SYNTHESIS
GLERL LABORATORY REVIEW PANEL COMMENTS

The following is a synthetic report created by combining the written comments made by the six panelists at the GLERL laboratory review, held on 4/5 December, 2000. Under the terms of the Federal Advisory Committee Act (FACA), the panelists could only provide individual written reports to the OAR Assistant Administrator. Therefore, their separate reports were combined and edited (solely to reduce duplication and repetition) to produce this synthesis which as accurately as possible reflects their opinions. Nothing in this report was added by the editor.

SYNTHESIS

The new Director and all personnel at GLERL are to be congratulated on the quality of their scientific achievements and the effectiveness of their working environment. GLERL occupies a unique position because its researchers are actually anxious to do applied research; university researchers are often reluctant to get involved in practical problems - except perhaps in very broad problems such as climate change. If GLERL were to disappear, universities would not fill up the void and there would be many important questions unanswered.

The Great Lakes do not receive the attention given to the oceanic coastal zone, but considering the population depending on them and the potential problems facing them, their preservation and management should be a major NOAA priority. The principal NOAA presence in the basin is GLERL, one of the largest research laboratories in the region. Its excellent international research program contributes to the overall credit of environmental research in the U.S., and should be staffed and supported to accomplish its diverse mission and goals. Its staff and scientists are involved in a wide variety of high-quality research providing scientific insight into, and conservation of these major lake ecosystems and marine coastal ecosystems. The high quality of much of the ongoing research, the extensive collaborations with other scientists and institutions from around the world, a very effective outreach program, and an efficient management system are impressive. Comments at the review from partner organizations were consistently positive. There has been a distinct improvement in the attitudes and sense of institutional pride amongst employees since the 1994 review.

Strategic Planning The GLERL strategic plan offers a bold vision, a well-articulated mission statement and a series of goals, objectives and activities to realize that vision. However, the review process highlighted a pronounced disconnect between the laboratory’s current capabilities and its plans for the future. On the one hand, the Director offered a series of ambitious new ideas that would greatly enhance current core activities of the laboratory while expanding into new research areas. On the other, at best GLERL’s budget provides operational support for a maintenance mode, and at worst, for reductions in scientific staff and research capabilities that will compromise severely its ability to meet its vision. At both the NOAA and GLERL levels, there is a preoccupation with the laboratory’s short-term survival, and a decided lack of focus on longer-term actions needed to realize fully the vision articulated in the strategic plan.

It may be useful to convert more of the scientific research into significant accomplishments both
in future reviews and in reporting to OAR, NOAA, DOC, constituents, partners, and Congress. For example, the Great Lakes water level modeling effort was presented during the review; but, the significance of the results of the research were not immediately apparent. If this were done, and it resulted in any recognition for GLERL (including increased budget), through the NOAA or OAR strategic planning process; then, the benefits or reporting results (significance of research) may become more evident to GLERL.

The Strategic Plan might also consider the relationship between GLERL’s research, the missions of other NOAA line offices, and constituents, especially in relation to the creation of the research agenda (annually or over some time period). For example, the recent decision to expand GLERL research to include fisheries appears to be somewhat controversial, in part because it may not have been fully vetted before it was implemented. Unfortunately, the information we were provided did not afford a close examination of this topic.

Recommendations
There is no question that GLERL research priorities such as species invasions, fluctuating water levels, and contaminants are well justified, but whether or not GLERL has the resources to properly address these issues is questionable. Leadership at the NOAA and GLERL levels must jointly address the disconnect between GLERL’s current “survival-mode” status and its ambitious plans to be a “preeminent, world-class, multi-disciplinary environmental research laboratory” (GLERL Vision Statement). Toward this end, GLERL’s strategic plan must be accompanied by a NOAA-supported task and activity statement with time-line and budgetary requirements for accomplishing the laboratory’s vision.

A facilitated effort should be made to convert the GLERL strategic plan into a more RESULTS-based document that relates directly to the OAR Strategic Plan and the NOAA Strategic Plan. The GLERL Strategic Plan could benefit from the inclusion of Performance Measures that are expressed quantitatively and are time specific. Without these it will be difficult to determine whether or not the goals are accomplished with or without the planned activities.

It might be worth creating an advisory body of NOS, NMFS, NWS, and OAR to discuss the GLERL research agenda.

Management The Director, Steve Brandt, seems to be an excellent manager, generally described as fair, thoughtful, and efficient. His most important trait is his interest and willingness to cooperate with others, giving GLERL the ability to leverage personnel and resources to accomplish significantly more than its resources would permit. Two panelists commented about staff complaints about a perceived autocratic approach by the Director to internal laboratory matters, although this did not appear to be an over-riding problem. Relationships between the laboratory’s management and the union representing staff appear to be positive.

The new organizational structure appears to be generally well-accepted by staff at all levels. Chiefs of the five branches report directly to the Director and both scientists and science support staff seem to feel they have more direct access to the Director than previously. Morale has improved because scientists are all directly accountable to the same person (the Director) and interactions among
scientists are perceived as being improved. Scientists liked the new annual proposal system for the allocation of research funds and the distribution of science support staff.

Separation of science support staff and scientists into different sections created some controversy. Some scientists feel an important functional link has been severed because they have much less input into the duties and responsibilities of staff working in their labs. The time that scientists spend training staff could easily be lost when people are reassigned to different projects. In contrast, science support staff favor the new arrangements, feeling they will become more diversified in their expertise and have a stronger voice. This structure has resulted in increased access to the director, enhanced interaction among scientists across disciplines, and a more rational system of accountability between staff and management, and it supports the concept of integrative ecosystem research which has been broadly accepted as the management approach for the Great Lakes throughout Canada and the United States. It also minimizes implementation costs by combining the resources of the Technology Branch and the Lake Michigan Field Station. Many people recognized that new organizational initiatives were required and are willing to 'try the experiments'.

The institution of annual reward systems for excellence also generated varying opinions. Supporters felt there was equity in the process that made everyone feel their contributions were being appreciated, and recognition of research groups rather than just individuals was positively received. Doubters, on the other hand, felt that ‘simply getting a baseball cap’ after a period of special effort, or receiving the same financial reward as everyone else, was an inadequate incentive. While equity in the process has been improved, the lack of meaningful financial rewards for outstanding service is a problem.

Recommendations
The GLERL Director should be congratulated for his changes to organizational structure and operation, and these changes should continue to be implemented and allowed to mature. An evaluation of the new structure in the context of the GLERL mission should occur over the next two years.

The provision of a meaningful financial reward for those who truly excel is still considered by some to be the most effective form of positive feedback. To a degree, the nature of rewards is constrained by labor union policy at the lab, however most people felt the union’s impact has been positive.

Physical Resources The main building is well equipped, but resources at the field station and the research platform (ship) are not sufficient to support an appropriate research presence in the Great Lakes. The Director has proposed upgrading the Muskegon facility and modernizing the research vessel as high priority budget items. Library facilities appear to be adequate. There is an excellent instrument design and fabrication facility that leads to the design and construction of new instruments and equipment for the limnologic and oceanographic communities, contributing to the overall development of these fields.

Muskegon. The station, one of the lab strengths, is directed and energized by one of the top biological limnologists in the country, Gary Fahrenstiel, but needs attention.

Shared research facility. During the review, Steve Brandt spoke of his interest in developing a shared
research facility in Ann Arbor (at a cost of $40-50M) that would house all, or much of, the current large lakes research activities now going on in the vicinity of Ann Arbor. None of the panelists wrote in favor of this; the only comments regarding it were negative. Two panelists felt this would be a very difficult task to bring to fruition: the cooperation and coordination between all the players that are envisioned to be involved probably would not work, and it would be unlikely to be worth the time spent on planning and then trying to get it funded.

Recommendations

A research platform is an essential, immediate need of GLERL. The proposed vessel described during the review is quite adequate.

GLERL should develop new programs at an enlarged Muskegon field station. This would bring significant benefits to their current mission, build on their strengths and would be easy to do. Obviously, they could use additional funding, one-time if necessary, to get a good facility, but absent that, they should try to do what they can with current funds. It's not clear if a new initiative or two could help GLERL get a significant increase in their annual funding, but it is worth trying. The ability to do lab experiments using ambient lake water and conditions, and the proximity to the ship and the shore, will enable them to do different and important experiments that they are now unable to do.

The Director should spend his planning time on reinventing and revitalizing GLERL, rather than trying to develop a very expensive, probably unworkable, joint facility in Ann Arbor.

Personnel Personnel are highly dedicated to the laboratory; some staff say that although salaries are not competitive, and support staff and facilities are sometimes inadequate, it is still a great place to work and they wouldn't think of leaving. There is no doubt that the main strength of GLERL is the reputation of the scientists and technical staff for excellence. The decline in staff over the past decade, along with new issues (species invasions, climate change, endocrine modulators) means that the staff are definitely stretched to the very limit. Combined with the fact that they are now encouraged to compete for external funding, this will further limit their ability to be dedicated to research areas/topics. Lab personnel seem to be optimistic about the organizational restructuring, but admit that some of the restructuring, such as the increased use of pooled support, has yet to be tested.

One major issue now facing the lab is the coming major changes in personnel. GLERL is facing the daunting task of replacing many scientists and staff in the next five years or so, and finding productive replacements. However, this turn-over also presents the opportunity to renew and refocus the lab. *This is the major task facing Steve Brandt and GLERL--how to convert the 20th century GLERL into a GLERL for the 21st century*. FTE’s at the lab have declined from 75 in 1992 to 54 in 2000, and 20 people will be eligible for retirement or early retirement within the next five years. Apparently only two of the 22 scientists are under 50 years of age. Many of the scientists consider the number of science support staff to be inadequate, and recent losses (e.g. GIS, lipid chemistry, climate) have left gaps in some programs that have only been partially filled. Lack of clear planning for staff renewal is partly due to governmental financial and procedural strictures: recruitment is very cumbersome, requiring broad job advertisements that result in an overly diversified candidate pool. Because staff do not have to reveal retirement plans much in advance and funding for positions only
becomes available after a retirement or resignation, there is little opportunity to plan future hires. It appears that these are made on an ad hoc basis.

Several panelists felt that the recent hiring of a fish biologist is a microcosm of these problems and how they are perhaps being dealt with. With the USGS-BS Ann Arbor Fisheries lab just down the street, why hire a fish person? Why not hire a hydrologist to replace those who left or who are soon to leave, and cooperate with the USGS lab or a CILER partner when fish expertise was needed? Part of the justification for the hire was that this is a very important area in the scientific plan mission field of the lab, and they felt that they needed in-house expertise. It was not clear who made the decision, how the decision was made, and how explicitly the issue of lab renewal is being discussed. Also, since the lab faces the imminent loss of many scientists and much of the institutional expertise and knowledge they possess, it would be greatly beneficial to have some replacements in place, being mentored, before the experienced staff member leaves. Permit ‘bridging loans’ to hire young researchers at least one year before the retirement of leading scientists in order to assure a continuation of the corporate knowledge of GLERL [note: this is not possible - ed.].

Given that research organizations around the world are faced with similarly aging scientists, competition for the best during the next decade will be fierce. GLERL has apparently supported the development of young scientists by using cooperative institutes, the hiring of young scientists to fill vacancies, the inclusion of new topical areas in the research agenda, and the inclusion of graduate students in the work force as non-federal employees. Notwithstanding, there is little evidence that GLERL will fare well in this competition. A recent joint appointment of a modeler between GLERL and Fish and Wildlife at MSU is a positive step. Of the two science appointments made since the new Director arrived one is young but the other was much more senior. It is unfortunate that this rare opportunity to appoint new young scientists was not fully exploited. Plans to develop an emeritus program to keep senior scientists active as mentors after retirement, and a sabbatical program to help existing staff develop new initiatives, are positive steps but do not offer a complete solution.

Graduate students and post-doctoral fellows appointed through CILER have made up for some of the staff losses but clearly this can only be temporary given the high turnover rate of students. The Director did not seem inclined to use graduate programs as a means of ensuring a pool of appropriately educated scientists for appointments at GLERL [note: all Federal appointments must be competitive - ed.].

Recommendations

The development of a clear staff renewal plan is critical. The Director should create a committee of GLERL (and possibly OAR) staff to help do so. This plan should identify the future science initiatives and themes that direct the appointments required and develop programs for educating and mentoring young Great Lakes scientists who could compete for GLERL positions. Panelists had mixed opinions about whether GLERL has an effective education program. In any case, this educational component must be fully supported by NOAA.

Further, such a plan could help address EEO and diversity issues that appear to exist at the facility, in which diversity of the current workforce appears to be less than in the general workforce. If this conclusion is correct, then having a plan to increase diversity could bring structure to recruiting and
hiring decisions beyond those addressed by the type of science conducted. Finally, a human resources management plan could help increase the inclusion of contractors instead of federal employees to perform some of the tasks at the facility (e.g., information technology, computer maintenance, and software development).

Scientific Expertise The excellent reputation of GLERL has been earned with its scientific accomplishments. Its real strength is that it is the only research facility in the Great Lakes Basin including a truly interdisciplinary research group that can integrate research issues such as contaminants, climate change, ecosystem dynamics, episodic events, invading species, water resources and physical processes of limnological systems. This breadth of topics covered by only 22 scientists means that in some areas there already exists a critical minimum of expertise. Considering the demographics of the research group, future retirements can mean the complete loss of expertise in such areas.

Contaminants: This is a very strong research area (primarily owing to the exceptional efforts of one person) with emphasis in the dynamics of organic contaminants, well-focused on important, current issues including bioavailability in sediment and quantifying critical body residues. There is strong interaction with other research groups. Because of dependence on one person, it is weak with respect to long term staffing issues.

Climate Change: This is the only group in the Great Lakes involved with issues such as hydrology, hydraulics and ice cover. Considering the importance of this issue to all aspects of the Great Lakes (economic, social and ecological), it is essential that future base support be provided for it. Representatives from Environment Canada were strongly supportive.

Ecosystem Dynamics: Until recently the main focus of this research group was benthic ecology; with recent additions it can now address research issues throughout the food web. Research focuses on multiple stressors, but the twelve programs obviously stretch team resources. With growing issues such as species invasions, the decline of Diporicia and fish recruitment, etc., resources are seriously constrained by the lack of funds, which is unfortunate because these problems sound like they are going to get a lot worse. This is an area where extra funding could be well used to anticipate problems.

Monitoring and Assessment: Important temporal and spatial data sets from monitoring can be used to quantify the relative importance of perturbations (physical, chemical, biological) in the food web and environmental quality of the Great Lakes. Lack of such information affects our ability to manage these complex ecosystems. An essential base program for GLERL, it provides the “glue” to integrate the other areas of expertise and interest. Linkages to other monitoring programs related to Lake Area Management Plans (LAMPs) and Remedial Action Plans (RAPs) might be a means of obtaining a longer term resource commitment for this.

Water Resources: The main strength of this research team is forecasting lake levels and hydrology within the Great Lakes basin. Issues such as heat flux and effect on alewife, uncertainty analyses, weed growth effects are all important, and GLERL is without a doubt the leader in this area of Great Lakes research. The physical limnology group is one of the best at GLERL. They have already solved a lot of first order problems, such as predicting thermal structure, currents and waves, and are on to much more ambitious pursuits such as predicting sediment resuspension and transports in southern Lake Michigan. Operational predictions of such events may affect the way in which cities, such as Chicago,
draw water from the lake. In addition, the operational wave model developed by Schwab et al. has already been adopted by the National Weather Service. For some reason, although the U.S.A. Corps of Engineers acknowledges the NWS for the Great Lakes wave forecasts presented on the Corps web page, the same forecasts appear on NWS pages but without the surface wave analysis charts. 

*Episodic Events:* Strengths in water resources research and other areas were influential in the funding of this research program. Many of the major fluxes of contaminants, nutrients and changes in thermal structure are in response to episodic events. Despite the importance of such events, the limited support suggests that the information and research results will not significantly influence management plans and decision making in the Great Lakes.

**Recommendations**

At the NOAA level, it is essential that GLERL's base budget be enhanced to provide adequate depth in all scientific research associated with its mission. Internally, it is essential that the GLERL strategic plan focus existing budgetary resources on the laboratory’s core mission; that a staff renewal strategy be implemented to provide mentoring of junior scientists; and that incentive programs and other procedures be established to enhance individual and collective productivity as measured by peer-reviewed publications.

The review identified several areas where the quality and productivity of GLERL science has been, or could be, compromised. Budgetary constraints have resulted in a steady decline in the number of principal investigators in recent years. Discretionary funds for researchers are extremely limited, and the laboratory has unmet needs in the areas of technology, facilities, and vessels. GLERL staff is notably lacking in depth, in many cases only one or two principal investigators have expertise in certain fundamental areas. This is particularly problematic given the aging GLERL workforce and lack of junior scientists to ensure sustainability in those areas. Finally, productivity varies greatly among principal investigators as measured by the publication of peer-reviewed articles: relatively few scientists produce the great majority of publications. These short-comings must be addressed if the laboratory is to retain its stature as an outstanding research facility.

**Productivity** There are outstanding scientists at GLERL known around the world for their work. Hydrological modeling, nonindigenous species, contaminants, CoastWatch, Coastal Forecasting, and EEGLE are particularly important. Scientific productivity can be measured both by the publication of peer-reviewed papers and the provision of services to the user community. By the latter criterion the lab is doing extremely well – a wide variety of products including access to online physical information about the lakes, extensive outreach programs, and many technical reports have been developed. By the former, performance is spottier (and the Director recognizes this). Scientists published 1 – 1.5 peer-reviewed papers per year recently, but up to one-third of papers were published by the four or five most productive investigators, leaving the others, many of whom are not intellectually or scientifically competitive, with at best modest records. This may be an indication that staff are over-extended. Combined with the limited amount of 'discretionary'/competitive research funds ($200,000 for 22 scientists), it is actually surprising to see the current level of publication being maintained. Limited resources might be affecting some areas of research more than others. Of the many 1995-2000
publications listed, seven were in *Limnology and Oceanography*, arguably the premier freshwater journal in the world.

Within the present budget constraints Brandt is trying to reward good proposals / projects with increased staff support. That is a good idea, but it is difficult for outside reviewers to understand if it works. In the briefing notebook section "GLERL Incentive Awards Policy" there is no specific mention of who have been receiving awards for what activities. That would have been interesting.

**Recommendations**
Recognizing that some of the research at GLERL must be directed towards more specialized journals, they should publish more in top journals. If GLERL scientists hope to be competitive in major grants programs [not possible under Federal policy - ed.], improvement in the numbers of refereed papers and in the quality of target journals ought to be sought. The Director’s efforts to achieve this should be encouraged, and scientists should be financially rewarded for noteworthy scientific achievement. The Director should evaluate programs designed to reward excellence. It is important to recognize the value of financial incentives for high achievers as opposed to giving the same rewards to everyone.

While it may not be unusual for a few of the scientists to do most of the publishing, it is not unreasonable to expect an increase in the number of publications by more of the scientists. Performance plans can be used to help correct this situation, but doing so **REQUIRES** the complete support of the organization’s management. Since this issue has apparently existed for some time, increased attention should be given to resolving it.

The Director should closely monitor the new administrative structure that separates science support staff from the scientists. A balance between career development for technical staff and the time invested by scientists in specialized staff training should be sought.

**The Review** Brandt is a fine spokesperson for GLERL, and he orchestrated a good review. Providing information in a variety of formats - a looseleaf book, standup presentations in the conference room and posters throughout the lab - was an efficient way of informing the review panel without overloading their circuits. It would have been useful to have included information on past reviews, including actions taken and accomplishments resulting from the implementation of previous recommendations. Such information could help make the current review more efficient, less duplicative, and more constructive. Some GLERL staff expressed skepticism regarding the impact of the review process on laboratory structure and operations, and several who participated in the last review noted that the review outcomes were not shared with staff, who said they are never certain whether or not changes at the lab have occurred as a result of the external reviews. There was no basis for determining what, if any, changes were made and how they may have affected the laboratory’s operations.

One panelist devoted considerable effort to critiquing the review documents provided. He felt that a reviewer should be able to read the introductory statements and comprehend 50% of the important accomplishments, linkages and issues. The first two pages, "GLERL Management and Organizational Structure" were deadly; a terrible thing to do to a reader at the very beginning. Those pages, in particular, needed editing to reduce the level of bureaucratic buzz. The turgid language used in
some parts of the notebook was disappointing; sentences were overly long and filled with unnecessary superlatives such as "world class", and the top and middle level overviews in the looseleaf notebook were difficult to understand. On the other hand, the three pages headed "Some of GLERL's Top Accomplishments and Payoffs" were written in a much more refreshing style. The looseleaf book provided by GLERL was not synchronized with the list of review considerations.

**Recommendations**

All GLERL staff should be provided with a copy of the NOAA-prepared synthesis report summarizing the review panel comments and associated findings and recommendations. Further, future reviews should evaluate the impact of recommendations from the previous review panel. This would ensure that an external review is a 'living document' that becomes an integral part of the lab's continuing evolution. Morale would be boosted by the positive comments in the reviews, and everyone would be aware of the issues requiring attention.

More efforts should have been made to keep the review on schedule; some of the presentations went well over their time, infringing on others. The posters were all well done, and required a significant effort to produce. They presumably will be useful for other presentations of the labs interests and products.

The private session with the scientists and staff went well, as did the dinner at the $$ local restaurant. The large tables ensured a mix of staff, outside collaborators, reviewers and OAR staff. However, the price probably dissuaded some staff from attending. Perhaps something similar but less expensive next time.

It would have been very beneficial to have had more quality time with the Director to hear of his plans for the future of the lab.

One panelist was confused by the "Laboratory Review Considerations", explaining that they seemed to be for a NOAA administration internal review rather than an outside review panel. Some questions seem inappropriate for an outside panel to consider, in particular III.B.4. "How do you ensure that NOAA derives the maximum benefit from your research?". The terms vision, goal, objective, and theme may have very definite meanings within NOAA, but outside panelists would be unaware of them. Even GLERL seems to be confused about the distinction between "themes" and "disciplines" (see p.5, 2nd paragraph of Strategic Plan 2000).

**Partnerships** The review process clearly indicated that GLERL's approach to its mission depends heavily on partnerships and collaboration with other U.S. and Canadian scientific and policy institutions at all levels of government and academia. These arrangements take a variety of forms and are pursued for a range of purposes. For example, the laboratory's partnership with the Cooperative Institute for Limnology and Ecosystem Research (CILER) at the University of Michigan allows GLERL direct access to much-needed research funds and scientists that would otherwise not be possible given federal limitations. In other instances, the laboratory joins other federal agencies (e.g., USEPA, USFWS) to address shared regional priorities. Additionally, GLERL often collaborates with agencies and organizations with policy, resource management and/or public outreach functions, providing science-based decision support.
While the emphasis on partnership and collaboration is both positive and necessary, it appears to lead to some confusion related to the nature of GLERL’s mission and how it differs from that of other research-based Great Lakes institutions. The relationships between GLERL and CILER and their individual missions were not well articulated during the review process. The fact that CILER is vibrant and growing masked the gravity of GLERL’s budgetary constraints and staffing reductions. Although GLERL’s strong partnerships with other federal research institutions has had positive effects on the efficiency with which science is delivered, it poses special challenges in demonstrating the laboratory’s unique mission and associated contributions to Great Lakes science. The review featured presentations by a number of partner agency representatives, all of whom spoke highly of GLERL’s disposition as a team player. However, these positive public statements were tempered by undercurrents of concern expressed during informal conversations with representatives of various federal research institutions in the Great Lakes region. Specifically, two panelists felt that the relationship between GLERL and the USGS Great Lakes Science Center, also based in Ann Arbor, needs to be better articulated and partnership opportunities more aggressively pursued.

Recommendations
GLERL should continue to enhance partnerships and collaborative arrangements to advance the organizational goals and objectives identified in its strategic plan and to deliver the products identified there. In so doing, GLERL must better define its own mission and unique contributions to the Great Lakes research effort. Its relationships with other primary federal research institutes in the Great Lakes region, in particular the USGS Great Lakes Science Center, need to be assessed internally in order to maximize partnership opportunities. Further, GLERL should fully exploit its role in providing science-based decision support to policy and resource management institutions at all governmental levels. Many research and monitoring activities central to its mission address priority policy issues (e.g., lake levels, non-indigenous species prevention and control), and these institutions rely on GLERL research to make informed decisions.

Finally, GLERL should become more involved in international programs being established under LakeWide Management Plans (LaMPs) and Remedial Action Plans (RAPS), particularly for long term monitoring and assessment.

Budget  There is no question about the quality of the scientific expertise and research products at GLERL. Considering the Great Lakes basin represents approximately one-third of the gross national product of the United States, the main question is “how one can justify such a low level of support for the laboratory over the past decade?” Critical future issues American society must address that will have major economic implications include water diversions, increased water demand, urban planning, electrical generation, etc. Indeed, GLERL is the only Great Lakes research center with the ability to comprehensively address such future concerns. Failure to do so in a timely manner will be very costly to the people of both United States and Canada. Judging from the previous review, many of the concerns identified above existed over six years ago, yet the ‘loss by attrition’ management by NOAA continues today.

While the Director has to plan on steady or slowly declining funding, he also has to have
contingency plans for the day OAR calls to ask how the lab would effectively spend a $2 million/year increase in their budget each year for seven years (or a one time step increase, or another budget increase scenario), to carry out the environmental priorities of the Bush administration--with a response in 24 hours.

Although the annual GLERL budget has remained roughly constant for the past eight years, it has actually declined in deflated dollars by about 14%. An enormous effort is required each budget cycle simply to maintain the status quo, let alone improve staffing and facilities. The scientists seem generally frustrated with this budget process and have little confidence that their concerns are ever communicated far enough up the chain of command to have any impact. Departed staff have not been replaced, the technology base has declined, buildings and ships are in need of repair, exciting new research opportunities arise but cannot be grasped due to limited funding and staff, and strategic milestones are not being met. The only flexibility that exists in the budget is roughly $200,000 that is used to fund research programs at GLERL. A relatively small amount, approximately $100,000 per year, is competitively awarded. This is not only a paltry amount for competitive research, but its existence depends on scientists receiving external grants that provide some budget relief. Requiring GLERL scientists to compete for external funds is a good thing (it forces the scientists to keep current and competitive), but since the scientists cannot apply for funds from agencies such as NSF, Sea Grant, Great Lakes Protection Fund (except through CILER), and some EPA programs, NOAA should review its current policy on the external funding programs to which GLERL scientists have access [note: policy regarding eligibility for grants to Federal scientists is set outside of NOAA - ed.]. On the other hand, although external funding increases financial resources of the lab, it stretches the capacity of the limited number of scientists to deliver quality products.

If the lab budget were increased by even a small amount it would make the competitive process a lot more effective. The Director noted that an estimated $10-15 million is needed annually in base budget to meet laboratory goals and objectives. Maintaining the status quo or focusing only on incremental improvements to the current budget will not address this problem. This is particularly true in light of the Director’s plans for large scale renovations of the Muskegon facility, vessel upgrades, and technology improvements for the Ann Arbor facility. GLERL is at risk of adopting a “consulting firm” approach in the name of institutional survival, and this trend must be reversed.

Recommendations

NOAA leadership must be fully informed of GLERL’s precarious budgetary situation, and the fact that its role as a scientific support system for Great Lakes management has been compromised by the steady erosion of funds. NOAA needs to reaffirm its commitment to, and support for, GLERL’s mandate by supporting significant budgetary increases that reverse the multi-year decline of base funding; restore a full complement of scientific investigators; provide for much-needed facility, vessel and technology upgrades; provide an environment that can attract and retain a highly professional staff; allow for the flexibility needed to respond to emerging issues; and eliminate undue reliance on creative “soft money” arrangements to accomplish laboratory goals and objectives. These funding issues are largely out of the Director’s and the lab’s hands. Unless NOAA and OAR decide that fresh water and Great Lakes issues deserve additional resources, and are willing to push the issue within the Commerce
department, with OMB and with Congress, GLERL will need to be satisfied with its current slice of the pie. GLERL’s reputation has been established and maintained despite a long term loss of resources (personnel and financial), but the laboratory is nearing a critical point where decisions on future direction and support must be made. How to maximize programs with a slowly diminishing budget? It continually gets harder. Triage of programs? Perhaps underway. Benign neglect?

Future budgets should make provisions for a) an adequate amount of base budget support for scientific research (at least $1.2 million annually), b) a realistic annual budget that covers increases in salaries and operating costs, and c) capital expenditures of $5 million to bring the research vessel and Muskegon facilities up to acceptable operational standards. Consider an internal “cap” on external funding so that scientists are not so “stretched”.

During the review there was some mention of needing more money to anticipate problems rather than just responding to problems once they occurred. If problems are not anticipated, GLERL scientists know that some will wind up in their own laps. It appears that the GLERL budget, if augmented, should be directed at research to anticipate problems.

Public Information and Outreach  GLERL has made a serious commitment to public information and outreach, as demonstrated by its new organizational structure, emphasis on publications in the popular literature, and commitment to outreach activities that range from community open-houses to informational briefings for members of Congress. Their web site is excellent; it is a well-organized, in-depth source of most of GLERL’s products, which are easily acquired from it. Plans for innovative outreach techniques, such as web-cams at major recreational facilities, are indicative of creative thinking at the staff level. These activities have the potential to raise dramatically GLERL’s profile among its constituency.

GLERL’s research offers policy makers and resource managers a scientific basis for informed decisions. However, the linkage between GLERL scientists and the policy/resource management community is not as strong as it could be and varies greatly from issue to issue. In some areas, such as hydrologic modeling and lake levels monitoring, GLERL scientists interact extensively with this community. In other areas the interaction is more limited. A formal mechanism for involving this community in the development of research priorities and the application of research outcomes is lacking on a laboratory-wide basis, despite its presence at the project-specific level. As a result, policy and resource management institutions at various levels of government in the Great Lakes region neither fully understand the GLERL mission nor benefit fully from GLERL products and services.

Recommendations
GLERL should be applauded for its public information and outreach initiatives and encouraged to pursue them aggressively; communicating of science is essential, and the Information Service Branch is important. Maintaining an appropriate balance between publication in peer-reviewed journals and the popular literature should be a priority for all staff scientists. Further, GLERL should institutionalize a staff position that facilitates “translation” of scientific research for public consumption. The new, jointly-sponsored position with the National Sea Grant Program is a step in the right direction. The review
process also identified a need for GLERL to demonstrate how its research projects have practical applications to resource management problems and issues that affect its constituents.

GLERL constituents in the policy/resource management community should be consulted in the development and implementation of research priorities and projects. At the laboratory-wide level, consideration should be given to the establishment of a policy advisory committee that would help maximize the benefits and practical applications of GLERL products and services. This committee might be comprised of representatives from U.S. and Canadian federal, state/provincial and regional agencies, as well as those from business/industry, citizen organizations and other user groups that benefit from GLERL research.

**Summary overview** The science program at GLERL is outstanding, and the research being done is critical to the integrity of the Great Lakes and Coastal ecosystems of North America. The laboratory runs smoothly and personnel expressed a high level of contentment due in large part to the efforts of the new Director. Additional efforts are required to increase the rate and quality of scientific publication from the lab, to institute a clear plan for staff renewal and mentoring of young scientists, and for NOAA to take more seriously its financial commitment to maintaining a strong science presence in the Great Lakes and Coastal ecosystems.