicated by Governor Schaefer in early FY 1992. When officially completed, the state will assume responsibility for operation and maintenance of the project throughout its 50-year life. A beach monitoring and renourishment program, cost-shared with the federal government, is an integral feature of the maintenance phase of the project.

Other Shore Erosion Control Projects

The Shore Erosion Control Program (SECP) also provides technical and financial assistance to shore-front property owners throughout the state. Technical assistance, provided free of charge, is in the form of on-site visits to assess erosion problems and make recommendations to the property owners about alternative corrective actions. For cases where shore erosion poses a severe threat to long lengths of shorefront property, the state maintains a Revolving Loan Fund, which provides 25-year, interest-free loans for the design and construction of structural projects. Shorter term loans are

available for structures designed to withstand storms of a 15-year frequency expectation.

SECP also administers a state program of matching grants which provide funds to property owners in stabilizing suitable eroding shorelines by means of vegetative plantings.

The following table provides a summary of activities in the areas mentioned above for FY 1991.

**Shore Erosion Control Program
FY 1991**

	No.	Value	Length In Miles
Technical Assistance Actions:			
Structural and Non-Structural	149		
Applications Received:			
Structural	22		
Non-Structural	66		
Financial Assistance Awards:			
Structural	14	\$2,682,249	
Non-Structural	7	\$189,619	
Projects Completed:			
Structural	18	\$2,155,769	1.27
Non-Structural	27	\$403,962	1.70

Another responsibility of SECP is the management of design and construction contracts for selected projects on state and public lands. Many of these are undertaken in coordination with other DNR programs related to developing Bay access, open space, or state parks. Some of the highlights of these accomplishments during FY 1991 are:

Sandy Point State Park in Anne Arundel County: Design work for the East Beach where protective stone works will be installed along with beach replenishment in late 1991.

Elk Neck State Park in Cecil County: Over 6,891 linear feet (LF) of shoreline at Turkey Point has been stabilized with stone revetment.

Choptank River Fishing Pier State Park: Design work was undertaken for two projects to be installed in late FY 1992. One project will continue protection along the Choptank River in Talbot

County and the second will protect the location of the Grand National Hunt Club Waterfowl Monument in Dorchester County.

Point Lookout State Park in St. Mary's County: Design work was undertaken for a project which will protect the south parking lot and sanitary facilities and will be constructed in late FY 1992.

Chesapeake Bay Trust

The generosity of Marylanders and their desire to take part in the Bay cleanup continues to merge in the successful collaboration that is the Chesapeake Bay Trust. The Trust was created in 1985 as a link between the business community, private donors, and the many community groups and educators that need financial support for their Bay projects.

The Trust funded 135 Bay restoration projects in 1991 for a total of \$780,000. Grant awards ranged from \$7,188 for an extensive volunteer cleanup of the Monacacy River to \$215 for a waste reduction project bringing senior citizens and students together at Gwynn Park Middle School.

Requests for support to the Trust almost doubled between 1990 and 1991, rising from 229 to 419. Marylanders have empowered the Trust to meet the growing demand through their generous support of the tax checkoff and the new Bay license plate.

The Chesapeake Bay and Endangered Species Fund tax checkoff had another record setting year raising over \$1,047,000 in 1991. Treasure the Chesapeake license plates went on sale in January of 1991. Within three months 100,000 were sold and \$1,000,000 was raised for the Trust's grant-making program. Plate sales continue to soar and the Trust looks forward to the many projects that will benefit from the proceeds.

Additional Trust funded projects include:

- The development of wetlands curriculum for Maryland schools by Environmental Concern.
- A regional educational conference on water quality testing by the Alliance for the Chesapeake Bay.
- The building and placement of hundreds of wood duck nesting boxes by Chesapeake Wildlife Heritage.
- A volunteer stream monitoring program in Howard County.

Maryland Environmental Service

The Maryland Environmental Service (MES) was created by the General Assembly in 1970 to offer planning, engineering, financing, operating, and management services to the State's smaller communities and industries to help them meet new and rigorous standards for water supply and wastewater treatment.

An agency of more than 400 employees, MES currently provides quality services in the areas of water supply, wastewater treatment, energy and resource recovery, sewage sludge disposal, recycling, compost marketing, dredged material containment, and solid and hazardous waste management. MES serves state agencies and institutions, municipalities, county governments, and the private sector.

MES operates both as an agency of the Department of Natural Resources and as a non-profit utility corporation. It is entirely self-supporting through charges billed to its clients and customers. Charges are based upon actual direct costs of the services provided and are made in accordance with agreements and budget estimates. Service contracts range from under \$5,000 to multi-million dollars per year.

The Agency's staff consists of certified water and wastewater technicians, chemists, biologists, horticulturists, heavy equipment operators, mechanics, financial analysts, engineers of several kinds – mechanical, environmental and civil, and a variety of other professionals who perform their duties at the Annapolis headquarters and at projects and facilities throughout the state.

The corporate affairs of MES are managed by a seven-member Board of Directors, including the MES Director, Deputy Director, Secretary and Treasurer, and three appointed citizens of Maryland. The Board of Directors is appointed by the Secretary of Natural Resources with the approval of the Governor. MES is organized into three program areas: Administration and Finance, Waste Management, and Water and Wastewater.

ADMINISTRATION AND FINANCE

This program is responsible for setting the direction of MES and for its internal support functions,

including personnel, purchasing, issuance of revenue bonds, data processing, contract management, fiscal activities, grant administration, and accounting.

MES secured financing through the issuance of bonds for projects in excess of \$15 million. The Agency successfully implemented a new State system for fleet management and budget preparation.

Corporate employees at MES are now offered the same health care benefits that its State employees receive. In addition to more health insurance options, employees also benefit from upgraded 401K investment options.

WASTE MANAGEMENT

The Waste Management Program provides engineering capabilities within MES for planning, design, and construction. The program operates and maintains projects for dredged materials containment, solid and hazardous waste disposal, yard waste composting, recycling, construction services, restoration of sludge disposal operations, and water quality monitoring services.

Recycling Division

The Recycling Division provides a full range of recycling services to the State and to local governments. Services include program planning and implementation, facility management and operation, and the marketing of materials.

Baltimore County Resource Recovery Facility

The Maryland Environmental Service operates several solid waste facilities for Baltimore County including the Baltimore County Resource Recovery Facility (BCRRF) near Cockeysville, MD, the Western Acceptance Facility in the southwest part of the County for transferring county solid waste to BCRRF and other facilities, and two homeowner drop-off recycling centers. The combined facilities employ about 75 people. Both residential and commercial waste from Baltimore County are handled at these facilities for recovery and recycling.

Montgomery County Recycling Facility

MES is providing management and technical support services to Montgomery County in the construction of a Materials Processing Facility (MPF) to process 100 tons of co-mingled materials, 140 tons of newspaper, and 400 tons of yard waste per day. The \$8 million facility was constructed by New England CRinc and began accepting material on August 1, 1991.

Similar support services are being provided to the County in their Recycling Drop-off Program for the citizens in the higher-density areas. Five sites have been identified and collection began in July 1991. MES provides collection and hauling services to these sites and the materials are taken to the MPF for processing.

Composting and Organic Products

In Montgomery County, MES continued to operate the Yard Waste Composting Facility near Dickerson. Nearly 14,000 tons of yard waste were received at the facility. Grass was also collected on a voluntary basis within the Montgomery County Collection District and was co-composted with the leaf collection. Municipalities within the county are continuing to contribute their collection of yard wastes to the Dickerson Facility.

In Prince George's County, MES continued to operate both yard waste composting and wood waste processing facilities. The leaf and grass portion of the yard waste collection is composted at the Western Branch Facility in Upper Marlboro with wood waste being processed at the existing Brown Station Road Landfill.

During FY 1991, the U.S. Patent and Trademark office issued a registered trademark to the Maryland Environmental Service for Leafgro[®] organic compost. ComPRO[®] and Leafgro[®] sales were steady last year. MES sold 30,781 cubic yards of ComPRO[®] and 11,332 cubic yards of Leafgro[®]. Gross revenues for the ComPRO[®] program totalled \$292,555.24 and \$118,687.18 for Leafgro[®].

Used Oil Recycling Program

MES is responsible for managing a unique statewide program available for citizens to properly dispose of their used motor oil. The ever-increasing number of government-operated collection sites

now total 150 across the State. In 1990, 160,000 gallons of used oil were collected.

Used Antifreeze Recycling Program

This year an integral expansion of the Used Oil Recycling Program, is a statewide collection program for citizens to recycle their used antifreeze. To date, 97 collection locations have been established, with over 8,000 gallons recycled. Included are several marinas to serve the Maryland boating community.

Maryland Recycling Directory

A valuable recycling resource for over ten years, the Directory is a comprehensive guide which lists detailed information on recycling programs and businesses which buy or accept as donation, many recyclable items in the State. Single copies of the directory are free of charge.

Recycling Information Line

MES maintains a toll-free telephone number to assist Maryland citizens with various recycling inquiries. Information provided concerns office recycling, used oil and antifreeze recycling, locations of recycling centers, and how to prepare materials. In 1990, over 15,000 calls were processed, with over 70 percent of the requests concerning used oil or antifreeze recycling. The toll-free number is 1-800-I RECYCLE (1-800-473-2925).

Tire Recycling

MES is developing a program for alternative disposal of scrap tires. The program is working with the Department of Economic and Employment Development to locate companies that can recycle tires into other consumer goods and attract these companies to locate in Maryland. MES is encouraging State agencies to use retreaded truck tires, to pilot test remanufactured passenger tires and to switch to radial tires to reduce the volume of scrap tires generated each year.

Tire Reef Demonstration

MES is working with the DNR Tidewater Administration to establish an artificial reef development project near Tilghman's Island using scrap tires.

This project will re-establish oyster beds as well as dispose of tires.

Solid and Hazardous Waste Division

The MES Solid and Hazardous Waste Division provides services to state and local governments in the disposal of Solid and Hazardous Wastes.

Solid Waste Management

The State's first regional landfill for Caroline, Queen Anne's and Talbot Counties began accepting municipal solid waste in March 1991. Under MES management, the facility receives 290 tons per day and participates in MES-sponsored recycling programs. The Mid-Shore Regional Landfill relieves the capacity and operational limitations of several existing county landfills that have started to close down. MES designed a new solid waste landfill and the closure of an existing landfill for Garrett County. Construction of this new landfill is scheduled for early 1992. Aside for completing the design of the vertical extension for the existing landfill, MES is permitting and designing a new solid waste landfill for Somerset County. The division is also assisting Kent County in meeting its waste disposal requirements.

Hazardous Waste Management

During FY 1991, the Waste Management Program continued operations in Area 5 of the Hawkins Point Hazardous Waste Facility for Allied-Signal, Inc. accepting chromium contaminated debris generated from the dismantling of the old Baltimore Works Plant. The landfill is near completion with an anticipated closure date in Spring of 1992. After closure, the landfill will go into a 30 year post-closure period which will continue to require leachate collection and groundwater monitoring.

MES also operates Areas 2 and 3 of the Hawkins Point Hazardous Waste Facility for the Maryland Port Administration (MPA). Chrome ore tailings and product from the Baltimore Works Chrome Planting Process were used as fill material in these areas. MES collects the leachate generated by the chrome ore tailing and performs all required monitoring in this area.

The Waste Management Program assisted the MPA with containment of contaminated soils and management of contaminated waters at the Dundalk

Marine Terminal. In April of 1991, it was determined that remedial action would be required at the Dundalk Marine Terminal to prevent or mitigate release of contaminated waters into the Baltimore Harbor. The work to be performed by MES is broken down into three phases: the 14th Street storm drain rehabilitation, the corrective measure implementation procedure plan and the 15th street twin 96 storm drain system. The work associated with phase 1 & 2 has already begun and will be completed by the end of FY 1992.

Special Projects Division

The Special Projects Division provides planning, operation and engineering services for dredged material management for the State's shipping channels. In FY 1991 new initiatives were introduced by the Department of Transportation that will change the future approach to dredged material management in the Chesapeake Bay. Key technical and administrative assistance was provided by MES to formulate and begin implementation of those initiatives. The Special Projects Division provides construction services as well as environmental monitoring services, primarily for in-house and State facilities and projects.

Dredged Material Management

MES played a lead role in formulating, negotiating and documenting the recommendations of Governor William Donald Schaefer's Task Force on Dredged Material Management, February 1991. The Task Force was composed of representatives from diverse interests such as resource agencies, special interest groups and the maritime industry. The theme of that report was partnership and beneficial use, providing the direction to enhance the environmental quality of the bay while maintaining a viable and competitive port of Baltimore.

Development of a Long Term Management Strategy (LTMS) for dredged material was initiated in FY 1991. The strategy begins with a comprehensive planning effort with the State in a unique partnership with the Corps of Engineers. Specific processes and projects were being targeted for this program, which will be cost-shared with the federal government.

In FY 1991, MES continued to operate and maintain the Hart-Miller Island Dredged Material Containment Facility designated to accommodate

dredged material from the deepening of the Baltimore Harbor Shipping Channels. The 50 foot deepening project was completed in late 1990. The facility continues to receive material from maintenance of these channels. By the end of FY 1991, placement had been reached of approximately 55 million cubic yards. The interior containment volume of the facility is approximately 62 million cubic yards.

Crust Management activities were commenced in spring 1991 to enhance desiccation and consolidation of the hydraulically placed material. These activities are in preparation for planned recreational development at the site.

Environmental Monitoring Services

In FY 1991, the Monitoring and Analysis Group (M&A) provided environmental support services to over 16 projects. Clients were in both the public and private sector. Services included:

- environmental technical support;
- environmental permit reporting;
- monitoring of drinking water, hazardous waste, solid waste, groundwater, point source discharges, dredged material and channel sediments;
- laboratory analysis of samples by MES laboratories and contracted laboratories; and
- project management of environmental monitoring projects.

The most notable project was the Allied-Signal dredging project. This was a \$150,000 project which MES managed in close coordination with Allied-Signal, special interest groups and regulatory agencies. In this project, the Allied-Signal corporation was under consent order to complete dredging of its outer bulkheads in the Baltimore Works Facility. This dredging generated 140,000 cubic yards of contaminated material. MES established additional monitoring requirements for this project and coordinated activities with interested public interest groups and regulatory agencies.

M&A expanded its provision of services to DNR clients in FY 1991. We now have two projects with five investigative groups with the Water Resources, Tidewater and, Boating Administration. These projects provide analytical services for

water, sediment and tissue samples collected by principal investigators in DNR. These service agreements totaled \$80,000 in FY 1991.

M&A also, expanded its services to the Maryland Port Administration, with lead project management responsibility for a \$466,932 study of the Pooles Island dredged material placement area.

Construction Services

The construction group successfully completed \$750,000 in construction placement. The projects ranged from in-ground pipe placement to dike construction on a hazardous landfill. The budgets on the 35 projects completed in FY 1991 ranged from \$7,500 to the \$225,000 beach recreation project on Hart-Miller Island. This project is for DNR's Boating Administration, in conjunction with a private contractor to complete boardwalks, place a ranger's station, install water & sewer lines to the existing clivus style rest rooms.

WATER AND WASTEWATER

This Program provides planning, design, construction, inspection, and operational services for water and wastewater treatment facilities throughout the State. The Operations and Maintenance Division operates and maintains over 135 wastewater and water treatment facilities. The Engineering Division provides Operations with technical support and provides project management for new construction, plant renovations and expansion, and sludge management.

Operations and Maintenance

The Operations and Maintenance (O&M) Division is responsible for operating over 135 water, wastewater, and other environmental facilities Statewide. Operations comprises the largest division of the program supported by Administration, Maintenance, Training, Safety, Laboratory, and Permits and Compliance sections. The division employs over 180 people and has annual revenues of over \$10 million.

Services are provided by the O&M Division to both State and non-State clients and range from full service contracts to part-time technical assistance on an as-needed basis.

The O&M Division grew significantly during FY 1991. It is now responsible for 69 wastewater treatment plants, 49 water treatment plants, 14 wastewater pumping systems, 3 regional sludge disposal facilities, 4 regional laboratories, and 1 incinerator, in addition to numerous monitoring and special projects. Other significant new projects include overall management and O&M of the Town of Poolesville's wastewater treatment system. Regional sludge facilities currently under design and/or construction will be the responsibility of this division upon completion.

All sections have computerized data handling and reporting, in addition to the expanded and improved training and safety programs. Many State facilities were upgraded during the year, and deferred maintenance was accomplished. Compliance with pollution control and drinking water regulations continued to improve dramatically in FY 1991.

Operations

The Operations Division is made up of over 125 licensed operators and is primarily field-based. The division is divided into four geographic regions of the state, including sub-regional "anchor" headquarters located at the larger facilities.

During the year there were several start-ups of new or significantly upgraded water and wastewater treatment plants. Among them were the wastewater treatment facilities at Cheltenham, Greenridge, and Eastern Pre-Release. Also during the year, MES assumed operations of the Poolesville and Waysons Corner wastewater treatment plant and the Fair Hill water system.

Maintenance

The Maintenance section is responsible for corrective and preventive maintenance and calibration of equipment at facilities operated by the division. During the year, the mechanical and electrical maintenance staff respond to numerous emergency situations, or managed contractors, as needed to effect repairs or rehabilitation of equipment. Demands on the maintenance section have increased in direct proportion to the complexity and sophistication of upgraded and new facilities.

A major initiative of the section has been the planning for the implementation of computerized, preventive maintenance systems throughout the State. This will require a two-year effort, but is expected to greatly enhance the efficiency of the maintenance staff by enabling them to better plan work loads. This is also expected to reduce the number of emergency maintenance calls.

A new capability at MES is the implementation of a wastewater and sludge hauling service. In addition, TV inspection, leak detection and inflow and infiltration (I&I) services are now available to both State and corporate clients.

Laboratory, Permits and Compliance

This division manages four regional laboratories:

- monitoring and sample collection,
- permits management,
- data management,
- and reporting.

More than 26,000 samples were processed during FY 1991 at the Crownsville, Dorsey Run, MCI, and Elkton labs, and contract laboratories.

In addition to the routine laboratory analyses, there were numerous special studies conducted by the sections environmental specialists and technical staff. Treatment for the removal of phosphorus at the Elkton Wastewater Treatment Plant (WWTP) and intensive process control monitoring to allow the Dorsey Run Advanced WWTP to discontinue the use of powdered activated carbon are two examples of diagnostic services which this section has provided. Capabilities have been expanded to include a wide variety of sampling and monitoring techniques performed under close quality control in accordance with the Safe Drinking Water Act and the Clean Water Act regulations. Liaison activities between regulatory officials and State and corporate clients have been expanded and include representation of clients in negotiation of permits and enforcement activities.

This section developed the pretreatment limits for the Town of Elkton and updated the town's sewer use ordinance, which functions as a model by state officials.

Maryland Geological Survey

GENERAL DIRECTION

The Maryland Geological Survey (MGS) conducts research on the geology, water and mineral resources of the state and applies this knowledge to practical problems related to environmental and natural resources issues. Publication of maps and technical reports are the primary means of relaying this information to the public, private industry, local, state and federal government agencies. Exhibits on subjects like building stones of Maryland and Chesapeake Bay research are shown at schools, libraries and public events. MGS is the lead agency in preparation of geological displays for the Sideling Hill Exhibit Center.

MGS was represented at meetings of the Interstate Mining Compact Commission, Outer Continental Shelf Policy Committee, Land Reclamation Committee, Association of American State Geologists, American Geological Institute and Committee on Water Resources Research of the National Research Council.

Geological Society of America Meeting

The Northeastern and Southeastern Sections of the Geological Society of America held a joint meeting in Baltimore on March 14-16, 1991. MGS co-hosted the meeting with the US Geological Survey with assistance from The Johns Hopkins University, Towson State University and University of Maryland. Over 1,347 professionals and students from as far north as Canada and as far south as Florida attended. Foreign registrants included participants from the United Kingdom, Germany, Norway, Saudi Arabia and Switzerland. Fourteen staff members assisted in the meeting's preparation and served as local committee members. M. Gordon Wolman gave the annual banquet speech and Robert W. Ridky presented a paper at the symposium. Drs. Wolman and Ridky serve as MGS Commissioners.

Symposium papers and poster sessions by MGS personnel included:

Effects of Borehole Enlargement, Development and Stimulation, and Drilling Inclined Collectors on

Yield of a Well Constructed in Fractured Rock by Mark T. Duigon.

Holocene Sediment Accumulation in Chesapeake Bay: Rates and Patterns co-authored by Jeffrey P. Halka.

Lithostratigraphy of the Lower Cambrian Tomstown Formation by David K. Brezinski.

Progressive Deformation of Cover Rocks at the Western Margin of the Blue Ridge In Maryland co-authored by David K. Brezinski.

Comprehensive Sediment Budget for Chesapeake Bay by Randall T. Kerhin.

Harry J. Hansen presided over a session on *The Role of Hydrogeology in Ground Water Science and Engineering* and a session on *Coastal Plain Estuaries - A Comparison of Chesapeake and Delaware Bays* was chaired by Jeffrey P. Halka.

Two contractual employees co-authored papers: *Heavy Mineral Abundances and Their Association with Sediments and Stratigraphy of the Inner Continental Shelf of Maryland*, Andrew H. Wulff with Randall T. Kerhin and Frank J. Pazzaglia co-authored with Emery T. Cleaves a paper on *Surficial Geology and Landform Evolution of a Portion of the Eastern Piedmont, Maryland and Pennsylvania*.

Six field trips were conducted, two of which were hosted by MGS personnel:

- **Bottom Sediments of the Chesapeake Bay: Physical and Geochemical Characteristics** by James M. Hill and Jeffrey P. Halka;
- **Sideling Hill Road Cut and Visitor's Center - An Educational Opportunity Combining Outcrop and Classroom** led by Kenneth A. Schwarz.

Kenneth N. Weaver, MGS Director, moderated a *Public Forum on Science In Chesapeake Bay - An Estuary in Transition*. The forum consisted of speakers from both Maryland and Virginia who gave talks on managing growth in the Chesapeake Bay region, water quality and living resources,

shore erosion and sedimentation, tidal and non-tidal wetlands and National Water Quality Assessment Projects in the Bay area. A question and answer session concluded the forum, which was open to the public.

HYDROGEOLOGY AND HYDROLOGY PROGRAM

Most projects of this program are carried out under a cooperative agreement with the US Geological Survey (USGS). Through this agreement, funds budgeted by the state and participating intrastate agencies are generally matched by the federal government on a 50/50 basis. Staffs of both Surveys participate in project activities. The program is responsible for the maintenance of a statewide Water Data Network and the investigation of the hydrologic and geologic characteristics of Maryland's water resources. The Surface Water Network provides information on minimum, maximum, and average streamflows for the planning of water supply and sewage facilities, water power projects, dams, bridges, and other public and private works. The Ground Water Network provides information on water levels and ambient water quality from selected wells and springs. The Ground Water Network monitors the hydrologic effects of long-term changes in pumpage, land use patterns and precipitation.

Local and county projects are undertaken to determine aquifer and streamflow characteristics, water quality parameters and rates of replenishment. Applied research projects of this type are often supported by matching funds from county or state cooperators. Investigations were underway in areas of Anne Arundel, Garrett, Harford, Howard, Kent and Worcester Counties.

Streamflow Gauging Network

The USGS maintained 75 continuous-record stream gauging stations, including 14 quality-of-water sites and 7 sediment sites. In addition, 17 low flow sites were operated. Data from these stations for the 1990 water year appear in *Water Resources Data for Maryland and Delaware*, USGS Water Data Reports MD-DE-90-1 and MD-DE-90-2.

The Low Flow Study continued and a low flow transfer technique was developed which can be

used to make estimates of low flow characteristics at ungaged stream sites upstream and downstream from gaged sites. Considerable progress was made on the multiple regression analysis to develop regionalized estimating equations for determining low flow characteristics at sites on ungaged streams.

Ground Water Data Networks

Water Levels: This project maintains a continuous inventory of ground water levels in aquifers and selected springs of the state and relates changes in ground water levels to withdrawals and precipitation. Of the 194 observation wells and 3 springs monitored in the network, 3 wells are located in the Appalachian Plateau, 8 wells in the Valley and Ridge, 1 well and 1 spring in the Blue Ridge, 19 wells and 2 springs in the Piedmont, 69 wells in the Coastal Plain Western Shore, and 94 wells in the Coastal Plain Eastern Shore.

Ambient Ground Water Quality Network: Ten wells and four springs in Allegany, Garrett and Washington Counties were selected for inclusion in the statewide ground water quality network. This brings the total number of wells and springs in the network to 52 sites. This network serves to monitor the effects of non-point sources of pollution such as road salting and agricultural chemicals on ambient water quality. About 475 water samples were processed by the USGS laboratory for chemical parameters including major ions, radon, trace metals and organic compounds. The Western Maryland wells and springs represent the fourth segment of a statewide network which will be established over a five-year period in cooperation with the USGS and the Maryland Department of the Environment.

Project Reports Published or In Press

The following reports were either published or were in press at year's end:

- Bulletin No. 35, *Hydrogeology and Ground-Water Resources of Somerset County, Maryland* by W.H. Werkheiser.
- Bulletin No. 36, *Water Resources by Washington County, Maryland* by M.T. Duigon and J.R. Dine. (in press)

- Open File Report 91-02-5, *Hydrogeology and Stratigraphy of a 1,515-Foot Test Well drilled Near Princess Anne, Somerset County, Maryland* by H.J. Hansen and J.M. Wilson.
- Report of Investigations No. 53, *Geologic and Hydrologic Assessment of Coastal Plain Sediments in the Waldorf Area, Charles County, Maryland* by W.B. Fleck and J.M. Wilson.
- Report of Investigations No. 54, *Simulated Hydrologic Effects of the Development of the Patapsco Aquifer System in Glen Burnie, Anne Arundel County, Maryland* by G. Achmad. (in press)

The following report was issued by the USGS and is available:

- *US Geological Survey Open File Report 88-714, Water Withdrawal and Use in Maryland, 1986* by J. C. Wheeler.

STATUS OF ACTIVE COUNTY WATER RESOURCES PROJECTS

Howard County

A draft of the basic data report was in review at year's end. This report is a compilation of hydrologic data and includes locations and descriptions of 2,484 wells and 29 springs in the county. It also includes water level data measured in 65 wells, geophysical logs of 6 wells and measurements of physical properties from 11 springs. Results of chemical analyses from well and spring samples include 179 major ion and organic carbon analyses, 120 analyses of trace elements and radon, 68 triazine group pesticide analyses, 69 analyses for carbamate group pesticides, 11 volatile organic carbon compound analyses, 24 tritium analyses and 61 assorted nitrogen and phosphorus analyses.

Streamflow information includes drainage basin characteristics for 34 sites, monthly and annual flow statistics for 11 gaging stations, and discharge measurements at 22 partial record stations. Results of chemical analyses from stream samples include 281 major ion analyses, 52 bacterial and 13 assorted analyses from the Patapsco River, 111 analyses of nitrogen and phosphorus, and 11 pesticide and 10 trace metal analyses from bottom materials.

Water appropriation data from ground and surface water sources also are presented.

The Howard County water resources bulletin was being prepared at year's end. Major sections of the bulletin will address ground water characteristics and availability, streamflow characteristics (providing estimates of streamflow duration and low flow and peak flow frequency by sub-basin), estimates of hydrologic budgets by sub-basin and chemical quality of surface and ground water sources in the county.

Kent County

The well inventory was completed with approximately 1,175 wells field checked and accurately located on maps. From this database, wells were selected for a county observation well network. Network wells will be monitored for water level fluctuations and sampled for chemical analysis. The USGS will drill a 480-foot core hole in the Chestertown area. The core hole will help define the aquifers and confining beds underlying Kent County.

Somerset County

Bulletin No. 35 discusses the characteristics and availability of ground water in the county with particular emphasis on the Crisfield and Princess Anne Eastern Correctional Institution areas.

Washington County

Bulletin No. 36 discusses ground water (water levels, aquifer properties, well yields and water quality), surface water (basin characteristics, flow durations, flood frequencies, low flow characteristics and water quality) and hydrologic budgets of drainage basins.

Anne Arundel County (Annapolis Neck, Broadneck and Mayo Peninsula Areas)

A major objective of the project is to evaluate, using aquifer modeling methods, the effect that ground water pumpage from the Aquia and Magothy aquifers may have on the distribution and rate of movement of brackish water intrusion from Chesapeake Bay. Test drilling and field sampling were concluded. Data matrixes for water levels, aquifer characteristics and pumpage were compiled

and calibration runs of the multiple-aquifer flow model were made. Using closely-spaced test well data for calibration, a cross-sectional, salt water intrusion model was constructed through the Quiet Waters Park site on Annapolis Neck. After calibration of the models is completed, predictive runs will be made to estimate the effect of future pumpage on ground water levels and brackish water intrusion.

Anne Arundel County (Glen Burnie Area)

This project was begun in January 1991 in cooperation with the Anne Arundel County Department of Utilities and the Maryland Department of the Environment. The major objectives of this study are to estimate zones of contribution to the county well fields using various methods (determining the advantages and disadvantages of each) and to evaluate alternative well sites and pumpage conditions to minimize recharge from known sources of pollution. This study is partially funded by the US Environmental Protection Agency (EPA) as part of their Well Head Protection Program.

Fractured Rock Aquifers of the Piedmont (Westminster Area)

The City of Westminster cooperated in a project to ascertain the effects of certain construction and development procedures on well yield in fractured rock. A well was constructed and tested using both six-inch and fifteen-inch diameters and results show that yield approximately doubled after enlarging the diameter to fifteen inches; brushing, surging, hydraulic fracturing and drilling inclined collectors did not appear to improve yield significantly. A comprehensive report was in preparation at year's end.

Harford County (Coastal Plain Area)

The first draft of the Report of Investigations describing the results of this project was completed and in review at year's end. The report characterizes the Coastal Plain aquifers in eastern Harford County and evaluates their potential for future water supplies. Major sections of the report discuss water use, hydrogeology, ground water quality, ground water supply potential and effects of increased pumpage on water quality. A 1992 publication date for the report is anticipated.

Stormwater Infiltration

A comprehensive report examining the effects for stormwater management practices on ground water quality was funded by the Governor's Commission on Chesapeake Bay Initiatives with technical support and matching funds from the USGS. Hydrologic and chemical data from three sites were analyzed to determine the factors which mitigated or abetted contamination in ground water receiving stormwater infiltrate. The sites are located in Calvert, Anne Arundel and Carroll Counties. The findings of the study have general application to similar management facilities.

Some results of the study are:

- The major ion and trace element chemistry of ground water was modified, beneath and down-gradient of stormwater impoundments.
- The EPA and Maryland Department of the Environment regulations for drinking water quality for aluminum, cadmium, chloride, chromium and lead were occasionally exceeded in ground water.
- Concentrations of anthropogenic organic compounds which were measured in storm-water were below or at detection limits in ground water.
- Ground water concentrations of barium, cadmium, chloride, copper, nickel, strontium, zinc and total dissolved solids were consistently elevated compared to background levels for two of three sites, while dissolved oxygen concentrations and pH tended to be lower than background at each site.
- Elevated concentrations of chloride and trace metals in ground water resulted from hydrodynamic factors that prevented effective dilution and geochemical factors (especially pH fluctuations) which enhanced constituent solubility.

Worcester County (Ocean City Area)

The Ocean City Manokin Aquifer System is the sole supply of potable water for Ocean City which withdrew about 2,000 million gallons of water from this aquifer system in 1990. Brackish water exists in parts of the aquifer system and chloride

concentrations have risen over the past twenty years. Last year, a study of the distribution and movement of brackish water in the Ocean City and Manokin aquifer system began. Work includes relating the distribution of chlorides to the hydrostratigraphy of the aquifers and confining beds, collection and analysis of water-quality data, recalibration of a ground water flow model of the Ocean City area and development of a solute transport model to simulate the movement of salty water in the aquifer system.

The eastern Worcester County Observation Well Network continued with collection of pumpage, water quality and water level data.

Other Active Projects

- The effect of ground water pumpage on water levels in the vicinity of three Southern Maryland power plants (Calvert Cliffs, Chalk Point and Morgantown) was monitored. In the spring and fall, several hundred wells were measured and synoptic water level maps prepared for the Aquia and Magothy aquifers. Water level monitoring at the Vienna Power Plant in Dorchester County and the Perryman Peaking Plant in Harford County was continued. Project activities are carried out in cooperation with the Power Plant Research and Environmental Review Division, Tidewater Administration.
- Local data collection networks were operated in the Glen Burnie area of Anne Arundel County to monitor ground water levels and stream flow in Sawmill Creek and on Kent Island in Queen Anne's County to monitor ground water levels and chloride content.
- The hydrologic effects of deep mining are being investigated at the Mettiki coal mine in southwestern Garrett County. Changes in stream flow, ground water levels and water quality are being documented at several sites and related to mining progress, mine geometry and volume of mine drainage.

ENVIRONMENTAL GEOLOGY AND MINERAL RESOURCES PROGRAM

This program is responsible for geologic and environmental mapping and research, topographic map revision, mineral and energy resources investi-

gations and dissemination of geologic information. Research studies provide the basic geologic framework for delineating and managing the state's mineral, energy and land resources.

Geologic, Topographic and Mineral Resources Mapping

The major activity of this program remains geologic mapping. Field and office work were in progress for the Bittinger, Artemas, Bellegrove, Middletown, Keedysville, Clear Spring, Shepherdstown, Harpers Ferry, Funkstown, Libertytown, Littlestown and Manchester Quadrangle Geologic Maps. Several maps were in preparation for open-file status. The Hampstead Quadrangle Geologic Map by Peter D. Muller was published during FY 1991.

The York COGEOMAP Project completed its second year of federally supported mapping. A surficial geologic map and an overburden-thickness map were near completion for the Delta quadrangle, and a landform map was near completion for the Bel Air quadrangle. A bedrock geologic map of the Bel Air quadrangle and a reconnaissance geologic map (scale 1:100,000) of the Lineboro, New Freedom, Fawn Grove, Delta, Conowingo Dam and Rising Sun quadrangles were also completed.

Compilation continued on three of a new six-sheet Geologic Map of Maryland. The Lower Eastern Shore sheet has been scheduled for publication in FY92. The entire set may be completed by 1996, which marks the 100th anniversary of the modern Maryland Geological Survey.

Revised Topographic Maps of Carroll County by Jonathan Edwards, Jr. and St. Mary's County by John D. Glaser were published during the year, and the ever-popular Topographic Map of Garrett County was reprinted. Work continued on the revision of the Howard County Topographic Map.

The new map of Mineral Resources of Somerset County was produced in blue-line and a similar map for Worcester County was nearly ready for reproduction as were minerals resources maps for six other Eastern Shore counties.

Geologic Studies and Reports

Published in FY 1991 were *Information Circular 49, Directory of Mineral Producers in Maryland - 1989*, and Bulletin No. 37, *The Geology of Cecil County, Maryland* by Michael W. Higgins and Louis B. Conant. Two out-of-print pamphlets were reprinted: *Building Stones of Maryland* and *Earthquakes and Maryland*. Also printed was a new *1991 List of Publications*.

Work continued on a Report of Investigations, tentatively titled the *Lithostratigraphy of the Blue Ridge to Great Valley Transition Rocks in Maryland*. An offshoot of geologic mapping, this research closely examines a problematic suite of rocks in Washington County. Preliminary results were presented this spring in two papers at a Geological Society of America meeting.

The final report, *Heavy Mineral Abundances on the Continental Shelf of Maryland*, was submitted, thus completing three years of the program's involvement with the Minerals Management Service (US Department of the Interior). Results of the research were presented in a poster session at the GSA meeting.

Progress was also made on a geologic transect, or road log, of Maryland from one end of the state to the other. The result will be a pamphlet for the general public which describes geologic points of interest along the major highways from US 50 at Ocean City to I-68 at the West Virginia border.

A USGS-Maryland Geological Survey cooperative drilling and coring project near the town of Weverton was completed, having penetrated a fault at a depth of 80 feet. The joint venture was useful to mapping projects of both the USGS and MGS. Geologic interpretation in this part of the Blue Ridge of Maryland has been problematic, but information obtained from this rock core should greatly aid in a better understanding of the local geology.

Outreach Activities

Numerous speaking engagements constituted the major outreach activity. These included talks to inmates at the Juvenile Detention Center in Chestertown about Maryland's natural resources; to students from North Hagerstown High School,

Smithsburg Elementary School, West Middle School, and the Greater Patapsco Community Association on the subject of Sideling Hill Exhibit Center and Sideling Hill geology; to students at Fairview Outdoor School (Washington County) on local geology; to 200 students at Westminster High School on mining and the environment in Maryland; to classes at the Bryn Mawr School on local geology; to students at the House of the Good Shepherd on map making; to several classes at Camp Hickory in Garrett County about geology and soils; to a group of patients at Springfield State Hospital about rocks of Maryland; and to the Geology Department at the University of Delaware on the subject of mapping in the Maryland Piedmont.

Other activities included staffing the Sideling Hill Exhibit aboard the *Bay Lady* as part of Tourism Week in the Inner Harbor and providing a Building Stones of Maryland Exhibit at the Atlantic Coast Gem and Mineral Show in Pikesville.

Interdepartmental/Interagency Activities

Effective October 1, 1990, the regulatory component of DNR's oil and gas exploration and production program was transferred from the Maryland Geological Survey to the Water Resources Administration.

There were numerous meetings concerning the geologic exhibits at the Sideling Hill Exhibit Center. These included pre-bid and post-bid conferences, continued monitoring and consultation concerning construction of exhibits, several visits to the site in Washington County, and continued geological education of Forest and Park Service personnel assigned to the Center. Staff worked closely with representatives from State Highway Administration, the State Forest and Park Service, Engineering and Construction (formerly Capital Programs), Office of Tourism Development, and others.

A program geologist attended monthly meetings of both DNR's Wildlands Committee and the Savage River State Planning Team at various locations around the state. Issues ranged from wildlands designations to land use of state forest.

Representatives of the Carroll County Planning Department and MGS personnel met concerning the Survey's map, *Mineral Resources and Mined*

Land Inventory of Carroll County, in regard to the county's re-evaluating its policy regarding potential mineral resources. Geologists met a second time with county representatives concerning mineral extractive operations and zoning in the county.

Other Professional Activities

The petroleum geologist attended the 22nd Annual Appalachian Petroleum Geology Symposium in Morgantown, West Virginia and presented a paper reviewing Maryland's oil and gas activities for 1990. He also attended the annual meeting of Minerals Management Service - Regional Technical Working Groups in Herndon, Virginia to discuss the latest five-year Outer Continental Shelf leasing plans and schedule.

A question about the legal boundary between Maryland and the District of Columbia resulted in one of our geologists attending an informational meeting of the District of Columbia Boundary Bicentennial Committee (DCBBC), a subcommittee of the American Congress of Surveyors and Mappers. The DCBBC's intent was to celebrate the bicentennial of the L'Enfant-Ellicott-Banneker 1791 monumentation of the District of Columbia's boundaries. As part of the celebration, they resurveyed those monuments with state-of-the-art instrumentation. MGS was instrumental in getting 200 bags of Sakrete donated by American Stone-Mix, Inc. for planting the markers; providing letters of identification as volunteers and agents for MGS in the field work; and providing liability protection under the Maryland Tort Claims Act.

Earth Science Information Center (ESIC)

Through ESIC, technical and non-technical information can be obtained on reports, topographic and geologic maps, aerial photographs, satellite imagery, geodetic and tidal datum information, and various other types of resources relating to geology and geography.

The ESIC Office is an affiliate of the USGS Earth Science Information Network. This network contains affiliates throughout the United States, including Alaska and Hawaii. Data relating to the earth sciences are transferred throughout the network and ESIC uses this network to answer public

inquiries. This year, ESIC handled nearly 1,000 requests for earth science information and has hosted various field trips at MGS for school children.

The library also serves as a resource center. Materials include state and federal publications, periodicals, maps, aerial photographs, and historical publications which have been put in archives. The library maintains an exchange program with other state and foreign geological surveys.

COASTAL AND ESTUARINE GEOLOGY PROGRAM

The program investigates and determines the geologic framework and resources of the state's coastal environments extending from the barrier island of the Atlantic Ocean to the wetlands and shorelines of Chesapeake Bay. The modifications of the geologic framework by modern geological processes is an important element. These studies are conducted by geologists from both the Coastal Deposits and Cohesive Sediments Projects.

Geological History of Chesapeake Bay Study

The cooperative study with the USGS and the Virginia Institute of Marine Science culminated in a final publication entitled *Ancient Channels of the Susquehanna River Beneath Chesapeake Bay and the Delmarva Peninsula* in Geological Society of America Bulletin, Volume 102 (1991). The paper describes three paleochannels of different ages and their geologic origins and evolution.

Currently, a combination of sedimentology, radiometry, palynology and sediment geochemistry is being used to assess the depositional setting of each paleochannel. Data from deep (200 feet) continuous cores from each paleochannel are used to delineate these different depositional environments.

Studies Along Ocean City and Assateague Island

Profiling continued on the Ocean City beach at 17 transects, many of which have been surveyed since 1972. With Phase I of the Ocean City Beach Replenishment Project completed and Phase II near

completion, the long-term profiling provided a basis for comparison. A report describing beach changes over this twenty-year period will be completed in the next fiscal year.

In cooperation with the Minerals Management Service, two research studies were initiated: (1) investigation of the shallow geologic framework off Ocean City using the sedimentary model developed offshore of Assateague Island and (2) environmental mapping of the geochemical and sedimentological conditions of Isle of Wight Bay and Assawoman Bay.

Studies of Shoreline Changes

In cooperation with the Coastal Resources Division, Tidewater Administration, re-mapping of the historical shoreline changes is in its third year of study. A combination of techniques of imagery processing and computerization of 90 orthophoto quadrangles is being used to update the historical shorelines at a scale of 1:24,000. Nine quadrangles in the Potomac River were selected as a pilot test for methodologies and procedures. The Solomons Island quadrangle was also selected for evaluation with procedures developed by the National Oceanic and Atmospheric Administration. A new study was launched with the Geography Department of The Johns Hopkins University to investigate the slope erosion processes along the cliffs in Calvert County. Sites were selected at Chesapeake Beach, Scientist's Cliffs, Calvert Cliffs State Park, and Chesapeake Ranch Estates. Water monitoring wells were drilled by the Water Resources Administration's crew at these four sites. Instrumentation to monitor water level is in place at two of the sites. Nearshore bathymetry was conducted to investigate the waves and along-shore drift in the erosional process.

Hart-Miller Island Monitoring Study

For the past nine years, physical features and geochemical components of the sedimentary environment around Hart-Miller Island Dredged Material Containment Facility have been monitored. These long-term data sets have been incorporated into the 3-D Hydrodynamic Model of Chesapeake Bay developed by the US Army Corps of Engineers. A poster session entitled, *Effects of the Hart-Miller Island Dredged Material Containment Facility on the Surrounding Sedimentary Environ-*

ment was presented by Lamere Hennessee, June Park, James M. Hill and Darlene V. Wells at the Chesapeake Bay Consortium Conference, "New Perspectives in the Chesapeake Bay System."

The difficulties in interpreting and comparing trace metal data in sediments due to variations in sediment textures in addition to differences in analytical methods are discussed in a paper by James M. Hill, Lamere Hennessee, June Park and Darlene V. Wells. The paper entitled, *Comparison of Interpretive Techniques for Assessing Trace Metal Levels in Estuarine Sediments Around a Dredged Spoils Containment Facility* is in the final review process. A second paper, *Zinc Enrichment of Bottom Sediments Around The Hart-Miller Dredged Material Containment Facility* by the same authors is also in final review. Zinc enrichment in the bottom sediments due to effluent discharges is being tracked with the use of the 3-D model.

Dredged Sediment Study

In cooperation with Water Resources Administration, the eleventh year of study continued to monitor the sediments dredged from the approach channel to the Chesapeake and Delaware Canal. The dredged sediment depositional model, constructed in the previous year, provided a new method to evaluate the physical and volumetric changes associated with overboard emplacement. The model is described in Open File Report No. 10, *Monitoring of Sediment Dredged from the Approach Channel to the Chesapeake and Delaware Canal, November 1988 -September 1989*.

A contract was signed with the US Army Corps of Engineers, Philadelphia District, to determine the remaining capacity of the overboard disposal sites in the upper Bay. The study will include a historical analysis of the upper Bay bottom modifications associated with dredging practices. Staff geologists participated on the Dredged Sediment Task Force chaired by the Maryland Environmental Service.

Sediment Resuspension Study

The Sediment Resuspension Study initiated field work last fiscal year. The study will examine relationships between the sediment resuspension and the movement of toxic substances across the sediment-water and benthic interface. To characterize the resuspension of sediment-bound toxics, detailed *in situ* measurements were collected during several cooperative sampling cruises. The multi-discipline research team included scientists from the University of Maryland. A paper examining resuspension processes was published in *Marine Geology* by Lawrence Sanford, William G. Panageotsu and Jeffrey P. Halka entitled, *Tidal Resuspension of Sediments in the North Chesapeake Bay*.

Sediment Geochemistry

Research efforts have been directed toward developing information on the geochemical cycling history of Chesapeake Bay which involves natural gas generation in Bay sediments and its effects on the environment and water quality history of the Bay. The initial results were presented by James M. Hill at a conference sponsored by the Shallow Gas Group in Edinburgh, Scotland. The paper is entitled, *Geologically Constrained Shallow Gas in Sediments of Chesapeake Bay: Distribution and Effects of Bulk Sediment Properties*.

Support Operations

In support of the program's research projects, new laboratory and field equipment were purchased, including a Thermo Jarrel-Ash inductively-coupled plasma spectrophotometer and a Datasonics remote altimeter.

The research vessel, *Discovery*, logged 762 hours of operation. The vessel was also utilized by DNR units of Power Plant and Environmental Review, Maryland Environmental Service, Water Resources Administration, Fisheries, and Coastal Resources Division as well as the Department of the Environment and the University of Maryland's Center for Environmental and Estuarine Studies.

Public Lands

STATE FOREST AND PARK SERVICE

From the splendor of Swallow Falls to the colonial charm of Fort Frederick, to the spacious beauty of Assateague, history, recreation and nature continue to thrive in Maryland's state forests and parks. Approximately 8 million people annually visit these incredible 65 locations throughout Maryland.

The roads, boundary lines and trails managed by the Forest and Park Service, if placed end to end, would stretch across the country. Some descriptive numbers include: 2,500 campsites, 11 swimming beaches, 5,700 picnic sites, 600 miles of shoreline, 1,500 buildings and 5,300 acres of impounded water.

The Service accomplishes their work with a multi-talented work force. Rangers are law enforcement officers who also do nature programs and maintenance. Technicians provide the varied expertise to maintain the facilities.

During the first six months of 1991, twelve park areas were closed due to budget restrictions. During that time, volunteerism was encouraged; and with management direction, eight of the parks functioned with volunteers. This citizen involvement helped to revitalize the volunteer efforts in numerous parks.

Other highlights from 1991:

- A three person Substance Abuse Unit was formed as part of the effort initiated by the Governor's Drug and Alcohol Abuse Commission. This unit focuses upon prevention of drug use and enforcement on public lands.
- Rocky Gap State Park hosted the third annual Country Bluegrass Music Festival in August of 1991. The three day event attracted 30,000 people and involved a staff of 100 employees.
- Fair Hill Natural Resources Management Area hosted a Country/Bluegrass Festival in August of 1991, which attracted 25,000 people to the one day event.
- Sandy Point State Park hosted Chesapeake Appreciation Days in October; and in September the Maryland Seafood Festival and APBA Power Boat Races.
- Gunpowder Falls State Park hosted the Bass Masters Classic in August.
- Maryland hosted the National Rails to Trails Conference in June, including a "Function at the Junction" event on the Northern Central Trail in Gunpowder Falls State Park.

FY 1991 Visitation

Assateague	220,963
Big Run	152,328
Calvert Cliffs	55,158
Casselman River	28,980
Cedarville	39,864
Chapel Point	10,972
Choptank River	86,566
Cunningham Falls	997,803
Dan's Mountain	20,229
Deep Creek Lake	107,268
Elk Neck	325,535
Fort Frederick	124,659
Gambrill	377,283
Gathland	46,880
Greenbrier	266,527
Gunpowder Falls	540,930
Herrington Manor	121,687
Janes Island	180,352
Governor Ritchie Overlook	64,775
Jonas Green	46,198
Martinak	49,277
Matapeake	54,736
Morgan Run	9,927
New Germany	85,184
Patapsco Valley	821,576
Patuxent	17,552
Pocomoke River	279,369
Point Lookout	346,655
Rocks	149,260
Rocky Gap	276,474
St. Clement's	12,886
St. Mary's	20,975
Sandy Point	512,548
Seneca Creek	221,717
Severn Run	33,895
Smallwood	103,954
Soldiers Delight	69,432
South Mountain	74,690
Susquehanna	172,917
Swallow Falls	154,737
Tuckahoe	80,505
Washington Monument	56,398
White Water	21,508
Wye Oak	43,594
Youghiogheny River	7,890
Green Ridge	288,656
Savage River	141,381
Potomac-Garrett	49,087
Pocomoke	9,145
TOTAL	7,980,882

PEOPLE IN PARKS

The "People In Parks" division of the Maryland Forest and Park Service was created in April, 1991. Its primary focus is citizen involvement on public lands. From voluntary participation on advisory committees, to shared operating responsibilities such as those in the Adopt-A-Park programs, to active participation in outdoor activities, the goal is public involvement on public lands.

Staff members immediately assumed responsibility as lead agency for the development of the Savage River State Forest Ten Year Management Plan. Designed to create a plan which combines resource and citizen needs over the next decade, the process includes numerous public involvement sessions and the coordination of the activities of a 22 member citizen advisory committee and a 19 member interdisciplinary resource planning team.

Resource management and professional volunteer assistance came together at Deep Creek Lake State Park when volunteers from the Maryland Forest Association and the Sierra Club assisted with the removal and clean up of 300 dead or dying trees in the day use area. The involvement of those concerned citizens was valued at approximately \$50,000. Plans are now being made to replant the area.

Private donations and volunteer assistance kept the Maryland Conservation Corps active in 1991. Over \$287,000 in federal, local, county, industry and private grants enabled approximately 500 youth to complete 9,300 hours of environmental education while completing over 50 environmental work projects across the State. Projects included bank stabilization, stream clean up, trail and footbridge construction and construction of a boardwalk and nature trail for the physically impaired. Our Corps won National Recognition for their work at the Mt. Briar Wetlands in Washington County.

Activities to make our facilities and programs accessible to people with disabilities were not limited to the actions of the Conservation Corps. Over 800,000 visitors with disabilities came to use the forests and parks. The Chesapeake Regional Accessible Boating Program began at Sandy Point State Park by providing sailing opportunities and instruction for people with disabilities.

Across the State accommodations for people with disabilities included sign language interpreters and

accommodations for the mobility impaired at special events and programs and new accessible facilities at Patapsco Valley State Park including campsites, day-use facilities and scenic overlooks.

Visitors enjoyed a variety of traditional park programming including nature study, living history, Bay education programs and special events of all kinds. Yet several program highlights are worthy of special mention. 1991 saw the kick-off of our new Outdoor Adventure Programming featuring canoe trips, backpacking, wind-surfing, mountain biking, and hiking. There is an outdoor adventure for everyone. Afternoon trips or overnight retreats guided and staffed by professional rangers allowed park visitors to enjoy, experience and learn about the outdoors in a manner that best suited their personal needs.

Making nature and environmental education fun is the goal of our "Scales and Tales" program which is jointly funded by the Service, the Maryland State Park Foundation and private donations. During 1991 over 900 programs were presented to over 200,000 children and adults on state forests and parks and off-site presentations. Private donations exceeded \$20,000 in 1991.

Environmental and drug education are primary components of our Junior Ranger and Camp Concern residential camps for kids. Over 2,300 children benefitted from their experiences as Junior Rangers and approximately 200 Baltimore City youth participated in Camp Concern which is a partnership program between the Service and the Baltimore City Parks and Recreation Department. This year saw the birth and infancy of our drug education program, "Take The Drug Free Trail."

Finally, in 1991 we began to identify and develop new and better marketing relationships. Special exhibits were featured at fourteen trade shows, fairs and special events. Joint promotions with DEED and county tourism offices focused on camping, canoeing and hiking opportunities in Maryland. Familiarization tours of state park facilities were conducted for the staffs of the State Highway Visitor Information Centers. We even made great inroads for television and radio coverage to begin during the summer of 1991.

ENTERPRISE DEVELOPMENT

The Enterprise Development Program is responsible for all real estate transactions impacting land managed by the Department of Natural Resources. This Program promotes the development, use and rehabilitation of the Department's real property through public-private partnerships. The activities of Enterprise Development are accomplished through three primary divisions: Public Private Ventures, Cultural Resources Management and Real Property Review and Evaluation.

Public-Private Ventures

The Public Private Ventures Division promotes development of recreational and tourism facilities on state lands by private entities and local governments to generate benefits and revenue for both the public and private sectors. These ventures ensure the preservation and integrity of our natural resources while enhancing their recreational potential and fiscal productivity. Following are examples of the type of projects which the Public Private Ventures Division handled in FY 1991:

Rocky Gap State Park - continued negotiations with and assisted a nationally known developer and operator in obtaining debt and equity financing for the construction and management of a Resort Hotel/Conference Center and 18 hole Jack Nicklaus Signature Golf course. Construction is expected to begin in the spring of 1992.

Fair Hill Natural Resource Management Area - Construction of an 11,000 square foot office building on land leased by the Department for use as the national office headquarters for the Thoroughbred Racing Association and Thoroughbred Racing Protective Bureau was completed in May 1991.

Susquehanna State Park - At the request of the local delegation, completed a feasibility study for the creation of a public-private venture for the development of a golf course.

Fort Washington Marina - Assisted the Department's Boating Administration in marketing this newly renovated marina for operation by the private sector.

Patapsco Valley State Park - Negotiated a lease with a non-profit corporation, the Maryland Council for Special Equestrians, Inc., which provides for the construction of an indoor riding arena for use in therapeutic riding programs for handicapped children. Construction of the indoor arena shall be completed in the fall of 1991.

Patapsco Valley State Park - Completed lease negotiations with Carroll County Government to develop the Raincliffe area as a day use recreation area.

Cultural Resources Management

The Cultural Resources Management Division secures private sources of funding for preservation and restoration of historic structures owned by the Department of Natural Resources. It also assists other units in matters dealing with the acquisition and capially-funded improvement of historic structures. And it provides information and guidance to the State parks in matters of historic interpretation (exhibits, publications, living history demonstrations, etc.).

In FY 1991, the Cultural Resources Management Division accomplished the following:

Secured Board of Public Works approval for four additional resident-curatorships, bringing the total number of curatorships to 16 and representing an additional commitment of \$494,647 of private sector investment in the improvement of State-owned historic structures.

Secured Board of Public Works approval for two long-term leases of historic structures representing an additional private sector commitment of \$262,599 of improvements to State-owned historic structures.

Supervised various on-going private preservation projects representing a minimum of \$140,000 of actual private sector investment in improvements of State-owned historic structures (figure is for calendar year 1990). Total actual value received by the State from all curatorships and leases of historic structures through calendar year 1990 is \$1,324,785.

Directed the publication of "Sketches from Prison", a Confederate artist-prisoner's record of life at Point Lookout Civil War prison. Publication paid

for by the Maryland State Park Foundation, Inc., a private, non-profit charitable corporation. "Sketches" is to be offered to the public through State park concessions.

Supervised installation of tobacco exhibits at Smallwood State Park.

Conducted 16 routine and one final inspection of curatorship/lease projects.

Spoke at ten different public meetings on various aspects of Maryland history.

Real Property Review and Evaluation

This Division is responsible for the overall review, coordination and execution of all housing, outbuilding, agricultural, grazing leases, and miscellaneous long term leases, as well as all right of ways, easements and use agreements for the Department. This Division also maintains all real property records and inventory, does reappraisals and processes real property gifts, disposals, razings and office space requests.

In FY 1991 the Real Property Review and Evaluation Division accomplished the following:

Processed 98 requests for new right of ways, easements and use agreements.

Reviewed, coordinated and approved approximately 300 lease agreements (annual income in excess of \$900,000).

Inspected and reappraised 76 houses owned by the Department.

Reviewed, coordinated and received Board of Public Works approval for new office space in Annapolis, Cumberland and Frostburg.

MARYLAND ENVIRONMENTAL TRUST

The Maryland Environmental Trust was established by the General Assembly in 1967 to conserve, improve, and perpetuate the state's natural, scenic, and cultural qualities. Activities of the "Keep Maryland Beautiful" program were also transferred to the Trust in 1967 from the State Highway Administration. Programs and policies of the Trust

are defined and supervised by a volunteer Board of Trustees consisting of 12 citizens and three ex-officio members (Governor, President of the Senate, Speaker of the House).

For 19 years, the Trust's major program has been the acquisition of conservation easement donations (development rights) on properties of recognized public conservation value. Private properties protected by conservation easements include farm and forestland, waterfront, marshes, streams and ponds, scenic views, wildlife and plant habitats, historic properties, archeological sites, and properties of educational or recreational value. The Trust has accepted conservation easements on 208 properties statewide encompassing approximately 36,308 acres valued at over \$80 million. Easements accepted by the Trust are reviewed and approved by the Maryland Board of Public Works prior to recordation.

The Trust received 125 easement inquiries in FY 1991. A total of 26 easements covering 5,290 acres were documented, accepted and recorded this fiscal year. Six of the easement properties are adjacent to prior easement sites. Six have frontage on tidal tributaries of the Chesapeake Bay, increasing the protection of an additional five miles of Bay shoreline. Six are the sites of historic homes, and 15 include productive agricultural land.

Regional easement highlights for the year include:

The largest conservation easement donation in MET's history is an eastern region easement covering 2,532 acres of extensive shoreline along the Transquaking and Chicamacomico Rivers in Dorchester County. The property will be used as a nature preserve, hunting area, and for environmental education. Other new easement properties in the eastern region include a 212-acre farm on the Wye East River in Queen Anne's County and a 93-acre property on Braddock Bay in Dorchester County held jointly by MET and the Eastern Shore Land Conservancy. Two other easement donations were donated to be held jointly by MET and the Lower Shore Land Trust — one 175-acre property in Somerset County along the Annemessex River and Annemessex Creek providing protection for an eighteenth century historic house, and a 25-acre property protecting farm and forestland.

In the southern region, two easements were donated in Calvert County to protect farm and forestland and provide buffers in two significant watersheds, Governor's Run and Parker's Creek. Another 27-acre easement in Howard County protects an historic farmhouse and the scenic open space surrounding it.

In the central region, Baltimore County FY 1991 easements totalled 645 acres to protect farm and forestland, three historic houses, historic districts, and watersheds of the Prettyboy Reservoir and North Branch. Harford County FY 1991 easements totalled 224 acres to protect farm and forestland, an historic district, and buffers for Thorton Branch, Little Gunpowder River, and Gunpowder State Park. A new 437-acre easement in Kent County preserves an historic house with its surrounding farm and forestland. A 106-acre easement in Cecil County protects a natural heritage area and Money Creek.

In the western region, a Frederick County easement of 170 acres protects a civil war historic site and Frostown Branch. A 150-acre easement in Washington County provides protection for farm and forestland, and potential archeological values on the Conococheague Creek.

The Keep Maryland Beautiful Committee of the Maryland Environmental Trust Board of Trustees selected the following organizations as winners of the Keep Maryland Beautiful Awards: the Echo Hill Outdoor School of Kent County was chosen as the recipient of the Margaret Rosch Jones Award of \$1000 and two Environmental Education mini-grants of \$500 each were awarded to the Calvert County Wildflower Project and Dennett Road Elementary School of Garrett County.

The Land Trust Assistance Program, conducted in cooperation with the Chesapeake Bay Foundation with a \$34,000 grant from the National Oceanic and Atmospheric Administration implemented through the Coastal Resources Division of the Department of Natural Resources, has resulted in the formation and training of nine new local land trusts in Maryland. Local land trusts pursue land protection on a local level using a variety of techniques including conservation easements held jointly with MET. The total number of local land trusts in Maryland is currently 34, representing a dramatic increase since October 1988 when only seven existed.

Local land trusts now protect 12,365 acres of open space in the state. MET works with these trusts and several national land conservation organizations through the Maryland Land Trust Alliance, an umbrella group for coordinating land trust activities in Maryland. A Land Trust Assistance Manual, published by the Trust, guides new local land trusts in formation and in participation with this joint program. In 1991, MET provided matching administrative grants totalling \$53,000 to 14 local land trusts through the Janice Hollmann Land Trust Grant Fund, named for the founder of the Severn River Land Trust.

Also in FY 1991 MET continued the Rural Historic Village Protection Project for a second year. The Project is a collaborative effort of the Maryland Historical Trust, The Maryland Office of Planning, the National Trust for Historic Preservation, the Maryland Agricultural Land Preservation Foundation, and the Chesapeake Bay Foundation, as well as local officials and land trusts. The Project is designed to market a menu of state and local land preservation programs around selected villages in order to protect these villages in their historic rural setting of farm and forest lands, or bay shorelines. The program was funded in FY 1991 by grants from the Maryland Historical Trust, the Kaplan Fund Inc., and the National Trust for Historic Preservation. Grants were made to three local land trusts to carry out easement solicitation work in seven of the villages.

Resource Conservation

FORESTRY DIVISION

The Forestry Division provides technical assistance to private landowners, municipalities, and other government units for the management of their forests and individual trees. The program's goal is to improve and maintain the economic, aesthetic, recreational, environmental, and social contributions of trees, forests, and related resources for the benefit of Maryland's citizens.

The program has five major elements: Forest Resource Management, Forest Protection, Chesapeake Bay Forestry Initiative, Urban and Community Forestry, and Forest Products Utilization and Marketing.

Accomplishments of the past year include:

- More than 600 forest management plans involving 26,000 acres, were written for forest land owners to assist them with good stewardship of the forest resource.
- Tree seedlings were planted on approximately 5,700 acres of land; 4,100 acres reforested and 1,600 acres of field plantings.
- The Green Shores program produced 686 acres of buffer plantings.
- The Maryland Forest Conservation Act of 1991, the first statewide forest protection legislation in the nation was signed into law on April 29, 1991. This law is an important part of a "no net loss" forests strategy for Maryland. DNR's Forestry Division was charged with writing regulations and the implementation manual for the conservation law for counties and municipalities by January 1, 1992.
- The Buckingham Forest Tree Nursery grew 5.3 million seedlings in FY 1991. These seedlings were planted for various conservation purposes including watershed protection, wildlife habitat improvement, windbreaks, highway beautification and timber production. Many were distributed to schools for Arbor Day, Earth Day and Tree-Mendous Maryland

celebrations. The nursery played an integral role in helping to meet Governor Schaefer's One Million Tree Challenge.

- Sixty school forests were established through the Green Shores' Chesapeake Bay School Reforestation project. The project is aimed at educating students on the value of trees, especially for watershed protection. The project is coordinated by the Maryland Association of Forest Conservancy District Boards.
- Another education project sponsored by the Forestry Boards was the 16th Forestry/ Conservation and Natural Resources Week, August 12-18, 1990 at Camp Hickory in Garrett County. Forty-eight students interested in pursuing forestry and other related conservation careers attended. During FY 1991, Forestry Board members volunteered 12,053 hours of their time promoting the wise conservation, management and use of Maryland's forest lands.

FY 1991 was Tree-Mendous Maryland's best year to date. More than \$160,000 was raised through the Gift of Trees program, equating to 13,000 balled and burlapped trees or 100 acres of mature forest.

The Gift of Trees launched a program to help replant our parks. In 1991 Carroll County joined Baltimore County in recycling Christmas trees and rewarding recyclers with seedlings. Tree-Mendous Month saw 34,000 citizens involved in planting 1,250,000 seedlings and trees. This activity will become an annual focal point in the Forestry Division for citizen involvement.

The primary goal of the Urban and Community Forestry program during FY 1991 was to create an environmental awareness among the citizenry which would, in turn, stimulate action to improve the quality of life in communities throughout the state. Direct technical assistance was provided to more than 150 county and municipal governments by providing advice and guidance in their efforts to develop local urban forestry management programs.

Specific accomplishments included:

- A computerized tree inventory program, the Street Tree Enumeration and Management System (STEMS), was developed and became fully operational.
- Twenty-three communities were provided street tree inventories or were trained in the process of developing their own survey.
- Forestry Division personnel worked with another 45 communities to develop or update tree protection ordinances, create citizen tree commissions and train public works department staff on the proper techniques of tree care.
- Through the division's direct efforts, Maryland now has 22 municipalities, each certified by the National Arbor Day Foundation as a "Tree City, USA", a 35% increase over 1990.

Designated the lead agency to meet Governor Schaefer's One Million Tree Challenge, the Forestry Division developed a comprehensive program to involve citizen volunteers, service groups, businesses and other government agencies in carrying out the largest single reforestation effort in the state's history.

As part of that effort the following accomplishments were realized.

- During April 1990, designated "Tree-Mendous Month" in Maryland, more than 34,000 volunteers participated in 458 individual tree planting events and planted 1,250,000 trees.
- Three hundred people attended eight Tree Planting Supervisor's Workshops conducted throughout the state for the express purpose of developing a corps of individuals who could be called on to organize and lead planting activities in their communities.
- Two hundred ten commercial nursery businesses participated as Tree-Mendous Month sponsors, carrying the forestry message to thousands of people. Trees purchased from sponsors during April were counted toward the 1,000,000 goal.

- Corporate partners who joined the effort and contributed significantly to the success of the program included Hardee's, McDonald's, IKEA, Chem-Lawn, Jones Intercable, Baltimore Television Channel 24 and PEPCO.

The Urban and Community Forestry Program is responsible for the efficient and consistent enforcement of several tree protection laws: Roadside Tree Care, Tree Expert and Reforestation Laws.

Accomplishments of note:

- As a requirement of the Reforestation Law, forests cleared because of the state-funded construction of highways, water and sewerage facilities and housing projects must be replaced. Division foresters reviewed more than 100 construction projects and developed plans and supervised the planting of 281,000 seedlings on 355 acres during the spring of 1991.
- Thirteen hundred fifty-six tree permits were issued to Maryland residents, utility companies and municipalities. Each permit application was inspected by a forester or technician to determine the need, intensity and procedure for the requested tree care. Personnel spent nearly 20,000 hours supervising and inspecting tree trimming and clearance operations of electric and communications utilities to ensure the health and beauty of the state's roadside trees.
- Seventy-four new Tree Experts were certified and licensed by the Forestry Division, bringing the total number of licensed tree experts in the State of Maryland to four hundred and ninety-eight.

In FY 1991 the project to update the Big Tree Champions of Maryland was completed with publication of *The Big Tree Champions of Maryland*. The book features the 157 champion trees, historic trees of our state and lists the 600 nominations. The Big Tree Champion process continues to locate and record new champions and nominations.

The **Resource Protection** program had an active and exciting FY 1991. During the year Forestry personnel responded to and aided in suppressing 655 wildfires that burned 6,250 acres of woodland, marsh and grass. The leading cause of wildfires was improper debris burning which caused 29 per cent of the fires. Arson was next with 25 per cent and equipment was third at 11 per cent.

Fire prevention was a major activity throughout the year. Three prevention programs were held as part of the Smokey Bear sports program in cooperation with the US Forest Service, National Park Service and the Bureau of Land Management. The Baltimore Orioles, Washington Capitals, and the Washington Bullets each hosted Smokey Bear and provided forest fire prevention messages and materials to their school-aged fans and parents. Forest fire prevention programs were also given at many schools throughout Maryland.

Maryland hosted the 1990 Mid-Atlantic Interstate Forest Fire Protection Compact training meeting at Wilson College in Chambersburg, Pennsylvania. The theme of the meeting was the Incident Command System (ICS) and how it functions to handle all types of emergencies including wildfires, floods, and hurricanes. Sixty-five people attended from the seven member states plus Minnesota, Wisconsin, Florida, the US Forest Service and the Northeast Forest Fire Compact.

Assistance to fire departments increased in FY 1991 through the Federal Excess Personal Property program. More than \$500,000 worth of equipment (trucks, portable pumps, tools, hose fittings, etc.) to use in forest fire suppression was acquired by the Department. Most of this was loaned to volunteer fire departments who assist the department on natural fuel fires.

The Forestry Division also assisted the fire departments through the Rural Community Fire Protection (RCFP) program. A total of \$38,000 in matching funds was granted to thirty-five (35) rural volunteer fire departments. These funds, available through the Cooperative Forestry Assistance Act, enable the US Forest Service to help state foresters train and equip rural fire departments to prevent and suppress wildfire.

Forestry personnel assisted the Maryland Department of Agriculture with the gypsy moth spray program. More than 150,000 acres were sprayed

in the spring of 1991. DNR Forestry Division works closely with Agriculture's Forest Pest Management Section to monitor and observe various forest insect and disease pests.

A total review of the fire program was completed during the fiscal year. Ten teams were named to examine specific areas of the fire program and make recommendations, where necessary, to improve the efficiency of the program and the delivery of services. All classifications of employees were represented on the teams. A final report was prepared and several recommendations have been implemented.

A new timber bridge over the Wye Narrows was completed. The 706-foot bridge was built from timber as a pilot project for the DNR-Forestry initiative to promote Maryland's forest resource and wood as a viable construction material for highway bridges. A design was accepted for a wooden bridge, a cost savings of \$2.3 million over a concrete and steel structure.

The Forestry Division, in cooperation with the lead organization, the Maryland Forests Association, organized and held the second annual Loggers Field Day. More than 2,000 people attended the two-day event at the Garrett County Fair Grounds. Exhibits and demonstrations at the event were designed to promote and educate people about environmental forestry conservation.

The **Eastern Region** sponsored four days of school tours in October with 1,800 students and teachers from Wicomico and Worcester Counties learning about forest fire prevention and urban forestry. An open house at the Project Office and the Wicomico Demonstration Forest informed 300 local and area residents of forestry programs. It was a regional effort and involved the cooperation of many organizations.

In the **Western Region**, demonstration areas were completed in Walkersville and at the Monocacy Natural Resource Management Area, both in Frederick County as part of the Monocacy Forested Watershed Project. At Walkersville Heritage Farm Park a demonstration area containing a nature trail was developed with the cooperation of the Walkersville Town Commissioners, town maintenance staff and a Boy Scout doing a service project as part of his Eagle Scout requirements. The nature trail is called the "Forest Buffer Nature

Trail" and is a loop through various buffer plantings which demonstrate the value of stream buffers. An official dedication was held with the high school band, local and county politicians, and other officials in attendance. With the help of boy scouts, girl scouts, college students and other interested citizens (60 volunteers in all) 7.7 acres of buffer were planted as part of a stream buffer demonstration area. The seedlings are being managed in different ways; some with tree shelters, some by mowing, a few with herbicides and a few with no management. Barbed wire fencing was installed to keep the cattle which graze on the property out of the stream. A gravity-fed water trough to provide water for the cattle was installed, a stream crossing was improved, and gravel was placed on several roads.

The Central Region manages two demonstration forests, Elk Neck in Cecil County, and Stoney in Harford County. These areas exhibit sound forest stewardship-management to promote watershed protection, wildlife management, timber management, recreation and aesthetics. Elk Neck, a 3,200-acre forest, contains a rifle and pistol range which are used by approximately 20,000 visitors annually. The ranges were closed in February because of safety concerns and a lack of funding for maintenance. Three sportsmen's organizations, Stoney Creek Fishing and Hunting Club, Maryland State Rifle and Pistol Association, and the Baltimore County Fish and Game Club donated the materials and supplies necessary to rebuild the ranges. On Memorial Day weekend, forestry personnel joined approximately fifty volunteers on Elk Neck to rebuild the rifle and pistol ranges. The ranges were reopened for public use June 1, 1991.

The Natural Design in Development Conference was presented in April. The conference was designed to educate the development industry about the preservation and management of natural resources during the development process. The conference was designed to encourage communication among the various professions – engineers, developers, builders, biologists, foresters and planners.

The Maryland Heritage Tree Conservancy program was developed to protect Maryland's legacy of great trees. The Conservancy is an organization dedicated to the protection of champion, historic, and otherwise significant trees within

the State of Maryland. The Conservancy has developed a conservation easement program to protect these significant trees and ensure their continued survival.

The Southern Region, highlighting the Forestry Division's people-oriented service, had personal contact with nearly 25,000 people during tree plantings, workshops, tours, school programs and fire prevention activities. Nearly 300 programs were presented across the region to show the value of forest and tree management.

WILDLIFE DIVISION

The Wildlife Division is responsible for the conservation of Maryland's varied wildlife resources. Its goal is to protect, manage and enhance wildlife populations at levels consistent with the capacity of the land and society's needs. The division manages over 85,000 acres of land on 35 different wildlife management areas.

Conservation efforts for wildlife habitat on private land include technical assistance from regional staff, coordination with other government agencies, and automated geographical information systems. Major programs provide technical species-management for forest wildlife, upland game, furbearers, non-game and urban wildlife, and waterfowl. Additionally, the division's sponsorship of Project Wild, a nationally-recognized outdoor education curriculum, provides elementary school children with environmental education.

The following are highlights of Wildlife Division accomplishments for FY 1991:

Headquarters Operations

In cooperation with the US Department of Agriculture, Animal Damage Control Unit, a 1-800 Nuisance Wildlife Hotline was established. This phone line provides assistance to citizens experiencing problems with wildlife. Technical assistance is provided over the phone, while a list of wildlife cooperators provide fee-for-service assistance such as trapping.

Project WILD celebrated the start of its third full year of activity in June. Designed to provide balanced and accurate instructional material on wildlife biology for use in primary and secondary

school programs, Project WILD has been adopted by all 50 states. Since June 1989, more than 1,600 facilitators and other educators have received training in the use of Project WILD's educational tools and materials.

The **Wildlife Database and Geographic Information System** program began aggressive development of automated data systems for wildlife information. Major applications under development include an automated environmental review system, and a habitat inventory and species richness (known nationally as GAP analysis). By automating information collected over several years, analysis can be conducted through use of a GIS to evaluate the general health and well being of Maryland's natural resources.

The **Environmental Review** program reviewed a large number of permits (1,000+) and interagency coordination items to make improvements for wildlife. Special attention was given to technical assistance for cooperating landowners who wanted to improve areas for wetland wildlife. Wetlands have become a major focus area and good examples of conservation projects for wetland enhancement and creation were provided.

Regional Operations

Regional staff maintained 85,000 acres of wildlife management areas, including during FY 1991 the creation of 1,400 acres of herbaceous openings, planting 29,200 trees and shrubs and managing 132 acres of timberland. Public use facilities maintained included 61 buildings, 215 parking lots, and 142 miles of road. These lands are managed to benefit the wildlife resource and provide hours of recreation to sportsmen, birdwatchers, hikers and other nature enthusiasts.

Managed hunting programs were conducted on a number of wildlife management areas, and other properties managed through cooperative agreements. These areas include 4,700 acres of private land in Baltimore and Carroll Counties, the Frederick City Watershed, Liberty and Prettyboy Watersheds. In FY 1991, staff issued over 15,000 hunting permits to hunt on public lands, equating to over 50,000 man-days of recreation.

Regional wildlife staff continued to provide public service in all areas relating to wildlife conservation, management and wildlife problem resolution. Staff

performed the following functions for the public: deer damage assessment, wildlife habitat improvement plans for landowners, technical assistance, and nuisance animal/injured wildlife complaints. Also included are cooperative efforts with state, federal and local jurisdictions in resolving wildlife resources related issues.

Regional personnel participated in public information activities, such as displays, programs, tours, and acted as workshops facilitators for the Environment Program and Project Wild. Staff at the Gwynnbrook WMA managed the Wild Acres Trail which serves as an urban demonstration area for the public. Visitors are welcome to walk the self-guided trail and observe various wildlife management practices for urban as well as rural areas to attract wildlife. A brochure of the trail and various information sheets are available at the trail entrance.

The Merkle Wildlife Sanctuary staff continued to offer natural resource-oriented programming to thousands of visitors over the past year. Visitation to the sanctuary remained high, particularly to view the wintering Canada Geese. The Critical Area driving tour, over the Merkle Sanctuary, continues to educate the public about land use issues and practices as they relate to the Chesapeake Bay.

Forest Wildlife

Maryland hunters harvested a record number of deer in FY 1991 with bowhunters taking 8,605, firearm hunters taking 33,072 and muzzleloader hunters taking 4,640 for a total of 46,317. Participation in bow and muzzleloader hunting continues to increase as more hunters opt for the more primitive weapons. Bowhunters had 22 days added to their season in FY 1991.

One-hundred twenty-one wild turkeys were trapped and relocated to unoccupied habitat in Maryland. Twenty-two counties in Maryland now have established turkey populations. As a result of previous transfers, five new counties were open to spring turkey hunting in 1991. A record harvest of 1,145 gobblers was reported.

A Black Bear Management Plan was developed to provide guidance in managing the black bear resource in Maryland. Studies monitoring reproductive success, damage complaints, mortalities have continued. The first documented litter of four cubs was found in Maryland this year. An inten-

sive trapping and tagging study on black bears was initiated in the spring of 1991. The study was designed to provide information on population size, survival, and age structure. The study was made possible by contributions from seventeen sportsmen's organizations in Maryland.

Fifty-eight ruffed grouse were trapped in Western Maryland and southeast Pennsylvania and transferred to Zekiah Swamp in Charles County. The purpose of translocation is to reintroduce grouse in historic range on coastal plain. The relocation project is being financed by the Ruffed Grouse Society with the cooperation of the Pennsylvania Game Commission and Maryland Department of Natural Resources.

Upland Game and Furbearers

The Upland Habitat Restoration Project (UHRP) continued in Anne Arundel, Calvert, Charles, Baltimore, Carroll, Frederick, Prince George's, St. Mary's and Washington Counties. The long range goal of the project is to restore traditional farm habitat for upland game species. Wildlife management plans are prepared by UHRP personnel for each private land holding accepted for habitat restoration. In FY 1991, 160 landowners filed applications to participate in the project.

In cooperation with the Maryland Chapter of Quail Unlimited, the Wildlife Division sponsored a public workshop on habitat improvement for bobwhite quail. More than 100 private landowners attended the workshop. They received information and advice on basic land management practices beneficial to quail, on federal agricultural assistance programs applicable to habitat improvement and on integrated pest management.

Habitat Program

The Blackwater-Nanticoke Focus Area Plan, the first of several to be created under the Atlantic Coast Joint Venture of the North American Waterfowl Management Plan, has been completed and awaits implementation. A plan for the Patuxent River is next on the agenda and plan preparation will begin shortly. Funding to restore drained wetlands has been obtained from the US Fish and Wildlife Service and restoration will begin shortly.

The Wildlife Habitat Incentives Program (WHIP), which pays landowners to plant and leave unharvested crops that provide food for geese, pheasants, and quail, has been a resounding success. Thousands of geese are benefitting from the abundant food provided, and notable increases in quail and pheasant have resulted from the program. Wildlife contributions to the Critical Area program have provided protection for targeted wildlife species.

Migratory Bird Program

Undertaken in FY 1991 were surveys of waterfowl abundance and distribution, trend surveys of woodcock and mourning dove breeding populations, and surveys of waterfowl harvest, survival and movement. November and January waterfowl surveys indicated a significant increase in wintering Canada geese, due in part to more restrictive hunting regulations implemented to reduce harvest and increase goose numbers. Canada goose estimates totaled 377,000 in November and 332,000 in January. During the January survey significant increases were noted for both dabbling and diving ducks. Total waterfowl counted by aerial survey crews was 689,977 compared to 436,400 in 1990.

Research findings from the observations of neck-banded geese during 1984-89 were presented at the International Canada Goose Symposium in April 1991. These results indicated that harvest regulations implemented in 1988 reduced harvest and harvest rate and significantly increased survival - the first step to stopping the decline of the state's wintering goose flock. Research also indicated that there is a strong fidelity of geese to return to Maryland in subsequent years if they are alive. However, it does appear that a small segment of the Kent County flock is now wintering in New York.

Research was initiated to determine the population size, survival, and movement of nonmigratory or resident Canada geese in Maryland and the Atlantic flyway. Wildlife Division personnel captured and neckbanded 800 resident geese during the summer on municipal parks, golf courses, and farm pond in Maryland. Information from this research will be used to evaluate the effectiveness of specific resident Canada goose hunting seasons in reducing the population growth rate. In addition, 1,600 migrant geese were captured and neckbanded in the state during late winter as part of this project. Observations of these geese will provide precise

estimates of annual survival and an assessment of the effectiveness of recent hunting regulation restrictions in improving population status.

Waterfowl habitat projects were completed on Fairmount, Deal Island, and Fishing Bay WMAs, Eastern Shore Hospital property, and Wye Island NRMA.

Non-game and Urban Wildlife

Over 1,000 backyards and properties were certified as wildlife habitat under the Wild Acres program. Two Natural Design in Development workshops were held to foster communication in sound environmental planning by developers, land use, and natural resource professionals. A special merit award, as part of Renew America's Searching for Success national awards program, was presented to the Urban Wildlife Program by the National Environmental Awards Council.

Annual monitoring of the state's bald eagle nesting population documented 128 pairs in Maryland, of which 92 pairs successfully raised 169 young. Seven pairs of peregrine falcons nested, six producing 16 young. Twelve endangered Delmarva fox squirrels were live trapped and translocated to a site in Kent County in an effort to establish a new population there. Nesting colonial waterbirds, including herons, egrets, gulls, terns, black skimmers, and brown pelicans, were monitored. An assessment of barn owl and northern harrier populations was continued statewide. An intensive survey of nocturnal marshbirds was conducted for the second year to assess that status and distribution of these birds' breeding populations.

NATURAL HERITAGE PROGRAM

The Natural Heritage Program is the lead unit within DNR for the identification and protection of threatened and endangered species and their habitats. The program also locates and helps protect natural areas (pristine natural communities that are the best examples of the ecosystems that make up Maryland's landscape). These species, habitats, and natural areas are essential elements of our state's natural heritage and their loss would diminish Maryland's biological diversity.

The Natural Heritage staff systematically collects, records and analyzes information about the state's biotic diversity, and maintains an extensive data base of species and habitat information in Maryland. Program activities include: identifying rare and endangered species and their habitats; monitoring of these species and habitats to assess threats to their survival; and protecting these significant resources through information exchange and environmental reviews (over 2,500 in FY 1991), coordination with land management agencies, and the development of acquisition and easement priorities. The program also identifies important natural areas and works for their protection through acquisition, easement and voluntary landowner cooperation.

The addition, the program aids may private and public conservation groups, such as the Maryland Environmental Trust, The Nature Conservancy and the Chesapeake Bay Foundation, to facilitate their efforts to protect significant habitats. The following are the highlights of the program's accomplishments for FY 1991.

The Natural Heritage Program received nearly \$250,000 from the Chesapeake Bay and Endangered Species Fund. Projects initiated with these funds included:

- continued surveys to locate new populations of wood rats, rock voles, water shrews, black rails, map turtles, barking tree frogs, carpenter frogs, narrowmouth toads, mussels, rare butterflies, tiger beetles, and cave invertebrates;
- life history and habitat studies on northern flying squirrels, wood rats, loggerhead shrikes, regal fritillary butterflies, tiger beetles, harperella, sandplain gerardia, and swamp pink; this information will help determine protection and restorations plans for these species;
- monitored piping plover nesting success and erected predator exclosures on Assateague Island National Seashore in cooperation with the National Park Service; also initiated a taste aversion study with the purpose of teaching red foxes to avoid eating piping plover eggs;

- purchased a state-of-the-art computerized mapping system which will allow tracking of rare species throughout the state with great detail and accuracy;
- employment of an information and education coordinator to help educate the public about the value of protecting and restoring threatened and endangered species populations;
- promotional activities that promote public understanding of the need for the tax check-off and keeps them informed on tax check-off projects.

A major effort funded by the tax check-off is the continuation of the Natural Areas Registry Program. The Registry Program helps protect significant natural features, such as rare, threatened and endangered species or rare, unique or pristine natural communities through voluntary cooperation with landowners. Owners of significant natural areas are informed of the importance of their property and invited to enter a verbal, non-binding agreement to protect the site. A plaque is presented to cooperating landowners to recognize their contribution to maintaining Maryland's biological diversity. Nearly 150 landowners have been visited and 67 agreed to register their sites. With funding from a Coastal Zone Management Grant administered through Tidewater Administration, staff prepared and distributed the first Natural Areas Registry newsletter as a means to maintain contact with registry participants.

Life history research, surveys and protection efforts, funded by federal endangered species grants, were conducted for Maryland's federally-listed species and species which are candidates for federal listing. They include the northeastern beach tiger beetle, puritan tiger beetle, dwarf wedge mussel, Maryland darter, Allegheny wood rat, loggerhead shrike, Canby's dropwort, sandplain gerardia, harperella and swamp pink. In Calvert County, major progress was made towards protecting the world's largest remaining tiger beetles populations with the cooperation of the Calvert County Commissioners, homeowners' associations, and Columbia Liquid Natural Gas, Inc.

Other important projects include natural community restoration at Soldiers Delight Natural Environment Area and Maryland's only snow trillium site,

providing the C & O Canal National Park and Antietam National Park with management recommendations for their rare species, continuing protection work in the Sideling Hill watershed, and contributing to the natural area and listed species protection sections of the Savage River State Forest Management Plan.

FRESHWATER FISHERIES DIVISION

The Freshwater Fisheries Division manages the freshwater fisheries resources of the state. These resources include 14 game fish, 15 panfish, and 65 rough and forage fish species. Gamefish species include: brook, brown, lake and rainbow trout; largemouth bass; smallmouth bass; walleye; northern pike; striped bass; yellow perch; tiger muskellunge; and channel catfish.

The Freshwater Fisheries Division's long-term goal is to revitalize the warmwater, coolwater, and coldwater fisheries of Maryland. The primary objectives of the division are to protect, conserve, and enhance the quality and diversity of the state's fishery resources and to continue to provide varied angling opportunities through scientific inventory, classification, and management of these resources.

During FY 1991, the division directed a major effort toward intensive ecological studies of the following streams and reservoirs: North Branch Potomac River, Gunpowder Falls, Savage River and its tributaries, Youghiogheny River, Hunting Creek, Bee Tree Run, Paint Branch, Little Seneca Creek, Potomac River, Deep Creek Lake, Prettyboy Reservoir, Loch Raven Reservoir, Piney Run Reservoir and Liberty Reservoir. These studies supported a state-wide effort to establish an automated data base of the freshwater fisheries resource of the state. Freshwater Fisheries also conducted inventories on 12 major basins located throughout the state to evaluate trout populations.

Surveys and Inventories

Largemouth Bass and State Impoundments

The division directed a major effort toward inventory of the tidal largemouth bass fishery and the middle and upper Potomac River and major impoundments of the state.

Deep Creek Lake B.A.S.S. Tournament (Garrett County)

Personnel collected data from the Deep Creek Lake Bass Anglers Sportsman Society Tournament on July 8, 1990. During the tournament, 116 anglers caught 186 smallmouth and 53 largemouth bass. The trend towards larger average size fish, which coincided with the initiation of a spring catch-and-return season in 1988, continued. Despite the effects of variable-year class strength, the average size of smallmouth and largemouth bass has increased each year beginning in 1988, reversing a downward trend which began in 1981. Reduced harvest during the catch-and-return season is credited for altering the size and age structure of black bass populations in Deep Creek Lake to produce more older and larger individuals.

Brown Trout - North Branch Potomac River (Garrett County)

Sampling on the North Branch Potomac River below Jennings Randolph Lake provided large numbers of brown trout, apparently holdovers from spring stocking and escapees from the Net-Pen Trout Rearing Facility. Personnel collected the samples by electrofishing near the Jennings Randolph Dam tailrace at Barnum. Division personnel also collected one wild adult brook trout in the tailrace.

Brown Trout - Lower reaches of Western Run (Baltimore City)

During an electrofishing survey of the lower reaches of Western Run, Baltimore City personnel found naturally-reproduced brown trout and measured standing crops of 26 lbs/acre.

Brown Trout - Morgan Run (Carroll County)

At Morgan Run the 1991 standing crop of brown trout at the Jim Bowers Road Station increased 20 percent over that calculated in 1990 and the standing crop at the Klee Road Station increased 129 percent.

Eastern Shore Coldwater Fisheries

Freshwater Fisheries personnel completed a survey to determine the status of the coldwater fisheries of the Eastern Shore. Personnel surveyed Basin run, Principio Creek, Winch Run, and Love Run:

Fisheries personnel manage Basin Run and Principio Creek as put-and-take trout fisheries and stock them with rainbow trout each spring. Basin Run also supports a wild brown trout population. The numbers and size of trout, along with the collection of young-of-the year trout, indicate the population is expanding in size and range. At Principio Creek, personnel found holdover rainbow trout from spring stockings at all three sites sampled.

The survival of rainbow trout through the summer indicates that efforts should be made to establish a wild trout population in the Creek. Love Run and Winch Run are not stocked with trout, but have wild trout populations. At Winch Run, the only Eastern Shore stream to have a known population of brook trout, personnel collected two adult and one young-of-the year brook trout. Personnel estimated the wild trout population in Love Run at 458 adults and 563 trout/mile.

Liberty/Piney Run Reservoir - Striped Bass (Baltimore & Carroll Counties)

Monitoring of the Liberty Reservoir striped bass population continued in 1991. This is the fifth consecutive year of natural reproduction by striped bass in Liberty Reservoir. For the first time personnel collected young-of-the-year striped bass in Piney Run Reservoir. This is the first known occurrence of striped bass reproduction in the U.S. in a freshwater reservoir less than 300 acres.

Savage River - Trout (Garrett County)

An analysis of the 1991 Savage River trout population survey indicated that the standing crop of brown trout (30 lbs/acre) was higher than brook trout (23 lbs/acre) in the artificial-lures-only Trophy Trout Area above Piedmont Dam. The number of adult brook trout was more than twice the number of adult brown trout, reflecting the higher average size of brown trout in the lower Savage River. The standing crop of wild trout at the remaining four stations showed similar ratios of brook to brown trout, but lower standing crops. The number of young-of-year brook trout exceeded 1500 per mile at all locations except the lower station near the mouth of the river where it amounted to a respectable 862 trout per mile.

Gunpowder Falls - Rainbow and Brown Trout (Baltimore County)

The division conducted annual population estimates of trout in Gunpowder Falls at eight stations. Rainbow and brown trout fingerlings stocked in Gunpowder Falls in 1991 had significantly greater survival than fingerling trout stocked in 1990. The division attributes greater survival of trout stocked in 1991 to colder water temperatures and a decrease in spillover of warmwater from the dam at Prettyboy Reservoir. Trout populations (pounds/acre) were at an all time high. Personnel collected many large rainbow trout in the no-kill zone above Falls Road. Survival and growth of fingerling brown and rainbow trout stocked during the spring of 1991 was excellent, especially for rainbow trout. Personnel collected a smaller number of naturally reproduced brown trout young-of-the year from stations downstream of Mese-more Road. Of the eight stations surveyed, six included an increase in the standing crop of brown trout in 1990.

Bee Tree Run - Trout (Baltimore County)

The annual trout population survey of Bee Tree Run indicated all three established survey stations had significant increases in standing crops over 1990. The lower station increased 44 percent (18 to 26 lbs/acre); the middle station increased 118 percent (22 to 48 lbs/acre); and the upper station increased 58 percent (26 to 41 lbs/acre). The spring of 1991 marked the second year that put-and-take trout stocking had been discontinued in Bee Tree Run. The results of the 1991 data suggest that fishing pressure on the more accessible lower station may be the reason this station has the lowest standing crop.

Little Antietam Creek (Washington County)

Several years ago the native rainbow trout population in Little Antietam Creek was nearly eliminated by a fish kill. Sampling in 1991 showed that the population is recovering with several age groups being present.

St. Mary's Lake (St. Mary's County)

To evaluate the success of the slot-length regulation implemented in 1985, Freshwater Fisheries personnel estimated the population of largemouth in St. Mary's Lake. Population estimates show greatly

improved numbers of big bass in St. Mary's Lake over previous years. St. Mary's lake is now one of the best lakes in Maryland for big bass.

Production and Stocking

Ninety Streams and Ponds - Brown and Rainbow Trout

During FY 1991 Hatchery personnel produced and stocked approximately 264,600 adult rainbow trout and 38,000 adult brown trout into 90 streams and ponds in order to provide a high-catch-rate put-and-take trout fishery. In addition, 47,000 fingerling rainbow trout and 94,000 fingerling brown trout were stocked in support of a high quality put-and-grow trout fishery. Albert Powell Hatchery and Cushwa Rearing Station produced 159,900 adult rainbow trout and 140,000 fry rainbow trout for grow out at the Bear Creek Rearing Station. Bear Creek Rearing Station produced and stocked 101,300 adult rainbow trout and 3,400 adult brown trout. The Net Pen Trout Rearing Station reared and stocked 34,652 adult brown trout.

Deep Creek Lake - Brown and Rainbow Trout (Garrett County)

During the springs of 1990 and 1991, fisheries personnel stocked Deep Creek Lake with adult brown and rainbow trout for the first time since the early 1970s to assess the lake's potential for long term survival and growth rates of brown and rainbow trout. Surveys and angler reports indicate that survival and growth rates of stocked trout exceeded expectations. Stocking of trout in Deep Creek Lake is receiving strong support by anglers.

Warner Hollow Run (Washington County)

In May 1987, Freshwater Fisheries personnel introduced 100 brook trout from Fishing Creek into Warner Hollow Run, Washington County. In July 1990, personnel sampled Warner Run for the first time since the introduction of brook trout in 1987. The introduction has been an outstanding success. Several age groups including young-of-year were found.

Ballenger Creek (Frederick County)

Another success story is Ballenger Creek located in Frederick County. The division introduced brown trout from Jones Falls in 1976. During annual

sampling, personnel found no trout until June 1991 when they collected adult, yearling, and young-of-year trout. Adult trout ranged from 10 to 20 inches long.

Henryton Tributary of Patapsco River

The division has stocked brown and brook trout from nearby streams in the Henryton tributary to the Patapsco River for several years. During electrofishing surveys in 1991, personnel collected adult and young-of-year brown and brook trout. This shows that the stream can hold both trout species through the warm summer months and that natural reproduction is occurring.

Warmwater and Coolwater Fish Species

The division stocked the following numbers of warmwater and coolwater fish species in Maryland waters during FY 1991:

SPECIES	SIZE	NUMBERS
largemouth bass	spring fingerlings	60,000
largemouth bass	fall fingerlings	9,000
smallmouth bass	spring fingerlings	5,000
walleye	fry	4,400,000
bluegill	fall fingerlings	152,000
redeer sunfish	fall fingerlings	54,000
tiger musky	fingerlings	21,000
striped bass	fingerlings	7,000
hybrid sunfish	fingerlings	12,000

Studies

Frostburg State University - Brook Trout

The Freshwater Fisheries Division funded a project of the Appalachian Environmental Laboratory at Frostburg State University that examined the genetic structure of brook trout populations in Maryland streams.

Hooking Mortality - Trout

Fisheries personnel conducted a hooking mortality study to compare the mortality rate of trout caught on artificial lures (spinners) on the lower Savage River and Jennings Randolph Lake stilling basin. Personnel held trout caught for 48 hours. All fish mortality occurred (four fish caught by spinners) soon after capture. Eleven-point-three percent of

the fish caught on spinners died and one-point-two percent of fish caught on flies died.

Nontidal Eastern Shore Streams

The Freshwater Fisheries Division is cooperating with the University of Maryland to evaluate existing and potential fisheries of the nontidal streams of Maryland's Eastern Shore. The division samples streams fisheries from the Nanticoke River to the Pocomoke River to obtain information on species presence and relative abundance for purposes of planning and environmental review.

Fisheries personnel completed the initial phases of a research project for the tidal tributaries of the Nanticoke River south to Pocomoke River. The division obtained species presence and relative abundance information for 51 sites. Personnel collected and are currently analyzing information regarding geographic distribution of game fish habitat. Personnel observed angler presence and obtained information on stream permanence and amount of flow. They categorized streams as either bass, sunfish, or nongame waters. They created stations for monitoring long-term fisheries habitat and water quality. They established these stations to represent unimpaired "benchmark" streams to serve as reference sites. The streams reflect typically degraded conditions. Thirty-nine fish species were collected which represented 16 families.

Largemouth Bass in Tidal Potomac River

The Freshwater Fisheries division obtained information from the continuing tidal Potomac River Largemouth Bass Radio Telemetry Study that indicated a need to determine if bass displaced from one side of the river to the other would return to their home sites. Radio transmitters were attached to eight bass collected from Piscataway Creek on 26 April 1991. Four of these fish were released back into Piscataway Creek as controls, and four were released on the Virginia side of the Potomac River in Pohick Bay. On the same date, four bass from Pohick Bay were outfitted with radio transmitters and released in Piscataway Creek.

Through July 1991, three of the four fish displaced from Piscataway Creek to the Virginia side returned to the Maryland side and two of the four fish displaced from Pohick Bay to the Maryland

side returned to the Virginia side. All bass that crossed the river did so within 30 days of being tagged. This information is similar to the results from the radio telemetry studies where bass were displaced upstream or downstream on the same side of the river from their capture site. The radio telemetry study of largemouth bass is planned for September 1992 to further study the movement patterns and effects of displacement upon tidal Potomac River largemouth bass populations.

Federal Aid Projects - Final Reports

The division completed final reports for Federal Aid Projects F-36-R (Survey, Inventory, and Management of Maryland's Coldwater Fisheries Resource) and F-29-R (Statewide Fisheries Survey and Management) in 1991. The reports covered studies conducted from 1986 to 1991. A note of interest is that during the past five years, 32 new streams (334 miles of stream) with naturally reproducing trout populations were discovered. Maryland now has 162 trout streams (816 miles) that have naturally reproducing trout populations.

Hatchery Production

Lewistown

The Lewistown Fish Hatchery produced the following numbers of fish:

107,550	fingerling brown trout
5,000	2-4 inch tiger musky
1,300	8-10 inch tiger musky
14,000	largemouth bass fingerlings
1,100	6-12 inch channel catfish
50,000	redeer sunfish fingerlings
105,000	bluegill fingerlings
5,000	smallmouth bass fingerlings
12,000	hybrid sunfish fingerlings

Unicorn

Unicorn Fish Hatchery produced and stocked:

51,500	spring fingerling largemouth bass
2,300	largemouth bass fall fingerlings
35,400	bluegill

Manning

The Joseph H. Manning Fish Hatchery produced:

5,700,000	walleye fry
11,600	largemouth bass fingerlings
53,000	bluegill fingerlings
40,700	redeer sunfish fingerlings

Net Pen Trout Rearing Facility

Personnel added two cells to the Net Pen Trout Rearing Facility at Jennings Randolph Reservoir increasing capacity to six cells. Personnel reared approximately 75,000 fingerling and 35,000 adult brown trout for stocking in Maryland waters.

Public Relations

Aquarium and fishery management displays

Freshwater Fisheries Personnel erected and manned aquarium and fishery management displays at 12 major sporting events, including the Harrisburg Outdoor Show.

Additional activities

- Evaluation of walleye introductions in Deep Creek Lake, Potomac River, Jennings Randolph Reservoir, and Rocky Gap Lake.
- Evaluation of black bass populations in the Potomac and Patapsco Rivers.
- Evaluation of slot length for black bass in St. Mary's Lake, Little Seneca Lake, and Potomac River between Dam 3 and 4.
- Population estimates on 35 trout streams including the tailwater fisheries of the Gunpowder, Savage River, Hunting Creek, Youghiogheny River, Little Seneca Creek, and North Branch Potomac River.
- Youghiogheny River trout investigations
- Stocking of coldwater, coolwater, and warmwater fish for put-and-take, put-and-grow, and corrective stocking.
- North Branch Potomac River trout restoration project

Natural Resources Police

The programs and policies of the Natural Resources Police are administered by two major bureaus: field operations and support services. The following is an overview of the activities of both field operations and support services for the past fiscal year.

FIELD OPERATIONS

Easily the most visible of Natural Resources Police operations is the field operations bureau, which is the largest unit within the Natural Resources Police and currently consists of 189 uniformed officers. These officers are deployed by way of 31 large patrol boats, 89 Boston Whalers, and 100 patrol vehicles. Field operations is responsible for all enforcement activity involving wildlife, fisheries, and boating laws. Officers are assigned to either marine or inland-related activities. All officers are cross-trained in each activity at entrance level training. In addition to conservation and boating law enforcement, all Natural Resources Police officers have full police authority and frequently encounter and deal with violations of other criminal laws such as theft, assault, fraud, drugs, and homicide/manslaughter.

Field operations personnel are involved in virtually every program and activity within the agency which includes: boat accident investigations, criminal investigations, applicant investigations, recruitment, public relations, and education and training.

Law Enforcement Overview

NRP officers issued 9,581 citations and 17,141 warnings in FY 1991. The most common violations encountered involved boat registrations and safety equipment. Over recent years an alarming factor that has become evident is the increase in the number of boaters using controlled dangerous substances (CDS). Enforcement effort was increased this year on waterfowl activity. While the number of field officers available has decreased, prioritization and innovative patrol techniques during waterfowl season maintained a high level of visibility and patrol.

Special Initiatives

Potomac River Safety Initiatives

The Potomac River separates the states of Maryland, Virginia, and West Virginia. Heavy rains during the spring of 1989 resulted in an unusually high flow of water in the upper Potomac River area. This condition, combined with extensive recreational use of this area by boaters led to an abnormally high number of drownings (18) during the period from April through August of 1989.

In response to this increase, representatives from the Natural Resources Police, National Park Service, West Virginia, elected officials, private organizations, and the public met to address the problem. As a result of these meetings, the Natural Resources Police was chosen as the lead agency to address this issue. This working group instituted several initiatives designed to promote river safety and reverse the increase in fatalities.

These initiatives centered in four major areas: information and education, search and rescue, enforcement, and regulations.

Public involvement in the overall process was also encouraged. As a result of work in this area, the public is now better informed concerning ways to use the river safely. In addition, new regulations make wearing of life preservers (PFDs) mandatory for all boaters during the most dangerous periods. Since 1990, when the initiatives were implemented, there have been no boat accident fatalities on the river. The success of these initiatives has sparked interest in utilizing this combined approach to address safety issues in other areas of the state.

Other Field Operations Activities

SCUBA Dive Team

The Natural Resources Police SCUBA Dive Team consists of a diving officer and 12 certified divers. Two of the certified divers serve as master divers to supervise and coordinate dives. In FY 1991, the SCUBA dive team engaged in 95 dives, up from 59 dives the previous year. Dives were performed to recover: drowned victims, evidence related to

criminal cases, stolen or lost property, and to conduct biological surveys and perform underwater maintenance on patrol boats. Officers trained and certified as divers perform this function in addition to any other regular law enforcement duties. Divers are volunteers and receive no additional compensation for this service.

Trends and Future Plans

Statistics and direct observations have indicated that there has been a continuing increase in the use of Maryland's waterways by recreational boaters. Recreational boats are increasing in size, and speed. Personal watercraft have become extremely popular and have generated safety concerns. New regulations governing the use of personal watercraft were recently enacted to address those specific concerns. The Natural Resources Police will be evaluating patrol procedures, equipment and safety programs to address the expansion and change in traditional recreational boating. Classes in the safe use of personal watercraft, utilizing departmentally-owned watercraft have already been initiated.

A change from traditional large patrol boats to a more mobile vehicle/vessel patrol unit is currently being evaluated and may be expanded.

As the commercial harvesters of the resource become more sophisticated in their methods, improved enforcement techniques and equipment will be needed to keep pace. The emergence of the Natural Resources Police as a fully trained full service police agency has led to requests from other law enforcement agencies for joint activities such as drug raids, surveillance, and drug interdiction duties. This, a non-traditional role for a conservation law enforcement agency, is expected to continue and expand in future years to meet the demand of society. However, the Natural Resources Police is committed to keep the focus on the primary mission as a conservation and boating law enforcement agency.

SUPPORT SERVICES

Specialization is the operative word in maintaining a police force which is responsive to the changing environment and increased demands for services from the public. This specialization is needed to enable the Support Services Bureau to fulfill its

mission of providing technical and logistical assistance to the uniformed force. Divisions and units within Support Services include: investigations, education and training, technical services, aviation, communications, recruiting, and records.

Many of the technical advances and enforcement innovations brought about by the Natural Resources Police can be attributed to the following Support Services Units.

Aviation Section

Aviation personnel flew a total of 869 flight hours on 422 missions in FY 1991. Ninety-one percent of these missions were involved in enforcement, search and rescue, or in support of other state agencies. Utilizing a fleet of two rotary-wing and one fixed-wing aircraft, Aviation personnel were directly responsible for 167 arrests for a variety of wildlife, fisheries and boating violations. The installation of a forward looking infrared (FLIR) device on a helicopter operated by the section has proved to be invaluable for search and rescue and enforcement efforts. With the ability to detect heat emitted by persons, vessels, and vehicles, areas can be searched in total darkness to locate missing persons or violators. Applications for its use will undoubtedly increase.

Communications Center

The Natural Resources Police Communications Center is located in the agency's headquarters at Annapolis. The Communications Center provides a full range of communications and dispatch services. Modern technology, such as, in-house computers have provided greater control of field operating units and the rapid retrieval of statistical information that, in the past, would have taken days to hand-search. The center also receives and dispatches all requests for information concerning vehicle and vessel registrations, summonses, warrants, and lost and stolen property. The agency's criminal case file is also accessible by the center. Serving as the primary contact point with the public, the center receives requests for assistance, information and handles citizen complaints as part of the state-wide 911 network, through VHF radio, and several phone lines including a recently installed "800" line. This line alone received over 18,000 calls during the past year.

INVESTIGATIONS DIVISION

The Investigations Division is composed of the Criminal Investigations Section, the Dangerous Substance Abuse Unit (DSAU), and the Special Operations Unit.

Criminal Investigations Section

Criminal, boating accident, internal, and applicant investigations are the primary responsibility of the three investigators assigned to this section. Boating accidents and fatalities continue to increase, placing a heavy demand on investigators. Sixteen of the state's 33 boating and hunting fatalities were investigated by the section. One hundred and seventy five cases were assigned to the section during the past year including 28 serious boating accidents, 5 suicides or suspicious deaths, 5 serious hunting accidents, 36 felony thefts, and 1 rape, and 82 applicant background investigations. In addition, the section also serves as the repository for all boat accident records for Maryland. During the past year, 435 boating accidents were reported, an increase of 26 percent over the previous year.

Dangerous Substance Abuse Unit (DSAU)

The DSAU was created to combat illicit drug use and trafficking on the waterways of the state. Created as part of the governor's initiatives to fight drug abuse, the unit with officers is funded by a federal grant. While the majority of the year was spent organizing the unit, personnel assigned initiated 25 investigations into suspected drug activities. These investigations involved the importation of drugs into the US, distribution and manufacture of drugs within Maryland, and checking suspicious persons and vessels. Boarder searches were conducted in conjunction with the US Customs Service on several vessels in the Maryland area. Several areas of suspected marijuana cultivation were located and placed under surveillance.

Special Operations Unit

The primary responsibility of the Special Operations Unit is to conduct covert investigations of individuals or organized groups who have been recognized through information received from uniformed patrol officers as habitual violators of state and federal conservation laws. Special atten-

tion is paid to those species of fish, wildlife, and plants designated as endangered or threatened. Violations of criminal laws pertaining to theft and drugs are often encountered and acted upon by covert investigators, when, such actions do not compromise an on-going investigation.

TRAINING AND EDUCATION DIVISION

The Natural Resources Police Training and Education Division administers the boating and hunting education programs. A brief overview of these programs includes:

Boating Education

The Natural Resources Police Boating Education program consists of instruction of school children in grades Kindergarten through 3, boat operator training, white water training, and the legally-mandated boating education program.

The Division staff revised the K-3 activity book in FY 1989. Over 15,000 of these books were reprinted in FY 1990 and FY 1991. These booklets were made available to interested school systems and distributed on a request basis. Additionally, program personnel visited elementary schools and gave presentations on boating safety to supplement the printed material.

The Natural Resources Police offered its " Boat Operators Training " to interested agencies and organizations. This program provides basic water safety training as well as training in the operation of boats. The program was given to the US Fish and Wildlife Service, two local Recreation and Parks programs, and the Maryland Toll Facilities maintenance personnel.

The Education Division also offered white water training to interested rescue agencies. Basic and advanced courses were presented to Agency personnel, Maryland Forest, Parks, and Wildlife, and the US Park Service rescue personnel.

In light of the increased popularity of personal watercraft (jet skis), the staff designed a program of hands-on education to acquaint users with the safety procedures for these vessels. Classes were offered in many state parks. A training program was also conducted for Natural Resources Police

personnel who intend to use the vessels for enforcement work. Division staff rewrote the existing alcohol and drugs water safety program. The new program entitled "Drowning is NO Accident," targets middle and high school students, and stresses the dangers of alcohol and drug use as they relate to water safety. This message is conveyed in a one hour presentation by trained, uniformed Natural Resources Police officers. Interest in the program has been high. Officers also presented this program to local community groups. The agency hopes to expand this successful theme in 1992.

Hunting Education

The Natural Resources Police administers the legally-mandated hunter education program. The Training and Education staff is directly responsible for the coordination of volunteer instructors who teach the Maryland Hunter Education Course. This 10-hour course provides instruction in the principles of safe hunting practices, hunter ethics, and wildlife management to first time hunters. Classes taught by both staff and volunteer instructors, are offered to the public in various location such as schools, 4-H clubs, state parks, private clubs, community centers, and Boy Scout troops. One instructor team taught the class for students at the Maryland School for the Deaf. All graduates of the Hunter Education Program are eligible to attend the NRP annual Maryland Hunter Education Challenge. This program allows youths, ages 12-18, to further their safe hunting skills through rifle, shotgun, and bow competition.

Hunter Education instructors are kept abreast of the latest in Hunter Safety by attending one of the 14 workshops conducted last year by staff.

The program also manages the Bow Hunter Education Program. This program consists of a voluntary 10-hour block of instruction on advanced bow hunting techniques.

Catch-A-Poacher Program

The Maryland Association for Wildlife originally proposed the Catch-A-Poacher (CAP) program in 1984. The program began as part of an aggressive campaign against the illegal taking of game and non-game wildlife. The program has since expanded to include illegal taking of fish as well.

The CAP program is administered by the Natural Resources Police. The program focuses attention on the negative impact of poaching and offers financial rewards of \$50 and up to citizens who supply the Natural Resources Police with information leading to the arrest and conviction of violators. Citizens may lodge complaints by calling a toll-free telephone number which is manned 24 hours a day by personnel from the Natural Resources Police Communications Center. Each case is assigned an individual case number and the anonymity of the caller is assured. Last year 165 CAP calls were processed. If an arrest and conviction results, a review board, composed of interested citizens, determines the amount of rewards. In the last year, over \$1,000 was awarded. The program is funded through private donations.

Law Enforcement Study

At the request of the governor, the Department of Budget and Fiscal Planning initiated a review to determine the advisability of merging certain law enforcement entities into the Maryland State Police. Those entities included, the Natural Resources Police, the Maryland Toll Facilities Police, the State Fire Marshall, the MD Port Administration Police, and the Mass Transit Police. This review was to identify potential benefits, drawbacks, and costs of merging the respective agencies into the Maryland State Police. Particular attention was to be paid to missions, service levels, recruitment, training, and salaries and benefits. A review of placement of counterpart police agencies in other states was to be part of the process.

Natural Resources Police, Officer of the Year Corporal Paul E. Chenoweth was selected as the Outstanding Natural Resources Police Officer for 1991 by a committee of retired NRP officers. Nominated by his Supervisor, Corporal Chenoweth's overall ability, expertise, and dedication to conservation law enforcement were deciding factors in his selection.

TIDEWATER ADMINISTRATION

GENERAL DIRECTION

This program provides overall direction, supervision and coordination within the administration, as well as coordination of boards and commissions that affect the Bay and its tributaries. In addition, this program also administers an annual fishing activity.

Fishing for the Needy

This is a one day coordinated effort between the Tidewater Administration, Solomons Charterboat Captains Association, Maryland Saltwater Sport Fishermen's Association, Maryland Office on Aging and the Maryland Food Bank. This program provides Senior Citizens with a free day of fishing. In addition, catch from not only Seniors but other participating groups are cleaned and wrapped by volunteers then donated to the Maryland Food Bank for distribution to soup kitchens and homeless shelters statewide.

COASTAL RESOURCES DIVISION

The Coastal Resources Division coordinates Maryland's Coastal Zone Management (CZM) Program. The Division uses federal funds to provide financial assistance to local governments and state agencies for coastal management and to improve the data base for better decision making. It ensures that state and local projects take into consideration preservation and protection of coastal resources.

The CZM Program is primarily based upon existing state and local laws and regulations. These laws provide the legal and administrative basis for activities in the coastal zone. Through signed agreements, the local jurisdictions and six state departments concerned with coastal zone management have agreed to carry out the goals of the program.

The Coastal Zone Management Act

Reauthorization of 1990 extended the federal coastal zone program for a five-year period and

mandated two significant new initiatives: Sections 309 and 6217. Section 309 requires states to assess management needs and the adequacy of existing management programs in eight issue-areas such as wetlands, coastal hazards and public access. Based on this assessment, states are to develop detailed multi-year strategies explaining how they will change existing programs to address issue-areas identified as priority concerns. The strategies will be used by the federal government as the basis for allocation of funding provided through Section 309. Maryland developed a draft assessment in late 1991 and will finish the assessment and produce the required strategies in early 1992.

As part of the Coastal Zone Act Reauthorization Amendments of 1990, Congress also enacted a new Section 6217, entitled "Protecting Coastal Waters." Section 6217 requires each state with a Coastal Zone Management Program to develop and implement a coastal nonpoint program that meets the approval of the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA). During this year, the Division coordinated the state's written comments to NOAA and EPA regarding the proposed Coastal Nonpoint Pollution Control Program development guidelines.

The Coastal Resources Division is composed of the following programs: Interagency Coordination, Local Technical Assistance, Resource Enhancement, Chesapeake Bay National Estuarine Research Reserve, and Public Participation and Education. Overall program direction and fiscal management is carried out through the leadership of the Program Director with the assistance and support of the program chiefs and support staff.

Direction and Coordination

This section provides overall direction to the activities for the division. Fiscal management activities and the Public participation Section are included in the unit. Staff support is provided to the Coastal Resources Advisory Committee (CRAC).

Interagency Coordination Program

This program is responsible for conducting the Interagency Coordination activities of Maryland's Coastal Zone Management (CZM) Program. This section undertakes cooperative work efforts with, and provides technical assistance to, other state agencies to further the objectives of the CZM Program. It also ensures the effective implementation of the Memoranda of Understanding with other state agencies. During the past year, this program, in conjunction with other state agencies, has continued development of a comprehensive data base on protected lands and sensitive natural areas for use in meeting the requirements of the federal CZM Act and the Chesapeake Bay Agreement. The Division's Map and Image Processing System (MIPS) is used to produce this comprehensive data base.

Through contractual agreements between Tidewater's Coastal Resources Division and other state agencies, this program has financially supported the establishment and implementation of local land trusts, development and implementation of the state's Greenways program, continuance of a multi-year effort with the Maryland Geological Survey to update and computerize information on historic shorelines and shore erosion rates, implementation of stream restoration efforts in conjunction with Save-Our-Streams, and development of tidal tributary vessel management plans for the Chesapeake Bay.

In order to be eligible for funding under Section 309 of the 1990 Reauthorization of the federal CZM Act, Maryland's CZM Program conducted an assessment of the adequacy of existing management measures, outstanding management needs and the relative priority of eight enhancement objectives specified in Section 309. Interagency Coordination Program staff solicited comments regarding these concerns from federal, state and local agencies and the Coastal Resources Advisory Committee (CRAC). The latter served as the principal mechanism for soliciting public input. The views of CRAC members were sought through both a written survey and a presentation at the July, 1991 CRAC meeting. Staff developed a draft assessment using government agency and public input and information from previous annual reports submitted to the National Oceanic and Atmospheric Administration (NOAA). A final assessment is due to NOAA in January 1992. Based on the assess-

ment, Maryland's CZM Program will prepare a strategy addressing priority needs for funding provided under Section 309.

Additional activities of the Interagency Coordination Program include updating the Coastal Zone Management Program Document; monitoring meetings of the State Soil Conservation Committee and the Joint Legislative Committee on Growth and Development; providing staff support to Chesapeake Bay Program work groups and departmental efforts relating to growth management and sensitive area protection.

Local Technical Assistance Program

The Local Technical Assistance Program (LTAP) facilitates the involvement of local governments in the implementation of the overall Coastal Zone Management (CZM) Program.

Through the funding provided by the annual federal CZM grant, the LTAP is able to provide financial and technical assistance to coastal local governments (16 counties, Baltimore City, the Baltimore Regional Council of Governments and the Tri-County Council for Southern Maryland). These funds are used by local governments to implement the CZM Program by incorporating the program's goals and objectives into their planning and regulatory activities. Examples of CZM-funded special projects include: development of a stream valley management and protection program, a public access study, a natural features computer mapping project, a stormwater management study, and development of a nontidal wetlands protection program.

During the past year, the LTAP provided funds to the Natural Heritage Program (NHP). NHP focused their efforts on documenting the ecological values and protection strategies for sensitive habitat areas designated as of Special State Concern under the new nontidal wetlands regulations and for acquisition through the state's Program Open Space. NHP also initiated preliminary studies to determine protection and management needs for two types of sensitive areas: Delmarva Bays and Coastal Plain bogs.

The LTAP also coordinated a contractual agreement with the Chesapeake Bay Critical Area Commission. Efforts this year were directed toward developing a computer-aided medium

through which the Commission can monitor implementation of the local Critical Area Programs and track development in the Critical Area. This funding allowed the development of a computer software program that can integrate these two principle functions of the Commission.

The LTAP sponsored a workshop for Maryland's local government coastal zone planners. Every coastal county was represented along with Baltimore City, the Baltimore Regional Council of Governments and the Tri-County Council for Southern Maryland. The workshop provided a forum for the exchange of information and ideas pertaining to coastal zone management. State and federal representatives were also invited to participate.

The LTAP serves as DNR's liaison to the Chesapeake Bay Program's Local Government Advisory Committee and acts as the liaison between this committee and the Bay Program's Living Resources Sub-committee. All pertinent information is provided to the interested local jurisdictions.

The LTAP staff coordinated the state's efforts in response to the above-mentioned Section 6217 Coastal Nonpoint Pollution Control Program.

Finally, the LTAP provided staff support to the department's efforts relating to growth management and sensitive areas protection.

Chesapeake Bay National Estuarine Research Reserve in Maryland (CBNERR- MD)

The Chesapeake Bay National Estuarine Research Reserve (CBNERR-MD) in Maryland is one of nineteen Research Reserves across the country which provides opportunities for estuarine education, research, and monitoring. The Reserve Program is managed through a federal-state cooperative venture with the assistance of local government agencies and interest groups. Maryland has three designated research reserve sites: Monie Bay, located in Somerset County; Jug Bay, located in Anne Arundel and Prince George's Counties; Otter Point Creek, located in Harford County. Monie Bay was designated as part of the Research Reserve Program in 1985. Jug Bay and Otter Point Creek were added to complete the CBNERR-MD in late 1990. The CBNERR-MD currently provides protection to over 4,500 acres of natural habitat. The purpose of the program is to establish

estuarine areas that can be used for short-term and long-term estuarine research and environmental education.

The three CBNERR-MD reserve sites have increased the availability of educational programs and research opportunities. Monie Bay is primarily reserved for scientific research. Designation of Otter Point Creek and Jug Bay has allowed for expansion of outdoor environmental experiences for children as they use cleared trails and canoes. In addition, Jug Bay has a very strong volunteer program. Volunteers assist with the monitoring efforts, field lectures, well as the many outreach activities offered to the public.

CBNERR-MD is currently working with Harford County on preliminary engineering for a planned visitors center at the Otter Point Creek reserve. The center will provide classroom space, a wet lab for researchers, and exhibits depicting the importance of estuaries.

Plans are also being developed for an annex onto the existing Visitors Center at the Jug Bay Wetlands Sanctuary of the Jug Bay Component. The annex will support and enhance the ongoing and very popular programs already in existence.

Research projects taking place in the CBNERR-MD include the study of habitat alteration in the tidal freshwater wetlands of the Otter Point Creek reserve, the study of the copepod Mytilicola porrectus at all three reserve sites, and the paleobotanical study of sea level rise and its effects on marsh vegetation at Monie Bay.

Resource Enhancement Program

The Resource Enhancement Program carries out the Chesapeake Bay Initiatives of 1984 which established a goal of restoring submerged aquatic vegetation (SAV) to regions of the Chesapeake Bay where they were historically abundant. A policy document adopted by the Executive Council of the Chesapeake Bay program in July, 1989 commits the signatories to:

- Assess the resource annually - This is being accomplished through the Bay-wide aerial photographic survey.

- Protect the existing resource - This being accomplished through the permit review process.
- Restore the resource to its former abundance - Transplanting of SAV to areas where it formerly was present was used to accomplish this goal.
- Communicate research findings to the public to enhance appreciation and public protection of the resource.

The annual aerial survey is the most detailed and comprehensive survey of SAV currently undertaken anywhere in North America. The area of Chesapeake Bay bottom covered by SAV has increased every year for the last four years on a Bay-wide basis. However, sub-basins such as Eastern Bay have experienced significant declines during that same time.

No transplanting activity occurred in 1991. However, citizen interest in planting as a restoration technique remains high. The program regularly receives requests for plants and for technical information from citizen groups. The success of transplants is highly dependant on weather patterns. Low rainfall years are favorable to the survival of SAV, and during 1991 most transplanted areas increased in plant densities. Some of the planted beds in the upper portion of the Bay have expanded significantly and are reducing wave generated shoreline erosion as evidenced by the establishment of black rush beds along some stretches of shoreline where SAV was planted two years before.

Public information needs are served by the distribution of *A Field Guide to the Submerged Aquatic Vegetation in the Chesapeake Bay*. In addition, a set of historical distribution maps were developed as an aid to permit review agencies. Arrangements are being made to print and distribute these maps during 1992.

Hydrilla verticillata, an unintentionally introduced species, required management in the Potomac River during 1991. The Department of Natural Resources, Metropolitan Washington Council of Governments, Virginia Water Control Board and the Army Corps of Engineers signed a Local Cooperation Agreement to jointly fund these management operations including: inspections, workplan development and cutting of access paths

and swimming areas to provide public access to the river. A harvesting contractor was selected and conducted all the cutting and disposal of the Hydrilla.

Coastal Resources Advisory Committee

The Coastal Resources Advisory Committee acts as the public participation and advisory body to Maryland's Coastal Zone Management (CZM) Program. The executive secretary of the committee is part of the Coastal Resources Division staff, and acts a liaison between the committee and the Maryland Program.

The Coastal Resources Advisory Committee is represented by a broad base of concerned individuals and organizations that include special interest groups, developers, the private business sector, corporations, and local, state and federal government agencies. The committee provides a public forum to discuss matters relating to Maryland's coastal zone. The committee then has the authority to forward its recommendations to the Secretary of the Maryland Department of Natural Resources, the Governor's Office, the Legislature and Congress.

The committee actively endorses and encourages Maryland's participation in the annual COASTWEEKS event, a national celebration and appreciation of America's coastal areas and resources. Coastal Resources Division staff coordinated the production and distribution to the public of the "MARYLAND COASTWEEKS '91 CALENDAR OF EVENTS" which contains information on upcoming coastal events throughout the state that are sponsored by community organizations, special interest groups, and local and state governmental agencies.

Public Participation/Education

This section of the Coastal Resources Division responsible for citizen education and outreach for the Maryland Coastal Zone Management (CZM) Program through the production and distribution of literature and press releases. The use of a poster and matching postcard, "You can make a difference - help restore the Chesapeake Bay and Maryland's costal areas" is distributed on a regular basis to federal, state, and local agencies, commu-

nity associations, private interest groups, schools, libraries and the general public.

These distributions will continue until the supply is depleted. The brochure that was planned in 1990, "Maryland Coastal Program Report - Site Creation and Improvement," is being updated to include the public access sites completed in 1991. The newsletter, "Maryland Coastal Management Report," has been re-designed and when final approval is obtained, will contain CZM Program related articles.

Staff video-taped the 1991 Coastal Planner's Workshop where planners from Maryland's coastal counties presented their particular coastal-related problems and the solutions. Staff also visited a number of the CZM Program Section 306A sites, video-taped and photographed them for use in future productions of literature or videos. Staff arranged for public meetings during the National Oceanic and Atmospheric Administration's annual evaluation of the CZM Program. The public was invited to participate in the meetings and supply oral or written comments to NOAA regarding Maryland's implementation of the CZM Program.

In 1991, CRD staff assisted in the coordination of the activities of nearly 100 volunteers for the "BAYFEST" Bay Bridge Run/walk.

Staff produced a 32-page booklet, "*MARYLAND'S CHESAPEAKE BAY AND ENVIRONMENTAL RESOURCES GUIDE*" for the Governor's Chesapeake Bay Communications Office. More than 5,000 copies were distributed to the public. The guide lists, by agency, the environmental-based programs and services available.

CHESAPEAKE BAY RESEARCH AND MONITORING DIVISION

The Chesapeake Bay Research and Monitoring Division (CBRM) consolidates Tidewater's research and monitoring activities focused of the Chesapeake Bay and coordinates the Bay-related activities of other units of the Department. Results of the technical studies and evaluations made by CBRM are used for licensing and regulatory purposes by other elements of DNR, as well as other State and federal agencies. Similarly, the results are utilized for policy and management decisions by other State agencies.

Acid Deposition Program

The Acid Deposition Program evaluates the effects of acidic deposition on Maryland's surface waters and living resources. The program conducts a wide range of research on topics such as atmospheric transport and deposition, responses of surface waters and biota to atmospheric deposition, and mitigation of surface water acidification. In addition, the program prepares an annual report on acid deposition in Maryland which summarizes research findings and identifies topics needing further study. For the past several years, a major focus has been on determining the extent and magnitude of stream acidification across the state. Regional surveys and intensive watershed studies have shown that a large percentage of freshwater Coastal Plain streams and streams in western Maryland are either acidic or sensitive to pulses of acidity during precipitation events. Aquatic toxicity studies performed on migratory fish such as blue-back herring, yellow perch, American shad, and striped bass show that early life stages, particularly larvae, are sensitive to increased acidity and dissolved aluminum levels in streams.

Studies in FY 1991 were directed toward determining the dynamics of episodic stream acidification in western Maryland and evaluating stream liming techniques.

The first year of a multi-year study of episodic stream acidification in the Big Run watershed of Garrett County, a tributary to the Savage River Reservoir, was completed. Stream samples were collected from a number of stations along Big Run and its tributaries during five rain storm and one snowmelt event, and during base flow periods. The samples were analyzed to examine changes in stream chemistry. Precipitation samples were also collected and used to estimate atmospheric inputs of various chemicals to the watershed. Flow data and watershed physical characteristics were also collected. The goal of this study is to develop input-output budgets of chemical constituents and predictive models which will be used to evaluate the effects of acid deposition on stream chemistry.

Another continuing area of research is evaluating stream liming as a method of mitigating stream acidification. One project is investigating the ability of automated stream liming equipment ("dosers") to neutralize pulses of increased acidity and improve survival of early life stages of fish

such as yellow perch, blueback herring and white perch in Coastal Plain streams. The doser, located on Bacon Ridge Branch in Anne Arundel County, operated from February through June, the spawning period for the local fish species. Prespawning yellow perch were stocked in Bacon Ridge Branch and North River, an adjacent tributary to the South River system, in spring 1991, in an attempt to restore a depleted fish fauna. The success of this strategy will be evaluated in future years. A comparison is being made of the stream biota in the limestone treated versus untreated tributary to aid in understanding the impacts of chemical alteration on habitat quality.

A potential site for lime slurry dosing on the Eastern Shore was also evaluated. Faulkner Branch and a reference site (Tull Branch) were sampled to determine whether the stream experienced episodic acidification. This candidate stream was selected from a larger set of potential candidates whose baseflow chemistry indicated that they may be susceptible to pH pulses during rainfall events.

The Western Maryland Watershed Liming Project is an acidic deposition mitigation project was stimulated by the 1987 Maryland Synoptic Stream Chemistry Survey that demonstrated that over 50 percent of the streams in the Appalachian Plateau region of western Maryland were either acidified or sensitive to acidification from acidic deposition (or acid rain). In an effort to evaluate mitigative techniques that could be used to lessen or reverse the impacts of acidic deposition on surface waters and their biota, the Western Maryland Watershed Liming Project was begun in 1989. The goal of the project is to test a mitigation technique used extensively in Scandinavia and other parts of Europe to improve water quality in acidic streams. The watershed liming techniques involves applying high-quality, fine-particle limestone to the ground surface in recharge zones adjacent to a stream or lake, and allowing the dissolution of the limestone in natural water runoff pathways to provide long-term neutralization of acidic water entering the stream or lake.

In October 1991, limestone was applied to 80 acres of recharge zones in the 580-acre watershed of Alexander Run, a small stream in the Savage River State Forest in Garrett County. This stream is currently acidic (pH between 4.1 and 4.5) and does not support any fish populations. The effectiveness

of the watershed application of limestone on Alexander Run will be monitored for several years, and compared to pre-treatment data on soil chemistry, water quality, terrestrial vegetation and aquatic biota.

Power Plant Topical Research Program

The goals of the Power Plant Topical Research Program are to identify information needs associated with the siting and operation of power plants in Maryland and to conduct the research necessary to obtain information related to environmental concerns. Research ideas are annually solicited from the scientific community in the form of preproposals, and later developed into full proposals if specific scientific and relevance criteria are met.

Metallothionein Bioindicator Study

Oysters in the Patuxent River have tissue burdens of cadmium, zinc and copper that are among the highest in Chesapeake Bay. Recent advances in the biochemistry of molluscan metal binding proteins (metallothioneins) make it possible to evaluate their usefulness as a biochemical indicator for metal contamination. Tissue burdens in Patuxent River oysters decline in a seaward direction from the Benedict bridge, providing an opportunity for transplant experiments to determine the relationship between metallothioneins as a detoxification system for metals, tissue residual concentration of the metals, and the potential toxicity of the metals. The results of this study will allow an interpretation of oyster tissue contaminant levels in terms of ecological risk to the oyster.

Six additional studies that are expected to start by January 1992 are:

- Studies on the Influence of Power Plant Emissions on Aquatic Mercury Biogeochemistry and Bioaccumulation.
- Mechanisms Whereby Magnetic Field Exposure Modifies Pineal Indoleamine Metabolism and Secretion.
- Size Distribution and Growth of Trace Element Bearing Aerosols Depositing on the Chesapeake Bay.

- Prediction of Mixing Zones for Toxic and Conventional Pollutant Discharges in Reversing Tidal Flows.
- Quantification of In-Situ Distribution Coefficients for Mercury and Organo-Mercury Species in Lacustrine and Estuarine Sediments.
- Physiological Energetics of the Blue Crab *Callinectes sapidus*.

Fisheries Research Program

The primary mission of the Fisheries Research Program (FRP) is to provide the best technical basis for decisions related to the management of Chesapeake Bay fishery resources. The program is responsible for research and assessment activities that include: development of technical portions of fisheries management plans; conducting analytical fisheries stock assessment and other analyses that provide a scientific basis for management and regulatory decisions; survey sampling design and research project evaluation; development, coordination and funding of a Bay-wide fisheries research program; coordination of the Chesapeake Bay Stock Assessment Committee; and representation on interstate and other federal fisheries technical committees concerned with research and management of Chesapeake Bay fishery resources. Three sections comprise the FRP: Research Planning and Coordination, Resource Analysis; and Special Investigations.

Through its representation on the Interstate Striped Bass Scientific and Statistical Committee and the Striped Bass Stock Assessment Committee, both under the aegis of the Atlantic States Marine Fisheries Commission, program staff are contributing to the development of an east coast population assessment of striped bass. The latter will serve as the basis of interstate fisheries management decisions for these coastal stocks.

The FRP continued its involvement in Maryland's monitoring plan for the recreational striped bass harvest in its jurisdictional waters, including the Potomac River, during the 1991 fishing season. Program staff estimated each user group's weekly harvest and total seasonal harvest at the level of precision required by ASMFC's Striped Bass Fisheries Management Plan. This survey provided state management officials with the ability to control closure of the fishery when the recreational

harvest quota was attained. The monitoring program will provide a precise post-season estimate of total recreational harvest.

In 1990, the RFP received funding from the National Marine Fisheries Service under the Anadromous Fish Conservation Act to conduct a research investigation to examine the mechanisms of Chesapeake Bay striped bass recruitment and those factors which influence the determination of year-class strength. The project's goal is to improve understanding of the stock-recruitment relationship and the role of density-dependent (stock biomass) and density-independent (e.g., environmental, anthropogenic) factors on the recruitment process. Work on this research investigation is ongoing.

The FRP developed age-length keys for adult striped bass collected during the Maryland Striped Bass Stock Assessment Survey (1982-90). These keys can be applied to total length frequency data and estimate total age distribution of the sampled stock. Additional analyses were initiated to evaluate striped bass age-sample size requirements from the survey to determine if the number of fish which must be aged to estimate the age structure of the stock can be reduced. In addition, FRP staff evaluated the use of age-length keys in the calculation of CPUE (catch-per-unit-effort) indices at age for adult striped bass. Indices of spawning potential were recalculated based on CPUE-at-length, and fecundity-at-length relationships.

The FRP is currently developing a long-term research and monitoring program for important commercial and recreational fisheries in the Chesapeake Bay as part of the Chesapeake Bay Stock Assessment Committee (CBSAC) activities.

Research projects include:

- assessing the status of blue crabs in Chesapeake Bay,
- improving the accuracy and timeliness of commercial catch and effort statistics,
- collecting biological information on the commercial catch,
- monitoring the status of recreational fisheries, and

- designing a prototypical fishery independent monitoring system.

Researchers and managers from the University of Maryland (UMD), the Virginia Institute of Marine Science, and the Virginia Marine Resources Commission are participating in these activities.

Other program responsibilities relating to the CBSAC include coordinating the relevant fisheries research actions of other state agencies, and serving as a forum for review and discussion of methods and status of Chesapeake Bay resource assessments. The FRP is coordinating a population study on blue crabs in Chesapeake Bay in cooperation with UMD/CEES-CBL.

The report includes:

- a blue crab stock assessment,
- results of the winter dredge survey program with a sampling procedure for future years, and
- analysis of catch-per-unit-effort data obtained for 1987 to 1991 from commercial blue crab fishing vessels and processing plants.

FRP staff are participating in the development of the technical component of interstate fisheries management plans for striped bass, bluefish, Atlantic sturgeon, winter flounder, scup, summer flounder, and black sea bass. These activities are carried out under the auspices of the Scientific and Statistical Committees of the Atlantic States Marine Fisheries Commission, and other inter-jurisdictional fisheries technical and research committees on which the state is represented by FRP personnel.

Habitat Impacts Program

This program implements Chesapeake Bay initiatives concerned with monitoring living resources, understanding and correcting habitat problems, and management of living resources data.

Living Resources Monitoring

Participation in the Baywide living resources monitoring program, in cooperation with several other state and federal agencies, is the key responsibility of this project.

Long-term data collection is required to meet monitoring objectives:

- to collect information on the abundance and habitat quality of living resources;
- to determine the effectiveness of pollution control measures in protecting and restoring the living resources of Chesapeake Bay; and
- to assess the effects of habitat quality on survival and reproductive success of living resources.

Efforts to implement a coordinated program are being guided by the Chesapeake Bay Living Resources Monitoring Plan, which was developed by an interstate work group under the direction of the program manager, and adopted by the Chesapeake Executive Council in 1988. Significant progress has been made in several areas of the plan, including improved management of living resources data, more consistency between state monitoring programs, and a series of technical workshops to coordinate and improve elements of the monitoring program. For example, workshops were held during the past year on Baywide monitoring of oysters and zooplankton; juvenile fish and wetlands monitoring workshops are planned for early 1992.

The importance of long term data sets in illustrating population trends of commercially important fish species is well documented. However, scientists and managers are now beginning to understand

the value of taking an ecosystem approach, as opposed to a species-specific one, to understanding and managing the Bay. The Habitat Impacts Program is taking the lead in this new approach by chairing the effort to develop a *Strategy for the Restoration and Protection of Ecologically Valuable Species*, as directed by the 1987 Chesapeake Bay Agreement, and by cooperating with the interstate Bay Program to support computer modeling of the Chesapeake ecosystem.

Biologists and analysts are also working to develop "biological indicators" of the quality of Bay habitats, based on the abundance, diversity, and health of fish. An estuarine "index of biotic integrity" has been developed from data collected as part of the Fisheries Division's long term juvenile striped bass seine survey. The index is being tested and refined with recent monitoring data from several Bay

tributaries including the Magothy, Severn, South, and Wicomico Rivers, Curtis Bay and Rock Creek on the western shore, and Fishing Bay on the Eastern Shore. Some of these areas suffer from water quality problems like low dissolved oxygen. The goal of this effort is to understand the influence of habitat conditions and pollution on the abundance and diversity of fish and to make the information easily accessible to non-specialists.

In response to recommendations from a November 1990 oyster monitoring workshop, the Maryland fall oyster survey was modified to provide better information on annual spat set, oyster mortality, prevalence and geographical distribution of the lethal oyster parasites "dermo" and MSX, and other attributes of the oyster stocks. Long term oyster monitoring data is being mapped and analyzed to gain retrospective information about the oyster resource in Maryland.

Cooperative research and monitoring efforts with the University of Maryland in various portions of the Choptank River showed that

- 1) disease, rather than low dissolved oxygen, was the major factor related to oyster mortality during 1986-1988;
- 2) predation on very young oysters by the oyster flatworm was a major source of mortality; and
- 3) survival and growth of young oysters was not related to the quantity or quality of food (small algal cells) available during the spawning and settlement season.

Data Management Project

The Data Management Project has two functions:

- 1) to provide the overall program with the programming, data entry, data base management, and hardware and software support necessary to manage the large quantities of data collected and to ensure that they are readily available for use and analysis; and
- 2) to assist the interstate Chesapeake Bay Program to acquire, document, and quality assure living resources data for its Chesapeake Bay data base.

All data collected before January 1991 has been standardized and appended to the historical resource monitoring database. Work is under way to write programs to standardize data from additional monitoring programs. These projects include; Toxics Monitoring, Citizens Monitoring, Fall Oyster Survey, SAV Monitoring, and Small Tributary Monitoring. Although these data have not been standardized, key entry is either complete or underway and the data sets are available for analysis. Federal funding has been requested for a pilot project to design an enhanced system for data storage and retrieval utilizing a commercial database software product. This enhanced database system will allow the rapid assimilation of data into the data base by allowing multiple file formats. It will also allow the retrieval of data sets for analysis by non-programming personnel.

Chesapeake Bay Program Activities

In August 1991, **Habitat Requirements for Chesapeake Bay Living Resources, 1991 Revised Edition**, was published. This report, of over 500 pages, was a cooperative effort among the Department of Natural Resources, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the Chesapeake Research Consortium, and a large team of experts from universities and public agencies. A large portion of the final editing and production work were done by Habitat Impacts staff.

Habitat Impacts staff serve on several Bay Program subcommittees and work groups, where they contribute their knowledge, expertise, and time to the regional effort to restore and protect the living resources of Chesapeake Bay.

Toxic Aquatic Contaminants Program

The Toxic Aquatic Contaminants Program is responsible for the assessment of the impacts of releases of toxic chemicals on the living resources in the Chesapeake Bay and its tributaries. This program is accomplished by direct measurement of the toxicity of chemicals and the water bodies they are released into, monitoring impacts of chemicals on habitats and living organisms, development of data bases for risk assessment and directing research into assessment methods for determining the effects of toxic chemicals on Bay species. In

addition, the program operates a mobile bioassay laboratory with the capability of reacting to quick response situations, special projects and in-depth investigations in support of risk assessments.

Ambient Toxicity Assessment Project

This project implements the commitments of the Bay Program's Toxics Reduction Strategy for "Baywide assessment of the effects of toxic substances within natural habitats, on selected commercially, recreationally and ecologically important species of living resources" and "to provide a better understanding of the current significance of toxics in the Bay and the potential risks associated with their presence".

The long term objectives of the project are to monitor the effects of toxic substances in natural habitats on commercial, recreational and ecologically important plant and animal species by measurement of bioassay responses to water and sediment using target species and/or laboratory test species. Also, the project was initiated to develop and implement a water quality assessment system to systematically appraise the biological impact of toxic contamination on living resource habitats, provide data for the evaluation of risks of toxic chemicals to living resources and identify regions where toxicity levels warrant further investigations.

Previous testing in water and sediment demonstrated the presence of toxic conditions in the Elizabeth River, Virginia. Toxic conditions were also demonstrated in the Patapsco River, Maryland, but not to the same degree as in the Elizabeth River. Sediment and biochemical assays conducted in the Wye River, Maryland (presumed toxic contaminant free control site) indicate possible toxic contamination of the sediments. In the Potomac River, some sediment bioassays demonstrated toxic conditions at all five stations (three freshwater and two saltwater). Some water column bioassays demonstrated toxic conditions at three stations (one freshwater and two saltwater). Limited chemical analysis of water and sediment samples do not provide conclusive information on the causative agent(s).

The primary objective of 1991 sampling was to verify previous assays and to assess temporal variation of bioassay results. The Patapsco and Wye Rivers were sampled at the same locations as in 1990. The Potomac was sampled at the same two saltwater stations as in 1990. All stations were

sampled in late summer and again in the fall. Two additional test species were also introduced into the testing array. Additional test species assays are being developed to include as wide a phylogenetic array of species as possible. Ultimately the program will identify the proper suite of assay species and procedures to accurately assess the presence or absence of toxic impacts in the Bay and its' tributaries in a cost effective manner. It will also support the development of a toxicological data base in ambient water and sediments with which to calculate the correlations with fish and benthic community assessments and develop risk assessments.

Currently, the mobile laboratory is available for testing at a permanent operating base or for on-site situations.

Aircraft De-icer Toxicity Investigation

In coordination with the multi-agency Targeted Watershed Project and the Maryland Aviation Administration, an assessment of the toxicity of commercial aircraft de-icers is under investigation. The resulting information is supporting habitat impact monitoring and restoration efforts in one of the targeted watersheds (Sawmill Creek) that receives runoff from airport runways and aircraft during de-icing activities.

Acid Stream Habitat Quality Assessment

In-stream bioassays are currently under way to support monitoring activities associated with CBRM's Watershed Liming Project. The assays were designed to appraise the effectiveness of watershed liming as a mitigation method to remedy the effects of acidic deposition on natural trout streams in Maryland. The study stream, Alexander Run, showed acute toxicity to native species of fish prior to watershed liming. Further testing, planned for 1992, will evaluate ambient toxicity conditions in Alexander Run following liming operations.

Cooperative Oxford Laboratory

The Cooperative Oxford Laboratory was created in April 1987 by an agreement between the Maryland Department of Natural Resources and NOAA's, National Marine Fisheries Service to establish a state/federal research laboratory to study the impact

of diseases on fish and shellfish in the Chesapeake Bay. The agreement combined trained shellfish and finfish pathologists, a unique technical library on fishery disease information, a 13,000-square foot laboratory, and state personnel familiar with Bay management problems. The present program concentrates on describing the disease distribution and the resultant impacts on fish and shellfish stocks in the Bay. Several research projects are underway to improve survey methodology, develop new diagnostic techniques, describe new life stages of parasites and diseases, and to evaluate potential management tools to offset the impact of disease. The first year of funding under the Governor's Bay Initiative Programs, (FY 1989) expanded the state component of the Laboratory by adding three senior staff members and five technical support personnel to accomplish the shellfish disease survey and research tasks. The Cooperative Lab completed analyses of annual surveys of the oyster disease situation in 1986 through 1991, and statistically organized all existing data on shellfish diseases in Maryland waters. These studies show two major periods of MSX disease infestation (1965 through 1968 and 1981 through 1988), as well as a gradual intensification and spatial expansion of Dermo disease throughout this 23 period. From the results of 1991 surveys, MSX disease was found only in Tangier Sound, whereas, Dermo disease continued to spread up all river systems and intensify in its impact. Oyster mortality induced by Dermo disease is at a lower level than mortality caused by MSX, but has caused high mortality of market-sized oysters on several oyster bars.

The Cooperative Laboratory and Shellfish Propagation personnel operated Deal Island Hatchery to spawn and evaluate the use of disease resistant stocks of oysters developed by New Jersey and Virginia. Spat from these special stocks and from Maryland stocks have been placed in various river systems throughout the Maryland portion of the Chesapeake Bay. In 1990, these studies found unusually high infection rates of Dermo and MSX in early life stages of both disease resistant and Maryland oysters; the persistence of Dermo disease intensified as the oysters grew older. Research activities developed a rapid blood diagnostic technique to determine the presence of MSX and Dermo diseases in the circulatory system of oysters. A recent modification of this procedure includes a gill biopsy which now allows diagnosis of all stages of shellfish infection in less than two weeks after collection of oysters. In the past,

traditional histological techniques required an entire year before a final assessment of the oyster disease situation in Maryland waters could be completed.

Several Maryland lease holders submitted their oysters to the Oxford Laboratory for diagnoses and technical advice on how to better utilize their oyster leases. Experimental studies have developed an in vitro test technique to study treatment of oyster diseases with chemotherapeutic drugs. It is anticipated that an array of treatments for oyster diseases will shortly be available to the management agencies.

Cooperative investigations of finfish disease are conducted among members of the Maryland Department of the Environment, University of Maryland at College Park, University of Maryland Medical School, DNR-Fisheries Division personnel, and the Cooperative Oxford Laboratory staff. Fish kill numbers have been very high during recent summers and have provided an opportunity to describe several new bacterial and parasitic infestations in Chesapeake Bay fish populations. These investigations provide a definition for fish mortality causes which are especially useful to management agencies.

Toxics

While Maryland has long had strong programs to control the discharge of toxic substances into its waters, most of the emphasis, appropriately, has been on human health concerns and reducing toxic inputs from industrial sources. The Bay Agreement of 1987 and the subsequent "Basinwide Toxics Reduction Strategy" have put an additional emphasis on protecting the Bay's living resources from harmful exposures to toxic contaminants. In 1990, a new effort was begun to assess the potential danger to living resources from toxics - not only those discharged by industry, but also the many toxic substances that can reach the Bay in runoff from farms, cities, and residential areas. Bay water and bottom sediments from several sites will be tested according to carefully developed methods to determine whether their toxicity to fish and invertebrate animals. Do toxic effects occur only in a few highly contaminated areas, or "hot spots", or are they more widespread? The answers to this important question will help to determine how toxic contamination problems are to be managed by the Chesapeake Bay Program and the states.

A three-day scientific workshop held in July 1989 helped to review the objectives and guide the methods of this effort. The proceedings, "Chesapeake Bay Ambient Toxicity Assessment Workshop Report," were published by the Chesapeake Bay Program in May 1990.

POWER PLANT AND ENVIRONMENTAL REVIEW DIVISION

The Power Plant and Environmental Review (PPER) staff direct environmental research and provide technical information and recommendations to regulatory agencies concerning actions necessary to minimize the impact of projects throughout the state. This is accomplished through the Power Plant Research Program (PPRP) and the Environmental Review Program (ERP). The PPRP staff review the siting and operation of power plants, transmission lines, and associated facilities and make recommendations to the Public Service Commission. The ERP staff provide technically based reviews for permits issued by various federal, state and local jurisdictions for impacts upon aquatic resources.

Major Power Plant Related Activities

Throughout 1991 the Power Plant and Environmental Review staff conducted the following activities:

- participated in a proceeding to determine the need and appropriate configuration for Baltimore Gas and Electric Company's proposed generating facility at its Perryman site;
- provided an initial set of conditions designed to insure that BG&E's proposed plant in Harford County can operate with acceptable levels of environmental impact;
- participated in a proceeding to evaluate Potomac Edison Company's proposal to construct three scrubbers at its Harrison Power Plant to comply with its Phase I requirements under the new Clean Air Act Amendments;
- participated in a regional working group which is examining regional implementation issues associated with the Clean Air Act legislation;
- presentations and participation in a state wide committee looking at state implementation problems associated with the Clean Air Act;
- published the seventh edition of the Power Plant Cumulative Environmental Impact Report for Maryland. The report includes recommendations outlining State environmental policy and objectives pertaining to power plants;
- conducted an evaluation and provided testimony for the state on Conowingo Power Company's application before the PSC to construct a 15 mile 230 kv transmission line from Cecil to Colora substations in Cecil County;
- participated in an Energy Summit, sponsored by the Governor, to develop an energy agenda of items that could be implemented within a short time framework;
- participated in a panel discussion to address "How Will Government Actions on the EMF Issue Affect Business" for Washington International Energy Group Conference, "The Business of EMF";
- involved in the ongoing monitoring program, conducted by MGS and USGS, to study the hydrologic effects of power plants on aquifers in southern Maryland;
- coordinated review efforts and commented on the development of groundwater monitoring plans to be implemented at PEPCO Station H pertaining to the fuel oil storage facility of 10 million gallons capacity;
- continued monitoring of radionuclide concentrations and distributions in Susquehanna River and Chesapeake Bay to assess the environmental impact of radioactivity discharged by Peach Bottom and Calvert Cliffs Nuclear Power Plants;
- served as lead state agency for review of changes implemented prior to the restart of the Calvert Cliffs Nuclear Power Plant;
- reviewed procedures and technical specifications related to the Calvert Cliffs Independent Spent Fuel Storage Facility;

- participated in plan development and exercises of plume and ingestion phases of radiological emergency response activities at Peach Bottom and Calvert Cliffs Nuclear Power Plants;
- resolved issues associated with entrainment impacts to forage finfish at the Potomac Electric Power Company's Chalk Point Steam Electric Station. The resolution resulted in a long-term settlement agreement which assures the continued restoration of Patuxent River fisheries through aquaculture and fish passage projects;
- conducted a variety of studies to evaluate options for modifying operation of the Deep Creek Lake Hydroelectric Facility to better enhance and protect Deep Creek Lake and Youghiogheny River natural resources and resource users as part of PPER lead agency responsibility with hydropower projects;
- PPER, Philadelphia Electric Company and other state, federal and private organizations dedicated the new east side fish lift at Conowingo Dam. This facility represents the first major step in long established cooperative efforts to restore American Shad to the Susquehanna River;
- continued to evaluate issues and developments related to the implementation of fish passage facilities at Holtwood, Safe Harbor and York Haven dams on the Susquehanna River;
- monitored and evaluated the effectiveness of turbine venting at Conowingo Dam to assure the facility complies with Maryland water quality standards for dissolved oxygen in the tailrace;
- continued ongoing field studies to determine the impacts of Winter Peaking operation by The Conowingo Hydroelectric Station on the Susquehanna River;
- continued active participation in the multistate activities aimed at the restoration of American Shad and other anadromous species to the Susquehanna River;
- submitted the "Status Report on Potential Human Health Effects Associated with Power Frequency Electric and Magnetic Fields" to the Public Service Commission. These reports form the basis for the state position regarding EMF issues;
- PPER established a monitoring program to determine the EMF levels that will be found in the new wing of the Tawes State Office building;
- conducted the necessary initial reviews of four transmission line projects during preliminary siting, pre-application, PSC hearing and construction stages;
- continued evaluation of the potential impacts of toxic releases from power plants on the State's natural resources and specific studies on the potential ecological risks from mercury contamination in Maryland;
- participated in three collaborative processes identifying and designing potential demand side management programs for PEPSCO, BG&E and DP&L;
- completed econometric load forecasts for two of Maryland's major utilities, Allegheny Power System and Baltimore Gas and Electric Company;
- participated in a proceeding with Delmarva Power and Light Company to review Delmarva's proposal to competitively solicit future baseload generation capacity from non-utility generators;
- and initiated a review of Maryland's major utilities' preliminary plans for complying with the Clean Air Act.

Major Environmental Review Activities

The Project Review Program of the Power Plant and Environmental Review Division is responsible for providing and coordinating the comment on environmental impacts statewide as they affect natural resources under the responsibility of the Tidewater Administration.

During FY 1991 an important function of the environmental review responsibilities was implementing the requirements of Section 307 of the federal Coastal Zone Management Act. The Act requires that federal activities in the coastal zone be

consistent with, to the maximum extent practicable; the state's Coastal Zone Management Program. Due to the broad nature of the CZMP, this requires a comprehensive review of the potential impacts associated with a development proposal. Outside of the coastal zone, the division's review focuses primarily on impacts to water and aquatic resources. Major types of projects reviewed include erosion control, dredge and fill, municipal and industrial waste disposal, filling within the 100 year tidal and non-tidal floodplain, shoreline residential development, and transportation projects.

In FY 1991, the distribution of caseload by type of project was as follows:

DNR Clearinghouse	86
Discharge Permits	39
Land Planning Service Reviews	47
Maintenance and Repair	28
Corps of Engineers Public Notice	314
Strip Mine Application	6
Public Drainage Association	34
Proposed Pond	28
Preliminary Project Plans	13
State Clearinghouse Review	348
State Highway Administration	51
Surface Mining Permit	28
Temporary Construction	19
Toxic Material Permit	73
Waterway Construction Permit	90
Wetland License (State wetlands)	275
Wetland Permit (Private wetlands)	18
Water Quality Certification	376
Nontidal Wetland Permits	4
Water Appropriation Permits	2
Miscellaneous	4
Total	1,886

Examples of some of the more significant activities and reviews conducted include the following:

- participated in the on-going review of proposed dredge disposal projects associated with the enlargement of the C&D Canal;
- participated with a MES task force to develop of pre- and post-disposal monitoring programs to evaluate potential impacts of dredge disposal at Poole's Island;
- evaluated the potential ecological and resource impacts of BG&E's Brandon Woods Coal Ash Site in Anne Arundel County;

- cooperative study of thermal impacts of existing farm ponds in Use III waters within Baltimore County was conducted. Cooperative parties included the Baltimore County Environmental Protection and Resource Management Section, Baltimore County Soil Conservation District, Trout Unlimited, and Tidewater Administration;
- reviewed a permit modification request to use controlled blasting techniques for bedrock removal to complete installation of an effluent outfall and diffuser pipe in the Potomac River near Williamsport;
- reviewed a proposal to construct five road crossings and relocate/channelize 1,250 feet of Beaver Run in Carroll County. Beaver Run is presently stocked with trout. Concern was expressed for impacts to trout populations and resident aquatic species;
- reviewed a proposal by Philadelphia Electric Company to use explosives to remove old cement structures in conjunction with construction of a fish passage facility at Conowingo Dam;
- reviewed permit application of the Howard County Country Club. They proposed development of five ponds along the Cattail Creek drainage (Use III waters) in the Patuxent River drainage;
- conducted a review on a summary package of economic development projects proposed for Allegany, Garrett, and Washington Counties by the Tri-Country Council for Western Maryland, Inc.;
- conducted a review of the proposed realignment and reconstruction of MD Rt. 450 bridge over the Severn River; and
- comments were prepared by staff on the Federal Highway Administration's initiative to merge the Section 404 permit process with the National Environmental Policy Act (NEPA) process. The procedure provides for the issuance of a Department of the Army permit for the SHA selected alternate at the conclusion of the NEPA phase.

At the request of the Bureau of Mines, nine proposed abandoned mine reclamation projects in Garrett and Allegany Counties were reviewed for potential fishery resource impacts. It was determined that five of these projects could impact fishery resources.

In coordination with the Freshwater Fisheries Division, a fish, stream flow, and water temperature study was conducted for Piney Branch, Watts Branch, and Muddy Branch located in Montgomery County. Piney Branch was stocked with 1300 brown trout fingerlings and Watts Branch with 500 brown trout fingerlings. Flow measurements were conducted through the summer to document the range of stream volume discharges. Continuous recording temperature devices were installed in these streams and monitored to document stream temperatures through the summer months.

FISHERIES DIVISION

The Fisheries Division is responsible for the management and enhancement of the tidewater finfish and shellfish resources through the State of Maryland. Management of the tidal fisheries includes monitoring species abundance, regulating harvesting activities, collecting and analyzing catch statistics, conducting biological investigations, planting oyster shell and seed and cooperating with other State and Federal Agencies to enhance Maryland's fisheries. The introduction of hatchery raised fish and shellfish into Maryland waters has supported fishery enhancement efforts statewide. The Fisheries Division's goal is to maintain optimum condition of fisheries stocks for purposes of harvest and ecological balance and to encourage greater returns for the citizens of Maryland.

Recreational Fisheries

The primary goal of the Recreational Fisheries program is to improve the quality of sport fishing on the Chesapeake Bay and its tributaries. This goal is achieved through conservation of sport fish stocks, enhancement of recreational fishing opportunities, habitat protection or creation, and research on tidal fishery resources.

Major areas are:

- access through fishing piers and boat launching ramps;

- artificial reef construction;
- hatchery production;
- youth-oriented fishing derbies;
- an annual Maryland Sport Fishing Tournament;
- and a 1991 Governor's Youth Fishing Derby which drew a crowd of over 4,000 youth at 18 locations across the State on a single day.

Staff prepared displays and exhibits for nine major outdoor shows with a total attendance in excess of 500,000 persons. In addition, seminars, small shows and media programs were assisted. Administrative help was given to seven major fishing association tournaments and other events including the 1991 Bassmasters Classic.

Freshwater and saltwater fishing citations, patches, and date bars were issued to over 2,000 anglers for their participation in the 27th annual Maryland Sport Fishing Tournament. A Catch-and-Release Awards Program was initiated to reward anglers who catch trophy sized fish and release them alive. In its first year it issued over 250 citations and patches. This effort joins our fishing video "Keeping Score: Releasing Fish for Tomorrow", and several printings on tips for successfully releasing fish.

A major renovation of the public fishing pier at North Beach, Calvert County was completed. The fishing piers at Point Lookout, and the Choptank River were improved and a major fishing pier is being planned for Solomons Island, Calvert County to improve shoreside fishing access. Funding has been allocated for shoreside boat launching ramps and parking areas to increase access for anglers at the developing 952 acre Jennings Randolph Lake in Allegany County.

The Urban Fishing Project enhances fishing opportunities. Over 20,000 pounds of catfish were stocked in more than 32 community ponds for the promotion of sport fishing and education at youth fishing rodeos held cooperatively by community organizations. Twenty events were held during National Fishing Week.

The artificial reef feasibility study was completed in 1990. The study recommended the enhancement of Chesapeake Bay environmental habitats through re-establishment of complex oyster reef communities. A pilot project was completed in 1991, with

the assistance of the Maryland Saltwater Sports-fishermen's Association, to place 200 habitat units near Love Point, Queen Anne's County. An additional 15,000 to 30,000 units are being constructed for placement in mid-1992.

Publications

Brochures, pamphlets, information sheets and booklets containing commercial laws and regulations for fishing, oysters, crabs, clams and fish were designed and updated for these user groups.

The Tidewater Fisheries News was produced on a monthly basis and staff wrote and distributed materials on particular fisheries issues for sport fishing magazines.

Aquatic Resources Education

Maryland Aquatic Resources Education program assists Maryland's public and private schools by providing an aquatic resources education grants' reimbursement program, which is available to schools from Grades K through 12.

Under the grants' program, three to four regional mini-conferences are held for teachers and feature 17 to 19 concurrent workshops stressing aquatic resources. Workshops are attended by social studies and science teachers and outdoor education coordinators.

The grants' reimbursement program is available to Maryland's marine museums for the purpose of educating people of all ages about Maryland's aquatic resources. Being able to obtain funds from the grants' reimbursement program enables marine museums to develop a broader environmental education program.

"Hooked on Fishing, Not on Drugs" fishing clinics is another major component of Maryland's Aquatic Resources Education Program. The program is conducted during the summer months to children seven to twelve years old, and children are recruited in May from schools in five areas of the State. The program provides drug education as well as aquatic education studies, ethics and responsibility. Both the grants' reimbursement program and the fishing clinics provide opportunities to minorities and to those with special needs.

Fisheries Statistics

The Fisheries Statistic Project continually evaluates the harvest estimation systems. Harvest data is electronically processed and analyzed. Commercially harvested fish species are sampled for sex and size composition data. These data are used for developing and implementing fish management.

Annual sportfishing surveys are conducted in cooperation the National Marine Fisheries Service. The intensively managed spring and fall striped bass recreational and charterboat fishery is monitored by: intercepting and interviewing anglers and captains; telephone surveys; permits and fish tags; and charterboat logbooks.

Fish Passage

Restoring migratory fish to historic spawning habitat is a commitment of the 1987 Chesapeake Bay Agreement and an integral part of the overall Chesapeake Bay Cleanup. There are three components of the Fish Passage Program:

- Biomonitoring of streams for species diversity and abundance;
- construction of fish ladders, lifts, breaches or removal of blockages; and
- transplanting or stocking of juvenile and adult fish.

Approximately 887 stream barriers have been identified that prevent migratory fish from reaching their historic spawning habitat. The barriers range in size from large dams to road culverts, weirs, pipeline crossings and low-head dams. Over 100 of these barriers block anadromous fish spawning rivers or streams.

The watersheds of the Susquehanna, Patapsco, Patuxent, Anacostia, Nanticoke and Choptank Rivers have been designated as priorities.

Twenty-five sites were identified for near-term action in 1990, ranging from planning and surveys to design and construction. To date, the effort has enabled the construction of one major fish lift, two fish ladders, removal of two dams and breaching of seven blockages. Several additional construction projects are underway.

This work is part of a cooperative effort with the University of Maryland Chesapeake Biological lab to produce biological data to guide management. Information will be used to assess crab population trends and to guide recommendations in the bi-state Blue Crab Management Plan.

Shad and Herring Project

Improvement continued in the upper Chesapeake Bay stock of American shad as the estimated number of spawning adults increased from 123,830 in 1990 to 141,049 in 1991 although the fishery remains closed. The University of Maryland tagged shad in Virginia waters at the mouth of the Chesapeake in 1991. Tag returns were from Virginia waters of the Bay as well as rivers in Delaware, New York and Connecticut. Other stock discrimination work done in the Atlantic off the coast of Maryland and Virginia indicates that the ocean fishery for shad may be taking significant numbers of shad from Maryland rivers.

Significant commercial harvest of river herring is now limited to only the Nanticoke River and the spring 1991 harvest was about equal to last year's. Estimates of total annual mortality for alewives (55.0%) and bluebacks (37.6%) in 1991 increased slightly from the 1990 estimates (44% and 35%, respectively).

Juvenile herring production in the Nanticoke River surpassed all the other river systems sampled. Juvenile alewife increased 552% over the previous five year mean. However, juvenile blueback catch was 74% below the previous six year mean. No juvenile shad were collected from this system during 1991. Young of year shad, alewives and bluebacks in 1991 in the Upper Chesapeake were markedly reduced. Even though the catch of juvenile American shad from the upper Bay remains low, the steady increase in the number of spawning adults provides strong evidence of the continued recovery of this stock.

Striped Bass Project

Maryland striped bass stock assessment programs were supplemented by the addition of intensive monitoring projects directed at the commercial and recreational fisheries.

Surveys in 1990 indicated that the abundance of female striped bass spawning in the Chesapeake Bay continues to increase due primarily to reduced fishing mortality. Study results show a general increase in overall stock size and age composition indicating stock growth and recovery to levels not seen since the mid 1970's.

The 1990 Baywide striped bass juvenile index was 2.1. This index was derived from the annual estuarine juvenile finfish survey which monitors reproductive success of tidewater fish species in the Upper Bay, Choptank, Nanticoke and Potomac Rivers. Although the Spring, 1990 striped bass spawning stock survey indicated that the adult population is continuing its recovery, the right combination of natural factors which determine spawning success such as rainfall and appropriate spring water temperatures, did not occur in 1990. The 1990 juvenile survey indices indicated that striped bass reproductive success in the Choptank River (3.1) and in the Upper Bay (3.8) was higher than in the Potomac (0.6) and Nanticoke Rivers (0.9). The occurrence of one or two areas having relatively higher reproductive indices while other areas have lower indices is typical of the Chesapeake Bay system.

The moratorium on the harvest of Maryland striped bass was lifted upon the opening of carefully controlled recreational and commercial fisheries in 1990. The Maryland striped bass management decision to open a limited fishery is guided by Atlantic States Marine Fisheries Commission (ASMFC) requirements. ASMFC requirements allow for a conservative fishery while maintaining continued stock growth. To insure that fishery exploitation was within ASMFC guidelines, the Maryland Department of Natural Resources had adopted a quota based management system to regulate the total annual striped bass harvest. Landings for all fisheries combined were approximately 100,000 pounds less than the 750,000 pounds allowed by the 1990 Maryland quota.

Fisheries Management Plan Project

The Fisheries Management Plan Project develops management plans for species in Maryland waters. Several of the plans (striped bass, crabs, etc.) are jointly produced with Virginia, the District of Columbia, Pennsylvania and the Potomac River Fisheries Commission. In FY

1991 Governor Schaefer and other signatories to the 1987 Bay Agreement signed management plans for bluefish, weakfish and spotted seatrout. Regulations accomplishing plan recommendations for bluefish were in place for the summer of 1991.

The weakfish plan will not be fully implemented until the Atlantic coastal plan is finally adopted. Public participation in plan formulation was maintained by a blue crab workshop held in April 1991. There have been several public informational meetings during the process of writing plans for eel, croaker, spot and summer flounder.

Yellow Perch Project

The yellow perch project monitors adult and juvenile yellow perch populations in tidal portions of nine Maryland rivers and the upper Chesapeake Bay region. The project also stocks both adult prespawning perch and hatchery raised perch and assesses the impacts and benefits of each method of stock enhancement.

Commercial catches of yellow perch in the upper Bay have declined since 1988 in all systems that remain open to commercial fishing. Analysis of age structures and juvenile production in the upper Bay indicate that decreasing catches are a function of the removal of the very strong 1988 year-class from the population. Test nets in the Choptank River system, Wye East River, and Miles River also produced lower relative abundance measurements compared to the good year experienced in 1990.

Juvenile production declined in all sampled areas except the Corsica River. In 1991, upper Bay juvenile production dropped to the levels of the late 1980's after a very good spawning season in 1990. Hatchery efforts produced 503,500 juvenile yellow perch which were stocked in the Corsica River, Wye River and Marshyhope Creek. A blood analysis technique is being developed to differentiate hatchery fish from wild fish. Results of the tests are not complete.

Adult fish stocking efforts were concentrated in the South River system (10,300), Patuxent River (15,400), Marshyhope Creek (6,600), and Choptank River (12,600). Tag returns of the perch stocked in the South River indicate that

stocked perch returned to the upper Bay which suggests that adult stocking may not be suitable for western shore systems. In contrast, tag returns of yellow perch stocked in eastern shore systems indicate that translocated perch remained in the stocked systems.

WATERSHED AND GROWTH MANAGEMENT DIVISION

The Watershed and Growth Management Division was formed in early 1991. The division is comprised of five programs that will assist in planning, assessing and managing the effects of growth and development on the resources of the State with the goal of protecting or restoring healthy stream and river ecosystems in every watershed of the State.

Targeted Watersheds Program

The Targeted Watersheds program plans and conducts case studies such as the current Targeted Watersheds Initiative to determine the actual impact of land use on watersheds, their streams and aquatic resources and the effectiveness of various point and nonpoint source controls in mitigating these impacts.

The Targeted Watersheds program is active in four watersheds: Sawmill Creek in Anne Arundel County; German Branch in Queen Anne's County; Piney and Alloway Creeks in Carroll County and Bird River in Baltimore County. Sawmill Creek and Bird River are in urban areas with plans for future development. The other two streams are in heavily-farmed regions of the state. These four watersheds were selected because they represent land use types that are of priority concern to the state in directing restoration efforts for the Chesapeake Bay.

Water quality monitoring, aquatic life surveys and flow measurements are being used to assess the progress of these stream clean-ups. Two years of sampling have been conducted in the Sawmill Creek and German Branch watersheds. Piney and Alloway watersheds have been monitored for a year and a half. Storm monitoring has been completed for the Bird River and based on this monitoring, restoration plans are being

drafted and will be implemented in the upcoming year.

Many restoration actions are already underway: The agricultural agencies are focusing their efforts on nutrient control through best management practices incentive programs; in the urban watersheds pollution sources are being identified and brought to the attention of regulatory and planning agencies at the county and state level. Communication between government agencies, citizens and researchers is fostering pollution control and assessment activities.

Citizen-volunteers are collecting water quality or assessing stream health in all of the watersheds. Citizens also are planting trees, conducting stream clean-ups and assisting with watershed surveys.

The data collected by these trained citizen-monitors augments the work of government agencies. Most of volunteers are recruited and trained by the Alliance for the Chesapeake Bay and by Save Our Streams.

Citizen Involvement Program

The Citizen Involvement program develops and conducts programs such as Adopt-A-Stream involving civic, environmental and community associations, the business community and local governments to protect and restore watersheds.

A major focus of the Citizen Involvement program is Adopt-A-Stream, which educates the public on the value of Maryland's streams. Through the coordination of volunteer activities, a large number of people get involved in learning about the environment and helping to improve the health of Maryland streams. This affords groups and individuals the opportunity to assume responsibility for a stream or a stream segment by conducting one of six adoption activities: Water Quality, Monitoring, Sediment and Erosion Control Monitoring, Watershed Inventory, Stream Survey, Stream Clean-Ups and Storm Drain Painting.

Growth Management Program

The Growth Management program assists in coordinating Tidewater's efforts related to

growth management. The program acts as a liaison with local governments on growth management issues, and assists local governments to obtain technical support in cooperation with the Coastal Resources Division.

Much of the program activity in 1991 deals with growth issues in the seaside bays area of Worcester County. The northerly three bays, Assawoman, Isle of Wight and Sinepuxent are shallow and slow to flush. This makes them vulnerable to degradation by non-point source problems originating from agriculture and urban-suburban growth. The drainage basins of the three bays are the principal areas that have received recreational resort-related growth. They are also the areas Worcester County's comprehensive plan has chosen to receive continued growth. There is substantial concern about both Ocean City's growth and from the more than 50,000 dwelling units now within the three Bays' basins, the County plan envisions locating more than 40,000 additional dwelling units there by the year 2005.

The program is engaged in working with citizens and with the State's larger efforts to develop a clearer picture of the implications of growth in the seaside Bay's region.

The program's staff has taken part in the EPA Bay Program's Committee on Population Growth and Development deliberations and has provided input to the legislative committee presently attempting to formulate a growth/sensitive areas bill for the 1992 legislative session.

Other activities have involved habitat management issues such as placement of dredged spoil from navigation channels. Much effort has gone into design of monitoring programs for overboard spoil disposal near Poole's Island, stabilization of the eroding Poplar Islands with spoil and restoration of Bodkin Island (Eastern Bay), Dobbins Island (Magothy River) and a new proposed site adjacent to Bethlehem Steel (Patapsco River).

Watershed Impact Evaluation Program

The Watershed Impact Evaluation program develops and implements methods for documenting the cumulative impact of man's activities on watersheds and their streams and rivers. The program examines relationships between land use and development activities and resulting effects on stream ecosystems. The program assists in prioritizing watersheds as necessary for various restoration and protection programs.

Intensive studies of several watersheds are being conducted in order to determine the effectiveness of various land use and growth management mechanisms that could help protect stream ecosystems. Field monitoring of water quality, water quantity, habitat and population dynamics are being combined with Geographic Information System (GIS) analysis of land use patterns in an attempt to identify the points at which man's activities may overwhelm a stream system.

Studies will evaluate the existing institutional structure of environmental protection. A list of existing protection techniques which would include permits or standards are waterway construction; stormwater management; point source pollution discharge; flood management; wetlands protection; water quality certification; water supply and sewage disposal. Generally these issues are the responsibility of a variety of different agencies and they are reviewed on a case-by-case basis.

There are limited examples where these techniques are applied on a watershed basis. Staff are working with a number of counties and several regional planning agencies in order to expand and refine the focus on stream ecosystem protection and watershed management. The techniques to be emphasized will have to be tailored to the specific land use and physiography of the local jurisdictions.

The program's responsibility also involves acting as the lead agency for certain types of environmental impact assessments. A significant amount of effort is devoted to coordinating DNR's review of landfill permits that are issued by the Department of the Environment. This includes the review of Hazardous Materials

permits and county Comprehensive Waste Management Plans.

In 1991 active projects encompassed sixteen counties and the City of Baltimore. Three county solid waste management plans were reviewed as well as two hazardous substance permits, one landfill closure, two solid waste facility permits, two land clearing debris applications, sixteen rubble landfill permits and eight sanitary landfill applications which includes landfill expansions. At this point in time, interdepartmental coordination involves MET, CPA, MES, FPWS, WRA, MGS, and PPER within TWA. Correspondence and documents are also sent to MD Historical Trust.

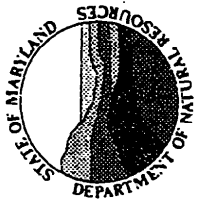
Mapping and Data Analysis Program

All of these activities are supported by the Mapping and Data Analysis program. The program uses geographic information systems (GIS) to provide the geological analyses necessary to evaluate the effects of growth on Maryland's watersheds. The program is responsible for data base development and maintenance and statistical analyses of the data gathered in the other programs.

Significant accomplishments for 1991 include the calculation of stream lengths for the state of Maryland based on 1:24,000 scale digitized USGS topo maps, support for the Sawmill Creek targeted watershed project and display maps created for various conferences. The Sawmill Creek watershed analyses estimated the population, calculated acreages of various land uses and calculated lengths of stream segments within the watershed.

HC
107
.M3
M263A
MDNR

Maryland. Dept of Natural Resources.
Annual activities report.



MARYLAND DEPARTMENT OF NATURAL RESOURCES
TAWES STATE OFFICE BUILDING
ANNAPOLIS, MARYLAND 21401



Restoring The Chesapeake