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ON THE COVER: Tinicum Marsh, a registered National Natural Landmark located at the boundary of Philadelphia and Delaware counties. Part freshwater and part saltwater, this is a critical and delicate physical feature and biological sanctuary closely surrounded by urban developments.
FROM THE DESK
OF THE
STATE GEOLOGIST . . .

THE EXPANDING ROLE OF
ENVIRONMENTAL IMPACT STATEMENTS

The advent of environmental impact statements (EIS) several years ago was properly heralded as a constructive, formal procedure designed to evaluate, in advance, the impacts which a proposed project would have on the environment. If unfavorable reports were found to be likely, the project could be modified, or even cancelled.

In the early days of this process, the primary concern was to avoid disastrous impacts upon our biological environment (plant and animal life) and upon our physical environment (soil erosion, water quality, etc.) However, as time went by, the definition of environment began to change and environmental impact statement guidelines called for the inclusion of assessment of the socio-economic impacts of each proposed project. Thus, we now find that the EIS deals not only with the physical and biological sciences, but with the less-than-exact subjects of sociology and economics. Of course, those aspects of impact are important; the number of new jobs which may be created by a project vs the number of businesses or farms displaced; the increased tax revenue from new industry attracted by the project vs the increased costs of schools and sewer lines due to prospective new houses and factories.

Having expanded into the realm of socio-economics, the EIS's should now go one step further and evaluate the geo-political and international aspects of each project. An obvious example would be a coal-burning power plant which not only would support our domestic coal producing industry, but would make us less dependent on foreign oil - a major economic, military, and international impact. Less obvious might be a proposed factory (even with related highway and energy needs) whose new and efficiently produced products could compete on the world market and reduce our imbalance of payments ratio. Or a new fertilizer or farm equipment installation which enables the U.S. to produce more food for export to a hungry world. True, not each and every environmental impact of such installations is beneficial - they rarely are. But despite some additional energy demands, some local displacements, some community needs such as schools and sewer systems, the overall benefits to our national and international position may be highly desirable.

The Pennsylvania Geological Survey is involved in the review process of environmental impact statements. We look for a thorough

(continued on page 32)
Sinkholes are commonly found in areas underlain by limestone and dolomite. In the York-Hanover Valley of York County, Pennsylvania, sinkhole-cave associations are common in the Vintage, Kinzers and Ledger dolomites, all of Cambrian Age.

There was a recent discovery of a previously unknown sinkhole of particular interest at Rudy County Park. During the afternoon of February 24, 1980, an unidentified person was riding a horse in John Rudy County Park, located on Mundis Race Drive, about 1.32 miles east of Emigsville. Although Rudy Park is the headquarters of the county park system the property is not yet developed. Riding on one of the unimproved dirt roads near the northern boundary of the park the hoof of the horse suddenly fell into what appeared as a typical groundhog hole. With the entire leg of the horse sinking into the hole the weight of the horse forced more soil downward. After a few minutes there was a hole measuring 6 feet in diameter and 8 feet deep with the horse lying on its back at the bottom. After park personnel with a Caterpillar bulldozer worked for several hours the animal was safely freed.

How does this horse story relate to the area geology and sinkholes? Geologically the location of this event took place within the
Antietam Quartzite. Because this formation does not contain any carbonate it seems odd that a sinkhole would appear. Looking closer at the structure this thin belt of quartzite is a klippe bordered by a fault on the south side. This klippe is surrounded by the Vintage Dolomite with the nearest Antietam rocks being 0.5 miles north and east (Stose and Jonas, 1932, pl. 1; Wilshusen, 1979, pl. 1). Apparently the underlying Vintage Dolomite slumped forming a sinkhole not detectable on the surface due to the overlying quartzite. Through the freezing and thawing processes the quartzite and overlying soil became mobile. The extra weight of the horse and rider over this “arch” caused the material to collapse, filling the cavity once occupied by the Vintage rocks.

In summary it should be noted from this occurrence that sinkholes are not only restricted to carbonate formations on the surface, but may also occur in carbonate rocks overlain by other rock types. Engineers and contractors, among others, should be aware of this type of collapse even when the presence of sinkholes seems unlikely.

REFERENCES
INTRODUCTION

This publication is the twenty-third annual report on Geological Research and Publications in Pennsylvania. This is an attempt to list all current geologic research in Pennsylvania and includes persons and projects other than those of the Pennsylvania Geological Survey. Because of the large number of projects reported to us, we exercise editorial license to reduce the description of the research projects to fit our available space.

We have also attempted to determine an anticipated completion date (ACD) for each project. The anticipated completion date is the estimate of the date when the author will complete his report; additional time should be anticipated until the report is published. If you wish more information on a project described herein, please write directly to the author; most of these projects will not be published by the Pennsylvania Geological Survey inasmuch as most are not Survey staff projects.

The listings are grouped into major categories of research to facilitate your search for information on a particular subject. Reports published are listed alphabetically by author.

As with all compilations, there may be omissions; this is unintentional. Additional copies of this report may be obtained by writing to the Bureau of Topographic and Geologic Survey, Department of Environmental Resources, P.O. Box 2357, Harrisburg, Pennsylvania 17120.

AREAL GEOLOGY

ROBIN ABEL, The Pa. State Univ., and T. M. BERG and W. D. SEVON, Pa. Geol. Survey. Lithologic Map of Pennsylvania. This map will show (at a scale of 1:500,000) about 25 rock units across Pennsylvania and is being derived from the new state geologic map. ACD: Late 1981.


A. M. THOMPSON, Univ. of Del. Bedrock Geology and Mapping in Northern Delaware and Adjacent Southeastern Pa. Continuation of mapping of bedrock geology and brittle structures in southern Chester and Delaware Counties, Pa., and northern New Castle County, Del.

G. H. WOOD, JR., U.S. Geol. Survey. Southern Anthracite Field, Pa. If time is available, field work to map structure and stratigraphy of the Weatherly quadrangle, Pa., will be continued during FY 1980. Report preparation on the eastern part of the study area will continue. ACD: Continuing.

**ECONOMIC GEOLOGY**

T. M. BERG, A. D. GLOVER, C. H. DODGE, J. R. SHAULIS, and V. W. SKEMA, Pa. Geol. Survey. Coal Resources of Greene, Washington, Allegheny, Fayette, Westmoreland, Beaver, Butler, Cambria, Indiana, and Somerset Cos. Available data for coal-bearing strata in Greene and Washington Counties have been assembled and prepared for computer entry into the National Coal Resources Data System (NCRDS). Some information for Greene County has already been entered. Data for Allegheny, Fayette, and Westmoreland Counties are being assembled and prepared for entry, with ACD: Summer, 1980. Data for Beaver, Butler, Cambria, Indiana, and Somerset Counties will be assembled and prepared for computer entry by summer 1981. Coal reserve maps and tables, in addition to other derivative maps, will be produced when the output capabilities of NCRDS at the U.S. Geol. Survey in Reston, Va., are operational.

M. D. CARTER, U.S. Geol. Survey. National Coal Resources Data System. Information on coal resources and related subjects will continue to be collected and entered in computerized data system. Data are contributed to the system by the State Survey. This project has taken over the task of developing techniques for preparing geologic and resource maps that are computer generated. ACD: Continuing.

C. B. CECIL, U.S. Geol. Survey. Geology of Contaminants in Coal. Regional stratigraphic studies of the Upper Freeport Limestone to the Brush Creek Shale interval to determine the depositional history of the Upper Freeport coal will continue. Sampling programs will be initiated to test models that have been developed for the Upper Freeport coal bed; one sampling area will be the Pocahontas #3 coal bed in West Virginia, a low-sulfur low-ash coal; the other sampling site,
not yet selected, will be in a high-sulfur, high-ash coal bed. ACD: Continuing.

WALLACE deWITT, JR., U.S. Geol. Survey. Land Classification—Oil and Gas, Eastern Region. The project will provide an evaluation of the oil and gas resources of selected wilderness and RARE II areas in the States of West Virginia, Virginia, Alabama, Kentucky, Pennsylvania, Illinois, and Mississippi, ACD: 1981.


JANE EGGLESTON, Skelly and Loy. Extraction/Preparation Research and Development Needs for Anthracite. Skelly and Loy is formulating a comprehensive research and development plan for the DOE, that will promote enhanced recovery and expanded utilization of the extensive anthracite reserve base. ACD: May 31, 1980.

J. A. HARPER and C. D. LAUGHERY, Pa. Geol. Survey, and W. S. LYTLE, Univ. of Okla. Pennsylvania Oil and Gas Fields Project. Project is intended to update, standardize, and define the limits of all oil and gas fields in Pennsylvania. The final result will be a new oil and gas fields map showing major reservoirs as well as field and pool areas. ACD: 1981.

G. W. LENEY, U.S. Dept. of Energy, and BENDIX FIELD ENGINEERING CORPORATION. National Uranium Evaluation Program. Field work, preparation of preliminary folios, and recommendations on the assessment of uranium resources have been completed for Scranton, Williamsport, and Harrisburg 2° NTMS quadrangles, under the NURE program. Field work is in progress on the Newark quadrangle. ACD: 1983.


rences for use in ceramic and non-ceramic applications, including collection of data on the mineralogy and major- and minor-oxide chemistry of the occurrences. ACD: 1980.

B. J. O'NEILL, JR., and FIELD MAPPING DIVISION, Pa. Geol. Survey, and U.S. BUREAU OF MINES. Investigations for High-Calcium Limestones in Pa. Objectives are: (1) to sample and analyze limestone units where information is lacking, incomplete, or widely scattered; (2) to map any newly discovered high-calcium limestone unit that has potential commercial applications, and (3) to synthesize the data into publications which will be useful guides to exploration targets. ACD: Continuous.


A. W. ROSE and A. T. SMITH, The Pa. State Univ. Geology and Geochemistry of Cu-U Occurrences in the Catskill Fm. in Pa. About 50 Cu-U occurrences have been located and the geology and sedimentology described. Most occur in local reducing zones adjacent to permeable sandstones with evidence for deposition on a coastal plain influenced by tidal phenomena. ACD: Aug. 1980.

R. C. SMITH, II, and J. H. BARNES, Pa. Geol. Survey. Geologic and Mineralogic Interpretation of Gamma Ray Reconnaissance Data for the Reading Prong, Eastern Pa. [portions of Berks, Lehigh, Northampton, and Bucks Cos.]. To supplement aerial gamma ray data, collected as part of the NURE reconnaissance survey for the U.S. DOE, a ground survey is being made to locate anomalous areas. Representative samples from these areas will be collected for petrographic and trace element studies. ACD: June 1981.

TOM SPOHN and ALICE BLOUNT, Rutgers State Univ. at Newark. Mineralogy of the Residual Soils Which Overlie a Talc Deposit in the Stateline Serpentine, Pa. Samples of residuum obtained by hand
auger along three traverses across the talc body and along one traverse not intersecting talc are being analyzed by X-ray diffraction and IR techniques. ACD: Fall 1980.

ENGINEERING GEOLOGY

PAUL CARNEY, Penn-Dixie Industries, Inc. Surface Drainage Patterns and Facies Changes Associated with Regression of the Vanport Sea [Worthington, Chicora, East Brady, and Kittanning Quads. in Butler and Armstrong Cos., Pa.]. Objective is to delineate erosional channels and structural changes relative to mine roof conditions. To date, a southwest meandering river drainage system has been partially mapped. Stratigraphic and engineering characteristics, transverse to drainage, are being studied. ACD: 1981.

W. E. DAVIES, JOHN POMEROY, PAUL RUANE, and ROBERT HACKMAN, U.S. Geol. Survey. Safe Mine Waste Disposal, Appalachians. The current phase of the project covers determination of slope stability, old and recent landslides, the cause of landslides and their stabilization. Mapping at 1:24,000 in Pennsylvania is complete and 7½-minute sheets are being prepared for open file. Printed 1:250,000 maps and a Professional Paper will be completed later. ACD: 1980 for Pa.

ENVIRONMENTAL GEOLOGY


GENERAL GEOLOGY


J. P. WILSHUSEN, Pa. Geol. Survey. Geology of the Appalachian Trail in Pa. [SE Pa.]. A description of characteristics of each physiographic section with detailed, illustrated accounts of points of interest along the trail route. Sketch maps with geologic cross sections and descriptions at specific points are keyed to a geologic map of the trail. ACD: Dec. 1980.

T. O. WRIGHT, Allegheny Coll., G. C. STEPHENS, George Washington Univ., and L. B. PLATT, Bryn Mawr Coll. Structure and Stratigraphy of the Martinsburg and Reedsville Formations in the Central Appalachians. The goals of this project are to develop a biostratigraphy, based on graptolites, for these rocks, to investigate structural relationships, including cleavage development, and to determine the environment of deposition and geologic history in some detail. ACD: 2 years.

GEOCHEMISTRY

Member of the Catskill Fm. near Jim Thorpe are weakly anomalous in uranium and thorium and uranium in zircons. The oxidized paleoaquifer near the Penn Haven Junction U occurrence is distinctly anomalous in uranium. ACD: May 1980.


GEOMORPHOLOGY


NOEL POTTER, JR., Dickinson Coll. Distribution and Origin of Colluvium and Gravel, North Flank of South Mountain, Cumberland Co. ACD: Continuing.


W. B. WHITE, The Pa. State Univ. Caves of Pa. Complete descriptions and maps are being compiled for all caves in Pennsylvania. Data for Centre County were completed and data for Mifflin County are largely complete this year. ACD: 1980.
GEOPHYSICS

W. H. DIMENT, U.S. Geol. Survey. Seismotectonics of the northeastern U.S. Studies of deep geologic conditions as revealed by analyses of gravity, magnetic, heat-flow, seismic, and drilling data will continue in the northeastern states. A gravity map of the State of Pennsylvania will be prepared during FY 1980. Gravity and magnetic data from the Appalachian region will be analyzed to determine the deep structural features of that area. The relationship of eastern U.S. seismicity and seismogenic structures will also be analyzed. ACD: 1983.

B. F. HOWELL, JR., The Pa. State Univ. Seismic Hazard Studies in the U.S. Methods of predicting the probability of occurrence of earthquakes of various sizes in any year are being investigated for all and various parts of the United States and other areas. ACD: 1982.

ROB VAN DER VOO and P. BROWN, Univ. of Mich. Paleomagnetism of the Wilmington, Del., district and adjacent Piedmont areas. ACD: July 1982.

GLACIAL GEOLOGY


HYDROLOGY


ANTHONY SEGZDA and JOHN TOMIKEL, California State Coll. Seasonal Variations in the Discharge of Pike Run. This is a Master’s project for a graduate student. ACD: Aug. 1980.


L. E. TAYLOR and D. W. ROYER, Pa. Geol. Survey. Summary Groundwater Resources of Adams Co., Pa. Description and inventory of the groundwater resources of Adams County. A geologic map at scale of 1:50,000 will be included along with tables of well records and selected chemical analyses. ACD: June 1980.

MICHAEL TERRETTI and JOHN TOMIKEL, California State Coll. Seasonal Changes in Acid Mine Drainage [small streams in SW Pa.]. This is a Master’s project; the results will not be published. ACD: July-Aug. 1980.


MINERALOGY

have been added since the *Mineralogy of Pennsylvania 1966-1975* was published. Revisions will be published bi-annually in *Pennsylvania Geology*. ACD: Continuing.

**PALEONTOLOGY**


A. G. HARRIS, U.S. Geol. Survey. Conodont Succession Across Lower/Middle Ordovician Boundary, Central Appalachians. Field investigations will take place in the Valley and Ridge province of Pa., W.Va., Va., and Md. during FY 1980. Outcrop sections will be measured and described and samples collected for conodont analysis. Lower Ordovician strata in Pa. and N.J. will also be sampled for conodont analysis. A preliminary report on collections from measured sections that were analyzed earlier will be prepared. ACD: Continuing.


Corals and ostracodes of the Keyser and Helderberg units are being studied both systematically and bio-stratigraphically. ACD: 1984-1985.


SEDIMENTOLOGY


S. B. KATZ, SUNY at Stony Brook. A Chemical and Hydrologic Model for the Lockatong Fm. (Triassic) of N.J. and eastern Pa. The distribution and morphology of evaporites and sedimentary textures in a closed basin is dependent upon many parameters, such as brine chemistry and ground water hydrology. Models exist for modern closed basins, however, these have not been applied to ancient deposits. To date seven lithotypes, including possible paleosoil textures have been identified. ACD: Aug. 31, 1980.


M. A. THOMSEN and W. D. MARTIN, Miami Univ. Petrology of the Mudstones and Shales of the Dunkard Group (Upper Pennsylvanian and Permian) of Pa. and W.Va. [Dunkard basin—Washington and Greene Cos., Pa.]. This research is directed toward a petrologic investigation of the mudstones and shales of the northern Dunkard Basin. The main objective will be to determine the mineral composition of the various size fractions. Clay polytypes will be studied to determine detrital from authigenic origins. ACD: Aug.-Sept. 1980.
STRATIGRAPHY


A. D. GLOVER, C. H. DODGE, V. W. SKEMA, and J. R. SHAULIS, Pa. Geol. Survey. TASIC (Temporarily Available Stratigraphic Information Collection). This project is a continuing program for recording stratigraphic data on active coal and clay strip mines while exposures are available. The ongoing project is designed to provide data for future mapping and regional mineral resource evaluation. ACD: Continuing program; volume 4, 1981.


J. B. ROEN, U.S. Geol. Survey. Stratigraphy of the Devonian Black Shale in the Appalachian Basin. Project will continue to gather and analyze data and to prepare reports and maps that establish a regional stratigraphic framework and delineate the areal extent, thickness, and structure of the Devonian black shales and related rocks. Final goal of the project will be the complete characterization and determination of the hydrocarbon resource potential of the Devonian black shales. ACD: Continuing.

STRUCTURAL GEOLOGY


A. A. DRAKE, JR., U.S. Geol. Survey. Central Appalachian Continental Margin Transect (U.S. Geodynamics Transects Program) [corri-
dor from Ithaca, N.Y., thru eastern Pa. and north-central N.J. to Atlantic City to central Baltimore Canyon Trough]. Study is to assess the state of understanding of the structure and history of this transitional area from the North American craton and Atlantic oceanic lithosphere, to identify major problems, and to recommend programs for their solution. ACD: Late summer 1981.

A. A. DRAKE, JR., and A. E. NELSON, U.S. Geol. Survey, and L. M. HALL, Univ. of Mass. Basement-Cover Relation Map of the Appalachian Orogen (part of IGCP Project 27, Caledonian orogen) [Appalachian-wide, includes Reading Prong, Blue Ridge, and Piedmont of Pa.]. This map will show rocks which were basement during the Caledonian orogenic cycle and their relation to cover. Their age, date of last major tectonism, metamorphic state, and tectonic status (autochthonous, parautochthonous, allochthonous, or highly allochthonous) will be depicted. ACD: Late summer 1981.

R. T. FAI LL, Pa. Geol. Survey. Tectonic Map of Pa. Map will display: 1) location, extent, and name of each of the major folds and faults; 2) prominent joint orientations; 3) contours on top of basement; 4) outcrop trace of Old Port Formation, and important angular unconformities; 5) structure contours on top of Onondaga in western and north-central Pennsylvania; 6) igneous bodies; 7) tectonic and metamorphic boundaries; 8) radiometric dates with locations; and 9) earthquake epicenters. ACD: June 30, 1981.

L. D. HARRIS, U.S. Geol. Survey. Structural Studies of the Devonian Shale in the Appalachian Basin. Field investigations have been completed, and FY 1980 will focus on the completion of reports on all structural features that may have produced natural subsurface fracturing and, thus, would allow for gas production from the Devonian black shale sequence. ACD: 1981.


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<th>Journal/Book/Conference</th>
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**LIME IN PENNSYLVANIA**

The U.S. Bureau of Mines reports that at the end of 1978 there were 155 lime producing plants in the U.S. Pennsylvania ranked 4th in the nation with 10 plants. One Pennsylvania lime producer, the Annville plant of Bethlehem Steel Corporation in Lebanon County ranked as the 6th largest individual lime producer in the country.

Following is the complete list of Pennsylvania lime producers:

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<thead>
<tr>
<th>Company</th>
<th>Plant Name</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. E. Baker Co.</td>
<td>York</td>
<td>York</td>
</tr>
<tr>
<td>Box 1189 York, PA 17405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bethlehem Steel Corp.</td>
<td>Hanover</td>
<td>Adams</td>
</tr>
<tr>
<td>Martin Tower</td>
<td>Annville</td>
<td>Lebanon</td>
</tr>
<tr>
<td>Bethlehem, PA 18016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. &amp; W. H. Corson, Inc.</td>
<td>Plymouth Meeting</td>
<td>Montgomery</td>
</tr>
<tr>
<td>Stenton Ave. and Joshua Rd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plymouth Meeting, PA 19462</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Charles H. Updegraff joined the Department of Mines and Minerals in 1967 as an Oil and Gas Inspector in the Division of Oil and Gas. One year later he assumed the duties of Petroleum Engineer. One of his duties included mapping and taking samples of fluids flowing from abandoned oil or gas wells located along various watersheds where the streams were being polluted from these discharges. Abate-
ment procedures were developed from these studies and wells were plugged on three watersheds under Division supervision. Other duties included maintaining compliance with the Underground Gas Storage and Oil and Gas Conservation Acts.

In May 1977 he was appointed Acting Chief of the Division, then under the Bureau of Land Protection, and continued as Acting Chief when the Division was transferred to the Survey. In June 1979 he was appointed as Geologist Supervisor to implement the Division’s role in administering the Federal Natural Gas Policy Act. This was a completely new and complex program and Charlie’s attention and dedication made it possible to get the program going to the satisfaction of all concerned.

Charles Updegraff was born in Latexo, Texas, reared in Williamsport, Pennsylvania and graduated from Penn State in 1938 with a B.S. degree in Geology. He is a registered professional engineer. He has been associated with the oil and gas industry since his graduation from Penn State, mainly as an independent until he joined the Commonwealth. He has represented Pennsylvania on numerous committees of the Interstate Oil Compact Commission.

Charlie and his wife Elsy live in Coudersport, Pennsylvania, where one daughter and one son also reside. His other daughter resides in Hershey, Pennsylvania. You probably can find Charlie in his garden or on the golf course upon his retirement.

The Commonwealth and the oil and gas industry have greatly benefited from Charlie’s dedicated services. We wish him and his family many, many years of healthy, happy retirement.
On May 7, 1980, John P. Navola retired from the Division of Oil and Gas Regulation of the Survey where he had been an Administrative Officer. John began his career with the Commonwealth in the Department of Mines and Minerals, which later became part of the Department of Environmental Resources. He brought many years of experience in the coal mining industry to the Division and was primarily responsible for instituting the office procedures for implementation of the Oil and Gas Laws in Pennsylvania.

John Navola has provided the Department with outstanding and conscientious service over the past 23 years and will certainly be missed. We wish him many long years of good health and happiness.

GEOLOGIST JOINS SURVEY

THOMAS A. McELROY joined the Environmental Geology Division of the Survey July 31 as a hydrogeologist. He will be compiling groundwater reports of surface-mined areas of Pennsylvania. At the conclusion of a four-year hitch in the Air Force, which included a year in Vietnam, Tom enrolled at SUNY Binghamton, where he completed his studies for a B.A. in geology in 1976. After a year and a half of working on a seismic crew in Colorado, Wyoming and Idaho, he entered the Master's program at the University of Massachusetts at Amherst, where he studied hydrogeology, geophysics, and glacial geology. He will receive his M.S. from the University of Massachusetts upon completion of his thesis, "Hydrogeology of Fish Hatcheries in Western Massachusetts."

Continued from State Geologist, pg. 1...

assessment of the project impacts on the geology and vice versa. But we cannot be oblivious to the overall and net impacts of a project. Having long ago moved beyond the assessment of only biological and physical impacts, the environmental impact assessment calls for broader perspectives than were originally involved in EIS's. We must now fairly evaluate the positive and negative aspects, keeping in mind not only the protection of our physical and biological elements, but the economic, social, and military strength of our community and our nation in a highly competitive and frequently hostile world. The environmental impact assessment never was simple, nor should it be; the strength and survival of our society calls for the broadest possible assessment that will enable decision makers to do what is best for our state and our nation.