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BASIC CONSIDERATION AND CONSTRUCTION OF WATER GARDEN

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Water garden is a type or feature or part of a landscape where any type of water feature is a basic or dominant component along with aquatic, water-loving, bog or marsh plants and occasionally ornamental fishes. Water gardening is the process of simulating a natural environment with a body of water via careful design and the use of various plants and other features which aids in breaking up the monotony of a vast landscape. An ornamental pond has decorative fish, but a water garden solely contains plants, thus the name garden which is the main difference. It provides a calming aesthetic effect and appears to re-establish a connection with the natural aquatic environment. It might be built in a pond, a natural land depression, a man-made pool or a lily poll, rivers and lakes. A bog garden for plants that prefer soggy soil could be included in a water garden.

History of Water Gardening in India

The Buddhist era has the earliest mention of a water garden where Lotus ponds were typically seen in stupas and temples. Lord Buddha reportedly observed lotuses and blossoming trees at *Nandanavana*, according to the poet Asvaghosa (100 A.D.) (Roy, 2013). In some literature it is written that first creation of water garden was done by the Egyptians who channelled water from the Nile into their royal gardens and planted lotuses, a holy plant and a main source of healing. Lotus petals were found surrounding Ramses II's coffin during an excavation of his tomb in 1881, indicating that they were utilized 5,000 years ago. Next came the Persians, where water gardens and other water elements have been a common component of both public and private gardens. Statuary was first used in water gardens by the Greeks. Japanese and Chinese water gardens were intended to be spaces for introspection and thought and these were modernized, stone-built structures that may be found in cities during the Italian Renaissance (Randhawa and Mukhopadhyay, 1986). Running water was one of the most crucial elements of Mughal gardens since it gave the plants life. For instance, growing

Chinese spinach on floating gardens is mentioned in the (about 304 CE) Nanfang Caomu Zhuang.

Consideration for Establishment of Water Garden

Site selection: Consider the plants that will grow in the pond, the soils on the site, how level the grade is, surface drainage on the site, the view of the pond site from the house, the overall fit of the pond in the existing landscape, and anticipated maintenance needs when choosing the location for the water garden.

Location: A water garden should be situated where it can be well visible from the home that's why the owner will be better able to notice predators (Kleinholz, 2000c), in full sun, or as much as is possible, close to water and power, and where the water may reflect the beauty of the nearby scenery. A water garden placed within sight of the home enables enjoyment, pet and child monitoring, predator observation, and decreased costs for pipes, electrical equipment, and pumping. Never construct an ornamental pond over gas, water, sewage or electrical wires. All water garden plants should receive at least 5 to 6 hours of direct sunshine each day for the optimal development and establishment (Sink *et al*, 2014). The positioning of a water garden shouldn't obstruct pond upkeep or surface water drainage from storm runoff. A water garden shouldn't be placed in an area where trees drop leaves which may have the ability to contaminate water, release harmful compounds into ponds, and block filters.

Design consideration:

Size of pond: A healthy, balanced pond is said to have a minimum surface area of 50 square feet. The pond's depth should be between 18 and 24 inches and should contain a part that is 3 to 5 feet deep to withstand winter freezes and offer fish a cool retreat in the summer. At least two-thirds below ground level water gardens retain heat in cold weather and cool down in hot weather (Masser and Anderson, 2010).

Shape: A geometrically structured pond would be great for a formal setting. A pond with a less formal or geometric design might be more suited to a casual environment.

Edging: The use of edging materials enables the water feature to blend in with the garden's general design. The pond can be framed with bricks, pebbles, steel edging, wood, or any combination of these materials.

Construction: When choosing materials, factors like as price, availability, installation requirements, and compatibility with other materials in the landscape should be taken into consideration. Pools with an earthen or plastic lining can be built with minimal expertise. Rain-related run-off water may result in muddiness, oxygen issues, chemical contamination, fish escape, and other issues. A berm may be needed to deflect run-off water away from the garden if the surrounding topography is higher than the water garden (Kleinholz, 2000a). Another issue that might arise is precipitation saturation of the soil under the water garden, which could lead to overflow or cause it to float out of the ground. Build unique drainage systems under the pool to prevent this issue. In order to convey debris towards the deepest section of the pool where it can be cleaned out, sides should be tiered and/or sloping rather than vertical to prevent detritus (such as dirt, leaves, etc.) from accumulating along the edge of the pool bottom. Cutting pool sides into two or three levels, each around 12 inches wide, is a frequent construction technique. Tiers provide ledges for plants and other aesthetic things in addition to aiding in the retention of liners. Different construction materials are earthen materials, flexible liners, fiberglass or plastic and concrete (Masser, 2010).

Components of Water Garden

Water: City water, well water, subterranean water, and occasionally rainwater collecting are the most common sources. Dissolved oxygen, nutrients, algae, ammonia, nitrite, pH, alkalinity, hardness, and contaminants or pollutants, such as pesticides, are some frequent elements affecting water quality. The pH fluctuates daily due to the activities of photosynthesis and respiration and should normally cycle from 6.5 to 9 without harming the fish; if the pH is outside of this range, buffers should be added to increase the alkalinity. The amount of oxygen in the ornamental pond is determined by the amount of dissolved oxygen (D.O.). Water has extremely little dissolved oxygen, thus it is measured in parts per million (ppm), which can range from 0 to 20 ppm, though 4 to 7 ppm is more normal. Water hardness is often determined by the amounts of calcium and magnesium present, however ferrous iron may have a substantial impact on the hardness of groundwater. For decorative ponds and water gardens, the recommended range for hardness is greater than 5 ppm, but it should be 20 ppm or above to preserve fish health and reproduction.

Water Feature, Water Follies, Stream Gardens

A water feature is any one or more objects from a variety of fountains, rills, artificial waterfalls, and streams in landscape architecture and garden design. Modern water features

are often self-contained, which means they don't need water pipes; instead, they recycle water from a pond or a secret reservoir called a sump.

Plants:

- Submerged plants, also known as oxygenators, are those that spend practically their entire lives beneath water. Ex: *Ceratophyllum demersum*, *Hottonia palustris*, *Myriophyllum spicatum*, *Potamogeton lucens*, *Vallisneria americana*, *Sagittaria natans*, *Elodea Canadensis*, *Cabomba caroliniana*, *Myriophyllum* sp.
- Marginal or bog plants are those that live above the surface of the water with their roots submerged. Ex: *Iris* sp., *Ranunculus fluitans*, *Scirpus lacustris*, *Typha latifolia*, *Colocasia esculenta*, *Sagittaria latifolia*, *Pontederia cordata*.
- Floating plants are ones that aren't at all attached to the soil but instead float freely on the top (Anonymous, 2012). Ex: *Azolla* sp., *Salvinia* spp., *Marsilea vestita*, *Pistia stratiotes*, *Eichhornia crassipes*, *Lemna* sp., *Wolffia* sp.
- Deep aquatic: *Nymphaea* sp., *Nelumbo* sp., *Nuphar luteum*
- Marsh plants: *Calla polustris*, *Primula japonica*, *Saxifraga pellata* can be selected.
- Moisture loving plants: *Alocasia isp.*, *Hedychium* sp., *Cyperus alternie folius*, bamboo and grasses can be selected.
- Creeping aquatic plants: *Jussica repens*

Filters: Water circulation is necessary for ornamental ponds and water gardens in order to prevent stagnation, remove solids, and biologically decompose and detoxify dissolved pollutants. Mechanical and biological filters are the two primary categories. Biological filters are more challenging to install but may only require maintenance once a month, for example. Water filters such as *Nitrosomonos* sp., *Nitrospira* sp., etc. work well. Mechanical filters that aid to catch or remove dirt and organic debris include leaf skimmers, foam filters, and settling basins.

Liner: There are several types of liners utilized, including PVC, butyl or rubber, fiberglass, and concrete, each of which has a lifespan of 7 to 15, 30, or lifetime. Sand, gravel, or boulders may be used to adorn the water garden's interior. However, compared to flexible liner materials like PVC, polyethylene, or EPDM rubber, stiff liners are often more costly, may need heavy machinery, and are more difficult to create. Flexible liners are often less costly than rigid liners, have a wide range of durability and longevity, and may be UV-

resistant. Because of its flexibility, adaptability to uneven surfaces, chemical inertness, and resistance to puncturing and UV radiation, EPDM sheeting is the most popular liner material for ornamental ponds (Kleinholz, 2000b). To cover the liner and equipment holes, it could be more visually pleasing to let the pond's boundaries protrude 1-2 inches above the water.

Pumps: The pond's pump should have the capacity to circulate all of the water through a filter in one to two hours.

Fish: Common pond fish examples include: Ricefish (Himedaka), Mosquitofish, Rosy Red minnows, White Cloud Mountain minnows, Common minnows, Goldfish (*Carassius auratus*), Crucian carp, Koi or *Cyprinus carpio* (Nishikigoi, Butterfly Koi and Ghost Koi to obtain their unique color, scale, and fin characteristics), Mirror carp, Common carp, Grass carp, Weather loach, Stone loach, Golden orfe, Golden tench, Golden rudd, Gudgeon, Red shiner, Three-spined sticklebacks, Channel catfish, Bluegill, Pumpkinseed, Black bass, Sturgeon, Snakehead and Goby etc. Regardless of the variety of fish used in the ornamental pond, it's critical to understand the environmental needs of each species and which fish will thrive there (Masser, 1999).

Media for plants: All pond plants should be potted in fertile heavy clay loam. Fertilizers, herbicides, and other pesticides should not be present in this soil. To keep the clay from mixing with the pond water, all media must be coated with a 1 to 2 inch layer of coarse gravel or pebbles (not sand).

Maintenance tools: For removing leaves and other debris that has fallen, a long poled net comes in useful. Water plant trimming is made easier by garden shears. To measure the pH of the water, a pH meter or testing kit is helpful.

Construction of an Artificial Water Garden

In the absence of a natural pond, an artificial pond may be constructed using cement or concrete with a geometric pattern in the form of a simple circle, rectangle, or other shape. Pond dimensions can be 15 sq m (5 x 3) or 20 sq m (5 x 4), with a depth of 1 to 1.5 m. However, pigmy or very little fish up to 40 cm, medium fish up to 90 cm, and huge fish up to 2 m deep may be preserved.

After excavating and making drainage and supply pipe arrangements, 15.0–22 cm thick concrete layers made up of 3 parts aggregate—not more than 2 cm—1 part sand and 2

parts cement are poured at the bottom. Make the concrete airtight by coating it with cement when it has dried. However, the optimum mortar consists of one part cement, three parts fine sand, and a water-proofing substance. Mortar should be applied in two coats, preferably when the first coat is still wet yet solid, and should be around 1.5 to 2.0 cm deep. In order to remove toxicity from the water, potassium permanganate crystals can be added in precisely the right amount to turn the water a bright pink tint. Add 40g of washing soda to the 5 litres of water used to prepare the mixture in order to make it waterproof for use in mending fissure surfaces. If repairs are made without emptying the pond, mix ash and water and let this seep out. Normal water depth is kept at 60 cm, whereas lotus requires 1 m.

Beginning of the monsoon season is the ideal time to plant. The bottom of the pond is covered with a layer of dirt and compost that is 25–35 cm thick. The planning may be done either directly in the soil or in soil mixture-filled baskets that are 40 cm in diameter and 25–30 cm deep; the soil layer at the base of the garden may be as deep as 10 cm. The roots of plants that are first planted in baskets will eventually escape the baskets and wander in the soil. Plants that have fully developed roots that can quickly assimilate nutrients are pulled from the ground. One to two baskets of cow dung and a tablespoon of bonemeal or other similarly slow-acting fertilizer may be applied annually for water plants.

Conclusion

A water garden can provides a unique and soothing environment that combines the tranquility of water with the beauty of aquatic plants and fish. Whether it's a small container water garden or a large pond, there are several benefits and considerations to keep in mind. It can serve as a focal point in a garden and provide a sense of relaxation and tranquility and can also attract wildlife, such as birds, butterflies, and dragonflies, adding an element of nature and biodiversity to your surroundings. It can create a mini-ecosystem that supports various organisms, contributing to the overall balance and health of garden. It can help improve air quality by releasing moisture into the atmosphere, which can be beneficial in dry climates or during hot summers. The evaporation of water from the surface of the pond can also help cool the surrounding area, making it more comfortable.

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