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Environmental Services

Project

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ENVIRONMENTAL SERVICES PROJECT

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PART I: HISTORY OF ENVIRONMENTAL AGENCIES AND LAWS

Major Themes

- Balance is the keynote word in the environmental area. Balance is defined as "a state of equilibrium or parity characterized by cancellation of all forces by equal opposing forces."
- The forces that must be balanced are:
 - Ecology
 - Economics
 - Equity
- Any equilibrium achieved is not static, but dynamic. Any compromise achieved results from the weighting of the importance of these forces.
- There have been changes in the weighting of importance of these factors over time.

Prior to the 1960s, government, both state and federal, promoted the development of the abundant natural resources. Prior to 1969, except in the area of public lands management, federal government's role was quite limited. Government's unique responsibility, however, has been recognized for centuries. John Stuart Mill speaking of natural resources in the early 1800s said: "These are the inheritance of the human race. . . No function of government is less optional than the regulation of those things, or more completely involved in the ideal of a civilized society."

In Minnesota, with statehood came aggressive development of resources. State policy encouraged mineral exploration and speculation to boost the economy. Forest logging was encouraged to provide wood for homes, paper, and to acquire more agricultural land. "The plow should follow the ax." Water was in "overabundance" and the policy of free use, no regulation or conservation, and promotion of drainage to provide agricultural land was followed.

The perceived abundance of resources led to wasteful practices. As population increased, and demands for food and land increased, regulation came in to protect game and fish. Significant scandals and corruption caused a moratorium in leasing state lands for mineral rights, and the state moved more aggressively to claim its title to resources. Around the turn of the century, public ownership was declared in Minnesota for mineral rights in all lands, of all wildlife.

In the early part of this century, increased population led to more waste and "dilution is the solution to pollution" no longer worked in all areas of the state. State moved to claim ownership and control of all surface and groundwater. Water pollution caused by sewage and industrial waste being discharged into waters, especially in the Mississippi in the Twin Cities had reached a level that the river was described as being "unfit for bathing and boating," and fish life was "practically exterminated."

After about a century of pro-development policies, a movement for change in the weighting of the forces began. "There is a change in attitude from the first settler's confident belief that nature will provide for man's wants, to a present sense of the threat to social existence generated by environmental problems. This is coupled with a growing conviction that past policies of uncontrolled development and management of water and related land resources have brought about the change from an ecology of abundance to an ecology of scarcity." (William Walton and David Hills, 1970, Water and Related Land Resources, State Administration, Legislative Process and Policies in Minnesota, 1970, page 320). A flood of environmental laws in the late 60s and 70s focused on control of discharges from pipes or facilities, known as "point source pollution." As progress was made in the control of direct discharges through permits and treatment requirements, the contribution to pollution from indirect sources (nonpoint source pollution) grew in importance and in size as the population increase also continued. Regulation increasingly included individual activities as well as facilities, creating conflicts. The individual's "right" to use land he owned as he chose possibly conflicted with the "need" to preserve wetland or protect a shoreland.

- Organizational structures tried in the environmental area reflected a quest for balance between the competing forces and for protection of the inalienable right of each citizen to share in and enjoy the resources of the state.

Andrew McFarland: "Our political institutions are based on the Madisonian assumption of the wisdom of separating and fragmenting state authority and then slowly piecing together such authority in particular through a long process of consultation and negotiation among numerous interests and institutions."

In response to each demand for governmental action in the environmental area, a program or agency is created. The pattern is similar at the state and federal levels. In general, the pattern is to develop along media or resource lines, e.g. air, water, timber, minerals. In Minnesota, a fear of putting too much control under one person, led to a pattern initially of elected officers addressing the issue. When oversight was inadequate for the need, boards of various types and composition were created. When inefficiency or politics infected a board, it was abolished or restructured. Another trend was to move from overseers with little or no technical training in the area to more involvement by technically trained persons.

- For decades, States and the Federal Government have attempted some sort of resource or multimedia integration.

The 1931 Conservation Act in Minnesota sought to restructure state natural resource and conservation agencies into one technical unit and to remove from politics the technical administration of resources. It was first suggested by the Governor's Commission on Efficiency and Economy in State Government in 1913. The first biennial report of the Conservation Board stated: "Whereas formerly the various sub-divisions of the State government which dealt with matters of conservation acted independently and cooperation between these sub-divisions was entirely voluntary on the part of those who directed the division affairs, and was not always to

be had, under the new law this cooperation is assured. Policies can now be formulated on a comprehensive scale which take in the work of all these former divisions, making it possible to bring into effect a scientific, comprehensive conservation program."

On the federal level, the creation of the Environmental Protection Agency was also the result of a recommendation from the President's Advisory Council to consolidate programs scattered among a half dozen agencies where "an integrated approach to environmental management would prevail, reducing pollution in a comprehensive manner throughout all media: land, air, and water. Traditional media-specific organization and approaches would wither away-an anachronism of a less sophisticated understanding of environment and its holistic nature." (EPA Journal, Vol. 16, No.5, page 12) "Proponents asserted that in the future, states, local governments, and industries would benefit by being able to go to a single agency to find out what pollution control measures they must take and by the consistent, coordinated environmental quality standards monitoring and enforcement that the new agency would provide. Furthermore, they predicted, EPA would be in an ideal position to recognize the emergence of new environmental hazards and problems and develop new programs to deal with them. (Beatrice Hort Homes, History of Federal Water Resources Programs and Policies, 1961-70, U.S. Dept. of Agriculture Miscellaneous Publication No 1379, page 231.)

- In Minnesota, the complexity of environmental management is further complicated by the natural land diversity of the state.

Brief Chronology of Selected Environmental Laws and Agencies

1858 - STATEHOOD

- First game laws passed establishing seasons on prairie chickens, grouse, quail, deer, and elk.
- Federal Acts giving land to State dedicated its use to developing and populating the new State.
- Governor recommends in first message to Legislature the creation of a central State land department to oversee and dispose of state land; recommends that State Treasurer be given responsibility for collecting the revenues from state lands. Legislature rejects idea of a separate department, instead opting for a practice of ex-officio officers.

1861 - Ex-officio board of school and public lands commissioners established. (Governor, Attorney General, Superintendent of Schools); responsible for general supervision of state land; emphasis on sale of lands for homes and development. Abolished 1862.

1862 - State auditor made commissioner of land office with individual boards of appraisers for each county. In 1931, authority for lands transferred to the new Department of Conservation. Auditor refuses to comply with transfer. State Supreme Court delays transfer until 1933.

1864 - Legislature authorizes Governor to appoint a State Geologist.

1872 - **Board of Health** established with a State Health Officer who operates out of his office in Red Wing. A serious concern is the connection between water supplies and the transmission of waterborne diseases.

- Geological and Natural History Survey created under the control of the Board of Regents of the University of Minnesota. Goal: to assess all aspects of the geology of the state with an emphasis on all economic materials. Geologic investigations halted in 1900 to study botany, zoology.

1874 - Fish Commission established (3 members) to receive and distribute fish stock, spawn, fry.

1876 - Minnesota Forestry Association established; "quasi-official state agency," received funds to plant trees in prairie and prevent fires.

1881 - Chief Game Warden appointed; paid by fines collected from violators.

1885 - Minnesota passes first law to prevent pollution of State's rivers and other sources of water supply.

- Minnesota State Dairy Commission created for purpose of prohibiting the sale of oleo margarine and adulterated milk.

1889 - Chief Fish Warden appointed.

- State park system initiated with 12 acre monument site near Montevideo.
- State Dairy and Food Commission authority expanded to regulate all food products.

1891 - Board of Game and Fish Commissioners created; Chief Game Warden named as Secretary, 5 members. Abolished in 1915.

1893 - Red River Valley Drainage Commission first official State unit dealing with water resources. Goal: to supervise drainage appropriations and develop farm land.

1894 - Fire in Hinckley results in State Auditor being named ex-officio forest commissioner with authority to hire fire warden.

1897 - State Drainage Board formed to care for, control and supervise all drainage ditches constructed in the state (3 non-salaried members appointed by Governor). Abolished 1901.

1899 - Citizen Forestry Board established to manage forest lands (9 citizens appointed by Governor).

Federal Rivers and Harbors Act enacted. (Refuse Act).

1901 - State Drainage Commission formed composed of Governor, Secretary of State and State Auditor; advises other governmental units with drainage responsibilities, constructs ditch systems on swamp land to permit agricultural use. Abolished 1919.

1907 - Minnesota Dairy and Food Department adopts food standards and labeling rules. Begins first educational program with theme "National Decay Begins in the Individual's Stomach."

1911 - New Forestry Board established with permanent secretary and trained forester.

- New Geological Survey established in connection with the Geology Department of the University of Minnesota. Chair of Department is made Director of Survey.

1915 - Office of Game and Fish Commissioner created.

1919 - Commissioner of Drainage created with same powers as State Drainage Commission; abolished in 1931 to become Division of Drainage and Waters in the Department of Conservation.

- **Department of Agriculture** established to promote agriculture. Merges with the Dairy and Food Department in 1923 to become Department of Agriculture, Dairy and Food. Two commissioners serve until 1929. Name changed to Department of Agriculture in 1961.

1925 - Forestry board abolished; Forester becomes commissioner of forestry and fire prevention. Conservation Commission formed consisting of Commissioner of Forestry, Game and Fish Commissioner, and State Auditor to administer State Parks.

1927 - State Board of Health given duty to enforce all laws relating to pollution of any waters in Minnesota. Most laws deal with sewage and industrial waste disposal.

1931 - **Department of Conservation** formed. Governor appoints a 5-member Commission, Commission appoints Commissioner of Conservation. (Commission abolished in 1937.) Contains Game and Fish Department, Division of Forestry (including Parks), Division of Lands and

Minerals, Division of Drainage and Waters, all transferred authorities. Goal: the promotion of coordination between resource units and the generation of administration policies formulated on a comprehensive scale, taking into account all natural resources.

1937 - Soil and Water Conservation Districts and Board established.

1941 - Department of Iron Range Resources and Rehabilitation created with a commissioner appointed by the Governor. In 1943 a 7 member commission created, 3 from Senate, 3 from House plus Commissioner of Conservation to advise commissioner. Goal: development of low-grade iron ore, peat, other natural resources, tourism, farming, wood products and a program of rehabilitating the unemployed in northeast Minnesota.

1945 - State Water Pollution Control Act passed creating Water Pollution Control Commission composed of officers of departments of health, conservation, agriculture, dairy and food, state livestock sanitation board and one public member appointed by Governor. Commission relies primarily on educating and persuading existing dischargers to stop or treat but **requires** permits for new and expanded discharges of sewage and waste. Much opposition. Constitutionality of Act later contested and repeal sought. Public opinion comes to support of Commission.

1947 - Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) enacted.

1948 - Federal Water Pollution Control Act (FWPCA) enacted.

1951 - Water Pollution Control Commission restructured to include 4 agencies and 3 members appointed by the Governor representing municipal government, industry and the public. Department of Health provides services to the Commission.

1955 - Minnesota Watershed Act creates Water Resources Board. Goal: establishment of watershed districts and resolution of certain prescribed water conflicts.

1961 - Water Pollution Control Advisory Committee formed to serve as liaison between commission and communities and industries. Sanitary regions formed from congressional districts and authority provided for the creation of sanitary districts comprised of contiguous areas involving more than a governmental jurisdiction. Two representatives from each sanitary region serve on committee.

1963 - Water Pollution Control Commission authority extended to groundwater. Commission charged to adopt water use classification and establish standards for water quality and purity for all waters of the state. Abolished in 1967.

- Minnesota Natural Resources and Recreation Act passed. (Amended in 1967.) Creates Legislative Commission on Minnesota Resources. Goal: to review the long-range program of development of State's natural and recreational resources.

1965 - Federal Solid Waste Disposal Act enacted.

1967 - **Pollution Control Agency** created "to meet the variety and complexity of problems

relating to water, air and land pollution." Nine-member citizen board appointed by governor and given authority formerly held by Water Pollution Control Commission and additional authority for air-quality control and solid waste management. Director appointed by governor with consent of Senate and functions as Executive Secretary of the Board and chief executive officer of agency.

1969 - Minnesota Shoreland Management Act passed. Goal: to set development standards for lakeshore property throughout Minnesota.

- National Environmental Policy Act passed.

1970 - U.S. Environmental Protection Agency created.

- Federal Clean Air Act enacted.

1971 - Minnesota Environmental Rights Act passed. " ...each person is entitled by right to the protection, preservation, and enhancement of air, water, land, and other natural resources located within the state ...It is in the public interest to provide an adequate civil remedy to protect air, water, land and other natural resources within the state from pollution, impairment, or destruction."

- Department of Conservation renamed the Department of Natural Resources.

1972 - Federal Clean Water Act enacted. (Federal Water Pollution Control Act Amendments.)

1973 - Minnesota Environmental Policy Act passed.

- Minnesota Environmental Quality Board (EQB) consisting of state agency heads and members of the general public appointed by the Governor created to facilitate interactions between state agencies for solutions to environmental problems.

★ - Minnesota Power Plant Siting Act passed.

★ - Minnesota Critical Areas Act passed.

1974 - Federal Safe Drinking Water Act (SDWA) enacted.

1976 - Federal Toxic Substances Control Act (TSCA) enacted.

- Federal Resource Conservation and Recovery Act (RCRA) enacted.

- Minnesota Environmental Coordination Procedures Act passed to "establish a mechanism in state government which will coordinate administrative decision-making procedures, and related quasi-judicial and judicial review, pertaining to these permits."

1980 - Waste Management Act passed. Creates **Waste Management Board** "to improve waste management . . . by reduction, separation and recovery, coordination, orderly development and financial security." Responsible to find a site for hazardous waste disposal. Board abolished in 1988; duties transferred to Pollution Control Agency. Office of Waste Management created in 1989; duties transferred from the Pollution Control Agency.

- Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) enacted.

1982 - State Acid Deposition Control Act enacted.

1983 - Minnesota Environmental Response and Liability Act (MERLA) enacted. Creates "superfund" to assist with clean-up of hazardous wastes.

- Interstate Low-Level Radioactive Waste Compact established.

1984 - Minnesota enacts law regulating the disposal and transportation of high level radioactive waste.

1985 - Authority to regulate underground storage tanks (UST) enacted. Hazardous Substance Injury Compensation Board (5 members appointed by Governor, a physician, an injury specialist, an attorney and 2 public members) created to compensate "victims" suffering injuries or property damage from releases of hazardous waste.

- Comprehensive Local Water Management Act passed. Goal: to encourage counties to develop and implement a comprehensive water plan and coordinate with contiguous counties and other local units of government.

1987 - **Board of Water and Soil Resources** created by merger of Soil and Water Conservation Board, Water Resources Board, and Southern Minnesota Rivers Basin Council. Goal: to develop a unified, coordinated state approach to local government for water and soil programs.

1988 - Petroleum Tank Release Cleanup Act enacted. Creates 5-member Petroleum Tank Release Compensation Board (commissioners of MPCA and Commerce, Governor-appointed representatives from petroleum and insurance industries) to administer "Petrofund."

- Mandatory Motor Vehicle Inspection Program authorized.
- Amendment to Minnesota Constitution adopted establishing a permanent Minnesota environment and natural resources trust fund in the state treasury.

1989 - Minnesota Groundwater Protection Act enacted. "It is the goal of the state that ground water be maintained in its natural condition, free from any degradation caused by human activities...where it is not currently practicable, the development of methods and technology that will make prevention practicable is encouraged." Establishes framework of programs in several State agencies to protect ground water, building on an existing mix of laws and programs.

- Minnesota Infectious Waste Control Act passed.

1990 - Minnesota Toxic Pollution Prevention Act passed. "It is the policy of the state to encourage toxic pollution prevention. The preferred means of preventing toxic pollution are techniques and processes that are implemented at the source and that minimize the transfer of toxic pollutants from one environmental medium to another."

CHAPTER 116D

ENVIRONMENTAL POLICY

116D.01 Purpose.	116D.045 Environmental impact statements; costs.
116D.02 Declaration of state environmental policy.	116D.06 Effect of existing obligations.
116D.03 Action by state agencies.	116D.07 Governor, report required.
116D.04 Environmental impact statements.	

116D.01 PURPOSE.

The purposes of Laws 1973, chapter 412 are: (a) to declare a state policy that will encourage productive and enjoyable harmony between human beings and their environment; (b) to promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of human beings; and (c) to enrich the understanding of the ecological systems and natural resources important to the state and to the nation.

History: 1973 c 412 s 1; 1986 c 444

116D.02 DECLARATION OF STATE ENVIRONMENTAL POLICY.

Subdivision 1. The legislature, recognizing the profound impact of human activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high density urbanization, industrial expansion, resources exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of human beings, declares that it is the continuing policy of the state government, in cooperation with federal and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which human beings and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of the state's people.

Subd. 2. In order to carry out the policy set forth in Laws 1973, chapter 412, it is the continuing responsibility of the state government to use all practicable means, consistent with other essential considerations of state policy, to improve and coordinate state plans, functions, programs and resources to the end that the state may:

- (a) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- (b) Assure for all people of the state safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- (c) Discourage ecologically unsound aspects of population, economic and technological growth, and develop and implement a policy such that growth occurs only in an environmentally acceptable manner;
- (d) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever practicable, an environment that supports diversity, and variety of individual choice;
- (e) Encourage, through education, a better understanding of natural resources management principles that will develop attitudes and styles of living that minimize environmental degradation;
- (f) Develop and implement land use and environmental policies, plans, and standards for the state as a whole and for major regions thereof through a coordinated program of planning and land use control;
- (g) Define, designate, and protect environmentally sensitive areas;
- (h) Establish and maintain statewide environmental information systems sufficient to gauge environmental conditions;

Sustainability

- (i) Practice thrift in the use of energy and maximize the use of energy efficient systems for the utilization of energy, and minimize the environmental impact from energy production and use;
 - (j) Preserve important existing natural habitats of rare and endangered species of plants, wildlife, and fish, and provide for the wise use of our remaining areas of natural habitation, including necessary protective measures where appropriate;
 - (k) Reduce wasteful practices which generate solid wastes;
 - (l) Minimize wasteful and unnecessary depletion of nonrenewable resources;
 - (m) Conserve natural resources and minimize environmental impact by encouraging extension of product lifetime, by reducing the number of unnecessary and wasteful materials practices, and by recycling materials to conserve both materials and energy;
 - (n) Improve management of renewable resources in a manner compatible with environmental protection;
 - (o) Provide for reclamation of mined lands and assure that any mining is accomplished in a manner compatible with environmental protection;
 - (p) Reduce the deleterious impact on air and water quality from all sources, including the deleterious environmental impact due to operation of vehicles with internal combustion engines in urbanized areas;
 - (q) Minimize noise, particularly in urban areas;
 - (r) Prohibit, where appropriate, flood plain development in urban and rural areas;
- and
- (s) Encourage advanced waste treatment in abating water pollution.

History: 1973 c 412 s 2; 1986 c 444

116D.03 ACTION BY STATE AGENCIES.

Subdivision 1. The legislature authorizes and directs that, to the fullest extent practicable the policies, rules and public laws of the state shall be interpreted and administered in accordance with the policies set forth in sections 116D.01 to 116D.06.

Subd. 2. All departments and agencies of the state government shall:

- (a) On a continuous basis, seek to strengthen relationships between state, regional, local and federal-state environmental planning, development and management programs;
- (b) Utilize a systematic, interdisciplinary approach that will insure the integrated use of the natural and social sciences and the environmental arts in planning and in decision making which may have an impact on the environment; as an aid in accomplishing this purpose there shall be established advisory councils or other forums for consultation with persons in appropriate fields of specialization so as to ensure that the latest and most authoritative findings will be considered in administrative and regulatory decision making as quickly and as amply as possible;
- (c) Identify and develop methods and procedures that will ensure that environmental amenities and values, whether quantified or not, will be given at least equal consideration in decision making along with economic and technical considerations;
- (d) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;
- (e) Recognize the worldwide and long range character of environmental problems and, where consistent with the policy of the state, lend appropriate support to initiatives, resolutions, and programs designed to maximize interstate, national and international cooperation in anticipating and preventing a decline in the quality of the world environment;
- (f) Make available to the federal government, counties, municipalities, institutions and individuals, information useful in restoring, maintaining, and enhancing the quality of the environment, and in meeting the policies of the state as set forth in Laws 1973, chapter 412;

(g) Initiate the gathering and utilization of ecological information in the planning and development of resource oriented projects; and

(h) Undertake, contract for or fund such research as is needed in order to determine and clarify effects by known or suspected pollutants which may be detrimental to human health or to the environment, as well as to evaluate the feasibility, safety and environmental effects of various methods of dealing with pollutants.

History: 1973 c 412 s 3; 1985 c 248 s 70; 1986 c 444

116D.04 ENVIRONMENTAL IMPACT STATEMENTS.

Subdivision 1. [Repealed, 1980 c 447 s 10]

Subd. 1a. For the purposes of sections 116D.01 to 116D.07, the following terms have the meanings given to them in this subdivision.

(a) "Natural resources" has the meaning given it in section 116B.02, subdivision 4.

(b) "Pollution, impairment or destruction" has the meaning given it in section 116B.02, subdivision 5.

(c) "Environmental assessment worksheet" means a brief document which is designed to set out the basic facts necessary to determine whether an environmental impact statement is required for a proposed action.

(d) "Governmental action" means activities, including projects wholly or partially conducted, permitted, assisted, financed, regulated, or approved by units of government including the federal government.

(e) "Governmental unit" means any state agency and any general or special purpose unit of government in the state including, but not limited to, watershed districts organized under chapter 103D, counties, towns, cities, port authorities, housing authorities, and economic development authorities established under sections 469.090 to 469.108, but not including courts, school districts, and regional development commissions other than the metropolitan council.

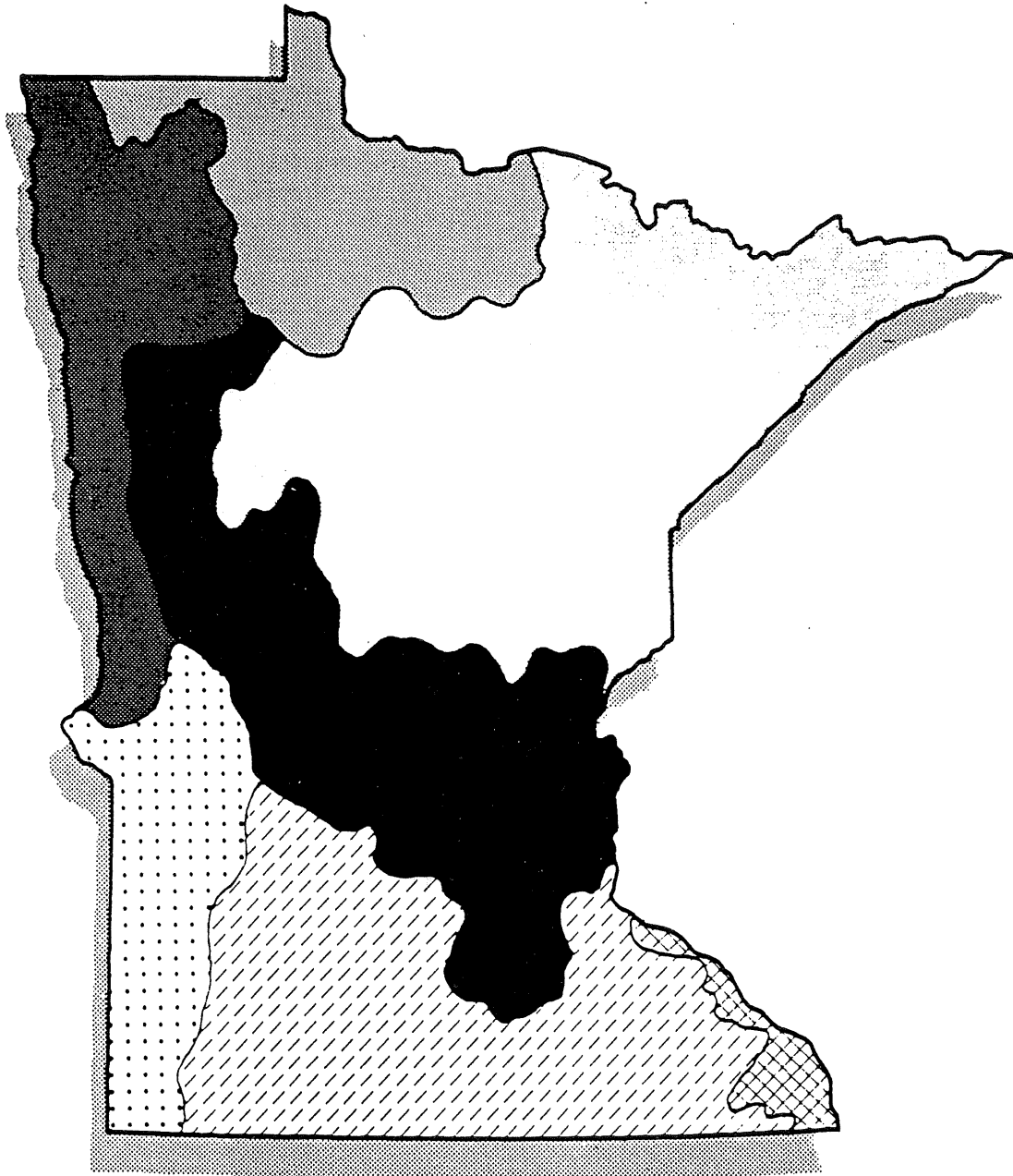
Subd. 2. [Repealed, 1980 c 447 s 10]

Subd. 2a. Where there is potential for significant environmental effects resulting from any major governmental action, the action shall be preceded by a detailed environmental impact statement prepared by the responsible governmental unit. The environmental impact statement shall be an analytical rather than an encyclopedic document which describes the proposed action in detail, analyzes its significant environmental impacts, discusses appropriate alternatives to the proposed action and their impacts, and explores methods by which adverse environmental impacts of an action could be mitigated. The environmental impact statement shall also analyze those economic, employment and sociological effects that cannot be avoided should the action be implemented. To ensure its use in the decision making process, the environmental impact statement shall be prepared as early as practical in the formulation of an action.








(a) The board shall by rule establish categories of actions for which environmental impact statements and for which environmental assessment worksheets shall be prepared as well as categories of actions for which no environmental review is required under this section.

(b) The responsible governmental unit shall promptly publish notice of the completion of an environmental assessment worksheet in a manner to be determined by the board and shall provide copies of the environmental assessment worksheet to the board and its member agencies. Comments on the need for an environmental impact statement may be submitted to the responsible governmental unit during a 30 day period following publication of the notice that an environmental assessment worksheet has been completed. The responsible governmental unit's decision on the need for an environmental impact statement shall be based on the environmental assessment worksheet and the comments received during the comment period, and shall be made within 15 days after the close of the comment period. The board's chair may extend the 15

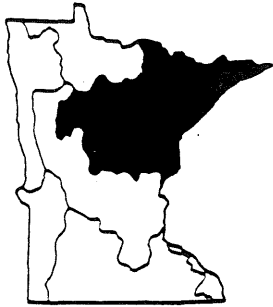
Minnesota Ecoregions



Key

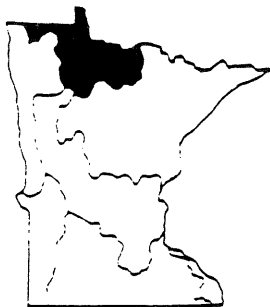
- | | |
|---|---|
|  Northern Lakes and Forests |  Northern Glaciated Plains |
|  Northern Minnesota Wetlands |  Western Cornbelt Plains |
|  Red River Valley |  Driftless Area |
|  North Central Hardwood Forest | |

Source: Minnesota Pollution Control Agency



The Northern Lakes and Forest ecoregion, located in northeastern Minnesota, encompasses approximately one-third of the State. This heavily forested area contains a large proportion of the State's high quality lakes and represents a prime recreational resource. Streams and wetlands are also very high quality and offer good recreational opportunities. Most inhabitants of this lightly populated area reside in Duluth and the Iron Range communities where mining is, and has been, an important activity.

Agricultural activity, as suggested by the low percentage of cultivated and pastured land uses, is not extensive in this ecoregion. As a result, nonpoint source pollution in the Northern Lakes and Forest area is of relatively minor concern. However, there are other factors, such as slope and lake nutrient levels, that suggest sensitivity to nonpoint source pollution. Pollution problems that do occur are expected to be localized in areas where lakeshore development, urban areas, mining, or intensive forestry practices occur.



The Northern Minnesota Wetlands ecoregion, which represents approximately ten percent of the State, is dominated by extensive forests and covered by large areas of water and wetlands. The few lakes and streams that occur here represent high quality water bodies.

The population density is very low and the activities of many of the inhabitants are oriented towards forestry and the wood products industry.

Agricultural activity is limited to small areas with well drained soils.

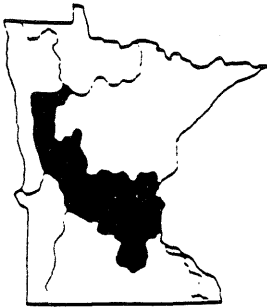
Nonpoint source pollution of the Northern Minnesota Wetlands ecoregion is not extensive. Similar to the Northern Lakes and Forest ecoregion, pollution problems that do exist are localized in pockets where small community development, extensive forestry practices, and limited agricultural activities occur.



The Red River Valley ecoregion, in the northwestern corner of the State, is well known for its agricultural productivity. Over 80 percent of this region is cultivated, predominantly with small grains. Soils are generally thick and dominated by a clay texture. Land on this ecoregion is very flat with only a few areas having slopes that exceed two percent.

Because few water bodies exist in the Red River Valley area, streams represent an important natural resource. Many of the streams in the Red River Valley have been

increasing in nitrate and suspended solids concentrations. Average nitrate concentrations, although they have been increasing, still represent relatively low levels. In contrast, suspended solids concentrations are quite high and levels have increased dramatically over the past twelve years. This assessment and the intensive land use suggest nonpoint source pollution problems with respect to suspended solids and possible nitrates are occurring and may be considered important water quality concerns for the Red River Valley ecoregion.



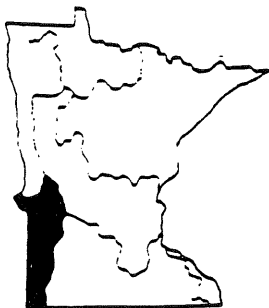
The North Central Hardwood Forest ecoregion runs diagonally across the State and represents a transition between the northern forests and the southern agricultural areas. While about 50 percent of the ecoregion is cultivated, there are a variety of other land uses.

Along with the variety of land uses is a high population density. Many of the Central Hardwood Forest ecoregion inhabitants reside in the southeastern part of the ecoregion. There are several moderately sized communities, along with the Twin Cities, located in this area.

Stream water quality of the Central Hardwood Forest area can be considered moderate, but may be deteriorating as suggested by a slight increase in suspended solids concentrations over the past 12 years.

This suggests that the Central Hardwood Forest ecoregion is sensitive to and being impacted by nonpoint source pollution, particularly from sediments and nutrients. The nonpoint source pollution problems do not appear widespread throughout the entire area, but are limited to areas with intensive land use such as urban development or agricultural activities. In addition, there is an abundant surficial drift ground water resource that is subject to nonpoint source pollution from nutrients and pesticides.

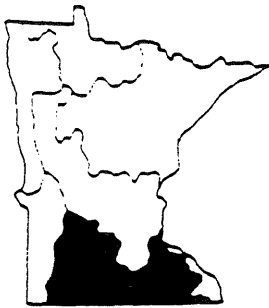
The Central Hardwood Forest ecoregion could benefit from both nonpoint source pollution control and protection activities. There are waterbodies in this ecoregion that have been impacted by nonpoint source pollution where control activities could be beneficial. There is also an abundance of non-impacted waterbodies that should be protected from future degradation by land-use activities.



The Northern Glaciated Plains ecoregion is located in southwestern Minnesota. This is an intensely cultivated area with a low population density and many factors that suggest nonpoint source pollution is a concern.

There is very little forested area in this ecoregion, with 80 percent of the land area cultivated to row crops of corn and soybeans. Soil texture is predominantly silt, an easily eroded type of soil, and slopes are slight to moderate.

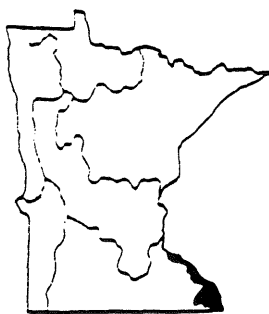
Streams of the Northern Glaciated Plains ecoregion have been showing increasing concentrations of nitrates and suspended solids. This resource is also sensitive to pesticides and nutrient pollution, suggesting nonpoint source pollution is a concern in the Northern Glaciated Plains ecoregion. The water resources of the area are impacted by both nutrients and sediments. The water resources, because of their importance for recreation and agricultural production, should be protected from the deteriorating effects of nonpoint source pollution.



The Western Cornbelt Plains, which occupies about 20 percent of the southern portion of the State, is similar to the Northern Glaciated Plains in many ways. This region of slight to moderate slopes is prime agricultural land used primarily for the production of corn and soybeans. The thick silty soils are naturally productive, but often enriched with fertilizers and treated with pesticides to increase crop yields.

The population density of the this ecoregion is, however, greater than the population density of the Northern Glaciated Plains ecoregion. Farms tend to be slightly smaller and there are numerous small to moderately sized communities scattered throughout the region.

Both streams and lakes in the region are considered nutrient rich, reflecting the naturally productive soils as well as the fertilizers used to increase crop production. Concentrations of nitrates and suspended solids have been increasing in area streams, suggesting nonpoint source pollution is affecting many waterbodies in this ecoregion.



The Driftless Area, although the smallest of Minnesota's ecoregions, is quite interesting. This ecoregion represents only two percent of the State and it is located in an area of southeastern Minnesota not subjected to recent glacial activity. Soils of the Driftless Area ecoregion are thin and streams in the well developed drainage system have cut deep valleys resulting in numerous steep slopes. Open pasture or forested areas occur on the steep slopes, while much of the flatter land in the region is use for agricultural production of corn and other row crops.

Streams, in general, have high suspended solids levels and moderate, but increasing, nitrate levels. Although the Driftless Area is small, the stream resource is important because many streams are ground water fed and can support cold water fisheries.

PART II: CURRENT STATE ORGANIZATIONAL CONTEXT

MAJOR ENVIRONMENTAL DEPARTMENTS AND AGENCIES

Definition of State Departments

Minnesota statutes confer department status on twenty entities in state government. Three departments have major environmental responsibilities:

Agriculture
Health
Natural Resources

State Departments are headed by Commissioners and do not have governing boards. The commissioners are gubernatorial appointees.

Definition of State Agencies

Agencies in state government are designated in state law as "boards," if they have at least one of the following powers:

1. Perform administrative acts, including spending state money.
2. Issue and revoke licenses or certifications.
3. Make rules.
4. Adjudicate contested cases or appeals.

There are four major agencies that are exclusively devoted to environmental activities:

Board of Water and Soil Resources
Environmental Quality Board
Office of Waste Management
Pollution Control Agency

The governor appoints the Commissioner of the Pollution Control Agency (PCA) and the Director of the Office of Waste Management (OWM). PCA has a board, and OWM does not have a board.

Department of Natural Resources

Established: 1931

Commissioner: Rod Sando

Mission: To preserve, protect and enhance Minnesota's natural resource heritage in order to benefit the environment, economy, and quality of life of all Minnesotans, present and future. ("Directions for Natural Resources: Challenges for the Decade," DNR, January, 1991). In 1967, the Legislature adopted a purpose statement for the department, stating its intent that DNR "coordinate the management of the public domain...and to best serve the public in the development of a long range program to conserve the natural resources of the state."

Organization: In terms of budget and workforce, DNR is the largest state environmental agency, and it is highly decentralized. For FY 1993, DNR is expected to spend about \$176.5 million, and its workforce consists of about 1,500 full-time employees and up to 2,500 part-time employees. About two-thirds of the full-time employees and nearly all of the seasonal workers are based in the field close to the resources they manage.

The DNR is headquartered in St. Paul and has six regional offices in Bemidji, Grand Rapids, Brainerd, New Ulm, Rochester and St. Paul. Across the state, DNR staffs more than 350 offices in cities, small towns, woods and agricultural areas. The department is organized into seven divisions, according to the natural resources it manages:

- Forestry
- Fish and Wildlife
- Parks and Recreation
- Minerals
- Trails and Waterways
- Enforcement
- Waters

Authority: The commissioner of DNR has authority over all of the public lands, parks, timber, waters, minerals, and wildlife of the state and their use, sale, leasing, or other disposition. He also is responsible for encouraging programs and promoting the safe use of watercraft and firearms. He has jurisdiction over the harvest of wild rice from public waters. In addition, he has jurisdiction over 65 state parks, 16 waysides, about 900 state-owned wildlife management areas, lands within state forest boundaries, and 1,460 miles of recreational trails. He also is responsible for providing fire protection within the state's forested areas.

Pollution Control Agency

Established: 1967

Commissioner: Chuck Williams

Board: Unlike most state agencies, PCA consists of both a policy board and a staff agency. The governor appoints members of the nine-member board to staggered terms, and also appoints PCA's commissioner. The PCA Board has most of the agency's formal power. Almost all agency actions must be approved by the board or explicitly delegated to staff.

Board members hold four-year terms. State law requires that one of the members must be knowledgeable in the field of agriculture.

The board is a public access point. At board meetings, citizens and representatives of industries and environmental organizations have the opportunity to present information and argue their positions on upcoming board decisions.

Mission: The mission of the MPCA is to serve the public in the protection and improvement of Minnesota's air, water and land. (MPCA 1990 Biennial Report to the Legislature). The 1967 statutes establishing the agency said, "To meet the variety and complexity of problems relating to water, air and land pollution in the areas of the state affected thereby, and to achieve a reasonable degree of purity of water, air and land resources of the state consistent with the maximum enjoyment and use thereof in the furtherance of the welfare of the people of the state, it is in the public interest that there be established a pollution control agency."

Organization: PCA is a regulatory agency that issues and enforces permits within its four Divisions of Air Quality, Ground Water and Solid Waste, Hazardous Waste and Water Quality. PCA has an Administrative Services Division, which provides support functions as well as engages in environmental assessments and conveys public information.

MPCA has five regional offices in Detroit Lakes, Marshall, Brainerd, Rochester and Duluth. Each office has about seven to 10 people. PCA has more than 700 employees, and is estimated to spend about \$61 million in fiscal 1993.

Authority: PCA is engaged in environmental monitoring, enforcement, emergency response and technical assistance and planning. It enforces state and federal pollution control laws and standards in Minnesota. The key enforcement tool is the environmental permit, required of all major facilities that discharge to the air, land or water.

Each of PCA's divisions administers certain programs for the U.S. Environmental Protection Agency (EPA). EPA has delegated to Minnesota major regulatory responsibilities for superfund cleanups and air, water and hazardous waste regulation.

Department of Health

Established:

Commissioner: Marlene Marschall

1872 as the State Board of Health

1977 became Department of Health, Board was abolished

Mission: The department is responsible for developing and maintaining an integrated system of programs and services for protecting, maintaining and improving the health of the citizens of Minnesota. The mission of MDH is accomplished through a combination of regulatory activity, technical consultation and support for health-related programs and activities, funding support for other agencies and organizations engaged in doing the work of public health, the issuance of formal advisories on health problems and issues, education and information programs aimed at reducing health risks and the direct provision of some health-related services to the public. (Rural Investment Guide, publication of the State of Minnesota, 1991)

Organization: The department is divided into nine divisions, including the Environmental Health Division. Health has its central office in Minneapolis and has seven district offices.

Authority: The mission of the Division of Environmental Health is to reduce and prevent the occurrence of environmentally induced and occupationally induced disease and injury. The Division acts as an advocate and protector of public health. It is the principal state agency charged with the responsibility of protecting the public health from exposures to environmental hazards.

It has regulatory and nonregulatory activities. It has the following responsibilities:

1. Controlling and monitoring contaminants in water.
2. Assessing health risks associated with exposures to environmental contaminants.
3. Reducing incidence of occupational disease, illness and injury.
4. Controlling and monitoring exposure to radiation.
5. Minimizing foodborne and waterborne disease from public facilities.
6. Promoting and developing expansion of local environmental health services.
7. Minimizing exposure to indoor air contaminants.
8. Reducing the incidence of elevated blood lead levels.

Elisabeth Study / Task Force

Department of Agriculture

Established: 1919

Commissioner: Elton Redalen

Mission: To encourage, promote and facilitate the growth and development of a stable and viable agricultural industry in Minnesota. Agriculture includes a range of activities that include the supply industry through on-farm or production agriculture to marketing, processing, distribution and consumption activities. (Department of Agriculture publication)

The department works to promote Minnesota food product, protect consumers, provide information and assistance to the state's farmers, and protect our natural environment. (Minnesota Guidebook to State Agencies, 1992)

Organization: The department is organized into three large areas:

Agricultural Promotion Service
Agricultural Protection Service
Administration and Financial Aids Service

The department is both a service and regulatory state agency. In the environmental arena, the Department of Agriculture is a regulator in the Agricultural Protection Service. The Agronomy Services Division regulates the sale, storage, use and disposal of pesticides. The Dairy and Livestock Division administers and enforces dairy laws and regulations designed to protect public health and be of service to the dairy industries. The Laboratory Services Division provides microbiological and chemical analysis of samples submitted through the department's inspection activities.

Authority: The Department of Agriculture's environmental responsibility was expanded through the Comprehensive Groundwater Protection Act of 1989. This new law stresses prevention of groundwater contamination. The Agriculture Department is involved in the following manner: fertilizer regulation, water monitoring for pesticides and fertilizer, pesticide plan/regulation and registration, ag chemical incident response/cleanup, water pesticide collection, and sustainable agriculture and integrated pest management.

Environmental Quality Board

Established: 1973

Board Chairman: Robert Dunn

Executive Director: Michael Sullivan

Mission: The Minnesota Environmental Quality Board shall be responsible for the identification of environmental and natural resource problems and issues of statewide significance; coordinating the response of state agencies to those problems identified; and carrying out the programs suited to its unique orientation. The Board shall take those actions necessary to establish it as the "focal point" for the provision of environmental policy recommendations and advice to the Governor and the Legislature. This policy advisory role will emphasize those environmental issues, problems and policies which are interagency in nature. (Adopted by the EQB at a February, 1988 Board Meeting)

Organization: The EQB is a principal forum for discussing environmental issues and provides an opportunity for the public to have direct input into the development of the state's environmental policy. The EQB is an independent decision making body and is staffed by the Office of Strategic and Long Range Planning.

There are 15 members on the Environmental Quality Board, including five public members appointed by the governor. The governor appoints the chair. State law specifies the other members of EQB: commissioners of the Departments of Agriculture, Health, Natural Resources, Transportation and Public Service, the commissioner of the Pollution Control Agency, the director of the Office of Strategic and Long Range Planning, the chair of the Board of Water and Soil Resources, and the director of the Office of Waste Management.

Ongoing activities of the Board established in statute and supported by staff include: Administration and implementation of Environmental Review, Power Plant Siting and Transmission Line Routing, Pipeline Routing, Critical Areas, Genetic Engineering regulation, Water Planning and Nuclear Waste Disposal programs.

Authorization: The Board has a number of powers and duties identified in state law, including initiating interdepartmental investigations, reviewing environmental rules and criteria for granting permits by state agencies, resolving conflicts involving state agencies' programs, rules, permits and procedures, conducting public hearings, and reporting to the Legislature and Governor on proposed legislation and administrative actions.

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Board of Water and Soil Resources

Established: 1987

Board Chairman: Jim Nielsen

Executive Director: Ron Harnack

Board: The board has 12 voting and five nonvoting members. The voting members include three county commissioners, three soil and water conservation district supervisors, three watershed district representatives, and three unaffiliated public members. Voting members are appointed by the Governor to staggered four-year terms. The Governor designates the Chair from among the voting members. The five nonvoting members represent the Department of Natural Resources, Pollution Control Agency, Department of Health, Department of Agriculture and University of Minnesota.

Mission: Provide leadership enabling local governments to properly manage water and soil resources and to help all citizens be stewards of our irreplaceable natural resources. (1990 BWSR Annual Report)

Organization: In 1990, BWSR had 32 full-time staff people. Its central office is in St. Paul, and it has regional offices in Duluth, Bemidji, Marshall, Brainerd, New Ulm and Rochester. Its expenditures for fiscal 1993 are expected to be about \$9 million.

BWSR was created through the merger of the Water Resources Board, the Southern Minnesota River Basins Council and the Soil and Water Conservation Board. It assists three types of local governments: 91 local soil and water conservation districts, 77 watershed districts/watershed management organizations and 87 counties.

Soil and Water Conservation Districts (SWCDs) are local units of government whose purpose is to manage and direct conservation programs. Generally, they follow county lines, although some counties are split. They were organized in the 1930s during the dust bowl, and originally helped farmers fight soil erosion. Their powers have expanded. Each SWCD is governed by a five-member elected board of supervisors.

Watershed districts are special purpose local units of government whose boundaries follow those of a natural watershed (an area of land in which all water drains to one outlet). Watershed management organizations (WMOs) are watershed units in the Twin Cities area that are doing water planning under the Metropolitan Water Management Act. Watershed districts have the legal and financial authority to act on proposals aimed at solving and preventing water-related problems. They are governed by a board of managers appointed by county boards.

Traditionally, counties have had authority in natural resource management, but it was expanded in the 1980s in the water management area.

Authorization: BWSR has major statutory authority, which allows it to establish rules and policies, award state grants to local units of government, and serve as a mediator or adjudicator in resolving resource management conflicts between people, local governments and agencies. It has a key service function to local government units.

Office of Waste Management

Established: 1989

Director: Dottie Rietow

Mission: To help government, business and the public manage waste in environmentally sound ways, including reducing waste and preventing toxic pollution. (Office of Waste Management publication)

Organization: The OWM does not have a board, and its staff is based in St. Paul. Its history goes back to the Waste Management Act of 1980, which established the Waste Management Board. The Waste Management Board was abolished in 1988.

The OWM emphasizes cooperation among local governments, industry and citizens to develop programs and facilities that are both environmentally sound and economically viable.

It is divided into four major areas:

- Local Government Assistance
- Hazardous and Problem Wastes
- Grants and Market Development
- Public Information and Education

It is expected to spend about \$20 million in fiscal year 1993, and a significant portion of that budget is allocated for county block grants

Authorization: OWM does not regulate or enforce environmental laws, but instead provides assistance both technical and financial, in recycling, reducing waste at the source, building facilities to process solid waste, preventing pollution, reducing and managing hazardous and industrial waste, and county solid waste planning. The office also publishes a wide variety of educational materials for the public.

Did Bd. Pass Resolution That would no need to site ~~State~~ HAZ. Waste disposal facility.

State Ground Water and Related Resources Management Organization

State Planning Agency
 Staff for Environmental Quality Board and WRC
 Land Management Information System
 Systems for Water Information Management (SWIM)
 Data Compatibility Standards
 Ground Water Data Clearinghouse
 Environmental Education

Pollution Control Agency
 Ambient Ground Water Monitoring
 Water Quality Standards
 Pollution Discharge Permits
 Clean Water Partnership Grants
 Agricultural Waste Systems
 Nitrogen Pollution Study (with MDA)
 Solid and Hazardous Waste Management
 Tanks and Spills Program

Department of Health
 Water Well Program
 Wellhead Protection
 Public Water Supply Program
 Health Risk Limits
 Community Health Services Grants

Office of Waste Management
 County Solid Waste Planning Grants
 X Hazardous Waste Facility Siting X
 Waste Education

Coordination

Environmental Quality Board
 Water Resources Committee (WRC)
 Interagency Water Policy Development
 State Water Plan and Priorities
 Water Monitoring Plan
 Water Information & Education Plan
 Water Research Needs
 Quality & Quantity Trends Reports
 Environmental Congress

Board of Water and Soil Resources
 Local Water Resource Protection Grants
 Local Plan Review/Approval
 Erosion Control and Water Quality Grants
 RIM Reserve Program
 Well Sealing Grants
 Environmental Agriculturalist Contracts
 Metro Local Water Management Study

Local Coordination
 Local policy directions set through Comprehensive Water Plans
 Under the...
 Comprehensive Local Water Management Act;
 The Metropolitan Water Management Act; or,
 The Watershed Act

Department of Natural Resources
 Water Appropriation Permits
 Consumptive Water Use Study
 Ground Water Sensitive Areas Criteria and Mapping
 County Geologic Atlases (with MGS)
 Regional Hydrogeologic Assessments (with MGS)
 Regional Aquifer Studies
 Observation Well Network
 DNR/USGS Geological Survey Cooperative Programs

Department of Agriculture
 Fertilizer Regulation
 Nitrogen Fertilizer Study
 Water Monitoring for Pesticides and Fertilizer
 Pesticide Plan/Regulation
 Pesticide Use Survey
 Pesticide Registration/Applicator Certification
 Ag Chemical Incident Response/Cleanup
 Waste Pesticide Collection
 Pilot Pesticide Container Collection
 Crop Consultant Certification Study
 Sustainable Ag/Integrated Pest Management

Member EAB
Department of Public Safety
 Emergency Management Assistance
 Hazardous Substances Data Management

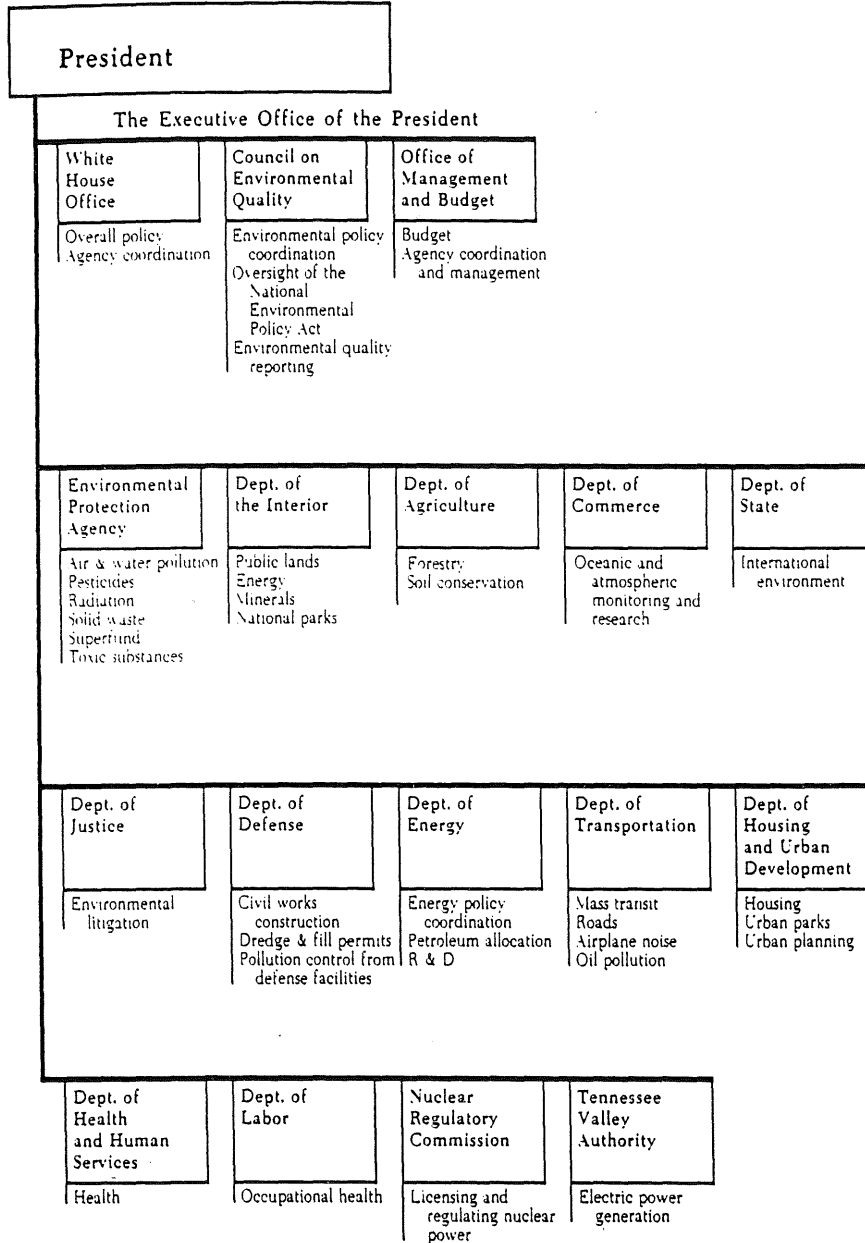
Minnesota Extension Service

Minnesota Geological Survey (U of MN)
 Hydrogeologic Mapping
 County Geologic Atlases (with DNR)
 Regional Hydrogeologic Assessments (with DNR)

Key

———— Denotes formal coordination link
 - - - - - Denotes informal coordination link

Figure 1-1 Major Executive Branch Agencies with Environmental Responsibilities



Source: Council on Environmental Quality, *Environmental Quality, Sixteenth Annual Report of the Council on Environmental Quality* (Washington, D.C.: U.S. Government Printing Office, 1987).

PART III: MAJOR ENVIRONMENTAL TRENDS

The '90s and Beyond: A Paradigm Shift

Beginning in the mid-80s, some of the basic premises of environmental regulation began to be questioned. This was a response to growing recognition that efforts to "streamline," coordinate, and integrate were having limited impact on the complexity of environmental regulation and resource management. These concerns resulted in: (1) a re-examination of the relationship between environmental protection and conservation and growth and development; (2) renewed interest in the use of economic and market incentives as alternatives to traditional standards-based command and control regulations.

- **Sustainable Development.** Groucho Marx is reported to have said: Why should I care about posterity? What has posterity ever done for me? In contrast, Gro Harlem Brundtland, the premier of Norway, argued in 1984 before the Organization of Economic Cooperation that governments could dramatically reduce the environmental harm done by growth if they would create incentives for companies to use raw materials more frugally. She said that meant harnessing the inventive energy of industry and defined "sustainable development" that which "meets the needs of the present without compromising the ability of future generations to meet their own needs."

Put in a slightly different way, the report sponsored by the Business Council on Development and the Environment entitled Changing Course notes:

"Sustainable development requires forms of progress that meet the needs of the present without compromising the ability of future generations to meet their own needs.

The cornerstone of sustainable development is a system of open, competitive markets in which prices are made to reflect the costs of environmental as well as other resources.

Three basic mechanisms can be used to move business to internalize environmental costs, to pay for the costs of pollution, or to limit damage to the environment by other means: command and control, self regulation, economic instruments."

- **Market Incentives.** In 1988, an effort sponsored by Senator Timothy Wirth (Colorado) and the late John Heinz (Pennsylvania) and directed by Dr. Robert Stavins of Harvard's Kennedy School of Government entitled Project 88 was released. The Foreword by Senator Wirth and Senator Heinz begins, "Timeless folk wisdom tells us that there is more than one way to skin a cat. Common sense and this report tell us that there are also many ways to a cleaner environment. Among them are innovative measures to enlist the forces of the marketplace and the ingenuity of entrepreneurs to help deter and to change the conduct that wastes and degrades nature's resources."

Quoting from Governing Magazine, David Osborne and Ted Gaebler in their new book Reinventing Government, they note increasing interest in prevention rather than controlling pollution. "At present, federal and state regulations -- and consequently most technology development -- focus on waste destruction and separation. . . . Meanwhile, there is a growing trend toward pollution prevention and waste reduction."

Speaking of the advantages of market-based instruments, Frances Cairncross in her book Costing the Earth argues:

"Most economic instruments for tackling pollution work by creating incentives to become cleaner. When properly designed they should impose on a polluter the costs that would otherwise be dumped on the environment. . . .

They have two advantages over standards: In the short term, they will generally provide a given level of environmental improvement at a lower cost to society than will regulations. . . .

Second, in the long run economic instruments offer companies and individuals a continual argument for going further than a standard would demand. . . .

The difference in cost to the community between typical regulation and well-designed instruments may be as much as five to ten times [although] in reality they are usually much smaller, but still important."

- **Sustainable Development and Minnesota Policy.** The Minnesota Environmental Policy Act, enacted in 1973, states that one of the "ends" of state policy is to:

"discourage ecological unsound aspects of population, economic and technological growth, and develop and implement a policy such that growth occurs only in an environmentally acceptable manner;
[and, that governments and agencies of the state government shall]

"recognize the worldwide and long range character of environmental problems and, where consistent with the policy of the state, lend appropriate support to initiatives, resolutions, and programs designed to maximize interstate, national and international cooperation in anticipating and preventing a decline in the quality of the world environment."

In 1991, the report on Round 2 of Project 88 was released. Speaking of the environmental agenda for the 1990s, it notes:

"The political landscape of environmental policy has changed dramatically over the past two years, as environmentalists, legislators, bureaucrats, business persons, and citizens have begun to recognize that market-based approaches belong in our portfolio of environmental and natural resource policies. So far, however, we have taken only the first steps toward improved environmental policy. The steps that remain will be not only more important, but more difficult. The real work of detailed design and implementation lies ahead. We now have an opportunity -- created by a receptive mood at the Federal and state levels and internationally -- to take up this challenge and begin to make progress (p. 13)."

**SUMMARIES OF ENVIRONMENTAL LAWS
ADMINISTERED BY THE ENVIRONMENTAL PROTECTION
AGENCY**

SUMMARY

Ten major statutes form the legal basis for the programs of the Environmental Protection Agency.

The **Clean Air Act (CAA)** requires EPA to set mobile source limits, ambient air quality standards, hazardous air pollutant emission standards, standards for new sources, and significant deterioration requirements; and to focus on areas which do not attain standards.

The **Clean Water Act (CWA)** establishes the sewage treatment construction grants program, and a regulatory and enforcement program for discharges into U.S. waters.

The **Ocean Dumping Act (ODA)** regulates the intentional disposal of materials into ocean waters and authorizes research on effects of, and alternatives to, ocean disposal.

The **Safe Drinking Water Act (SDWA)** establishes primary drinking water standards, regulates underground injection practices, and establishes a groundwater control program.

The **Solid Waste Disposal Act and Resource Conservation and Recovery Act (RCRA)** provides regulation for solid and hazardous waste.

The **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**, or Superfund, establishes a fee-maintained fund to clean up abandoned hazardous waste sites.

The **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)** governs pesticide products and their use.

The **Toxic Substances Control Act (TSCA)** regulates the testing of chemicals and their use.

The **Environmental Research and Development Demonstration Act (ERDDA)** authorizes all EPA research programs.

In part, the **National Environmental Policy Act (NEPA)** requires EPA to review environmental impact statements.

Parts of some statutes preexisted the Environmental Protection Agency's formation in 1970, but contemporary environmental law was established by Congress during the 1970s, and has been expanded by major amendments. During twenty years, Congress has assigned to the Environmental Protection Agency the responsibility of administering a considerable body of law and associated programs.

CLEAN AIR ACT

The Clean Air Act (CAA), codified as 42 U.S.C. 7401 *et seq.*, is Congress' response to deteriorating air quality due to the growth in American industry, population, and use of the automobile. The Act is designed to protect human health and the environment by controlling ambient, or outdoor, air pollution through reducing individual pollutants at their sources.

Table 2. Clean Air Act and Major Amendments
(codified generally as 42 U.S.C. 7401-7671)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLIC LAW NUMBER</u>
1955	Air Pollution Control Act	P.L. 84-159 (Act of July 14, 1955)
1959	Reauthorization	P.L. 86-353
1960	Motor vehicle exhaust study	P.L. 86-493
1963	Clean Air Act amendments	P.L. 88-206
1965	Motor Vehicle Air Pollution Control Act	P.L. 89-272, title I
1966	Clean Air Act Amendments of 1966	P.L. 89-675
1967	Air Quality Act of 1967	P.L. 90-148
	National Emission Standards Act	P.L. 90-148, title II
1970	Clean Air Amendments of 1970	P.L. 91-604
1973	Reauthorization	P.L. 93-13
1974	Energy Supply and Environmental Coordination Act of 1974	P.L. 93-319
1977	Clean Air Act Amendments of 1977	P.L. 95-95
1980	Acid Precipitation Act of 1980	P.L. 96-294, title VII
1981	Steel Industry Compliance Extension Act of 1981	P.L. 97-23
1987	Clean Air Act 8-month extension	P.L. 100-202
1990	Clean Air Act Amendments of 1990	P.L. 101-549

CLEAN WATER ACT

The principal law governing pollution of the Nation's waterways is the Federal Water Pollution Control Act, or Clean Water Act.¹ Originally enacted in 1948, it was totally revised by amendments in 1972 that gave the Act its current shape. The 1972 legislation spelled out ambitious programs for water quality improvement that are still being implemented by industries and municipalities. Congress made certain fine-tuning amendments in 1977, revised portions of the law in 1981, and enacted further amendments in 1987. Table 5 lists the original law and major amendments to it.

Table 5. Clean Water Act and Major Amendments
(codified generally as 33 U.S.C. 1251-1387)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLIC LAW NUMBER</u>
1948	Water Pollution Control Act	P.L. 80-845 (Act of June 30, 1948)
1956	Water Pollution Control Act Amendment of 1956	P.L. 84-660 (Act of July 9, 1956)
1961	Federal Water Pollution Control Act Amendments	P.L. 87-88
1965	Water Quality Act of 1965	P.L. 89-234
1966	Clean Water Restoration Act	P.L. 89-753
1970	Water Quality Improvement Act of 1970	P.L. 91-224, title I
1972	Federal Water Pollution Control Act Amendments	P.L. 92-500
1977	Clean Water Act of 1977	P.L. 95-217
1981	Municipal Wastewater Treatment Construction Grant Amendments	P.L. 97-117
1987	Water Quality Act of 1987	P.L. 100-4

SAFE DRINKING WATER ACT

The Safe Drinking Water Act (P.L. 93-523), enacted on December 16, 1974, and codified as 42 U.S.C. 300(f) *et seq.*), is the basis for protecting public drinking water systems from harmful contaminants. The major part of this law is title XIV of the Public Health Service Act – Safety of Public Water Systems. Basically, the Act directs the EPA Administrator to develop: (1) national primary drinking water regulations that incorporate maximum contaminant levels or treatment techniques; (2) underground injection control regulations to protect underground sources of drinking water; and (3) groundwater protection grant programs for the administration of sole-source aquifer demonstration projects and for wellhead protection area programs. The Act permits these activities to be implemented by the States. The Act was last reauthorized in June 1986 (P.L. 99-339), and is authorized through FY91.

**Table 9. Safe Drinking Water Act
and Amendments**
(codified generally as 42 U.S.C. 300f-300j-11)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLICLAWNUMBER</u>
1974	Safe Drinking Water Act	P.L. 93-523
1977	Safe Drinking Water Amendments of 1977	P.L. 95-190
1979	Safe Drinking Water Act amendments	P.L. 96-63
1980	Safe Drinking Water Act Amendments	P.L. 96-502
1986	Safe Drinking Water Act Amendments of 1986	P.L. 99-339
1988	Lead Contamination Control Act of 1988	P.L. 100-572

FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT

The Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA), gives EPA the statutory authority to regulate pesticides. Before a pesticide can be marketed in the United States, it must be granted a "registration". The registration decision is based on a determination that there are no unreasonable adverse effects for humans and the environment, within the constraints of approved uses. All pesticides must be labeled, and the label must specify approved uses and restrictions.

It is a violation of the law to use a pesticide in a manner that is inconsistent with the label instructions. EPA is also authorized to suspend, cancel, or restrict the use of a pesticide if it is found, at any time, to pose unreasonable adverse effects or imminent hazards to the environment.

Table 16. Federal Insecticide, Fungicide, and Rodenticide Act and Amendments
(codified generally as 7 U.S.C. 136-136y)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLIC LAW NUMBER</u>
1947	Federal Insecticide, Fungicide, and Rodenticide Act	P.L. 80-104
1964	Federal Insecticide, Fungicide, and Rodenticide Act amendments	P.L. 88-305
1972	Federal Environmental Pesticide Control Act	P.L. 92-516
1975	Federal Insecticide, Fungicide, and Rodenticide Act Extension	P.L. 94-140
1978	Federal Pesticide Act of 1978	P.L. 95-396
1980	Federal Insecticide, Fungicide, and Rodenticide Act amendments	P.L. 96-539
1988	Federal Insecticide, Fungicide, and Rodenticide Act Amendments of 1988	P.L. 100-532
1990	Food, Agriculture, Conservation, and Trade Act of 1990	P.L. 101-624

TOXIC SUBSTANCES CONTROL ACT

Federal toxic substances control legislation was originally proposed in 1971. The President's Council on Environmental Quality published a report, "Toxic Substances," outlining the need for comprehensive chemical control legislation. The House and Senate each passed bills in both the 92d and 93d Congresses, but controversies over the scope of premarket screening, costs, and the relationship to other regulatory laws stymied final action. Episodes of damage to health and the environment--including the kepone pesticide incident in Hopewell, Virginia, the contamination of the Hudson River and other waterways by PCBs, and the threat of stratospheric ozone depletion from chlorofluorocarbon emissions--together with more exact assessments of the costs of imposing toxic substances controls, opened the way for final passage of the legislation. President Ford signed the Toxic Substances Control Act (TSCA -- P.L. 94-469, 15 USC 2601 *et seq.*) into law on October 11, 1976.

Since that time, the law has been amended to include legislative directives about how to control specific toxic substances--control of asbestos exposures in public buildings, especially schools was required in 1986 (P.L. 99-519), and assistance to States about addressing exposure to radon gas was added in 1988 (P.L. 100-551). Amendments specific to individual toxic chemical control actions may indicate congressional frustration and disappointment in EPA's implementation of TSCA; if true, additional chemical-specific legislation may be offered in the future. The authorization of appropriations in TSCA expired on September 30, 1987.

**Table 18. Toxic Substances Control Act
and Major Amendments**
(codified as 15 U.S.C. 2601-2671)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLIC LAW NUMBER</u>
1976	Toxic Substances Control Act	P.L. 94-469
1986	Asbestos Hazard Emergency Response Act	P.L. 99-519
1988	Radon Program Development Act	P.L. 100-551
1990	Radon measurement	P.L. 101-508, §10202
1990	Asbestos School Hazard Abatement Reauthorization Act of 1990	P.L. 101-637

OCEAN DUMPING ACT

INTRODUCTION

The Ocean Dumping Act (codified as 33 U.S.C. 1401-1445), the first two titles of the Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532), has two basic aims: to regulate intentional ocean disposal of materials, and to authorize related research. The third title, not addressed here, authorizes the establishment of marine sanctuaries.

The Act's basic provisions have remained virtually unchanged since 1972, but some new authorities have been added as indicated by Table 7. These include (1) new research responsibilities for EPA; (2) specific direction that EPA phase out the disposal of "harmful" sewage sludges and industrial wastes; (3) a 1991 ban on the ocean disposal of sewage sludge and industrial wastes, (4) inclusion of Long Island Sound within the purview of the Act, and (5) inclusion of medical waste provisions.

**Table 7. Ocean Dumping Act
and Amendments**
(codified as 33 U.S.C. 1401-1445)

<u>YEAR</u>	<u>ACT</u>	<u>PUBLIC LAW NUMBER</u>
1972	Marine Protection, Research and Sanctuaries Act	P.L.92-532
1974	Ocean Dumping Convention Implementation	P.L.93-254
1974	Authorization of Appropriations	P.L.93-472
1975	Authorization of Appropriations	P.L.94-62
1976	Authorization of Appropriations	P.L.94-326
1977	Authorization of Appropriations	P.L.95-153
1978	Intervention on the High Seas Convention - Oil	P.L.95-302
1980	Authorization of Appropriations	P.L.96-381
1980	Congressional Reports Elimination Act	P.L.96-470, §201 (f)
1980	Authorization of Appropriations	P.L.96-572
1981	Authorization of Appropriations	P.L.97-16
1982	Surface Transportation Assistance Act	P.L.97-424, §424
1986	Budget Reconciliation	P.L.99-272, §6061-6065
1986	Superfund Amendments and Reauthorization Act of 1986	P.L.99-499, §127
1986	Water Resources Development Act	P.L.99-662, §211,728,1172
1987	Water Quality Act of 1987	P.L.100-4, §508
1987	Omnibus Budget Reconciliation Act	P.L.100-203, §5063
1988	Reauthorization	P.L.100-536
1988	Ocean Dumping research amendments	P.L.100-627, title I
1988	Ocean Dumping Ban Act	P.L.100-688, title I
1988	United States Public Vessel Medical Waste Anti-Dumping Act of 1988	P.L. 100-688, title III
1988	Shore Protection Act of 1988	P.L. 100-688, title IV
1990	Regional marine research centers	P.L.101-593

FROM: **Project 88 -- Round II: Incentives for Action: Designing Market-Based Environmental Strategies**, A Public Policy Study sponsored by Senator Timothy E. Wirth and Senator John Heinz and directed by Dr. Robert N. Stavins, Washington, D.C., 1991.

CHAPTER 1 ENVIRONMENTAL POLICY FOR THE 1990'S

In many ways, Earth Day 1970 signaled the beginning of the modern era of environmentalism. By Earth Day 1990, the United States and other nations had enacted a host of environmental laws and regulations, and had made substantial gains in environmental protection. In some spheres, the environment *is* cleaner today than it was before. But significant domestic and global environmental challenges remain -- both ongoing problems, such as solid and hazardous waste management, and newly recognized problems, including the threat of global climate change. At the same time, the costs of environmental protection continue to increase. We now spend over \$100 billion annually in the U.S. to comply with Federal environmental laws and regulations.¹

As we enter the 1990's, political leaders are giving greater attention to a promising set of new environmental policies which recognize market forces, not only as part of the problem, but also as a potential part of the solution. An opportunity now exists to enter a new era of enlightened environmental policy by mobilizing market forces to complement traditional regulatory strategies. An outline for such a dramatic new thrust in environmental policy was provided two years ago in this report's predecessor, *Project 88: Harnessing Market Forces to Protect Our Environment*.² That report dovetailed with interest within the Administration, the Congress, the environmental community, and private industry, by proposing thirty-six policy recommendations that would enlist market forces to prevent pollution and reduce waste of natural resources.

Over the past two years, the nature and tone of political debate on environmental issues has evolved rapidly, as illustrated by the enactment, late in 1990, of a major overhaul of the Clean Air Act to include a market-oriented approach to controlling acid rain. Many factors contributed to this rapid evolution of policy prescriptions, including strong interest within the Executive Office of the President; aggressive participation by some segments of the environmental community;³ and

¹See: U.S. Environmental Protection Agency. *Environmental Investments: The Cost of a Clean Environment*. Report of the Administrator to the Congress of the United States. Washington, D.C., December 1990. This estimate excludes environmental activities not directly associated with pollution control or cleanup, such as wildlife conservation and land management. The \$100 billion estimate covers spending by private business (63.0%), local governments (22.5%), the Federal government (11.0%), and state governments (3.5%).

²See: Stavins, Robert N., ed. *Project 88: Harnessing Market Forces to Protect Our Environment -- Initiatives for the New President*. A Public Policy Study sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania. Washington, D.C., December 1988.

³When introducing his Clean Air proposals at the White House on June 12, 1989, President Bush said: "Let me commend Project 88 and groups like the Environmental Defense Fund for bringing creative solutions to long-standing problems, for not only breaking the mold, but helping to build a new one."

bipartisan support in the Congress, including the release, in December 1988, of the first Project 88 report.⁴

There is a growing consensus in the policy community that market-oriented or incentive-based⁵ approaches should be considered as part of our overall portfolio of environmental-protection strategies. If Round I of Project 88 helped to introduce these "good ideas" into policy deliberations, the question which must now be addressed is whether these are indeed "good ideas that work." We must move from general concepts to the design of *effective and practical* incentive-based policy mechanisms for improved environmental protection and natural resource management. As part of the effort, this report focuses on design issues associated with incentive-based policies for three problem areas of particular importance: global climate change due to the greenhouse effect; generation and disposal of solid and hazardous waste; and management of natural resources.

THE CHANGING POLITICAL LANDSCAPE OF ENVIRONMENTAL POLICY

Environmental quality has been a pressing issue on the American agenda for at least two decades,⁶ but has attracted unprecedented attention in the last two years. Private industry has responded to this burgeoning interest in environmental affairs,⁷ which has included substantial attention to incentive-based policy approaches.⁸ In the past, economic-incentive approaches were often characterized as "licenses to pollute" or dismissed as completely impractical. President Lyndon Johnson's proposal for effluent fees was never given serious consideration, nor were President Richard Nixon's recommendations for a tax on lead in gasoline and a sulfur-dioxide emission fee. Now, however, economic-incentive policies for enhancing environmental quality have moved to center stage in Washington and a number of state capitals.⁹

⁴Several other studies followed the Project 88 report, including: Moore, John L., *et. al. Using Incentives for Environmental Protection: An Overview*. Washington, D.C.: Congressional Research Service, June 1989; and Anderson, Robert C., Lisa A. Hofmann, and Michael Rusin. *The Use of Economic Incentive Mechanisms in Environmental Management*. Washington, D.C.: American Petroleum Institute, June 1990.

⁵These policies are described within the policy community as "economic incentive approaches," "market-based," "market-oriented," or "incentive-based." In any case, both (positive) incentives and disincentives are included.

⁶See: Ladd, E. C. "Clearing the Air: Public Opinion and Public Policy on the Environment." *Public Opinion*, February/March 1982, pp. 16-20.

⁷See: Main, Jeremy. "Here Comes the Big New Cleanup." *Fortune*, November 21, 1988, pp. 102-118; Smith, Emily T. and Vicki Cahan. "The Greening of Corporate America." *Business Week*, April 23, 1990, pp. 96-103; and Jacobs, Deborah L. "Business Takes on a Green Hue." *New York Times*, September 2, 1990, p. 25.

⁸See: Passell, Peter. "Private Incentives As Pollution Curb." *New York Times*, October 19, 1988, p. D2; "The Greening of the Invisible Hand." *The Economist*, December 24, 1988, p. 107; Cairncross, Frances. "Costing the Earth." *The Economist*, September 2, 1989, pp. 1-18; and Morgenson, Gretchen and Gale Eisenstodt. "Market-Driven Environmentalism." *Forbes*, March 5, 1990, pp. 94-100.

⁹For an analysis of why these changes have occurred, see: Hahn, Robert W. and Robert N. Stavins. "Market-Based Environmental Regulation: A New Era From An Old Idea?" *Ecology Law Quarterly*, volume 18, number 1, forthcoming 1991.

Actual policy mechanisms for specific environmental problems are now being examined within the Administration and in Congress. The Administrator of the U.S. Environmental Protection Agency (EPA), William K. Reilly, partly in response to the first Project 88 report, established an Economic Incentives Task Force to investigate the potential application of market-oriented policies throughout EPA's jurisdiction.¹⁰ More dramatically, the tradeable-permit system for acid-rain control, which was recommended by Project 88, was adopted by the Administration,¹¹ and then included in the Clean Air amendments approved in 1990 by the Congress. In addition, the Congress is considering bills that would apply economic-incentive mechanisms to problems as diverse as water pollution and hazardous waste management,¹² and the Administration has examined incentive-based policies to address the threat of global climate change.¹³ In Canada, active interest in market-oriented approaches to environmental protection has also increased dramatically over the past two years, at both the national and provincial levels.¹⁴

In the United Kingdom, the Thatcher government embraced a study recommending increased reliance on economic-incentive mechanisms for a variety of resource and environmental problems.¹⁵ Major incentive-based programs have been initiated in Belgium and Italy, and the approach is gaining ground elsewhere in Europe, as well. Perhaps most striking, as massive political and economic changes have gripped the Soviet Union and Eastern Europe, several of these nations have expressed interest in market-oriented environmental policies. Within the Soviet Union, the Central Institute of Mathematics and Economics of the Academy of Sciences has advocated the use of pollution taxes, while Polish and Czechoslovakian government officials have endorsed a variety of market-oriented approaches to air and water pollution problems.

Within the U.S., these changes in the political landscape of environmental policy represent a significant departure from long-term trends. Only a few years ago, serious consideration of market-oriented environmental-protection policies was restricted to economists and others at research

¹⁰See: U.S. Environmental Protection Agency. *Economic Incentives: Options for Environmental Protection*. Office of Policy, Planning, and Evaluation, Economic Incentives Task Force, 21P-2001. Washington, D.C., March 1991.

¹¹On June 12, 1989, President Bush announced the tradeable-permit system for acid-rain control as part of the Administration's Clean Air Act amendments. This proposal was sent to Congress on July 21, 1989.

¹²More than 100 bills characterized by EPA as using economic incentives were introduced in the 101st Congress. See: U.S. Environmental Protection Agency. *Economic Incentives in Pending Environmental Legislation*. Office of Policy, Planning, and Evaluation. Washington, D.C., July 1990.

¹³Although the Administration has maintained that it is still too soon to establish greenhouse goals and standards, it has also suggested that when and if such standards or goals are established, consideration should be given to cost-effective, market-based policy instruments. See Chapter 2 of this study.

¹⁴See, for example: Nichols, Albert L. and David Harrison, Jr. *Using Emissions Trading to Reduce Ground-Level Ozone in Canada: A Feasibility Analysis*. Final Report Prepared for Environment Canada. Cambridge, Massachusetts: National Economic Research Associates, Inc., November 1990.

¹⁵See: Pearce, David, Anil Markandya, and Edward B. Barbier. *Blueprint for a Green Economy*. London: Earthscan Publications, 1989.

institutions.¹⁶ But late in the 1980's, a new breed of environmentalism emerged that began to embrace these innovative approaches,¹⁷ which are now winning support among major environmental advocacy groups.¹⁸

MARKET-BASED ENVIRONMENTAL POLICIES: WHAT THEY ARE AND HOW THEY WORK

Why all this emphasis on market forces, in the first place? The answer is purely practical. Selective and careful use of economic incentives can enable us to achieve greater levels of environmental protection at lower overall cost to society. A central principle is that as consumers and as producers, each and every one of us needs to weigh the full social costs and consequences of our decisions before acting. This principle applies, for example, to our decisions as consumers to use products such as lead-acid batteries and to dispose of them at municipal landfills, where the lead can eventually contaminate ground water aquifers. It also applies to producers' decisions to generate electricity in ways that may inject sulfur dioxide into the atmosphere, causing acid rain at downwind locations.

Market-based environmental policy mechanisms provide various ways to make consumers and producers recognize these social costs and consequences, and thus provide incentives for environmental protection. The creativity and power of the market -- the awesome strength of millions of decentralized decision-makers -- can be deployed on behalf of environmental protection, instead of against it. Incentive-based approaches can also encourage firms to develop and implement more effective and efficient pollution-control technologies and strategies.

Incentive-based mechanisms are not appropriate for all environmental and resource problems, however.¹⁹ To identify appropriate applications, we need to understand both the merits and the limitations of these market-oriented policy mechanisms. By way of background, it is useful to review

¹⁶Legal scholars and practicing attorneys have been among the most eloquent supporters of these strategies. See, for example: Stewart, Richard B. "Controlling Environmental Risks Through Economic Incentives." *Columbia Journal of Environmental Law* 13(1988):153-169; Krier, James E. "Marketlike Approaches: Their Past, Present, and Probable Future." LeRoy Graymer and Frederick Thompson, eds., *Reforming Social Regulation*, pp. 151-158. Beverly Hills: Sage Publications, 1982; and Levin, Michael H. "New Directions in Environmental Policy: The Case for Environmental Incentives." *Proceedings of Annual Midwinter Meeting, American Bar Association, Section of Natural Resource Law*. Keystone, Colorado, March 18-20, 1988.

¹⁷See: Krupp, Frederic D. "New Environmentalism Factors in Economic Needs." *Wall Street Journal*, November 20, 1986, p. 34.

¹⁸The Environmental Defense Fund, the Wilderness Society, the National Audubon Society, the National Wildlife Federation, the Sierra Club, the Natural Resources Defense Council, and the Conservation Law Foundation have all come to support *selective* use of economic-incentive mechanisms.

¹⁹Also, most incentive-based policy mechanisms actually rely upon an underlying conventional regulatory structure, a point that will be illustrated throughout this study.

the approach most often applied to environmental regulation in the United States and other countries: command-and-control.²⁰ Pollution-control problems provide good examples.

Conventional Command-and-Control Regulatory Mechanisms

With conventional approaches to pollution control, the government either specifies the technology that must be used for this purpose (a **technology-based standard**)²¹ or sets an emission-rate cap that all sources must meet (a **uniform performance standard**). In the first case, government in effect specifies the equipment that must be used to control pollution. An electrical utility, for example, may (in effect) be required to install flue-gas scrubbers to control sulfur dioxide emissions or electrostatic precipitators to control particulate matter. **Greater flexibility is provided by performance standards, which allow firms to decide how they will meet the specified goal** (for example, a maximum allowable level of pollutant emitted per unit of product output).

These conventional policy approaches can be effective in achieving environmental goals, but they tend to impose relatively high costs on society, because some unnecessarily expensive means of controlling pollution will be used. The costs of controlling emissions vary greatly from one source to another. For certain pollutants, the cost per unit controlled may vary by a factor of 100 or more,²² depending upon the age and location of plants and **the technologies at their disposal**. To control total pollution to a given level at the lowest possible cost, all firms must control at the same incremental or marginal cost (as opposed to the same emission or control level). Otherwise, the same aggregate level of pollution abatement could be achieved at lower total cost by increasing the control exercised by low-cost controllers and decreasing control by high-cost controllers.

To achieve a cost-effective allocation of the pollution-control burden, the government could force all sources to control at the same marginal control cost. This would ensure that low-cost controllers control more, and high-cost controllers control less. But the government would need detailed information about the costs faced by each individual source, which could be obtained only at very great cost, if at all. Fortunately there is a way out of this impasse. Economic-incentive systems lead firms to undertake pollution-control efforts that allocate the control burden appropriately. By making it costly for firms to increase their pollution, **the government encourages them to clean up in a cost-effective manner: the invisible hand of the market is brought to bear on behalf of the environment**. Incentive-based approaches fall into five major categories: **pollution charges; tradeable permits; deposit-refund systems; market-barrier reductions; and government-subsidy elimination**.

²⁰This part of the chapter draws, in part, on: Stavins, Robert N. "Innovative Policies for Sustainable Development: The Role of Economic Incentives for Environmental Protection." *Harvard Public Policy Review*, volume 7, number 1, pp. 13-25, Spring 1990; and Hahn and Stavins, *op. cit.*

²¹Usually, regulations do not explicitly specify the technology, but establish standards on the basis of a particular technology. In situations where monitoring problems are particularly severe, however, technologies *are* specified.

²²Numerical examples of the variance of incremental costs of air-pollution control are provided by: Crandall, Robert W. "The Political Economy of Clean Air: Practical Constraints on White House Review." *Environmental Policy Under Reagan's Executive Order: The Role of Benefit-Cost Analysis*, ed. V. Kerry Smith, pp. 205-225. Chapel Hill: The University of North Carolina Press, 1984.

Pollution Charges

Producers of pollution may be charged a fee or tax on the amount of pollution they generate (not simply on their pollution-generating activities).²³ It will then be worth their while to reduce pollution up to the point at which their (marginal) cost of control is equal to the pollution-tax rate. As a result, firms will control to different degrees, with high-cost controllers controlling less, and low-cost controllers controlling more. An effective charge system minimizes the aggregate costs of pollution control and gives firms ongoing incentives to develop and adopt newer and better pollution-control technologies.

An effective pollution charge system can impose a significant monitoring burden on government, however. Also, it is difficult to estimate in advance how large a charge will be required to obtain a desired level of pollution reduction, and it may be difficult -- in a political context -- to establish charges large enough to achieve given environmental objectives.

Although air and water pollution charges have been adopted in France, the Netherlands, Sweden, Norway, Denmark, Finland, Italy, and West Germany,²⁴ these charge schemes have been designed primarily as revenue-raising devices, rather than as serious incentive-based environmental policy instruments.²⁵ Several European nations remain interested in imposing further "green taxes." This study investigates various policy mechanisms that apply the pollution-charge concept, including a CO₂ (carbon or BTU) charge to help combat global climate change; "environmental costing" at electrical utilities; and unit charges for pickup and disposal of municipal solid waste.

Tradeable Permit Systems

Unlike a charge system, a system of tradeable permits allows the government to specify an overall level of pollution that will be tolerated. This total quantity is allotted in the form of permits among polluters (firms). Firms that keep their emission levels below the allotted level may sell or lease their surplus allotments to other firms, or use them to offset excess emissions in other parts of their own facilities. Such a system will tend to minimize the total societal cost of achieving a given

²³For example, a pollution charge might take the form of a charge per unit of sulfur dioxide emissions, not a charge per unit of electricity generated. The choice of whether to tax pollution quantities, activities preceding discharge, inputs to those activities, or actual damages will depend upon tradeoffs between costs of abatement, mitigation, damages, and program administration, including monitoring and enforcement.

²⁴Opschoor, J. B. and Hans B. Vos. *Economic Instruments for Environmental Protection*. Paris: Organization for Economic Cooperation and Development, 1989.

²⁵Whatever their motivation, properly designed pollution charges will have the effect of discouraging fundamentally undesirable activities (pollution), whereas conventional taxes tend to discourage fundamentally desirable activities, namely labor and the generation of capital.

level of pollution control.²⁶ It is important to note that both charges and permit systems can be used to improve environmental quality, not just to maintain the status quo.

A disadvantage of tradeable permit systems is that the total cost of control is not known in advance. Also, if the number of regulated sources of emissions is great, the administrative (transaction) costs of these systems can be very high. On the other hand, if very few sources are involved, problems of concentration in the permit and product markets may arise, with consequent inefficiencies introduced by noncompetitive behavior.²⁷ Finally, regulators must decide how to allocate permits among sources: should they be given away as an endowment, or should they be sold through an auction? If they are distributed free of charge, what criteria should be used in the allocation?

Tradeable permit mechanisms have been applied primarily in the U.S., under EPA's Emissions Trading Program,²⁸ the nationwide phasedown of lead in automotive fuel,²⁹ and chlorofluorocarbon (CFC) reduction. As mentioned above, Congress has enacted a tradeable-permit system for acid-rain control. Other potential areas of application include: local, "criteria" air-pollution control; point- and nonpoint-source water-pollution control; control of global climate change through international trading in greenhouse gas permits;³⁰ and recycling credits, whereby recycling targets are combined with tradeable permits. The last two mechanisms are investigated in Chapters 2 and 3, respectively, of this study.

Deposit-Refund Systems

Nine states of the U.S., several Canadian provinces, and a number of European nations have enacted "bottle bills" to reduce littering with beverage containers. In effect, purchasers of potentially polluting products pay a surcharge, which is refunded to them when they return the product to an

²⁶See: Hahn, Robert and Roger Noll. "Designing a Market for Tradeable Permits." *Reform of Environmental Regulation*, ed. Wesley Magat, pp. 119-146. Cambridge: Ballinger, 1982.

²⁷These and other concerns are discussed in detail in Chapter 3 in the context of our investigation of a specific tradeable permit program, recycling credits.

²⁸Firms have generally not made extensive use of the components of the Emissions Trading Program -- bubbles, offsets, netting, and banking -- partly because states are not required to use them, and partly because of uncertainties about the future course of the programs. Nevertheless, companies such as Armco, Du Pont, USX, and 3M have traded emissions credits; even this limited degree of trading has resulted in more than \$4 billion in savings in control costs, with no adverse effect on air quality. See: Dudek, Daniel J., and John Palmisano. "Emissions Trading: Why Is This Thoroughbred Hobbled?" *Columbia Journal of Environmental Law* 13(1988):217-256; and Liroff, Richard A. *Reforming Air Pollution Regulations: The Toil and Trouble of EPA's Bubble*. Washington, D.C.: The Conservation Foundation, 1986.

²⁹From 1982 through 1987, during EPA's phasedown of the leaded content of gasoline, refiners could create credits by producing gasoline with a lower lead content than required by law. Savings due to the lead trading program were about \$200 million annually. See: U.S. Environmental Protection Agency. *Costs and Benefits of Reducing Lead in Gasoline, Final Regulatory Impact Analysis*. Washington, D.C., February, 1985. The Netherlands accomplished its own leaded-gasoline phasedown (over a period of two years) through a tax differential of 8¢/gallon.

³⁰All of these options were examined in the Project 88/Round I report.

approved center for recycling or proper disposal. Such deposit-refund systems could be used for containerizable hazardous waste and for some other forms of solid waste, as we discuss in Chapter 3. Lead-acid batteries, motor vehicle oil, and industrial solvents are potential candidates. Rhode Island and Maine have enacted deposit-refund systems for automobile batteries, and Maine has a system for commercial-size pesticide containers. Denmark has such a plan for mercury and cadmium batteries, and Norway and Sweden have implemented deposit-refund systems for car bodies.

Removing Government Barriers to Market Activity

In some cases, environmental protection can be improved simply by removing existing government-mandated barriers to market activity. For example, measures that facilitate the voluntary exchange of water rights can promote more efficient allocation and use of scarce water supplies, while curbing the need for expensive and environmentally disruptive new water supply projects. We examine this policy approach in detail in Chapter 4. Similarly, comprehensive least-cost bidding at electrical utilities would promote economically rational energy generation and consumption. This option is examined in Chapter 2, in the context of policies to combat global climate change.

Eliminating Government Subsidies

Many government subsidies promote economically inefficient and environmentally unsound development. A major example is the U.S. Forest Service's "~~below-cost timber sales~~," which recover less than the cost of making timber available. The result has been inefficient timber cutting on government lands, which has led to substantial losses of habitat and damages to watersheds. We consider alternative means of eliminating these below-cost timber sales in Chapter 4. Other examples of programs that may be both economically inefficient and environmentally disruptive include certain U.S. Army Corps of Engineers flood-control projects³¹ and certain U.S. Bureau of Reclamation projects.

Comparing Market-Based Approaches with Conventional Policies

In many cases economic-incentive approaches will allow a given level of environmental protection to be achieved at lower total cost than would be possible with conventional policy approaches. Rather than set rigid technology-based standards, incentive-based systems ~~impose a cost~~ on pollution-causing activities, allowing individual firms to decide how they will achieve the required level of environmental protection. In a competitive market economy, ~~market forces will then tend~~ to drive these decisions toward least-cost solutions. The resulting savings in production costs and consequent increases in productivity are especially valuable at a time of substantial concern regarding the United States' international competitiveness. It has been estimated, for example, that the market-

³¹See Chapter 6 of Round I of Project 88. Also, see: Stavins, Robert N. and Adam B. Jaffe. "Unintended Impacts of Public Investments on Private Decisions: The Depletion of Forested Wetlands." *American Economic Review* 80(1990):337-352; and Stavins, Robert N. "Alternative Renewable Resource Strategies: A Simulation of Optimal Use." *Journal of Environmental Economics and Management* 19(1990):143-159.

based approach to acid-rain reduction could save \$1 billion per year over a dictated technological solution.³²

Incentive-based policies can also stimulate the private sector to develop new pollution-control technologies and expertise. Because investments in pollution control can improve firms' profits under incentive-based systems, firms will be encouraged to adopt superior pollution-control technologies, which in turn creates incentives for research and development of cheaper and better pollution-abatement techniques. Incentive-based approaches have the additional benefit of making the environmental debate more understandable to the general public. Attention can focus directly on what our environmental goals should be, rather than on difficult technical questions concerning alternative means of reaching those goals. Also, incentive-based approaches need not be any more expensive for the government to administer than conventional methods. But no program of controls can be effective without a government commitment to monitoring and enforcement, and that will inevitably mean significant government expenditures.

In any event, market-oriented policies will certainly not fit every problem. Whereas incentive-based approaches seem virtually tailor-made for problems of aggregate pollution levels over a large area (for example, acid rain), some environmental problems involve highly localized effects and threshold damages. In such cases, concern focuses on the level of pollution emitted by individual sources, and a command-and-control approach, such as a source-specific emission limit, may represent the preferred policy.

In some situations, moreover, practical problems may make it impossible to implement incentive-based environmental policies successfully, even if they are appropriate on theoretical grounds. Such implementation problems can render even the best policy idea quite useless. To design improved policies, it will be necessary to adapt, not abandon, present programs and build step-by-step on previous initiatives with market-based methods.³³

DESIGNING MARKET-BASED ENVIRONMENTAL POLICIES

The original Project 88 report provided a comprehensive examination of thirteen environmental and natural resource problems facing the U.S.,³³ and recommended thirty-six policies for dealing with those problems. Because of the scope of that effort, the policy recommendations were necessarily broad and conceptual; relatively little attention was given to specifics of program design. The current study helps fill this gap by focusing on a much smaller set of problem areas and providing more intensive analyses of policy design issues.

³²ICF Resources, Inc. *Analysis of Six and Eight Million Ton 30-Year/NSPS and 30-Year/1.2 Pound Sulfur Dioxide Emission Reduction Cases*. Washington, D.C., February 1986.

³³The thirteen problem areas were: the greenhouse effect and climate change; stratospheric ozone depletion; local air pollution; acid rain; indoor radon pollution; threats to energy security and environmental quality; inefficient use and allocation of water supplies; degradation of surface and ground water supplies; management of public lands; depletion of wetland resources; solid waste management; presence of toxic substances in the environment; and management of toxic and infectious waste.

Throughout the study, we ask whether the policy mechanisms being investigated will result in real improvements over existing or alternative policies. In particular, we keep in mind the following criteria for improved environmental and resource policy:³⁴

- Will the policy achieve our environmental goals?
- Will the policy approach be cost-effective? That is, will it achieve environmental goals at least cost to society at large?
- Will the strategy provide government agencies and private decision makers with needed information?
- Will monitoring and enforcement costs be reasonable?
- Will the policy be flexible in the face of changes in tastes, technology, or resource use?
- Will the policy give industry incentives to develop new environment-saving technologies, or will it encourage firms to retain existing inefficient plants?
- Will the effects of the policy be equitably distributed, and will any inequities be resolvable through government action?
- Will the purpose and nature of the policy be broadly understandable to the general public?
- Will the policy be truly feasible, in terms of both enactment by the Congress and implementation by the appropriate departments or agencies?

As we enter the 1990's, three environmental issues stand out, because of their magnitude and timeliness, and the applicability of incentive-based approaches. Specific policy mechanisms to address these major problem areas -- global climate change due to the greenhouse effect; the generation, storage, and disposal of hazardous and solid waste; and management of natural resources - are investigated in Chapters 2, 3, and 4, respectively. The following sections of this chapter provide a very brief overview of the policy mechanisms we investigate.

Global Climate Change

The possibility of global climate change due to the greenhouse effect is potentially one of the most important -- and certainly one of the most controversial -- environmental threats we currently face. Scientific evidence suggests that global mean temperatures may increase by 2 to 5 degrees

³⁴See: Bohm, Peter and Clifford S. Russell. "Comparative Analysis of Alternative Policy Instruments." *Handbook of Natural Resource and Energy Economics, Volume I*, eds. Allen V. Kneese and James L. Sweeney, pp. 395-460. Amsterdam: North-Holland, 1985.

Fahrenheit in the next century, because of increasing atmospheric concentrations of carbon dioxide and other gases. Given the high degree of uncertainty still prevailing within the scientific community, this report makes no attempt to draw conclusions regarding the likely magnitude of damages induced by global warming or the level of appropriate controls (if any). Instead, we focus on the policy questions that will have to be faced should various levels of government decide that action is warranted. Three policy proposals are offered:

- *International trading among nations in greenhouse gas source/sink permits* should be part of any effort to allocate greenhouse targets among nations. Such a mechanism can simultaneously address issues of cost-effectiveness and equity.
- *Revenue-neutral CO₂ (carbon or BTU) charges* can be a practical mechanism for reaching domestic emissions targets that arise from international negotiations. Such charges would cost less than most alternative measures, and their potential effects on competitiveness could be mitigated through reductions in distortionary taxes.
- *Comprehensive least-cost utility bidding and planning* can be used, even in the absence of international agreements, to increase efficiency of electricity generation and use, and thus reduce CO₂ emissions. Auctions for new power sources would incorporate environmental impacts into cost estimates and would allow for bids based upon demand-side reductions through conservation.

Solid and Hazardous Waste Management

Solid and hazardous waste problems have become ubiquitous throughout the United States and much of the industrialized world. The issues are diverse. For some wastes, space is the principal issue, as old landfills close and it becomes increasingly difficult to find sites for new landfills or incinerators. For other wastes, the problem is one of improper disposal, with effects ranging from the aesthetic consequences of litter to potential health and ecological damages from toxic materials. Since waste management represents a broad range of challenges rather than a single policy problem, and since disposal economics can vary dramatically across geographic areas, a portfolio of policies tailored to local conditions is required. While the Federal government may play an important role in promoting certain actions, much of the activity must occur at the municipal and state levels. Several market-based policies should be included in the regulator's tool kit:

- *Unit pricing of municipal solid waste collection and disposal* ought to be considered the first line of attack. Much of the municipal solid waste problem arises because consumers and producers fail to recognize the real costs of the wastes they generate. Better price signals can reflect the real incremental costs of waste generation and disposal. Local conditions will determine which instrument is most appropriate.
- *Retail disposal charges* may supplement or substitute for unit pricing in situations where unit pricing is impractical or where certain products have especially high disposal costs relative to their volume.

- *Virgin materials charges*, which can incorporate material disposal costs into product economics, can also help to reduce the flow of municipal wastes.
- *Recycling credits -- recycling targets combined with tradeable permits --* can be a cost-effective means for achieving recycling-content goals.
- *Deposit-refund systems* can be an attractive option for wastes that pose health, ecological, or aesthetic effects when improperly disposed of.
- *Local binding referenda linked with negotiated mitigation packages* can help ease the NIMBY ("not in my backyard") problem (which plagues the siting of new facilities) by reducing incentives for intransigence and more accurately addressing concerns of local citizens.

Natural Resource Management

The management of our endowment of natural resources remains one of the most contentious areas of environmental concern. Our use of water supplies is hotly debated, particularly in the West, where supplies are especially scarce. Great concern also focuses on the management of other public lands and resources. Economically inefficient, heavily subsidized timber cutting on public lands, for example, has led to loss of habitat, damage to watersheds, and a diminution of recreational opportunities. To address these resource management concerns, this report proposes that:

- *Water markets for voluntary exchanges* should be facilitated by Federal and state agencies to improve economic efficiency and create incentives for greater conservation and environmental protection.
- *Below-cost timber sales on national forests should be eliminated* by decentralizing forest management, incorporating the economic values of *all* forest uses, and improving payment mechanisms to localities.

THE IMPORTANCE OF EQUITY CONSIDERATIONS

Throughout this study and the original Project 88 report, we focus attention on policies that will achieve environmental goals at least overall cost to society. But efficiency (or cost-effectiveness) constitutes only one of several criteria that need to be considered when evaluating public policies. A particularly prominent concern is fairness or equity.

Market-oriented environmental policies bring some good news and some bad news. The good news is that environmental goals can be achieved at lower (often much lower) total cost to society than with conventional command-and-control approaches. Thus, society as a whole is better off than it would otherwise be. The bad news is that some individuals may be worse off. In other words, while the aggregate benefits of a policy may greatly exceed its aggregate costs, some individuals or firms may bear costs that are higher than the benefits they receive. This liability, however, is common to all policies, conventional or market-based.

The tension between efficiency and equity is brought into focus, although not created, by market mechanisms. Because of the important ethical concerns surrounding these issues and because of their great importance in the real world of environmental politics, these tradeoffs cannot be ignored. We must ask ourselves whether and under what circumstances we should modify our proposals for cost-effective reforms to mitigate outcomes perceived to be inequitable. If such adjustments are called for, what form should they take?

A pragmatic approach, which merits consideration in the context of specific policies, is to include equity-enhancing measures in policies chosen because they are cost-effective. Where merited, such efforts should be linked to the nature of the harm done. That is, if jobs are lost as a result of a policy change, it is preferable to provide compensation in the form of new job opportunities, as opposed to simple monetary payments. Inevitably, the strength of the case for some form of compensation or mitigation depends on the specific policy approach and problem being considered. General rules are of little use; instead, each specific policy mechanism must be investigated within its setting to determine whether the overall policy package should include provision for adjustment, mitigation, or compensation.

PROGNOSIS FOR CHANGE: AN ENVIRONMENTAL AGENDA FOR THE 1990'S

Governments, corporations, and individuals around the world have never paid more attention to environmental and natural resource issues than they do today. During the past two years they have focused increasingly on a new breed of policies intended to harness market forces to protect the environment. Round I of Project 88 helped to introduce such ideas into high-level policy deliberations. The question we face now is how to transform these good ideas into policies that work. As we move from general concepts to the design of effective and practical market-based environmental strategies, we seek policies that are not only technically sound, but also politically realistic.

Creative thinking can allow us to design effective, efficient, equitable, and truly feasible policies and programs. The first Project 88 report emphasized that selective use of incentive-based policies could enable us to achieve greater levels of environmental protection at lower overall cost to society, but that market-based policies were not necessarily appropriate for all problem areas. Project 88/Round II reinforces that message: no single policy approach -- whether market-based or command-and-control -- can be a panacea for the diverse environmental and natural resource problems we face. The real challenge is to choose the right policy for each job.

The political landscape of environmental policy has changed dramatically over the past two years, as environmentalists, legislators, bureaucrats, business persons, and citizens have begun to recognize that market-based approaches belong in our portfolio of environmental and natural resource policies. So far, however, we have taken only the first steps toward improved environmental policy. The steps that remain will be not only more important, but also more difficult. The real work of detailed design and implementation lies ahead. We now have an opportunity -- created by a receptive mood at the Federal and state levels and internationally -- to take up this challenge and begin to make real progress.

CHAPTER 5

EFFICIENCY, EQUITY, AND THE POLITICS OF MARKET-BASED ENVIRONMENTAL POLICIES

Many environmental and resource policy proposals -- whether conventional command-and-control or incentive-based -- involve some tradeoff between efficiency and equity. Although we examine the efficiency and equity impacts of alternative policy mechanisms throughout the study, in this chapter we investigate the possibility of resolving this tension by combining feasible, cost-effective environmental policy reforms with adjustment packages designed to mitigate associated equity problems. To provide a context for this discussion, we begin by reviewing the major incentive-based policy mechanisms investigated in the study. After our discussion of designing policies to include equity considerations, we offer some concluding comments regarding the future role of market-based policies for natural resource management and environmental protection.

AN OVERVIEW OF MAJOR INCENTIVE-BASED POLICY MECHANISMS

Conventional command-and-control regulatory mechanisms can be usefully supplemented by incentive-based approaches to environmental protection and natural resource management. Five general categories of policy instruments are promising: ~~pollution charges, tradeable permit systems, deposit-refund systems, removing market barriers, and eliminating government subsidies.~~ The choice among alternative policy instruments will be made on the basis of broader criteria of what constitutes good public policy.¹

This study has identified a dozen policy mechanisms by which we can address environmental and resource problems within three broad problem areas: global climate change, solid and hazardous waste management, and natural resource management (Table 5-1). For the reasons spelled out in previous chapters, these twelve incentive-based policy proposals merit serious consideration, but only within the context of well-defined problems. We need to develop a clear understanding of the problems we face before we begin our search for appropriate tools of public policy.

IMPLEMENTING INCENTIVE-BASED POLICIES: THE ROLES OF ADJUSTMENT, MITIGATION, AND COMPENSATION

As we have emphasized throughout this report, the choice of appropriate environmental policies depends on considerations of equity as well as cost-effectiveness. A market-oriented approach cannot avoid one problem that attends any policy change: some affected parties may end

¹As discussed in Chapter 1, environmental and natural resource policies can be assessed in terms of cost-effectiveness, equity, flexibility, and feasibility, among other criteria.

Table 5-1: Incentive-Based Policy Mechanisms for Major Environmental and Resource Problems

Problem Area	Specific Policy Problem	Incentive-Based Policy Mechanisms
GLOBAL CLIMATE CHANGE	How can national greenhouse targets be cost-effectively reallocated among countries, subsequent to international negotiations?	International trading in greenhouse gas source/sink permits
	How can internationally mandated domestic greenhouse targets be cost-effectively achieved in the U.S.?	CO ₂ charges (carbon charge, BTU charge) Domestic trading of greenhouse gas permits
	What actions could the U.S. undertake without waiting for international agreements or further research results?	Comprehensive environmental least-cost bidding and planning at electrical utilities
SOLID AND HAZARDOUS WASTE MANAGEMENT	Insufficient capacity at landfills and incinerators for existing volumes of municipal solid waste.	Unit charges for curbside pickup and collection (with possible differential pricing for specific, separated recyclables)
	Social disposal costs (health, ecological, and aesthetic impacts) associated with specific products in excess of volume-related costs (and/or unit charges are impractical).	Retail disposal charges
		Virgin material charges
		Deposit-refund system
	Improve cost-effectiveness of programs using recycled-content standards.	Recycling credits (recycling targets combined with tradeable permits)
Need to identify new sites for facilities for ultimate disposal and recycling (NIMBY).	Local binding referenda linked with negotiated mitigation package	
NATURAL RESOURCE MANAGEMENT	Increase efficiency of water use to reduce demand for new dams and reservoirs and to protect environmental quality.	Water markets for voluntary exchanges
	Protect public lands from uneconomic timber cuts, save taxpayers money, and continue to provide compensation to localities.	Eliminate below-cost timber sales on national forests (and provide payments to localities based on true economic value of all forest uses)

Note: The policy problems and incentive-based policy mechanisms are explained in Chapters 2 (Global Climate Change), 3 (Solid and Hazardous Waste Management), and 4 (Natural Resource Management).

up worse off than they were before. Furthermore, the implementation of economic-incentive policy mechanisms will tend to focus attention on the tradeoff between efficiency and equity.² Because of the important ethical concerns surrounding these issues and because of their great importance in the real world of environmental politics, these tradeoffs cannot be ignored. Under some circumstances, it may be desirable to design policy packages that include measures to mitigate outcomes which are perceived to be inequitable.³

Why Provide Adjustment, Mitigation, or Compensation?

There are several possible reasons for offering some kind of compensation to those affected by an environmental policy. First, and most pragmatic, is the consideration that the potential losers from a particular policy change may have the power to prevent it.⁴ The losers are particularly likely to be able to block change if they are easily identifiable and well organized, and if the gainers are widely distributed and less well-organized.⁵ In such situations, it may be necessary to offset part of their losses to build political consensus.

Second, equity considerations may suggest providing compensation. To take an extreme example, suppose a particular policy change (for which aggregate benefits would exceed aggregate costs) would provide very small per capita benefits to a very large number of people, while all its costs would fall on a small group of relatively poor people (building a freeway through a low-income neighborhood, for instance). Even if total benefits to society exceeded total costs by a wide margin, many citizens would be uneasy about proceeding with the project. Adjustment, mitigation, or compensation might be attractive options.⁶

²For comparisons of incentive-based and conventional environmental policies in terms of their differential equity impacts, see: Buchanan, James and Gordon Tullock. "Polluters' Profits and Political Response: Direct Controls Versus Taxes." *American Economic Review* 65(1975):139-147; Dewees, Donald. "Instrument Choice in Environmental Policy." *Economic Inquiry* 21(1983):53-71; Harrison, David Jr. and Paul R. Portney. "Who Loses from Reform of Environmental Regulation?" *Reform of Environmental Regulation*, ed. Wesley A. Magat. Cambridge, Massachusetts: Ballinger, 1982; Leone, Robert A. and John E. Jackson. "The Political Economy of Federal Regulatory Activity." *Studies in Public Regulation*, ed. G. Fromm. Cambridge, Massachusetts: MIT Press, 1981; and Hahn, Robert W. "The Political Economy of Environmental Regulation: Towards a Unifying Framework." *Public Choice* 65(1990):21-45.

³This part of the chapter draws, in part, upon a paper prepared for Project 88/Round II by Dallas Burtraw and Paul R. Portney, "Implementing Market-Based Environmental Policies: The Role of Compensation."

⁴Providing compensation can make it much easier to get reform enacted. See: Tullock, Gordon. "Achieving Deregulation - A Public Choice Perspective." *Regulation*, November/December, 1978, pp.50-54.

⁵Olson, Mancur. *The Logic of Collective Action*. Cambridge, Massachusetts: Harvard University Press, 1968.

⁶The mere existence of "losers" does not justify compensation. On the contrary, the "equity justification" has substantial force only when those who are hurt by an efficient policy belong to a particularly disadvantaged group in society.

An Overview of Potential Adjustment Mechanisms

Adjustment mechanisms have often been used for policy changes. For example, when -- in the interests of free trade -- the U.S. has eliminated protective tariffs or import quotas, "trade adjustment assistance" has sometimes been provided, including extended unemployment compensation for workers who may lose their jobs as a result of the policy revision. Similarly, compensation has been offered to people whose homes were torn down to make way for new highways or other rights-of-way in urban areas. Assistance has also been given to workers who lost their jobs because their industry was deregulated to increase economic efficiency. (Airlines provide a recent example.)

(1) Implicit and Explicit Adjustment and Compensation

To the extent that they cost less than command-and-control regulations, ~~market-based~~ incentives provide savings that can be used to fund mitigation or compensation. For instance, the total cost of our attempts to reduce acid deposition can be minimized by using market-based policies. Under a tradeable-permit pollution-control program, the initial allocation of emission permits can be designed to favor (implicitly compensate) those firms that would otherwise suffer the greatest losses. Compared with a uniform-standard approach to pollution control, ~~marketable permits generate~~ efficiency gains that can help compensate those ~~who are harmed by a regulation.~~

The proposed international tradeable permit system for greenhouse-gas sources and sinks also allows for implicit compensation. The initial allocation of permits can be designed to relieve much of the financial burden on developing nations. In this way, the industrialized countries would essentially be subsidizing cost-effective control measures in the developing world.

Sometimes, however, explicit compensation may be necessary, as in the siting of waste management facilities. In negotiating an agreement with a developer, virtually any host community will insist on compensation of some kind. Such arrangements are illustrated by our policy proposal for linking mitigation packages with binding local referenda.

(2) Linked Adjustment and Compensation

Compensation need not take the form of monetary payments to those harmed by a prospective policy change, and in fact, such payments may be a less appropriate form of mitigation or compensation. Adjustment mechanisms directly linked to the type of harm imposed by a policy change are likely to be more readily accepted and may cost less than cash compensation. Understanding what level of compensation is appropriate for accepting a hazardous waste facility in one's community is difficult, because the calculation involves tradeoffs in multiple dimensions -- time, income, property values, and health risks. Tradeoffs along a single dimension are easier to calculate and may provide more consistent answers. Thus, if a hazardous waste facility reduces property values in a community, this injury could be offset by the dedication of amenities (for example, open space) that bolster property values. This "linked" adjustment and compensation approach validates community concerns, reflects a willingness to compromise on the part of policy makers, and avoids

a host of troublesome issues, such as how to distribute cash compensation and whether it will disproportionately accrue to certain individuals or groups.⁷

Other forms of linked compensation could respond to other community concerns. For example, if citizens are worried about possible health effects, compensation may take the form of subsidies for health care for local residents, community-financed improvements in drinking water quality, or other measures aimed directly at improving human health.

(3) Choosing the Appropriate Baseline

In designing any adjustment or compensation package, it is important to consider the baseline against which a policy change is being measured. In the case of a proposed ban on mineral extraction, for example, it makes a difference whether the restriction applies to a wilderness area that has never been mined or to an area in which mining has been carried on for some time. Similarly, if we decided to implement a carbon charge or tradeable CO₂ permits, we need to consider whether compensation should be judged against a baseline of no regulation, or a traditional command-and-control approach to the problem of potential climate change. In considering hazardous waste management, should economic incentives be set in relation to a situation of no regulation, or to the existing rules under RCRA and Superfund?

Consider the evolution of the recently enacted Clean Air Act amendments dealing with acid rain.⁸ If the new regulation is compared with the current baseline of no policy at all, the losers would be the electric utilities, their shareholders, and ratepayers who would bear the costs of controlling sulfur dioxide emissions.⁹ But, if losses are measured against command-and-control regulation -- especially technology-based standards such as mandated installation of scrubbers -- then a different set of actors would appear to be hurt by market-based approaches. In this case, electricity consumers and corporate shareholders would benefit (because they would pay less for pollution control than under baseline conditions), while the losers would be miners of high-sulfur coal, since

⁷The costs of linked compensation may be less than comparable monetary expenditures because of public-good aspects of compensation. For instance, if a company locating a hazardous waste facility provides open space as compensation to the community, the company itself may benefit from the associated increase in property values in the community. In contrast, monetary compensation to affected residents does not generate a public good.

⁸For a brief overview of the concept of "acid rain reduction credits," see Chapter 3 of the first Project 88 report; a more detailed description and analysis is provided by: Bohi, Douglas R., Dallas Burtraw, Alan J. Krupnick, and Charles G. Stalon. "Emissions Trading in the Electric Utility Industry." Discussion Paper QE90-15. Washington, D.C.: Resources for the Future, 1990.

⁹Obviously, there is a large and important set of winners, too -- those who are harmed in a variety of ways by current acid deposition. We concentrate on the losers because our interest here is in adjustment issues.

the market for their product would shrink.¹⁰ In other words, the baseline makes a big difference in thinking about whether and how to adjust for the effects of policy changes.

The Roles of Adjustment, Mitigation, and Compensation in the Design of Market-Based Policies

Throughout this study, we have identified the principal equity considerations associated with each policy mechanism and suggested ways to address these equity concerns through policy adjustments, mitigation, or actual compensation. Table 5-2 summarizes this information for the three major problem areas we have addressed.

Although market-oriented mechanisms provide a kind of implicit compensation in that they cost less than would traditional command-and-control regulations, it may be appropriate in some instances to compensate those who are harmed by the introduction of new policies. Where -- for reasons of equity, efficiency, or political pragmatism -- adjustment is merited, it should be linked whenever possible to the nature of the harm done. That is, if jobs are lost as a result of the policy change, compensation might best take the form of new job opportunities, as opposed to a simple monetary payment.

The strength of the case for adjustment and compensation depends on the specific policy approach that is being considered. The argument is relatively weak when a new regulation brings an environmental cost into the private decision framework. If new and different controls are being layered onto a pre-existing regulatory mechanism, the case may be stronger. As always, general rules are of little use; instead, each specific policy mechanism must be investigated within its relevant setting to determine whether provision for adjustment, mitigation, or compensation ought to be part of the overall policy package.

THE FUTURE ROLE OF MARKET-BASED POLICIES: WHERE DO WE GO FROM HERE?

As we enter the 1990's, policy makers, environmentalists, and private industry all seem receptive to a new, more market-oriented approach to environmental problems. A consensus is emerging that carefully designed economic-incentive programs will often be able to achieve greater environmental protection at lower total cost to society than is possible with command-and-control regulation on its own. A market-based approach can lead both consumers and producers to consider the true costs of their decisions, encourage technical progress in pollution control, save policy makers from sinking into a morass of obscure technical issues, and keep government attention focused on the important issues, such as how much pollution control should be desired.

¹⁰This potential problem was addressed in 1990 by the Congress when it reauthorized the Clean Air Act. In separate legislation, a program was established to provide job-training and other forms of compensation for workers displaced by the new law, at an estimated cost of \$250 million over the next five years. See: Schneider, Keith. "Lawmakers Reach an Accord on Reduction of Air Pollution." *New York Times*, October 23, 1990, pp. A1, A18.

Table 5-2: Equity Concerns & Policy Responses

Problem Area	Incentive-Based Policy Mechanisms	Potential Equity Concerns	Possible Policy Responses
GLOBAL CLIMATE CHANGE	Int'l Trading in Greenhouse Gas Permits	Developing countries unable to pay for control	Initial allocation of permits on basis of equity considerations
	CO ₂ Charges (contingent upon prior international action)	Competitiveness of domestic energy-intensive industries compromised	Charge revenues used to reduce distortionary taxes; charges applied to imported products as well
		Impacts on employees of carbon-intensive fuel producers	Job-search and job-training for displaced workers
	Comprehensive Least-Cost Environmental Bidding	Higher energy prices may impose burden on low-income households	"Life-line" rates for initial increment of energy use
Possible employment losses at high-polluting energy providers		Job-search and job-training for displaced workers; job matching between firms	
SOLID & HAZARDOUS WASTE MANAGEMENT	Better Price Signals (including curbside unit charges)	Higher disposal costs may impose burden on low-income households	"Life-line" rates for initial increment of waste disposal services
		Possible impacts on industries involved with extraction and distribution of some virgin materials	Job-search and job-training for displaced workers
	Recycling Credits	Possible impacts on selected firms involved with regulated materials	Job-search and job-training for displaced workers
	Deposit-Refund Systems	Costs may impose burden on low-income households	Refund component assures that financial losses can be avoided
	Referenda for Facility Siting	Low-income communities may carry burden of hosting new facilities	Referenda gives community ultimate say; linked compensation
NATURAL RESOURCE MANAGEMENT	Implement Water Markets for Voluntary Exchanges	General third-party impacts	Protected under state water laws
		Farm workers may incur income losses or even unemployment	Job-search and job-training for displaced workers
	Eliminate Below-Cost Timber Sales	Loss of revenue for some local governments	System of compensation based on economic value of all forest uses

Our analyses of specific policies for three major problem areas -- global climate change, solid and hazardous waste issues, and natural resource management -- illustrate that translating the broad concepts of market-based environmental protection into practical and effective policy mechanisms will require attention to numerous design issues -- some quite technical, some not. The problems are by no means insignificant, but neither are they insurmountable. With creative thinking, policies and programs can be designed that are effective, efficient, equitable, and truly feasible.

As we emphasize in Chapter 1, however, not all environmental problems are amenable to incentive-based policies. For example, highly localized pollution problems that exhibit significant threshold effects in human-health damages may well call for conventional command-and-control approaches. Furthermore, it is not enough to identify policies that are cost-effective or efficient. Several other criteria must also be considered, including the equity effects of policies -- their differential impacts on various income groups, geographic regions, and sectors of the economy. In this context, it may sometimes be appropriate to include adjustment, mitigation, and compensation mechanisms in new environmental policy packages.

As we have seen, the monitoring, enforcement, and other administrative costs associated with environmental policies -- whether incentive-based or conventional -- can be significant barriers to effective implementation. One must be able to define and measure changes in polluting behavior and detect undesirable responses to policies, such as illegal dumping. Unless a policy is self-enforcing, enforcement mechanisms to ensure compliance are critical.

Just as command-and-control policies pose a distinctive set of problems, so too do market-oriented approaches. In general, these economic-incentive policies depend upon the existence of well-functioning markets. If the market for tradeable permits is thin, for example, or transaction costs are high, the outcome will be less cost-effective than anticipated. Firms must be able to identify potential trading partners, and regulatory constraints to trading must be minimal. Also, if permit markets are highly concentrated, we may achieve our environmental objectives, but not in a cost-minimizing fashion.

The first Project 88 report recommended the *selective* use of incentive-based policies. Project 88/Round II reaffirms the notion that no single policy approach -- whether market-based or command-and-control -- can solve all our environmental and resource problems. The real challenge is to choose the right policy for each job. Numerous opportunities exist to improve environmental protection and natural resource management with incentive-based policy reforms, but they must be assessed on a case-by-case basis.

This report has explored some promising alternative policies for several pressing environmental problems and offered some specific policy prescriptions, as in the case of implementing water markets and eliminating below-cost timber sales. On other issues, we have suggested alternative policies, with the final choice to depend on preconditions of international action (as for mechanisms to combat global climate change); the results of further investigations (as in the choice between tradeable recycling permits and deposit-refund systems for used lubricating oil); or the specifics of local market conditions (as in the case of unit charges for municipal solid waste

management). For these and the other policy proposals examined, we have tried to highlight the major challenges that must eventually be resolved for effective design and practical implementation.

In many respects, the real work lies ahead. Translating these and other good ideas into effective policies will require the active participation of all segments of the diverse environmental policy community. Policy makers -- at the Federal, state, and local levels -- must provide leadership to ensure that these options are given reasonable consideration in the appropriate contexts. Regulators, environmental activists, private industry representatives, and academic researchers can focus on issues highlighted in this report and begin hammering out the specifics of better environmental policies.

Over the past two years, we have witnessed dramatic changes in the political landscape of environmental policy. Legislators, bureaucrats, environmentalists, business persons, and citizens of all kinds have come to recognize that **market-based instruments belong in our portfolio of environmental and natural resource policies**. But as dramatic as these changes have been, they are only the first steps toward improved environmental policy. While the window of opportunity remains open, we must take up this challenge and continue to move ahead.