NATIONAL GEOLOGIC MAPPING ACT OF '92

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON RESOURCES HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

ON

H.R. 3198

TO REAUTHORIZE AND AMEND THE NATIONAL GEOLOGIC MAPPING ACT OF 1992, AND FOR OTHER PURPOSES

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NATIONAL GEOLOGIC MAPPING ACT OF 1992

TUESDAY, APRIL 23, 1996

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES, COMMITTEE ON RESOURCES,
Washington, D.C.

The subcommittee met, pursuant to call, at 2:06 p.m., in room 1324, Longworth House Office Building, Hon. Ken Calvert [chairman of the subcommittee] presiding.

STATEMENT OF HON. KEN CALVERT, A U.S. REPRESENTATIVE FROM CALIFORNIA, AND CHAIRMAN OF THE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

Mr. CALVERT. The committee will come to order. The subcommittee meets today to take testimony on H.R. 3198, a bill to reauthorize and amend the National Geologic Mapping Act of 1992, and for other purposes.

The "father" of the 1992 Act is former Chairman Nick Rahall of West Virginia. His ranking member then was Barbara Vucanovich so I guess she would be the "mother" of the Act. Both are cosponsors of my bill to reauthorize this important program.

The 1992 Act established a cooperative mapping program at institutions of higher education in the U.S. in partnership with the United States Geological Survey and the 50 State surveys. The goal of the program was then and remains today the acceleration of detailed geologic mapping of critical areas in the Nation by using the combined talents of the three participatory groups.

Detailed geologic mapping provides basic information for solving a broad range of problems. These include the delineation and protection of sources of safe drinking water, environmental system understanding, and foundations of ecosystems management; identification and mitigation of natural hazards, such as earthquake-prone areas, volcanic eruptions, landslides, and other failures, and many other land-use planning requirements; and assessment of coal, petroleum and natural gas, construction materials, metals, and other natural resources.

The critical areas have been identified at State level by State-Map Advisory Committees. These critical areas include Federal, State, and local priorities. Only about one-fifth of the Nation is mapped at a scale adequate to meet these needs. Reauthorization of the '92 Act will allow Federal, State, and academic interests to continue to address these needs cooperatively.

Funding for the program is incorporated in the budget of the U.S. Geological Survey. State Geological Surveys and University participants receive funding from the program through a competi-

tive proposal process that requires 50/50 matching funds from the applicant, ensuring the value of each proposal is weighed against its cost in Federal and State appropriated funds.

As I have said often during my brief tenure as Chairman, finding the proper balance between the Federal and State and local government agencies in program areas within our jurisdiction is of paramount interest to this subcommittee, as well as to the Chairman, Chairman Young, of the Full Committee, and indeed the leadership of the 104th Congress.

I believe the reauthorization of this cooperative program at participation levels agreed upon between the State Geological Surveys acting collectively with the U.S. Geological Survey demonstrates a visible commitment from the Administration to this goal and one I would like to see repeated in other legislation we have pending but which we have not yet received Administration agreement as yet.

Mr. CALVERT. Before I turn to ranking member, Mr. Abercrombie—I am sure he will be here pretty soon—for any opening statement he may wish to ask, let me collectively welcome today's witnesses who have joined us as far away as the Bay area of my State of California, as well as Idaho, Tennessee, Virginia, and Maryland, which proves this certainly is a National program.

While we are waiting for Mr. Abercrombie, who I will give the time to give his opening statement when he arrives, why don't we go ahead and introduce our first panel to give their testimony. First, Dr. P. Patrick Leahy, Chief Geologist of the U.S. Geological Survey; Dr. Robert D. Hatcher, President of the American Geological Institute; and Dr. Earl H. Bennett, State Geologist and Associate Director, Idaho Geological Survey.

If you would like to come on up and take your seats at the table and begin your testimony. And when Mr. Abercrombie arrives, we will accommodate him for his opening statement. First, I would like to introduce Dr. P. Patrick Leahy, the Chief Geologist, U.S. Geological Survey, for your statement. Doctor?

STATEMENT OF DR. P. PATRICK LEAHY, CHIEF GEOLOGIST, U.S. GEOLOGICAL SURVEY

Mr. LEAHY. Thank you. Mr. Chairman, I am pleased to be here today to express the Administration's support for H.R. 3198, a bill to reauthorize the National Geologic Mapping Act of 1992. I appreciate the opportunity to review the progress made under the Act since 1992 and to outline the goals that we are setting through the reauthorization.

Geologic maps and digital geologic map layers are the cornerstone of the U.S. Geological Survey's mission. These are spatial data bases that show the distribution of rock, soil, water, energy, and mineral resources at or near the earth's surface. Geologic maps address each of the four themes of the USGS's mission. Those themes include information, hazards, resources, and the environment.

Geologic maps are the best means to collect and convey the geologic information that is essential for reducing losses from earthquakes, volcanic eruptions, landslides, floods, and natural and manmade contamination. The maps are essential for identifying

areas that will be affected most by hazards and for projecting economic losses that will result from these hazardous events.

Maps are essential for exploring, identifying, and cataloging the nation's natural resources such as water supplies, construction materials, fertilizers, metals, coal, petroleum, and natural gas. And, certainly, geologic maps are essential for recording the extent of natural variation in the geologic record to provide a scientifically credible baseline for public policy on development and environmental issues.

The National Cooperative Geologic Mapping Program, which is authorized by the National Geologic Mapping Act of 1992, produces geologic maps needed by the public and private organizations. Fiscal constraints at all levels of government require that a broad range of stakeholders determine priorities for these geologic products. Toward that end, all who produce and use geologic maps must work cooperatively to maximize each other's strengths and to avoid duplication.

It is often said that cooperative efforts of a group exceed the sum of individual efforts. Today, I would like to cite some examples of how activities under the National Geologic Mapping Act are applying such a cooperative and synergistic approach with other Federal agencies, with the States, with universities, and with the private sector as partners.

The National Geologic Mapping Program is now named the National Cooperative Geologic Mapping Program. This appears to be a small change in name but is a significant change in that it recognizes the strong partnering aspects of the program with the State Geological Surveys, with academia, with groups like the National Park Service, and other Federal and private sector agencies. I would like to use some exhibits as part of my presentation, and they are included in my written testimony also.

The National Cooperative Geologic Mapping Program is implemented through four principal components. The first component is known as EDMAP which ensures the training of students in the production of geologic maps. In 1996, cooperative matching fund agreements are being made with 37 universities to support geologic mapping projects across the nation. This is demonstrated in the top exhibit. (Exhibit 1 and 2)

The second component of the program is called STATEMAP. This is a matching funds cooperative program with the States. The STATEMAP component was increased from only 6 percent of total funds in 1995 to a minimum of 20 percent of appropriated funds in 1996. Cooperative agreements are being made with 42 States to help support 60 geologic mapping projects around the nation. And, again, Exhibit 1 shows the distribution of projects among States.

The USGS continues to be active in executing and supporting geologic mapping through the third and fourth components of the program called FEDMAP and SUPPORTMAP. As a result of input from stakeholders and partners, and Exhibit 2 shows where these types of studies are conducted. The program has evolved from a large number of essentially one person projects that focused on rural and wilderness areas to integrated cooperative projects with stakeholders in urban areas. These urban areas are particularly

important because this is where competing land use decisions can benefit most from improved geologic map information.

I would like to highlight two examples of these studies. The first is the Southern California Areal Mapping Project, and it is an example of one of the 12 FEDMAP/SUPPORTMAP projects. This study is being done cooperatively with the California Division of Mines and Geology and is centered on the Los Angeles urban area covering most of southwestern California.

Exhibit 3b. Shown on the exhibit, clients are numerous and varied, ranging from the U.S. Military and National Park Service to local water management districts. And you can see our partners listed on the exhibit. The project is involved in mapping the geometry of groundwater basins, tracking contaminant plumes, mapping limestone and aggregate building resources, helping site a dam between two strands of the San Andreas Fault, and helping map earthquake faults in the vicinity of a new reservoir, which, when completed, will be the largest water-retention structure in southern California.

I would like to highlight another study, the Middle Rio Grande Basin Project, which is shown in this exhibit. (Exhibit 4) This is a new integrated effort that involves all four components of the National Cooperative Geologic Mapping Program, as well as other Divisions within the U.S. Geological Survey. This study is being undertaken in cooperation with the New Mexico Bureau of Mines and Mineral Resources, local water agencies, and universities.

This project will provide a geologic framework and a geologic map data base for investigation of the Middle Rio Grande Basin, a region that includes extensive Federal lands, as well as the principal urban centers of New Mexico. You will note in the middle of this diagram in the Albuquerque area there is a prominent bull's-eye that shows a severe depression in the water table that is expected to develop beneath Albuquerque during the next two to three decades unless new water supplies are found or development is carefully managed.

This cooperative geologic mapping effort, and associated contracted geophysical surveys, will provide the three dimensional framework for the region that is critical to identifying the extent of groundwater resources in the area. This information will serve as a guide for future development decisions.

In conclusion, Mr. Chairman, I would like to state for the record that the National Geologic Mapping Act of 1992 has been instrumental in helping focus more attention on the nation's need for a systematic, high quality, geologic map data base to serve as the primary underpinning for virtually all applied and basic earth science investigations.

The Administration supports reauthorization and urges bipartisan support. Thank you, Mr. Chairman, for the opportunity to express the views of the U.S. Geological Survey on the benefits of the current Act and the value of reauthorizing this program. I would be happy to respond to any questions you may have.

[The prepared statement of Mr. Leahy may be found at the end of hearing.]

Mr. CALVERT. Thank you, doctor, for your testimony, and I will have some questions for you later. Dr. Hatcher, President of the American Geologic Institute. Go ahead and give your testimony.

STATEMENT OF DR. ROBERT HATCHER, PRESIDENT, AMERICAN GEOLOGIC INSTITUTE

Dr. HATCHER. Mr. Chairman, good afternoon. I appreciate the opportunity to present testimony in support of H.R. 3198 and the efforts to reauthorize the National Geologic Mapping Act of 1992. I have spent most of my professional career either making geologic maps, teaching others to make geologic maps, and reviewing the geologic maps and related work of others. I, thus, am testifying both as a representative of academia and as the current President of the American Geological Institute.

Let me begin by commending you for introducing this important piece of legislation. Reauthorization of the National Geologic Mapping Act sends a strong message that geologic maps are of National importance. It also sends a strong message of the importance of partnerships needed to maximize the impact of scarce Federal dollars these days.

This program has the potential to be one of the best examples of partnering between the USGS, State Geological Surveys, and Academic Institutions. But the partnerships authorized in the original Act have received only partial funding to date. I hope that by reauthorizing this Act Congress will also be encouraged to increase support for the cooperative elements of this program.

My main purpose here is to address the EDMAP component and the promise that it represents. EDMAP has two components: to provide education and experience for young scientists in field geology and to provide useful data through the States and through the geological surveys to the States.

Despite the fact that this is the smallest funding component in the program, EDMAP has the potential to deliver the greatest long-term benefit by providing valuable experience and training for the next generation of field geologists. From the relatively small amount of funding hopefully to be provided in 1996, along with that recently provided by STATEMAP, the cooperative program has already built new bridges and repaired some old ones between academic institutions and Federal and State agencies where the need for geologic maps has long been recognized.

It is critically important that the Administration and Congress work together to fully fund EDMAP and ensure that we will continue to have a cadre of trained mappers ready to tackle the problems of the next century. Not only is it imperative that we continue to train geologists to gather the data to construct geologic maps, but we also must continue to train all who want to become geologists to understand the field relationships portrayed in geologic maps because the laboratory of our science is the crust of the earth, and accurate geologic maps are the most fundamental data set by which the crust can be portrayed.

Unfortunately, there is a trend today toward less field and more indoor laboratory oriented geologic research in most of academia. Full funding of EDMAP will help reverse this trend. As noted above, the EDMAP component has been slated for funding at the

level of around $360,000 for the first time ever in fiscal year 1996 in conference report 104.402.

Contractual awards will be made through a competitive peer review process, and this year I served as a member of the selection committee. Proposals were received from universities in 34 States. These proposals included, for example, construction of new geologic maps in parts of the rapidly growing Albuquerque, Phoenix, and Atlanta metropolitan areas. Students will gain firsthand experience in identifying problem areas for regional planners and developers, as well as for engineers involved in major construction projects.

I want to emphasize that the EDMAP component of the National Cooperative Geologic Mapping Program, like the cooperative STATEMAP component, involves contractual agreements to universities and colleges that contain clear deadlines and deliverables, along with a required cost-sharing component and a requirement for coordination with the specific needs identified by either State or Federal geological surveys.

We strongly support these attributes of the program and feel that they will contribute to its ultimate success. I appreciate the opportunity to present my views to the subcommittee and would be pleased to answer any questions or to provide additional information for the record. Thank you.

[The prepared statement of Dr. Hatcher may be found at the end of hearing.]

Mr. CALVERT. Thank you, doctor. Next, Dr. Earl Bennett, State Geologist and Associate Director, Idaho Geological Survey. Doctor?

STATEMENT OF DR. EARL H. BENNETT, STATE GEOLOGIST AND ASSOCIATE DIRECTOR, IDAHO GEOLOGICAL SURVEY

Dr. BENNETT. Congressman Calvert, I also have the pleasure this year as serving as the President-elect of the Association of American State Geologists, otherwise known as AASG. Our membership consists of the State geologists from all 50 States and Puerto Rico.

In contrast to the many contentious issues currently facing our nation, it is a pleasure to report to you today about a modest Federal program that is working well and with your reauthorization will continue to serve our nation's needs into the next century. I am speaking of the National Geologic Mapping Act which was passed by Congress and signed into law in 1992.

The purpose of this Act is simple. It is to map the geology of the United States as a cooperative Federal-State effort based upon a combination of National and State mapping priorities and to ensure that new geologic mappers will be trained to continue this task in the coming years.

I will not reiterate all of the specifics as to why we need geologic maps. Our written testimony covers this adequately, but perhaps a quote from a recent press release by Secretary of the Interior Babbitt will serve as a good summary. And I quote, "Geologic mapping represents the backbone for virtually all applied and basic earth science investigations."

Simply put, and true, and the State geologists would add that the importance of geologic mapping goes far beyond just the earth sciences. Imagine trying to understand why certain trees or crops grow better in some areas than others without knowing the phys-

ical properties of the plant soil and the source of that soil and the underlying rocks.

Would you even try to understand how leaking gasoline from an underground storage tank is moving into your groundwater without knowing anything about the geologic materials surrounding the leak? Or try and explain to a citizen why he can't build his house on a segment of the San Andreas Fault in California without a geologic map showing where the fault goes?

And certainly I do not need to remind this committee of the demand for geologic maps by all facets of our mining industry who provide the minerals and materials that are so critical to our domestic economy and quality of life.

So having established that geologic mapping is fundamental to many human endeavors, where do we stand in our mapping efforts? Well, unfortunately, we are not in very good shape. Only about 20 percent of the country is mapped at the scale of the standard 7.5 minute topographic quadrangle.

To remedy this situation, the U.S. Geological Survey and AASG began working on passage of the National Mapping Act. Fortunately, we were successful and today the program contains the three key elements: FEDMAP, the USGS's geologic mapping program, which is nationwide in scope; STATEMAP, a competitive grassroots program to provide funds for the State Geological Surveys to do geologic mapping; and EDMAP, a modest program to train future geologic mappers at our colleges and universities.

I would like to comment on STATEMAP which is the part of the Act which is nearest and dearest to the State surveys. How does it work? The first part of the answer is that this is truly a grassroots program. Each participating State must have a map advisory committee comprised of experts in the State who help the State geologists prioritize their States' mapping needs.

Each survey then submits a proposal to a peer-review committee of State and U.S. Geological Survey geologists. This committee evaluates the proposals and makes competitive awards of Federal dollars to the States. And the best part here is that each Federal dollar is matched dollar for dollar or better by the States. Upon completion of a contract, the States submit their final map products to the USGS. All of these maps will eventually be added to a standardized digital National geologic map data base.

What are the tangible measurements of this program's success? Since the first year's funding, we have invested about $7.4 million in Federal funds matched with an equal amount of State funds. Forty-six States have participated in the program since 1992. Hundreds of 7.5 minute quadrangles have been mapped. We believe it is hard to find another Federal-State program that has had this degree of success for such a modest investment.

I would be greatly remiss if I did not recognize the importance of the U.S. Geological Survey to this program. Director Eaton, although faced with a reduction in force and the possibility of serious budget cuts, made the decision to up the ante for STATEMAP in fiscal year 96' from 1 million to $4 million.

We have made numerous improvements in the STATEMAP proposal process in defining the overall program, thanks, in part, to Dr. John Sutter and Arthur Shultz with the U.S. Geological Survey

who are the program coordinators at the present time. So there we have it. The States get to address their most pressing geologic mapping needs and at the same time a National data base is prepared for the USGS and other Federal agencies.

Just how important is this program to the States? Our written testimony contains Affidavits from 27 State geologists pointing out the direct impact and importance of the National Mapping Program to their States.

So in this brief perspective from the State Geological Surveys, I ask you on behalf of the Association of American State Geologists to reauthorize the National Geologic Mapping Act of 1992 as described in House Bill H.R. 3198. This is a program which is benefiting the entire nation and fulfilling an important Federal mandate. Thank you for the chance to testify at these proceedings.

[The prepared statement of Dr. Walt Schmidt may be found at the end of hearing.]

Mr. CALVERT. Thank you for your testimony. This is one of those happy times where I think everyone is in agreement that we want to reauthorize this. As a matter of fact, Dr. Leahy, this is a historic day because this is the first time that the Administration has—the Department of Interior has come forth and supported us on the subcommittee on the outset. So I am very grateful for your support and look forward to moving this bill as quickly as possible.

On page two of your written testimony, you mentioned the word metadata to be made available over the Internet. Just what do you mean by the term metadata? I am trying to keep up with all these new acronyms here in Washington.

Mr. LEAHY. Well, metadata is that information that goes with the data that explains—gives more detail in terms of where it came from and what it means. So instead of simply being a number, there is some background information that supports that information.

Mr. CALVERT. Like I said, I am trying to stay up on the information highway here so that is important. I understand before you became the Chief Geologist at the USGS that you served in the Water Resources Division of the agency. And, of course, southern California water is important out there, and you were very perceptive in bringing some maps from southern California.

Mr. LEAHY. Lucky guess.

Mr. CALVERT. And I know they emphasize the cooperative program of the State and local governments in that program area. But in the water cooperative program, usually State or local funds are matched against Federal dollars to put USGS scientists to work, whereas the matching funds in this program are to put State survey scientists and academics to work making geologic maps. What is your view of the cooperative programs in general? And does the matching funds requirement mean that the programs get more scrutiny before approval of those projects do you believe?

Mr. LEAHY. Well, this particular program is peer reviewed as you said in your opening remarks. So there is a real partnership in terms of setting priorities, and I think that is particularly healthy so with the limited resources that we have, we attack the most important problems.

Mr. CALVERT. OK. This question I want to ask to the entire panel and the sign of a sensitive subject—the word privatization which is used quite a bit around here, obviously, in this Congress and contracting out, and the mapping work on an ongoing basis between the topological mapping area, ARM, the USGS, and the private sector aerial survey and photo mapping firms, are any of the functions of this bill of the 1992 Act it seeks to reauthorize susceptible to being done more efficiently through bidding out to private consultants or left to the private sector to perform completely on a profit basis? Any comment from any of the three of you? Yes, sir.

Dr. BENNETT. Mr. Chairman, I would be glad to comment on that. There are, of course, a number of private firms that do geologic mapping, and perhaps the best known ones would be mining companies, for example. They map usually very small, specific areas and almost always all of their information is held proprietary.

The purpose of this program, of course, is to provide a general overall geologic framework for the United States. There is nothing in the private sector that does this particular type of work. Now, are we utilizing privatization in our program? Well, very much so. Many of the States under the STATEMAP program hire outside geologists—outside of their own organization to do the mapping.

And one of the reasons it is so efficient is we can hire a lot of university professors, for example, in the summertime just for the summertime at a relatively low cost who are very, very good geologic mappers. And almost all the States that are involved with this program are doing exactly that.

So by our way of thinking, we are, in effect, trying to privatize parts of this program, but on the larger scale, there are no overall entities that are interested in doing this particular type of work.

Mr. CALVERT. I am glad you are keeping those college professors busy. It seems like down here they all run for Congress eventually. With that, I want to introduce the ranking member, Mr. Abercrombie from Hawaii.

Mr. ABERCROMBIE. Well, thank you very much, Mr. Chairman. My apologies for not being here right at the very beginning. Mr. Chairman, I want to congratulate you on introducing the bill, and with your permission, I would like to submit a statement to that effect and amplifying my remarks.

Mr. CALVERT. Without objection.

Mr. ABERCROMBIE. And I think that will cover it. I have no questions or anything at this point.

[The prepared statement of Hon. Neil Abercrombie follows.]

STATEMENT OF HON. NEIL ABERCROMBIE, A U.S. REPRESENTATIVE FROM HAWAII

I am pleased that the Chairman has introduced H.R. 3198, a bill to reauthorize the National Geologic Mapping Act of 1992. I supported enactment of the 1992 Act and I support H.R. 3198 and intend to add my name to the list of cosponsors calling for the reauthorization of the program. It is particularly agreeable to be considering legislation that would extend a USGS program since over the past two years we have had to fight off a Republican attempt to abolish this fine and valuable agency.

Geologic mapping is needed in our society for many worthwhile purposes, including emergency preparedness, environmental protection, land-use planning, and resource extraction. These maps are also especially practical tools for people who are trying to mitigate natural hazards—such as the volcanoes we experience in my home State of Hawaii.

Unfortunately, over the years, the need for geologic maps has grown steadily while map production has not kept up. As we consider reauthorization of the 1992 Act during Earth Week, we should bear in mind that the earth provides the physical foundation for our society—we live upon it and we use its resources. Therefore, we need to work toward a better understanding of Earth's resources and potential dangers.

Geologic maps are one effective way to convey the earth-science information needed for better understanding and decisionmaking by all of us—Federal agencies, State and local governments, private industry, and the general public alike.

The National Geologic Mapping Act of 1992 authorized a National program of geologic mapping to be accomplished through partnership with State geological surveys, academia, the private sector, and the USGS. This kind of partnership is essential to develop the extensive amount of information needed across the National for informed decisionmaking. This kind of legislative proposal is exactly the kind of progressive approach that the American people want from their Federal Government.

The National Geologic Mapping Act of 1992 provides intriguing challenges to institutions with responsibility for mapping the geology of our Nation. One challenge is to reinforce partnerships in geologic mapping and to reinvigorate geologic mapping among all geological surveys. A second challenge is to develop methods of accelerating geologic mapping and publication of geologic maps. Another major challenge is to develop new methods of clearly presenting geologic map information to an expanding, map information for effective policy making at all levels of government. An effective partnership among all participants in the geologic mapping program is the key to meeting these challenges successfully.

I am happy to join my colleagues in consideration of legislation that will extend this program for another five years and look forward to hearing the testimony of our witnesses today.

Mr. CALVERT. This is one of those happy days where we are all agreeing with each other. Mr. Duncan.

Mr. DUNCAN. Well, thank you very much, Mr. Chairman. I was meeting with some of my constituents and, unfortunately, got here later than I had wanted. But I would like to welcome another one of my constituents, Dr. Hatcher, to the committee today, and we are certainly pleased to have you with us, Dr. Hatcher.

I don't know how well you knew him, but when I was a Judge prior to coming to Congress, I had working for me a long-time friend of mine, Dr. Jimmy Walls, who was a geology professor at the University of Tennessee and taught there I think longer than almost any other professor in the history of the university. But I understand your National reputation, and we are proud of you, and thank you very much for being here.

Dr. HATCHER. Thank you. It is my pleasure.

Mr. DUNCAN. Since I didn't hear the testimony, I won't ask any questions at this time. I don't think there is any real disagreement or controversy about this, Mr. Chairman, and I certainly will support your legislation on this. Thank you very much.

Mr. CALVERT. Thank you, Mr. Duncan. I just had one other question. Since you had all those great maps up on southern California, I was wondering if anybody can predict the next earthquake in California? I guess catch an early flight out.

I am only half kidding. I know that there has been a lot of studies and research especially in highly populated areas. I don't know if there is any comment about that. Obviously, those of us who live in California are always interested in any new information about earthquake research.

Mr. LEAHY. Mr. Chairman, this is a little bit off the track, but certainly geologic mapping information is critical to understanding earthquake hazards, be it in southern California or elsewhere in the country. Many of our activities are focused on mitigating the

hazard. We are not looking at the prediction aspects as much as defining the risk associated with these natural hazards.

Mr. CALVERT. Thank you and I thank this panel. As you can see, I think we are all in agreement. Hopefully, we are going to be able to move this bill out as quickly as possible——

Mr. ABERCROMBIE. Can I just have another——

Mr. CALVERT. Sure. Certainly.

Mr. ABERCROMBIE. Just more of an observation and perhaps you can just enlighten me because I haven't been able to quite successfully get an answer on it. In your STATEMAP awards for the past three years or four years rather, including 1996, there was none in Hawaii.

It is not that I am asking why isn't there in Hawaii so much because I know there has been extensive work done, but is that because like the work done with the Volcanic Institute and others through the university has been able to accomplish what needs to be done? I am not quite sure who to ask but perhaps Dr. Hatcher.

Dr. HATCHER. I don't know of any. Maybe the State geologists would like to respond.

Mr. CALVERT. Dr. Leahy?

Mr. LEAHY. Yes. There has been some mapping done as part of volcano work associated with the Hawaiian Volcano Observatory. It is my impression that there has not been a proposal from Hawaii soliciting funds through the STATEMAP program.

Mr. ABERCROMBIE. I also thought perhaps the Oceanographic Institute had done a lot of work, and a lot of our geologic work is not necessarily—I don't want to say compatible—it is entirely compatible but not in the same realm necessarily. But I did find it interesting that it hadn't happened. There are some other States too I notice that have had little or none in the way. And I just wondered what the reasoning for that was, whether they had other operations underway that were compatible or comparable. Yes, sir?

Dr. BENNETT. Congressman Abercrombie, Mr. Chairman, there are several reasons for that. If you take a look, for example, at Kentucky, you will note that they have never had a STATEMAP award, and that one is simple to explain. A number of years ago, Kentucky went out with the USGS and mapped the whole State of Kentucky at 7.5 minute scale.

In the case of Hawaii and some of the other States, if you would like to talk to your State geologist and ask him to please submit a proposal, we would be more than happy to consider it.

Mr. ABERCROMBIE. Thank you. It is just that it has always fascinated me, and there is so much available. I just kind of assumed that the work was associated with you, and now I find that it hasn't. So, obviously, there is a multiplicity of funding sources being used in a variety of ways. Thank you, Mr. Chairman.

Mr. CALVERT. Thank you. And I want to thank this panel for your testimony and your cooperation in answering questions. And we are going to ask for the next panel to come on up. Panel II is Ms. Martha Blair Tyler, the Principal Planner, Spangle Associates, Urban Planning and Research, and Dr. James Stribling, Principal Scientist, Tetra Tech, Incorporated. We thank this panel for coming out and testifying today. And, first, I would like to ask Ms. Martha Blair Tyler for your testimony.

STATEMENT OF MARTHA BLAIR TYLER, PRINCIPAL PLANNER, SPANGLE ASSOCIATES, URBAN PLANNING AND RESEARCH

Ms. TYLER. Thank you very much. It is a pleasure to be here. It is a real privilege. The reauthorization of the National Geologic Mapping Act of 1992 will continue a program that is important to the practice of urban planning. Geologic maps are used by planners for many purposes including general land-use planning, environment and resource protection, and site selection for facilities such as landfills, dams, trails, infrastructure, and other projects.

Geologic maps are also used by planners to mitigate the effects of geologic and seismic hazards. This statement discusses the use of geologic maps primarily to mitigate seismic and geologic hazards.

Basic geologic maps are the foundation of interpretative maps depicting geologic and seismic hazards. As such, they are the basis for any effort to avoid or mitigate the hazards. Planners need to know the locations of active faults, areas prone to landsliding, liquefaction, and amplified earthquake groundshaking in order to plan for the location of new development and the mitigation of hazards during construction.

I began my career as a planner in 1972 in California just after the San Fernando earthquake and about the same time that the U.S. Geological Survey began the San Francisco Bay Region Study, a pilot project jointly with HUD to provide maps for land-use planning in the San Francisco Bay area.

At that time, it was recognized that geologic information was an essential ingredient of land planning, a precondition to avoiding hazards, preserving resources, and minimizing the environmental impacts of construction.

As a demonstration, the project produced geologic maps for much of the Bay region, usually at a scale of 1:62,500 [one inch equals a mile approximately], and for some of the areas provided interpretative maps based on the geologic maps such as landslide susceptibility, liquefaction potential, and expected groundshaking intensities. My first assignment as a planner at Spangle Associates was as part of this USGS-HUD study to write guidelines for planners in applying these maps.

Twenty years later, the maps from the San Francisco Bay Region Study are still the basic maps used by planners in the Bay area, particularly at the regional and county levels. Many have been reformatted or printed at larger scale and sometimes reinterpreted by consultants and local staff members.

Why do we need more geologic mapping? Very little mapping has been done in the Bay region since the 1970's, and the mapping done at that time did not cover the whole region. It was done on a pilot basis. Geologic maps are still not available for many parts of the San Francisco Bay Area, particularly the outlying areas where most of the current development is taking place.

The situation is worse in other areas of northern California. Much development is now taking place in the Central Valley, in the Sierra foothills, and north of both Sacramento and San Francisco. And land-use decisions are being made in these areas without benefit of adequate geologic information. The same is generally true in

southern California where mapping is less likely to be available for the nonurban areas experiencing much of the new development.

The California legislature—I am sure you are familiar with this—enacted the State Seismic Hazard Mapping Act after the Loma Prieta earthquake, and it is a mapping program administered by the California Division of Mines and Geology, our State geological survey, to provide seismic hazard zone maps showing areas with significant potential for earthquake-induced liquefaction, landsliding, and amplified groundshaking.

The objective of the program is to prepare maps for the entire State at 1:24,000 or one inch equals about 2,000 feet, with priority on the State's metropolitan areas. CDMG will issue guidelines to local governments regarding the use of the maps.

The intent is to create a program similar to the Alquist-Priolo Earthquake Fault Zone program in which the State provides local governments with maps of active fault zones and mandates geologic studies prior to the approval of development in the zones, and prohibits most construction directly across a fault.

The State Seismic Hazard Mapping Act meets a strong need for geologic and seismic information by local governments in California. The problem is funding. The legislature intended to fund the program with a surcharge on building permit fees, but the State's prolonged recession sharply reduced the projected income.

The program was barely off the ground when the Northridge earthquake hit. In the Northridge aftermath, FEMA allocated hazard mitigation funds to the program, and some funds from the National Geologic Mapping Program have also been allocated to do mapping in the declared disaster areas—Los Angeles, Orange, and Ventura Counties.

The rest of the State is still waiting, probably well into the next century, for its geologic maps, and the earthquake clock keeps ticking. So the need is great in California for assistance with geologic mapping.

Planners in California use geologic maps for three main functions. They use them in seismic safety elements or seismic safety elements of local general plans. The State of California requires all cities and counties to adopt general plans and to include in the plans an element evaluating geologic and seismic hazards and policies and programs to mitigate the hazards. Geologic maps and interpretative maps derived from the geologic maps are essential to evaluating hazards for these local elements.

The California Environmental Quality Act, CEQA, patterned after the National Environmental Protection Act, requires an environmental assessment of all projects in the State. The assessment must include geologic and seismic hazards affecting the project site. Geologic maps are frequently used to screen project sites for geologic and seismic hazards. If the screening shows that hazards are present, full evaluation is required in an environmental impact report.

And then geologic report requirements. Many local governments use geologic maps to identify potentially hazardous areas where additional geologic studies are required prior to development. Typically, the maps alert local staff to a potential problem; a consultant retained by the project applicant conducts the geologic investiga-

tions and recommends mitigation, if needed; and the local government staff seeks peer review of the geologic report and ensures that the recommendations are met.

All three applications help protect prospective developers, investors, insurers, and buyers and renters of real estate from potentially catastrophic impacts of seismic and geologic hazards. They also protect the general public as taxpayers from the costs of damage to infrastructure and public facilities and the huge costs of disaster assistance. All three types of applications depend on the availability of geologic maps and the associated interpretative maps.

Is geologic mapping a proper Federal concern? In attempting to balance the Federal budget, Congress often looks to the private sector or to State and local governments to provide services traditionally considered Federal responsibilities. This can mean that the service simply isn't provided.

Private sector geologists and consultants do geologic mapping to meet specific needs like construction of a building or mineral exploration, but the information is not usually available to the public, is restricted to relatively small areas, and the result is an inconsistent patchwork of geologic information.

State geologic surveys are logical agencies to undertake basic geologic mapping, but most are seriously underfunded and capabilities differ from State to State. The National Geologic Mapping Act provides the State surveys with much needed support for geologic mapping. They could use even more support.

A few local governments have retained consultants to provide geologic maps of their jurisdictions but it is hard to convince local councils and boards of supervisors to fund such efforts unless they have suffered a recent disaster. Even when local governments initiate mapping projects, geologic maps prepared by USGS or State Geological Surveys typically provide the foundation for the work. The availability of basic geologic maps encourages such local efforts.

I don't believe it will be possible to build a National geologic data base or provide the geologic maps essential to hazard mitigation without a federally supported effort. I believe we need more, not less, Federal funding for geologic mapping. The costs of geologic mapping in areas with hazards need to be balanced against the costs of developing without geologic information.

These can include damage to public and private property, injuries and death, and significant public expenditures for disaster assistance. In this context, geologic mapping is a small ounce of prevention. And it has been a real pleasure to have the opportunity to speak to you.

Mr. CALVERT. Thank you for your testimony. Dr. James Stribling, you may begin your testimony. Thank you.

STATEMENT OF JAMES STRIBLING, PRINCIPAL SCIENTIST, TETRA TECH, INCORPORATED

Mr. STRIBLING. Thank you, Mr. Chairman. I am an environmental biologist working for a National Environmental Consulting firm, Tetra Tech, located in the Baltimore Office in Owings Mills, Maryland. The primary focus of the work that I and my colleagues

do is to use biological data as indicators of ecological or ecosystem health, mainly for aquatic ecosystems.

We design and implement environmental monitoring and assessment programs that sample biological, physical, and chemical components of ecosystems. Although I am not a geologist, I would like to give you a picture of why geological information is important to the work that I and many others like me do every day.

I also want to express my support for the reauthorization of the National Geologic Mapping Act of 1992 as the key for providing the necessary basic information needed to properly monitor the environment in support of sound environmental policy.

Traditionally, the health of streams, rivers, lakes, and other bodies of water was determined by monitoring chemical contamination. However, we have now taken an important step forward in understanding water quality by realizing that water resources are much more than just chemical components. The biological system associated with water, that is, the insects, the fish, the bugs, the birds, and microorganisms that live in the water, are many times key indicators of water resource health.

We call these data that we collect to be indicators of ecological or ecosystem health. To use biological indicators in a practical way, we design decision thresholds for each ecosystem we study. Whether an ecosystem is considered healthy or in good condition is judged by comparing data from that ecosystem with others where a baseline of biological information has already been established.

The compared ecosystem is a control or a reference condition. When these thresholds are developed, they are tailored to meet local, regional, State, or National needs, and this is a demonstration of why a single criterion cannot be used across the country to assess all ecosystems.

Now, why are geology and surface landform important to this process? Very simply, biology is related to habitat, and habitat results directly from underlying geology. The abundance and diversity of organisms, even without human disturbance, is highly variable.

A scientist who is monitoring the environment must understand this variability so not to misinterpret the data that he or she collects. Geological information helps by providing the framework for organizing environmental information.

There is a vast diversity and quantity of ecological and biological data available which must be put into a useful geographic system so that environmental scientists and the public can begin to understand how natural variability can be used to develop these decision thresholds. One of the primary mapping methods used for this that we use is called the ecoregion approach.

Ecoregion maps use a variety of both mapped and unmapped information to develop an ecological landscape classification. They use vegetation maps, climate, wildlife maps, water, land-use patterns, soils, land form or physiography, and geologic structure.

With all of these diverse variables, a map may become overly difficult to understand, but establishment of ecoregion is aimed at organizing the complexity contained within this information to more straightforward grouping.

Part of the information, as I said before, used to develop the ecoregion maps is geologic information. Let me explain how many of the components of ecosystems are tied to basic geology. The structure and function of biological communities are dependent on environmental conditions, that is, the quality of available habitat, food, and water.

Plants are an integral part of any biological community, and that growth is dependent on the soil structure, mineralogy, and water. Soil and water chemistry and their mineral content directly result from wind and water erosion and the weathering of bedrock or other underlying geologic structure.

Landscape structure, such as mountains, valleys, river channels, form as a result of one or a combination of several factors, including erosion, movement of bedrock as a result of earthquake activity, volcanic activity, and past glacier movement.

Because water flows downhill, the landscape structure or landform is responsible for how large or how small a watershed is, where wetlands occur, the type of habitat that is present in a particular location, rates of soil erosion, and the geographic distribution of plants and animal communities.

To lack an understanding of the environmental factors related to ecosystem structure and function would decrease the accuracy with which we could predict the effects of human activities. Mapping geological information on landform and underlying geology is the type of information provided by this Act.

I feel that a cooperative Federal, State, and local program to continue production and refinement of maps depicting data concerning underlying geologic and surficial landform information is important.

This bill, for continuing the funding of that Act, is crucial to maintaining and improving the quality and accuracy of the nation's environmental management activities. I appreciate the opportunity to offer this testimony in support of reauthorization of the National Geologic Mapping Act.

[The prepared statement of Mr. James Stribling may be found at the end of hearing.]

Mr. CALVERT. Thank you, doctor. Ms. Tyler, you work for a private firm. What role do you think there is for the private sector in gathering, analyzing, and compiling the data which goes into a geological map?

Ms. TYLER. I am not a geologist and I am not that familiar with mapping by the private sector, but my assumption would be there would be a fairly large role that would not be at all inconsistent with the purposes of the Act.

The importance of having the Act is to have uniform standards. A geologic map means a geologic map throughout the country or at least in a region. Private sector mapping is done for specific purposes, and one of the main difficulties is that it is rarely available for public use.

Cost from the local government point of view is a real problem. There are mapping services—aerial mapping services where they can get maps, but the costs are quite high compared to the maps made available through the U.S. Geological Survey now.

Mr. CALVERT. Your company probably wouldn't be involved in competing to do maps of 1:24,000. You would be more involved in the specific analysis of your business——

Ms. TYLER. We are strictly a planning firm. All of us are urban planners. We are not geologists. We do a great deal of work with communities about using geologic information because we work for a community that has a lot of geologic hazards and have had to develop some expertise in how to use it.

Mr. CALVERT. Thank you. Doctor, since you are here, I thought I would ask you just a little more controversial thing we talked about this last year—was the National Biological Survey. And I must ask you how the consulting biological sciences community feels about the shortlived NBS service being placed under the wing of the USGS?

From your perspective, would you be better off if the staff went back to Fish and Wildlife and the other agencies where they came, or do you see this as being a good fit when the kinks are worked out and things are going to be OK?

Mr. STRIBLING. I think it is a good fit within the USGS. If I followed your question right, I think it was an appropriate placement of the National Biological Service within the USGS. Did I misinterpret your question?

Mr. CALVERT. Yes.

Mr. STRIBLING. I am sorry.

Mr. CALVERT. Thank you. Mr. Abercrombie.

Mr. ABERCROMBIE. Thank you very much. Dr. Stribling, I was very interested and not completely aware before except perhaps in a vaguely intellectual way about the connections that you were able to draw so clearly in your testimony—the synthesis, if you will, with the geologic survey and mapmaking.

Now, I am one of the former professors that the Chairman referred to and hope one day to have honest work again perhaps in that area. And I am asking a question with respect to how this is actually done, how one is trained. And my information is that during the past 15 years, the teaching of geologic field methods and analysis has declined or been abandoned in many colleges and universities.

Now, I realize there is probably a combination of factors in that, including availability of funds. But more than that, I expect that this is a very time and labor-intensive activity, something akin to animated film work, which, when you see the product, it all seems very fluid and well formed, and all makes sense. But when putting it together, just as a good map, by definition is an exercise in clarity. Right?

Mr. STRIBLING. Yes. That is right.

Mr. ABERCROMBIE. But in order to accomplish that, to achieve that, I imagine there is a lot of quotidian work that is involved, a lot of very intense labor and a lot of what we in politics would call a lot of scutwork. It is not all glamor like you see here before you displayed today. It is all the basic work that has to be done in order to bring an election off.

What I remember in high school when I had earth science, which I liked because I didn't quite understand and I have never been able to command physics the way I would like, it is something like

a symphony to me. I can comprehend it, but I am not sure I apprehend it.

I don't understand how it is done. How does somebody write a symphony? How does somebody compose? I played a musical instrument, but it was beyond me. And I wondered whether you could comment on then whether my observation is correct, that this is something that we may be losing and need to have more emphasis on academically in the United States?

And, secondly, if that is the case, what do we need to do? What can we do perhaps even with this legislation being authorized to complement or amplify the necessary components to see that this task is able to be accomplished in the future?

Mr. STRIBLING. Yes. I do think that there should be more emphasis placed on training people in order to do this. Ecoregion maps, in particular, do take a synthesis using a number of different kinds of information like I said.

I think that one of the big factors that would drive or enhance the visibility or not necessarily visibility but the usefulness of these products—the maps—would be to demonstrate what are the different applications of them.

They are used in environmental manners. Like we use them—I am a biologist, and I don't do map production myself, but I use the maps in order to help me interpret my biological data. I understand that in producing the ecoregion maps that there are some numerical, quantitative work that goes into that, but there is also quite a bit of surrounding yourself with maps—your desk—surrounding with these different kinds of maps.

And you are looking at overlaps of the different regions, whether it is vegetation patterns, whether it is geologic—a bedrock structure or even climatic pattern. They all go into structure in these ecoregion maps.

Mr. ABERCROMBIE. As you know, one of the components of the legislation is the developing programs will teach the principles of geologic mapping and field analysis. Do you have any idea perhaps—Ms. Tyler, you might have from the private sector point of view. You say you use it in planning, and I am sure you must particularly in California have to pay very, very close attention in this area. What is needed? Do you have an idea of what the academic needs might be and what we are talking about in terms of support?

Ms. TYLER. I am not sure I can comment reasonably on that.

Mr. ABERCROMBIE. Well, OK. Maybe you can but, like the Chairman, you are here in front of us, and I want to take advantage of——

Ms. TYLER. I would like to comment, if I may, on the question the Chairman asked me.

Mr. ABERCROMBIE. Maybe one of the former witnesses—maybe, Dr. Hatcher, if you wouldn't mind. Ms. Tyler, I don't mean to cut you off.

Ms. TYLER. That is fine.

Mr. ABERCROMBIE. I will take you at your word. In other words, Ms. Tyler, in effect, is telling us she is taking advantage of what is available for her professional judgment. And then what is available is dependent it seems to me in this legislation on whether we

have the academic foundation available, doctor. Is that a fair assessment?

Dr. HATCHER. Yes, it is. One of the things that I know for a fact right now is that oil companies are starting to hire geologists again, and many of them call me to ask do I have students coming out at this time. They are interested in people who have a strong field background even though they may never set foot again in the field to make a geologic map.

The same is true, as I understand it, in the environmental industry and in the relatively few who are hired in mining—relatively few are being hired in mining today. But in terms of the backgrounds of students, there is an interest in the industry, all kinds, in having people with a strong field background.

Mr. ABERCROMBIE. So as we look to the next century then and try to balance environmental concerns and resource exploitation in the proper context of that word, this legislation then is important, is it not——

Dr. HATCHER. Absolutely.

Mr. ABERCROMBIE.—in giving us at least a foundation context within which then to make decisions about academic support and continuing to attract people to the field?

Dr. HATCHER. Yes. Mr. Abercrombie, this is a very important element of the legislation. I think the academic institutions themselves have moved away from that partly because of the kinds of funding they are able to get out of Federal agencies in the recent past and up till now from some of the other agencies that emphasize more laboratory-oriented kinds of research. And yet with people trained in field geology, they are able to go directly into jobs easier I think than they are with the laboratory-type training.

Mr. ABERCROMBIE. So I guess my final point then would be because the light is on there and I appreciate your indulgence, Mr. Chairman, maybe this goes all the way down into the high school level then when we were encouraging young people—this is a field, if you will, or a series of associated fields that if we could get academic advisors to understand it and make information available to them, those who have an interest in physics, those who have an interest in geography, those who have an interest across the spectrum then of—and as I say before listening to Dr. Stribling's testimony, I really hadn't seen that synthesis.

Even in the high school level then we can say, look, there is work out here. The 21st century is going to be—you will not find yourself on an esoteric or marginal edge of activity, academic or professional, in the business world.

Dr. HATCHER. I couldn't agree more.

Mr. ABERCROMBIE. OK. Thank you very much, Mr. Chairman. I appreciate it. Thank you.

Mr. CALVERT. Thank you. And before I conclude the hearing, I want to point out I am not being critical of college professors since this place is operated by college professors. And I want to thank you for your testimony and coming out here to Washington to give it so have a good day, and with that, this hearing is adjourned.

[Whereupon, at 3:08 p.m., the subcommittee was adjourned and the following was submitted for the record.]

I

104TH CONGRESS
2D SESSION

H. R. 3198

To reauthorize and amend the National Geologic Mapping Act of 1992, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

MARCH 29, 1996

Mr. CALVERT introduced the following bill; which was referred to the Committee on Resources

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A BILL

To reauthorize and amend the National Geologic Mapping Act of 1992, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Geologic Mapping Reauthorization Act of 1996".

SEC. 2. FINDINGS.

Congress finds that—

(1) in enacting the National Geologic Mapping Act of 1992 (43 U.S.C. 31a et seq.), Congress found, among other things, that—

(A) during the 2 decades preceding enactment of that Act, the production of geologic maps had been drastically curtailed;

(B) geologic maps are the primary data base for virtually all applied and basic earth-science investigations;

(C) Federal agencies, State and local governments, private industry, and the general public depend on the information provided by geologic maps to determine the extent of potential environmental damage before embarking on projects that could lead to preventable, costly environmental problems or litigation;

(D) the lack of proper geologic maps has led to the poor design of such structures as dams and waste-disposal facilities;

(E) geologic maps have proven indispensable in the search for needed fossil fuel and mineral resources; and

(F) a comprehensive nationwide program of geologic mapping is required in order to systematically build the Nation's geologic-map data base at a pace that responds to increasing demand;

(2) the geologic mapping program called for by that Act has not been fully implemented; and

(3) it is time for this important program to be fully implemented.

SEC. 3. REAUTHORIZATION AND AMENDMENT.

(a) DEFINITIONS.—Section 3 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31b) is amended—

(1) by striking "As used in this Act:" and inserting "In this Act:";

(2) by redesignating paragraphs (2), (3), (4), and (5) as paragraphs (3), (4), (5), and (6), respectively;

(3) by inserting after paragraph (1) the following:

"(2) ASSOCIATION.—The term 'Association' means the Association of American State Geologists."; and

(4) in each paragraph that does not have a heading, by inserting a heading, in the same style as the heading in paragraph (2), as added by paragraph (3), the text of which is comprised of the term defined in the paragraph.

(b) GEOLOGIC MAPPING PROGRAM.—Section 4 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31c) is amended—

(1) by striking subsection (a) and inserting the following:

"(a) ESTABLISHMENT.—

"(1) IN GENERAL.—There is established a national cooperative geologic mapping program between the United States Geological Survey and the State geological surveys, acting through the Association.

"(2) DESIGN, DEVELOPMENT, AND ADMINISTRATION.—The cooperative geologic mapping program shall be—

"(A) designed and administered to achieve the objectives set forth in subsection (c);

"(B) developed in consultation with the advisory committee; and

"(C) administered through the Survey.";

(2) in subsection (b)—

(A) in the subsection heading by striking "USGS" and inserting "THE SURVEY";

(B) in paragraph (1)—

(i) by single-indenting the paragraphs, double-indenting the subparagraphs, and triple indenting the clauses;

(ii) by inserting "LEAD AGENCY.—" before "The Survey";

(iii) in subparagraph (A)—

(I) by striking "Committee on Natural Resources" and inserting "Committee on Resources"; and

(II) by striking "date of enactment of this Act" and inserting "date of enactment of the National Geologic Mapping Reauthorization Act of 1996";

(iv) in subparagraph (B)—

(I) by striking "State geological surveys" and inserting "Association"; and

(II) by striking "date of enactment of this Act" and inserting "date of enactment of the National Geologic Mapping Reauthorization Act of 1996"; and

(v) in subparagraph (C)—

(I) by striking "date of enactment of this Act" and inserting "date of enactment of the National Geologic Mapping Reauthorization Act of 1996";

(II) by striking "Committee on Natural Resources" and inserting "Committee on Resources";

(III) in clauses (i) and (ii) by inserting "and the Association" after "the Survey";

(IV) by adding "and" at the end of clause (ii); and

(V) by striking "; and" at the end of clause (iii) and all that follows through the end of the subparagraph and inserting a period; and

(C) in paragraph (2)—

(i) by inserting "RESPONSIBILITIES OF THE SECRETARY.—" before "In addition to"; and

(ii) in subparagraph (A) by striking "State geological surveys" and inserting "Association";

(3) in subsection (c)—

(A) in paragraph (2) by striking "interpretive" and inserting "interpretative"; and

(B) in paragraph (4) by striking "awareness for" and inserting "awareness of"; and

(4) in subsection (d)—

(A) in paragraph (1) by inserting "FEDERAL COMPONENT.—" before "A Federal";

(B) in paragraph (2)—

(i) by inserting "SUPPORT COMPONENT.—" before "A geologic"; and

(ii) by striking subparagraph (D) and inserting the following:

"(D) geochronologic and isotopic investigations that—

"(i) provide radiometric age dates for geologic-map units; and

"(ii) fingerprint the geothermometry, geobarometry, and alteration history of geologic-map units,

which investigations shall be contributed to a national geochronologic data base;";

(C) in paragraph (3) by inserting "STATE COMPONENT.—" before "A State"; and

(D) by striking paragraph (4) and inserting the following:

"(4) EDUCATION COMPONENT.—A geologic mapping education component—

"(A) the objectives of which shall be—

"(i) to develop the academic programs that teach earth-science students the fun-

damental principles of geologic mapping and field analysis; and

"(ii) to provide for broad education in geologic mapping and field analysis through support of field studies;

"(B) investigations under which shall be integrated with the other mapping components of the geologic mapping program and shall respond to priorities identified for those components; and

"(C) Federal funding for which shall be matched by non-Federal sources on a 1-to-1 basis.".

(c) ADVISORY COMMITTEE.—Section 5 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31d) is amended—

(1) by striking subsection (a) and inserting the following:

"(a) ESTABLISHMENT.—

"(1) IN GENERAL.—There shall be established a 10-member geologic mapping advisory committee to advise the Director on planning and implementation of the geologic mapping program.

"(2) MEMBERS EX OFFICIO.—Federal agency members shall include the Administrator of the En-

vironmental Protection Agency or a designee, the Secretary of Energy or a designee, the Secretary of Agriculture or a designee, and the Assistant to the President for Science and Technology or a designee.

"(3) APPOINTED MEMBERS.—Not later than 90 days after the date of enactment of the National Geologic Mapping Reauthorization Act of 1996, in consultation with the Association, the Secretary shall appoint to the advisory committee 2 representatives from the Survey (including the Chief Geologist, as Chairman), 2 representatives from the State geological surveys, 1 representative from academia, and 1 representative from the private sector."; and

(2) in subsection (b)(3) by striking "and State" and inserting ", State, and university".

(d) GEOLOGIC MAPPING PROGRAM IMPLEMENTATION PLAN.—Section 6 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31e) is amended—

(1) in paragraph (1) by inserting "cooperative" after "national";

(2) by striking paragraph (3)(C) and inserting the following:

"(C) for the State geologic mapping component, a priority-setting mechanism that responds to—

"(i) specific intrastate needs for geologic-map information; and

"(ii) interstate needs shared by adjacent entities that have common requirements; and";

(3) by striking paragraphs (4) and (5) and inserting the following:

"(4) a mechanism for adopting scientific and technical mapping standards for preparing and publishing general-purpose and special-purpose geologic maps to—

"(A) ensure uniformity of cartographic and scientific conventions; and

"(B) provide a basis for judgment as to the comparability and quality of map products; and"; and

(4) by redesignating paragraph (6) as paragraph (5).

(e) NATIONAL GEOLOGIC-MAP DATA BASE.—Section 7 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31f) is amended by striking subsection (b) and inserting the following:

"(b) STANDARDIZATION.—

"(1) IN GENERAL.—Geologic maps contributed to the national archives shall have format, symbols,

and technical attributes that adhere to standards so that archival information can be accessed, exchanged, and compared efficiently and accurately, as required by Executive Order 12906 (59 Fed. Reg. 17,671 (1994)), which established the National Spatial Data Infrastructure.

"(2) DEVELOPMENT OF STANDARDS.—Entities that contribute geologic maps to the national archives shall develop the standards described in paragraph (1) in cooperation with the Federal Geographic Data Committee, which is charged with standards development and other data coordination activities as described in Office of Management and Budget revised Circular A–16.".

(f) ANNUAL REPORT.—Section 8 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31g) is amended in the first sentence—

(1) by striking "Committee on Natural Resources" and inserting "Committee on Resources"; and

(2) by striking "program, and describing and evaluating progress" and inserting "program and describing and evaluating the progress".

(g) AUTHORIZATION OF APPROPRIATIONS.—Section 9 of the National Geologic Mapping Act of 1992 (43 U.S.C. 31h) is amended to read as follows:

"SEC. 9. AUTHORIZATION OF APPROPRIATIONS.

"(a) IN GENERAL.—There are authorized to be appropriated to carry out the national cooperative geologic mapping program under this Act—

"(1) $24,000,000 for fiscal year 1997;

"(2) $26,000,000 for fiscal year 1998;

"(3) $28,000,000 for fiscal year 1999; and

"(4) $30,000,000 for fiscal year 2000.

"(b) ALLOCATION OF APPROPRIATED FUNDS.—

"(1) IN GENERAL.—Of the amount of funds that are appropriated under subsection (a) for any fiscal year up to the amount that is equal to the amount appropriated to carry out the national cooperative geologic mapping program for fiscal year 1996—

"(A) not less than 20 percent shall be allocated to State mapping activities; and

"(B) not less than 2 percent shall be allocated to educational mapping activities.

"(2) INCREASED APPROPRIATIONS.—Of the amount of funds that are appropriated under subsection (a) for any fiscal year up to the amount that

exceeds the amount appropriated to carry out the national cooperative geologic mapping program for fiscal year 1996—

"(A) for fiscal year 1997—

"(i) 76 percent shall be allocated for Federal mapping and support mapping activities;

"(ii) 22 percent shall be allocated for State mapping activities; and

"(iii) 2 percent shall be allocated for educational mapping activities;

"(B) for fiscal year 1998—

"(i) 75 percent shall be allocated for Federal mapping and support mapping activities;

"(ii) 23 percent shall be allocated for State mapping activities; and

"(iii) 2 percent shall be allocated for educational mapping activities;

"(C) for fiscal year 1999—

"(i) 74 percent shall be allocated for Federal mapping and support mapping activities;

"(ii) 24 percent shall be allocated for State mapping activities; and

"(iii) 2 percent shall be allocated for educational mapping activities; and

"(D) for fiscal year 2000—

"(i) 73 percent shall be allocated for Federal mapping and support mapping activities;

"(ii) 25 percent shall be allocated for State mapping activities; and

"(iii) 2 percent shall be allocated for educational mapping activities.".

○

STATEMENT OF DR. P. PATRICK LEAHY
U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR
TO
COMMITTEE ON RESOURCES
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES
APRIL 23, 1996

Mr. Chairman, I am pleased to be here today to express the Administration's support for H.R. 3198, a bill to reauthorize the National Geologic Mapping Act of 1992. I appreciate the opportunity to review the progress made under the Act since 1992 and to outline the goals that we are setting through the reauthorization legislation.

The Earth provides the foundation of our society--we live upon it and we utilize its products. A thorough knowledge of the Earth's resources and dangers is crucial for informed decisions in making public policy. Geologic maps are the best tools to collect and convey this information. The National Cooperative Geologic Mapping Program, authorized by the National Geologic Mapping Act of 1992, produces geologic maps needed by public and private organizations, maps essential to our continued economic health and vitality.

Geologic maps are the keystone of the U.S. Geological Survey's mission. They address each of the four principal themes of the Survey's mission: information, hazards, resources, and the environment. The geologic maps prepared by Survey scientists over the past century have been the primary means of communicating geologic information and data. In the past 100 years, society's needs have risen dramatically and have focused the attention of the earth science community on processes at and near the Earth's surface. We continue to seek and refine information that is essential for the protection of human health and safety and for continued economic growth, outcomes that can be traced ultimately to high-quality geologic maps. Old geologic maps must be revised and updated, and new ones prepared. Tight fiscal constraints require that the broadest range of stakeholders determine what information is needed so that our efforts are well targeted. These constraints require that all those who prepare geologic maps, within the U.S. Geological Survey to State geological surveys and the academic community, work cooperatively to maximize each other's strengths and to avoid duplication. It is often said that cooperative efforts of a group can exceed the sum of the individual efforts - today, I will outline how activities under the National Geologic Mapping Act are applying such a cooperative and synergistic approach among the Federal Government, the states, and the academic community.

To the extent possible, humans must be safe from natural hazards. Although natural hazards such as earthquakes, volcanic eruptions, landslides and floods cannot be stopped, recognizing and planning for these dangers can significantly reduce the chances for a major disaster. Geologic maps are the principal means for discovering and recording areas that will be affected by natural hazards and for communicating the dangers of hazards such as earthquake-producing faults, landslides, collapse structures, expanding soils, volcanic eruptions, and both natural and manmade pollution. Identifying the location of hazardous areas on maps allows land managers, industry, and the public to predict potential losses, develop strategies to minimize these losses.

Human health depends largely on environmental quality. Effective environmental policy requires an understanding of the complex interrelationships among components of the biosphere, including the Earth itself. Geologic maps provide the foundation needed to achieve balanced and scientifically credible environmental protection. They provide information on the location of rock types that produce radon, release toxic heavy metals, or interact with water to produce acid drainage. They provide the framework to predict flow paths for contaminated ground water plumes, to identify safe locations for waste sites and other facilities that will minimize the chances for pollution of soil and water. They also help to delineate specific soil or rock types necessary for certain plant communities.

Economic growth is driven largely by access to the Earth's resources. Water, energy, and building materials are required to sustain our vital economic engine. Geologic maps provide the keys for the location of safe drinking water; energy resources such as coal, petroleum, and natural gas; construction materials such as sand, gravel, limestone, and building stone; soil and rock types that enhance agricultural productivity; and metals and other mineral resources as diverse as gold, fertilizer, and kitty litter (zeolite and vermiculite). Policy makers must know the nature and extent of resources in order to plan how to manage the land in an economically sustainable way. Industry and local governments need geologic maps to help estimate the available resources for water supplies, building, energy production, and extraction of raw materials.

NATIONAL COOPERATIVE GEOLOGIC MAPPING PROGRAM

The National Cooperative Geologic Mapping (NCGM) Program ensures that our Nation will continue to have the geologic maps it needs to protect the health of our citizens and promote economic growth. Through involvement with private industry, public policy makers, and the public, the Program seeks to ensure that mapping efforts are focused on priority areas. The Program also uses stakeholder input to determine what formats are most useful as we move into the information age; new geologic maps are being produced in digital formats that can be put on the Internet.

The NCGM Program has been designed so that the Nation will have the quantitative geologic map data needed to address tomorrow's problems. To this end, the following goals are being pursued:

- Continue to enhance the outreach to stakeholders thus ensuring that the maps address societal priorities and are produced in forms easily accessible and usable.

- Expand cooperative agreements with the State geologic surveys, academic communities, other Federal agencies, and the private sector to enhance the output of map information and data.

- Develop metadata for the National Geologic Map database and make the data available through the Internet. Enhance the ability to produce digital as well as analog (paper) map products.

The NCGM Program brings together Earth scientists from the U.S. Geological Survey, State geological surveys, and academia through a process of partnering. The program will ensure

a balance of funding between State geological surveys and academia. The goals of the academic funding are to ensure that we train the scientists who will provide the geologic maps of the future.

The National Geologic Mapping Act of 1992, Public Law 102-285 authorized the establishment of a National Cooperative Geologic Mapping Program with the U.S. Geological Survey as the lead Federal agency responsible for coordinating and managing the geologic mapping program. The act also stated that the program is to be implemented through four components: FEDMAP and SUPPORTMAP which constitute the Federal component of the geologic mapping program, STATEMAP, which supports the States' efforts in producing geologic maps, and EDMAP, which ensures the training of students in the production of geologic maps. The 1992 Act also called for the establishment of a National Advisory Committee, the development of a National Geologic Map Database, and the development of methods to increase public awareness of the role and application of geologic map information to the resolution of national issues. Several changes in the geologic mapping program have occurred since the passage of the National Geologic Mapping Act of 1992 that I am pleased to enter into the record:

1. PROGRAM NAME--The National Geologic Mapping Program is now named the NATIONAL **COOPERATIVE** GEOLOGIC MAPPING PROGRAM, a small change in the name, but a significant change in recognition of the strong partnering aspect of the program with the State geological surveys through the Association of American State Geologists (AASG), with academia, and with the National Park Service and other Federal agencies.

2. STATEMAP--In FY 1995 only about 6 percent of total program funding was available for matching by State geological surveys, whereas in FY 1996 and beyond a minimum of 20 percent of appropriated funds will be apportioned to the STATEMAP component, thereby significantly increasing the amount of high-priority geologic mapping required by individual States and the Nation. In FY 1996 cooperative agreements are being made with 42 States to help support 60 geologic mapping projects. These projects were recommended for funding by a peer review panel consisting primarily of State Geologists (Exhibit 1).

3. EDMAP--This important component of the geologic mapping program is being implemented for the first time in FY 1996. Two percent of the total program funding is available for matching by universities. The funding is to help support graduate students to conduct geologic mapping in areas of priority to State or Federal agencies. These studies not only help increase the geologic mapping of high priority areas but also help train the next generation of geologic mappers. In FY 1996 cooperative agreements are being made with 37 universities to support 40 geologic mapping projects recommended for funding by a peer review panel consisting primarily of university professors who are experts in geologic mapping (Exhibit 1).

4. FEDMAP/SUPPORTMAP--The USGS continues to be active in executing geologic mapping (FEDMAP) and supporting studies (SUPPORTMAP) of paleontology, stratigraphy, geochronology, isotope geology, geophysics, and geochemistry. Over the past few years the geologic mapping program has moved from large numbers of essentially one-person projects to more integrated regional synthesis activities in which clients and cooperators are involved in all phases of the planning, implementation, and execution of project work. For this reason, much of our geologic mapping has moved from rural and wilderness areas to the "urban corridor" and

"urban fringe" areas, where competing land use decisions benefit from improved geologic information. Three examples of the twelve regional synthesis projects are the Southern California Areal Mapping Project (SCAMP), the Middle Rio Grande Basin Project, and the Florida Cooperative Geologic Mapping Project.

Southern California Areal Mapping Project (SCAMP)

This geologic mapping project is centered on the Los Angeles urban area and covers most of southwestern California (Exhibit 3). This is a joint effort with the California Division of Mines and Geology. Clients include the U.S. Air Force (March Air Force Base and Edwards Air Force Base), the U.S. Navy (Twentynine Palms Marine Corps Air/Ground Combat Center and the Chocolate Mountains Gunnery Range), the U.S. Forest Service (San Bernadino National Forest), U.S. Army Corps of Engineers (Seven Oaks Dam), National Park Service (Joshua Tree National Park), San Bernadino Valley Municipal Water Agency (Yucaipa and San Bernadino Basins), Mojave Water Agency (Lucerne and Morango Basins and Mojave River), Metropolitan Water District, and the Southern California Earthquake Center.

The components of the project address a variety of urban geology issues for which geologic mapping provides essential primary data. These are: (1) mapping the geometry of ground water basins and flow regimes to assist several California water districts in dealing with water resource and recharge problems and to help the Air Force monitor contaminant plumes in ground water, (2) mapping limestone and aggregate building resources to assist the National Forest Service manage its land, (3) providing geologic map data to assist the Corps of Engineers in siting a dam between two strands of the San Andreas fault and (4) helping the Metropolitan Water District define the structural setting of the "Domenigoni" reservoir, now under construction, which when completed will be the largest water retention structure in Southern California.

Middle Rio Grande Basin Project

One of the new cooperative urban-focus projects organized within NCGMP in FY 1996 provides a geologic framework and geologic map database for investigation of the Middle Rio Grande Basin, a region that includes extensive Federal lands as well as the principal urban centers of New Mexico. This project addresses the critical issue of diminishing ground water supply in the rapidly developing Santa Fe-Albuquerque-Socorro urban corridor of New Mexico. Previous joint studies by the New Mexico Bureau of Mines and Mineral Resources and USGS have shown that the extent of the primary aquifer in the region is more limited in size and distribution than previously believed, and unless new water resources are identified, urban development will be limited (Exhibit 4). NCGMP has joined with other USGS Divisions, with area universities, New Mexico Bureau of Mines and Mineral Resources, and other federal agencies in a 5-year effort to better define the hydrology and geology of the Middle Rio Grande Basin. As

illustrated in Exhibit 4, NCGMP is taking the lead in compiling the overall geologic map database for the region at 1:100,000-scale and in developing airborne geophysical data sets for identifying buried aquifers and geologic structures that control ground water flow.

Florida Cooperative Geologic Mapping Project

This is a cooperative effort with the Florida Geological Survey (FGS) to provide surficial and shallow subsurface geological mapping in the State of Florida (Exhibit 5). The activities of the FGS include primary responsibility for surficial geologic mapping, stratigraphic test drilling, and analysis and curation of drill core samples. NCGMP provides high resolution biostratigraphy and interpretation of the ancient environments where sediments were deposited. This joint work has established the geologic framework for hydrologic flow modeling by the South and Southwest Florida Water Management Districts and USGS and has resulted in a re-evaluation the stratigraphic setting and flow patterns within the principal Floridan aquifers. This cooperative work with the State has extended the stratigraphic range (thickness) and defined depositional settings where economic deposits of phosphate occur in Florida.

NCGMP has also formed a partnership with the Florida Geological Survey, South and Southwest Florida Water Management Districts, Dade County, U.S. Army Corps of Engineers, National Oceanic and Atmospheric Administration, Everglades National Park, and several area universities to investigate the quality and quantity of water delivered to both the southeast (Biscayne Bay) and south (Florida Bay) coasts of Florida (Exhibit 5). Both of these shallow bays are showing increasing signs of distress such as algal blooms, seagrass die-offs; fishery declines, increases in pollution, and changes in nearshore vegetation patterns. It is important to know how many of the observed changes are direct consequences of human activity and how many are related to natural variations in the ecosystems. This project is testing theories about human influence by examining the geologic record for the past 300 years and examining the ability of the natural systems to recover from disturbances. Initial results suggest that there are both man-induced changes, such as changes in plant distribution related to canal-building, as well as natural cycles in seagrass abundance and fishery productivity.

5. EXTERNAL ADVISORY COMMITTEE--The U.S. Geological Survey sponsored two national workshops, one in December of 1994 and a second in February of 1995, to begin the process of soliciting advice on the planning and implementation of the geologic mapping program. Workshop participants were producers and users of geologic map information including representatives from Federal and State agencies, academic institutions, and the private sector. Just recently, a 16-member National Cooperative Geologic Mapping Program Advisory Committee has been chartered and appointed. It is scheduled to hold its first meeting April 25-26, 1996, in Washington, D.C.

6. NATIONAL GEOLOGIC MAP DATABASE--A draft of this database design has recently been released for comment via the Internet by creating a site on the World Wide Web

(WWW). The Uniform Resource Locator (URL) for this site is "http://wwwflag.wr.usgs.gov/ngmdb". This web site is also linked to the recently created web site for the National Cooperative Geologic Mapping Program whose URL is "http://ncgmp.usgs.gov". A critical element in database construction is the development, acceptance, and adherence to a certain level of standardization. The USGS is currently working with both producers and users of geologic map information to develop draft format, symbols, and technical attribute standards so that geologic map database information can be accessed, exchanged, and compared efficiently and accurately as required by Executive Order 12906 (59 Fed. Reg. 17,671; 1994), which established the National Spatial Data Infrastructure (NSDI).

7. USGS CIRCULAR 1111--"Societal Value of Geologic Maps", published in 1993, is an economic analysis by the geologic mapping program that describes geologic maps, a rigorous benefit-cost model for valuing geologic map information, and the economic issues associated with determining whether or not a geologic map is a public good (Exhibit 6). Nearly ten thousand copies have been requested since publication. This publication and similar studies are increasing public awareness of the utility (value in use) of geologic map information to issues of land use management.

8. FEDERAL PARTNERSHIPS--The geologic mapping program is developing a series of cooperative relationships with various Federal partners in addition to our State and academic cooperators. The most mature of these is with the National Park Service (NPS). In 1995, the USGS and NPS signed a Memorandum of Understanding that outlined areas of interaction between the two agencies. The geologic mapping program responded by working with NPS during 1995 as part of their "Science in the Parks" initiative to direct a portion of the program's geologic mapping and supporting activities toward priorities established by NPS. The NPS used a national project call and priority system to rank over 100 proposals for geologic work in FY 1996. The geologic mapping program has begun work in FY 1996 with 10 of the 30 top-priority parks. The geologic mapping program is currently in the process of fostering similar partnerships with other Federal agencies including Bureau of Land Management, U.S. Forest Service, Environmental Protection Agency, and Department of Energy.

Mr. Chairman, in concluding my remarks, I would like to state for the record that the National Geologic Mapping Act of 1992 has been instrumental in helping focus more attention on the Nation's need for a systematic, high-quality geologic map database to serve as the primary underpinnings for virtually all applied and basic earth science investigations. The Administration supports reauthorization and urges bipartisan support for this legislation. Thank you, Mr. Chairman for the opportunity to express the views of the U.S. Geological Survey on the benefits of the current National Geologic Mapping Act and the value of reauthorizing this program. I would be happy to respond to any questions you may have.

EXHIBITS 1 – 6

To Accompany the

Statement of Dr. P. Patrick Leahy
U.S. Geological Survey, Department of the Interior
to
Committee on Resources
Subcommittee on Energy and Mineral Resources
U.S. House of Representatives
April 23, 1996

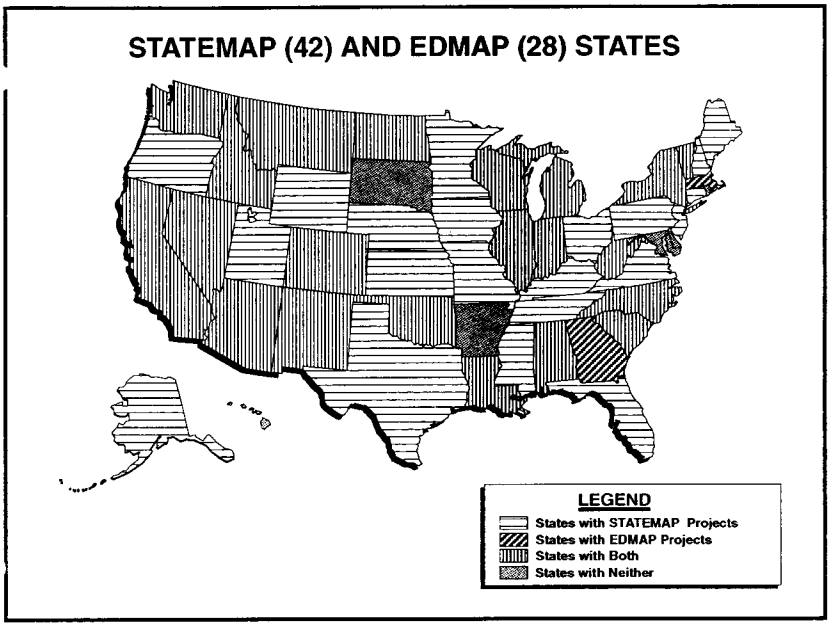

Exhibit 1. United States map showing the distribution of the 60 STATEMAP projects in 42 States and 40 EDMAP projects with 37 universities in 28 States.

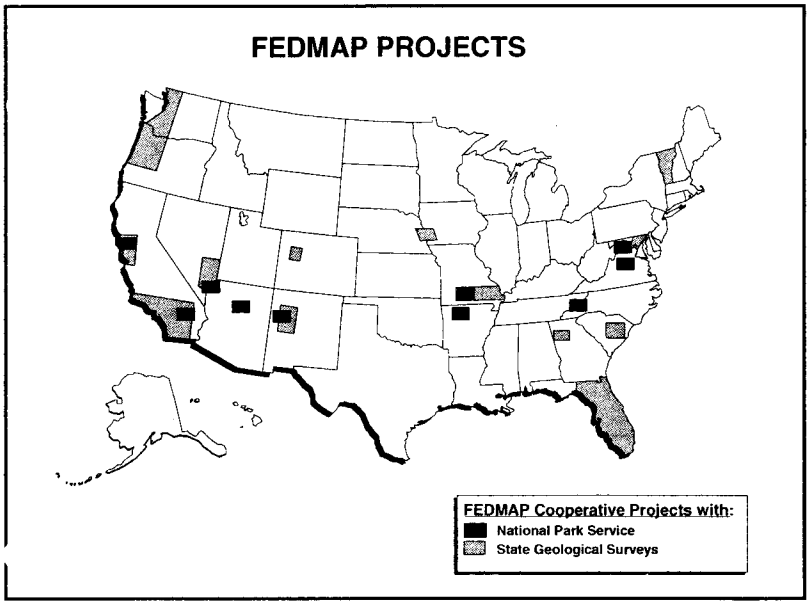

Exhibit 2. United States map showing the distribution of FEDMAP projects.

Southern California Areal Mapping Project

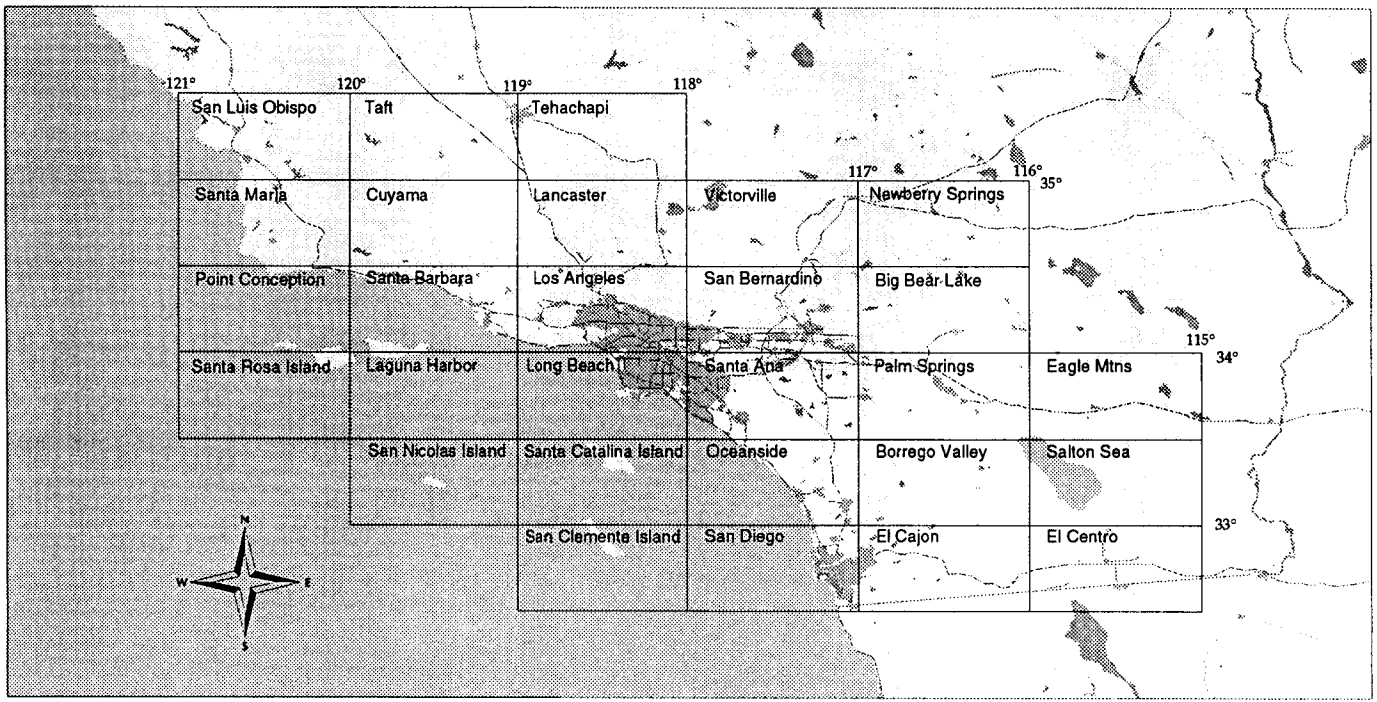

Exhibit 3a. 1:100,000-scale geological mapping.

Southern California Areal Mapping Project

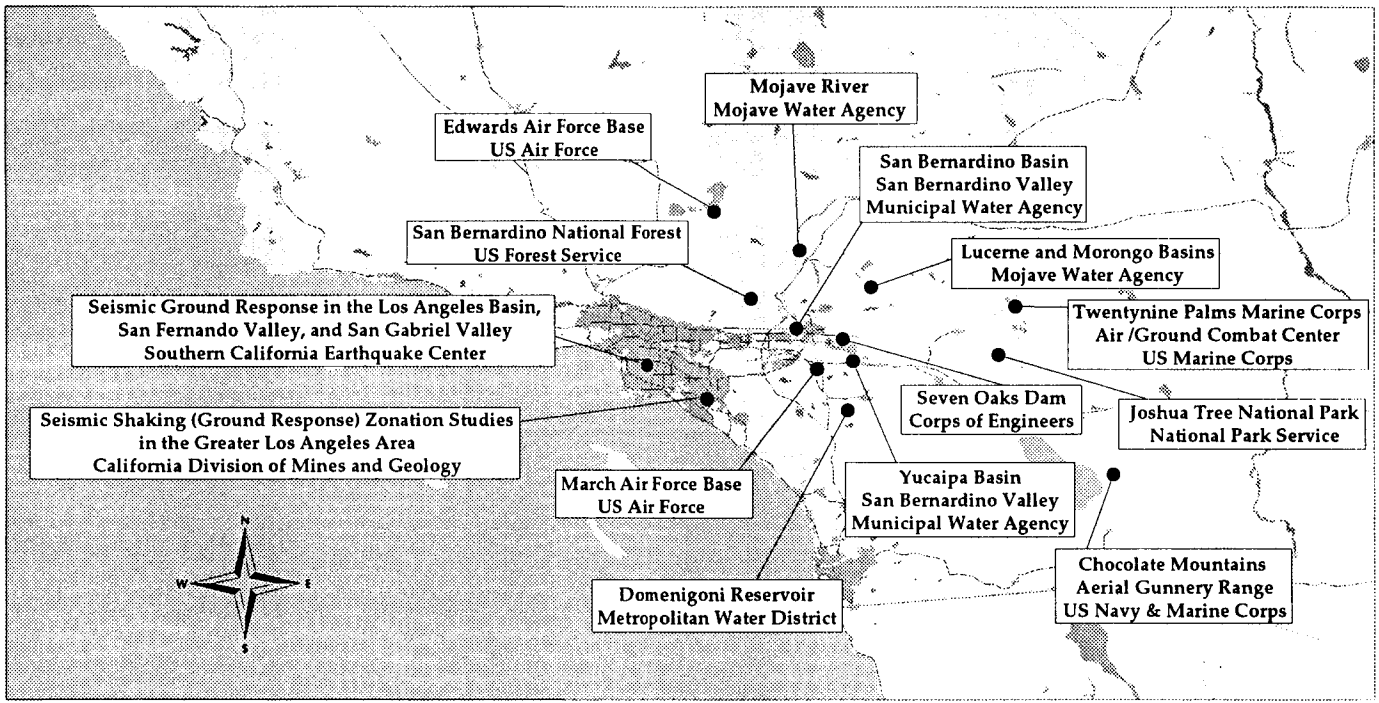

Exhibit 3b. Cooperative projects.

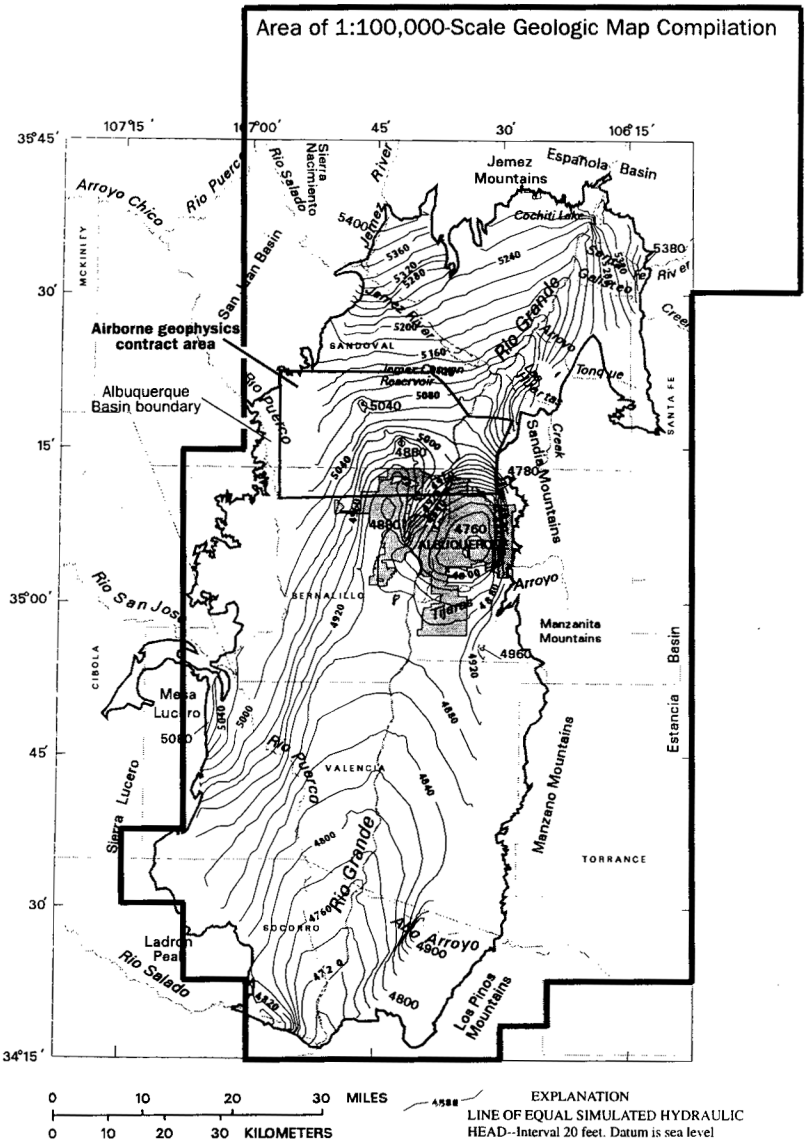

Exhibit 4. This shaded relief map shows the Middle Rio Grand Basin, which extends from near Santa Fe at the north and follows the urban corridor along Interstate 25 to Socorro at the south. The contours are for a model for the year 2020 AD. The prominent bull's-eye pattern shows a predicted depression in the water table beneath Albuquerque.

NCGMP ACTIVITIES IN FLORIDA

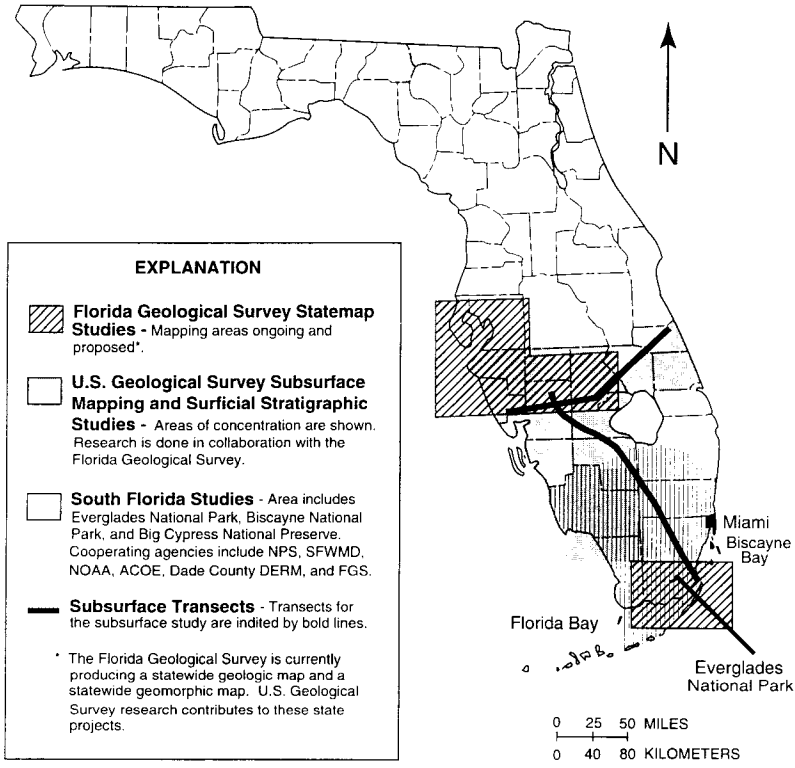

Exhibit 5. The National Geologic Mapping Program encompasses three major research efforts in Florida. (1) The Florida Geological Survey (FGS) map mapping investigations produce geologic maps at the 1:100,000 scale. (2) U.S. Geological Survey subsurface mapping and surficial stratigraphic studies, done in collaboration with the FGS, produce data for use by managers dealing with water, mineral, and waste disposal issues. (3) The South Florida studies represent a tremendous collaborative effort with a number of other federal, state, and local agencies; the analyses are investigating the hydrology and environment of South Florida. The collaborators on the South Florida studies include National Park Service (NPS), South Florida Water Management District (SFWMD), National Oceanic and Atmospheric Administration (NOAA), Army Corps of Engineers (ACOE), Dade County Department of Environmental Resources Management (DERM), and Florida Geological Survey (FGS). The primary geographic areas covered by these research efforts are indicated on the map.

USGS Circular 1111

A Case Study of Environmental Risk

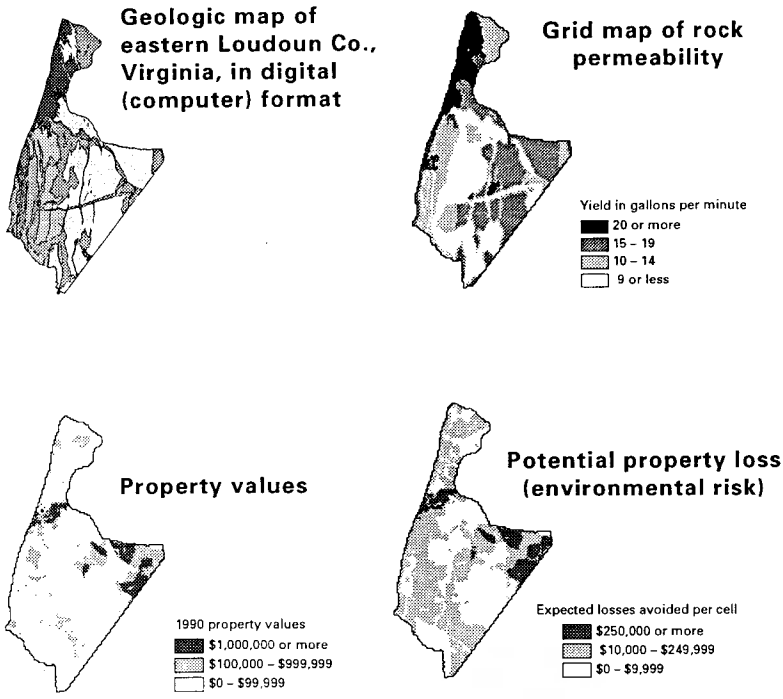

Exhibit 6. U.S. Geological Survey Circular 1111, Societal Value of Geologic Maps, presents a quantitative analytical procedure in which geologic map data are used to analyze economic risk factors in locating a waste-disposal site. Example maps from this procedure are shown in this Exhibit. Similar methods are being used to evaluate economic risks from landslides, earthquakes, and other natural hazards.

Statement by

Robert D. Hatcher Jr., M.S., Ph.D.

to the

Subcommittee on Energy and Mineral Resources

Committee on Resources

U.S. House of Representatives

in support of

H.R. 3198: National Geologic Mapping Reauthorization Act of 1996

April 23, 1996

Mr. Chairman and Members of the Subcommittee:

Good afternoon. I would like to thank you for this opportunity to present testimony in support of H.R. 3198 and efforts to reauthorize the National Geologic Mapping Act of 1992. I am a UT/ORNL Distinguished Scientist and Professor of Geology at the University of Tennessee (Knoxville) and Oak Ridge National Laboratory. I am a member of the Advisory Committee for the National Cooperative Geologic Mapping Program and have spent most of my professional career making geologic maps, teaching others to make geologic maps, and reviewing the geologic maps and related work of others. I am also testifying as the current President of the American Geological Institute, a nonprofit federation of 29 geoscientific and professional associations that represent more than 80,000 geologists, geophysicists, and other earth scientists. Founded in 1948, AGI provides information services to geoscientists, serves as a voice for shared interests in our profession, plays a major role in strengthening geoscience education, and strives to increase public awareness of the vital role the geosciences play in mankind's use of resources and interaction with the environment.

Let me begin by commending Chairman Calvert for introducing this important piece of legislation. Reauthorization of the National Geologic Mapping Act sends a strong message that geologic mapping is of national importance. It also forcefully endorses the importance of initiating partnerships in order to maximize the impact of scarce federal dollars in this time of shrinking budgets. This program has the potential to become the premier joint venture between the USGS, the state geological surveys, and academic institutions. Unfortunately, the funding made available to create these partnerships has been inadequate. I hope that by reauthorizing this act, Congress also will be encouraged to increase support for the cooperative elements of this program.

I was reminded of the importance of partnerships this February when I chaired an intersociety workshop convened by AGI to discuss the pending merger of the National Biological Service with the U.S. Geological Survey. This workshop provided the affected scientific communities with an opportunity to provide input into the merger process. One of the strongest themes to emerge from the workshop was the importance of developing alliances between the USGS and other federal agencies, state and local governments, the academic community, and the private sector.

The National Geologic Mapping Act as originally authorized emphasizes partnerships, and the Advisory Committee on which I serve comprises representatives from these partners. Although the promise of the Act has been slow to materialize, there are signs that progress is underway. For example, this committee was stipulated in the 1992 Act but was assembled only this past year. The cooperative State Geologic Mapping (STATEMAP) component, which matches federal funds with state funds for mapping performed by state geological surveys, never received more than $1.6 million during the first three years but is slated to receive $4.4 million in fiscal year 1996. Also, the Geologic Mapping Education (EDMAP) component, created to help train the next generation of geologic mappers by matching federal and university dollars, was not funded during the first three years but is to receive a small but important amount of funding ($360,000) for the first time in fiscal year 1996. These are positive steps, and I believe that they represent a growing commitment on the part of the USGS to broaden its base of cooperation.

Geologic Mapping Education

I will now address the EDMAP component and the promise that it represents. EDMAP is the smallest part of the overall program in terms of funding but has the potential to deliver the greatest long-term benefit, providing valuable experience and training for the next generation of field-oriented geoscientists. From the relatively small amount of funding hopefully to be provided in 1996, along with that recently provided by STATEMAP, the cooperative program has already built new bridges and repaired some old ones between academic institutions and federal and state agencies where the need for geologic maps has long been recognized.

It is critically important that the Administration and Congress work together to fully fund EDMAP and ensure that we will continue to have a cadre of trained mappers ready to tackle the problems of the next century. Not only is it imperative that we continue to train geologists to gather the data to construct geologic maps, but we must also continue to train all who want to become geologists to understand the field relationships portrayed in geologic maps. The laboratory of our science is the crust of the Earth, and accurate geologic maps are the most fundamental data set by which the crust can be portrayed. Unfortunately, there is a trend today toward less field- and more indoor laboratory-oriented geologic research in most of academia in part attributable to the kinds of research that the primary sources of grants for the Earth sciences -- the National Science

Foundation, the Department of Energy, and NASA -- wish to fund. Full funding of EDMAP will help to restore some balance to this situation.

As noted above, the EDMAP component was funded for the first time ever in fiscal year 1996, although the money will not be distributed until Congress and the President reach agreement on the fiscal year 1996 appropriations for the Department of the Interior. Awards are given through a competitive, peer-reviewed process. This year, I served as a member of the selection committee with Prof. Edward B. Evenson of Lehigh University, Dr. Steven J. Reynolds of Arizona State University, and Dr. Sandra J. Wyld of Rice University. Despite the short timeframe between the announcement and the proposal deadline, universities from 34 states submitted proposals. The committee recently completed the first cycle of reviews and identified a group of high quality projects that will provide important new information that have both direct benefits to state and local planners, engineers, and others, as well as providing a useful opportunity for graduate students to gain valuable experience and conduct research toward advanced degrees. As the program is allowed to grow toward its original funding goals, we hope to be able to provide support for some undergraduate students as well as those seeking advanced degrees. Most of the awards will be approximately $10,000 per project.

These proposals included, for example, construction of new geologic maps in parts of the rapidly growing Albuquerque, Phoenix, and Atlanta metropolitan areas. Students will gain first-hand experience in identifying problem areas for regional planners and developers, as well as for engineers in major construction projects.

I want to emphasize that the EDMAP component of the National Cooperative Geologic Mapping Program, like the cooperative STATEMAP component, involves contractual agreements to universities and colleges that contain clear deadlines and deliverables, along with a required cost-sharing component, matching federal dollars with state and university funds, and a requirement for coordination with specific needs identified by either state geological surveys or the USGS. I strongly support these attributes of the program and feel that they will contribute to its ultimate success.

Background

Geologic maps have always provided the fundamental data to help earth scientists understand the basic framework of the Earth's surface and its underlying architecture. These maps are also immensely practical tools for geologists and non-geologists alike who are trying to mitigate natural hazards (such as earthquakes, volcanoes, and landslides), undertake energy and mineral resource assessments, characterize potential nuclear and other hazardous waste disposal sites, and understand complex ground-water systems. The development of geographic information systems (GIS) has greatly enhanced the use of geologic maps in digital form as a primary data source for ecosystem management, land-use planning, hazard mitigation, and engineering projects. Over the years, the need for geologic maps has grown steadily, but geologic map production has not kept up. In 1988,

the National Research Council released a study emphasizing the fundamental importance of geologic maps and concluded that there would be a significant increase in the need for these maps in the future. Recognizing this problem, the state geological surveys and the USGS instituted a national cooperative geologic mapping program. In order to provide direct statutory authority for these programs and to "expedite the production of a geologic-map data base for the nation" by making more funds available, Congress passed the National Geologic Mapping Act with strong bipartisan support, and it was signed into law by President Bush, May 18, 1992. Because the original act authorized funds only through fiscal year 1996, it needs to be reauthorized during this Congress, sometime before fiscal year 1997 begins on October 1, 1996. I hope that this legislation will continue to be noncontroversial and bipartisan, passing Congress and signed by the President without difficulty. The Administration's support from the outset will be helpful in ensuring a smooth reauthorization.

The original 1992 legislation designated the USGS as the lead federal agency and set up a "mapping association" consisting of the USGS, individual state surveys represented by the Association of American State Geologists, and academic scientists. It also established an advisory committee comprising representatives from the mapping association, the private sector, and other federal agencies, including the Environmental Protection Agency and U.S. Department of Agriculture. The mapping program was designed with four components: Federal Geologic Mapping (FEDMAP), Geologic Mapping Support (SUPPORTMAP), STATEMAP, and EDMAP. FEDMAP supports USGS mapping activities, and SUPPORTMAP funds USGS work in geophysics, paleontology, geochronology, and other fields that contribute additional database information for geologic maps. As discussed earlier, STATEMAP and EDMAP are both cooperative programs, leveraging federal dollars with state and university funds.

The Act authorized funding levels that were to progressively increase from fiscal year 1993 through fiscal year 1996. Despite the authorization in the Act, however, additional funds have not been forthcoming. USGS has continued to fund its internal geologic mapping program at only slightly increased levels, and the money available for STATEMAP has never come close to the $18 million that was authorized and for which matching funds already existed in the states. Although H.R. 3198 is similar to the original Act in most respects, it establishes a more realistic and more fair funding arrangement. I hope that by setting more attainable funding targets in the reauthorization, this bill will further encourage increased support.

Contracting: A Separate but Related Issue

A thorny issue that affected the original Act is the role of contracting for mapping services. The private cartography and survey industry has been very forceful in its efforts to increase the amount of these services that are contracted out to the private sector or privatized outright, primarily focusing on aerial photography, photogrammetry, and other support services. Although we generally favor the use of contracting for topographic map

production, aerial photography, and other services where the private sector has demonstrated that it can do a better job, we are concerned that cost and quality be considered in any calls for an increase in contracting of the mapping functions of the USGS and other Interior agencies. I also question whether the primary geologic or topographic mapping functions can be carried out in the private sector because these functions cannot be driven solely by immediate or local need, and they must be viewed from a national or at the least a state-by-state perspective.

This issue has been taken up on a much broader scale by the American Congress on Surveying and Mapping, which has coordinated efforts to develop a comprehensive, unbiased study of all federal surveying and mapping functions, not just geologic mapping, to be undertaken by the National Academy of Public Administration. This study will address the appropriate federal role in these activities, identify functions that are suitable for commercialization or privatization, and also identify opportunities for consolidation or restructuring of these functions to achieve greater efficiencies. I would urge Congress to await the completion of this study before acting on this matter. I particularly urge this committee to refrain from attaching premature contracting or privatization provisions to H.R. 3198, as they could seriously jeopardize the bill's bipartisan support and wide acceptance.

I appreciate this opportunity to present my views to the subcommittee, and I would be pleased to answer any questions or to provide additional information for the record.

Thank you.

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TESTIMONY
IN SUPPORT OF THE

REAUTHORIZATION OF THE NATIONAL GEOLOGIC MAPPING ACT OF 1992
H.R. 3198

BEFORE

U. S. HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON ENERGY
AND MINERAL RESOURCES
APRIL, 23, 1996

STATEMENT OF THE ASSOCIATION OF AMERICAN STATE GEOLOGISTS
WALTER SCHMIDT, (Ph.D.) PRESIDENT

INTRODUCTION

The Association of American State Geologists (AASG) represents the State Geological Surveys in all 50 states and Puerto Rico. The state surveys function as the basic solid earth science information source for their state governments' executive, legislative and judicial branches, and for the public, industry, and academia. Some surveys have regulatory responsibilities for water, oil and gas, land or mine reclamation, and dam safety, among other environmental and land-use operations.

BACKGROUND

Our society and each of our citizens is dependent on Earth resources. As population increases, there is greater demand and increased competition for the available land surface and its included energy, materials and water resources. With this background the State Geologists

collectively through the Association, in conjunction with the U.S. Geological Survey (USGS), initially identified the critical need for geologic map data in each and every state and throughout the country. The nationally small number of detailed geologic map products was documented (only about one-fifth of the Nation is mapped at an adequate scale), and the fundamental need for this information was communicated to state and federal elected officials in support of the passage of the original act in 1992.

Geologic interpretations provided by geologic maps supply a credible basis for natural resource assessments in support of infrastructure rebuilding needs and national security, ground water and other natural resources conservation and protection, environmental regulation support, land-use and management plans, ecosystem management foundations, geologic hazards mitigation, and many other issues which impact society and the overall health and welfare of the public and the survival of our life-sustaining environment.

The original act enjoyed widespread bipartisan support in the Congress; it was supported by environmental and conservation groups, by industry and the private sector, by academia, and by the general public. All 50 state geologists supported the act and described the benefits of its passage to their respective delegations. The National Governors Association unanimously endorsed the act in the form of a resolution. In addition, many federal and state agencies, national organizations, and professional groups supported this bill. In a time when both federal and state budgets were being highly scrutinized, this act was described as "win-win" legislation. The act required federal and state coordination of prioritized geologic mapping project needs, and the STATEMAP and EDMAP components required a 50% state match to the federal funding, in effect doubling the available dollars for clearly identified state needs when the state committed their own funds.

A NATIONALLY CRITICAL PROGRAM & FEDERAL ROLE

Detailed geologic map information and knowledge of our solid earth is critical for many reasons. Mineral resources are the foundation of all our societies (and the world) infrastructure. Our very life styles, health, and the public welfare, including national security, are dependent on our mineral knowledge. Our ability to predict changes to our dynamic environment from pollution, over-consumption, or natural hazards begins with our fundamental understanding of the solid earth.

Many federal agencies and programs require geologic map information to carry out their missions. These agencies provide input to the USGS (the federal lead agency so designated) regarding their needs, and the various federal program requests are prioritized by the USGS to initiate geologic mapping projects. These include land management agencies such as the Bureau of Land Management, the National Parks Service, the U. S. Forest Service, the Department of Defense, and the Bureau of Indian Affairs. It includes environmental regulatory agencies such as the Environmental Protection Agency, the Minerals Management Service, and the Army Corps of Engineers, and environmental or ecosystem research agencies including the U. S. Geological Survey, the National Oceanic and Atmospheric Administration, the National Biological Service, and the National Atmospheric and Space Administration.

Clearly these kinds of national and international issues demand a federal presence and coordination. This is provided by the U.S.G.S. guided by the Advisory Committee as described in the Act. In addition, National data bases, trend compilation and analysis, standards establishment, unique topical expertise, and general program oversight are roles appropriately designated to a federal program with a "national" mission, such as the U.S.G.S.

STATE AND LOCAL PROGRAM NEEDS

State and local agencies must deal with local society environmental problems on a daily basis. This is where the truly applied aspects of environmental and resources problem solving takes place. Geologic maps and associated data provide vital information needed for land-use planning, in particular, in disposing of municipal and hazardous wastes and the siting of waste disposal facilities; locating and protecting surface and ground-water resources; locating and developing on- and off-shore mineral and energy resources; reducing the risks from earthquakes, landslides, volcanoes, ground-failure hazards, natural geochemical concerns (such as radon or mercury concentrations); predicting hazards from stream and shoreline erosion or accretion; siting of facilities and infrastructure rebuilding (and associated zoning concerns); routing of highways and pubic-utility lines; implementing and understanding fundamental earth systems which are the foundation of land management plans and environmental regulations.

Each state sets priorities for its geologic mapping needs with a "state geologic mapping advisory committee." These committees represent a wide spectrum of in-state

people and agencies who are knowledgeable about the many applications and uses of geologic maps. Proposals are evaluated and funding recommendations are made by a review panel composed of State Geologists and the USGS.

FEDERAL / STATE PARTNERSHIPS AND COST SHARING

The STATEMAP component of the National Cooperative Geologic Mapping Act provides matching funds for competitive contracts for the State Geological Surveys to do geologic mapping. This mapping is done under guidelines established by an advisory committee composed of State Geologists, the USGS, other federal agencies, university faculty, and other key users and makers of geologic maps. The State Surveys have a long tradition of geologic mapping. Also, because they are "local" they can do the job efficiently and very cost effectively, especially since they are matching the federal contribution dollar-for-dollar. State Geological Surveys maintain and have access to vast quantities of data and sample repositories with which to base new efforts and to build on to begin new mapping.

In keeping with the partnership policies of the present Administration, and the Congressional demands for efficient, cost effective, proven programs with clear societal benefits, reauthorization of the National Cooperative Geologic Mapping Act is easily supportable. The funding match provided by the State Geological Surveys has demonstrated a proven, working program, stretching the federal dollars with state funds to focus on high priority needs. Attachment A reviews the recent STATEMAP projects funding by state. In addition, Attachment B provides brief state specific reviews of many of these projects. These project deliverables clearly could not have been accomplished without the joint funding from both governments. In fact, upon initial authorization of the act in 1992, the 50 State Geological Surveys had identified $18,000,000.00 per year available from their respective collective budgets to match the federal STATEMAP component. Nevertheless, federal appropriations have not met authorized amounts and state funds have been left unmatched. The State Geological Surveys remain committed to the critical need, viability, and potential of this outstanding program. This remains true today even with the drastically curtailed federal commitment to the STATEMAP component. During FY 1995-96 the USGS increased the federal funds available for STATEMAP from $1 million to $4 million reflecting their desire to take maximum advantage of the state match. The products produced demonstrate the usefulness and efficient nature of the joint state / federal geologic mapping programs.

ENDORSEMENT

The Association of American State Geologists, unanimously recommends approval of the Reauthorization of the National Geologic Mapping Act of 1992, in the form of H.R. 3198. It is a bill which demonstrates partnerships between federal and state governments, which State Geologic Surveys have already committed state funds to match the federal funds. It is a bill which provides private sector opportunities in the form of subcontractor work in support of geologic map data compilation and presentation. It is a bill which provides basic support for ground water conservation and protection, and other natural resources inventories. It provides supporting data for environmental regulations, land-use planning and management plans. It provides fundamental data for environmental understanding. Finally, detailed geologic map products and the associated minerals data compiled provides a critically needed database for national security needs.

On behalf of the Association of American State Geologists, we commend your consideration of H.R. 3198, with the hope that is will indeed be reauthorized. We thank you for this opportunity to address this important subject.

Attachment A: STATEMAP AWARDS FOR 1993, 1994, 1995 & 1996

STATE	1993 $	1994 $	1995 $	1996 $
Alabama	20,000	17,608	30,000	66,293
Alaska	51,993	50,000	30,000	138,682
Arizona	80,161	80,000	55,000	136,247
Arkansas	NP	25,000	10,000	NP
California	80,000	55,000	50,000	127,806
Colorado	10,000	35,000	25,000	85,897
Connecticut	0	NP	NP	89,459
Delaware	18,290	NP	NP	NP
Florida	0	30,000	30,000	70,000
Hawaii	0	NP	0	NP
Idaho	15,000	50,000	35,000	105,859
Illinois	72,395	80,000	35,000	108,920
Indiana	24,426	87,938	50,000	132,642
Iowa	9,000	39,095	30,000	68,179
Kansas	64,385	0	0	70,000
Kentucky	NP	NP	NP	50,000
Louisiana	23,761	25,076	NP	105,818
Maine	8,750	32,244	43,000	48,960
Maryland	0	0	0	NP
Massachusetts	15,000	0	0	NP
Michigan	NP	NP	15,000	77,246
Minnesota	11,980	18,000	15,000	33,529
Mississippi	0	20,000	0	64,000
Missouri	36,629	59,316	35,000	86,775
Montana	105,000	110,000	40,000	120,000
Nebraska	27,000	40,002	0	76,110
Nevada	20,000	20,000	10,000	123,780
New Hampshire	NP	NP	NP	35,000
New Jersey	30,000	40,000	30,000	104,247
New Mexico	20,000	50,000	50,000	165,334
New York	9,000	20,000	0	63,563
North Carolina	21,000	60,000	60,000	112,436
North Dakota	23,998	23,031	9,000	44,377
Ohio	109,874	105,000	40,000	133,181
Oklahoma	20,000	50,000	30,000	68,967
Oregon	39,000	45,000	35,000	130,029
Pennsylvania	40,000	40,000	40,000	75,489
South Carolina	18,000	25,000	15,000	116,000
South Dakota	0	NP	NP	NP
Tennessee	0	15,000	13,000	22,500
Texas	56,233	79,164	51,000	100,395
Utah	30,000	38,000	30,000	125,000
Vermont	NP	23,043	21,000	48,523
Virginia	NP	NP	NP	20,702
Washington	25,000	30,000	30,000	120,492
West Virginia	23,167	53,000	22,000	60,210
Wisconsin	24,000	40,789	32,000	47,502
Wyoming	0	12,000	10,000	8,499
TOTAL	**1,183,042**	**1,623,306**	**1,056,000**	**3,588,648**

NP - No Proposal submitted.

ATTACHMENT B: CONTRIBUTIONS FROM THE STATEMAP PROGRAM FROM 1992 TO 1995.

The awards won by participating states over four years under the StateMap program are shown in Attachment A. The amounts in Attachment A represent only half of the actual expenditure on these projects because the states match the awards shown dollar-for- dollar. The projects were proposed by the individual states in concert with their StateMap Advisory Committees. These proposals were then peer reviewed by a panel of state and U.S. Geological Survey (USGS) geologists, and the awards made accordingly. Since enactment in 1992, the states have completed or are working on hundreds of separate quadrangles or digital compilations for a total investment of $7.4 million in federal funds and a matching amount in state funds. In FY-96, the U.S. Geological Survey significantly increased the federal funds for StateMap from approximately $1 million to $4 million for a total State/federal program of $8 million annually.

All of these individual maps will become part of the national 1:100,000-scale digital geologic map database maintained by the USGS. The NGMA has propelled all participating state surveys into the world of digital cartography and Geographic Information Systems (GIS). Access to a number of these map products will soon be available to those able to "surf" the World Wide Web.

How successful has the National Geologic Mapping Act been? The following paragraphs describe the impact of the StateMap program on many of the participating states, as related by the State Geologists.

ALABAMA
Dr. Ernest A. Mancini - State Geologist

StateMap projects in Alabama since 1992 have resulted in important contributions to our understanding of the geology of the state. Two 7.5-minute quadrangles have been completed and two are presently in progress. Three of the four quadrangles, Leeds, Helena, and Alabaster, are in areas of extreme rapid urban expansion east and southeast of metropolitan Birmingham in Shelby , Jefferson, and St. Clair Counties. Basic geologic data are urgently needed in these areas to assist in planning and development, remediation of environmental problems, protection of groundwater, and evaluation of mineral resources. Geologic mapping of the Leeds Quadrangle provided the basis for a Wellhead Protection Program in Leeds, which was completed in 1995 by the Geological Survey of Alabama. Current mapping of the Alabaster Quadrangle in Shelby County and the Anniston Quadrangle in Calhoun County will provide geologic data that are needed for completion of the Alabaster and Oxford Wellhead Protection Programs, respectfully, which are currently being conducted by the state survey.

Quadrangles scheduled for mapping in Fiscal Year 1996 include Oxford, Munford , and Eulaton Quadrangles in Calhoun and Talladega Counties. In 1997 we will propose mapping several quadrangles in the Tuscaloosa -Bessemer corridor in Tuscaloosa , Jefferson, and Bibb Counties, which will include the Mercedes Benz and other industrial sites. This mapping will provide basic geologic data that are vital to the economic and social welfare of these areas and to the state.

ARIZONA
Dr. Larry D. Fellows - State Geologist

Since 1992 we have completed geologic mapping in the Phoenix 1 degree x 2 degree Quadrangle, which includes the west half of metropolitan Phoenix and the sparsely-populated areas to the west. We are currently working on the west half of the Mesa 1 degree x 2 degree Quadrangle, which includes the east half of Phoenix. Once our geologic maps have been released, we know who purchases them, but we usually are not told how, or if, the maps are used. We believe that geologic maps produced with StateMap funding have been used in support of the following projects:

- The Cholla landfill site was denied a permit by the director of the Arizona Department of Environmental Quality, largely because of geologic conditions. The site is on the Phoenix North Quadrangle.

- Geologic mapping on the piedmont of the White Tank Mountains, located on the west edge of metropolitan Phoenix, was used by the Flood Control District of Maricopa County and the Arizona Department of Water Resources to assess the hazard from alluvial-fan flooding.

- An employee of the Arizona Department of Environmental Quality was doing some groundwater modeling in the Wickenburg area. He used our geologic map of the Vulture Mountain area to provide data used in the model.

- A major mineral exploration company, which wishes to remain anonymous, is currently conducting a drilling program east of Phoenix. Their project geologist has seen our geologic map of the area and has discussed the geology with our geologists. We assume that this information had a role in development of the drilling program.

- During the last month we had a telephone call from a geologist from South Africa to obtain information about a gold and platinum exploration project in the Phoenix Quadrangle. Based on our mapping in the area, we could say that there was a possibility of a gold occurrence, but there are no platinum source rocks.

- Gutierrez and Palmenburg, a consulting firm, is employed by the Yuma Proving Ground to prepare an Environmental Impact Statement. They used our geologic map and consulted with one of our geologists in the early stages of the project.

CALIFORNIA
Dr. James F. Davis - State Geologist

The National Geologic Mapping Act has significantly advanced the geologic mapping activities in California that are underway by both State government and the U.S. Geological Survey (USGS). We strongly support the reauthorization of this important statute.

The Division of Mines and Geology has been working with the USGS since the late 1970s in order to coordinate the mapping activities of both institutions. However, the passage of the National Geologic Mapping Act (NGMA) has provided the opportunity for an even closer cooperation. This results from the competitive proposal process that is required under the NGMA. The Division of Mines and Geology has established a State Advisory Committee in order to develop priorities for its new mapping proposals. The Advisory Committee includes representatives of the USGS, the mineral industry, geologic hazards consultants, and university research scientists. Some of the selected areas have been worked on jointly by both the USGS and State geologists with the results published as co-authored maps. In some cases, 1:24,000- scale compilation maps have been prepared for adjoining quadrangles in order to provide a coherent and integrated interpretation of the complex geology of the regions.

The areas investigated have been in southern California, in urban and urbanizing portions of the State where a premium on understanding geologic hazards exists. In the NGMA proposal process a focus has been placed on the interpretation of active faults and landslides. The areas covered by this joint mapping program have been extensively greater than could have been accomplished by State of California or the USGS alone. Furthermore, the funding from the USGS has allowed the State to expand its area of mapping significantly. The Division of Mines and Geology has completed several quadrangle maps including ones for the Long Beach, Oceanside, and San Diego quadrangles (.5 degree by 1 degree; scale-1:100,000).

The NGMA has also afforded an opportunity for the State to interact with the USGS on GIS technology more closely than would otherwise have been possible. Digitization of the geologic maps is included in the proposals that have been made.

The benefits of the NGMA mapping include the provision of important geologic information that is currently being used in seismic hazard zoning maps prepared for urban southern California on a scale of 1:24,000, which are mandated to be used by local governments in land-use regulation in order to minimize earthquake losses. The need for up-to-date and sophisticated geologic map information for geologic hazard zoning in southern California is extensive and additional funds in the NGMA available to the State could significantly accelerate the zoning program.

COLORADO
Ms. Vicki Cowart - State Geologist

From 1908 to about 1930, the Colorado Geological Survey (CGS) had a program of geological mapping primarily focused on mineral resource development. Funding difficulties in the intervening years did not permit the CGS to conduct geological mapping until the advent of the matching fund formula of the StateMap component of the National Geological Mapping Act of 1992 (NGMA). In 1993 the CGS began a geological mapping program at a scale of 1:24,000 with NGMA funding. The annual output of the CGS mapping program has grown from a half quadrangle in 1993 to three and a half quads in 1996. The focus of this program is basic geological mapping emphasizing geological hazards and potential mineral resources in areas experiencing development and other social pressures.

The CGS defined nine areas in the state that did not have adequate 1:24,000 geological mapping. The most urgent need is in the Interstate Highway 70-State Highway 82 corridor in central Colorado. This region contains the cities of Eagle, Gypsum, Glenwood Springs, and Carbondale plus several other smaller communities. Since the late 1980s, this region has been under considerable development pressure and the need for geological information has become more pressing.

The CGS has completed geological maps of the Glenwood Springs, Shoshone, Cattle Creek, Center Mountain, and the north half of the Cottonwood Pass quadrangles with funding from the NGMA since 1993. The mapped areas contain several active debris flows, areas of hydrocompaction , and a rockfall zone. The area also contains known coal beds, base metal occurrences, oil and gas resources, limestone, and sand, gravel, and aggregate resources. The Garfield and Eagle County governments and other citizens and developers continue to be eager users of geologic hazard and resource data in their planning process.

DELAWARE
Dr. Robert R. Jordan - State Geologist

The Delaware Geological Survey had a StateMap project to map the Seaford East and West Quadrangles in 1993. The project area is the focus of several State and federal environmental initiatives that have large groundwater components (U.S. Environmental Agency Non-Point source Pollution Program, DuPont, Inc, Seaford Resource Conservation and Recovery Act Site, State of Delaware Priority Watershed Initiative, and two Delaware Superfund Sites). The area is a region of significant expanding industrial and agribusiness ventures. Previous efforts in groundwater investigations generated much of the data and samples needed for geologic mapping and identified several geologic problems.

StateMap funds enabled the speedy completion and publication of a geologic map that has facilitated our understanding of the distribution of water-bearing units as well as available hard minerals-- sand for use in construction, thus enabling the State to plan for the wise use of land in the area.

FLORIDA
Dr. Walter Schmidt - State Geologist

The State of Florida has benefited from the National Geologic Mapping Act (NGMA). A StateMap contract provided the funding for the Florida Geological Survey (FGS) to carry out the necessary drilling, field investigations and in-house research to carefully map the environmentally sensitive areas encompassed by the Homestead 1:100,000 quadrangle in southern-most peninsular Florida during 1995 and 1996. The Homestead quadrangle covers a portion of the rapidly growing Miami-Dade metropolitan area and the critically sensitive environments of the Everglades and northeastern Florida Bay. The resulting maps will be of assistance in developing the Everglades restoration plans.

StateMap is also providing funding to map the Sarasota 1:100,000 quadrangle during 1996-97. The Sarasota area is one of the rapidly growing areas in southern Florida where development pressures have a potentially significant effect on the ecosystem. Mapping the Sarasota quadrangle will provide much needed data to assist with proper ecosystem management.

NGMA with its StateMap component provides valuable assistance for the FGS to pursue geological mapping in areas of rapid growth and environmental sensitivity. Without this funding, the mapping would not be attempted at the current level of detail.

IDAHO
Dr. Earl H. Bennett - State Geologist

StateMap projects in Idaho have concentrated on the Pocatello, Twin Falls, and Coeur d'Alene urban areas. In Pocatello (second largest city in Idaho), mapping in the Pocatello South 7.5 minute quadrangle revealed that 100 homes near Johnnie Creek were built on an old landslide. All of these homes are on septic systems, which occasionally fail due to the irregular drainage in the landslide debris. The city was concerned that effluent from these failed systems might contaminate the Portneuf aquifer (Johnny Creek drains into the Portneuf River), the main source of drinking water for Pocatello. The Johnny Creek residents were initially reluctant to pay to connect to the Pocatello sewer system, but a presentation by the State Survey and an explanation of the poor drainage in the landslide (to say nothing of their surprise at finding out that their homes were built on the hazard) convinced them that a central sewer made sense. In the Twin Falls area, geologists pointed out to the city fathers that their aquifer, which they believed was extensive, was probably more constrained than they had thought and that contamination from a rapidly growing dairy industry could be a problem for this fragile water supply. Mapping in and around Coeur d'Alene has provided important information about the regional Spokane-Rathdrum aquifer and the location of aggregate sources.

In addition to new urban environmental mapping, IGS will begin the compilation of the entire state's geology at 1:100,000 next year, also under StateMap. This database is in demand by users of Geographic Information Systems (GIS) as a basic coverage and by the USGS for a national database. This geologic resource is so important and in such high demand that the state legislature appropriated special StateMap matching funds for FY-97.

ILLINOIS
Dr. William W. Shilts - State Geologist

Since its passage in May 1992, the StateMap component of the National Geologic Mapping Program has funded the geologic mapping in Illinois of all or parts of seventeen 7.5-minute quadrangles by the Illinois State Geological Survey (ISGS). Under the program, 1:24,000-scale geologic maps have been completed for 8 quadrangles. Mapping of five quadrangles is under way, and four quadrangles, which have just been funded, will be mapped in the coming year.

Since the termination of COGEOMAP in 1992, StateMap has funded an active ISGS quadrangle-based field mapping program that has made significant headway in mapping of critical priority regions. The program also has allowed the ISGS to retain key field geologists, whose expertise might otherwise have been diverted to other programs.

Three priority areas that have been targeted by the Illinois Geologic Mapping Advisory Committee include an area of seismic hazard in the northern part of the New Madrid Seismic Zone (NMSZ) and two major suburban growth centers near Chicago and St. Louis. In the seismically active region of far southern Illinois, field mapping has identified Pliocene-Pleistocene surface ruptures along faults previously thought to have been inactive since the Mesozoic. These discoveries have substantially revised understanding of the tectonic framework in the northern portion of the NMSZ . In the rapidly expanding suburban Chicago region, quadrangle geologic mapping has been used to identify potential aggregate resources, to assess the susceptibility of aquifers to contamination, and provide local planners with a geologic basis for landfill siting decisions. New mapping planned in southwestern Illinois in the suburban St. Louis region will map an area having a major faulted flexure, extensively karsted carbonate units, thick landslide-prone loess deposits, and rapidly expanding urban sprawl.

INDIANA
Dr. Norman C. Hester - State Geologist

The StateMap program of the NGMA is the single most important enhancement to geologic mapping in the State of Indiana. Without StateMap, the Indiana Geological Survey would have no new field-based geologic mapping underway. Two projects have been ongoing since the inception of the program. Both are focused at generating geologic terrain maps, illustrating the 3-dimensional internal architecture of surface landforms and near surface unconsolidated deposits.

The first project is located in the Evansville metropolitan area of Vanderburgh County, along the Ohio River. Currently, terrain maps are completed for two quadrangles, a third is nearly complete, and a fourth will be studied in the upcoming year. Derivatives of these maps will be used to assess seismic risk and groundwater protection. The second project is located in the Gary metropolitan area of Lake County, along the Lake Michigan coastline.

Terrain maps of three quadrangles and a 30 x 60 minute sheet are complete, and three additional quadrangles are nearly finished. Derivatives of these maps will be used to address a variety of environmental concerns from groundwater quality enhancements and protection to the siting of a new municipal landfill.

IOWA
Dr. Donald L. Koch - State Geologist

Since 1992 the surficial geology of six quadrangle areas, and the bedrock geology of Linn County have been mapped under the StateMap program. These maps have provided county and municipal land-use planners, the mineral extraction industry, environmental consulting firms, and state and federal agencies with sound baseline geologic information. This information allows for more well-informed land-use decisions, better environmental assessments, and helps government agencies, the private sector, and individuals better understand, protect, and manage geologic and groundwater resources.

Since 1994 Iowa's involvement with StateMap has focused on the Cedar Rapids metropolitan area in Linn County, in eastern Iowa. This program has allowed the Iowa Department of Natural Resources, Geological Survey Bureau (GSB) to establish cooperative arrangements with local government and private interests in the county for collecting and analyzing pertinent geologic data. County and municipal governments and private industry are presently using maps produced as part of the Linn County StateMap program in land-use zoning, aggregate resource assessment, well head protection programs, and the siting of a new county sanitary landfill facility.

KANSAS
Dr. Lee C. Gerhard - State Geologist

The STATEMAP program is important to the Kansas Geological Survey and the State of Kansas, for providing funds for the completion of geologic mapping of all Kansas counties and the renewed mapping of old or poorly mapped counties in the state. These maps provide the important geologic base for utilization of the land, understanding of the topography of the area, development of the natural resources, and base information for environmental concerns. Without geologic mapping of an area it is very difficult to determine possible causes or develop remediation for environmental problems should they be natural or anthropogenic. This program has provided funds for geologic mapping in Bourbon, Greenwood and Ford counties, and for planned new mapping starts in Comanche, Hamilton, and Kearny counties. The new maps will be in digital format to allow the availability of the maps at different scales, and for utilization of the information in the new Geographical Information System (GIS) programs for improved analysis of geologic problems.

MINNESOTA
Dr. David L. Southwick - State Geologist

Between 1985 and 1993, under the cooperative state-federal COGEOMAP program, The Minnesota Geological Survey mapped the bedrock geology of eleven 7.5-minute quadrangles along the North Shore of Lake Superior. These were published as standard printed maps using conventional color-separation printing technology. In 1993-1994, under the STATEMAP component of the National Geologic Mapping Act, the geologic data contained in these printed maps was digitized and entered into a geographic information system. As electronic files, the data on rock types, structural conditions, geochemistry, and geophysical rock properties in the area were organized spatially in a form convenient for users. In this format the data have been applied to mineral potential evaluation, the assessment of mine-tailings containment problems, and issues relating to the availability and natural quality of groundwater in one of the most scenic and environmentally sensitive areas of the Upper Midwest.

In southeastern Minnesota, a major geologic concern is the protection of groundwater quality in sandstone and carbonate-rock aquifers. This is especially true in areas that contain Karst conditions, or networks of solution-enlarged openings in the rocks, through which groundwater can move rapidly without the natural cleansing effects of filtration and bacterial activity. Once contaminated, the groundwater in Karst systems is notoriously difficult to restore to acceptable quality. Since 1994, the Minnesota Geological Survey has been mapping the bedrock geology of Houston County, a Karst-prone area, under the STATEMAP component of the National Geologic Mapping Act. Mapping was completed for the eastern half of the county in 1995, and will be completed for the western half in mid-1996. County and local officials are using the maps in the design of agricultural best-management practices (BMPs), which are intended to diminish the likelihood of farm runoff entering the groundwater system. The maps also will contribute to the design of land-use plans for bluff-top development along the Mississippi River and its tributaries.

Two Minnesota STATEMAP projects approved for start-up in 1996, pending resolution of the federal budget impasse, are in the western part of the Twin Cities metropolitan area. Rapid urbanization is requiring state and local entities to make land-use decisions without sufficient information about the geological conditions. The principal need is for detailed mapping of the unconsolidated, near-surface sediments that were deposited by processes related to continental glaciation within the past two million years. Water in these sediments supplies most domestic wells in the outer-ring suburbs, and the sediments themselves are the repository for waste, the foundation materials for virtually all construction, and the source of sand and gravel for building. The proposed geologic mapping of glacial deposits will contribute to appropriate decisions about wellhead protection, wetland preservation, land-use zoning, and engineering-design criteria in an area of expanding population and economic activity. The two pending projects will be completed in 1997.

MONTANA
Dr. John C. Steinmetz - State Geologist

In Montana, the StateMap component of the NGMA has provided the opportunity to address a badly out-of-date and incomplete geologic map base for the State. The existing 1:500,000 scale geologic map was published in 1955, using turn-of-the-century data, and has large essentially unmapped areas. We are now engaged in an intense and highly productive mapping program involving both compilation of a wealth of new data and extensive field mapping.

Beginning at the North Dakota border in 1987, under sponsorship of USGS programs antecedent to StateMap, we have mapped the eastern third of Montana and are well into the central part of the State. This mapping is being conducted at 1:100,000 scale, a minimum scale for adequate detail of the geologic framework of an area. Approximately 35 new maps have been completed.

Additionally, since 1992, under StateMap, Montana's mapping program has also included a category of Special Focus maps. These more detailed maps are being made in areas of the State where rapid population influx is creating significant pressures on land areas and resources, creating an immediate need for accurate, detailed maps that address such factors as groundwater resources, seismic hazards, slope stability, flood-prone areas, and location of economic resources. These maps, such as the Billings 1:48,000, are at a scale that is easily adapted to English measurement in feet, and have text that is practical and useful to the nongeologist.

In 1993, Montana established a GIS capability, and beginning with our current StateMap contract, we are now submitting both new and revised earlier maps in digital format. We are assigning a substantial portion of our StateMap budgets now to convert the earlier map products into digital format – a formidable task, as we also keep new field mapping underway. We are constantly contacted by county commissioners, land-use planners, rural improvement districts, and other agencies requesting geologic information.

Additionally, MBMG is the resource for other State and Federal agencies needing geologic data in digital format. STATEMAP program monies are absolutely critical to this essential work on behalf of Montana's citizens.

Montana has benefitted in yet another way from the NCGM program: three academic institutions competed for graduate field thesis research in Montana through the EDMAP program, and one was successful. The reputation of this excellent program for students is now established, in Montana and elsewhere; it is certainly one of the best of a very limited number of such programs.

Reauthorization of the National Cooperative Geologic Mapping Act is very important to Montana, a large state with a great need for an updated and detailed geologic data base.

NEBRASKA
Dr. Perry B. Wigley - State Geologist

The National Geologic Mapping Act has resulted in numerous positive benefits for the state of Nebraska. Probably chief among these is to provide the geological framework to help all 23 Natural Resource Districts in the development of state-mandated groundwater management plans. Without geologic maps, preparation of these plans would not have been feasible or their value would have been greatly reduced. While we have not done a thorough economic analysis of geologic mapping, it has provided the necessary data for mineral discoveries, i.e., a world class uranium mine has been developed. Among our current primary audiences are resource managers and planners. In the urban areas of the state, we are developing land-use suitability maps, and geologic mapping is one important aspect of this activity.

NEVADA
Dr. Jonathan G. Price - State Geologist

Nevada is benefiting from the National Geologic Mapping Program. Under the StateMap component of the program, the Nevada Bureau of Mines and Geology (NBMG) is sharing costs with the USGS for 1:24,000-scale mapping. We are mapping areas of rapid urban expansion in the Las Vegas and Reno areas (where geologic maps will help avoid problems during construction, minimize damage from geologic hazards, and protect groundwater resources) and near Tuscarora (where geologic mapping will help us understand the origin of gold deposits and provide the basis for environmentally sound mineral extraction in the future). Other StateMap projects have been completed in the Las Vegas, Carson City, and Fallon areas. Within the FEDMAP component of the program, the USGS, in conjunction with NBMG and geologists at UNLV, is preparing 1:100,000-scale geologic maps of the Las Vegas and Lake Mead 30x60-minute quadrangles.

NEW JERSEY
Dr. Haig F. Kæsabach - State Geologist

Since the enactment of the NGMA in 1992, the additional funding has enabled New Jersey to produce detailed geologic maps of several places where environmental problems exit. Areas have been mapped in Sussex County where local municipalities have encountered sinkholes during and after construction. By doing detailed geologic mapping, the New Jersey Geological Survey (NJGS) has been able to produce maps which allow local government to establish rational zoning ordinances for sinkhole-prone limestone formations.

NJGS also has performed detailed mapping in urban/suburban areas where contaminants have entered the groundwater and are migrating. The detailed maps, showing the major aquifers, assist the regulatory agencies in remediating these sites and, in one case, provided information that some of the contaminants may be natural.

One of the biggest uses for detailed geologic maps in New Jersey is for establishing aquifer recharge and wellhead protection areas to protect the State's groundwater supplies. We have finished one county due to the availability of geologic maps.

NEW MEXICO
Dr. Charles E. Chapin - State Geologist

The StateMap projects under the National Geologic Mapping Act of 1992 have had a major impact on water supply investigations in the Rio Grande urban corridor of New Mexico. Seven quadrangles (scale 2 inches = 1 mile) have been completed within and adjacent to Albuquerque and Santa Fe, and eight more will be done in FY 96/97. Mapping these quadrangles is providing much needed information on soils, basin-fill sediments, aquifer characteristics, faults, and engineering geology. Rapid population growth has strained available water supplies and resulted in housing developments with septic tanks and private wells encroaching on groundwater recharge areas and geologically unstable areas.

About $285,000 in federal funds are being matched dollar-for-dollar by State funds to support the mapping. The New Mexico Bureau of Mines and Mineral Resources has put together highly skilled teams of geologists that include professors, graduate students and consultants in addition to its own staff. An advisory committee with representatives from state and federal agencies, county and municipal governments, Indian Pueblos, universities and private industry establishes priorities and provides advice and oversight. The enthusiasm and assistance of this diverse committee have been a major asset. The NGMA is not only responsible for the gathering of essential geologic data in key urban areas, it is also pulling together citizens from a wide range of occupations to help solve community problems.

OKLAHOMA
Dr. Charles J. Mankin - State Geologist

The Oklahoma Geological Survey's StateMap project continues a very successful USGS-sponsored COGEOMAP program. Under COGEOMAP, the OGS completed 15 detailed geologic maps (1:24,000) of the northern part of the Ouachita fold and thrust belt and the southern part of the Arkoma Basin. To date, an additional five geologic maps in the Ouachitas and Arkoma Basin have been produced as part of StateMap, and two maps are in progress.

The geologic maps and many derivative reports from these programs have proved to be extremely useful to recent natural-gas exploration efforts. The map area is mostly south of the giant Red Oak--Norris and Wilburton gas fields. Prior to OGS efforts, the area was considered frontier and only six significant tests had been drilled. Shortly after the OGS made the first geologic maps available, several major discoveries were made in the area. As mapping progressed to the east, exploration progressed to the east. To date, more than 150 new gas wells have been drilled in and near the map area, and several new gas fields have been discovered. All of the companies exploring for natural gas in the Ouachita Mountains-Arkoma Basin transition zone acknowledge that the surface geologic maps have improved their understanding of the geology and chances for discovering new reserves immediately.

The map area of the new StateMap effort is important not only for hydrocarbon exploration, but also for environmental and engineering concerns, in the growing city of McAlester . Because of early coal mining in the region, many abandoned underground workings are present in and around the city. The geologic and companion maps that are being developed for this area will provide valuable information to the city engineers, planners, developers, and local citizenry.

OREGON
Dr. Donald A. Hull - State Geologist

The National Geologic Mapping Program, created by 1992 legislation (P.L. 102-285), has enabled an acceleration of geologic mapping in areas of growing population in several urban areas, including Medford, Bend, and La Grande. This mapping is providing needed information for the evaluation of groundwater resources, aggregate minerals, and geologic hazards in advance of growth in these communities. In 1997, 1998 and 1999, mapping is planned for other cities including Eugene and Klamath Falls.

Geologic mapping provides the fundamental information that is needed to identify the distribution and availability of groundwater, to inventory aggregate resources needed for the construction of buildings and roads, and to evaluate earthquake and landslide hazards. The damaging earthquakes in 1993 in Klamath Falls and Molalla and the 1996 floods and landslides throughout Oregon remind us of the vulnerability to geologic hazards. The heightened concern about access to water resources argues for better information on groundwater. The pace of growth in the economy is causing an increase in demand for the gravel and crushed stone that is needed for construction. All of these societal issues can be effectively addressed only through the timely availability of geologic maps at a suitable scale to facilitate local development while minimizing the impact on other resources.

OHIO
Dr. Thomas M. Berg - State Geologist

The State of Ohio has benefitted enormously from the StateMap element of the National Cooperative Geologic Mapping Program. The Ohio Geological Survey will complete a new statewide bedrock geologic map in 1997. This mapping will replace the 1920 state map of Ohio, currently the oldest, most out-of-date state geologic map in the Nation. This completely new map will show more than ten times the detail of the 1920 map. It has already revealed a very different geologic framework for Ohio, utilizing an enormous amount of geologic information accumulated over a 70-year period by the State Survey. This

geologic mapping program could not have been accomplished without the support of the StateMap Program of the NGMA.

The statewide geologic mapping is being plotted on 7.5-minute, 1:24,000 quadrangles, and is being released to the public as part of the Ohio Geological Survey Open-File Series as each phase is completed. The people of Ohio are already using the maps for a wide variety of purposes. The Ohio Department of Transportation is using the maps to plan new highways and bridges, in addition to modifying and upgrading the existing transportation infrastructure. The industrial mineral community is using the maps to locate new aggregate resources in the State. The oil and gas industry is using the maps to guide the development of new petroleum reservoirs. The coal industry is using the maps to assess new resources and address environmental concerns. Large cities and rural communities are using the new data to locate and evaluate new sources of groundwater. Waste-management officials are using the maps to identify sites for the safe disposal of municipal and hazardous waste. Of particular interest, the geologic maps being prepared by the Ohio Geological Survey under the StateMap Program will play a key role in statewide screening for disposal of low-level, radioactive waste for the Midwest Compact. In addition, the new maps will be pivotal in managing non-point-source pollution in Ohio.

PENNSYLVANIA
Dr. Donald M. Hoskins - State Geologist

Geologic mapping in Pennsylvania prior to enactment of the National Geologic Mapping Act of 1992 largely focussed on bedrock mapping to support groundwater, bituminous coal, and other mineral resource investigations, as well as on geologic hazards of collapse by landslide and sinkhole formation. Maps were largely published as standard graphic products.

Pennsylvania has utilized the National Geologic Mapping program to initiate a new type of geologic mapping whose objective is rapid release of standard-scale maps through Open File (mainly "zerox," or blueprint reproduction), followed by digital compilation of regional 1:100,000 maps. Through consultation with Pennsylvania's StateMap advisory group, several high priority areas were selected, mainly in metropolitan areas of Allentown- Bethlehem, Scranton-Wilkes Barre, and the Pittsburgh area. In addition to bedrock mapping, geologic mapping of surficial geologic materials was identified as a first priority since these materials are the most often affected by development and cause the most landslide hazards.

The pilot area project under NGMA in Pennsylvania is the Allentown .5- by 1-degree quadrangle, embracing most of the Allentown-Bethlehem-Easton metropolitan corridor. So far, 20 reconnaissance surficial materials geologic maps have been completed. These will be released in 1996 as Open File maps. In 1996 field work will begin on a similar project in the Scranton- Wilkes Barre area.

TEXAS
Dr. Noel Tyler - State Geologist

The funding provided by the NGMA (StateMap) has been of great benefit to the State of Texas. Basic geologic mapping is the foundation for most studies of aquifers, natural resources, and land use projects such as waste disposal or major developments. The Bureau of Economic Geology, the State Geological Survey of Texas, has special expertise in geologic mapping. Basic geologic mapping, however, is seldom supported by our traditional sources of project funds, and this important task occurs only by judicious use of State-appropriated money or of funds provided by the StateMap program. It is important to the State of Texas that this program continue.

In Texas, StateMap project areas are selected by representatives of several State agencies who meet annually to review progress and plan new work. High-priority areas are selected where the activities of our society are producing impacts on water resources, land use, or other natural resources that can be better addressed by an improved geologic data base. For the past few years, our efforts have focused

on two areas of Texas that are undergoing rapid development, expanding urbanization, and increased demands for water supplies. These areas are the El Paso County area and adjacent Rio Grande Valley and the San Antonio-New Braunfels area. The StateMap projects have produced new, high-quality, geologic maps totalling more than 2,500 square miles.

The new maps, covering more than 60 quadrangles, are currently available from the Bureau of Economic Geology for the cost of reproduction and have been submitted to the U.S. Geological Survey as part of the national database. We are currently in the process of digitizing these data to increase their utility. These maps and related products have been used by many State agencies and local water districts. They have also formed the basis for an improved understanding of essential resources such as the Edwards aquifer and have leveraged other funding for important Texas projects. Because of the success of these NGMA projects, additional work to expand the mapping of the geologic framework of critical aquifers and to digitize existing maps produced under StateMap has been approved, if funds are made available by Congress.

UTAH
Dr. M. Lee Allison - State Geologist

Moab quadrangle- After a request for assistance from Rep. Bill Orton (D-Utah) and using information from the newly completed Moab quad, the Utah Geological Survey (UGS) identified a number of potential geologic hazards that caused the Nuclear Regulatory Commission to reconsider their proposal to cap a uranium tailings pile in place on the Colorado River floodplain bordering Arches National Park. The UGS map showed that the Moab fault extended under the Atlas Uranium tailings pile at the edge of the town of Moab. We also identified the potential for flooding and dissolution of the underlying salt anticline. The NRC reopened their investigation and is currently evaluating having the tailings trucked to a less hazardous site. Local residents strongly support moving the tailings.

St. George quadrangle- Detailed mapping of sand and gravel deposits was used in land trade negotiations between state and federal agencies. The gravel is on land that may be traded for an area that is to be set aside as habitat for the endangered desert tortoise. The map was used to determine the volume and quality of the gravel deposits and estimate the value of the land. The area is one of the ten fastest growing counties in the US (percentage wise) and much development has been on hold pending resolution of the tortoise problem.

VERMONT
Dr. Laurence R. Becker - State Geologist

Vermont is working towards a new State bedrock geologic map as the 1961 state map is the oldest published bedrock map distributed by any of the New England states. The new map will be more detailed and incorporates 35 years of advancements made in the science of geology.

Funds provided by the StateMap program in the years 1994-96, as part of the National Geologic Mapping Act, are invaluable. The funds support detailed mapping at a scale of 1:24,000 as well as the placement of map data into digital format. The process of bringing information to a scale of 1:100,000 for the state map takes the time and expertise of compilers who are supported by these funds. The end product will be digitized for a data set that can contribute to resolving a host of environmental issues.

WASHINGTON
Mr. Raymond Lasmanis - State Geologist

StateMap has helped the Washington Division of Geology and Earth Resources stabilize its goals and objectives in a time of shrinking budgets. Without StateMap the Division would probably lose a significant number of important staff members and be unable to follow its strategic plan for the next ten years.

The StateMap program has allowed the Division to:

- Complete 1:24,000-scale field mapping that was critical to finishing three 1:100,000-scale quadrangles in geologically complex areas that, without funding, would have had to remain oversimplified and incorrect.
- Initiate a statewide digital geologic database program that will provide GIS coverage to the national spatial database as well as to local and regional users.
- Initiate a large scale mapping program to generate geologic maps suitable for hazard and resource planning.

These products are currently in high demand by a broad spectrum of users. To lose StateMap funding would deny the citizenry an extremely beneficial set of tools for its future and again throw our state survey's budget and planning into turmoil.

WISCONSIN
Dr. James M. Robertson - State Geologist

Since 1992, Wisconsin has benefitted significantly from the StateMap program of the National Geologic Mapping Act. This program, which matches each state dollar with an equivalent federal dollar, has enabled the Wisconsin Geological and Natural History Survey (WGNHS) to accelerate its county Quaternary mapping program. Specifically, StateMap has contributed almost $150,000 over the last four years toward the Quaternary mapping of three counties -- Lincoln, Wallworth, and Manitowoc. This mapping not only answers fundamental questions about the glacial history of Wisconsin, but more importanly, can be used directly by the counties to address a wide variety of groundwater delineation, groundwater protection, land-fill siting, sand and gravel resource, and general land-use issues. At this time, Lincoln and Wallworth Counties are completed, and Manitowoc County is in progress. State geologic mapping needs, identified and prioritized by Wisconsin, are being met with twice as many resouces and more quickly thanks to the StateMap program.

WYOMING
Dr. Gary B. Glass - State Geologist

The Wyoming State Geological Survey reccived a total of $30,499 from the StateMap Program for contract years 1994, 1995, and 1996. The Survey mapped the Laramie and Red Buttes Quadrangles in 1994 ($12,000), the Howell Quadrangle in 1995 ($10,000), and will map the Guernsey Quadrangle in 1996 ($8,499). These maps are part of the Survey's new program geared toward producing 1:24,000-scale geologic maps for the more populated areas of Wyoming. The purpose of the program is to provide detailed geologic information to the citizens, city/county planners, and developers in these areas, aiding them in their planning and siting efforts. The maps include structural cross-sections and a accompanying write-up summarizing the information on mineral and groundwater resources, potential geologic hazards, and structural geology as it may relate to development and planning within the mapped area. In addition, these maps are used by the mineral and energy industries in the State as exploration tools. This program has been quite successful in the Laramie area, with local consultants and planners using the new maps extensively. With the support of StateMap, this program will continue in the more populated areas in Wyoming that need new geologic mapping.

Testimony to the Subcommittee on Energy and Mineral Resources, Committee on Resources, U. S. House of Representatives relative to *H. R. 3198 "Reauthorization of the National Geologic Mapping Act of 1992"*

by

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Thank you Mr. (or Madam) Chairman. I am an environmental biologist working for a national environmental consulting firm, Tetra Tech, Inc., located in the Baltimore office at Owings Mills, Maryland. The primary focus of the work that I and my colleagues do is to use biological data as indicators of ecological or ecosystem health, mainly aquatic ecosystems. We design and implement environmental monitoring and assessment programs that sample biological, physical, and chemical components of the ecosystem. Although I am not a geologist, I would like to give you a picture of why geological information is important to the work that I and many others like me do every day. I also want to express my support for the reauthorization of the National Geologic Mapping Act of 1992 as the key for providing the necessary basic information needed to properly monitor the environment in support of sound environmental policy.

1. What are environmental indicators?

Traditionally, the health of streams, rivers, lakes and other bodies of water was determined by monitoring chemical contamination. Does chemical analysis give us the comprehensive data necessary to monitor water in a way to apply proper environmental regulations? In some cases, the answer was yes. However, we now have taken an important step forward in understanding water quality by realizing that water resources are much more than just chemical components. The biological system associated with water, that is, the insects, fish, plants, and microorganisms that live in and around water, are many times key indicators of water resource health. In addition, these biological indicators are features of the ecosystem that can be appreciated by the public to a greater extent than more traditional measures of water quality, such as water chemistry. We

found in some cases, for example, that a body of water with low level chemical contamination can still support a healthy, vigorous and diverse population of living organisms. Is this water therefore in need of management action? On the other hand , we have also found situations where low level chemical contamination, or even slight changes in water temperature due to thermal pollution could have drastic impacts on the populations of living organisms.

By studying questions such as these, we are able judge the status of the ecosystem in definable quantitative terms that take into account more components of the ecosystem. We therefore call the data we collect to be "indicators" of ecological or ecosystem health. These indicators are based on field data collected with the objective of answering questions about the condition of a natural resource. In 1995, the Intergovernmental Task Force on Monitoring Water Quality defined an environmental indicator as a "*...measurable feature or features that provides managerially or scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality*" (ITFM 1995). This definition requires that data used to define indicators must be scientifically-valid, practical in terms of costs and level of effort spent to collect them, and relevant to programmatic goals.

To use biological indicators in a practical way, we design decision thresholds for each ecosystem we study. Whether an ecosystem is considered healthy or in good condition is judged by comparing data from that ecosystem with that of other ecosystems where a baseline of biological information has already been established. The compared ecosystem is called a control or a reference condition. When thresholds are developed, they are tailored to local, regional, state, or national needs which demonstrates that a single criterion cannot be used across the country to assess all ecosystems.

2. Why are geology and surface landform (physiography or topography) important to this process?

Now what does all this have to do with geology? Very simply, biology is related to habitat and

habitat results directly from underlying geology. The abundance and diversity of organisms, even without human disturbance, is highly variable. A scientist who is monitoring the environment must understand this variability so not to misinterpret the data that he or she collects. Geological information helps by providing the framework for organizing environmental information.

There is a vast diversity and quantity of ecological and biological information available which must be put into a useful geographic system so that environmental scientists and the public begin to understand how natural variability can be used to develop decision thresholds. One of the primary mapping methods used now for this is called the ecoregion approach (Omernik 1995, Bailey 1996).

Ecoregion maps use a variety of both mapped and unmapped information to develop an ecological landscape classification, grouping together areas that are ecologically distinct, called ecoregions. These classes can be thought of as arising from the environmental interactions of vegetation, climate, wildlife, water, land use patterns, soils, landform (physiography), and geologic structure. With all of these diverse variables, a map may become overly difficult to understand, but establishment of ecoregions is aimed at organizing this complex information into more straightforward groupings.

3. Application of Ecoregions to Environmental Management

Let me give you a brief example of how my company has used ecoregion maps to increase the accuracy of environmental management decision making. A major paper company asked for an assessment of the effects of their manufacturing effluent on a large stream receiving the discharge. Use of ecoregions for defining reference conditions, or background, provided an assessment of stream conditions that showed factors, other than the company's discharge, were causing the majority of the problems. Specifically, it showed that nonpoint sources of pollution were involved to a greater extent in causing impairment of the stream than the discharge. The ecoregion maps provided the framework for determining that multiple sources of pollution were causing

impairment of stream health.

4. Relationship of Geologic Information to Environmental Management

Part of the information used to develop ecoregions is geological information. Let me explain how many of the components of ecosystems are tied to basic geology. The structure and function of biological communities are dependent on environmental conditions, the quality of available habitat, food, and water. Plants are an integral part of any biological community, and their growth is dependent on soil structure, mineralogy, and water. Soil, in turn, and its mineral content, directly result from wind or water erosion and the weathering of bedrock or other underlying geologic structure. Likewise, water chemistry also is determined, in part, by geology. Groundwater will pick up sediments and chemicals from the bedrock over which it is flowing. Surface waters also will pick up substances depending on the type of soils present, which in themselves are determined by geology. Soil types and natural water quality are, thus, essential components of the environment derived from the underlying geology and contributing to ecosystem structure and function.

5. Relationship of Surface Landform or Topography to Environmental Management

Other aspects of the geological condition affect water quality. Landscape structure, such as mountains, valleys, river channels, etc. form as a result of one or a combination of three factors: i) erosion, ii) movement of bedrock as part of earthquake activity, or iii) volcanic activity. Because water flows downhill, the landscape structure or landform is responsible for how large or small a watershed is, where wetlands occur, the type of habitat that is present in a particular location, rates of soil erosion, and the geographic distribution of plants and plant communities (in part). One can see how landform is, in part, a major factor that determines the structure and function of ecosystems. Surficial landform or topographic maps are essential to production of the ecoregion maps I spoke of earlier in my testimony.

To lack understanding of the environmental factors related to ecosystem structure and function would decrease the accuracy with which we could predict the effects of human activities. The geological information on landform is the type of information provided by the National Geologic Mapping Program.

6. Support for the Reauthorization of the National Geologic Mapping Act of 1992

I feel that a cooperative Federal/State/local program to continue production and refinement of maps depicting data concerning underlying geologic (bedrock) and surficial landform (topographic) information is important. This bill, for continuing the funding of that Act, is crucial to maintaining and improving the quality and accuracy of the nation's environmental management activities. I appreciate the opportunity to offer this testimony in support of H. R. 3198 to reauthorize the National Geological Mapping Act of 1992.

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