Mauritius Green Building Handbook

Water

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Introduction

Water scarcity is without doubt one of the greatest threats to the human species and has all the potential to destabilise world peace. Boutros Boutros-Ghali, writing for the Habitat Debate[1], comments that in his view "*there will be international disputes concerning water*". Many rivers are drying up before they reach the sea, potentially depriving those countries and users downstream.

Falling water tables are also a new phenomenon. Up until the development of steam and electric motors, deep groundwater could not be exploited. Now, however, deep drilling and powerful pumps are able to probe many kilometres down into the earth for aquifers. Unfortunately, once dry, they remain dry, as seasonal rain does not penetrate deeply enough to replenish them. Water tables have been falling in many countries, most notably in China, India and the United States, which together produce nearly half the world's grain.

Already many countries have pumped much of their underground aquifers dry. Egypt has withdrawn 96 percent of its total water resources, with 82 percent of that having gone to agriculture[2]. Algeria has progressed so far with this strategy that it now has to explore desalination for future capacity.

Water is essential to life: the human body is about 75 percent water, with up to 85 percent of brain cells liquid. Around 71 percent of the planet is covered in water, but 97,5 percent of it is salt water, and of the remaining 2,5 percent, some 70 percent is frozen in the polar caps and around 30 percent is present as soil moisture or in underground aquifers. Less than 1 percent is thus accessible for direct use by humans, animals and plants. Consequently, an estimated 1 billion people around the globe lack clean drinking water and about 3 billion do not have adequate sanitation. Humankind is currently using about 40 percent of the available freshwater. It is anticipated that by the year 2050 this will have risen to 90 percent, leaving only 10 percent for animals and plants.

Yet 40 percent of the water used globally is for sanitation and other uses in buildings. The operation of buildings places a strain on raw water reserves, while wastewater and sewage needs to be treated before being returned to watercourses.

Water and buildings

Water systems in green buildings are different in a number of ways from conventional buildings. A number of these characteristics are described below (Gibberd 2008).

- **Self sufficiency:** Green buildings aim to meet all, or most of their water needs from rainwater harvesting.
- **Water quality:** The quality of water is matched with use. For instance, the best quality water may be used for drinking and cooking and poorer quality water, such as

[1] Boutros Boutros-Ghali: Habitat Debate, UN-Habitat April 2003 Vol. 9 No. 1
[2] The World Bank: The Little Green Data Book, Washington 2003

grey water, used for flushing toilets and irrigation.

- **Onsite retention:** In natural environments vegetation and soil absorb and retain a large proportion of rain water that falls on to it. Green buildings aim to emulate this by ensuring that buildings and sites absorb and retain rain water on site and avoid generating large quantities of run off.
- **Evaporation and transpiration:** Air can be cooled and the humidity increased through evaporation of water and transpiration from plants. This may be used in green buildings to improve comfort levels without the use of mechanical systems.

Water consumption

Water consumption in buildings can be calculated by multiplying the quantity of water used by different water consuming devices in a building by the number of times these are used, as indicated in the table below.

Water consumption device	Water consumption (L)	Number of uses per day	Water consumption (L)
Flush toilet	9	8	72
Hand basin	3	8	24
Showers	40	4	160
Washing / cleaning	20	3	60
		Water consumption per day	316
		Water consumption per month	9,796

It should be noted that flush toilets and conventional water delivery devices have been used for the calculations above and that these figures can be reduced through use of waterless toilets and more efficient devices.

Fresh water and ground water conservation

The focus of this theme is to conserve freshwater and groundwater through the harvesting of rainwater, the recycling of greywater, and the protection of watersheds and aquifers, and the reduction in the use of water through efficient use of freshwater and ground water.

The following strategies will assist environmental designers in developing appropriate responses to water supply and demand.

Design strategies

- Try to locate all water using areas together to restrict piping and pumping lengths especially if use is to be made of grey water. Zone water-using areas within the building and the site.
- Analyse water usage to develop cost-effective water conservation and reuse strategies.
- Explore opportunities to improve the water efficiency of HVAC equipment.
- Investigate the use of grey water (inc. storm water) wherever possible.
- Separate the requirements for potable water and non-potable water to identify those fixtures that can be serviced with harvested water and/or grey water.
- Conserve and reuse cooling tower water by using efficient systems and strategies. Avoid ‘once-through systems’ commonly used for evaporation coolers, ice makers, hydraulic equipment, and air compressors.
- Select systems that maximise water conservation (i.e. automated blow-down systems, conductivity probes, deduct water metres, delimiters to reduce drift and evaporation, etc.).

- Specify efficient or low-flow and/or waterless plumbing fittings for use on the project including proximity detection shut off in toilet areas.
- Specify water-efficient appliances.
- Try to eliminate permanent irrigation systems through the use of plant materials suited to the location's climate, soil, and water availability.
- If permanent irrigation systems must be used try to limit its use to defined planting areas, utilise natural flow patterns of the topography, avoid irrigating sleep slopes, avoid high-pressure misting sprinklers, use drip irrigation systems, automate the system, use soaker hoses, use solar-electric power to operate controls, and install a sub-meter to monitor water use.
- Recommend sub-metering of water use including all large uses such as irrigation (if potable water is to be used) and/or tenant groups within the facility.
- Obtain projected water use arising from the performance requirements of the facility from the client. Make sure that the projected use includes all non-building-related uses. Estimate the water use per plumbing fixture (toilet, hand basins, sinks, showers, etc.) and other equipment. Calculate the downtime (including weekends and holidays) as this will show whether an on-site treatment facility will work.
- Explore the use of alternative treatment systems for swimming pools that are less chemically intensive, such as saline water and/or bromine use instead of chlorine.
- Explore strategies to reduce the evaporation rate from pool surfaces in warm climates.
- Analyse water usage to develop cost-effective water conservation and reuse strategies.
- Investigate the potential volume of rainwater that can be harvested within the locational area.
- Investigate the volume of water required by the brief.
- Determine the storage capacity required to satisfy the water requirement.
- Investigate storage options and location.
- Investigate what opportunities exist within the programmatic requirements for recycling and reuse of water.
- Investigate what opportunities exist within the locational area for the recycling and reuse of water.
- Determine what equipment can be used to satisfy the programmatic requirements of the brief but will also enable the reuse and recycling of water, e.g. HVAC process make-up water.
- Investigate what opportunities exist with the programmatic requirements for the optimal detection of water leaks.
- Determine what leak detection equipment to cover all main supplies is available to best suit the needs of the project.
- Select a site that will require minimum alterations and ecological impacts to the watersheds.
- Inspect the site and locate any existing watersheds, drainage areas, stream corridors, and wetlands in order to determine the area of the site most likely not to disturb existing watersheds once developed.
- Investigate whether existing watersheds are fed or feed adjoining watersheds and

determine the impacts of altering the current watershed condition.

- Assess whether a system of ‘wetland credits’ is in operation in the locational area.
- Investigate what interventions might be required to ensure that the quality of water in the watershed will not impact negatively on adjoining sites.
- Evaluate the sensitivity of the site and adjoining areas, depth to groundwater table, and local regulations before recommending on site pre-treatment strategies or discharge to a stormwater system.
- Use biologically based storm water management features such as swales, sediment control ponds, pools, wetlands along drainage courses, and infiltration basins to retain and treat storm water on site.
- Minimise disruption to existing hydrological features such as gulleys, creeks, streams, ponds, lakes, and/or wetlands.
- Prepare a stormwater management plan that includes groundwater recharge and stream channel protection strategies that will result in no net increase of stormwater runoff from existing areas to developed conditions.
- If the project is a refurbishment project develop a stormwater management plan that represents no net increase of runoff relative to the pre-developed condition.
- Assess whether developing a wetland(s) comprising of soil, vegetation and hydrology is feasible on the site.
- Work with natural drainage systems using swales and indigenous vegetation cover of soils to the greatest extent possible to naturally absorb and filter runoff and promote infiltration. These strategies often reduce the need for artificially constructed drainage channels and stormwater pipes.
- Use vegetated buffers to treat stormwater runoff from parking areas, streets, and rooftops. Vegetated buffers in the form of rain gardens or shallow vegetated swales or bioretention are low-cost alternatives to curbs and gutters and that naturally filter gasoline, oil and grease, herbicides, fertilisers, and other pollutants suspended in stormwater runoff. The system should be designed so that runoff is filtered and infiltrated on site and only overflow is drained away.
- Use open vegetated swales for infiltration wherever space permits. The recommended minimum area is 3.5m by 12m. Open drainage increases vegetative variety, filters contaminants, reduces the need for irrigation of landscaped areas, reduces drainage velocity and erosion, supports wildlife, and lowers maintenance obligations.
- Determine whether any aquifers exist in the locational area.
- Determine whether any preservation and protection of any aquifers is included in any environmental management plans of the authorities.
- Assess what interventions may be required to enhance the conditions of any aquifers serving the locational area.
- Prepare a strategy to ensure that any aquifers are protected and enhanced through the development (i.e. not removing water from depleted aquifers for irrigational purposes).

Conclusion

Clean water is becoming increasingly scarce: green buildings aim therefore to develop systems that minimise consumption and pollution of this resource. Careful design is used to develop rainwater harvesting, plumbing and ecological sanitation systems that enable buildings to be self reliant for their water needs and avoid polluting water. This reduces the requirements for large-scale water and sanitation infrastructure that consumes energy and can be highly wasteful.

References

Gibberd, J., 2008. Green Building Handbook Volume 1, alive2green, Cape Town.

Boutros Boutros-Ghali: Habitat Debate, UN-Habitat April 2003 Vol. 9 No. 1

The World Bank, 2003. The Little Green Data Book, World Bank, Washington.