

# **Water Summit White Paper**

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## Executive Summary

Water is increasingly being recognized as the next oil, the next truly essential ingredient for the survival and growth of the human race. With that recognition comes greater business interest in solving water problems. Milwaukee is not alone in recognizing the opportunity for job and wealth creation. But Milwaukee is somewhat unique in the degree to which it already has already started to build a “water cluster” in response to the opportunity. The question we seek to answer is what more must be done to succeed.

In order to truly build a global cluster of water and wastewater treatment companies in the Milwaukee 7 region, at least seven ingredients must be present. Portions of all seven ingredients are already located here. What are needed are the ingredients to be expanded. Not only must they be expanded, they must be expanded immediately, if the region is to maintain the modest lead that it currently has.

The ingredients that must be expanded include:

- **A core of firms in the industry:** build on the 120 or so that are here.
- **Experienced talent in the region:** utilize and expand the touted largest concentration of water treatment professionals in the US
- **A regional talent pipeline,** staffed, in part, by those who can create new technology solutions to water problems; e.g., dramatically expand the staff at the new UWM School of Freshwater Sciences
- **Collaboration** among water firms and academic water researchers; utilize the 87+ academics regionally that do water research and link them together with firms seeking solutions
- **Demand for the local solution of local water problems,** so as to show the rest of the world that such solutions exist and can be procured here
- **Desire by private water firms to grow,** so they aggressively seek new solutions and new distributions of those solutions
- **Recognition by the larger community** of the assets and potential of a rapidly growing water cluster
- **Resources and leadership** to help bring the necessary ingredients together.

The race is on. Many parts of the world want to become the Silicon Valley of water solutions. Milwaukee is out of the starting gate early. But unless the community steps on the accelerator hard and soon, placing a bet squarely on the expansion of this industry, dramatically expanding the ingredients just noted, Milwaukee will loose the race. That should not be allowed to happen. **Place the bet; make it large; move quickly.**

Key investments include additional faculty and staff positions at the new School of Freshwater Science, research and development on the many water problems in the region and elsewhere, and solving local water problems. These areas will require tens of millions of dollars. The speed of development that is needed will not come from small amounts of money. The region needs all the public and private support that it can possibly muster to really move to the lead. The region and its supporters must place a large bet on the water industry, beginning now. *Carpe diem.*

## **Introduction**

Milwaukee is surrounded by fresh water. The region is most fortunate in this regard. But having the water and preserving and using it wisely are two different and increasingly important issues, not only for the region but for the world. Water is becoming a precious commodity, even if we in the region are not yet charged its true value.

The truer value of fresh water will be recognized. It may take a while, but some states and regions of the US are more aware of the need for water than at any previous time. Atlanta learned last summer how close to disaster they came because the water they assumed was always there was not. Subdivisions in California were cancelled this year because they could not be guaranteed water for more than 20 years. Lake Mead has dropped fifty feet and threatens the Las Vegas water supply. California has banned the use of salt-based water softening because of the chloride build-up in the soils and the inability of sewage treatment plants to handle the large brine discharges. Utilities are challenged to find ways to make electricity that consume less energy and possibly use less water. Floods have caused all sorts of toxics to be dumped into our rivers and streams. The list can go on. Americans, as well as others in almost all parts of the world, are recognizing the need to be more resourceful with water.

Those conditions present opportunities for the Milwaukee 7 region. When statements like that are made, the first thought is that the region can just sell its water. But that is only a very small part of the opportunity. The larger opportunity is to grow the business sector that answers questions about how to be more resourceful with the use and re-use of water. This region already does provide solutions to those facing water quality and quantity challenges. The opportunity is for businesses to expand and to develop new answers to an increasingly widespread set of water challenges.

## **The Region's Challenge**

The challenge before us is how to build a “water cluster,” an enlarging set of companies in the region that work to provide solutions to a wide variety of water problems. The notion is to grow enough of these firms that they become an “agglomeration” economy, a place to which those seeking to be involved in providing solutions to freshwater problems gravitate.

The challenge is raised because it is apparent to many that there is potential in the Milwaukee 7 region to grow water-related businesses. The question is what is needed for this to occur. Key ingredients include:

- A core of firms already in the industry
- Experienced talent in the region
- A talent development pipeline
- Collaboration among firms and water researchers
- Demand for solutions (money to support development)
- Desire by the private sector actors to grow
- Recognition by the larger community of the assets and potential
- Resources and leadership to help bring the necessary ingredients together

Milwaukee is not the only community to see a potential future in water treatment. Singapore has been very aggressive about the topic, luring the R&D of both Siemens and GE Water to locate there with subsidies of half the cost. Closer to home, several communities in the Midwest are also thinking along these lines. Cleveland has announced an intention to move in this direction, and the State of Michigan just (4/11/08) announced the Michigan Water Technology Cluster. The Michigan effort “aims to generate jobs, attract private investment, and boost the state’s overall competitiveness by promoting the research, development, commercialization, and deployment of modern technologies and management practices to sustain essential water resources.”<sup>i</sup> And the Brookings Institution organized a group of 40 participants on May 12th and 13<sup>th</sup> to discuss the Great Lakes region’s assets and opportunities for emerging as a freshwater leader.

The race is on. If Milwaukee is to be a leader in this effort to build on the water-related resources that it has and the modest lead it has in organizing, then we must begin today to aggressively take more steps to ensure that this effort can succeed in building a significant water cluster in the Milwaukee 7 region.

### **Assessment of the Presence of Key Ingredients**

To succeed in the quest to build a water cluster, especially one that is recognized nationally and internationally, requires a number of ingredients, as noted above. Their current presence needs to be assessed, as does the need for actions to expand the presence of any and possibly all ingredients.

The assessment of the current status is based on available information and on our initial effort to survey CEOs of water companies located in the Milwaukee 7 region. As will be explained in greater detail below, one set of firms was targeted for the initial interviews. These are being followed by a second round of interviews that began in early July. The initial effort yielded eight formal interviews and three less-structured interviews with eleven of the firms. It is their responses that give additional insight into the status of water companies in the region.

### **Core Set of Firms**

The Milwaukee 7 region does have a core set of firms in the water industry. The region houses nine different facilities of five of the eleven largest water companies in the world (Table 1). In addition, the region contains at least another 90 firms that are involved in water, water treatment, wastewater treatment, or components used in water management or treatment and an additional 17 firms that do other things with water. Thus, the region has approximately 120 business establishments with a direct interest in water (not counting those that use water in production processes or as products, companies such as Miller Brewing and Coca Cola).

Table 1 Name and Rank of Largest Water Companies in the World

<u>Company Name</u>	<u>Country</u>	<u>2007 Water Revenues (\$Bil.)</u>
<b>Veolia</b>	France	15.2
Suez	France	10.8
Grupo Ferrovial	Spain	4.5
Sabesp	Brazil	3.2
Severn Trent	U.K.	3.1
RWE	Germany	3.1
<b>ITT Corp.</b>	U.S.	2.9
<b>Pentair</b>	U.S.	2.5
<b>General Electric</b>	U.S.	2.3
Mueller Water Works	U.S.	1.8
<b>Siemens</b>	Germany	1.8

Source: Goldman Sachs Group Inc.

None of the five largest is headquartered here, but a new drinking-water-quality joint venture between GE and Pentair will be.<sup>ii</sup> The five largest have a presence, actually more than a presence here. Most are involved in research and development here; they are seeking new solutions in order to be on the cutting edge. Most are seeking to grow. Almost all sales are outside the region (an average of well over 90 percent).

The 120 or so firms in the region are involved in a range of related industries and challenges. A first cut at categorizing the firms yields a picture of heavy concentration in manufacturing and a number of developers of intellectual property. Table 2 reveals the categories and the number of firms that to date have been identified as being in the region and contributing to water issues. No doubt some of the categorization can be disputed, but this attempt gives us a sense of the breadth and range of water-related firms located in the region.

Table 2 Categories and Numbers of Water-related Firms in Milwaukee 7 Region

Solution Providers (Water and Wastewater Treatment)	12
Components (Meters, pumps, valves, sensors, membranes Filters, chemicals, monitors, controls, heaters)	37
Distributors of Such Components not made locally	23
Address Other Water Problems (leaks, algae, weeds, Humidity, construction sites, etc.)	18
Plumbing Fixtures/Parts	5
Water Play Items	5
Other Water Services	6
Environmental Engineering Firms	<u>11</u>
TOTAL	117

The first group, the “Solution Providers,” consists of firms that have been identified as creating answers to water and wastewater treatment issues. These are the firms that can

soften water, remove phosphates, clean wastewater with anaerobic bacteria, desalinate, clean water for consumption, and so forth. They make water drinkable or able to meet a variety of regulatory standards for reuse. There are some twelve firms that meet this definition in the region.

Most of these firms are small, employing fewer than 30 employees, and a few are larger, employing more than 200 in a facility here and thousands elsewhere. Some are newcomers to water while others have forty or more years of experience.

The majority is involved in wastewater treatment, most commonly for commercial and industrial clients. But several do both water and wastewater treatment, and some serve both industrial and municipal markets. Several have niche-markets for treatments. Almost all claim to have some cutting-edge technology that can solve water problems. These include such items as water re-use systems, eliminating all sludge in wastewater treatment, electro-catalytic wastewater treatment for toxic, non-biodegradable materials, reverse osmosis treatments, salt-free water softening, membrane development and use, sensors that detect any life form in real time, and new, very efficient wastewater aeration systems, to name several. Technology development is important to these firms.

The second group of firms is by far the largest. These are the firms that manufacture in the region and provide components to the solution providers or provide solutions to other water problems. All members of this group are manufacturers. And they manufacture a range of components from chemicals with which to treat water, to filters, membranes, pumps, valves, meters, monitors, sensors, controls, software, heaters, or even portable treatment equipment. Firms may also provide small-scale water solutions, for example, those at the individual home level. At the moment the count is that some 37 firms are in this category in the region.

The third group is similar to the second in terms of the many components that they offer, but the components are not manufactured in the region. This group consists of distributors of filters, pumps, valves, membranes, sensors and so forth that are manufactured elsewhere in the nation or world. Their products often compete with those of the second group. But the “solution providers” need these as well, as they seek to find components for the best water and wastewater treatment. Some 23 distributors of components have been identified as being located in the region.

The fourth group addresses other water questions. Their target problems vary quite considerably. But they attempt in most cases to provide solutions. In some cases the issue is lake, stream, and irrigation canal management and the reduction of the influence of invasive plants. In others it is too much water, either in the air (dehumidification equipment) or in places it is not wanted (leak detection and solution). Some of these firms provide solutions in terms of water jets, TVs for sewer pipe analysis, trucks for sucking materials from sewers, materials for wells, aerators for landscaping with water and the like. They serve a wide range of needs. The current count is 18 such firms in the region.

The fifth group consists of environmental engineering firms. These firms are often used to specify solutions to a variety of water problems, be they water treatment, industrial wastewater treatment or municipal water or wastewater treatment. There are at least 11 such firms in the region. They are home to a good deal of knowledge about water and wastewater treatment. They have specific knowledge for certain industries as well as knowledge that can be applied in a broad range of situations.

The sixth group of water-related companies consists of firms that have been categorized as being in plumbing manufacture (5), water play items, e.g., motors, boats, boat equipment, and the like (5), and assorted others (6) for a total of 16. These firms do provide answers to a variety of water issues. Plumbing is the most direct, especially the increased pressure on developing more water-conserving fixtures. But boat motors that pollute less clearly belong, as does the development of more environmentally friendly water conditioning equipment.

There are many water-related companies in the region. There are far more than in most regions of the U.S. Few, if any, other regions in the U.S. can note that they have the presence of five of the world's largest water firms. The challenge is to not only grow these firms but also to start or attract and grow others firms. A strong core is here, but it is not yet the scale of cluster that can really help drive the economy forward. Other ingredients must be present as well. It is to those that we turn next.

One of the more unique ingredients is the manufacturing density in the region. Many local manufacturing firms are major suppliers to the companies that are more directly involved in water treatment. These are firms that bend metal or mold plastics into shapes needed for water treatment equipment or make any number of small parts for the equipment. One of the interesting early findings is that about one-quarter of the "solutions providers" do not manufacture themselves: they design solutions and then hire others to build them. This means that they are even more dependent on other manufacturers, mostly within the region. As the demand for the solution providers grows, that increases demand for manufactured goods from others.

Even those firms that do their own or most of their own manufacturing buy parts from other firms located in the region. One of the questions we are asking in the CEO call program is who are your major local and national suppliers? We will soon be able to say with greater certainty what firms in the region are likely to benefit from greater success in the water firms that are already located here.

Table 3 gives an insight as to the important suppliers in the region that have already been identified in our initial interviews. It confirms the point that many argue that Milwaukee benefits from a larger manufacturing cluster in that manufacturers here link to one another for securing the manufactured products that they need. The list does not begin to note the connection to the 37 manufacturers who produce pumps, valves, monitors, sensors, filters, and so forth that have already been mentioned.

Table 3 Industries of Major Suppliers of M7 Water Solution Firms

<u>Regional</u>	<u>Midwest</u>
Assembly	Membranes
Chemicals	Metal Fabrication
Controls	Pumps
Electronics	Software
Frame Materials and Modular Piping	Tanks
PVC parts	
Stainless Steel Components	

### **Experienced Talent**

Significant water and wastewater treatment talent already works in the region. The scale of that supply is such that it has been mentioned several times in interviews with CEOs. One CEO chose to locate his new wastewater treatment firm here, rather than anywhere else, because of his assessment of the talent available. He chose the Milwaukee region because he thinks that it has the greatest collection of water treatment talent in the country. Another CEO made a similar statement. With the concentration of talent already employed in the industry, it is an attractive place in which to do business, as the CEOs revealed:

*This area is a hotbed for water treatment.*

*There is a critical mass of other companies here.*

*There are no problems finding good employees here, whether engineers or hourly support staff.*

One factor that has brought the talent together in the region has been a long history of concern for the environment. The State of Wisconsin was among the first to create programs to begin to address water pollution. That fifty year history has helped to force the development of the industry and the concentration of talent.

Talent of another kind related to water treatment is also here, and it has been here even longer. The firms that build components often have a long history here. In addition, the metal-bending and machine-making industries have been here many decades. Industrial controls that were initially aimed at the controlling of the making of parts and machines expanded over time to become involved in controlling water and waste-water treatments. One CEO asserted that he thought 95% of municipal waste-water treatment plants have Rockwell/Allen Bradley controls. The proportion may not be exactly right, but the idea is correct.

A related skill set belongs to the many workers who build parts for the water and waste-water treatment solutions that are not characterized as being so directly involved in the components. But in many instances the work they do is even larger in terms of dollar value than component makers may realize. For example, to build a wastewater treatment plant requires machinery. This translates into contracts for steel benders, plastic makers,

electronic controls, and all sorts of other parts. One reason the solution providers are here in the region is that they can find most, if not all, of what they need in the supporting manufacturing sector.

CEOs stated as much in such quotes as:

*There are plenty of sub-suppliers here.*

*High quality fabrication is done in this area.*

The region has a long history of manufacturing. That is continuing and is a draw for the region. It is not just the plethora of water treatment professionals; it is the plethora of manufacturing firms that can meet the needs of the water solution providers.

## **Talent Pipeline**

Another critical ingredient is a pipeline of individuals who can contribute to water and wastewater solutions. It is important to have workers available today. But it is at least as important to have in place the educational infrastructure to be assured that new talent will be available to fill the vacancies created by company growth or relocation.

The Milwaukee 7 region is well served in this regard. Not only do the region's employers draw upon five engineering schools in state (Marquette University, Milwaukee School of Engineering, UW-Madison, UW-Milwaukee, and UW-Platteville), employers can and do draw upon the engineering school at Michigan Tech. Regional CEOs have commented on their ability to attract the skills they need from these sources.

Among the comments made in terms of talent are the following:

*Great access to higher education; our firm can grow university graduates; they are very qualified to start with.*

*There are two universities here with whom we can work on research and talent development.*

*An appeal of this location is the availability of a talented workforce.*

*There are more wastewater treatment businesses in the Chicago/Rockford/Milwaukee triangle than any where else in the world.*

Beyond those engineering schools, there is increasing need for scientists who know about water, water technology, water chemistry and biology, the physics of sensors, the modeling of groundwater, and the like. Employers will be increasingly well served by the new UWM School of Freshwater Science, expansion of Marquette University and UWM Schools of Engineering, as well as graduates in the sciences from the many colleges and universities in the state and larger region. Having the unique water school at UWM, however, should draw more attention, resources, and talent to the region to even better prepare individuals for careers in water and wastewater treatment.

At this time some 87 scientists and engineers that are working in some aspect of water or wastewater have been identified as residing in the region or in Madison. A detailed spreadsheet is available on the water website that describes what it is each of these

individuals does for research. A summary of their institutional affiliation appears in Table 4 along with a count of engineers and scientists that have water knowledge. It is unlikely that any other part of the US has such a large number of academics with interest and experience in fresh-water-related research.

Table 4 University Affiliation of the Region’s Water Researchers

	<u># of Faculty/Staff</u>
University of Wisconsin-Milwaukee	44
University of Wisconsin-Madison	25
Marquette University	<u>18</u>
Total (identified to date)	87

Examples of the research topics that are currently being studied by faculty and staff at these three universities are listed below. Many more detailed examples appear in Appendix 1.

- Aquatic chemistry
- Biofilms
- Bioremediation
- Means to recover and recycle phosphates from wastewater
- Means to track sources of *e coli*
- Microbial source tracking
- Novel pathogens (e.g., prions) and engineered nanoparticles in natural and engineered systems
- Pharmaceuticals in water
- Removal and disinfection of waterborne pathogens
- Storm water modeling, management and design

Because of the manufacturing nature of most of the firms involved in the water cluster, another source of talent is that of their production workforce. The region is fortunate to be well served by such quality tech colleges as Gateway, Milwaukee Area, Moraine Park, and Waukesha County. Their active presence assures employers that whatever technologies are to be developed will be able to be constructed, operated and maintained by a trained workforce. But to reinforce the water cluster, the effort must be made to keep the curriculum up to speed with the technology developments to come in water and wastewater treatment.

### **Demand for Solutions**

Oddly, it is one of the region’s greatest assets, the profusion of freshwater, that has helped to create the water-related industry that is located here. The state of Wisconsin realized early on that the fresh water had to be preserved or it was no longer an asset. The State became very active in regulating potential and past contributors to water pollution. This created a demand for solutions and helped to speed development of the industry here. Obviously, much of the rest of the country also realized the same thing.

But Wisconsin for years has been more stringent, with higher standards than many other communities.

In recent years Wisconsin's higher standards have been exceeded by other states in attempts to better address local needs. For example, California instituted a ban on salt-based water softening. Wisconsin has yet to do so. Virginia has instituted higher standards than Wisconsin on wastewater treatment with regard to the discharge of phosphates. The list goes on. The regional water treatment industry has been helped by Wisconsin regulations. The industry would be helped more at this point, if the state were to tighten standards and enforce them. That would add to the demand for solutions.

It is not as if the regulation to date has solved all of Wisconsin's water problems. The list in Table 5 reveals close to 30 different regional water problems that need to be solved. Others can be added to the list. If, for example, the DNR were to enforce standards for wastewater treatment that have already been enacted but not enforced because the belief is that the technology solutions known to date are thought to be too expensive to bear, that would result in new technology demands. Regional firms could address these problems, if money were to be spent by others seeking solutions to any or all of these problems.

A sweet irony of making explicit efforts to solve these local water problems is that it would provide a double benefit for the region. Not only would locally developed solutions create more jobs, they would make the region more appealing to individuals and businesses because of the improved water quality and quality of life. Addressing problems on this list provides the opportunity to showcase the new technologies that are being developed locally.

Increased demand for solutions can be driven by regulation or market pressures. Some problems will be addressed because factors such as energy cost have risen so much that they demand attention. Or the price or availability of water may drive corporations to seek solutions. For example, a brewing company may want to cut its use of water in half, thus saving water, energy, and opening new markets in which to brew. The brewery may also want to produce energy from its own waste stream. Other problems driven by citizens who may demand that pharmaceuticals be removed from drinking water, clean beaches be available, fishable waters prevail, or less acidic soil be the norm.

The fact is, though, that for progress to be made, money must be spent to stimulate solutions. Again the basic sources are businesses and governments. Both need to be involved. The scale of that monetary investment is far more than occurs today locally or nationally.

Federal, state, and local governments can all be involved in creating demand for improvements, either by forcing other entities to higher water quality standards or by purchasing solutions to water problems. The federal government can also be involved Research (SBIR) and Small Business Technology Transfer (STTR) grants. The state can

Table 5 Water Problems in Southeastern Wisconsin (that are found elsewhere as well)

<p><u>Municipal Wastewater Treatment</u>            Increasing efficiency of treatment            Removing pharmaceuticals            Removing high percent of phosphate            Speeding treatment to handle larger volumes            Utilization of sewage sludge            Reduced chemical use in treatment            Removing PCBs from sewer pipes</p>	<p><u>Water Quality Treatment</u>            Removing pharmaceuticals            Water softening without salt            Removing phosphates            Development of real-time sensor of life forms            Removing radium in ground water            Desalinization            Reduced chemical use in treatment            Meet international needs: e.g., tar sands, water quality in China, third world issues</p>
<p><u>Industrial Wastewater Treatment</u>            Disposing of/using liquid farm manure            Cleaning/recovering food processing waste            Recovering metals from industrial waste            Utilization of sewage sludge            Aquaculture water cleaning and reuse            Fish farm refuse removal</p>	<p><u>Residential Quality Use</u>            Increased efficiency of water heating            Water filtration in the home            Phosphate removal from well water</p>
<p><u>Storm Water Treatment</u>            Disinfecting storm water runoff            Limiting storm water sewer overflows            Removing road salt from storm water            Primary treatment of storm water at discharge            Containing storm water on site</p>	<p><u>Water Security</u>            Real-time monitoring at municipal level            User detection system</p>
<p><u>Water Process Issues</u>            Increasing beer brewing water efficiency            Increasing ethanol water efficiency            Increasing efficiency of utility water heating            Increasing efficiency of industrial water heating            Eliminating scaling in boilers            Reduced energy use in production of electricity</p>	<p><u>Quality of Life Issues</u>            Limiting growth of algae in lakes            Control growth of water hyacinth            Removing PCBs from lake and river beds</p>
<p><u>Non-technical Issues</u>            Speeding adoption by municipalities             Speeding adoption by businesses            Focusing scientists &amp; engineers on water tech</p>	<p><u>Water Conservation</u>             Technologies to make saving automatic</p> <p><u>Other</u>            Disinfecting ship's ballast water            Eliminating inflow &amp; infiltration in sewers            Increasing efficiencies in moving water            Utilizing gray water efficiently w/o problems</p>

force development through the DNR and help to support innovation through the Department of Commerce. MMSD and other sewerage districts can create demand for answers to problems facing them, help firms apply for available funds, and move the public agenda by educating the citizenry on the need to address specific problems.

A recent change at the Department of Natural Resources can also help. The DNR is looking for fiscally viable solutions for water pollution problems. They are seeking answers, not just punishing or scolding. They want to help communities develop fiscally viable solutions, solutions to problems to which they have traditionally given waivers, despite the fact that legislation requires solutions. It is this approach of helping communities find solutions that can increase demand for new solutions.

Federal dollars for research and development must be procured with the help of the Congressional delegation. State money must be invested in more faculty lines in water treatment and water science. Local money must be used to address some of the identified problems. The scale of needed investment in asset building such as faculty positions and in water solutions is tens of millions of dollars. Success will not come without large scale investment.

Furthermore, that investment must be made very soon or others will develop solutions that will beat local researchers and businesses to market, greatly limiting the payoff of regional efforts to build a water cluster.

### **Desire by Private Sector Actors to Grow**

Having all of the above ingredients in place will still not grow a water cluster unless the water-industry businesses want to grow. They must have a desire to develop and apply new technology and expand their markets. New firms must be generated here, and firms from outside the region must seek to locate here to be involved in the water industry to build a true cluster.

One of the strengths of the region is the presence of several older firms in the water treatment business. Most of these are innovating and continuing to expand market share. There have been a few, new additions to the list of water companies in the region, and there have certainly been purchases of local concerns by multi-national firms (e.g., GE, ITT, Pentair, and Siemens purchased eight firms here) seeking to build their mark in the industry. Names have changed. But only a limited number of new firms have come into being in recent years. That needs to change, as should the rates of expansion of all actors, should they seek to meet the rapidly growing demand for water solutions.

Entrepreneurship in creating water solutions must be encouraged. This will be aided by existing firms having more highly visible success in solving water problems. But more individuals must be cultivated to become involved in solving these problems, more angels must be willing to invest in the technology being developed, and more demand for local water problem solutions must help create a larger market for locally developed solutions.

Almost all of the solution providers currently in existence in the region that we have interviewed to date want to grow. Several acknowledged that their markets are generally slow-growth markets. But they also note that their sales are increasing faster than the growth rate of their market. The industry-wide expenditure for wastewater treatment is

growing by an estimate 3-5% per year. Most regional water solution firms are growing by some multiple of that. And almost all are doing R&D work to ensure that faster growth rate continues. That is precisely what is needed. But the pace of solution development needs to be accelerated.

## **Collaboration**

The world's economy is changing as are the basic business models. The vertically integrated firm that was so successful in the past is no longer the preferred model. One only need look at Ford or GM to realize that this no longer works. Toyota with its emphasis on reaching out to others and working with them on solutions is much more viable today. Some firms have gone even farther to true open-source problem solving. Proctor & Gamble, for example, has about 40% of its new products today being designed, at least in part, by individuals and firms outside of P&G. P&G plans to have more than half its new products suggested by outsiders by 2010.

The basic notion is that good ideas come from many different sources; they are not all internally generated. They work with others outside their firms. Regional water firms must take this truth to heart and work with the new business model. Academic scientists have done this for years; just look at the numerous authors' names that appear on many scientific papers.

In the Milwaukee 7 water cluster we have begun to get some movement in the direction of academics and businesses working together. This has occurred before; businesses have linked to academics. But now this needs to occur on a more massive scale. It will benefit both parties and the region. Memorandums of understanding should be created between universities and firms. Research agendas should be developed. And firms should begin conversations among themselves on topics where both might benefit without compromising their own competitive advantages.

The good news is rapid progress is being made in terms of business and academic alliances. In less than six months UWM and one water technology firm, signed a memorandum of understanding, developed a master agreement for research, developed a contract for research, which led to a patent application, with more to come. A new STTR grant application for further research has been written and submitted. MSOE has also entered into a memorandum of understanding with a water firm for work to be started soon. Universities are becoming savvier about technology transfer and the hope is that businesses are also becoming more interested. If both occur, then more collaboration should occur.

The bad news is that at this time very few of the dozen "solution providers" are currently working with local academics or any academics. When asked, few had even made inquiries to find if someone local might be able to assist them in their research. That behavior will have to change, if academic engagement with these businesses is to occur.

Perhaps surprisingly, collaboration between firms and suppliers has been occurring to a greater degree than that among the solution providers or between the providers and academics. Several of the firms mentioned that they have formal partnerships with specific suppliers in the region. Some also have collaboration with individuals at a range of firms, often because of previous work together. But this is usually not formalized; they work jointly to solve particular problems.

One firm mentioned that it is working with the patents developed by a customer to further develop them. A second mentioned several informal collaborations with local companies on new and unique ways to manage water. The basic driver is the desire to utilize new technologies in order to get a competitive edge in the marketplace.

On another front, the Milwaukee 7 region is truly collaborating on water, as the Water Council and the Water Summit illustrate. Individuals from all sorts of industries have joined together to take steps needed to help water industries succeed here. Perhaps as much as \$1 million worth of time has already been invested in this water effort, with more to come. This is precisely what is required in terms of collaboration.

In addition to business and academic collaboration, one element that might help move research along is the sharing of specific facilities. For example, A.O. Smith and Badger Meter have agreed to share their respective hot water and cold water labs with each other. They have indicated that they would be willing to extend the offer to other researchers and firms in the region. Access to such facilities might help speed development in certain areas of research.

Other area firms have very specialized testing facilities as well. Firms in the water industry should try to specify what special facilities and technologies are available and under what conditions they can be made available to other users. Such sharing facilities might create new ideas for even further collaboration.

## **Resources and Leadership**

To truly build a water cluster in the region, one that can easily eclipse what others are doing elsewhere requires more than just simple market responses by the firms that are here. Firms in the industry are doing well here, but they could do much better. One key is clearly greater demand for solutions to water quality and quantity issues. A second is faster development of new technology to meet the many needs that have been identified.

One critical way to build more effective demand for new water technology is to educate water users, especially large volume water users, of the potential connections to local academics and businesses that might have elements of solutions to their problems. The newly elevated costs of energy, food and other resources are likely to bring the need to address these problems to the top of business agendas. But unless the water users are forthcoming about their challenges, such connections are unlikely to be made. That is why much better lines of communication must be established among these actors.

A second important way to more rapidly build demand for certain types of solutions is for the Milwaukee 7 and others, such as the DNR, to step up and push for solutions to be developed and applied. The same can be said of MMSD and other public actors. The idea is that governmental entities can set standards for water quality or use that must be met by certain dates and statements that the standards will unequivocally be enforced. That automatically creates demand for solutions. While perhaps seemingly painful the standards lead to higher quality water available to all and a higher quality of life.

If we are able to solve or at least greatly reduce many of the 30+ local problems identified with water quality, much less water quantity, in the area, the region would be much more appealing as a great place to live and more jobs would be created as a result. The key is the application of new technology that is less expensive and far better at solution than what is generally available today.

To help move water-related manufacturers along in the quest for success, the Milwaukee 7 must also push for steps that will further assist local manufacturing to become truly Next Generation Manufacturers. These steps will make the creation of new products more appealing fiscally. Becoming leaner in the use of resources is an important component of this Next Generation Manufacturing (NGM). Becoming more innovative, another component of the NGM agenda, also will not only help the manufacturers but also their customers, including the water-related firms.

Another potential step that requires debate because it will be controversial is to explore the benefits and costs of putting a price on water. Water is currently treated as a free good. Consumers pay only for the cost of delivery. That notion seems archaic, especially as the supply of fresh water that is fit for human consumption is increasingly challenged by the growing demand. The Milwaukee 7 and its many communities should look at whether the costs of charging for water outweigh the benefits that a new supply of revenue could do to help promote water research and development in the region and affect behavior among water consumers.

In short, to really help create a water cluster, the Milwaukee 7 must support the efforts to bring collaboration and political support to addressing water issues and bringing NGM to interested participants.

### **Recognition by the Larger Community**

The message of the cluster must resonate and be repeated in the larger community. The importance of cleaning the region's waters for the double benefit of cleaner water and more jobs must be stressed and agreed upon. Both the region and the state must be convinced. The greater the recognition of the importance of clean water and the presence of the water cluster by the larger community, the more likely will come the buy-in by the political elements. That will result in greater support for water solutions, creating more demand for products and services from the Milwaukee 7 water cluster.

In addition, the larger world must be convinced that there is a water cluster here. That knowledge must be backed by the cluster actually existing on the scale portrayed. We should not get too far out front on claims. We do have a good start at a water cluster. We have the presence of five of the largest eleven water firms in the world here and almost 120 firms. We have a terrific start in terms of the academic resources that can contribute to the solution of technical problems, with at least 87 academics already identified working in water. We have water talent employed here and the elements in place to increase the supply of such talent over time. Now we need to pull the many important pieces together and take the steps needed to grow the many elements that will contribute to the growth of a true water sector.

With regard to the longer term, the region must build a greater sense of the importance of fresh water, be it local or any where in the world. The Water Council should, for example, build some educational event on the IMAX film on the Great Lakes that is coming to Milwaukee this summer. As we look out further, the region needs water themes and curriculums for elementary, middle, and high schools. Training sessions should also be developed. The region needs to build student (and parent) interest in solving local and world water problems. Both will help build economic opportunity here, as that interest translates into a workforce and a political force to address water issues.

The Water Council has taken a step in this direction with the creation of the Education Committee. Now that the committee needs to step into high gear and begin educating the region on water and water treatment.

### **Challenges**

Water-solution CEOs mentioned several challenges during the course of their interviews. In response to the question of what are their greatest challenges, given the location in the region, there was little agreement. A couple did mention taxes and one mentioned health care costs. Another mentioned the prevalence of a non-risk-taking mentality that hindered business development as well as new technology acceptance.

When these CEOs were asked what factors were inhibiting their growth in the region, taxes were only mentioned by one respondent. Two said nothing inhibited them while one said their own decision not to grow was responsible. Two others pointed to the national economy. And one said lack of investment capital while another said ability to find qualified people. In the latter the most common occupation cited was treatment engineers. Thus, there is no consistent view, no clear issues that must be addressed.

One topic that did come up more than once is the difficulty of getting governments to endorse new technology. Those who make decisions are reluctant to make a mistake, so they stick with traditional methods when given the opportunity. Reinforcing this proclivity is the need for competitive bidding. If a firm has a unique new technology, it cannot be specified for fear of challenges of fairness. Ways must be found to open the doors to leading-edge technologies being developed and adopted here.

But one issue that did come up that the Water Council and cluster building must address is greater efforts to collaborate. There is some collaboration already among firms (half of those we asked directly reported to be working with at least one other firm in the region), but more is needed. Two respondents indicated that this would be a good topic to discuss at the Water Summit. What makes this especially relevant is that three-quarters of the respondents indicated that their strongest local competitors are firms that we interviewed. To collaborate with them will require some more thought.

A related challenge is collaboration with university faculty and staff. Only one firm reported working with academics. One more is about to make a connection. But the majority has not even looked. If this type of collaboration is to occur, firms must decide that it is important to them and make the effort to make the connections. The faculty appears willing. But without contact from businesses, faculty and staff will remain in their ivory towers.

The last challenge to be cited is that of getting the word out that there is a Water Council, that there is an active effort to get water firms involved, that there will soon be a much stronger effort to get firms and academics interacting to solve many water problems. More than half of the “solutions” firms had not heard of the Water Council, much less the cluster effort. If these high profile actors are unaware, it is clear that many others are likely to be as well.

What may well help in this regard is the need to change the focus from talking about being a center of water treatment activity to one of expanding economic opportunity. The change may seem subtle, but it is important. Expanding economic opportunity theme is considerably more likely to resonate with business than merely being part of a cluster.

A related effort is the need to build entrepreneurship with this water focus. We have companies here, including some relatively new firms. To spur technology development, we need to emphasize the entrepreneurial opportunities. In addition, we need to ensure that the financial support is available for those new businesses that can make the case that they have marketable solutions to identified problems. Some of these ideas may come from existing firms. Others may come from the university research. And still others may come from individuals with ideas who are attracted to the cluster of water-related firms and density of academic research that is already in the region.

## Summary

To succeed, the region needs action on a large number of fronts. **To achieve a real cluster, recognized by others around the world, we need to be generating new technologies, new insights, and new solutions to a variety of freshwater problems.** We need to focus resources on these topics. We will get a boost if regulators require certain standards be met, in order to drive demand for new, cost-effective solutions. We must assist the growth of the School of Freshwater Science, demand new positions from the legislature, and help steer some of its research at technology solutions. We need

local, state, and federal political support. We need businesses with both interest in growing and access to ideas and capital. We need to realize that solving some of our own water problems will not only create a better place to live and do business but also business opportunities.

**We need, as a region, to place a large bet on this cluster, immediately.** To really succeed on the scale envisioned, this bet should be in terms of tens of millions of dollars. Water technology development for the Milwaukee 7 should be comparable to stem cell research in Madison that has received several hundred million dollars in state funding and tens of millions in federal and private funding. We need to invest in water solutions. That money must be spent on researchers at academic institutions, on collaborative research on specific issues, and on applying newly developed technology to solving local and subsequently global water problems. We need to move quickly or our lead and opportunity will be lost. We need to work in earnest on all seven of the steps discussed.

We have assets in place, opportunity at our doorstep, and interest in the cluster. What must happen to move forward is for rapid progress to be made on each of the seven ingredients discussed above. Individuals must take personal responsibility to take the steps that they can to make progress in the spheres in which they have influence.

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<sup>i</sup> Great Lakes Guy: Michigan Targets Water Tech Innovation. June 11, 2008: <http://greatlakesguy.blogspot.com/2008/06/michigan-targets-water-tech-innovation.html>.

<sup>ii</sup> Small Business Times, June 30, 2008.

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## Appendix 1

Effects of Pharmaceuticals in Water.

Behavior and fate of chemicals in the environment

Structure and function of microorganisms; biogeochemistry

Fluid Condition Monitoring, Biosensors

To gain insight into complex chemical and biochemical systems and processes as well as to develop novel materials and high performance chemical and biosensors.

Transport of groundwater pollutants

Biological treatment of contaminated groundwater

Biofilms, microbial ecology, microbiology of drinking water, biodegradation pathways

Urban Hydrology

Algae research is focused on photosynthesis, nutrient acquisition and nutrient limitation.

Wave Device Sensors (Chemical Sensors, Biochemical Sensors)

Aquatic chemistry in treatment and distribution of drinking water, removal and disinfection of waterborne pathogens, disinfection byproducts

Stability of Thin Liquid Films with Evaporation or Condensation

Computational and experimental hydraulics - Environmental dispersion processes

Energy Conversion Systems, Computational Fluid Dynamics, Heat Exchange Equipment, Heat Transfer, Thermal Engineering.

Microsensors, Solid State Device Sensors

Industrial waste treatment -- bioremediation of hazardous waste sites -- pollutant transport modeling -- water quality

Fate and Transport of Microbial Pollutants in the Environment; Microbial Biofilm

Fate and transport of toxic chemicals, novel pathogens (e.g., prions) and engineered nanoparticles in natural and engineered systems -- Bioavailability of organic contaminants

We use molecular tools to investigate microbial community structure and function in activated sludge, subsurface environments, and freshwater bodies.

Stormwater modeling, management and design

Ceramic membranes -- microporous ceramic materials -- colloidal thin-film ceramics

Environmental engineering; microbiology and biological treatment processes; wastewater engineering;

Struvite crystallization on Langmuir monolayers, self-assembled monolayers, and cation exchange membranes as a means to recover and recycle phosphorus from wastewater

Polymer nanocomposites, smart materials (actuators, sensors)

The emerging field of microbial source tracking. This specialty has applications to drinking water, wastewater, biosolids, agricultural wastes and more.

Dynamical nonlinear optical microscopy

fate and transport of toxic contaminants -- analytical chemistry of pollutants toxicology