Outcomes from the USGS Chesapeake Bay Advisory Review Team on the draft USGS Chesapeake Bay Science Plan
(April 26, 2005)

The Chesapeake Bay Executive Advisory Team (CBEAT) conducted a peer review of the initial draft of USGS Chesapeake Bay Science Plan, FY06-2011 on March 2-3, 2005. The CBEAT members produced two documents from the review (see attachments):
Attachment 1: Review Team Comments on science aspects of draft USGS Chesapeake Bay Science Plan, FY06-FY11
Attachment 2: Proposed items for the USGS Chesapeake Bay Science Plan and Operational Plan

These findings were use to revise the USGS Chesapeake Bay Science Plan, 2006-2010 (version May 5, 2005)

Executive Summary

Based on the findings in the two attachments, the USGS should consider the following items to further revise the USGS Chesapeake Bay Science Plan.
-Revising the USGS Chesapeake Bay science goals so they continue to be related to the issues of concern (land use, water quality, habitat, and living resources) but being more focused given the level of funding.
-Of these issues, science goals related to land use and water quality should be the highest priority. The function of near-shore areas and habitats in the biogeochemical cycling of nutrients and sediment would be an important complementary topic for water quality. Additionally, synthesis and delivery of information is a continuing high priority topic for the USGS.
-Improvement of a conceptual model of the Bay ecosystem (the Bay and its watershed) would help the USGS better develop and focus future science efforts.
-Studies of the estuary and living resources are mostly being led by other agencies and institutions so the USGS should consider these as a lower priority that may be addressed by forming scientific partnerships. This may be accomplished through greater interaction with institutions in STAC, and further partnerships with agencies conducting restoration activities.
-Having a higher proportion of studies in the watershed than in the estuary since there is a significant need to understand the relation between changes in human activities, nutrient and sediment sources, and water-quality response in the watershed and delivery to the Bay. However, there was strong agreement that an important component of the science goals would be to improve the understanding of relation between the watershed and the estuary. Further study of the near-shore areas (nontidal/tidal interface) including the influence of the environmental framework (shallow geology and watershed characteristics) on the delivery of flow, nutrients, and sediment from the watershed to the estuary was suggest as a critical science need.
-There needs to be a balance between monitoring, modeling, research, assessment and communication. The USGS should strengthen efforts in having monitoring, assessment, and research to improve models. The uncertainty inherent in these models should be identified to help guide the type of process studies needed to improve the models.
-There should be an effective balance between regional and process scale studies with continued focus on assessing regional conditions in the watershed and major river basins. Process scale studies should be conducted based on improving the understanding of

regional conditions and models. One or two "focus" areas should be identified to conduct the process-scale studies.
-The integration, synthesis, and delivery of information to help policy makers understand the implications of science findings should have high priority. The USGS should clearly articulate how efforts will be better integrated so that findings can be used to improve indicators of ecosystem condition, change, and restoration.
-Evolve from having a collection of individual studies to having fewer and more integrated studies focused on the highest priorities.

Attachment 1: Review Team Comments on Science Aspects of draft USGS Chesapeake Bay Science Plan

April 15, 2005

To: Scott Phillips and Dave Russ
From: Chesapeake Bay Executive Advisory Team (CBEAT)
Subject: Review of USGS Science Plan supporting Chesapeake Bay Management.

Introduction and background

The investigative research and assessment performed by US Geological Survey scientists in the Chesapeake Bay and its watershed have been coordinated, since 1983, with the Chesapeake Bay Program (CPB). The planning and execution of USGS work is conducted also to satisfy the missions and goals of several programs and cost-centers in the four disciplines of the Survey. The development of a coherent research plan is difficult because the work must satisfy these multiple missions. The recent establishment of an executive advisory team (CBEAT) is an attempt to cross some of these institutional, programmatic, and disciplinary boundaries. This should foster better communication and critical thinking, improve the focus of the work, and lead to stronger synthesis of results in support of Chesapeake Bay restoration. (See Appendices).

The CBEAT met for two days in early March to consider recent Survey accomplishments and to review the Survey's proposed plans for the next five years. The following is a report of the team's findings about the five-year plan (Draft revised U.S. Geological Survey Chesapeake Bay Science Plan, 2006-2011 (February 23, 2005)) followed by comments and/or recommendations to be considered by its authors. The findings, comments and recommendations represent a distillation of discussions that were made at various times in the meeting and by various members of the team.

Findings (F) and comments or recommendations (C/R)

F 1. The Chesapeake Bay (CB) ecosystem research effort requires better conceptual articulation of (1) the pre-settlement system and (2) various conceptual scenarios of human-managed system as potential restoration targets. We should be clear about what restoration means and about how progress toward success is measured. Improvements in

water clarity, SAV growth, and hypoxic zone reduction, though significant, may be inadequate.

C/R 1. In order to focus attention, scientific resources, and limited money most effectively for long-term work, scientists should try to identify those components that are central to system control, regulation, and potential management. The physical features such as climate, geology, morphology, hydrology, and hydraulics form a central core of variables that tend to be independent of biological control. The components in pelagic and benthic communities and including microbes, phytoplankton, vascular plants, and animals are biogeochemical variables; they interact in hierarchical orders as another, more dependent, set of core variables. Ecosystem components (physical, chemical, and biotic) interact according to rules of structure and function that are known well enough in conceptual terms that long-term research, monitoring, and assessment of core components can be more clearly identified and decisions about crucial work should be easier to support and defend. Financial resources are limited, some topics of study are required by laws, regulations, and trust agreements (e.g., some provisions of the endangered species act), and our pre-disposition is to attempt too much; thus it is necessary to learn how to focus the efforts.

F 2. A science manager's continuous challenge is to establish study priorities that satisfy programmatic goals and, at the same time, meet the needs of stakeholders and managers and also respond to ideas suggested by the course of investigation. Additional challenges involve finding gaps, avoiding redundancy, and acknowledging the regulatory or intellectual boundaries with other agencies, states, and academic institutions.

C/R 2. Here is an example of a gap related to institutional boundaries of several kinds:

The analysis of urban growth patterns is novel and significant because it addresses human induced change in direct fashion. Now this work needs to be linked to changes in relevant response variables in the Bay. Most of the Survey's role centers on documenting and understanding the loading processes from the Bay's watershed. Unfortunately, because so much of the urban growth is located downstream from the head of tide, these loading data do not include tidal reaches of the watershed that experience rapid urban growth. Thus there is a gap between documenting watershed contributions and the degradation of water quality in the Bay caused by features associated with cities or that are caused by processes and events in shallow, tidal reaches. A study of the transport and reaction processes in the tidal reaches of tributary embayments where urban growth is being documented should be considered by the CBP. Implementing this will require communication and collaboration among scientists working on watershed loading with scientists (many from other institutions) that monitor long-term change in the CB tidal embayments.

F 3. There is additional breadth of research capability in the Survey that is not being applied to CBP issues. (This may be true in other institutions too.) The effort needs additional process work and models, statistical (regional) modeling at several scales, flow and transport models, ground-water analysis; all in concert with long-term empirical

measurements (monitoring) in the watershed, in the embayments, and in the mainstem estuary.

C/R 3. This large requirement is limited by the lack of financial resources, by the fact that capable scientists are over-committed with work on other systems and other problems, and because programs, cost centers, and disciplines have different missions and mandates. These shortfalls, taken together, represent an institutional mismatch (driven, in part, by budget processes); that is, the requirements for solving a specific problem such as Chesapeake Bay restoration is not well matched by the capability of any existing institution.

F 4. Communication of results is an essential requirement for researchers.

C/R 4. There are three important elements. First, is the scientist's responsibility to publish manuscripts that report new knowledge in scholarly journals (i.e. reviewed by peers as part of the publication process). Second, is the need to communicate new knowledge to restoration managers and stakeholders. There was disagreement on the CBEAT about the relative importance of these two options even though one does not exclude the other. Some felt that reporting new information to managers and to the public was the highest priority; that making new information available in useable (understandable) form was the primary reason for doing the work. Others felt that publication in the peer-reviewed scientific journals was the highest priority because the peer-review assures the quality and objectivity that is necessary for credible and lasting contribution to knowledge. The latter will keep the highly visible Chesapeake Bay restoration project at the cutting edge of science. Successful publication is time consuming and expensive because page space in journals is limited (competition is tough so the rejection rate of manuscripts by the top-echelon journals is high). Nevertheless, this is the surest way (not the fastest) to communicate with the larger scientific community.

The resolution of this difference of opinion is, of course, to require both. Keep the pressure on all of the scientists to publish results in peer-reviewed journals and require communication with stakeholders, managers, and restoration decision makers. This will make the science more useful to the formation of policy while preserving the credibility of objective new information. But this is a two-way "street"; the delivery of scientific information should be an ongoing dialog between researchers and managers, and a joint responsibility. In this view, it is the responsibility of scientists to interpret and deliver new findings in forms useable by managers (along with peer-reviewed publications to back them up), and it is the responsibility of managers to make information needs known to researchers, to participate actively in information transfer, and to apply what is learned to management and restoration efforts.

The third element of the communication finding is encouragement of communication among scientists at meetings and workshops (faster). We believe that this is particularly important to generate understanding among researchers working in different places (or processes) of the CB system. It is from such communication that synthesis of

information is most likely to emerge. Absence of a compelling synthesis of the status of knowledge about change in the Bay and about the opportunity for progress in restoration is an impediment to progress. Thus, synthesis of emerging information and timely reporting is a continuing requirement. This, too, is time consuming and expensive, but we should not claim efficiency for work on difficult problems.

F 5. There are three foci for continued work on water quality; nutrients, sediments, and contaminants. Nutrients because of their relationship to eutrophication and anoxia in the Bay, sediments because of their role in nutrient and contaminant transport and their light-limiting properties affecting rooted aquatic vegetation, and contaminants because of their toxic effects on the biota, including human health.

C/R 5. Most of the Survey's work on these topics is aimed at loading processes in the watershed. Some effects of water quality changes may be observed in the rivers, but the goals of the CBP are centered on effects of water quality changes in the Bay. Most of the responses in the open Bay are being investigated by others. We believe that it is essential for full understanding to have better communication among these groups. Kevin Sellner's offer to serve as a contact with the Chesapeake Research Consortium is acknowledged thankfully. Perhaps there should be some agreement to exchange information more regularly with the university community. Nutrients, sediments, and contaminants originate in the watershed, but their effects play out in the Bay; that we don't fully understand how this works is unfortunate; we must get these two groups together more.

F 6. Coastal wetlands need more attention. There are two perspectives: (1) documentation of land use changes and (2) developing understanding of the functional roles of wetlands in the moderation of coastal erosion, the mediation of water quality, and the provision of habitat for CB biota.

C/R 6. This was discussed by CBEAT and was raised in a memo from the Fish and Wildlife Service. Wetlands seem to be a component of the system without a clear institutional champion. Attention to the construction of a conceptual ecosystem model (cf. C/R 1. above) will clarify where this fits and how it will be approached.

There were topics for which no recommendations were discussed but which, nevertheless, are comments that are relevant to the review and should be acknowledged.

- In the face of continued population growth and consequent changes in land use in the CB watershed, progress toward restoration of the CB, if any, will be slow and uncertain.
- Synthesis of emerging information is critical for applications to restoration efforts and identification of gaps in knowledge.
- While it is important and responsible to respond to information needs put forward by stakeholders and partners, it is equally or more important that science should have strong hand in setting goals. That is, we should set scientific priorities based on what is needed for system-level and large-scale understanding of how the Bay

works. With rigorous system understanding in place, management opportunities will be clearer for a wider array of specific resources. Furthermore the program will be positioned to identify potentially incompatible management goals.

- A management (restoration) goal of CBP is to remove CB from the list of impaired water bodies by 2010. This is a regulatory goal with specific and time-sensitive criteria. It is attended by law and great political leverage.
- Scientific effort is under-funded and spread too thin to accomplish fully all of the goals and "keystone" commitments of the Chesapeake 2000 agreement. The STAC report on scientific and technical needs for fulfilling Chesapeake 200 goals is relevant to this finding.
- The financial support for research and assessment in CB and its watershed is cobbled together from many sources with varying programmatic mandates and allegiances to different agencies. This diversity compels creative proposal writing by scientists and science managers. Programmatic funds dedicated to work on Bay restoration would allow the work to be focused and would provide for greater accountability for Bay-specific work.
- There is no formal program on "best management practices". Design, implementation, monitoring, and performance evaluation seem to be haphazard. Does this call for a better definition for roles of the states?
- The CBP would benefit from considering several levels of modeling. Examples:
    1. process models
    2. predictive games and/or simulation games for decision makers, for public education and to foster scientist-to-scientist and scientist-to-manager interactions
    3. limit work to a single tributary (Potomac?) to increase focus and depth
    4. ground water studies need expansion
    5. interface between non-tidal rivers and the main Bay

Concluding comment: The CBEAT conducted two days of lively and focused discussion of the revised five-year plan. The CBEAT was enthusiastic about its task and motivated to produce a useful review. The comments or recommendations are intended to be constructive and they should not detract from recent progress. This report may not capture all that was said or thought but it is close.

Attachment 2: Items to Consider for the USGS Chesapeake Bay Science Plan and Operational Plan

(April 26, 2005. Prepared by Tom Armstrong with input from Martha Garcia)

Introduction

While the USGS Science Plan listed activities that could be addressed, prioritization of the USGS' Chesapeake Bay Program's science goals and related management activities need to be contained in an **operational plan.** The Operational Plan should help guide which USGS Bureau Programs, science centers, and scientists have a primary role in carrying out the science during the course of the science plan (FY2006 through FY2010). The Chesapeake Bay Executive Advisory Team (CBEAT) suggests that the USGS attempt to evolve from coordinating a collection of annual activities (projects), each with its own specific goals and objectives, to integrating all activities over the course of the next five years into a set of shared goals with the ultimate objective of addressing the Chesapeake Bay's strategic science goals and associated resource management needs. The process for accomplishing increased integration may include having a fewer projects that are more focused and integrated on the highest priority issues, including:

-The impact of human activities on land use;
-Factors affecting water quality in the watershed and delivery to the estuary;
-Function of near-shore areas on water quality in the estuary and providing habitat for aquatic-dependent living resources; and
-Deliver and synthesize information for assessing, forecasting, and restoring the Bay ecosystem (the Bay and its watershed).

Furthermore, the next USGS Chesapeake Bay program implementation plan should include mechanisms to achieve improved integration. Given that multiple programs fund USGS Chesapeake Bay activities, the Review Team discussed achieving increased integration of projects through joint planning of multiple programs to fund common studies. With this in mind, we recommend that funding from the Priority Ecosystem Science (PES) program, the single largest funding contributor, be focused on the integration of various science, monitoring, and modeling activities, and the resultant attainment of the highest priority activities.

Outcomes from review that apply to the USGS Chesapeake Bay Studies to both the Science Plan and Operational Plan

In order to effectively carry out the mission of the USGS Chesapeake Bay Studies and the attainment of the highest priority science goals over the course of the Science Plan, the CBEAT strongly recommends the following management actions be accepted, implemented, and measured as the content of the revised science plan and associated operational plan. These actions include:

1. **Revision of the USGS Chesapeake Bay studies science goals**
    - The review panel felt that a conceptual model of the ecosystem components and processes was necessary in order to better show the need for science goals and related proposed activities. The conceptual approach

shown in figure 1 of the draft science plan (Feb 23, 2005 version) does not meet this need.

- The review team also felt priorities need to be determined for which goals should have the highest importance for the USGS to help determine the balance for the activities to be conducted in the future. The following priorities were discussed and agreed upon:
    i. There was consensus that science goals 1 (Human activities and land use) and 2 (water quality) should be the highest priority for USGS. Science goal 3 (vital habitats and living resources) should be more focused on the function of habitat in biochemical cycling of nutrients, sediment, and potentially carbon (since it plays an important role on nutrient cycling).
    ii. Terrestrial and near-shore habitat should have the highest priority since we are trying to address watershed transport of pollutants to the bay and the interface between nontidal and tidal areas would be one of importance.
- A focus of the function of near-shore habitats (wetlands, forests) on cycling of materials and the role of shallow geologic framework on transport pathways could be an important role for the USGS to consider.
- Study of the estuary is being lead by other agencies and institutions so the USGS should form partnerships to further study the link between water quality in the watershed and estuary.
- Studies of the function of habitat to support living resources (fisheries and migratory birds) are also mostly being led by other agencies and institutions and the USGS should consider these as a lower priority that may be addressed by forming partnerships. These studies need to be conducted at regional scales similar to science goals 1 and 2 if improved linkages are to be made between the watershed and the estuary.
- Finally, there seemed to be a consensus that USGS needed to improve, and have a high priority, for delivery, integration, and synthesis of information to help policy makers understand the implications of the science findings. The Science Plan should more clearly articulate how USGS findings will be used to improve indicators of ecosystem condition, change, and restoration that will be used. Therefore, generating the data needed to improve diagnostic tools (interpretative tools and predictive models) and synthesize findings needs to be improved through increased planning and coordination of USGS studies.

2. Alignment of research activities with the four science goals

- The Review Panel did not discuss the proposed activities in detail but focused more on the potential scope and priority of science goals.
- The Review Plan suggested a conceptual model be formulated to better identify the rationale for the proposed activities.

- As stated above, the Review Panel felt the scope of the science goals and proposed activities were too broad to be accomplished with the resources available to the USGS.
- Therefore the USGS should prioritize its science goals and proposed activities and better identify partnerships to conduct future activities.

3. Technical gaps between the stakeholder needs and the USGS science goals and proposed activities

- The potential gaps between stakeholder needs and USGS science goals that came up in the review include:
    i. Better defining what is meant by "human activities" and associated potential activities in science goal one (Human activities and land use).
    ii. Better defining the potential activities related to addressing the function, loss, and restoration of habitat (wetlands, forests, SAV).
    iii. Better relating the potential activities to improving diagnostic tools (predictive models and decision-support tools) to improve synthesis of findings for implications and forecasting for restoration activities.

  As stated previously, a conceptual model of the system will help improve the process and interrelation of ecosystem and processes that need to be addressed by the USGS and its partners.

4. High impact activities and the attainment of the science goals

- Overall, the activities related to:
    i. Human Activities and Landuse
    ii. Factors affecting Water Quality

  were the highest priority. The activities need to be refined to better reflect improvement and coupling of diagnostic tools for assessment and forecasting on ecosystem conditions.
- A better understanding of the inter-relation between human activities, water quality, and near-shore processes and interface in the tidal marsh areas was suggested by the review panel to link watershed processes with estuary response.

5. Interaction with partners

- The proposed interaction with partners needs to be improved. While the interaction with partners on current activities was in the draft science plan, future activities needs to be further defined. This is especially true for interaction with partners on studies of the estuary.

- The USGS should identify potential activities with Federal, State, and academic partners.

6. **The effective balance of proposed activities in the watershed and the estuary**
    - The Review Panel felt the USGS should focus a higher proportion of the activities in the watershed. This finding was based on:
        i. The need to understand watershed processes
        ii. The strength of USGS capabilities in this area
        iii. Studies of the estuary are already being conducted by other agencies and institutions
    - The USGS, working with appropriate partners, should attempt to understand the relation between delivery of materials to the estuary and response of water quality in tidal waters.

7. **The effective balance between regional and process scales studies**
    - The USGS should continue focus on assessing regional conditions in the entire watershed and major river basins.
    - Study of processes needs to be conducted to improve the understanding of regional conditions and improve diagnostic tools.
    - The three proposed "focus areas" (Lower Susquehanna, Potomac, and Lower eastern shore) should be reduced to 1 or 2 areas given the resources available.

8. **The proposed balance between monitoring, modeling, research, and information delivery**
    - The Review Team did not address this in detail but did feel there needed to be a strong emphasis for all activities (monitoring, research, interpretation) to improve diagnostic tools.
    - The uncertainty in different models should be identified to help guide the type of process studies that need to be conducted to produce findings to improve these models.
    - More thought needs to be given to the tools that will be used for "forecasting".
    - The USGS should strive to improve models to predict land-use change and water quality and also couple these models to forecast potential changes due to population increase and restoration scenarios.

9. **Specific USGS programs and cost centers should have a primary role in carrying out the proposed project topics**

- The priorities for the science goals and associated activities should help guide which USGS Programs, cost centers, and scientists that should have a primary role in carrying out proposed USGS activities.

- The Review Team suggested that the USGS attempt to evolve from coordinating a collection of projects to integrating efforts to address the science goals.
- The process for accomplishing increased integration may include having a fewer projects that are more focused and integrated on the highest priority issues.
- The Science Plan should include mechanisms to achieve improved integration.
- Given that multiple programs fund USGS Chesapeake Bay activities, the Review Team discussed achieving increased integration of projects through joint planning of multiple programs to fund common studies.

Funding from the Priority Ecosystem Science should be focused on the highest priority science goals.