AVOIDING COMMON MISTAKES WITH WATER FEATURES

By Pawel Gradowski, Managing Director of LASquare, Landscape and Aquatic Architecture

Some of the most common omissions and mistakes can give water features a mixed reputation, despite the fact that they provide very valuable elements in "place creation".

Several key issues related to water feature design are often overlooked during the conceptual design phase, by designers who may not understand the intricate patterns of flowing water, limitations of mechanical components or the complex environment of micro-organisms living in water. This results in issues such as excessive water wastage, difficulties during installation or high maintenance and operation costs.

Water feature components usually focus on shape (pond, stream, water channel, infinity edge, etc.) and on the desired visual effects of water animation (e.g. waterfalls, jets, mist, etc.) When the concept is approved for development, the detailed design of the mechanical components is usually completed near the end of the design phase by experts in fluid engineering. At that stage, the mechanical engineers, pool consultants or skilled contractors are requested to provide a design for the mechanical components (i.e. pumps, filters, piping and all fittings) in order to achieve the vision of the designer. However, specialists hired for designing plumbing are rarely responsible for any unforeseen consequences related to the size, location or shape of the flowing water. In some instances, a specialist consultant may comment on the vision of the designer as being unrealistic or extremely difficult to build. If the final effect is a success, both parties are proud of the accomplishment, but if something goes wrong, nobody wants to take responsibility for the unforeseen outcome.

At LASquare, we believe the main reason for flawed installations is the fact that neither party has a complete set of the skills necessary to provide the creative design while fully understanding the implications of fluid engineering.

The following is a brief discussion on selected issues that are most frequently overlooked during the initial design phase:

- storage of 'water in transit'
- length and shape of the weirs
- extent of water splash
- migration of water over building material surfaces
- pool depth
- colour of pool walls and floor

'Water in transit' is the volume of water that creates a desired effect of water in motion (i.e. a flowing stream or waterfall) in a recirculated water system. In a typical waterfall design, water is pumped from the lower pool to the upper pool(s) and gravitates back to the lower pool. When the pump is switched off, the 'water in transit' is not flowing and collects in the lower pond. When the pump is turned on, the collection pool supplies the 'water in transit' and when the pump is off, water rapidly returns to the lower pond. Unfortunately, the desired flow of the 'water in transit' is often overlooked when the size of the upper and lower pools is being established. This sometimes results in the lower pool not having the required capacity necessary for supplying or properly collecting the volume of 'water in transit'.

For example, if the upper pool is ten times bigger than the lowest pool and the desired intensity of waterfall requires raising water levels by 5mm in the upper pool, the fluctuation in the water level in the lower pool will be 50 mm. This change in water level occurs rapidly and has a number of implications related to aesthetic and functional issues. If the area of the collecting pool is significantly smaller than the combined area of the upper pools, then the provision of a surge tank may be necessary to supply and collect the 'water in transit'. This common solution may significantly complicate the mechanical design of the system and considerably raise the cost of the installation and operation of the feature. The necessary fluctuation of the water level in the lowest pond or the surge tank size and location have to be anticipated during the project design phase, and may significantly affect architectural or structural components.

In the case of weirs, difficulties of construction and required flow of 'water in transit' are the two main factors directly related to the length of the weirs. Using the LASquare Waterfall Flow Calculator, one can estimate that a gentle waterfall with a long weir requires a circulation flow to be at least 31 litres per second, a considerable amount of water. If this feature is designed to operate daily, the monthly cost of energy required for its operation may be significant. However, decreasing that flow will reduce the body of the waterfall, potentially turning it into a trickle. One practical solution may be to reduce the width of the waterfall or divide the long weir by introducing gaps between a series of smaller weirs.

Another very significant issue is the contractor's ability to provide the required precision while constructing the weir from specified materials (i.e. concrete or stone). Keep in mind that the entire edge of a weir has to maintain a constant level, with variations not exceeding half of the thickness of the waterfall. For example, running a 3mm thick sheet of water requires variation in the weir level to be less than 1.5mm. Otherwise, the water may not be distributed evenly along the edge, leaving undesired, visible patterns of dry and concentrated water flow along the weir.

The cross-section shape of the weir also plays a significant role in water flow characteristics. A sharp corner allows for water to separate

This water feature has a pleasing sound as the restaurant is close to a busy highway. A series of lit, cascading pools and a shallow pond are designed to be interactive.

An artistic, playful water feature provides a fun and sculptural water element. The bronze frog sculptures sit on granite blocks in random patterns and evoke a pleasant water sound.

from the edge of the weir and start dispersing in the air while free falling. A gently rounded edge allows water to "hug" the surface of the weir and keep flowing on the battered wall, thus significantly reducing the extent of the splash.

Water splash is a commonly overlooked characteristic of liquids, frequently resulting in significant wastage. Water splashing from waterfalls, jets or overflowing ponds usually flows onto the adjacent paving or into planters. Wet paving becomes either a nuisance or when slippery, a safety hazard. If splashed water ends up in planters, soil can become over-saturated and plant material that cannot handle excessive moisture frequently dies or looks very unattractive.

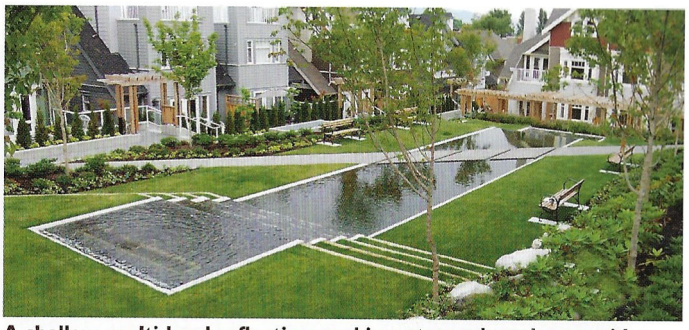
There are too many variables affecting the extent of splash, making it very difficult to accurately calculate. However, LASquare recommends that the minimum distance between the source of splash (i.e water jet or edge of a free-falling waterfall) should at least double the height of the feature. Therefore, a one metre high free-falling waterfall or a one metre high jet should be located at least two meters away from the pool's edge to eliminate splashing beyond the pool. Keep in mind that in windy areas, that distance may need to be increased to compensate for wind action.

Horizontal migration of water: The electro-static charge of droplets allows water to migrate sideways along smooth walls and horizontal edges, resulting in effects similar to splash. A vertical saw-cut or corner forces water to run down along its edge. Therefore, any patterns on walls (reveals in concrete or on the stone facing) near the weirs will affect the migration of water. A sandblasted, vertical, concrete wall with no reveals will allow water to migrate sideways from both sides of the weir at a 45° - 60° angle.

Pool depth: Shallow pools create difficulties when sourcing mechanical fittings that need to be submerged. Most components require a minimum depth above the fitting to operate properly. Another issue relates to the sun warming up water in a shallow pond faster than in a deep one, thus increasing complications related to algae and other water micro-organisms. In most jurisdictions, pond depth exceeding 0.45 metres is considered hazardous and requires safety fencing. Designing pools 0.30-0.45 metres deep appears to be the most practical.

Pool colour: The colour of the inside walls and floor of the pond affects the visual perception of the feature and may significantly impact on the cost of its maintenance. Dark pools are perceived as deeper and also mask small amounts of dust and organic debris suspended in the water and on the floor, which may require less frequent cleaning. The swimming pool-like colour of a pond is also very inviting and

This water feature provides animation to the plaza area and its organic form is in contrast with the geometric forms of the granite stone blocks. Shallow water meanders through the space in a playful manner, with the granite blocks providing interactive opportunities.



A shallow, multi-level reflecting pool in a stepped garden provides attractive reflections of the buildings, and the water cascades provide a gentle sound. The mechanical components of the system were carefully concealed. The entire system is installed as a green roof on top of the underground parkade.

encourages people to wade and play in the water, which may expose the owner to liabilities related to water sanitation. On the other hand, dark pools accumulate more heat from the sun and are more susceptible to chlorine or calcium deposit stains.

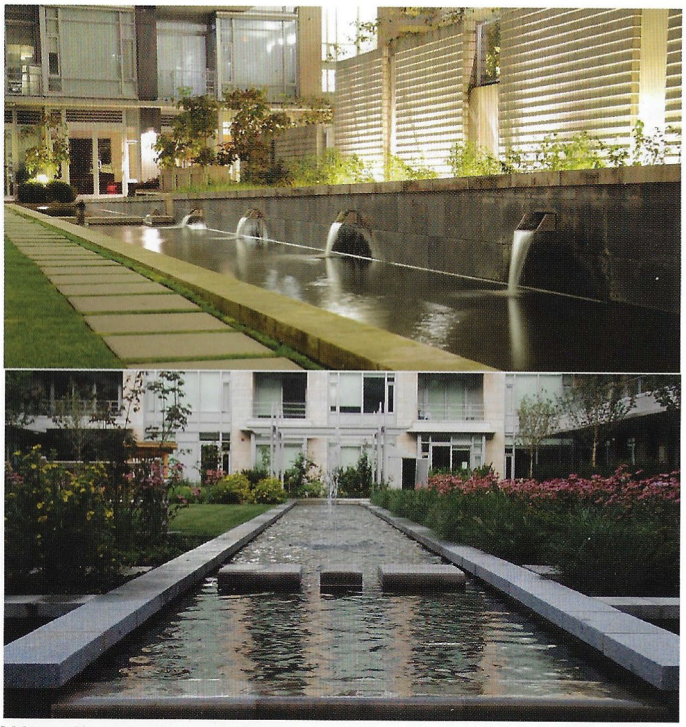
If a talented but inexperienced consultant has a brilliant vision for a water feature, this vision should be developed in collaboration with an experienced pool designer at the earliest stage, to allow for the constructive coordination of work and to navigate the outcome towards an impressive yet practical solution. LASquare strongly believes that a good, analytical observation of existing installations is a simple and practical learning tool to improve design quality and avoid common mistakes.

QUESTIONS AND ANSWERS

During a question and answer interview with Landscape SA, Gradowski provided the following additional information, summarised below:

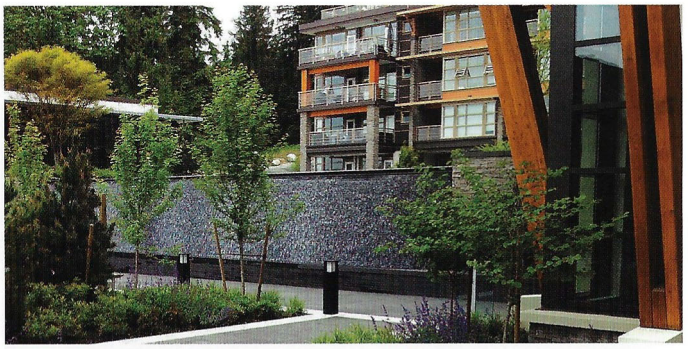
Q: In your line of work, are you given a brief as to the type of water feature the client wants, or do they leave it up to you to decide?

A: I believe it is best when it is a team effort between the client, architect and landscape architect to collectively introduce a design concept which can then be confirmed or modified. If I do get a brief, it



Water features were designed to capture the spirit of the Olympic Games. Emphasis was placed on rainwater harvesting to boost the efficient use of water and to create an environmentally sustainable community within the city. No potable water is used in any of the water features of this project.

This pre-programmed dancing water element incorporates mosaic as public art and invites the public to engage with it. Each jet has an integrated LED light that is synchronised with the splashing water patterns.



A 15m long waterfall from a large pool falls into a narrow trough. The gently rounded weir and battered wall allows for water to 'hug' the stone faced surface and minimise the extent of splash. A large surge tank located at the parkade below the pool supplies and collects 'water in transit'.

needs to embrace the function and general aesthetics of the project. In most cases I oversee the detailed design within its specific environment and all engineering aspects of a water feature.

Q: What factors define and influence your water feature designs, for example the space available, where the site is located, the style of surrounding buildings and the landscape in general?

A: The location has a lot to do with it and each setting needs to have an appropriate and suitable type of feature. I also ask myself what functions the water feature serves and what role the water itself is intended to play. Other influencing factors are issues related to technology, maintenance, the environment, socio-economic concerns and installation restrictions. For example, if there is a concrete slab beneath the water feature, I work closely with a structural engineer.

Q: Formal and informal water features, and where each one is appropriate?

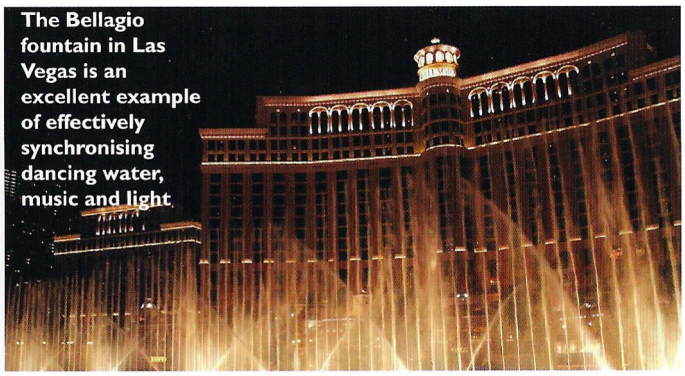
A: In general, landscapes always work hand in hand with the character of the settings around them, however I believe that sometimes juxtapositions work very well too. The client and environmental requirements must always be top of mind though.

Q: How would you describe the development of water feature design over the past 20 years?

A: Important issues are those relating to improved water management (controlling water to waste, water saving and rainwater harvesting) and new techniques in waterproofing, lighting, jets, filtering and pumps with better longevity and efficiency. From an environmental point of view, there have been advances in stormwater management and methods of re-using stored water.

Q: Your comments on lighting and music for water features?

A: Lighting should be looked at in terms of its technical characteristics, functionality and special effects. In the first instance one needs to consider the light source, cabling, location and waterproofing of junction boxes, timers and conduits for lighting going into the water. When designing the visual effects of lighting, one needs to take into account the unique optical characteristics of refraction and light reflecting from



The Bellagio fountain in Las Vegas is an excellent example of effectively synchronising dancing water, music and light

the water's surface. In addition to aesthetics, the function of lighting must also take into account the reduction of light pollution and public safety.

Music and light work well together and the water feature of the Bellagio Resort and Hotel in Las Vegas, USA, is a good example of this. (It is a vast dancing water fountain synchronised to music and light, with the fountain set in a 3.2ha man-made lake).

Other sound related issues are that:

* white noise can be either calming or annoying;
* splashing water can muffle traffic noise;
* foam jets are quieter than straight jets as they create less splash;
* water will sound different depending on whether it is falling into very shallow or deep water;
* although interactive water features have benefits, too much public noise arising from them can also be an unpleasant side effect.

Both lighting and music have various implications for installation and maintenance.

Q: Do you have a personal preference for designing certain types of water features?

A: I love a good challenge and have even had in mind a feature where the waterfall would appear to flow upwards! Environmental protection and storm water management are always big issues for me; I want to do right by the environment. Creative design and sound engineering principles working together must act in the best interests of the environment. I also enjoy designing interactive landscapes for public engagement and public art.

A successful water feature is one in which creative design and sound mechanics work together, marrying the artistic with the mathematical elements. Water is "the new oil" and we all need to use it wisely, protect it, and be aware of its value.

About the author

Pawel Gradowski (BLA, SACLAP, BCS LA, IFLA) was born in Poland and practiced landscape architecture in Canada for over 25 years. He operated his own design-build firm in Toronto from 1989-1997 and was also a partner at Durante Kreuk Ltd in Vancouver from 2008-2015. In 2016, he relocated to South Africa, where he has worked with Newtown Landscape Architects as the lead project manager on a public sector project aimed at creating a new gateway for the City of Tshwane.

His vast portfolio of projects includes water feature design, landscape design for urban and suburban developments, housing projects, streetscapes, commercial and industrial developments, vacation resorts, shopping malls, city parks, sports fields and recreational facilities.

He may be contacted on 072 655 0911 or email Pawel@LASquare.org. The LASquare website (http://LASquare.org) provides a few practical tools and calculators to help others to develop water feature designs based on a better understanding of this design discipline. **lsa**

All photos courtesy of the author.