Proposal for Authorization to Implement
the School of Freshwater Sciences
University of Wisconsin-Milwaukee

1. SCHOOL IDENTIFICATION

1.1. Name of the Proposed School or College:

The University of Wisconsin-Milwaukee School of Freshwater Sciences (SFS).

1.2. Mission and Goal of the School

The mission of the School of Freshwater Sciences is to advance, create, and disseminate new knowledge that will protect, restore and sustain the health and well-being of freshwaters and the lives of people dependent upon them.

The School aims to integrate science, engineering and policy to explore and discover novel approaches to the sustainable and equitable use and management of freshwater systems worldwide, and to create a multi-disciplinary, collaborative, and diverse atmosphere for training the next generation of professionals armed with the knowledge, skills and experience to anticipate, understand and resolve the freshwater issues of the future.

The goal of the School of Freshwater Sciences is to organize studies in freshwater sciences, engineering, and policy at the University of Wisconsin-Milwaukee in such a way as to establish both the capacity and the mechanisms to:

- Maintain a scholarly, productive environment for the education and training of professionals in the field of freshwater sciences
- Provide regional and national leadership in this field of endeavor
- Fulfill our mission of Great Lakes research excellence and societal relevance
- Fulfill our mission as an institution of higher learning
- Engage the greater regional and binational communities
- Stimulate compatible and synergistic economic growth and environmental sustainability

1.3. Background and Challenge

Establishment of the School of Freshwater Sciences will fortify the identity of the University of Wisconsin-Milwaukee as a leading institution nationally in freshwater research and Great Lakes studies, and will further the University’s mission as a major urban doctoral university providing educational leadership in meeting current and future social, cultural, and technological challenges.
“Of all the social and natural resource crises we humans face, the water crisis is the one that lies at the heart of our survival and that of our planet Earth”.¹

“Water defines Wisconsin. Wisconsin’s geology and geography, ecosystems and history, cultures and communities, economy and character, all reflect our natural endowment of water. Our lakes, rivers, wetlands, and underground aquifers are essential to human well-being and support the diverse array of species and ecological communities that share Wisconsin’s landscape. Water, in all its forms, underlies public health, prosperity, and the quality of life that Wisconsin’s citizens and visitors enjoy.

The value of Wisconsin’s water is at once immense and incalculable. The economic worth of Wisconsin’s water — for drinking water and domestic use, as a transportation avenue and a recreational resource, for wastewater treatment and industrial production, as a provider of vital ecosystem services — is vast. A firm commitment to water stewardship is critical if we are to sustain these economic and material benefits for future generations.”²

The resolution of the inherent historic conflict between human productivity and ecosystem sustainability is one of the grand challenges of the 21st century, and no challenge is more important or more pressing than that of the allocation of freshwater resources and keeping freshwater fresh.

Human population growth and industrialization have fundamentally altered freshwater hydrologic systems and ecologies to the point where freshwater is now an increasingly scarce resource limiting survival, growth, and prosperity for humans and wildlife alike. Demand for freshwater will continue to exceed supply, expanding in geographic scope well into the next century and beyond. The challenge we face is to deal with a severely limited vital resource with reason, fairness and a view to the sustainability of all life.

The formation of the School of Freshwater Sciences builds upon the long-standing strength of the University of Wisconsin-Milwaukee research programs in freshwater science. The Great Lakes WATER Institute counts its 40-year history from the establishment of the Center for Great Lakes Studies within the Graduate School in 1967. The existence of a strong portfolio of scholarly expertise, research capacity and infrastructure renders the formation of the new School of Freshwater Sciences largely a process of transformation and increased multidisciplinary collaboration. Over the next 18-24 months, the University of Wisconsin-Milwaukee will leverage these existing assets to meet the needs and challenges in freshwater studies and create a nationally unique School of Freshwater Sciences located on UWM’s Great Lakes WATER Campus.

The School also benefits from the unique circumstance of being planned concurrently with an accredited School of Public Health. There are clear linkages between public health and freshwater science, and environmental health will be an area of strong connection between the schools. The interdisciplinary approach to planning will ensure


that such linkages are encouraged and that the University and the community derive the maximum impact from the schools.

1.4. Timetable for Initiation

The plan is to present a proposal for approval of the School of Freshwater Sciences to the UWS Board of Regents in June 2008. The SFS will be initiated soon after approval is granted by the Wisconsin Legislature.

2. DESCRIPTION AND FIT WITH MISSION

2.1. School Description

The SFS will be one of the degree-granting schools at UWM. It will offer opportunities for faculty, staff and students in the areas of research, education, and service related to freshwater issues. At this time, it is expected that the SFS will offer the following degrees:

- Ph.D. degree in Freshwater Sciences
- M.S. degree in Freshwater Sciences

Additionally, the SFS will offer research opportunities for undergraduate students in the various majors at UWM.

The formation of the SFS will also enhance opportunities for extramurally funded research in freshwater sciences and related areas through the synergies obtained by bringing together the multidisciplinary strengths of UWM faculty and staff in the area of freshwater sciences. The SFS will be a unique academic entity and the first such school in the United States. It is envisioned that the SFS will be a regional, national and international leader in research, education and public service in freshwater sciences and related areas, increasing UWM’s visibility as a center for water research and graduate education. Through innovative interdisciplinary programs, outreach to area industries, and increased extramural and private support flowing from the School’s unique research foci, the School will have a significant impact on UWM’s profile as a research institution.

2.2. Relation to Campus Mission

The formation of the School of Freshwater Sciences fits well with the mission of UWM. As a major doctoral university, UWM has a critical role to play not only in offering “a balanced array of high quality doctoral programs in basic disciplines and professional areas”, but also to “promote public service and research efforts directed toward meeting the social, economic and cultural needs of the state of Wisconsin and its metropolitan area.”

Situated over one of the largest aquifer systems in the country, Wisconsin also lies between the largest river system in North America (the Mississippi River) and the largest body of surface fresh water on the planet (the Laurentian Great Lakes). As the 22nd

* UWM Select Mission Statement available at http://www4.uwm.edu/about_uwm/mission.cfm
largest metropolitan area in the United States, Milwaukee represents a racially, ethnically, culturally, economically, and demographically diverse setting in which to model freshwater research, education, and training. Thus, Milwaukee and the State provide an environment in which the achievement of sustainable water supplies (essential for long term economic viability of the region) is both possible and essential, and from which substantial benefits can be generalized both nationally and globally. Formation of the SFS will position UWM well to serve the economic, social and cultural needs of the State by capitalizing on our metropolitan location; our regional industrial, government, and business activity; proximity to agricultural areas within the watershed; potential for active community support and collaborations on federal, state and local levels.

To fulfill this vision and to meet these challenges, the University, in concert with recommendations of national studies\(^3\), recognized that a broader, multi-disciplinary approach to graduate education and training was required. Developing an academic focus and strength within a School of Freshwater Sciences places the University in a unique position of regional, national and international leadership and provides the level of administrative and programmatic substance deemed necessary to address the issues before us.

Further, the mission of UWM requires the pursuit of the academic goal to “engage in a sustained research effort which will enhance and fulfill the University’s role as a doctoral institution of academic and professional excellence.” UWM already has significant strength in research in freshwater science distributed over multiple academic departments in several schools in addition to the Great Lakes WATER Institute. The establishment of the SFS and the doctoral program within it will provide a focus for freshwater research and for the integration of science, engineering and policy to greatly enhance UWM’s role as an international leader in the area of freshwater.

One of the strategic goals of UWM is to be a major player in the economic well-being and development of the metropolitan Milwaukee area and the State. A supply of safe and high quality water ensures a healthy environment that is essential for the economic well-being of the region. The synergies between the SFS and the proposed School of Public Health in establishing a strong program in environmental health with a public health focus will add another unique facet to UWM’s role as a positive contributor to the economic development of the region.

2.3. Relationship of the proposed School to other Departments and Units

The proposed structure is intended to focus the campus expertise in freshwater within the School. The organization of the school will facilitate a highly interactive environment, offering opportunities on multiple levels to faculty and students across campus to participate, thereby drawing in the breadth of expertise needed to meet the freshwater social and natural resource challenges. Existing or anticipated contributors to the School of Freshwater Science include the current scientific academic staff of the WATER Institute, the proposed School of Public Health, College of Engineering and Applied

Science, School of Architecture and Urban Planning, College of Health Sciences, School of Information Studies, and the College of Letters and Sciences departments of Biological Sciences, Geosciences, Geography, Economics, Physics, Communication, Mathematics, and Chemistry. Mechanisms to foster collaborations will include:

- Offering Joint and Affiliated Faculty appointments within the School (see section 6.1); likewise, faculty within the proposed school would be encouraged to hold comparable appointments in other appropriate academic departments.
- Encouraging faculty with freshwater expertise to hold membership on graduate student committees.
- Providing matching funds to support graduate students on extramural grants that involve Investigators from collaborating departments.
- Hosting a campus-wide symposium on freshwater annually to increase visibility of current research activities within the School and foster networking of faculty interested in freshwater issues.

The philosophy of cross-campus collaboration will be integral to the annual budget and strategic planning processes within the proposed School.

2.4. Academic Programs:

2.4.1. Doctoral Program in Freshwater Sciences, educating the scientists and scholars who will lead and train the next generation.

In pursuit of its mission the School of Freshwater Sciences will organize interrelated, crosscutting “Research Alliances” (System Dynamics, Health and Sustainability, Freshwater Technology, Policy and Management, see section 2.3) to catalyze the collaboration of the broadest possible spectrum of scientists, engineers, and freshwater scholars engaged in the discovery of:

- how freshwater systems work,
- strategies to reconcile human activity and freshwater sustainability,
- the links between human and ecosystem health in freshwater systems
- discovery of technologies that can improve our use, management and stewardship of freshwater, and
- how science can inform policy and policy direct science for the sustainable, equitable use of freshwaters globally

Doctoral students will conduct research and training across these Research Alliances identified as key thematic areas of scientific and scholarly pursuit within the School. Each student will focus his/her studies and research within one of these alliances while receiving ancillary training in the others.

2.4.2. Master’s Program in Freshwater Sciences
A Master’s program will provide training and education in a subset of the four alliances. Within the M.S. Program, two tracks are proposed – a thesis (research) based M.S., and an Applied M.S. The thesis M.S. will provide cross-disciplinary training for students interested in studying current freshwater issues through a research program, with the possibility of continuing on to Ph.D. studies. As in the Ph.D. Program, M.S. students will conduct research and receive cross-disciplinary training, but the number of required core courses will be reduced.

The primary objective of the Applied M.S. Program will be to provide technical and cognitive skills related to freshwater management, policy and research that are required by management agencies, industry, business, and academia at the technical level. Today’s leaders and decision makers, whether in the private or public sector, are often faced with an overwhelming array of technical, social, economic, cultural and legal issues associated with a decision on a single proposed action. The demand for individuals with cross-disciplinary training in these areas is extremely high. Most enterprises cannot afford a host of experts.

The curriculum for the Applied M.S. program will be intensive and compact, e.g. complete within 11+ months, so as to fall within the general purview of a corporate “leave of absence,” or adopting existing models for executive programs. The program should tap the corporate, legal, governmental and NGO resources of the community, both for faculty and financial support, and should expose all students to the principal driving forces behind sustainability: economics; tax and legal policy; statistics, predictive modeling and risk assessment; the ecology of natural and human impacted systems; cultural diversity; globalization; e-commerce and communication technologies; emerging technologies; ethics and aesthetics; demographics and health.

2.4.3. Undergraduate programs:

The School will offer a research undergraduate learning environment in alignment with UWM’s new Office of Undergraduate Research. The Office of Undergraduate Research will foster and support the participation of undergraduate students with supervising faculty, research staff and graduate students in research projects that engage students in discovery and critical thinking. In the School of Freshwaters Sciences, undergraduate research will emphasize the unique opportunities for hands-on learning through intensive laboratory and field experiences that span the interdisciplinary breadth of freshwater studies and scientific inquiry.

The National Science and Technology Council report *Ensuring a Strong U.S. Scientific, Technical, and Engineering Workforce in the 21st Century* notes, “…The world is changing, in large part because of rapid advances in science and technology. The economy is shifting from an industrial base to knowledge-based enterprises. Highly educated and skilled workers are increasingly important in this new economy. Other nations are improving their education and training systems, particularly for scientists and engineers. Our nation must take steps to ensure that it is developing the human resources it will need, paying particular attention to seeking out talent in groups currently under-represented in the scientific, technical and engineering (ST&E) workforce.” Undergraduate training is arguably the most critical part of this national agenda.
Development of the undergraduate program in the School will be one of the first priorities of the Academic Program Committee (see Appendix I, Organizational Structure of the School of Freshwater Sciences, Section 3).

A central theme that emerged from the NSF Workshops on exploring undergraduate research was that students should be involved in real research and actively contribute to the production of new knowledge. Such research learning experiences are known to be a powerful pedagogical tool in science education giving students tangible gains in skills, scientific thinking, career goals, self-confidence, socialization into the profession, and a sense of responsibility and independence. The inherently interdisciplinary nature of Freshwater Science makes the opportunity for these types of gains to be real and to transform undergraduate education from an exclusive disciplinary pursuit to a vigorous and dynamic learning environment of engagement, diversity and inclusion.

The development of an undergraduate learning environment in freshwater science is underway, and in some form has been a hallmark of the institution for many years. The research experience for undergraduates program at the WATER Institute is now in its 20th year, numerous undergraduates have availed themselves of research opportunities on an ad hoc basis, and new programs, for example in marine engineering, are being developed. A key element of this learning environment is to engage undergraduates early in their university tenure, as freshmen and sophomores, as well as upper level juniors and seniors, and thereby have a stronger influence on their choices of major, career tracks, and acquisition of practical, professional skill sets. The undergraduate learning environment also gives the School a means to more effectively reach a broader and more diverse group of students who might not otherwise consider math and science training for lack of exposure, role models, or mentoring until it was too late.

In addition to the new Office of Undergraduate Research, UWM has much past experience in providing undergraduate students such opportunities through the Undergraduate Research Opportunities (UROP) program and independent study courses. The Center for Great Lakes Studies has been an active participant in the UROP program. The campus has allocated two faculty positions for joint appointments between College of Letters and Science and the proposed new School for enhancing undergraduate research opportunities.

2.4.4. Specialized Professional Certification, Continuing Education and Public Education and Outreach Programs

Future non-degree education and training programs are envisioned to include the following:

- Marine Engineering
- Aquaculture production technologies
- Environmental Resource Management
- State-of-the-art methods in environmental molecular biology

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2.5. Research Programs:

2.5.1. Research within the School of Freshwater Sciences is directed at improving our understanding of how freshwater systems work, and spreads across four major interacting and complementary thematic areas or Research Alliances:

- System Dynamics
- Health and Sustainability
- Freshwater and Technology
- Policy and Management

In establishing a broad set of Research Alliances the School of Freshwater Sciences aims to foster and stimulate research and training that will 1) address fundamental scientific questions with broad applications to aquatic ecosystems; 2) identify, understand, and predict stresses placed on our linked human and freshwater systems; 3) identify and develop technologies and strategies that will provide solutions to the problems we face; and 4) ultimately anticipate and avoid future problems and conflicts. By forming Alliances, the School of Freshwater Sciences recognizes the necessity of having scientists, scholars and practitioners with diverse perspectives who view freshwater resources in the context of an integrated ecological, technological, economic, social, and human health framework, and are committed to training the next generation of leaders and scholars through their engagement in interdisciplinary research. **System Dynamics:** To develop policy for sustaining freshwater systems, to understand the links between health and the freshwater environment, and to ascertain the reciprocal impacts of human activity and freshwater system dynamics we must increase our understanding of the fundamental underlying processes, forces and interconnections that structure freshwater systems and their responses to perturbations and change. Freshwater systems are highly dynamic – their physical, chemical and biological properties change across spatial scales of nanometers to hundreds of kilometers, and over temporal scales from microseconds to millennia. Understanding the nature of these changes, their causes, and their interconnections is not only critical to improving our fundamental understanding of how freshwater systems function, but is also necessary in order to determine how to manage these systems in a manner that preserves their functional integrity and allows for their sustainable and equitable use by the global human population dependent upon them. Core research areas in this alliance include: Freshwater Biogeochemistry; Freshwater Ecology; Fisheries dynamics; Surface and Groundwater Hydrology; Geophysical Fluid Dynamics and Hydrodynamics; Limnology; Meteorology; Watershed Dynamics; Land-margin Interactions; Freshwater Habitat and Community Structure; Climate Change; etc. Collaborations with the proposed School of Public Health would be particularly central to this research area. **Health and Sustainability:** Clean, freshwater is rapidly becoming the limiting resource for life on Earth. As a consequence of prolonged, intense human
activity, widespread chemical and biological pollution, invasive species, and engineered modifications, the Lakes have been degraded, destabilized, and placed at great risk. In turn, these changes have significantly compromised the Lake’s ability to provide clean, fresh water for inhabitants of the U.S. and Canada who live in the basin. This scenario is playing itself out in freshwater environments worldwide. In this context, a major role of the SFS will be to conduct studies along the environment-environmental health continuum that link the health of freshwater environments with human population health. These include (a) basic research on freshwater biological and chemical contaminants and pollutants in terms of their presence in the environment and the development of model research organisms for environmental disease studies (analytical and biotechnology research), their effects on indigenous organisms and populations (ecosystem toxicology), and their impact on humans who use the water (environmental and public health studies); and (b) translational research and policy development that foster ecosystem remediation and restoration and improved public health and (c) community engagement that increases education about freshwater environments and environmental health, and promotes improved ecosystem and public health.

Core research areas in this alliance include:

- Ecological change & diversity;
- Pollution and health, including toxicology, pathogens, etc;
- Ecosystem remediation, rehabilitation and restoration.

**Freshwater Technology:**

**Freshwater Engineering:** In addition to defining and understanding issues related to the use and sustainability of freshwater, the mission of the School is to pursue research that will aid in the planning, design, construction and operation of environmentally sound and sustainable infrastructure for freshwater; develop novel technologies for the conservation, treatment, purification, and regeneration of freshwater supplies; and devise cost-effective, sustainable engineering applications and practices that will improve human and environmental health. This research will lead in the development of new products and clean technologies, serve to place the Wisconsin and the Greater Milwaukee region as a national locus for innovation in research, technology development and economic growth based on freshwater.

**Prediction and Forecasting:** Key to understanding the impact of human activity on freshwater systems is the ability to forecast the effects of the interacting consequences of natural ecosystem perturbations, anthropogenic influences, and changing economic conditions. Hence the development of modeling and forecasting systems and platforms at all levels from micro- to macro-scale in time and space is an important research focus. Modeling expertise is essential for both public and private sector development of strategies and policies for sustainable and equitable water use.

**Exploration, observation, monitoring & detection technologies:** Promoting the conservation, security, efficiency and health of freshwaters requires the development of innovative diagnostic, sensor and monitoring systems and networks, including: remote sampling systems; sentinel surveillance systems; real time analytical techniques and methodologies; physical, chemical, and biosensors; intelligent autonomous vehicles, aquatic machines and IT systems; aquatic exploration tools and experimentation systems, etc.
New Approaches to Freshwater Food Production: The Food and Agriculture Organization of the United Nations estimates that more than 75% of the total animal protein in human diets is comprised of fish or shellfish products. The demand for fish products is increasing as the world’s population continues to grow at a high rate. However, most ocean fisheries stocks are over- or fully-exploited and cannot meet this demand. With increasing consumer demand and decreasing wild stocks, it is clear that fish culture will become the principal means for the supply of edible fish in the future. Research in freshwater food production is focused on developing new freshwater species such as yellow perch for aquaculture, and on technologies such as intensive recirculating systems for the production of freshwater fish species in an environmentally friendly way.

Policy and Management: The Great Lakes region faces a host of water resource problems, from invasive species and exotic pathogens, to wide-spread beach closings and combined sewer overflows, to ground water overdraws and Great Lakes diversions. These are politically charged issues that present important policy challenges. These issues are complex. Scientists are confronted almost daily with the problem of transferring science into the public domain, so that policy is well informed and based on the best possible science. The relationship between science and policy is reciprocal. Without the science and engineering done at the state of the art level, policy prescriptions will be inefficient if not flat wrong. Without good public policy research and teaching, the science cannot be implemented.

These issues are global. Worldwide more than 1.2 billion people are without adequate safe drinking water, and water borne disease results in the death of 27,000 persons per day, over one-third of these are children. The existing global water crisis demands strategic thinking, innovative policies and sustainable technologies.

The policy arm of the School of Freshwater Sciences will include Public Sector Economics, Architecture and Urban Planning, Public Health Administration and Policy, and Technology Transfer.

3. NEED

3.1. Need for the proposed school

Over the past four decades, UWM has built capacity to conduct research on various aspects of freshwater science and environmental health. The activities related to freshwater science take place in individual academic departments such as Geosciences, Biological Sciences, Chemistry and Civil Engineering, and in centers such as the WATER Institute, the NIEHS Marine and Freshwater Biomedical Sciences Center and others. There is currently no academic degree program specifically in the freshwater sciences. Formation of the School of Freshwater Sciences with its envisioned academic programs that integrate freshwater science, engineering and policy will enable UWM to

- Achieve national and international recognition as a premier academic and research institution in freshwater sciences
- Educate and train the next generation of scientists and professionals in freshwater science and management of freshwater resources by offering the planned unique doctoral and masters degrees
Grow extramurally funded freshwater and environmental health research – from federal and private sources

The structure provided by a new school for multidisciplinary collaborations and for a focus on freshwater research is key to positioning UWM to rise to the next level in these areas. The School of Freshwater Sciences will also play a key role in safeguarding one of Wisconsin’s most valuable assets: our proximity to the world’s largest reservoir of freshwater.

The Great Lakes region is a unique economic, social and cultural mega-region – a “Vital Center” with world-class institutions of higher education, innovation and research infrastructure, and natural resource assets in freshwater that are unequaled. Recent reports by Brookings and others have highlighted the tremendous potential for the Great Lakes region to become a global center of freshwater research and development. In Healthy Waters, Strong Economy, the Brookings economists conservatively estimate the economic benefit of restoring the Great Lakes to be $80-100B for a $20B investment.

The opportunity exists for the Great Lakes region to become an international center for applying new ideas, developing novel strategies, and inventing new products, processes and technologies for solving the world’s water problems. Hand in hand with technical innovation is the empowerment and education of our citizenry to maximize and fulfill its potential as producers and inventors, to fulfill the accelerating demand for water scientists and engineers, and to create a world-class workforce in freshwater technology.

The availability of water that is both fresh and pure is one of the major issues facing the world today. Despite living on an aquatic planet, less than 0.34% is available freshwater and hydrologists predict that by the year 2025 more than 50 nations and more than 2 billion people will face significant and life altering water shortages. The Laurentian Great Lakes alone contain one-fifth of the world’s supply of surface freshwater – the greatest single freshwater resource on the planet. Over 40 million North Americans live on these lakes, drink their waters, and enjoy their beauty. The lakes support a $4 billion a year recreational and commercial fishing industry, a multi-billion dollar a year tourism economy, and a huge industrial sector. The Great Lakes contain over 10,000 miles of coastline and 6 quadrillion gallons of water – enough to cover the continental U.S. to a depth of 9.5 feet.

Yet despite this abundance, the Great Lakes ecosystem is under significant, system altering stress and the region faces a host of water resource problems, from historic chemical pollution from PCB’s, mercury and other contaminants, to new sources of contamination by pharmaceuticals and personal care products, to invasive species and exotic pathogens, to wide-spread beach closings and combined sewer overflows, to ground water overdraws and Great Lakes diversions. These are politically and socially charged issues. Dealing with them results in the expenditure of 100’s of millions of dollars of public and private funds over decades. Hence climate change, population growth and sustainable resource capacity all interlink in the ensuing debates.

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Legislation and public referenda that may rule the land for generations are often drafted and decided on nuanced legal interpretations of scientific information, often inadequate to fully answer the questions posed. Fulfilling the demand for sound science, and well-trained scientists, is paramount in developing and implementing policies and management strategies that will provide a sustainable future.

Water problems require ecological and technological solutions, which in turn create the potential for commercial spin-off that can spur new investment, new industry, and more jobs. Throughout the country, more public works money is spent on dealing with water than any other problem. The Congressional Budget Office estimates that over the next 20 years the US will outlay $65-100B per year for water infrastructure, and that the demand for water technology is a $400B per year global business. Milwaukee has spent > $2.3 billion to upgrade its sewer system, yet despite having one of the best major urban sewage systems in the country, Milwaukee’s rivers and coastal waters are still impacted by occasional combined sewer overflows during short periods of extreme heavy precipitation, and by more frequent storm water inflow during all precipitation events. Global climate models predict large scale alterations in global meteorological patterns, particularly in temperate and high latitudes where shifts in the timing and magnitude of precipitation predict an increase in the severity of storms and changes in precipitation of up to 20% - a change which may exacerbate storm water discharge problems throughout the region. The Great Lakes are particularly sensitive to alterations in heat and precipitation fluxes. In 2007, water levels in Lake Superior reached an 80 year low. Demands for the export of Great Lakes water are increasing, and neither our ecological understanding nor our economic system is prepared to forecast the impacts of these demands. Hence water problems also require social, political and behavioral solutions. Advancing technology is only one piece of the issue at hand, and is only as useful as our ability to implement it. The challenge we face both regionally and globally is to deal with this increasingly limited vital resource with a scientifically sound basis and a view to fairness and the sustainability of all life.

It is widely recognized in the scientific community that to advance in our understanding of the complex problems that are at the heart of freshwater issues, a multi-disciplinary approach is needed – the traditional model of studying water issues from the perspective of single scientific discipline is no longer germane (American Society of Limnology and Oceanography, 2003; National Research Council, 2000)\(^7\). In recognition of this fact, several recent national studies have called for major investments by the United States in freshwater research (Naiman, et al., 1995; National Research Council, 2004), large lakes research (SOFIS, 2003), and a revitalization and investment in education and training in freshwater studies (National Research Council, 1996)\(^8\). Despite these recommendations,

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this mandate has largely yet to be carried out in the United States. In their outlook for the next ten years, the NSF Advisory Committee for Environmental Research and Education (2003) stated, “At two- and four-year colleges and research institutions, academic institutional structures and incentives should facilitate interdisciplinary environmental research.” There is a clear need for graduate training in this arena, both nationally and internationally. Furthermore, few institutions worldwide have the environment-environmental health continuum of expertise and perspective proposed here, and the opportunity to develop and emphasis on freshwater and health side-by-side with the School of Public Health is a powerful synergism. The School of Freshwater Sciences and the graduate degrees offered at UWM would be unique, and would meet a growing demand.

3.2. Comparable Schools or Colleges in Wisconsin and Neighboring States:

The School of Freshwater Science will be a unique academic entity in Wisconsin, in the Midwest, or in the United States. There is one school in each of Canada, Europe, and Australia that is similar to the proposed School of Freshwater Science. Aspects of freshwater research and training are ubiquitous in many institutions; however virtually no institution encompasses the full range of freshwater sciences. A 2005 international survey of universities with [Fresh]water/Hydrology programs identifies 115 worldwide. This survey only identifies 7 degree granting programs in the United States (Universities of Arizona, Florida, New Mexico and Washington, Colorado State, Georgia Tech, New Mexico Tech). None of these programs are in the Midwest. Further, none of these programs have their major focus on the Great Lakes, which contain nearly 20% of the Earth’s fresh surface water. The University of New Mexico conducts an interregional program with the University of Alabama, supported by a National Science Foundation Integrative Graduate Education, Research and Training (IGERT) grant, with perhaps one of the broadest coverage of the entire freshwater system of all those in the United States, but with a somewhat limited emphasis on the physical and ecological science of groundwater and riverine systems. In Canada, there are only 4 programs listed in this survey (Universities of Alberta, Manitoba, Quebec and the United Nations University). Programs that cover only a part of the freshwater system, of which there are many, are not identified in this survey.

There are excellent examples of multidisciplinary programs outside of North America that are consistently at the forefront of freshwater research. Notable among these are the Swiss Institute of Aquatic Science and Technology (EAWAG), which is a part of the Swiss Federal Institute of Technology (ETH), Zurich. Other well-known examples include the Australian Commonwealth Scientific and Industrial Research Organization - Land and Water Division (CSIRO Land and Water), the UNESCO-HE Institute for Water Education in Delft, Netherlands, and the United Kingdom’s Centre for Ecology and

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9 National Science Foundation Advisory Committee for Environmental Research and Education, “Complex Environmental Systems – A 10-year Outlook for the National Science Foundation”, (2003)

10 See www.nwl.ac.uk/ih/devel/wmo/wmohh.html
Hydrology (CEH). Both CSIRO and CEH are large organizations with multiple laboratories throughout their respective countries. All three organizations are examples of institutions that specifically recognize and are organized around the need for a multidisciplinary approach to freshwater science.

As identified in recent national studies there is a dearth of multidisciplinary, holistic programs in North America, and particularly in the Midwest, that provide training in the full spectrum of freshwater studies. The proposed School of Freshwater Science will be the first entity that will address this need. The School will house programs at all levels—doctoral, masters and bachelors—and will bring together scholars who together will cover all aspects related to freshwater research as outlined in the previous section. One particularly unique aspect of the proposed school is that it has the potential to link the health of the freshwater environment with human environmental health.

Wisconsin has a long and respected tradition of environmental leadership and innovation, and programs within the University of Wisconsin System reflect the state’s commitment to an environmental ethic. The Nelson Institute of Environmental Studies at the University of Wisconsin-Madison is internationally recognized as a leader in environmental science, policy and education. Current collaborations exist between the Nelson Institute and UWM Water Institute Scientists and UWM Faculty, including strong interactions with the Center for Sustainability and Global Environment in order to study the impact of climate change of the Great Lakes. The Center for Limnology at UW-Madison has a 100-year history of study of inland freshwater. The Center has internationally recognized expertise in aquatic studies and encompasses long-term studies, modeling, Great Lakes research, and application to resource management and environmental issues. Formation of the SFS would enhance existing collaborations between the Center and UWM faculty and Scientists with shared research interests on the Great Lakes. Other existing collaborations that would have the opportunity to expand are with Civil and Environmental Engineering (UW-Madison), UW-Oshkosh Biological Sciences, and UW-Green Bay. These are programs that play important roles but the proposed school will be the only comprehensive academic unit that addresses these and other freshwater-related research and education.

The unique feature of the SFS is the environment-environmental health/public health focus and expertise that imparts a special emphasis and vision to the program. The SFS will also be the only academic unit granting degrees in freshwater science. These features are what distinguish the SFS from all the other entities and foreclose other questions about the need for the proposed School of Freshwater Science.

3.3. Collaborations with other state, regional, and national organizations:

The School of Freshwater Sciences will explore cooperative programs with other UW System campuses to provide faculty members at those campuses with research interests in freshwater sciences both access to and advising responsibilities for graduate students through UWM, and expanded research opportunities. For these faculties, the UWM Great Lakes WATER Campus represents a System-wide resource whose potential is not fully tapped. The Freshwater Sciences program can serve as the vehicle for the expansion of these types of interactions, in keeping with the call for the need for such broad-based initiatives by the National Science Foundation, the National Ocean Partnership Program,
the National Institutes of Health (unique environment-environmental health focus), and other national and international agencies.

There are a number of excellent graduate environmental programs within the UW System that have freshwater ties. The majority offer a terminal degree at the master’s level and address portions of freshwater spectrum within their local area of interest. These programs have faculty with freshwater interests and expertise; these faculties could become engaged in the proposed doctoral program. At the other doctoral campus (UW-Madison), there are a number of doctoral training opportunities for students in freshwater studies or with a freshwater study interest. The principal ones are: Limnology and Marine Science, and Environmental Chemistry and Technology. The Nelson Institute offers master’s degrees in Conservation Biology and Sustainable Development, Land Resources, and Water Resources Management. The Center for Limnology has a long and renowned history of lakes research dating back to Birge and Juday. The Center offers interdisciplinary degrees in Limnology and Marine Sciences, through academic departments. Scientists at UWM have long-standing interactions with many of the faculty in these programs, and students have been occasionally drawn to Milwaukee to take advantage of the WATER Institute’s unique resources for freshwater research, particularly the R/V Neeskay, the aquaria facilities and the location on Lake Michigan. The existence of a new School and doctoral program at UW-Milwaukee would further enhance these opportunities, providing additional course work and field training experiences for graduate students, synergistic graduate committee advising opportunities for faculty throughout the UW System, and intercampus collaborative extramurally funded research projects.

UWM WATER Institute Scientists and UWM Faculty involved in freshwater research have built strong relationships with other academic, state and federal, and private agencies (NOAA, NIH, USGS, USDA, WDNR, MMSD, etc.) Current interactions are on multiple levels including joint research ventures, interfacing with the business community, collaborative committees to advise policy, and participation on scientific councils, task forces, and workgroups. Examples of these interactions are detailed in Appendix II. The proposed School is expected to solidify and strengthen these relationships by providing additional coordination and depth of expertise available through the academic community to agencies responsible for implementing water resource management, policy and regulation, and protecting our water resources and public health.

4. ORGANIZATIONAL STRUCTURE

The School of Freshwater Sciences will assume the research and outreach functions of its predecessor, the Great Lakes WATER Institute.

4.1. Administrative Structure: The School will be led by a Dean, working in concert with the School’s faculty. Standing faculty committees will include the Executive Committee of the Faculty (with Chair and Vice Chair), Planning and Budget Committee, Academic Program and Curriculum Committee, Research Committee, and other special committees. The Dean will be assisted by an Associate Dean who will be appointed from the ranks of tenured faculty for a fractional administrative appointment.
In the initial stage of the School’s development, an acting Dean will be appointed from within UWM for the duration of the search for the Founding Dean. A Founding Executive Committee will be constituted of tenured faculty with substantial ongoing research productivity in freshwater and/or demonstrated leadership skills derived from the pool of:

➢ faculty who conduct research related to freshwater and who have expressed interest through the faculty survey conducted in January 2008 in participating actively in research and instructional programs in the new School, and

➢ faculty with governance experience at the department, college and university levels.

The Founding Executive Committee will be appointed with the concurrence of the University Committee, the Dean of School of Freshwater Sciences, and the Provost. New tenured faculty members with their tenure home in the School of Freshwater Sciences will be added to the Founding Executive Committee. The appointments to the Founding Executive Committee shall be reviewed annually by the University Committee, Dean of SFS, and the Provost. When the number of tenured faculty appointments in the School of Freshwater Science reaches five, the UC, Dean, and Provost together will consider dissolution of the Founding Executive Committee. The campus will ensure that the necessary support is provided to the Founding Executive Committee to allow the faculty members to meet their full range of responsibilities consistent with campus policies.

The organizational structure, membership and responsibilities of the School are delineated in Chapters 1-3 of the Organizational Structure of the School of Freshwater Sciences (Appendix I).

4.2. Academic Structure: The immediate governance of the School is vested in its faculty, which has jurisdiction over the interest of the School, with authority to determine questions of educational and administrative policy, other than those matters that are vested in the Executive Committee. The faculty shall be responsible for teaching, research and public service (see Appendix I, Chapter 2). The School will be constituted
without academic departments. The faculty in SFS and affiliated faculty will be organized in four thematically defined, overlapping academic areas – System Dynamics, Health and Sustainability, Freshwater and Technology, and Policy and Management – based on their research interests. Faculty in each area will have primary responsibility for academic programs in that area with one faculty member as a coordinator for that area.

4.3. Support Service Structure:

Access to Academic Advising Support

The School of Freshwater Sciences will offer substantial advising and outreach for potential students in order to fully support their academic progress and success. A full-time program assistant is included in the budget for providing support for these functions. As the enrollments in the program grow, an academic advisor will be added (projected for 2014-15) to provide guidance to new students and develop academic timelines that best support the students’ needs and interests. Faculty will work with master’s and doctoral students to identify their strengths in freshwater sciences and align those with appropriate learning and research opportunities, and to advise on programs of study for the students. Specific outcome goals will be incorporated into program planning and curriculum development.

Access to Library Resources

Students and faculty will have access to current UWM library resources, as well as the seven collaborative libraries in UW System. As the school is formed, however, UWM’s library collections will be reviewed to identify the resources that are relevant to freshwater sciences and supplement those deemed as necessary. Additionally, students and faculty will have access to numerous online resources including meta search databases, Refworks accounts, reserve and e-reserve, video and DVD collections, archives, and more

Access to Campus Student Services

Students will have full access to the comprehensive student services provided by UWM, including the following:

- Graduate School Resources
- Financial Aid
- Advising
- Disability Services
- Student Health Services
- Counseling/Psychology
- Multicultural Student Services
- Technology Resources
- International Student Services
- Klotsche Athletic Center
In addition, all UWM students have access to the services and resources provided by University Information Technology Services which include: myUWM, Panthermail, PantherCal, PantherFile, PantherList, D2L (Desire to Learn), PAWS (Panther Access to Web Services), electronic security and antivirus, and desktop support.

5. **FINANCE**

5.1. **Operating Budget and Budget Narrative:**

The operating budget of the Great Lakes WATER Institute (~$2.4M) will be reallocated to the SFS along with the FTEs. The current budget consists largely of personnel costs (salaries and fringes) and operations and maintenance costs. Additionally, the Institute has averaged $3.3M in extramural funding over the past three years with data (2004: $2,872,740; 2005: $3,061,837, and 2006: $4,206,624).

The budgeted amount for the current 2.25 FTE faculty lines in the current WATER Institute budget is shown to be continuing. It is anticipated that 6 of the academic staff scientists will transition to faculty lines in 2010-11 according to the process outlined in Section 6.1. This is shown as an increase in the faculty salary line in the continuing budget and a concomitant reduction in the academic salary line in the continuing budget.

The principal new ongoing financial requirements for the School are the salaries for a new Dean, Associate Dean, and Program Assistant ($293,050 in 2009-10) and supplies and expenses. The salary for the Associate Dean shown in the table below is the expected differential amount over the full-time faculty salary. New faculty lines for the School will also be included in future UWM growth initiatives (~$100,000 each).
**Proposed Budget (General Program Revenue)**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Current and continuing Expenditures</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Continuing Salaries</strong></td>
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<td></td>
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<td></td>
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<tr>
<td>Faculty</td>
<td>$240,000</td>
<td>$248,400</td>
<td>$857,000</td>
<td>$886,995</td>
<td>$918,040</td>
<td>$950,171</td>
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<td>Academic Staff</td>
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<td>$1,311,063</td>
<td>$757,045</td>
<td>$783,542</td>
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<td>Classified Staff</td>
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<td>$290,362</td>
<td>$300,525</td>
<td>$311,043</td>
<td>$321,930</td>
<td>$333,197</td>
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<td>Fringe Benefits</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Faculty and Academic Staff</td>
<td>$527,355</td>
<td>$545,812</td>
<td>$564,916</td>
<td>$584,688</td>
<td>$605,152</td>
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<tr>
<td>Classified Staff</td>
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<td>$130,663</td>
<td>$135,236</td>
<td>$139,969</td>
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<td><strong>Continuing Salaries and FB</strong></td>
<td>$2,440,870</td>
<td>$2,526,300</td>
<td>$2,614,722</td>
<td>$2,706,237</td>
<td>$2,800,955</td>
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<td><strong>Continuing Supplies and Exp.</strong></td>
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<td>$81,887</td>
<td>$81,887</td>
<td>$81,887</td>
<td>$81,887</td>
<td>$81,887</td>
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<td><strong>Total Continuing Expenditures</strong></td>
<td>$2,522,757</td>
<td>$2,608,187</td>
<td>$2,696,609</td>
<td>$2,788,124</td>
<td>$2,882,842</td>
<td>$2,980,876</td>
</tr>
<tr>
<td><strong>New Expenditures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Salaries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dean, SFS</td>
<td>$145,000</td>
<td>$150,000</td>
<td>$155,250</td>
<td>$160,684</td>
<td>$166,308</td>
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<td>Associate Dean Academic Affairs</td>
<td>$10,000</td>
<td>$10,350</td>
<td>$10,712</td>
<td>$11,087</td>
<td>$11,475</td>
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<tr>
<td>Faculty (5 faculty members - open rank)</td>
<td>$500,000</td>
<td>$517,500</td>
<td>$535,613</td>
<td>$554,359</td>
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<tr>
<td>Program Assistant, Graduate Studies</td>
<td>$20,000</td>
<td>$40,000</td>
<td>$41,400</td>
<td>$42,849</td>
<td>$44,349</td>
<td>$45,901</td>
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<tr>
<td>Graduate Assistants</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fringe benefits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty and Academic staff</td>
<td>$59,675</td>
<td>$254,235</td>
<td>$263,133</td>
<td>$272,343</td>
<td>$281,875</td>
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<tr>
<td>Classified staff</td>
<td>$9,500</td>
<td>$19,000</td>
<td>$19,665</td>
<td>$20,353</td>
<td>$21,066</td>
<td>$21,803</td>
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<td><strong>Salaries and FB Subtotal</strong></td>
<td>$29,500</td>
<td>$273,675</td>
<td>$975,650</td>
<td>$1,009,797</td>
<td>$1,045,140</td>
<td>$1,081,720</td>
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<td><strong>Supplies and Expenses</strong></td>
<td>$10,400</td>
<td>$19,376</td>
<td>$24,350</td>
<td>$25,203</td>
<td>$26,085</td>
<td>$26,998</td>
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<td><strong>Total New Expenditures</strong></td>
<td>$39,900</td>
<td>$293,051</td>
<td>$1,000,000</td>
<td>$1,035,000</td>
<td>$1,071,225</td>
<td>$1,108,718</td>
</tr>
<tr>
<td><strong>Total all Expenditures</strong></td>
<td>$2,562,657</td>
<td>$2,901,238</td>
<td>$3,696,609</td>
<td>$3,823,124</td>
<td>$3,954,067</td>
<td>$4,089,594</td>
</tr>
</tbody>
</table>

**Resources**

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Current budget in WATER</td>
<td>$2,522,758</td>
<td>$2,608,188</td>
<td>$2,696,609</td>
<td>$2,788,124</td>
<td>$2,882,842</td>
<td>$2,980,876</td>
</tr>
<tr>
<td>One-time planning funds</td>
<td>$39,900</td>
<td>$293,050</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Budget Request in 2009-11 biennium</strong></td>
<td>$1,000,000</td>
<td>$1,035,000</td>
<td>$1,071,225</td>
<td>$1,108,718</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Resources</strong></td>
<td>$2,562,658</td>
<td>$2,901,238</td>
<td>$3,696,609</td>
<td>$3,823,124</td>
<td>$3,954,067</td>
<td>$4,089,594</td>
</tr>
</tbody>
</table>

**Notes:**

The current resources (including salaries, fringe benefits, FTE, capital, and supplies and expense budgets) of the WATER Institute will be part of the new school's resources. The above table shows the anticipated marginal increase in expenditures and resources for the School of Freshwater Science including current figures for WATER Institute.

In addition to the above, it is expected that there will be a growth in the extramural funding and in endowment funding as the School is established.

There is no expectation for graduate student support to come from GPR funds. Currently, there are 11 graduate assistants and 4 temporary research staff supported by extramural funding in the WATER Institute. It is expected that this will continue (and increase) into the future.
The total initial resources for the School, combining extramural and GPR resources, would be $5.8M. As additional faculty join the School and extramural and development plans are implemented, the School’s resource base is anticipated to increase to roughly $10M by 2013/14.

5.2. Capital Budget and Narrative:

Facilities: The immediate facilities improvement needed for the new School is the development of dedicated instructional facilities at the WATER Campus. Two new classrooms are being developed as a result of upgrades to the HVAC system, making the third floor of the Institute completely habitable for the first time. These will serve for lectures (capacity of 35), seminars (<20), colloquia (~60-100), and informal receptions and poster sessions. AV equipment and telepresence technologies will need to be integrated into these classrooms (see 7.3.2) at an estimated cost of $20,000.

A Freshwater Sciences Instructional Laboratory is proposed in combination with renovations for a “WET Bay” (Field sampling and research vessel access/operations facility) at an estimated cost of $300,000, for which extramural support is being sought.

Long-term capital improvements are envisioned by the Master Plan (see 7.2.2) in sequenced phases. Each phase has component elements that could be developed independently, and applications for remodeling and capital improvements are routinely updated and submitted. These developments will address the growing research space needs.

Research Vessel: The cost estimate for a new state-of-the-art research vessel (~120 feet length overall) is estimated to be $16,500,000 for design and construction, and $3,500,000 in operational endowment funds. Plans are to raise these funds from a combination of primarily private sources. A fundraising campaign for “The Future of Freshwater Sciences” is underway.

5.3. Extramural Research Support:

Extramural funding for the WATER Institute has averaged ~$3.3M annually in the three year period 2004-2006. Including freshwater related research in the other UWM schools and colleges, principally Letters and Science, and Engineering and Applied Science would add several $100K annually.

Both extramural and indirect costs generated by the WATER Institute over the last ~decade are given in the Institute’s Biannual Report. IDC return averaged 21.9% of direct costs over the period 1998-2006 (9 years) with some of the annual variation due to differences in reporting period between award and expenditure. Over the last 3 years ~80% of this funding is from federal sources, ~15% from state or local sources, and the remainder from the private sector. Important federal agencies (with IDC rate) include: NOAA, NSF and NIH (47%), NOAA Sea Grant (~25%), USDA (25%), USDA/ARS (0%), MMSD, State and local (15%), Corporate (47%), philanthropic organizations (0%).

Based upon the 2007-2012 Strategic Plan for the WATER Institute, estimates for extramural support within the new School are ~$4M per year initially, increasing by 50% within the next 5 years.
The formation of the School will also present unique opportunities for fund-raising to support endowed positions and research infrastructure. Given its mission and the growing importance of freshwater resources, it is anticipated that the School will be well-positioned to attract private funding in support of its programs.

6. PERSONNEL

The formation of the School of Freshwater Sciences builds upon the long-standing strength of the University of Wisconsin-Milwaukee faculty and staff in freshwater science, including the programs and infrastructure within the Great Lakes WATER Institute. Identification and inclusion of a core base of personnel from these groups of individuals and positions will render the transformation of the University’s intellectual assets, programs and facilities to a School readily attainable.

6.1. Faculty

The School’s faculty will come from three sources: new hires planned as part of future biennial funding requests; conversion of Academic Staff scientists to faculty appointments, and split faculty appointments with other schools and colleges within UWM. There is also a fourth group of affiliated faculty who will retain their appointments in other schools and colleges, but who have expressed interest in participating in UWM’s interdisciplinary freshwater research programs.

From an initial base of 10-12 FTE faculty in FY 10-11, it is anticipated that the School will grow to 15 FTE faculty by FY 11-12.

New faculty

New faculty lines for the School of Freshwater Sciences will accrue from future growth initiatives. The campus anticipates having 5 new faculty positions for the School of Freshwater Science included in the request for the 2009-11 biennium. A similar request will be made for the 2011-13 biennium.

Split Faculty appointments in the WATER Institute through the Graduate School. Currently there are 7 faculty with 25% or 50% split appointments with departments in the College of Letters and Science representing 2.25 FTEs. The following table contains the list of faculty with their levels of appointment in WATER Institute.

<table>
<thead>
<tr>
<th>2007/08 Faculty members</th>
<th>Rank</th>
<th>Appt in WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brooks, Art</td>
<td>Professor</td>
<td>50%</td>
</tr>
<tr>
<td>Cherkauer, Doug</td>
<td>Professor</td>
<td>25%</td>
</tr>
<tr>
<td>Petering, David</td>
<td>Professor</td>
<td>25%</td>
</tr>
<tr>
<td>Kaster, Jerry</td>
<td>Assoc. Prof</td>
<td>25%</td>
</tr>
<tr>
<td>Isbell, John</td>
<td>Professor</td>
<td>25%</td>
</tr>
<tr>
<td>Strickler, Rudi</td>
<td>Professor</td>
<td>50%</td>
</tr>
<tr>
<td>Sverdrup, Keith</td>
<td>Professor</td>
<td>25%</td>
</tr>
</tbody>
</table>

When faculty retire or leave the University, these partial appointments will remain in the School.
Current UWM faculty who do not have budgeted partial appointments in WATER can apply to join SFS after it is formed (through joint appointment or transfer) following existing codified UWM process.

**Conversion of Academic Staff Scientists** within the Graduate School Great Lakes WATER Institute to Faculty within the School of Freshwater Sciences. Currently there are 12 FTE doctoral level scientists (Assistant through Senior) on the research staff of the WATER Institute who would be eligible to be considered for possible appointment as faculty in the new school. Scientists who wish to be converted to faculty status must submit their portfolios within 12 months of formation of the School. Portfolios will be reviewed by the Founding Executive Committee in accordance with UWM Policies and Procedures for evaluating faculty candidates. The Dean of the School of Freshwater Sciences shall act on the positive recommendations from the Founding Executive committee for appointment and granting of tenure and rank per UWM Policies and Procedures in the following way:

- for tenured appointments, the Dean shall forward the portfolio to the appropriate Divisional Committee for their recommendation. After receiving the Divisional Committee recommendation, the Dean shall forward his/her recommendation for the appointment to the Provost;
- for tenure-track appointments, the Dean shall forward his/her recommendation to the Provost.

Upon receiving a letter of appointment specifying faculty rank and tenure status, or upon receiving a negative recommendation on appointment to a faculty rank, the academic staff scientist will have the option of remaining in his/her academic staff position with all the rights and responsibilities associated with that appointment. The following table has the current list of the Academic Staff Scientists in the Institute.

<table>
<thead>
<tr>
<th>Name</th>
<th>Appt %</th>
<th>Title</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aguilar, Carmen</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Binkowski, Fred</td>
<td>100%</td>
<td>Senior Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Bootsma, Harvey</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Carvan, Michael</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Consi, Thomas</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Probationary</td>
</tr>
<tr>
<td>Cuhel, Russell</td>
<td>100%</td>
<td>Senior Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Goetz, Rick</td>
<td>100%</td>
<td>Senior Scientist</td>
<td>Indefinite</td>
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<tr>
<td>Janssen, John</td>
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<td>Klaper, Rebecca</td>
<td>100%</td>
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<td>Klump, J. Val</td>
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<tr>
<td>McLellan, Sandra</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Indefinite</td>
</tr>
<tr>
<td>Waples, James</td>
<td>100%</td>
<td>Assoc. Scientist</td>
<td>Probationary</td>
</tr>
</tbody>
</table>

About half of the Academic Staff scientists have expressed interest in going through the conversion process.
Affiliated Faculty appointments with research and/or teaching interests relevant to the School of Freshwater Sciences as identified by the all campus survey, January 2008. These members of the faculty hold appointments in their respective departments.

It is anticipated that there will be significant engagement of faculty from the proposed SFS with the proposed School of Public Health. Currently, multiple freshwater scientists are engaged in environmental health research as it relates to Freshwater issues. Likewise, campus wide, public health faculty are actively engaged in water issues, either in collaboration with the NIEHS Center housed at the WATER Institute or with individual scientists directly. The recent NIH grant submission to form a Center for Children’s Environmental Health lists multiple investigators from the WATER Institute.

6.2. Academic Staff:

Current Academic staff within the WATER Institute, in addition to the scientists listed above, consists of 5 FTEs, all non-instructional, including an Assistant Director for Marine Operations and Facilities, two Researchers, an Information Technology Consultant and a Laboratory Manager.

Projected Additional Academic Staff. It is anticipated that additional Academic Staff will be added to the School as needed for student support, fundraising/development, and as new extramural grant projects get under way.

6.3. Classified Staff:

Current Classified Staff within the WATER Institute consists of 9 FTEs, including a Unit Business Manager (1 FTE), Financial Specialists (2 FTE), a Program Assistant (1 FTE), Instrument Makers (2 FTE), an Electronic Technician (1 FTE), a Research Vessel Captain (1 FTE) and a Research Vessel Relied Captain and Mate (1 FTE).

Projected Additional Classified Staff. Based upon the School of Freshwater Sciences future planning, it is anticipated that additional Classified Staff will be added to the School, as needed, primarily an Academic Program Assistant, within the first year.

6.4. Diversity:

Water is a basic human need, and water-related issues affect every human culture. Freshwater research encompasses by necessity local, regional watershed, continental and global perspectives. This inherent diversity is the context of operation for the School of Freshwater Sciences, and it will be expressed in the curriculum, research, and outreach programs of the School.

The School of Freshwater Sciences is fully committed to enhancing UWM’s goal of attracting and supporting students, faculty and staff from diverse backgrounds. UWM’s location in an urban environment will allow the school to establish close connections to a wide array of community-based organizations. The school will strive to attract diverse students and faculty so that curricula and research is reflective of, and applicable to, a broad range of populations. The School recognizes that equal employment opportunity, affirmative action, and diversity require positive action and deliberate efforts to remove systemic, institutional forms of exclusion and discrimination to ensure that UWM is
reaching out to all potential candidates in its personnel practices. As the chief administrative officer, the Dean will be responsible for implementing UWM’s EEO/AA programs within the School.

7. FACILITIES

7.1. Space and Capital Resources:

7.1.1. Existing Facilities: The WATER Institute is part of the University of Wisconsin System, administered by the University of Wisconsin-Milwaukee. The Institute is home to the UW Great Lakes Aquaculture Center, the National Institute of Environmental Health Sciences Marine and Freshwater Biomedical Sciences Center, the Center for Water Security, the Center for Great Lakes Studies, the Southeast Regional Office of the UW Sea Grant, the National Undersea Research Program Great Lakes Office, the US Department of Agriculture, Agriculture Research Services Great Lakes Aquaculture Cooperative, and the Wisconsin Department of Natural Resources (WDNR) Southeast Regional Lake Michigan Fisheries Management Unit and Law Enforcement Units. The WATER Institute operates the 71’ research vessel (R/V) Neeskay and serves as the homeport for the US EPA’s 180’ research vessel R/V Lake Guardian, the DNR’s R/V Gaylord Nelson, and numerous small craft.

The Great Lakes Research Facility (GLRF), which houses the Institute, was established in 1978 as the home for the Center for Great Lakes Studies. In 1997, the GLRF and the Center for Great Lakes Studies were reorganized to create the UW System/UW Milwaukee Great Lakes Wisconsin Aquatic Technology and Environmental Research Institute. The Center for Great Lakes Studies recently celebrated its 40th anniversary at UWM and continues to host internationally recognized speakers as part of the Recent Advancements in Limnology seminar series, which is held at the WATER Institute. The Institute is the largest U.S. academic institution of its kind in the Great Lakes region and is experiencing rapid growth in programs and research staff. In the past, space for new scientists was allocated from existing laboratory space or created through development of open space that met immediate needs. With the expected growth in programs, a more organized approach to development of the existing space was necessary and thus a master planning study was undertaken in 2002-03.

The Great Lakes WATER Institute is located on the inner harbor of Milwaukee and is housed in the former Allen Bradley ceramic tile factory that was built in 1965 and purchased by the University of Wisconsin System in 1973. It is a substantial building, built to industrial standards with a concrete superstructure, pre-stressed concrete floors, and a precast concrete exterior. Numerous remodeling projects have been completed, but the building still contains large amounts of unused or underutilized space, including, for example, the huge clay silos that stored the materials used in the tile manufacturing process. The 133,264 GSF building consists of three floors. The 93,382 GSF Main Floor contains most of the fisheries, research labs, shops, storage areas and office space. The 7,981 GSF Second Floor has research labs, and the 31,901 GSF Third Floor houses mechanical and building support functions. Currently there are approximately 86,500 ASF in the existing condition.
One of the most significant benefits of the existing facilities is its site. The WATER Institute is located two miles south of downtown Milwaukee, on the ~8 acre WATER Campus with views of the downtown skyline. The facility occupies approximately 40% of the existing site at 600 East Greenfield Avenue, with the remainder largely undeveloped vacant land. The site is flanked on the north and east boundaries by over 1400’ of deep-water boat docking facilities with capacity to serve ships to 250’ length overall (LOA) and direct access to Lake Michigan. Research vessels are an essential and unique aspect of the operation of the research programs within the facility and the Institute has operated a research vessel continuously on the Great Lakes for nearly 40 years.

Following the transformation of the WATER Institute into the School of Freshwater Sciences, the physical facility will be renamed the UWM Great Lakes WATER Campus. As with all other academic and research space on campus, the Provost will be ultimately responsible for allocation and utilization of assignable space on the UWM Great Lakes WATER Campus following standard practice for such allocations. The School will be responsible for management and provision of services and maintenance of the UWM Great Lakes WATER Campus facility, which will house the School plus tenants such as the State Department of Natural Resources, the Environmental Protection Agency, and UWM centers administered by other schools and colleges. Formal agreements describing the expectations of each tenant and the facility will be executed between the unit and the School of Freshwater Sciences. Components of the UWM Great Lakes WATER Campus are outlined below.
7.1.2. **Existing Capital Equipment:** In addition to the *Research Vessel Neeskay*, the WATER Institute also houses a diverse array of analytical instrumentation, a fully equipped Instrument Shop, and extensive aquaria and life support facilities and equipment.

7.2. **Additional Facilities and Capital Equipment Required:**

7.2.1. **Water Campus** With the creation of new instructional programs, both graduate and undergraduate, dedicated instructional space within the School at the UWM Great Lakes WATER Campus will be required. Two new classrooms are being developed (see section 5.2.1), and new office space for graduate students has been created in the adjoining space. The Institute currently has no dedicated instructional laboratory space. As of this writing, a proposal to the NSF program for Improvements in Facilities, Communications and Equipment at Biological Field Stations and Marine Laboratories (FSML) is being prepared, the objective of which will be to remodel two existing spaces to create a WET Bay (Field sampling and research vessel access/operations facilities) and a Freshwater Sciences Instructional Laboratory. Previous submissions, although unfunded, have received a “highly meritorious” rating and modifications in the proposal will address the improvements suggested by the panel. With these relatively modest improvements, the School will have the facilities necessary at the outset to serve its academic programs.

In the long term, the potential for future growth and development should be considered. The availability of outdoor space for future growth and expansion of facilities, and the potential for the renovation and build-out of interior space led to the development of a Master Plan Study (2003) directed by the Division of State Facilities and the University Office of Architects, Planning and Transportation, and led by the architectural firm of Kahler/Slater. The WATER Institute’s Master Plan Study includes a New Concept for the future development of the UWM Great Lakes WATER Campus consistent with development of a new School of Freshwater Sciences. During the Master Plan Study process, various design alternatives were studied for the relocation of the building’s main public entrance, improved utilization of the existing volume of space within the building, the optimal locations for new research, education and outreach activities, for boat launching and storage facilities, for expanded aquaculture facilities, and for vehicle parking needs. The Master Plan Study lays out a phased development and renovation plan that can be implemented in stages as funding and need arise.

The New Concept represents the culmination of the Master Plan Study process and provides the framework upon which future construction project planning will be based. Included is a program of space requirements defining functional and space needs, conceptual floor plans, site plan, building sections, and interior and exterior perspective sketches to illustrate the directions that may be taken by future construction projects. The New Concept includes a site plan and building plans. The New Concept site plan addresses the development of the west end of the site outside of the existing building.

These elements are crucial for improving the functionality, image and appearance of the UWM Great Lakes WATER Campus as well as providing the necessary facilities for a broad range of programs involving research, education, and outreach. With the addition of the small boat building and boat launch, the Institute will become more self-sufficient,
no longer relying on outside entities for vessel storage and launching. The new visitors parking lot will eliminate present parking problems and direct visitors to the new main entrance. The New Concept also addresses the development of the existing building from a new entrance to remodeling existing laboratories. The new main entrance and exterior façade will improve the outward appearance of the building, give it a visual identity, and direct visitors to the public entrance.

A new entrance lobby will define the public and private pathways inside the building and enhance security. The lobby will be flexible in design for use as a gathering space for receptions, fund-raising events, and tours of the School and out onto Lake Michigan. The lobby will also function as a “working exhibit” where visitors will be able to view activities in the adjacent spaces while physically remaining outside them. These views, from both the First Floor and the Second Floor overlook balconies, will include the Marine Operations Facility, Aquatics Laboratory, Robotics Laboratory, Electronics Shop, and Instrument Shop. The new lobby will also provide space for exhibit tanks, displays, and even a small boat if desired. The development of a new Second Floor within the existing building shell will provide new program space for laboratories, offices, and other functions. This will also provide flexibility for expansion of existing programs, relocation of activities during construction projects, and addition of needed mechanical and utility spaces. The development of the Third and Fourth Floor levels at the clay silo infill area will provide space for a centralized office area, with adjacent meeting and conferencing space, and a future solarium with views of the harbor, the research vessels, and downtown. This location, above the new entrance and lobby, will further define the public circulation pathways vertically through the building. Public access will be provided to offices and meeting rooms for daily activities, as well as, large group lectures. Plans include upgrades to existing laboratories, restrooms, and other building services to improve safety, increase accessibility, and enhance functionality.

7.2.2. Research Vessel: The WATER Institute has operated its research vessel, the R/V Neeskay on the Great Lakes, year-around, for over 30 years. Built as an Army Transport vessel, the Neeskay is 55 years old, was never designed for research, has very limited deck, laboratory space and accommodations, and is incurring increasing renovation and maintenance expenses for critical components with the attendant safety concerns. The WATER Institute is now engaged in the task of designing and building her replacement. The Institute is working with the UWM Development Office to raise funds for a new millennium research vessel that will live up to the demands of today’s scientific technologies—underwater robotics, high resolution acoustic and chemical sensor survey systems, mooring, navigation and stationing keeping requirements.

7.3. Library and Technology Needs:

7.3.1. Library: The WATER Institute houses a modest library of printed materials and relies heavily on electronic resource. Currently, the Institute maintains a subscription for electronic access to periodicals in marine and freshwater science through an outside library (Marine Biological Laboratory, Woods Hole), the cost of which is shared between the Institute and the Scientists/Principal Investigators. This arrangement in combination with the UWM Libraries is expected to meet the immediate needs of the proposed school.
7.3.2. **Information Technology** The IT infrastructure at the UWM Great Lakes WATER Campus primarily consists of three elements: Internet connectivity, presentation facilities, and a server room containing web/file servers. Each of these elements will be impacted by the establishment of the School of Freshwater Sciences.

The Institute's Internet connectivity is served by a 16 Mb/s 802.11a wireless microwave link to the UWM campus TCP/IP network. In addition, a 1-11 Mb/s wireless 802.11b connection exists from the campus network to the Research Vessel (R/V) Neeskay. The establishment of the School of Freshwater Sciences will increase the demands on this connection, and will likely require an upgrade to its capacity, reliability, and redundancy. The influx of graduate and undergraduate students to the facility will necessitate the installation of wired and wireless computer lab capacity. In addition, the increase in student lab and classroom activity across multiple campus and off-campus locations (east-side Kenwood campus, WATER campus, Downtown Grand Avenue, R/V Neeskay) will require more sophisticated web casting, teleconferencing, and other telepresence and distance learning technologies.

The presentation facilities currently consist of a permanently installed digital projection system in a central seminar hall, and a portable projector and PC on an A/V cart that can be taken to the existing classrooms and labs as needed. The increased activities of the SFS will undoubtedly include simultaneous lab and classroom sessions. Thus, the SFS will require that each classroom have its own dedicated presentation system, including an installed projector and PC.

The servers currently installed in the server room consist of a genomics computing cluster, and a web/file server with a 1TB redundant RAID array. The increase in instructional lab and classroom activity that will come with the SFS will require enhancements to the server infrastructure to handle: (a) the increased demands of a new SFS web presence, including the expansion of the WATERbase site to feature expanded datasets and technologies to aid in instruction and laboratory work; (b) servers to handle demands of aforementioned teleconferencing and telepresence technologies; (c) additional file and data storage required by the additional faculty, staff, and students that the SFS will bring to the WATER Campus, and (d) continuing expansion of on-site cluster computing.