Date of Report: July 1, 1997
LCMR Work Program Update

I. Project Title: ENVIRONMENTAL INDICATORS INITIATIVE (J 1)

Project Manager:	Keith M. Wendt, Environmental Indicators Initiative Chair under EQB auspices
Affiliation:	Department of Natural Resources
Mailing Address:	Box 10, 500 Lafayette Road, St Paul, Minnesota 55155
Phone:	612-297-7879
Fax:	612-296-6047

A. Legal Citation: ML 95, Chp. 220, Sec.19, Subd. 7(a) .
Total Biennial LCMR appropriation: $350,000
Balance: $0

Appropriation Language: This appropriation is from the trust fund to the Commissioner of Natural Resources to create the framework for an integrated, statewide network for selecting and monitoring environmental indicators to assess and communicate Minnesota's environmental health status and trends. The work program must be submitted to the Environmental Quality Board for review before approval by the Legislative Commission on Minnesota Resources. Data compatibility requirements in Subdivision 15 apply to this appropriation.

B. Status of Match Requirement: There is no matching grant for this proposal.

II. Project Summary: Minnesota currently lacks a comprehensive strategy for environmental monitoring. Existing monitoring efforts address isolated problems and have never been unified to provide overall measures of ecosystem health. This project will create the framework for an integrated, statewide network for selecting and monitoring environmental indicators.

Environmental indicators are measurable features of ecosystems that provide evidence of environmental quality. Environmental indicators can be biological, physical, or chemical measurements (for examples of indicators see "Minnesota Environmental Indicators Initiative: A Report of the Minnesota Environmental Indicators Task Force" June, 1994, 20pp.) This project will focus on integrating disparate databases from various scientific disciplines in order to create indicators that best reflect the integrity of whole ecosystems. This "ecosystem approach" will improve on past monitoring efforts that were fragmented or focused only on limited properties of the ecosystem.

Based on information from the network, project participants will assess and communicate Minnesota's environmental health status and trends. This project will provide the first statewide framework for 1) understanding and forecasting ecosystem status and trends, 2) assessing the ability of ecological systems to provide resource benefits, 3) anticipating emerging environmental problems, and 4) monitoring progress in maintaining and restoring ecosystems. Environmental indicator information will provide a basis for decision-making that better protects and manages Minnesota's environment.

The Environmental Indicators Initiative will integrate data from existing environmental inventory and monitoring efforts (e.g., the Minnesota County Biological Survey, the Forest Bird Diversity Initiative, and Biocriteria Development for Minnesota's Rivers and Streams), and develop new environmental indicators. It will make more efficient use of available resources by promoting comparable data and consistent reporting. The project will assess the capability of applying federal environmental initiatives, such as EPA's Environmental Monitoring and Assessment Program (EMAP), to a level of resolution useful for Minnesota. The Environmental Indicators Initiative will broaden and consolidate a consortium of monitoring researchers in public and private agencies and academia. The eventual product is that consistent reporting of ecosystem status and trends will become routine in FY 98-99. The Environmental Quality Board will provide leadership and maintain consortium communications.

III. SUMMARY - 1st Biennium Progress, July 1995 - June 1997

During the first biennium, the EII Task Force, representing Environmental Quality Board Agencies, industry, academia and nonprofit conservation efforts, achieved consensus on an approach for a statewide environmental monitoring framework and related indicators. A formal *EII Communications Plan* identified important stakeholders necessary to obtain broad consent for the development and implementation of resulting indicators. An *EII Program Coordination Matrix* identified over 100 related efforts. This matrix was used to assist EII staff as they collaborated with and serve the needs of many statewide and local initiatives. The matrix also was used to help generate the list of participants who attended the first indicators workshop in April 1997. Specific progress by project objective follows:

Objective A. Review and Catalog Existing Environmental Data. -- A draft *catalog* of existing environmental monitoring databases *(Environmental Indicators Catalog of Databases and Information Sources, Version 1.0)* was completed. It included over 160 entries from more than 24 local, state, and federal agencies and non-governmental organizations. The catalog was reviewed by monitoring professionals to obtain feedback on its general format and completeness. As the EII workshop process identifies specific indicators, a more complete evaluation of the quality and quantity of environmental data with respect to comprehensive monitoring in Minnesota will be possible. The current version was shared (upon request) with several other initiatives (e.g. Forest Resources Council); additionally, it was distributed to all participants and observers attending the first EII indicators workshop in April 1997. Periodic updates will be issued as additional databases are identified.

Brief summaries of the extent and condition of Minnesota's air, groundwater, and major ecosystems were completed. The major ecosystems are agricultural, forest, lakes, prairie, rivers, streams, urban/developed, and wetlands. These summaries were designed to assist indicator development, and will be useful for participants of future workshops. Each of the summaries contained concise information on important ecological characteristics, benefits, pressures, status and trends, and major policies and programs relevant to the particular system. More *refined descriptions* also were completed for six selected ecosystems under Objective B. A reference library on indicator-related literature was established and a "Selected Bibliography" was created.

Objective B. Indicator Development and Ecosystem Descriptions -- Detailed *descriptions* of six ecosystems (i.e. agricultural, forest, lakes, wetlands, rivers & streams, and groundwater) were prepared. These were used to identify nearly six hundred *candidate indicators* for consideration by workshop participants. The first of four proposed indicator selection workshops was held in April 1997. This workshop, conducted in the Eastern Broadleaf Forest Province, involved 35 participants. The workshop focused on evaluating indicators proposed by EII staff and selecting indicators to measure progress on environmental goals for the Cannon River watershed. Specific products of the first workshop are listed in section B.1.f.

Objective C. Design Environmental Indicators Network -- Significant progress was made in establishing a preliminary, albeit informal, EII Network. The project was initiated with the development of an *EII Program Coordination Matrix* and a formal *EII Communications Plan* to identify and effectively communicate with key audiences and potential EII Network members. EII staff developed and disseminated hundreds of *informational handouts* describing the EII, its progress, and potential ways various customers might use indicators.

EII staff *targeted technical assistance* to several ongoing efforts to develop and apply environmental indicators in a management context. For example, at the state/policy level, staff collaborated with the Minnesota Planning Agency to anticipate potential application of the EII framework and resulting indicators under the Sustainable Development Initiative and future Minnesota Milestones reports. At the agency/programmatic level, staff provided ongoing assistance in potential application of environmental indicators by the Forest Resources Council, and assisted with the strategic planning processes of the Pollution Control Agency and Department of Natural Resources. At the local level, staff assisted with the "pilot" development and potential application of environmental indicators under the Dakota County Indicators project and Cannon River Watershed Partnership.

Several *color slide presentations* (abstracts available) reached many resource professionals and potential network members at statewide conferences, including Minnesota Conference on Sustainable Development, MN Waters '96, a joint annual meeting of the Society of American Foresters/American Fisheries Society/The Wildlife Society, and a regional conference on Sustainable Communities. Newsletter articles, press releases, a radio interview, and a recent segment on the cable television show "Environmental Journal" reached thousands of members of the general public. EII staff also initiated or participated in numerous *meetings with potential collaborators* and/or indicator users. A complete list is given in section C.1.f.

Task Force members provided valuable linkages to numerous national and international efforts. All these outreach activities expanded project support, improved project design, expedited review of existing information, and minimized duplication of effort. These activities provided critical insights that will help shape the development of the Environmental Indicators Network. An *action plan* to develop the EII Network, based on preliminary indicators and the aforementioned consultation with "pilot" projects, will be prepared as part of the progress report for the 1995-97 biennium.

IV. STATEMENT OF OBJECTIVES:

Objective A. Review and Catalog Existing Environmental Monitoring Data. Evaluate existing monitoring data for their potential to develop environmental indicators that assess ecosystem health statewide. Identify gaps in information and monitoring programs. And, broadly document in a summary report what is known about the extent and condition of Minnesota's ecosystems, the public benefits they provide, and the stresses that alter ecosystems.

Objective B. Develop Environmental Indicators and Descriptions for Selected Ecosystems Use data identified in Objective A to develop refined descriptions for selected ecosystem classes. From this, conduct regional workshops of resource professionals to develop core environmental indicators for selected ecosystems and identify additional information needed to improve existing monitoring efforts. Summarize information gathered to date in a report. For those ecosystems not selected during this project time frame, select candidate indicators that will serve as temporary environmental measures until other regional workshops can be held.

Objective C. Design the Environmental Indicators Network. Create an action plan for developing a statewide network of environmental indicator researchers, study areas, and yearly reporting mechanisms. This action plan will include a method to establish guidelines and standards for consistent and collaborative collection of data on environmental indicators. The action plan will outline potential incentives to researchers for adoption of the guidelines and standards.

Time line for Completion of Objectives

07/95 01/96 07/96 01/97 6/97

Objective A. Review and Catalog Existing Environmental Monitoring Data

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Objective B. Develop Environmental Indicators and Descriptions for Selected Ecosystems

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Objective C. Design the Environmental Indicators Network.

xxxxxxxxxxxxxxxxxxx

V. Objectives/Outcomes:

A. Title of Objective/Outcome: Review and Catalog Existing Monitoring Data.
A.1. Activity: Review and catalog existing environmental monitoring data. Evaluate their potential for developing environmental indicators that assess ecosystem health statewide. Identify gaps in information and monitoring programs. And, broadly document in a summary report what is known about the extent and condition of Minnesota's ecosystems, the public benefits they provide, and the stresses that alter ecosystems.

A.1.a. Context within the project: Historically, environmental monitoring has been narrowly focused on discrete ecosystem elements or on collecting regulatory compliance data such as pollutant discharge monitoring (Intergovernmental Task Force On Monitoring Water Quality, 1992). Emerging environmental issues (e.g., biodiversity, ecosystem health and sustainability) and high risk environmental problems such as non-point source pollution, toxic contamination of biota, and habitat alteration and overall loss of biodiversity require more holistic and integrated monitoring approaches aimed at entire ecosystems. An ecosystem approach should include the monitoring of chemical, physical and biological indicators of ecosystem health. These ecosystem-level information needs are currently unmet in the state. Reporting on the state of the environment requires that information on separate indicators be integrated into comprehensive report cards or "vital sign" measurements. The Environmental Indicators Initiative provides this comprehensive overview. The initiative is designed to better integrate existing monitoring efforts, identify gaps, and provide consistent reporting of environmental health trends on a statewide bases.

A.1.b. Methods: The project participants will produce a catalog of existing environmental sampling and monitoring projects that contains information relevant to Minnesota. This catalog will document existing environmental databases, previous and ongoing monitoring projects, and trend analyses conducted for specific environmental resources. The results will be used to develop a State of the Environment report and to begin the initial work on Objective B, the selection of core indicators for two ecosystem classes. The catalog will be developed by using the knowledge of project participants, by contacting existing researchers around the state, and by searching the available literature and monitoring data from a wide variety of sources.

The State of the Environment report will summarize the primary benefits obtained from the state's ecosystems and current environmental conditions and trends. The report will include information on environmental benefits, ecosystem properties, and environmental stressors. The report will be produced by the project participants with the assistance of graphics design professionals.

Other communications tools beside final reports will be developed as resources become available. Some of the tools under consideration include videos, slide shows, fact sheets and inserts into existing publications.

The Starting Point -- Ecosystem Delineation. The initiative will organize the assessment, evaluation, and reporting of environmental indicators by *BROAD ECOSYSTEM CLASSES and ECOLOGICAL UNITS*. At the broadest level of display we will use eight ecosystem classes:

forests, prairies, agroecosystems, urban/developed, wetlands, surface waters, large rivers, and small streams. To capture the complexity of these systems across the state, ecosystem classes will be organized geographically by Ecological Units as defined in Minnesota's *ECOLOGICAL CLASSIFICATION SYSTEM* (Hargrave 1993). Ecological Units are segments of the landscape that have relatively uniform climate, landform, and "natural" vegetative attributes, that cause them to behave and respond relatively uniformly and predictably. Large scale Ecological Units -- often referred to as ecoregions -- will be used as a tool to organize information on the selection and reporting of environmental indicators. This system will provide a scientific base and also a common language for practitioners of environmental indicator development. Note: This ecosystem delineation strategy is described in further detail in "Minnesota Environmental Indicators Initiative: A Report of the Minnesota Environmental Indicators Task Force." (June 1994)

General Descriptions of Minnesota Ecosystems. For each of the eight broad ecosystem classes, this initiative will broadly identify: 1) public benefits provided by each ecosystem class, 2) fundamental ecosystem properties from which benefits are derived, and 3) stresses associated with each ecosystem class (such as acid rain, exotic species, habitat alteration and destruction, and toxic chemicals) that undermine ecosystem properties and reduce the flow of benefits. A general, conceptual model showing the relationships between ecosystem properties, ecosystem stresses and human benefits will be produced.

Evaluation of Existing Environmental Monitoring -- Based on ecosystem conceptual models, defined above, we will catalogue relevant environmental monitoring data currently being collected, evaluate their suitability for developing indicators to assess ecosystem health, and identity environmental monitoring gaps. Evaluation of existing monitoring data will be based on its capability to answer three levels of questions:

1) *Ecosystem Extent Questions* -- the capability to describe the current extent and geographical distribution of a select ecosystem class.
2) *Ecosystem Condition Questions* -- the capability to describe the integrity or quality of ecosystems of a given class.
3) *Correlative Questions* -- the capability to establish correlations between ecosystem conditions and stresses.

For each ecosystem class, information will be organized under the following categories: 1) Legislative mandates for ecosystem protection/monitoring, 2) Ecosystem classification (data on ecosystem extent and type diversity), 3) Public benefits of ecosystems, 4) ecosystem properties (i.e., composition, structure and function), 5) Stresses to ecosystems, and 6) Potential ecosystem indicators. This compilation will result in a preliminary snapshot of the extent, distribution, and condition of each ecosystem class and our current capacity to monitor ecosystem health trends.

A.1.c. Materials: The participating agencies/organizations will provide office space, materials and computer equipment.

A.1.d. Budget:

Total Biennial LCMR Budget:	$180,000
LCMR Balance:	$ 0

A.1.e. Timeline:

	07/95	01/96	07/96	01/97	6/97
Monitoring data catalog	**********				
Preliminary ecosystem descriptions	**********				
State of the Environment Report			**********		

A.1.f Work program Update: Principal work activities and accomplishments related to this objective included coordination with ongoing projects, data cataloging, literature review and information gathering, and design and preparation of EII informational reports.

Communication Planning

1. A comprehensive communication needs assessment was completed by staff and the Task Force using state-of-the-art techniques prescribed by the Institute for Participatory Management and Planning.

2. A formal ***Communications Plan*** was developed to implement communication tools identified by the needs assessment and to establish effective communications with key stakeholders; the plan includes a matrix of potential stakeholders and issues. All communication efforts are designed to ensure long term support for indicator development and implementation.

3. Over one hundred key projects and/or programs with which the EII requires coordination were identified and relevant information about each were included in a summary table entitled ***EII Program Coordination Matrix***.

4. The Task Force prioritized key projects (see item 3 above) for initial coordination and assumed "liaison" responsibilities to all individual projects under the guidance of the Communication Plan; a ***Record of Contact*** form was developed to ensure systematic and coordinated outreach to all key stakeholders. Written information was provided as a result of approximately 70 specific requests.

Coordination with Existing Projects

5. A number of meetings and formal presentations were conducted with key stakeholders and projects to foster collaboration and identify available information on existing environmental monitoring databases and efforts. Key contacts included the following:

Environmental Indicators Team (PCA)
Basin Planning Initiative (PCA)
Ecological Classification System project (DNR)
County Biological Survey (DNR)
Natural Resources Inventory Information Committee (DNR)
Sustainable Waters Initiative (DNR)
Cannon River Watershed Partnership Council (Private/The Nature Conservancy)
Great Plains Partnership (Public/Private/Interagency)
Statewide Wetlands Conservation Planning (DNR/EPA)
U.S. Fish and Wildlife Service-Region 3 (USFWS)
Fond du Lac Grand Portage Mille Lacs and Red Lake Bands of Chippewa Indians
Indicator researchers (Univ. of MN)
Gap Analysis Program (GAP National Biological Survey)
U.S. Environmental Protection Agency REMAP-Region 5
Sustainable Development Initiative (EQB)
Forest Generic Environmental Impact Statement (DNR)
School of Public Health (Univ. of MN)
Water Resources Committee (EQB)
Comparative Risk Assessment (PCA)
American Fisheries Society
Society of American Foresters
The Wildlife Society
State Environmental Goals and Indicator Project (U of FL/EPA)
National Water Quality Assessment program (USES)
Lake Superior Cooperative (U.S./CAN)
Dakota County
Chippewa National Forest
Citizens for a Better Environment/Urban Advisory Council
Forest Resource Council

6. Environmental Indicator Initiative information was made available to a broader public. The EII was introduced on "Destination Outdoors", a live radio talk show based in St. Cloud and presented at the 1996 Minnesota Conference on Sustainable Development in October. Articles were published in the DNR Review and newsletter of the American Fisheries Society-MN. An EII segment was produced for the cable television show "Environmental Journal" by Media Rare in conjunction with the first EII workshop. EII information was provided on the Internet by the Great Plains Partnership. It will also be available in the DNR homepage (http://www.dnr.state.mn) in July 1997.

Data Cataloging

7. EII staff were Minnesota contacts to the nationwide State Environmental Goals and Indicators Project coordinated by the Florida Center for Public Management. The latter group provided a national summary of available databases and existing environmental indicators entitled "Environmental Indicators and Associated Data Sources Catalog" (3/96).

8. Sample database catalogs were obtained (e.g. USFWS) and were used in conjunction with data standards of the DNR, PCA and Land Management Information Center to refine screening and formatting criteria for EII data cataloging efforts.

9. Information on over 160 databases from 24 state and federal agencies and other organizations was obtained. Staff coordinated database cataloging efforts with the PCA Environmental Indicators Team and with the DNR Natural Resources Inventory Information Committee. This activity will facilitate identification of gaps in information and monitoring programs.

10. A draft database catalog was completed and reviewed by Task Force members, LCMR staff and members of the LCMR Research-Related Projects Peer Review Panel. The draft catalog was distributed to attendees of the first workshop. Efforts to identify, document and evaluate existing databases and monitoring efforts are ongoing. Updated versions of the catalog will be completed and distributed as appropriate.

Information Collection and Referencing

11. Literature reviews and searches of available material were completed to establish a reference library. Extensive files house hundreds of information items including the following: summaries of monitoring programs and databases at local, ecoregion, and statewide levels; ecosystem class files including social information on environmental benefits, and scientific references, reports and journal articles on ecosystem properties, stresses, and candidate indicators; prototypes of indicator selection processes and workshops; and example "State of the Environment Reports" from various states and Canada. This information will assist in the completion of the three work program objectives.

12. A comprehensive literature review to identify the human "values" and "benefits" provided by Minnesota's ecosystems was completed by the DNR librarian and EII staff. This information was summarized for use in indicator development and reporting.

State of the Environment Reporting

13. Numerous examples of "State of the Environment" reports from across the U.S. and Canada were gathered and reviewed by the Task Force to facilitate development of the Minnesota EII reporting format.

14. Brief summaries of the extent and condition of Minnesota's air, groundwater, and major ecosystems (agricultural, forest, lakes, prairie, rivers, streams, urban/developed, and wetlands)

were used to facilitate indicator development in the first EII workshop and will be used in subsequent workshops. Each of the summaries contained concise information on important ecological characteristics, benefits, pressures, status and trends, and major policies and programs relevant to the ecosystem. More *refined descriptions* also were completed for six ecosystems (agricultural systems, forest, lakes, rivers and streams, and wetlands) under Objective B (see below). These descriptions detailed the defining ecological characteristics, the benefits each ecosystem provides, the primary threats to ecosystem integrity and the major policy goals directing current management. They are a critical part of "State of the Environment" reporting and an integral part of EII workbooks for indicator development workshops (see below).

B. Develop Environmental Indicators and Descriptions for Selected Ecosystems

B.1. Activity: Use data identified in Objective A to develop refined descriptions for selected ecosystem classes. (The selection of ecosystem classes will depend on the findings in Objective A). From this, conduct regional workshops of resource professionals to develop core environmental indicators for selected ecosystems and identify additional information needed to improve existing monitoring efforts. Summarize information gathered to date in a report. For those ecosystems not selected during this project time frame, select candidate indicators that will serve as temporary environmental measures until other regional workshops can be held.

B.1.a. Context Within the Project: The purpose of this objective is to identify and validate a set of core indicators for selected ecosystem classes in the state. This identification and validation will be based on the information collected in objective A. The selected core indicators will be related to the public benefits that ecosystems provide to the citizens of Minnesota. Benefits will be organized under the following categories: aesthetic (e.g., scenery), ecological (e.g., biodiversity maintenance), economic (e.g., timber), health (e.g., water quality), historical (e.g., historic landscapes), public use (e.g., recreation), and spiritual (e.g., creative inspiration). (See "Classification System of Benefits People Receive from Ecosystems: A Report to the Minnesota Environmental Indicators Initiative Task Force, 1994).

Core indicators will be selected based on their ability to provide insights about the responses of ecosystem properties to the exposure of stresses and the resultant impacts on public benefits. This approach should provide the state with a more integrated view of its ecosystems, combining perspectives on public benefits with actual data on environmental conditions and stressors. This process will bring together a diverse group of resource professionals both inside and outside of government.

B.1.b. Methods: Project participants will develop environmental indicators for selected ecosystem classes. These indicators will be stratified by the state's ecoregions. (The long term goal is to develop a list of indicators that measure the integrity of each ecosystem class). Workshops will be held in a variety of Minnesota's ecoregions to identify core indicators of selected ecosystem classes.

Core indicators will be selected based on their ability to provide insights about the responses of ecosystem properties (e.g., species composition, habitat diversity, and hydrology) to the exposure

of stresses (e.g., pesticide application, pollution emissions, and land use changes) and the resultant impacts on public benefits (e.g., impaired recreational use and diminished ecological services such as water cleansing and flood protection). Note: These relationships are described in detail within an Environmental Indicator Task Force Report entitled "A Conceptual Model for Selecting and Communicating Environmental Indicators." (Sept. 1994) We will summarize our understanding of the relationship of stresses to ecosystem response indicators through a hypothesis, or ecological model, that will serve to guide the selection of the best indicators.

For each core ecosystem indicator, a fact sheet will be produced that clearly displays current data (or trends) in a graphical form along with interpretive statements about the present status of the indicator and what it tells us about ecosystem conditions and their ability to maintain societal benefits. The fact sheets will define the nature of the indicator, methodology for its collection, major assumptions, and its limitations.

There are several tasks in the strategy of analyzing data for the development and use of environmental indicators. First, information collected in the catalog and the State of the Environmental report needs to be summarized for use in the regional workshops. This also includes information related to environmental benefits that will be collected prior to the start of the project. The environmental data collected will be initially screened for accuracy, consistency, and applicability to the 3 questions raised in A.1.b. methods. Second, a series of 4-8 workshops involving resource professionals will be conducted around the state to discuss and then finalize a potential set of indicators for selected ecosystem classes. Conceptual models of the ecosystem -- describing potential relationships between environmental benefits, environmental stressors and ecosystem properties -- will be presented at these forums. These models will be tested at the workshops, which will lead to the identification of core environmental indicators for the selected ecosystems. The workshops will also be used to better refine our understanding of what we know about Minnesota's ecosystems and what more we need to know to provide a more complete picture.

For monitoring purposes, we need methods to translate environmental indicators into an understanding of the current status and trends in ecosystem health. This is accomplished by comparing the measured systems with benchmark systems, and determining the level of change. It will be important to be able to interpret not only the current value of environmental indicators, but the rates of change of environmental indicators over time. The latter will provide an understanding of the direction and rates at which ecosystem health is changing.

B.1.c. Materials: The agencies will provide office space, materials and computer equipment.

B.1.d. Budget:

Total Biennial LCMR Budget:	$164,000
LCMR Balance:	$ 0

B.1.e. Timeline:

	07/95	01/96	07/96	01/97	06/97
Ecosystem Descriptions			**********	**********	
Core Environmental Indicators				**********	
Environmental Indicator Fact Sheets				**********	
Regional Workshops		**********	**********		

B.1.f. Workprogram Update: Progress on Objective B included the following: review of indicator literature, compilation and evaluation of potential indicators, development of a conceptual framework for environmental indicator collection, analysis, interpretation, and reporting, criteria for indicator selection, and design of a regional workshop process to select appropriate indicators and the first workshop.

1. A preliminary design for regional EII workshops for resource professionals was developed. The EII consulted with several local ecosystem management projects (i.e. the Cannon River Watershed Partnership, the Phalen Chain of Lakes Comprehensive Watershed Management Project, and the Glacial Lake Agassiz Interbeach Area Ecosystem Stewardship Improvement Project). EII also provided guidance to and participated in the PCA indicator workshop held in March 1996. Such collaboration promotes interagency efficiency and ensures local applicability of statewide indicators.

2. A consultation session between several EII Task Force members and the nationwide State Environmental Goals and Indicator Project staff was conducted in March 1996 to assist compatible development of environmental indicators across state boundaries and across agencies.

3. A conceptual framework for indicator selection was developed. The framework emphasizes the role of ecosystems and their properties in the production of public benefits and the positive and negative impacts of human activities on the ability of ecosystems to sustain those benefits. The framework operationally defines ecosystem integrity in terms of critical ecosystem properties and provides guidance for development of an integrated monitoring scheme.

4. Potential indicators for wetlands, forests, rivers and streams, agroecosystems, lakes, prairies, urban/developed areas, air, surface water and groundwater were compiled. Criteria to assist in selection of core indicators were drafted.

5. A general workshop design was created following consultation with groups located in the Nerstrand Big Woods, Dakota County and the Twin Cities urban area (the Citizens for a Better Environment, CETAP) and the first regional workshop was conducted in the Big Woods and Oak Savannah Ecoregions. The workshop addressed all ecosystem classes but focused on those ecosystem classes and management issues of greatest significance to the Eastern Broadleaf Forest Province.

6. An *EII Indicator Development Workbook* was produced for use by participants in regional EII workshops to select core indicators. The workbook describes the EII approach to selecting and

reporting environmental indicators and contains *brief summaries* of Minnesota's air, groundwater, and major ecosystems (agricultural systems, forests, lakes, prairie, rivers, streams, urban/developed, and wetlands). These summaries contain concise information on important ecological characteristics, benefits, pressures, status and trends, and major policies and programs relevant to the ecosystem. The workbook contains detailed characterizations of 6 ecosystems (agricultural systems, forests, lakes, rivers and streams and wetlands). There is also a matrix of potential indicators for specific ecosystems, a reference list of environmental indicator articles and information, and a environmental database catalog.

7. A subcontract for preliminary indicator testing and validation was initiated with the Natural Resource Research Institute.

8. Prototype **Indicator Fact Sheets** were drafted for potential indicators (e.g., the Index of Biological Integrity, groundwater nitrate concentrations). Fact sheets communicate background information about the indicator, suggested methods of measurement and potential problems that might be encountered during implementation. Fact sheets on potential indicators will aid participants in future workshops in evaluating and selecting core indicators and serve as tools for the users of indicators.

C. Design the Environmental Indicators Network

C.1. Activity: Create an action plan for developing a statewide network of environmental indicator researchers, study areas, and yearly reporting mechanisms. This action plan will include methods to establish guidelines and standards for consistent and collaborative collection of data on environmental indicators. The action plan will outline potential incentives (monetary and others) to researchers for adoption of the guidelines and standards.

C.1.a. Context within the project: The state of Minnesota, the federal government, university researchers and other researchers are currently collecting large amounts of data related to environmental conditions and trends. The challenge for a state-wide indicators project is to harness this information and the efforts of the researchers into a more cohesive initiative. A better method of collecting and reporting current research results is required if long-term trends are to be analyzed and if valid causal relationships are to be identified.

C.1.b. Methods: The project participants will develop an action plan for establishing a statewide network of researchers and a set of standards and guidelines for data collection and reporting. Consent among project participants will be developed on an integrated, statewide sampling network. This approach will provide standards and guidelines to ensure that participants use comparable field methods to obtain comparable data on environmental indicators. This will allow aggregation of data into regional and state reports. To foster consistency of data collection activities, a training program for participants should be proposed in the action plan that includes curriculum for agencies as well as for public and volunteer organizations. The network will be initiated in FY 96-97 and will be fully consolidated beginning in FY 1998.

C.1.c. Materials: The agencies will provide office space, materials and computer equipment.

C.1.d. Budget:

Total Biennial LCMR Budget: $6,000
LCMR Balance: $ 0

C.1.e. Timeline:

07/95	01/96	07/96	01/97	06/97
Action Plan			**********	

C.1.f. Work program Update: Significant progress was made in establishing a preliminary EII Network.

The *EII Program Coordination Matrix* identified key audiences and potential EII Network members and a formal *EII Communications Plan* facilitated communication with them. EII staff responded to dozens of *requests for information* with *informational handouts* describing the EII, its progress, and potential ways various customers might use indicators.

EII staff *provided technical assistance* in applying environmental indicators in several management contexts. Staff collaborated with the Minnesota Planning Agency to anticipate application of the EII framework and resulting indicators under the Sustainable Development Initiative and future Minnesota Milestones reports, provided ongoing assistance in application of environmental indicators by the Forest Resources Council, and assisted with the strategic planning processes of the Pollution Control Agency and Department of Natural Resources. Staff also assisted with the "pilot" development and application of environmental indicators under the Dakota County Indicators project and Cannon River Watershed Partnership.

Several *color slide presentations* (abstracts available) reached many resource professionals and other potential network members at statewide conferences, including Minnesota Conference on Sustainable Development, MN Waters '96, a joint annual meeting of the Society of American Foresters/American Fisheries Society/The Wildlife Society, and a regional conference on Sustainable Communities. Newsletter articles, press releases, a radio interview, and a recent segment on the cable television show "Environmental Journal" reached thousands of members of the general public.

EII staff also initiated or participated in numerous *meetings with potential collaborators* and/or indicator users, including:

Cannon River Watershed Partnership
Community Environmental Technical Assistance Program, CBE
Dakota County Indicators Project
DNR Region 4 and 5 ecosystem pilot project
Forest Resources Council
Forest Resource Management Partnership
Great Plains Partnership
Green Mountain Institute, VT

Lake Superior Binational Program Indicators project
Minnesota Milestones, MPA
Minnesota Sustainable Communities Network, OEA
Minnesota Wetlands Conservation Planning project
MPCA Indicators Project
MPCA Comparative Risk Project
Sustainable Agriculture Program, MDA
Sustainable Development Initiative, EQB
USEPA State Environmental Goals and Indicator Project, FL
USEPA Regional Environmental Monitoring and Assessment Program, Duluth
U.S. Fish and Wildlife Service (Region 3)
Water Resources Committee, EQB
Western Center for Environmental Decision-Making, CO

Task Force members provided valuable linkages to numerous national and international efforts. All of these outreach activities expanded project support, improved project design, expedited review of existing information, and minimized duplication of effort. These activities provided critical insights that will help shape the development of the Environmental Indicators Network.

An *action plan* to develop the EII Network, based on preliminary indicators and the aforementioned consultation with "pilot" projects, is part of an EII information document, *Developing Environmental Indicators for Minnesota: A Summary Report*. The major steps in network development following indicator selection are: 1) coordinate data collection organizations and capabilities, 2) establish common measurement protocols, 3) establish data processing and interpretation protocols, 4) facilitate information exchange among data collecting organizations. Public dissemination of indicator information is an integral part of each step.

VI. Evaluation

The Environmental Indicator Task Force developed guiding principles for selecting, collecting and reporting of environmental indicators. These principles are long-term and idealistic. Some of these principles are targets that may not be realized in the foreseeable future, but they provide a goal towards which the project will be directed. This project will be evaluated based on whether the project deliverables were completed and whether the guiding principles were followed.

Long-term Guiding Principles

Environmental Indicators:

1. Indicators enable resource managers and policy makers to develop ecosystem-based management strategies to protect the environment.
2. Indicators help characterize the benefits people receive from ecosystems, and recognize the relationship between ecosystem health and human health.

3. Indicators are part of a unifying framework that enables the monitoring and integration of chemical, physical and biological indicators of ecosystem health.
4. Indicators are understandable to the public.
5. Indicators provide a general measure of ecosystem quality and possess diagnostic capabilities for determining specific causes of ecosystem degradation.
6. Indicators are practical, meaningful and easily collected and measured using methods compatible with a standardized framework.

Environmental Indicators Initiative:

1. The initiative has a commitment to long-term support for monitoring indicators.
2. The initiative fosters cooperation and information exchange among representatives of all environmental monitoring interests. The initiative must review existing information and databases on indicators, and identify and prescribe strategies to fill gaps.
3. The initiative is tied to strategic planning activities allowing for effective evaluation of long-term environmental protection goals.
4. The initiative provides a process for the annual compilation, production, and dissemination of environmental indicator reports. Information on indicators must be readily accessible through databases.
5. The initiative is both practical and scientifically sound; the initiative must not underestimate or oversimplify the complexity of ecosystems and the difficulty in measuring ecosystem health or integrity.

VII. Context within field:

National Context

Many organizations, including the U.S. EPA, National Biological Survey, U.S. Forest Service, U.S. Geological Survey, universities and many state environmental agencies, are currently investigating the use of environmental indicators. A number of national multi-agency task forces are also working to build consistency among the efforts and to share information on the current state of indicator projects.

The Environmental Indicators Initiative in Minnesota operates within this national context. The information we generate will contribute to a picture of the overall health of the nation's environment. We will also learn from the national context since a substantial portion of environmental information is collected by federal agencies and their partners. The Minnesota initiative intends to participate in and learn from these national efforts in order to avoid previous pitfalls and to build upon the successes of other efforts. In this age of regional and national environmental problems, i.e., problems without boundaries, participation in an analysis of these national/regional problems is essential if we are truly to come to grips with the problems that emerge within the state.

standards and guidelines. Budgets for future biennia will be dependent on findings at the end of the project's first biennium.

XI. Cooperation

Project Staff	Affiliation	Time commitment
Paul Pajak, Project Coordinator	DNR/PCA	100%
Clarence Turner, Project Ecologist	DNR/PCA	100%
Laura Preus, Research Assistant	DNR/PCA	50%
Charlotte Bryant, Research Assistant	DNR/PCA	25%

Project Cooperators			Agency Contributions
Keith Wendt	DNR	LCMR Project Manager	15%
Paul Schmiechen	PCA	Cooperator	5%
Kim Chapman	TNC	Cooperator	5%
Mark Zumwinkel	MDA	Cooperator	5%
Dan Symonik	MDH	Cooperator	5%
Lee Pfannmuller	DNR	Cooperator	5%
Carl Richards	NRRI	Cooperator	5%
George Host	NRRI	Cooperator	5%
Mohamed Elnabarawy	3M	Cooperator	5%
Tim Kelly	DNR	Cooperator	5%
Kurt Rusterholz	DNR	Cooperator	5%
Paul Toren	EQB	Cooperator	5%

XII. Reporting Requirements

XIII. Required Attachment: