



William T. Kemper Center for Home Gardening

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Water Gardening

A water garden in the landscape brings an immediate sense of tranquility and intrigue. Like no other feature in the garden, a small pond of water lilies, cattails and Japanese Koi can transform an ordinary outdoor living space into an oasis.

Ancient Egyptians and Far Eastern cultures were of the first to develop water gardens in the landscape. It was common to find lotus plants, papyrus, water lilies and other aquatic plants used to accent and focus on man's relationship with nature. Since that time, Europeans have traditionally incorporated water gardens into the landscape and used Roman and Greek statuary to create formal pools and spectacular fountains such as those found at Tivoli Gardens in Rome and Versailles in France.

Still a common practice in European countries, water gardens are finding a place in American gardens today. Fast becoming a favorite hobby for experienced and beginning gardeners, a water garden can be quite sophisticated with a series of waterfalls and pond levels, as interesting as a single 3 to 4 foot pool in the corner of the yard, or as simple as a half wooden barrel filled with floating plants and small water lilies.

Installation of a Water Garden

The most popular type of water garden installed today uses a synthetic liner to form the sides and bottom. There is very little time involved in installing this type water garden because these materials are lightweight, portable and adaptable to a variety of shapes and sizes. However, for one which will give years of enjoyment you will need to begin by making some careful plans. Three factors to consider are the location of the water garden in the landscape, materials and plant selection.

Location

The first order of business is to find a place in the landscape to build the water garden. You might consider locating it in an area where it can be viewed and appreciated from a window in the home. On the other hand, locating it in a secluded area away from foot traffic and common access might be more important. Please consider the fact that small children will be drawn to the pool to view the aquatic organisms and plants. An element of safety should be highly regarded as part of the landscape design. In some localities, zoning ordinances may require that homeowners place a fence around the pool. Before you begin, check with the local authorities.

Most water lilies and lotus require a spot with full sunlight and at least 5 hours of direct light each day in order to flower and maintain blossoms for an extended period. Shadier spots will work, however, the plant selection will change to those plants which are more tolerant of less light. A location with afternoon shade is most preferred while morning light exposure is highly desired, since that time of the day represents the most cool period and insect, animal and plant life will be quite active.

The site should be level for ease of construction. Drainage is important to keep a balance of moisture in the ground surrounding the pool. Soils around the pool which are boggy and wet may shift and put pressure on the liner. This will lead to cracks in the liner and distortion of the pond's shape. A pool which is placed in a sandy soil will also lose shape over time. Special consideration should be given if you plan to construct a pool in this soil type to ensure that the sides do not shift or cave in.

If the pool is located directly under trees, especially deciduous, leaves will accumulate in it, decay and sink to the bottom. This may harm fish and other wildlife, clog pumps and filters and eventually form an organic residue at the bottom which will require removal. Some cleaning will be necessary no matter where the pond is positioned, however, a location away from trees is best. Also, you should study the wind patterns in your yard. If you have places where debris collects easily after a storm, these sites should also be avoided.

In due course, the pool will need to be filled with tap water from a garden hose and this means that you will need access to water. Also, water levels will fluctuate in the summer due to evaporation and therefore, periodically it will need to be refilled to keep the water level constant. Maintaining the water level is more of a problem for shallow pools less than 18 inches deep and those with a high surface to volume ratio. Overall, the pool should be located so that access to water is convenient. You may need to consider extending the water line closer to the pond if this is a constant problem and this can be simply done with plastic pipe buried below the frost line and sloped for ease of seasonal drainage and clearing. Secondly, you may need to consider access to electricity if there are plans to run a water fountain or filtration system. An electrical contractor should be consulted before this is initiated.

Construction Materials

Before the age of plastics, the only way to build a garden pool was to make it out of cement or cement blocks, mortared and sealed to prevent leaks. A concrete pool is still a good alternative and properly installed, it will last the longest. However, they are very expensive and tend to crack over time. Today, you can create a pool using flexible plastic sheets called liners or pre-molded fiberglass or plastic pools.

Sheet plastic liners are lightweight, inexpensive and can be molded to any shape pool desired. The most common are the PVC- type liners which should be extra thick (20 to 40 mil.) to resist tears. Sizes will vary, however, choose one which is large enough to overlap the edge of the pool. The excess can simply be cut off when fitted to the excavated hole. You should receive some warranty for how long to expect the liner to last. PVC liners should be durable for about 10 years. Another type of liner, made out of butyl rubber, is said to last even longer than PVC, is impervious to ultraviolet light and just as easy to install.

Fiberglass and plastic pools present a second option for pool construction. These are considerably more expensive than sheet plastic liners, however, they offer a preformed shape that will maintain itself for many years. This also presents tremendous ease of installation since there is no molding and shaping as with plastic liners. The only challenge is to make sure that the hole and the pool fit well without gaps. Most fiberglass pools will last from 5 to 10 years and come in a vast number of shapes and sizes. If you are interested in creating a shallow water shelf for marginal bog plants, you will need to shop around. Many fiberglass pools do not have this feature, providing only straight or curved sides which slope abruptly to the bottom.

The other miscellaneous materials you will need to start building a water garden include some sand to line the bottom of the hole and cushion the liner against the subsoil. Although not required, some water gardeners prefer to lay old carpet on top of the sand layer in the bottom of the hole to add more cushion and flexibility. This will assist in preventing tears in the plastic liners should it be necessary to walk in the pool or when rocks or other heavy and sharp objects fall into the pool.

For plastic lined pools, you will also need enough flat border stones to construct two layers around the edge of the pool. This forms a nice approach for kneeling and will secure the edge of the plastic liner to the shore.

You may also want to add a filtration system and a pump to keep the water garden free of debris. These are relatively inexpensive and will be especially useful when algal growth is abundant. This can be a common problem in the time period before the plants have grown to cover the surface of the pool. These plants exclude the light that otherwise stimulates algal growth. After plants have covered at least 75 percent of the surface, the threat of algal problems will lessen considerably. At this point, some water gardeners will opt not to use the filter system and allow natural decomposition and deposition of debris materials on the bottom. If fish are used in the pool, they will eat some of the debris. Over time, a steady state of recycling of organic materials should occur and if the proper number of plants and animals are present, filtration should not be a great concern.

As an option, you may wish to add a fountain or waterfall to create more interest and a focal point to a water garden. There are a wide range of fountain styles from geyser-like jets to simple bubble columns. The best advice is to choose a fountain which keeps the stream of water in proportion to the size of the pool. Too often, the water stream runs too high and dwarfs the effect of the plants for the size of the pool. Also understand that certain plants like water lilies do not thrive if constantly splashed by water. Locate the fountain away from major plants in the water garden and position the intake side of the fountain as close to the fountain head as possible. This will prevent unnecessary water currents that will detract away from the calmness of the pond. Fountains may range in price from \$40 to \$400.

Planting and Stocking the Pool

The real key to water gardening is with establishing a balance of plants and wildlife. Too many fish and/or plants will cause the balance to shift so that nutrients and water gasses like carbon dioxide and oxygen are in disproportionate amounts. When this happens, the pond can become overgrown with algae. The strategy for balancing the pond is to select the right types of plants. Overall, there are four types of plants to consider planting; deep water plants, bog or marginal plants, oxygenators and floating plants. You may also wish to add some select peripheral plants around the pool's edge and a few fish to heighten the interest.

In a natural pond, plants establish themselves in the bottom sediment and sometimes grow massive root systems. In a pond with a liner, the bottom sediment is covered and the only way to introduce plants is in pots that will sit on the bottom. A variety of containers can be used including lined baskets, plastic tubs, dish pans or clay pots. These keep the root system from spreading and eventually causing the pond to become overcrowded. Containers should be filled with damp garden soil. Soils with a significant amount of clay pack down well and have less of a tendency to float out of the pot. The top of the soil should be covered with an inch or two of pea gravel to keep the soil intact and less subject to disturbance caused by fish and currents. Regular potting soil should be avoided due to the high amounts of organic matter which may cause it to float when submerged.

Plants should be introduced into the pool during the growing season and allowed to grow in the absence of fish for 5 to 6 weeks.

Deep Water Plants

Perhaps the most spectacular of the deep water plants is the hardy water lily (*Nymphaeae*). The color selection is broad, from white to many shades of pink and red. These plants can be quite fragrant and easy to care for. Blooms float on the pool's surface or several inches above and may last for four to five days, closing every night and opening during the morning hours. It is not unusual to get a succession of blooms that lasts for months. Typically, the bloom periods fluctuate. During hot weather, you may expect some reduction in flowering activity. All water lilies require full sun and still water. Keep them away from pool

filter currents and fountains. In addition, water lilies are heavy feeders and should be fertilized on a monthly basis with pelleted fertilizer.

Although there are many sizes of waterlilies, the most frequent mistake is to plant them in containers which are too small. A soil depth of 6 to 8 inches is sufficient, however, the roots spread laterally and therefore larger diameter containers are better. Select a pan which is 12 to 14 inches in diameter to accommodate most small to medium-sized water lilies. These should be planted to a water depth of about 18 to 24 inches. Larger lilies will need to be planted in ponds deeper than 24 inches and the containers should be at least 18 to 20 inches in diameter.

Tropical water lilies offer more fragrant and vibrant colored blooms, come in more colors and bloom more often than hardy waterlilies. They should be planted when the temperature of the water reaches 65 to 75 degrees and do best when submerged in only 10 to 12 inches of water. The drawback to tropical water lilies is that they are more susceptible to winter injury. Therefore, these plants must be removed from the pond and wintered indoors. Hardy water lilies can remain in the pond year round provided the rootstock does not freeze.

Lotus (*Nelumbo*) is a relative of the water lily, but produce larger blooms extending as much as 10 inches above the water surface. The bloom season is considerably shorter than water lilies, however, their distinctive leaves and seed pods commonly used in flower arrangements make them very attractive. Most are hardy and can remain in the pond over the winter. Because of their large container requirement and leafspan, lotus is better suited to big ponds.

Bog or Marginal Plants

Plants which grow at the edge of the pond are known as bog or marginal plants. Bog plants grow in mud or up to 6 inches of water. Plants which fit into this category include the cattails, iris, bamboo, rushes, horsetails and tall grasses. They can be planted on a shallow shelf just below the waterline in containers. These plants will transform an ordinary pond into a more natural looking aquatic habitat and will provide protection and seclusion for visiting animals and aquatic insects and amphibians. Some plants like cattails will do well in part shade and other like the iris must have several hours of full sun in order to flower.

Oxygenator and Submerged Plants

Because water gardens generally are small and self-contained in the sense that there is not a regular, natural exchange of fresh water other than provided by rainwater, water oxygen can become quite limited, especially during the heat of summer. If depleted, algae may begin to grow and the pond could become stagnant. To help with this potential problem, a group of plants which remain submerged just below the surface can be added to the pond to replenish the oxygen supply, absorb carbon dioxide, nutrients and provide food for the fish plus a place for them to hide out of direct light.

A few of the most commonly used oxygenators include elodea (*Anacharis*), fanwort (*Cabomba*), hornwort (*Ceratophyllum*) and parrot's feather (*Myriophyllum*). These are relatively inexpensive and will multiply in the pond to the point where you may need to harvest them periodically. They also are quite winter hardy.

Floating Plants

Another group of plants for the water garden which can be used to provide coverage of the pond's surface and thereby limit algal growth are the floating plants. These plant do not need soil. They simply absorb nutrients directly from the water and are ultimately very easy to grow. Included are fairy moss (*Aolla*), water hyacinth (*Eichhornia*), frogbit (*Hydrocaris*), water lettuce (*Pistia*) and duckweed (*Lemna*).

Fish

When pond fish are added to a pool, it takes on another dimension of beauty. Ecologically, fish can be quite useful for eating excess foliage from overgrown plants and consuming mosquito larvae or other aquatic insects. The two most popular choices are pond bred goldfish and Japanese Koi. Goldfish are very hardy and survive winters by hibernating at the bottom of the pond. They can become quite large, growing to 1 foot or more and requiring a larger pond. Japanese Koi can become quite large fish, growing to 2 or 3 feet.

Selecting which fish to keep in the pond is a personal choice of color and scale pattern. By all means, buy only healthy and active specimens. Stock only 1 to 2 fish for every square foot of pond surface area so as to not overload and crowd. When introduced into a new pond, fish will need to be fed until some of the plant materials and algae have grown out and can be eaten. In winter, fish do not require food.

Caring for the Water Garden

Generally, water gardens require minimal care. However, you should expect to clean it periodically, removing leaves and debris so that organic sediment does not build up on the bottom and make it necessary to drain it more often than every 5 years. Immediately after installation and in the spring, algae will flourish and cloud the water. The algal growth is promoted by the warming effect of sunlight on the water. Once the aquatic plants cover at least 75 percent of the pool's surface, it will be less subject to being overrun by algal growth. Periodically, it may be necessary to use a dip screen to remove algal mats. Filters will assist in removing particulates and algae in the water. Pool filters should be cleaned every week to keep them functioning properly. Algicides can be used, but care should be taken to use a product which will not harm the fish.

Maintain the water level with the top of the pool by topping off. This is especially important during high evaporative periods in the summer. Filling the pool every few days is recommended as opposed to letting the water level drop for an extended period and refilling all at once. Pools maintained properly will assist the plants and aquatic wildlife to be much healthier. Also, the pool liner will be less subject to damage caused by UV light from the sun if it is not exposed for prolonged periods.

When the pond has been well stocked with a good balance of plants, fish will have plenty to feed on from the developing community of pond organisms. Ponds which become overcrowded with plants will become stagnant. To prevent this, start new plants, keep the foliage healthy and divide plants when they have become overgrown. Marginal plants growing on the pond's edge should be divided every two to three years while submerged plants like water lilies can be divided every three or four years. Plants will differ in growth and maintenance requirements, so become familiar with the plants you have and their needs.

Some water plants will require fertilization to maintain good growth during the summer. Water lilies are heavy feeders and can be fertilized every month with nutrient pellets which are pushed into the soil. Most marginal plants and those which are not fast growers will absorb nutrients from the water and therefore, do not need fertilization.

As winter approaches, you will want to clean the debris more regularly to keep falling leaves from decaying in the bottom of the pool and upsetting the oxygen balance. If leaf fall becomes especially heavy, the pool can be covered with a screen or net. Landscape mats will work very well for this. Generally, it is not necessary to drain the pool every season unless to repair the liner or do other trouble shooting. A good thorough cleaning is recommended every 5 years or so.

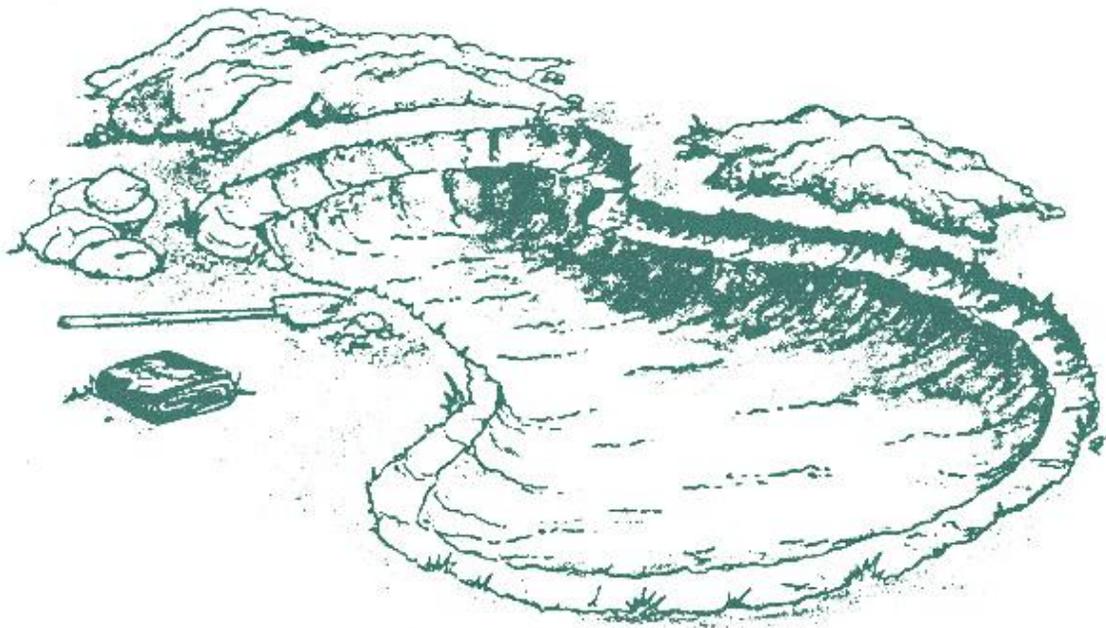
Ponds in very cold climates may need to be closed for the winter. This can be done simply by removing the filter system and letting the pond sit until spring. Hardy water lilies should be moved to the deepest part of

the pool. If the pond is likely to freeze completely, then plants and fish should be removed and stored in their containers at temperatures above freezing. Tropical plants and water lilies should be taken indoors. Preventing a pond from freezing can also be accomplished with use of a heater. As long as the rootstock of plants does not freeze, most should overwinter very well. The same goes for most pond bred fish. If ice should cover the surface for more than two weeks, it should be removed to allow air exchange. Fish enter a state of dormancy where body functions are reduced to a minimum. They do not require feeding during winter.

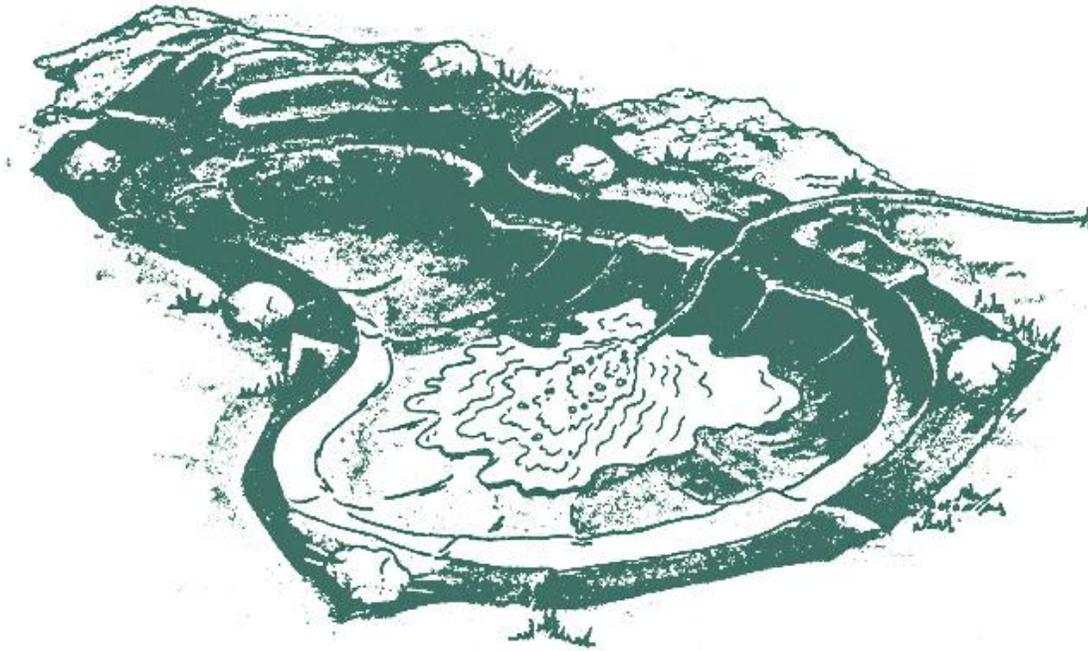
Step-by-Step Installation

Here is a series of briefly described steps to follow when installing a water garden using a sheet liner.

Step 1: If you are just beginning, start with a water garden that measures 6 feet by 6 feet and 24 inches deep. Use a string to layout the outside dimensions of the pool and guide you during excavation. As you dig the bottom out first, it would be helpful to use a line and a measuring tape to make sure the hole is as deep as you want it to be. Also dig out a shallow border trench about 2 inches deep and 18 inches wide. This is where the border stones will be placed to hold the plastic liner in place. If marginal bog plants are desired, create another shelf 2 inches lower down and 18 inches wide. This is where cattails, horsetails, and Japanese iris can grow.

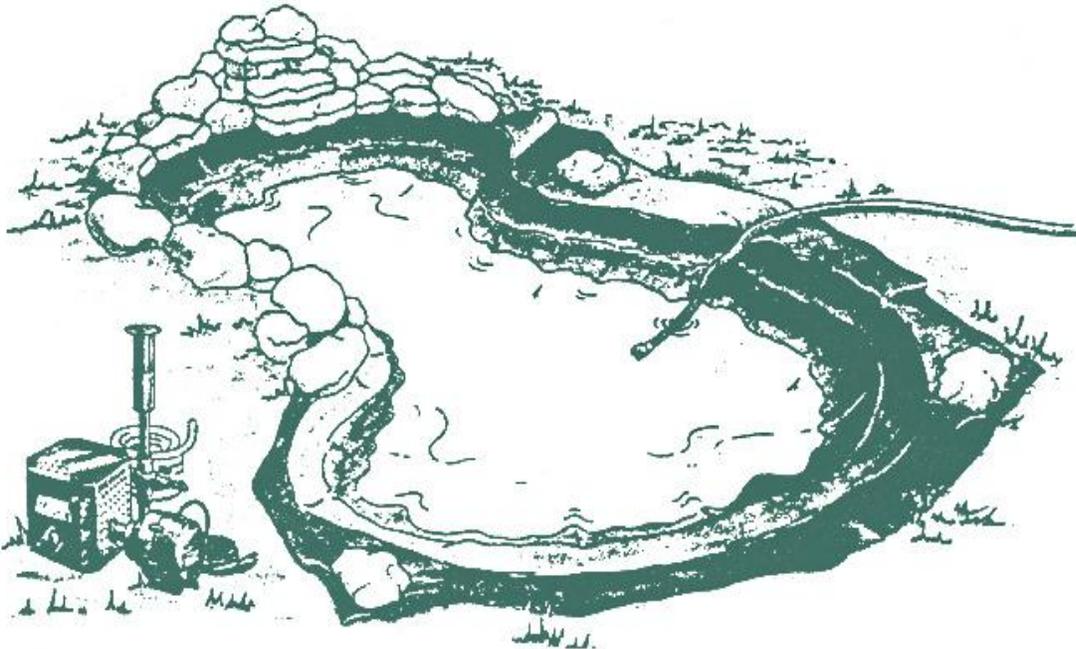


Step 2: Layer damp sand in the bottom of the hole to a one inch depth. You may wish to cover this sand with old carpet to add more cushion to the bottom securing the liner against accidental tears. Slip the liner into the pool and fold into overlapping pleats at the corners or curves. As you work from inside the pool, walk lightly so as to avoid tearing the liner. Extend the liner at least 18 inches beyond the outer edge of the pool.



Step 3: At the edge of the pool, sandwich the liner between two layers of flat border stone. The first layer should go on top of the liner on the 18-inch shelf and the liner wrap around the back and over the top of the stone. This layer of stone should stick about 2 inches out into the pond. A second layer of stone should be placed on top the first and overlap it by at least 6 inches in the back and 2 inches in the front towards the center of the pool. This boundary of stone will provide a good border for kneeling and viewing and create a crisp edge.

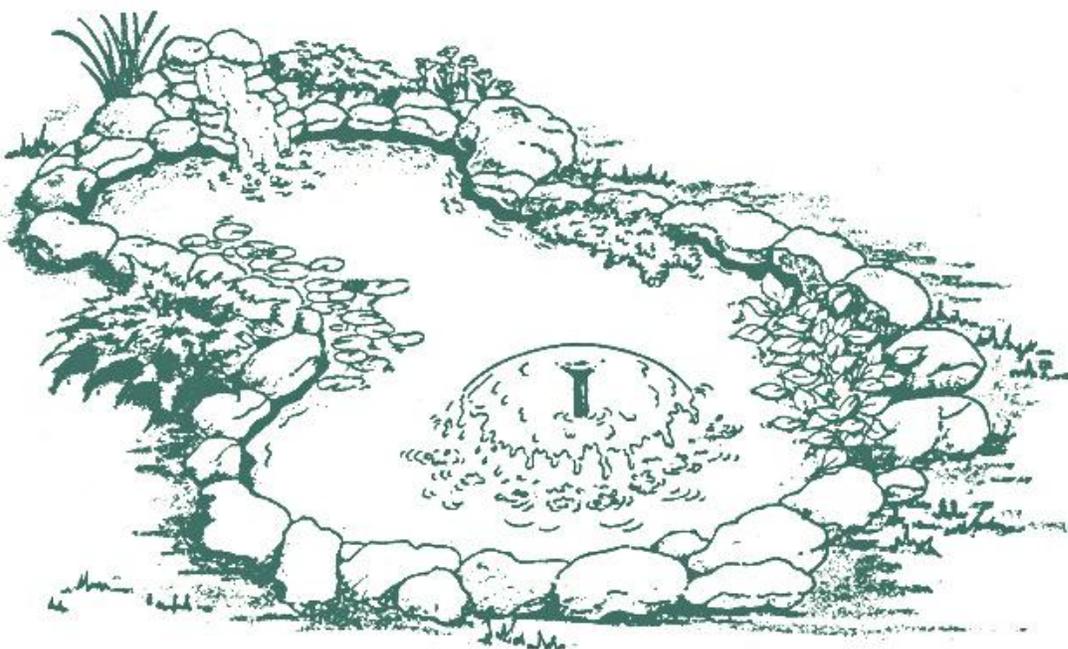
Step 4: Install a filter and fountain if desired. Secure plastic hose supply lines with rocks at the bottom. Follow dealer and suppliers suggestions for correct assembly and placement.



Step 5: Fill the pond completely with water and let stand one week to reduce the chlorine levels before fish or other wildlife is released. Stock the pond with Japanese Koi or pond goldfish, and grasses can be planted to transform the ponds edge into a complete aquatic habitat. Hardy marginal plants can be planted directly into the soil or in the case where a liner is being used, into shallow containers.

Step 6: Introduce selected oxygenating plants into the pool. A good choice is *Anacharis*, commonly known as elodea. These plants will begin to balance the oxygen levels of the water and reduce the carbon dioxide content which favors algal development. Introduction of water snails will also keep the algae growth down.

Step 7: Position other plants into the deeper areas of the water garden. Flowering aquatic and bog plants planted in containers and submersed into the pond will add great beauty. Popular plants include water lilies grown in wide plastic pots or tubs. Plants should be potted in good garden loam soil and an inch of pea gravel placed on the surface to hold the soil intact as it is submerged into the pond. Flat stones or bricks under the containers will serve to elevate the plants to their proper position relative to the water surface. Generally, large plants should be at least 6 inches below the water line.



Step 8: If you have developed a marginal shelf at the edge of the pond or have a low area which stays particularly wet, then marginal bog plants can be established here. Certain irises, cattails, horsetails and grasses can be planted to transform the pond's edge into a complete aquatic habitat. Hardy marginal plants can be planted directly into the soil or in the case where a liner is being used, into shallow containers.

Step 9: Plant trees and shrubs to complete the landscaping around the pool. These plants should be tolerant of wet conditions.

Step 10: As an option, install a bridge or a plank dock to observe fish and plants directly overhead. Generally, these can be constructed out of wood treated with a water sealer. Wooden bridges should last about 10 to 15 years. The preferred wood is white oak. Make sure that it is wide enough to cross comfortably and within scale of the water garden. Other types of bridges are constructed out of concrete and stone, however, they are quite expensive and should be done by a professional.