**Introduction**

VivoAquatics, a leading water management solution company, is engaged in the development and introduction of sustainable water and aquatic technology.

The State of Recreational Water is a presentation on availability of resources, emerging trends and overall scope of the commercial facility recreational water industry. This report contains the present state of industry, state of water, sustainability efforts, issues effecting the industry and future trends.

**Over 100 Commercial Properties Surveyed and 7,000,000 Data Points analyzed.**
Top 10 Markets in the US: 35%

309,000

Of all commercial swimming pools, spas, and water features are based in three markets: California, Florida, and Texas.

Swimming is popular!

Most popular recreational activity for children and teens (ages 7-17) and 4th most-popular activity for all age groups.

36 percent of children aged 7-17 years, and 15 percent of adults go swimming at least six times annually in the United States.

Multi-Family Apts 108,000
Lodging 60,260
Parks/Municipality 17,999
Schools/University 11,226
Community 25,776
Clubs 22,439
Other 63,300
Facilities Continue to Struggle to Provide a Safe Guest Experience

Each year, over **4,000** people end up in the emergency room due to poor water chemistry in commercial swimming pools and water features. In the past year, over 80% of all commercial properties have been cited for unsafe water conditions. (Source: CDC)

Swimming pools, spas and water features are a Top 3 guest amenity with poor conditions leading to negative reviews and occupancy. Studies have shown a **1 star** (on 5 star scale) rating increase will allow a property to increase prices by **10%** without impact on occupancy. (Source: “Impact of Social Media on Lodging Performance” - Cornell University Center for Hospitality Research)

One in Eight Public pools and spas is shut down after an inspection for safety concerns, and over **50%** of spas are believed to be in violation of local health ordinances. (Source: CDC)

Poor disinfection and operational practices can lead to Cryptosporidium and Legionella, two of the leading causes of illness, hospitalization and possible death. Outbreaks have increased **200%** since 2014. (Source: CDC)
Inside the Numbers: Is the Water Safe?

Our analysis of hundreds of commercial properties and over 7,000,000 data points identified insights in water management and safety.

Automation in spas provides **61%** safer water than manual dosing.

If automation is used, pools have **7%** safer water than spas.

Wader pools are least likely to be in compliance with safety standards.

Low or high pH is **5%** more likely the cause of unsafe water versus high or low chlorine levels.

Spas, especially with manual dosing, are a challenge to maintain consistent water chemistry due high variability of bather load in smaller bodies of water.

Pools, with larger volume, are easier for control systems to manage 24/7.

This is a concern considering waders are generally used by small children.

Resorts score the best in part due to having dedicated water management on property 24/7.

Who has the safest water?
1. Resorts
2. Fitness Clubs
3. Hotels
4. Apartment Buildings
Water Sustainability

Organizations are beginning to drive conservation as recreational water is expensive to manage as it needs to be continually pumped, treated, filtered and backwashed.

Where Does the Water Go?

- Evaporation: 21%
- Filter Backwashing: 23%
- Mineral Buildup: 56%

1,000

The Average backwash uses between 250-1,000 gallons of water without completely cleaning the filter.

102,000

Even a small leak in either pool equipment or the pools structure can represent a substantial waste. An inch a day leak in a 15x30 ft pool can waste 102,000 gallons per year.

Water Conservation Opportunities

- Reducing Leakage
- Installing Water Efficient Equipment
- Reducing backwash frequency and time
- Reducing pool evaporation

Client Case Study

“In 2017 Las Vegas Sands Corp replaced sand filtration with glass filtration for 12 swimming pools and 12 spas at The Venetian and The Palazzo resorts. Glass filtration will reduce backwash water demand by 70 percent, and provide clearer, cleaner, healthier water, in addition to saving upwards of 5 million gallons per year.” *US Dept. Of Energy
Energy Management

Rising energy costs are pushing facilities to find more creative energy management solutions.

Operators are addressing high costs through:
- Installing VFDs and **Variable Speed Pump** when your pump or motor fails
- Installing LED pool **lights** or LED **bulbs** in place of halogen or flood
- **Covering the pool** or using **evaporation reduction products** to reduce evaporation and heat loss
- Solar heating

Utilities in many States offer **incentives and rebates** that create unique opportunities to install energy efficient equipment while significantly reducing payback periods.

Manufacturers (i.e., Raypak, Pentair) continue to roll out new efficient (90%+) heaters that lower longer term energy costs.

For organizations that have a **Culture of Innovation**, energy reduction is attainable.

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**Annual Property Energy Cost**

<table>
<thead>
<tr>
<th>Aquatic Facilities</th>
<th>Resort</th>
<th>Hotel</th>
<th>Fitness Club</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$250,000</td>
<td>$15,250</td>
<td>$10,150</td>
</tr>
</tbody>
</table>

**Client Case Study**

The Sheraton Waikiki resort is a modern monument to traditional Hawaiian hospitality. They set goals for energy reduction through upgrades to the existing aquatics plant including the installation of VFDs.

The Sheraton Waikiki reduced annual energy costs through ideal flow rates and consistent amp draws. The property is saving over 480kwh per day and reduced annual energy use by over $49,000 per year.

**Table: Current HTR Eff, Cost W/95% and Annual Savings**

<table>
<thead>
<tr>
<th>Current HTR Eff</th>
<th>Cost W/ 95%</th>
<th>Annual Savings</th>
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</thead>
<tbody>
<tr>
<td>55%</td>
<td>$580</td>
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<tr>
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<td>$790</td>
<td>$210</td>
</tr>
<tr>
<td>80%</td>
<td>$840</td>
<td>$160</td>
</tr>
</tbody>
</table>

*For every $1,000 in annual pool heating costs*
Regulatory Requirements Continue to Drive Change

The Model Aquatic Health Code (MAHC) is a voluntary guidance document based on science and best practices that can help local and state authorities and the aquatics sector make swimming and other water activities healthier and safer.

Goals of MAHC

1. Reduction in water illness and injuries
2. Need for training and education
3. Adoption of universally recognized standards
4. Data collection and analysis
5. Data based decision making

Case Study

- Calcium Hardness from 1,000 ppm change to 2,500 ppm
- All pool and spa chemicals to require NSF 50 certification
- UV required on all splash pads
- Monthly testing on all interlock systems on chemical feeders and tighten requirements for the feeders
- Dosing to meet ideal levels of free available chlorine
- All chlorine dosing and generating equipment must be designed with a capacity to meet demand to maintain minimum Free Available Chlorine

60% of states and counties have mandated all or part of the MAHC

100% required federal compliance of VGB (Virginia Graham Baker act)

100% Required compliance of ADA act

Changes are Coming to the Virginia Graham Baker (VGB) Act including more detailed documentation of covers and flow rating required to be kept at aquatic facility.
Top Solution Trends

New approaches have come to the aquatic market. Companies are adjusting to the demands of consumers, regulation and compliance concerns and issues. Filtration, sanitation and robotic technology are also rapidly evolving. New solutions like alternative filtration media are proven, effective and superior alternatives to sand. Automation, monitoring and control have shown huge benefits for sustainability, safety and risk mitigation. Sustainable additives such as enzymes are allowing reduction in chemicals and improved water quality.

“The way we sanitize pools has become, in a word, sophisticated.”
Pool and Spa News

“Water quality automation can drive reduction associated with water usage, and chemicals. The systems are set up to allow proactive versus passive management, which allows personnel to operate from a basis of control versus chaos. We have seen chemical reductions in the amount of 15-20%, water 30-40%, electricity 30-50%, and labor up to 50%.”
Richard Lindhorn, Dir. of Business Development VivoAquatics
Areas to Watch in 2018

Monitoring and Analytics
A Monitoring and Analytics platform provides 24/7 remote monitoring of all networked systems. When a problem occurs the onsite manager is notified if any adjustments are needed.

A platform can securely maintain historical data and reports to outline key trends as well as can score individual properties on overall success.

Alarms and alerts can instantly notify the appropriate team to rectify any issues that occur.

Alternative Filter Media
Recycled glass media has become a standard replacement media for sand filtration due to its ability to filter down to 5 microns, last the life of a filter and provide water savings.

Automation and Control
These devices analyze your pool water, assess the proper levels of chemicals to inject and disperse the appropriate amounts of disinfectants and pH adjusters based on the water demand. They assist with chemical and water reduction, proper dosing and safety.

Variable Frequency Drives
The primary purpose of a VFD is precise SPEED CONTROL so that motor speeds can be ramped up and ramped down and the connected load can be maintained at the required speeds, which only utilizes the energy required.

Innovation in Sanitation
Industry continues to drive innovation to provide safer more effective means of sanitation:

Increased use of enzymes to manage non-living organic contamination by breaking down carbon based organic waste;

Introduction of slow-dissolve Cal Hypo feeders to provide alternative to potentially harmful Trichlor tabs;

Onsite chlorination to eliminate transport of chemicals;

Hydroxyl-based advanced oxidation systems to reduce chlorine use and destroy contaminants.
About VivoAquatics

VivoAquatics is the leading provider of innovative water management solutions to hotels, resorts, fitness clubs, multi-family apartments and waterparks worldwide. We help our clients protect their assets (i.e., guests, equipment, structures) and manage costs through the development of brand standards and best practices, the implementation of leading edge chemical automation equipment, and ongoing operational support & remote monitoring.

Connect and network water functions

Benchmark and monitor water quality and usage 24/7

Control and treat water (sanitize, manage scale, etc.)

Energy audits, brand standards & equip. support

www.vivoaquatics.com