# LAKE WATER QUALITY
# BEST MANAGEMENT PRACTICES
# AND RECOMMENDATIONS

**Prepared For:**
**The Town of Miami Lakes**
**Public Works Department**
**6601 Main Street**
**Miami Lakes, FL 33014**

**April 2019**

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# 1.0 INTRODUCTION

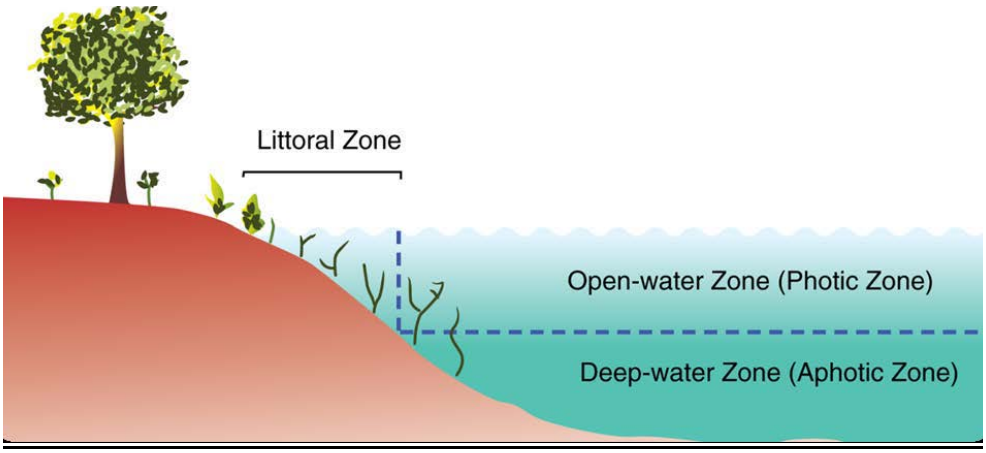
This document provides the best management practices (BMPs) for the protection of water quality. The Town of Miami Lakes contains 32 lakes. All the lakes are man-made and originated as borrow pits where the removed material was used to provide fill for adjacent developments. Nearly all of these manmade lakes are geometric in shape and all but three, which are Loch Doon, Loch Ness, and Lake Ruth, are closed systems. There are mostly residential properties adjacent to the lakes but there are some commercial properties as well as recreational facilities. A few lakes are under the ownership and management of a single Homeowner Association, but most lakes are divided under the ownership of the abutting properties. The South Florida Water Management District has partial ownership of the three lakes the District's Biscayne Canal runs through; these are Loch Doon, Loch Ness, and Lake Ruth.

To continue the Town's efforts to protect these valued natural resources, as a follow-up to a 2008 lake study conducted by Florida International University (FIU), in 2018 the Town requested Calvin, Giordano and Associates, Inc. (CGA) investigate the current condition of the lakes and to provide guidelines outlining best management practices (BMPs) for properties adjacent to the lakes. The report outlines lake BMPs and provides BMP recommendations for single family residential units, Condominium/HOA's organizations, and for commercial properties.

# 2.0 SHORELINE MANAGEMENT

## 2.1 Littoral Zone Planting

The littoral zone of a lake is the shallow area nearest the shore where enough sunlight penetrates the water to provide aquatic plants with adequate light for photosynthesis (Photic Zone). Typically, littoral zones are only several feet deep and extend several feet from shore, but they play an important role in the long term health of a lake and its water quality.




The littoral zone is the most biologically active area of a lake. Vegetated littoral zones improve the chemical processes that take place within a lake. Plants in littoral zones slow and filter runoff water while reducing erosion, which decreases the amount of pollutants that enter a lake. Aquatic plants also remove nutrients from water, which can reduce the likelihood and severity of algal blooms. Vegetated littoral zones also stabilize sediments, helping to improve water clarity, and they provide a physical barrier along shorelines that helps protect shorelines from waves that may cause erosion. Plants

additionally provide food and habitat to fish, wildlife and other aquatic organisms. Establishment of aquatic plants can take place naturally or via transplantation from other areas. Littoral plantings self-regulate the width of their growth based on the water depth/light transmissivity.

There are different types of aquatic plants that inhabit littoral zones.

- Emergent plants, like pickerelweed, establish in the shallow water along the water's edge. These plants root in submerged or saturated substrate with the upper portions of the plant emerging from the water surface. These plants self-limit to relatively shallow water.
- Rooted floating plants, like water lily, root underwater but have long stems with vegetation that floats on the water surface.
- Submerged plants, like coontail, are generally located in the deeper littoral zone and root in lake sediments with all their vegetation staying submerged. Again these self-limit to the degree of sunlight penetration.

Fluctuating water levels can cause problems for some emergent plants along immediate shorelines. Some emergent plants like Pickerel Weed, Duck Potato, Golden Canna, and Spikerush (respectively shown below) are tolerant of fluctuating water levels.

Pickerel Weed

Duck Potato

Golden Canna

Spikerush

Within the Town's 32 lakes there are approximately 20 lakes that have littoral areas available for planting. Table 1, shown below, identifies the lakes with littoral areas. The remaining lakes have seawalls or steep declines at the water edge not amenable to littoral planting. Table 2, attached, provides a list of native plants that successfully grow within and along littoral zones in lakes of South Florida and are commercially readily available. Table 2 also provides recommended planting depths as well as wetland plants for installation along the immediate shoreline. The current transmissivity, or photic zone, in the Town's lakes would allow plants to grow to 4-6 foot depth but 0 – 3.5 foot is the optimal.

Many homeowners desire to see a crisp shoreline delineated by mowed lawn, or an un-vegetated sandy 'Beach' and perceive a vegetated shoreline as unsightly or an impediment. It is important to understand that a littoral planting can be maintained to contain select plants in a select area. Any littoral planting is better than none if a property does not desire to have an entire shoreline vegetated. If there is a lower area along the shoreline where initial stormwater run-off flows into a lake, that would be an optimal area to install shoreline littoral planting to benefit the long term health and quality of the lake. Again,

any planting provides benefit, even a small area is better than none. Attached is Exhibit A. Photographs of the Littoral and Shoreline Plants contained in Table 2.

**Table 1. Lakes that Contain Littoral Zones**

| Lake Name | Lake # | Lake Name | Lake # |
|---|---|---|---|
| Lake Michael | ML01 | Loch Ness | ML15 |
| Lake Rose Ann | ML03 | Loch Lomond | ML16 |
| Lake Gloria | ML04 | Loch Isle | ML22 |
| Unnamed Lake | ML06 | Lake Martha | ML24 |
| Lake Silvercrest North | ML07 | Lake Suzie | ML25 |
| Lake Glenn Ellen | ML08 | Lake Sarah | ML26 |
| Lake Cynthia | ML09 | Lake Adele | ML27 |
| Lake Elizabeth | ML12 | Lake Hilda | ML28 |
| Lake Graham Dairy | ML13 | Lake Patricia | ML29 |
| Loch Doon | ML14 | Lake Katharine | ML30 |

Should a home owner install littoral plantings they should coordinate with the contracted maintenance firm for the lake to inform them not to eradicate desirable shoreline plantings. A homeowner may also want to install a "Do Not Treat" yard sign near the planting.

**Recommendation: Littoral Zone Planting**

- Install shoreline and littoral plantings where littoral zones exist
- Recommended plants can be installed from the shoreline to a depth of 3.5'
- Table 2 provides a list of suitable recommended plants
- Plants can be installed where slope allows for several feet of planting width to 3.5' foot depth
- Planting substrate should be sand or mucky material, avoid rock or rocky substrate
- Avoid planting an area used as access for kayaks/canoes etc. to limit disturbance
- Coordinate with lake maintenance firm to ensure they do not eradicate plantings

## 2.2 Shoreline Stabilization

Many lakes in the Town have seawalls or areas of stacked concrete bags for shoreline stabilization. All lakes in the Town are man-made; they range in age from approximately 56 years to 14 years. Many of the armoring structures along the shorelines may be reaching an age where failures have the potential to occur. It is important for property owners to routinely investigate and ensure these structures are still structurally sound. Seawall failures can occur with heavy rain events with run-off pushing behind failing seawalls, when this occurs, heavy sediment loads are dumped in the lake along with debris from the failed structure and the adjacent upland.

When seawalls are required to be replaced, 'living seawall' type structures (pictured below) should be considered as replacements or riprap should be installed at the base to provide fish and wildlife habitat to aid in improved water quality. Living seawalls provide textured surfaces designed to provide habitat for fish, wildlife and plants and enhance water quality.

**Recommendation: Shoreline Stabilization**

- Ensure shoreline stabilization structures (seawalls etc.) are sound
- Obtain professional inspection at no less than every 5 years to ensure the structures are sound
- When replacement is needed, replace with living seawall or place riprap at base of seawall

# 3.0 LAKE MANAGEMENT

## 3.1 Invasive Aquatic Plant Control Methods

Many of the lakes are owned by or surrounded by Home Owner Associations (HOA's) and the management firms of these HOA's obtain and administer Lake Maintenance contracts with licensed firms. Control of invasive aquatic plants is the main focus of these firms. Aquatic plant control can be done by several methods: Cultural/Education; Physical Control; Mechanical Control; Biocontrol; and Chemical Control.

Cultural control of aquatic weeds focuses on education and preventing invasive species introductions. Ensuring that boats, kayaks, canoes or other water craft (that are allowed within the Towns lakes) that were used in other lakes are rinsed and cleaned of any vegetative materials before being used in the Town's lakes is an example of cultural control. Signage at lake access points or information in an HOA newsletter is a means to disburse this type of education information. Educating residents to not dump aquarium plants into the lakes, as discussed below, is another example of cultural control.

Physical control is non-chemical, non-motorized practices used to control aquatic weeds; this can be proactive or reactive. Reactive control ranges from hand-pulling to water-level drawdowns, or altering water or sediment characteristics where the weeds are found. This typically is needed when an invasive species is so aggressive it is congesting the lake. Fortunately the Town's lakes do not have severe weed congestion that would require the need for such actions.

During the current assessment, many of the lakes showed signs that blue dye had been placed in the water. The use of 'Pond Dye' is a common practice. The absorption and spreading of sunlight by the pond dye reduces the clarity of the water and limits the growth of algae and submerged plants. Dyes do not hinder the growth of all aquatic plants; they do not hinder the growth of emergent plants, such as cattails, and are not efficient in managing floating-leaved plants (duckweeds and water lilies) once their leaves are floating on the surface. Pond dye reduces the depth of the photic zone a great deal; this restricts submerged plant and algae growth to only the shallowest areas of the lake. Dyes also inhibit the growth of filamentous algae, mat-forming algae, and single-cell planktonic algae. The use of pond dye is an example of a proactive physical control.

It is important to note that most dyes utilized for aquatic use are non-toxic; they will not harm birds, reptiles, mammals, fish, or turfgrass. The dye itself does not preclude the consumption of fish from dyed ponds. Pond Dye is not hazardous to recreational swimmers. Swimming in dyed ponds once the dye has diluted to the proper level will not result in stained clothes, skin, or hair. When initially introducing pond dye utilization, if too many aquatic weeds are blocked too quickly, this can cause fish kills from an excessive amount of rotting weeds depleting oxygen. Careful dosing must be considered if the lake has dense layers of submerged vegetation, label recommendation should always be followed.

Mechanical control refers to the use of large power-driven equipment to harvest an area of very dense growth of invasive aquatic plants, submerged or floating. The type of equipment includes cutter boats, shredding boats, rotovators (aquatic rototiller), and dredges. Again, the Town's lakes do not have severe weed congestion that would require the need for such actions.

Biocontrol is the introduction of natural enemies to control a nonnative invasive plant. Examples of biocontrol species include insects that feed on a certain plant, and grass carp. Grass carp are native to Eastern Asia and are very effective at aquatic weed control. The triploid grass carp is sterile and used extensively throughout Florida for weed control in lakes and canals.

Chemical control is the application of registered aquatic herbicides and algaecides to control aquatic plant growth. Licensed herbicides used in the lake management industry have undergone EPA review and have been approved for aquatic use. Applicators of these herbicides are required to be licensed before the products can be used. If excessive overgrowth of a nuisance species occurs within a lake and chemical control is utilized to eradicate it, please note this will leave a large volume of decaying debris on the bottom of the lake depleting oxygen as it degrades and leaving a large volume of sediment. For excessive nuisance growth scenarios it is best to utilize mechanical or physical control in conjunctions with chemical control to avoid this.

Glysophate based herbicides, such as Round-up, are commonly used chemical control products. These are touted as safe, effective and environmentally friendly, and are also under scrutiny as carcinogenic. Natural based weed killers such as vinegar, salt, oils and soaps are effective for limited, targeted locations above water but prove ineffective within aquatic environments. A professional, licensed lake management firm can provide suggestions on natural a treatment regime and current products.

For those lakes that are closed systems and that have disparate ownership not unified through an HOA, it would be advantageous for them to establish an organizational entity to jointly pursue an overall lake maintenance contract.

**Recommendation: Invasive Aquatic Plant Control**

- Control invasive aquatic plants
- An ongoing contract with a professional lake management firm should be maintained to address aesthetic above surface debris removal, algae and aquatic weed control, undesirable border grass and brush control to water's edge, and biological control
- The contract should encompass the entire lake
- Contractor should use most appropriate control method for problem
- Contract could include collection of duck eggs

## 3.2 Invasive Aquatic Plant and Animal Introduction

Aggressive, non-native plants cause harm to the environment, economy, or public health. Approximately 26% of all fish, reptiles, birds, and mammals in South Florida are exotic—more than in any other part of the United States—and this region hosts one of the highest numbers of exotic plant species in the world.

In Florida, approximately 24 aquatic plant species are currently considered invasive. Excessive and dominant growth of invasive aquatic plants forms dense surface canopies that shade out lower-growing native plants, reduce the predatory ability of large fish, interfere with water flow and turnover, and degrade water quality when the plants die forming dense sedimentation and reduced oxygen in the water column as bacteria break down the dying plant matter.

There are 34 exotic freshwater fish in South Florida lakes; all but one of these was introduced illegally. Releasing unwanted fish in Florida waterbodies is punishable by a $1,000 fine and up to one-year in jail. If a homeowner is faced with the situation of having an undesirable aquatic species, please do not dispose of these in your adjacent lake. Several options for properly disposing of these unwanted aquatic plants or fish include:

- Contact retailer for proper handling advice or for possible returns
- Give/trade with another aquarist, or water gardener
- Donate to a local aquarium society, school, or aquatic business
- Seal aquatic plants in plastic bags and dispose in trash
- Contact veterinarian or pet retailer for guidance on humane disposal of animals


**Recommendation: Invasive Exotic Plant and Animal Introductions**

- Do not introduce invasive aquatic plants or animals
- Do not dump your aquarium plants or animals in the lake
  1. Contact the retailer for proper handling advice or for possible returns
  2. Give/trade with another aquarist, or water gardener
  3. Donate to a local aquarium society, school, or aquatic business
  4. Seal aquatic plants in plastic bags and dispose in trash
  5. Contact veterinarian or pet retailer for guidance on humane disposal of animals
- Do not dump any unwanted plants or animals in the lake

## 3.3 Aeration and Re-stratification

Anoxic waters are areas of water that are depleted of dissolved oxygen (DO) and are a more severe condition of hypoxia (low oxygen levels). The US Geological Survey defines anoxic groundwater as those with dissolved oxygen concentration of less than 0.5 milligrams per liter. This condition is generally found in areas that have restricted water exchange. Anoxic conditions result from several factors; including stagnation, density stratification or large inputs of organic material.

The purpose of aeration in lake management is to increase the DO content of the water. DO is an important indicator of the health of a water body and its capacity to support a balanced aquatic ecosystem of plants and animals. Various methods are available: injecting air, mechanically mixing, or agitating the water. While aeration adds oxygen to deep waters, prevents stratification and anoxic zones, it may also increase turbidity if it disturbs and picks up the bottom sediment.

Aeration examples found in the Town's lakes include surface fountains and bottom aerators (bubblers). Bottom aerators are more effective at mixing waters at lower levels, surface fountains impacts are more limited to upper levels. Care must be taken when installing bottom aerators to avoid picking up the bottom sediments and creating turbid conditions. Table 3. Lakes with Aerator Systems, identifies those lakes in the Town that have been identified as having aeration devices installed.

**Table 3. Lakes with Aerator Systems**

| Lake Name | Lake Number | Lake Name | Lake Number |
|---|---|---|---|
| Lake Cynthia | ML09 | Lake Silvercrest South | ML18 |
| Lake Sandra | ML10 | Lake Windmill West | ML19 |
| Lake Carol | ML11 | Loch Lomond East | ML20 |
| Lake Elizabeth | ML12 | Loch Isle | ML22 |
| Lake Graham Dairy | ML13 | Lake Suzie | ML25 |
| Loch Andrews | ML17 | Lake Windmill East | ML32 |

**Recommendation: Aeration and Re-stratification**

- Provide lake aeration
- Aeration systems should be installed in all lakes
- Bubblers are more effective at mixing water at lower levels than fountains
- Bubblers installation should avoid picking up bottom sediment
- On lakes with lobes/arms, aerators/fountains should be installed in each lobe

# 4.0 WILDLIFE AND PET MANAGEMENT

## 4.1 Feeding Wildlife

Feeding bread to ducks and other wildfowl is bad for them; bread is not part of their natural diet and often leaves them with nutrient deficiencies. It's also bad for the water in the lakes. Feeding ducks attracts more ducks and other birds beyond what the natural resources of a lake can sustain. This overpopulation creates pollution in the form of droppings and uneaten bread that sinks to the bottom, causing siltation. Rotting food in lakes increases the nutrient level in the water which encourages algae to grow and reduces oxygen. Rotting food also helps diseases and parasites to breed. Uneaten bread left

on land encourages rats and other vermin. Do not feed ducks and other wildlife. Lawn maintenance contractors, or other trained staff or volunteers, can be contracted to collect duck eggs for humane disposal to control populations. Professional firms can be hired that can humanly capture injured, unhealthy, aggressive or unsustainable large populations.

**Recommendation: Feeding Wildlife**

- Do not Feed Wildlife
- Install "Do not feed wildlife" signage at all lakeside common areas and parks
- Install "Do not feed wildlife" signage at entrances to neighborhoods
- HOA newsletters should include do not feed wildlife educational information
- Collect duck eggs for humane disposal
- Professional firms can be hired to humanly capture unhealthy or aggressive wildlife

## 4.2 Pet Waste

Animal waste contains several types of pollutants that contribute to water quality problems including nutrients, pathogens and a naturally toxic material, ammonia. When animal waste ends up in a lake, it decomposes, using up oxygen and releasing its pollutant load. During summer months when the water is warm, the combination of low oxygen levels and ammonia can kill fish and other aquatic organisms. The nutrients cause excessive growth of aquatic weeds and algae. When these conditions make the water murky green and smelly, or when the surface of the water is completely covered with a thick mat of vegetation, the area becomes unattractive or unusable for swimming, boating or fishing.

Pathogens, the disease-causing bacteria and viruses associated with animal waste, can also make water unsafe for human use. For both quality of life and public health reasons, pet owners need to pick up after your pet. Preventing water pollution can be as simple as remembering to take along a plastic bag or pooper scooper when you walk your dog. Some diseases can be transmitted from pet waste to humans through soil contact; keep your yard and public spaces clean. Cleaning up waste from play and garden areas is especially important. Never dump cat litter in your yard, neighboring lake or down storm drains. Efforts should be made to educate about the health risks and owner misconceptions that pet waste is a fertilizer, or that it's fine as long as it is in their yard.

**Recommendation: Pet Waste**

- Pick-up after your pet
- Install "Pick-up after your Pet" signage at in common areas
- Pick up after your pet information should be included in community newsletters
- Proper disposal of cat litter should be included in community newsletter

## 4.3 Pet Waste Stations and Signage

Providing conveniently located disposal stations and educational signage in areas frequently used for dog walking, encourages owners to clean up after their dogs. Well-marked collection systems located in common areas that are frequented by pet owners are critical to proper disposal. These containers should also have bag dispensers for those owners that forgot to bring them with them.

For public beach and recreational waterfront areas where dogs are not allowed, ensure to provide sufficient signage to inform dog owners.

**Recommendation: Pet Waste Stations and Signage**

- Provide pet waste stations and education in common areas
- Maintain pet stations in public spaces that allow dogs
- Install “Pick-up after your Pet” signage in public spaces that allow dogs
- Ensure “Not Pets Allowed” signage is installed in public spaces that do not allow pets

# 5.0 LAWN MANAGEMENT

## 5.1 Lawn Mowing and Composting

Cutting your grass properly promotes a healthy lawn. Don't cut it too short, but do cut it regularly and use sharp blades. Mowing at the proper height increases turf density and promotes deep root growth; generally in the winter months from November 1 to April 30 mow at 4” to 5” and in the summer months from May 1 to October 31 mow at 3.5” to 4.5”. No more than a third of the grass height should be removed with any mowing. Dense turf requires less herbicidal treatment of weeds and impedes stormwater runoff as it absorbs more rainfall or irrigation. Lawn clippings can be an asset in your landscape too. Leaving short clippings on your lawn recycles the nutrients in the clippings reducing fertilization needs, and it helps retain soil moisture. This practice also helps reduce yard waste sent to landfills. Lawn clippings deposited in lakes is detrimental, creating excess nutrients and sediment, and reduced oxygen. Never hose or rake your lawn clippings into your neighboring lake or canal.

Yard wastes and compost piles should not be disposed of or stored by shorelines, or run-off ditches or swales, or near storm drains. Yard wastes release nutrients as they decompose and can pollute the receiving water. Place compost piles in a location where runoff will not flow directly into the water. Improper disposal of yard wastes can also contribute to flooding by causing stormwater runoff to back up in drainage systems. Additionally, improper disposal may lead to spreading of invasive plants to new areas. Never hose or rake your lawn clippings into the street, or down storm drains.

**Recommendation: Lawn Mowing and Composting**

- Do not cut your lawn too short, generally 2.5” to 3.5” is recommended
- Never hose or rake your lawn clippings into your neighboring lake or canal
- Do not place compost piles at the water’s edge
- Never hose or rake your lawn clippings into the street, or down storm drains

## 5.2 Lawn Maintenance

Excessive fertilizer that makes its way into bodies of water causes pollution. The misuse of fertilizer has negative effects on fish and other aquatic animals. Algae feed off of the nutrients in fertilizers, using up oxygen that fish and other animals need, and it promote excess algae growth. Ammonia released by fertilizer is harmful to fish.

Fertilizers contain differing amounts of nitrogen (N), phosphorous (P), and potassium (K). These are the three numbers represented on the label. The middle number on the bag, phosphorus, should be 2 or lower.

Slow-release granular fertilizers release small quantities of nutrients over a period in time. Plants will absorb more minerals and nutrients in a gradual feeding process. When using slow-release fertilizer this only needs to be applied once or twice per year. Never apply fertilizer when heavy rainfall is expected as most fertilizer will be flushed away. Apply fertilizer evenly and avoid overlapping. Clean up any spills. Put

a plastic bag or tarp on the ground where you pour out the fertilizer, so any spills can be caught and used.

Except near a protective seawall that impedes run-off, always leave a "ring of responsibility" around or along the edges of canals, lakes or other waterways when applying fertilizer. The ring of responsibility is an untreated buffer zone that protects water quality. The ring of responsibility should extend at least 10 feet from the edge of water next to lakes or other waterways when applying fertilizer. This buffer zone helps to ensure that fertilizers and other lawn chemicals do not come into direct contact with the water.

When applying liquid fertilizers, the "ring of responsibility" should be at least three (3) feet from the edge of the water. The same is true for applying granular fertilizers with a fertilizer spreader that features a deflector shield. A deflector shield only allows fertilizer to be distributed on one side. This half-circle application (instead of the typical full-circle application of most fertilizer spreaders) allows for more accurate fertilizer application. If you are applying a granular fertilizer without a deflector shield, the "ring of responsibility" should extend at least ten (10) feet from the edge of the water.

Irrigating lawns with water removed from the lakes supplies nutrients to the lawn and reduces the nutrient load from the lake. Irrigation intakes should be placed as close to the sediment/water interface in the deepest part of the lakes as practical.

When applications of herbicides, insecticides or pesticides may be needed, strictly follow label dosages and instructions, and strictly target only the area that needs to be treated. Do not apply when heavy rains are expected, do not overspray or overspray into waters, and most important do not rinse application equipment or dump excess material or rinse water in adjacent waters or down storm drains.

When mulching existing planting beds ensure the mulch does not run off into the lakes with rain events. The run-off of loose or disturbed soils creates sediment and turbid conditions in water bodies. When doing any kind of ground of ground disturbing activity in your yard ensure the loose soils are contained and not washed into the lakes.

**Recommendations: Lawn Maintenance**

- Strictly apply lawn fertilizers per label. Slow release fertilizer is best
- Only apply low phosphorus fertilizer, with a phosphorus amount of 2 or less
- Always leave a "ring of responsibility" when applying lawn fertilizer
- When herbicides, insecticides or pesticides are needed, strictly follow label dosages
- When herbicides, insecticides or pesticides are needed, strictly target only the area needed
- When using fertilizer/herbicides or pesticides do not dump excess material or rinse water in adjacent waters or down storm drains
- Never apply fertilizers/herbicides or pesticides when heavy rains are expected

## 5.3 Choosing a Lawn Maintenance Company

When choosing a lawn maintenance company, you need to decide if you want the company to apply fertilizer, herbicides and pesticides, which can include insecticides and fungicides. Ask if all personnel are properly licensed for herbicide and pesticide application (Limited Urban Commercial Fertilizer Applicator Certification, Commercial Landscape Maintenance Applicator Certification, or Pest Control Operator Certification). This is critical since many of these materials can be hazardous to humans, pets and non-targeted landscape plants if improperly applied. The correct pesticide applied at the correct rate, and for

a specific pest problem, is essential for proper maintenance. Be wary of service practices to provide preventive control for all pests on a year-round basis. Heavy pesticide applications may kill useful predators that keep disease organisms and damaging insects in check. Make sure the company chosen has the proper amount of liability insurance. Ask if they have pesticide and herbicide treatment on an as needed basis only.

**Recommendation: Choosing a Lawn Maintenance Company**

- Ensure the lawn maintenance company is licensed and insured
- Avoid unnecessary routine preventive maintenance applications of law products

## 5.4 Notification of Lawn Treatment(s)

When treatment is scheduled by a lawn maintenance contractor, notification should be provided to the homeowner to help prevent accidental contact by pets or humans, and accidental irrigation/watering and run-off into the lakes.

**Recommendation: Notification of Lawn Treatment**

- Ensure the lawn maintenance company provides notification to homeowner of lawn treatments

# 6.0 STORMWATER MANAGEMENT

## 6.1 Swales and Rain Gardens

Stormwater runoff is generated from rain events that flow over land or impervious surfaces, such as paved streets, sidewalks, and parking lots, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, pet waste, and dirt/sediment that can have negative impacts on the quality of the lakes. Stormwater should be directed to a swale or depressional area before flowing into a lake to allow the debris and pollutants picked up with the first flush to be contained in the swale.

A swale is a depressional area in your yard where the initial run-off is directed to allow it to collect in this retention area and soak into the ground. Swales typically are covered in turf grass. A rain garden is a swale that is planted with flowering and other appropriate plants and creates an attractive feature in your landscape while providing a valuable service filtering pollutants from run-off. The US Environmental Protection Agency describes a rain garden is “a depressed area in the landscape that collects rain water from a roof, driveway or street and allows it to soak into the ground. Planted with grasses and flowering perennials, rain gardens can be a cost effective and beautiful way to reduce runoff from your property.” Attached is Table 3 Rain Garden Plants, which provides a list of local plant materials suitable for installation in rain garden swales. The graphic below illustrates a rain garden.


On many of the highly impervious yards and shorelines of the Towns lakes, it is essential to ensure there is a swale or depressional area to collect the initial run-off from driveways and other impervious surfaces before it runs into the lakes.

**Recommendation: Swales and Rain Gardens**

- Direct initial stormwater run-off into a swale or raingarden

## 6.2 Outfalls

Turbidity is generally defined as the cloudiness or haziness of a fluid caused by large numbers of individual suspended particles that are generally invisible to the naked eye, similar to smoke in air. Turbidity is a result of sediment load and biomass. There are many sources of turbidity. Untreated stormwater runoff; ground disturbing construction activities entering waterbodies, shoreline erosion, and phytoplankton. Urbanized areas contribute large amounts of turbidity to nearby waters, through stormwater pollution from paved surfaces such as roads, bridges and parking lots. Many of the lakes in the Town contain outfalls from upland stormwater management systems, both public and privately maintained systems.

Disturbed ground surfaces should be stabilized and controlled in accordance with NPDES best management practices to manage stormwater run-off and keep large amounts of sediment from entering the lakes. Typically, best management practices at an active construction site with disturbed earth would include: sod, silt fence, staked turbidity barriers, or floating turbidity barrier. These measures would prevent run-off from washing disturbed soil into the water body or spreading throughout a water body.

Town and Residential Community storm drains collect stormwater run-off and in many cases direct it to waterbodies via lake outfalls. It is imperative to not dispose of materials in the storm drain systems. When washing a vehicle in the driveway the rinse water with detergents runs directly into the storm drains. When feasible, park the vehicle on the lawn when washing it to allow the rinse water to filter

through the lawn, and use bio-degradable detergent and high pressure spray technology to reduce water use.

**Recommendation: Outfalls**

- Sprinkling the disturbed surface with water will keep dust at a minimum
- Covering disturbed surfaces with straw or mulch will keep the dust at a minimum
- Install sod on disturbed areas as soon as possible when construction/disturbance is completed
- Install and maintain sit fencing and turbidity curtains and barriers until disturbance is completed
- Do not dispose of materials in storm drains

## 6.3 Street Sweeping

Implementing an effective street sweeping program removes tons of pollutants on an annual basis from entering the storm drain system and entering the lakes. Currently, non-residential Town controlled curbed roads are cleaned on a bi- weekly basis. The Town contract includes the curb and/or gutter or swale and covers the entire cross section of the road including turn lanes. There are privately owned and maintained roads in the Town should pursue a street sweeping program. This is a documented very highly effective tool in removing pollutants and sediment from entering the lakes through the storm drain systems.

**Recommendation: Street Sweeping**

- Prioritize sweeping of streets that have drainage connected to lake outfalls

# 7.0 ILLICIT DISCHARGE MANAGEMENT

## 7.1 Spills and Illicit Dumping

In addition to rinse water containing pesticide/herbicide, fluids from vehicles, solvents, household products, cleaners, chlorinated pool water, chemical containers, used oil, and paints are other typical residential products. Property owners should ensure these items are not intentionally or accidentally introduced to neighboring lakes or into storm drains. When hiring maintenance firms or other contractors ensure they are not introducing these items into the lake systems.

**Recommendation: Spills and Illicit Dumping**

- Do not dump materials into storm drains
- When hiring maintenance firms or other contractors ensure they are not introducing illicit items into the lake systems or storm drains

## 7.2 Septic Systems

Septic systems are designed to treat wastewater by separating solids from liquids and then draining the liquid into the ground. When system failures occur, untreated wastewater and sewage can be introduced into groundwater or nearby streams and water bodies. There are only eight septic systems that remain in the Town. For the protection of the ground water and lakes, it is imperative these be maintained to function as designed before these are ultimately connected to the municipal system.

Pollution prevention practices are designed to restrict pollutant and nutrient loads from improperly functioning septic systems from entering local water sources. Do not wait until septic system shows sign of failure. Inspect the system annually and have it cleaned when it reaches half full. When septic

systems are not pumped routinely, the leach field may become clogged. Choose household chemicals carefully as many may be harmful to the bacteria that make the system work, and non-degradable materials (cigarette butts, etc.) can clog the system. Bleach, drain cleaners, and paints harm beneficial microorganisms in the septic system. Paper towels, cigarettes and garbage disposal debris should never be flushed as these products can overload the septic system.

**Recommendation: Septic Systems**

- Maintain existing septic systems
- Conduct annual inspections and cleaning as needed
- Chose household chemical appropriately, avoid bleach, drain cleaners and paint
- Avoid introducing non-degradable items

## 7.3 Dumpsters

Discarded waste, such as trash, food scraps, and liquid waste can be hazardous to residents and lakes should it leak out of your trash cans or dumpsters into the storm drain system or adjacent lakes. These materials can carry harmful bacteria and can cause flooding by slowing or blocking the flow of rainwater into the storm drain system, including the curb gutter. Keep dumpster lids closed to prevent rain and pests from entering. Whenever possible, keep dumpsters away from storm drain inlets. Dispose of kitchen and restaurant wastes in special grease dumpsters and avoid disposing of liquids in a dumpster. Ask the service provider to switch out the dumpster for cleaning and to replace or repair leaking dumpsters when needed.

**Recommendation: Dumpsters**

- Ensure dumpsters do not leak and drain into lakes or storm drains
- Keep dumpster lids closed
- keep dumpsters away from storm drain inlets
- Keep dumpsters away from waters edge
- Replace or repair leaking dumpsters

## 7.4 Illicit Connection

An illicit connection is any constructed conveyance that connects non-stormwater discharges directly to a stormwater system. A common source of pollution from businesses is a floor drain that is improperly connected to a storm drain. It is illegal to connect industrial and business wastewater sources to the storm drain system. Any industrial discharge not composed entirely of stormwater that is conveyed to the storm drainage system or a waterbody is considered to be an illicit discharge. These discharges may contain a variety of pollutants that can affect both public safety and the aquatic environment. These discharges may be the result of connections to the storm drain that are unknown to the business owner. Facilities that receive NPDES stormwater permits are usually required to include documentation that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. If you suspect there may be an illicit connection contact the Town to investigate. If you are purchasing a commercial structure require verification of no illicit connections prior to purchase.

**Recommendation: Illicit connections.**

- Report any illicit connections
- Require verification of no illicit connections when purchasing a commercial property

# 8.0 Common Lake Issues

## 8.1 Murky Colored Water

During summer months, lake water may look murky, and have an unpleasant odor. The scum looks like blue-green paint and often drifts to the shore. This may be an algal bloom. Algae are microscopic plants that are natural components of lakes. Algal blooms are often the result of excess phosphorus (often from lawn fertilizer) entering the lake.

## 8.2 Yellow Green Dust

During early summer a yellow dust may appear on your lake. This dust is likely pollen from pine trees. Over time the pollen will sink to the bottom. This occurs in areas where these are concentrations of pine trees.

## 8.3 Oily Sheen

An oily sheen on the water is not always an indication of a human-induced spill. There is a naturally occurring algae, known as Botryococcus, that produces an oily substance that can be seen on the surface of the water. In Florida, Botryococcus algae blooms are fairly common, especially during the summer months. Its presence can cause alarm, as the algal cells are red or burnt orange in color and, in large enough concentrations, they have been known to temporarily change the color of a lake from green to orange. Also, in some instances, it will look very much like a gasoline spill or oil slick. A dark oily cloud may also be insect cases left behind from a hatch of aquatic insects. A wind can concentrate the cases along the shore, and as they decompose, an oily sheen forms.

## 8.4 Fish Kills

Naturally occurring fish kills can be related to physical processes (e.g., rapid fluctuations in temperature), water chemistry changes (e.g., lack of oxygen or changes in the pH), or they can be biological in nature (e.g., stress from spawning activity, viruses, bacterial infection, parasites, etc.). In Florida, the vast majority of fish kills are caused by one or more natural causes. The most common are low dissolved oxygen levels, spawning fatalities, mortality due to cold temperature, and fish parasites or diseases. An occasional dead fish is not cause for alarm. If you notice numerous dead fish, especially of more than one species, you should contact the local government or the Florida Fish and Wildlife Conservation Commission (FWCC)

## 8.5 Tannins

Throughout Florida it is common to see brownish stained waters or tannic water. This is created when leaves, grasses, pine needles, and other organic matter falls into the water. The matter breaks down over time, giving the water that tea-stained look. Tannins are considered an aesthetic problem. They may make water smell unpleasant and stain laundry, or buildings when used for irrigation, but they present no health hazard.

# 9.0 Best Management Practices (BPM) Recommendations

## 9.1 BMP Recommendations Overview

The best management practices recommendations presented throughout this report are consolidated below.

**Section 2.1 Littoral Zone Planting**

- Install shoreline and littoral plantings where littoral zones are available
- Recommended plants can be installed from the shoreline to a depth of 3.5’
- Table 2 provides a list of suitable recommended plants
- Plants can be installed where slope allows for several feet of planting width to 3.5’ foot depth
- Planting substrate should be sand or mucky material, avoid rock or rocky substrate
- Avoid planting an area used as access for kayaks/canoes etc. to limit disturbance
- Coordinate with lake maintenance firm to ensure they do not eradicate plantings

**Section 2.2 Shoreline Stabilization**

- Ensure shoreline stabilization structures (seawalls etc.) are sound
- Obtain professional inspection at no less than every 5 years to ensure the structures are sound
- When replacement is needed, replace with living seawall or place riprap at base of seawall

**Section 3.1 Invasive Aquatic Plant Control**

- Control invasive aquatic plants
- An ongoing contract with a professional lake management firm should be maintained to address aesthetic above surface debris removal, algae and aquatic weed control, undesirable border grass and brush control to water’s edge, and biological control
- Contractor should use most appropriate control method for problem
- The contract should encompass the entire lake
- Contract could include collection of duck eggs

**Section 3.2 Invasive Exotic Plant and Animal Introductions**

- Do not introduce invasive aquatic plants or animals
- Do not dump your aquarium plants or animals in the lake
    1. Contact the retailer for proper handling advice or for possible returns
    2. Give/trade with another aquarist, or water gardener
    3. Donate to a local aquarium society, school, or aquatic business
    4. Seal aquatic plants in plastic bags and dispose in trash
    5. Contact veterinarian or pet retailer for guidance on humane disposal of animals
- Do not dump any unwanted plants or animals in the lake

**Section 3.3 Aeration and Re-stratification**

- Provide lake aeration
- Aeration systems should be installed in all lakes
- Bubblers are more effective at mixing water at lower levels than fountains
- Bubblers installation should avoid picking up bottom sediment
- On lakes with lobes/arms, aerators/fountains should be installed in each lobe

**Section 4.1 Feeding Wildlife**

- Do Not Feed Wildlife
- Install “Do not feed wildlife” signage at all public lakeside parks
- Install “Do not feed wildlife” signage at in right of ways at entrances to neighborhoods
- Do not feed wildlife information should be included on Town information webpage
- Do not feed wildlife should be included in an information brochure from the City

- Collect duck eggs for humane disposal
- Professional firms can be hired to humanly capture unhealthy or aggressive wildlife

**Section 4.2 Pet Waste**

- Pick-up after your pet
- Install “Pick-up after your Pet” signage at in common areas
- Pick up after your pet information should be included in community newsletters
- Proper disposal of cat litter should be included in community newsletter

**Section 4.3 Pet Waste Stations and Signage**

- Provide pet waste stations and education in Common Areas
- Maintain pet stations in public spaces that allow dogs
- Install “Pick-up after your Pet” signage in public spaces that allow dogs
- Ensure “Not pets Allowed” signage is installed in public spaces that do not allow pets

**Section 5.1 Lawn Mowing and Composting**

- Do not cut your lawn too short, generally 2.5” to 3.5” is recommended
- Never hose or rake your lawn clippings into your neighboring lake or canal
- Do not place compost piles at the water’s edge
- Never hose or rake your lawn clippings into the street, or down storm drains

**Section 5.2 Lawn Maintenance**

- Strictly apply lawn fertilizers per label. Slow release fertilizer is best
- Only apply low phosphorus fertilizer, with a phosphorus amount of 2 or less
- Always leave a "ring of responsibility" when applying lawn fertilizer
- When herbicides, insecticides or pesticides are needed, strictly follow label dosages
- When herbicides, insecticides or pesticides are needed, strictly target only the area needed
- When using fertilizer/herbicides or pesticides do not dump excess material or rinse water in adjacent waters or down storm drains
- Never apply fertilizers/herbicides or pesticides when heavy rains are expected

**Section 5.3 Choosing a Lawn Maintenance Company**

- Ensure the lawn maintenance company is licensed and insured
- Avoid unnecessary routine preventive maintenance applications of law products

**Section 5.4 Notification of Lawn Treatment**

- Ensure the lawn maintenance company provides notification to homeowner of lawn treatments

**Section 6.1 Swales and Raingardens**

- Direct initial stormwater run-off into a swale or raingarden

**Section 6.2 Outfalls**

- Sprinkling the disturbed surface with water will keep dust at a minimum
- Covering disturbed surfaces with straw or mulch will keep the dust at a minimum
- Install sod on disturbed areas as soon as possible when construction/disturbance is completed
- Install and maintain sit fencing and turbidity curtains and barriers until disturbance is completed

- Do not dispose of materials in storm drains

**Section 6.3 Street Sweeping**

- Where feasible implementing an effective street sweeping program
- Prioritize sweeping to streets that have drainage connected to lake outfalls

**Section 7.1 Spills and Illicit Dumping**

- Do not dump materials into storm drains
- When hiring maintenance firms or other contractors ensure they are not introducing illicit items into the lake systems or storm drains

**Section 7.2 Septic Systems**

- Maintain existing septic systems
- Conduct annual inspections and cleaning as needed
- Choose household chemicals appropriately, avoid bleach, drain cleaners and paint
- Avoid introducing non-degradable items

**Section 7.3 Dumpsters**

- Ensure dumpsters do not leak and drain into lakes or storm drains
- Keep dumpster lids closed
- keep dumpsters away from storm drain inlets
- Keep dumpsters away from waters edge
- Replace or repair leaking dumpsters

**Section 7.4 Illicit Connections**

- Report any illicit connections
- Require verification of no illicit connections when purchasing a commercial property

## 9.2 Single Family Residential Property BMP Recommendations

Listed below are the BMP recommendations discussed throughout this report that are applicable to single family residential properties.

**Section 2.1 Littoral Zone Planting**

- Install shoreline and littoral plantings where littoral zones are available
- Recommended plants can be installed from the shoreline to a depth of 3.5’
- Table 2 provides a list of suitable recommended plants
- Plants can be installed where slope allows for several feet of planting width to 3.5’ foot depth
- Planting substrate should be sand or mucky material, avoid rock or rocky substrate
- Avoid planting an area used as access for kayaks/canoes etc. to limit disturbance
- Coordinate with lake maintenance firm to ensure they do not eradicate plantings

**Section 2.2 Shoreline Stabilization**

- Ensure shoreline stabilization structures (seawalls etc.) are sound
- Obtain professional inspection at no less than every 5 years to ensure the structures are sound
- When replacement is needed, replace with living seawall or place riprap at base of seawall

**Section 3.1 Invasive Aquatic Plant Control**

- Control invasive aquatic plants
- An ongoing contract with a professional lake management firm should be maintained to address aesthetic above surface debris removal, algae and aquatic weed control, undesirable border grass and brush control to water's edge, and biological control
- Contractor should use most appropriate control method for problem
- Contract could include collection of duck eggs

**Section 3.2 Invasive Exotic Plant and Animal Introductions**

- Do not introduce invasive aquatic plants or animals
- Do not dump your aquarium plants or animals in the lake
    1. Contact the retailer for proper handling advice or for possible returns
    2. Give/trade with another aquarist, or water gardener
    3. Donate to a local aquarium society, school, or aquatic business
    4. Seal aquatic plants in plastic bags and dispose in trash
    5. Contact veterinarian or pet retailer for guidance on humane disposal of animals
- Do not dump any unwanted plants or animals in the lake

**Section 3.3 Aeration and Re-stratification**

- Provide lake aeration
- Aeration systems should be installed in all lakes
- Bubblers are more effective at mixing water at lower levels than fountains
- Bubblers installation should avoid picking up bottom sediment
- On lakes with lobes/arms, aerators/fountains should be installed in each lobe

**Section 4.1 Feeding Wildlife**

- Do Not Feed Wildlife
- Collect duck eggs for humane disposal
- Professional firms can be hired to humanly capture unhealthy or aggressive wildlife

**Section 4.2 Pet Waste**

- Pick-up after your pet
- Proper disposal of cat litter

**Section 5.1 Lawn Mowing and Composting**

- Do not cut your lawn too short, generally 2.5" to 3.5" is recommended
- Never hose or rake your lawn clippings into your neighboring lake or canal
- Do not place compost piles at the water's edge
- Never hose or rake your lawn clippings into the street, or down storm drains

**Section 5.2 Lawn Maintenance**

- Strictly apply lawn fertilizers per label. Slow release fertilizer is best
- Only apply low phosphorus fertilizer, with a phosphorus amount of 2 or less
- Always leave a "ring of responsibility" when applying lawn fertilizer
- When herbicides, insecticides or pesticides are needed, strictly follow label dosages
- When herbicides, insecticides or pesticides are needed, strictly target only the area needed

- When using fertilizer/herbicides or pesticides do not dump excess material or rinse water in adjacent waters or down storm drains
- Never apply fertilizers/herbicides or pesticides when heavy rains are expected

**Section 5.3 Choosing a Lawn Maintenance Company**

- Ensure the lawn maintenance company is licensed and insured
- Avoid unnecessary routine preventive maintenance applications of law products

**Section 5.4 Notification of Lawn Treatment**

- Ensure the lawn maintenance company provides notification to homeowner of lawn treatments

**Section 6.1 Swales and Raingardens**

- Direct initial stormwater run-off into a swale or raingarden

**Section 6.2 Outfalls**

- Sprinkling the disturbed surface with water will keep dust at a minimum
- Covering disturbed surfaces with straw or mulch will keep the dust at a minimum
- Install sod on disturbed areas as soon as possible when construction/disturbance is completed
- Install and maintain sit fencing and turbidity curtains and barriers until disturbance is completed
- Do not dispose of materials in storm drains

**Section 7.1 Spills and Illicit Dumping**

- Do not dump materials into storm drains
- When hiring maintenance firms or other contractors ensure they are not introducing illicit items into the lake systems or storm drains

**Section 7.2 Septic Systems**

- Maintain existing septic systems
- Conduct annual inspections and cleaning as needed
- Choose household chemicals appropriately, avoid bleach, drain cleaners and paint
- Avoid introducing non-degradable items

## 9.3 HOA/Condominium BMP Recommendations

Listed below are the best management practices discussed throughout this report that are applicable to HOA/Condominium organizations.

**Section 2.1 Littoral Zone Planting**

- Install shoreline and littoral plantings where littoral zones are available
- Recommended plants can be installed from the shoreline to a depth of 3.5’
- Table 2 provides a list of suitable recommended plants
- Plants can be installed where slope allows for several feet of planting width to 3.5’ foot depth
- Planting substrate should be sand or mucky material, avoid rock or rocky substrate
- Avoid planting an area used as access for kayaks/canoes etc. to limit disturbance
- Coordinate with lake maintenance firm to ensure they do not eradicate plantings

**Section 2.2 Shoreline Stabilization**

- Ensure shoreline stabilization structures (seawalls etc.) are sound
- Obtain professional inspection at no less than every 5 years to ensure the structures are sound
- When replacement is needed, replace with living seawall or place riprap at base of seawall

**Section 3.1 Invasive Aquatic Plant Control**

- Control invasive aquatic plants
- An ongoing contract with a professional lake management firm should be maintained to address aesthetic above surface debris removal, algae and aquatic weed control, undesirable border grass and brush control to water's edge, and biological control
- Contractor should use most appropriate control method for problem
- The contract should encompass the entire lake
- Contract could include collection of duck eggs

**Section 3.2 Invasive Exotic Plant and Animal Introductions**

- Provide educational information in the Community newsletter/website to inform residents to not introduce invasive aquatic plants or animals and to not dump aquarium plants or animals in the lake, disposal should include:
    1. Contact the retailer for proper handling advice or for possible returns
    2. Give/trade with another aquarist, or water gardener
    3. Donate to a local aquarium society, school, or aquatic business
    4. Seal aquatic plants in plastic bags and dispose in trash
    5. Contact veterinarian or pet retailer for guidance on humane disposal of animals

**Section 3.3 Aeration and Re-stratification**

- Provide lake aeration
- Aeration systems should be installed in all lakes
- Bubblers are more effective at mixing water at lower levels than fountains
- Bubblers installation should avoid picking up bottom sediment
- On lakes with lobes/arms, aerators/fountains should be installed in each lobe

**Section 4.1 Feeding Wildlife**

- Provide educational information in the Community newsletter/website to inform residents to not feed wildlife
- Install "Do not feed wildlife" signage in common areas
- Install "Do not feed wildlife" signage at in right of ways at entrances to neighborhoods
- Collect duck eggs for humane disposal
- Professional firms can be hired to humanly capture unhealthy or aggressive wildlife

**Section 4.2 Pet Waste**

- Provide educational information in the Community newsletter/website to inform residents to pick-up after their pets
- Install "Pick-up after your Pet" signage at in common areas
- Pick up after your pet information should be included in community newsletters/website
- Proper disposal of cat litter should be included in community newsletter/website

**Section 4.3 Pet Waste Stations and Signage**

- Provide pet waste stations and education in common areas where pets are allowed

- Maintain pet stations in public spaces that allow dogs
- Install “Pick-up after your Pet” signage in public spaces that allow dogs
- Ensure “Not pets Allowed” signage is installed in public spaces that do not allow pets

**Section 5.1 Lawn Mowing and Composting**

- Do not cut your lawn too short, generally 2.5” to 3.5” is recommended
- Never hose or rake your lawn clippings into your neighboring lake or canal
- Do not place compost piles at the water’s edge
- Never hose or rake your lawn clippings into the street, or down storm drains

**Section 5.2 Lawn Maintenance**

- Strictly apply lawn fertilizers per label. Slow release fertilizer is best
- Only apply low phosphorus fertilizer, with a phosphorus amount of 2 or less
- Always leave a "ring of responsibility" when applying lawn fertilizer
- When herbicides, insecticides or pesticides are needed, strictly follow label dosages
- When herbicides, insecticides or pesticides are needed, strictly target only the area needed
- When using fertilizer/herbicides or pesticides do not dump excess material or rinse water in adjacent waters or down storm drains
- Never apply fertilizers/herbicides or pesticides when heavy rains are expected

**Section 5.3 Choosing a Lawn Maintenance Company**

- Ensure the lawn maintenance company is licensed and insured
- Avoid unnecessary routine preventive maintenance applications of law products

**Section 5.4 Notification of Lawn Treatment**

- Ensure the lawn maintenance company provides notification to homeowner of lawn treatments

**Section 6.1 Swales and Raingardens**

- Direct initial stormwater run-off into a swale or raingarden

**Section 6.2 Outfalls**

- Sprinkling disturbed surfaces with water will keep dust at a minimum
- Covering disturbed surfaces with straw or mulch will keep the dust at a minimum
- Install sod on disturbed areas as soon as possible when construction/disturbance is completed
- Install and maintain silt fencing/ turbidity curtains and barriers until disturbance is completed
- Provide educational information in the Community newsletter/website to inform residents to not dispose of materials in storm drains
- Establish a maintenance routine to clean catch basins that connect to lake outfalls

**Section 6.3 Street Sweeping**

- Where feasible implementing an effective street sweeping program
- Prioritize sweeping to streets that have drainage connected to lake outfalls

**Section 7.1 Spills and Illicit Dumping**

- Do not dump materials into storm drains
- Provide educational information in the Community newsletter/website to inform residents not dump materials into storm drains

- When hiring maintenance firms or other contractors ensure they are not introducing illicit items into the lake systems or storm drains

**Section 7.3 Dumpsters**

- Ensure dumpsters do not leak and drain into lakes or storm drains
- Keep dumpster lids closed
- keep dumpsters away from storm drain inlets
- Keep dumpsters away from waters edge
- Replace or repair leaking dumpsters

**Section 7.4 Illicit Connections**

- Report any illicit connections

## 9.4 Commercial Business BMP Recommendations

Listed below are the BMP recommendations discussed throughout this report that are applicable to waterfront commercial properties.

**Section 2.1 Littoral Zone Planting**

- Install shoreline and littoral plantings where littoral zones are available
- Recommended plants can be installed from the shoreline to a depth of 3.5'
- Table 2 provides a list of suitable recommended plants
- Plants can be installed where slope allows for several feet of planting width to 3.5' foot depth
- Planting substrate should be sand or mucky material, avoid rock or rocky substrate
- Avoid planting an area used as access for kayaks/canoes etc. to limit disturbance
- Coordinate with lake maintenance firm to ensure they do not eradicate plantings

**Section 2.2 Shoreline Stabilization**

- Ensure shoreline stabilization structures (seawalls etc.) are sound
- Obtain professional inspection at no less than every 5 years to ensure the structures are sound
- When replacement is needed, replace with living seawall or place riprap at base of seawall

**Section 3.1 Invasive Aquatic Plant Control**

- Control invasive aquatic plants
- An ongoing contract with a professional lake management firm should be maintained to address aesthetic above surface debris removal, algae and aquatic weed control, undesirable border grass and brush control to water's edge, and biological control
- Contractor should use most appropriate control method for problem
- The contract should encompass the entire lake
- Contract could include collection of duck eggs

**Section 3.2 Invasive Exotic Plant and Animal Introductions**

- Do not introduce invasive aquatic plants or animals
- Do not dump any unwanted plants or animals in the lake

**Section 3.3 Aeration and Re-stratification**

- Provide lake aeration

- Aeration systems should be installed in all lakes
- Bubblers are more effective at mixing water at lower levels than fountains
- Bubblers installation should avoid picking up bottom sediment
- On lakes with lobes/arms, aerators/fountains should be installed in each lobe

**Section 5.1 Lawn Mowing and Composting**

- Do not cut your lawn too short, generally 2.5" to 3.5" is recommended
- Never hose or rake your lawn clippings into your neighboring lake or canal
- Do not place compost piles at the water's edge
- Never hose or rake your lawn clippings into the street, or down storm drains

**Section 5.2 Lawn Maintenance**

- Strictly apply lawn fertilizers per label. Slow release fertilizer is best
- Only apply low phosphorus fertilizer, with a phosphorus amount of 2 or less
- Always leave a "ring of responsibility" when applying lawn fertilizer
- When herbicides, insecticides or pesticides are needed, strictly follow label dosages
- When herbicides, insecticides or pesticides are needed, strictly target only the area needed
- When using fertilizer/herbicides or pesticides do not dump excess material or rinse water in adjacent waters or down storm drains
- Never apply fertilizers/herbicides or pesticides when heavy rains are expected

**Section 5.3 Choosing a Lawn Maintenance Company**

- Ensure the lawn maintenance company is licensed and insured
- Avoid unnecessary routine preventive maintenance applications of law products

**Section 5.4 Notification of Lawn Treatment**

- Ensure the lawn maintenance company provides notification to homeowner of lawn treatments

**Section 6.1 Swales and Raingardens**

- Direct initial stormwater run-off into a swale or raingarden

**Section 6.2 Outfalls**

- Sprinkling the disturbed surface with water will keep dust at a minimum
- Covering disturbed surfaces with straw or mulch will keep the dust at a minimum
- Install sod on disturbed areas as soon as possible when construction/disturbance is completed
- Install and maintain sit fencing and turbidity curtains and barriers until disturbance is completed
- Do not dispose of materials in storm drains
- Establish a maintenance routine to clean catch basins that connect to lake outfalls

**Section 7.1 Spills and Illicit Dumping**

- Do not dump materials into storm drains
- When hiring maintenance firms or other contractors ensure they are not introducing illicit items into the lake systems or storm drains

**Section 7.3 Dumpsters**

- Ensure dumpsters do not leak and drain into lakes or storm drains

- Keep dumpster lids closed
- keep dumpsters away from storm drain inlets
- Keep dumpsters away from waters edge
- Replace or repair leaking dumpsters
- When applicable, dispose of kitchen and restaurant wastes in special grease dumpsters and avoid disposing of liquids in a dumpster.

**Section 7.4 Illicit Connections**

- Report any illicit connections
- Require verification of no illicit connections when purchasing a commercial property

## 10.0 Helpful References

Mowing Your Florida Lawn:
http://edis.ifas.ufl.edu/lh028

Shoreline Vegetation Management Practices:
https://cityofwinterpark.org/docs/departments/public-works/lakes/shoreline-permitting/shoreline-vegetation-best-management-practices-small-lakes.pdf

Fertilize Appropriately:
https://ffl.ifas.ufl.edu/handbook/Fertilize_Appropriately_vSept09.pdf

Florida Waters: Ours to Protect:
https://plants.ifas.ufl.edu/wp-content/uploads/files/mng/Florida_Waters_Ours_to_Protect.pdf

Some of Florida's Freshwater Exotic Fishes:
https://myfwc.com/wildlifehabitats/nonnatives/freshwater-fish/

Florid Yards and Neighborhoods (FYN) Homeowners Program:
https://ffl.ifas.ufl.edu/homeowner.htm

Pet Waste Management:
http://gardeningsolutions.ifas.ufl.edu/giam/fyn/florida_friendly_yards/pet_waste.html

Think about Personal Pollution-Videos:
http://tappwater.org/media/videos.cfm

Greening Your Backyard: Water Efficiency and Stormwater Solutions for Homeowners and Communities:
https://www.epa.gov/green-infrastructure/greening-your-backyard-water-efficiency-and-stormwater-solutions-homeowners-and

Non Native Species Muscovy Ducks:
https://myfwc.com/wildlifehabitats/nonnatives/birds/waterfowl/muscovy-duck/

Invasive Species:
https://myfwc.com/wildlifehabitats/habitat/invasive-plants/

Florida's Exotic Fish and Wildlife
https://myfwc.com/wildlifehabitats/nonnatives/

Florida-Friendly Plants for Stormwater Pond Shorelines:
http://edis.ifas.ufl.edu/ep476

Soak up the Rain: Rain Gardens:
https://www.epa.gov/soakuptherain/soak-rain-rain-gardens

Tips for Choosing a Lawn Care Company
http://www.marioncountyfl.org/Home/ShowDocument?id=5048

Florida Yards and Neighborhoods Program
http://sfyl.ifas.ufl.edu/miami-dade/natural-resources/florida-yards-and-neighborhoods-fyn/

## Attachments

Table 2. Littoral Zone and Shoreline Plants

Exhibit A. Photographs of Littoral and Shoreline Plants

Table 4. Rain Garden Plants

**Table 2. Littoral and Shoreline Plants**

| ***Plants for Littoral Shelf (0 to 1.5' water depth)*** | | |
|---|---|---|
| **Scientific Name** | **Common Name** | **Plant Type** |
| *Sagittaria latifolia* | Duck Potato | Emergent Plant |
| *Pontederia lanceolata* | Pickerel Weed | Emergent Plant |
| *Juncus effusus* | Soft Rush | Emergent Plant |
| *Thalia geniculata* | Fire Flag | Emergent Plant |
| | | |
| ***Plants for Littoral Shelf (1.5' to 2.5' water depth)*** | | |
| **Scientific Name** | **Common Name** | **Plant Type** |
| *Sagittaria latifolia* | Duck Potato | Emergent Plant |
| *Pontederia lanceolata* | Pickerel Weed | Emergent Plant |
| *Sagittaria spp.* | Arrow Areum | Emergent Plant |
| *Eleocharis interstincta* | Spikerush | Emergent Plant |
| *Thalia geniculata* | Fire Flag | Emergent Plant |
| *Juncus effusus* | Soft Rush | Emergent Plant |
| | | |
| **Plants for Littoral Shelf (2.5' to 3'water depth)** | | |
| **Scientific Name** | **Common Name** | **Plant Type** |
| *Schoenoplectus tabernaemontani* | Softstem bullrush | Emergent Plant |
| *Vallisneria americana* | Tapegrass | Submerged |
| *Nymphaea odorata* | Fragrant waterlily | Rooted Floating |
| | | |
| **Plants for Littoral Shelf (3.5 foot water depth)** | | |
| **Scientific Name** | **Common Name** | **Plant Type** |
| *Vallisneria americana* | Tapegrass | Submerged |
| *Nymphaea odorata* | Fragrant waterlily | Rooted Floating |
| | | |
| **Plants for Immediate Shoreline** | | |
| **Scientific Name** | **Common Name** | **Plant Type** |
| *Muhlenbergia capillaris* | Muhly grass | Shoreline |
| *Spartina bakeri* | Sand cordgrass | Shoreline |
| *Canna flaccida* | Yellow canna | Shoreline/Emergent |
| *Acrostichum danaefolium* | Leather Fern | Shoreline |

## Exhibit A. Photographs of Littoral and Shoreline Plants


***Sagittaria latifolia*** **Duck Potato**

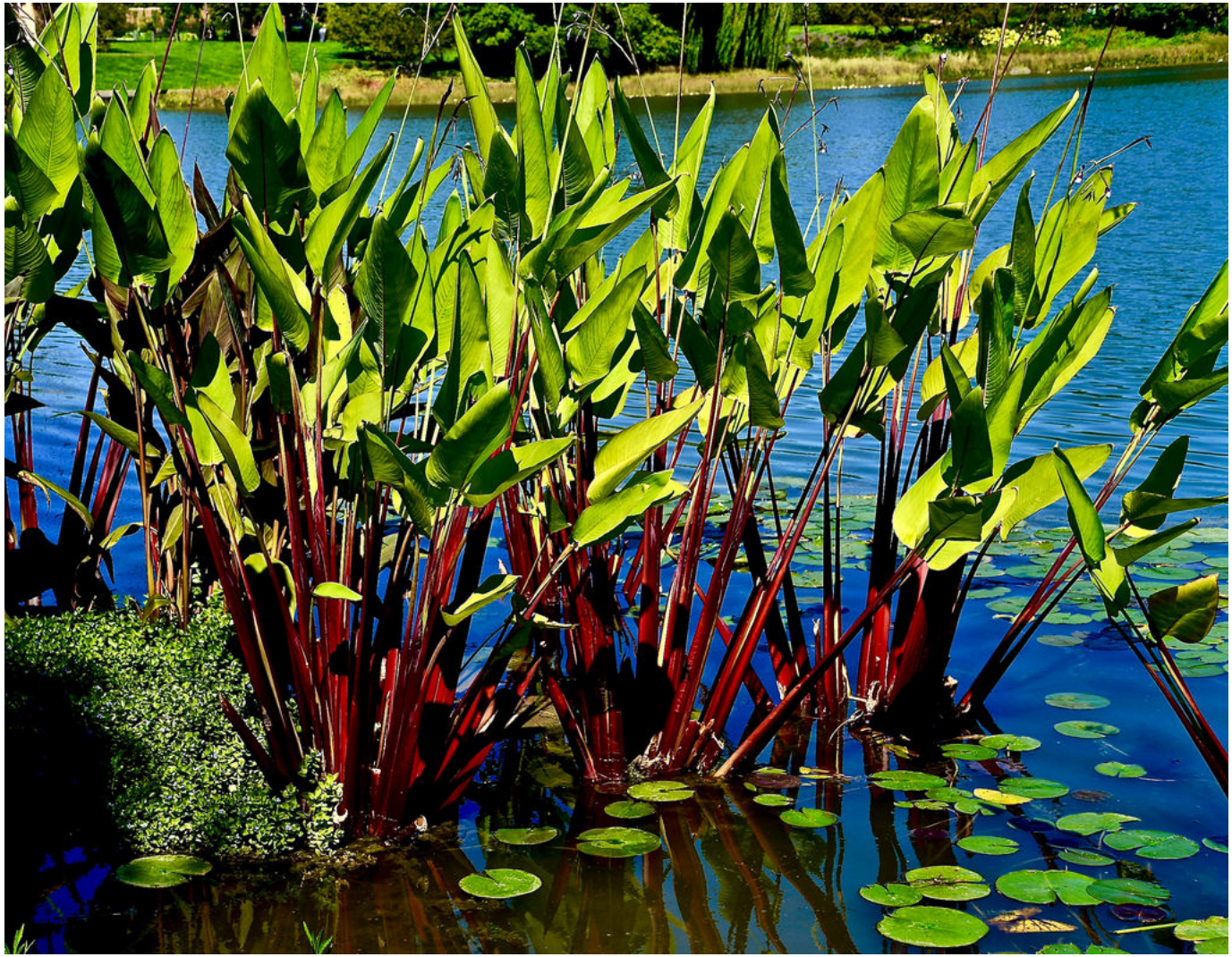
## Exhibit A. Photographs of Littoral and Shoreline Plants

***Pontederia lanceolate*** **Pickerel Weed**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Juncus effuses*** **Soft Rush**

## Exhibit A. Photographs of Littoral and Shoreline Plants



***Thalia geniculate*** **Fire Flag**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Eleocharis interstincta*** **Spike Rush**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Schoenoplectus tabernaemontani*** **Softstem Bullrush**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Vallisneria Americana*** **Tapegrass**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Nymphaea odorata*** **Fragrant Water Lilly**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Muhlenbergia capillaris*** **Purple Muhly Grass**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Spartina bakeri*** **Sand Cordgrass**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Canna flaccida*** **Yellow Canna**

## Exhibit A. Photographs of Littoral and Shoreline Plants

***Acrostichum danaefolium*** **Leather Fern**

**TABLE 4. Plant Selections for a Rain Garden Swale**

| | | | |
|---|---|---|---|
| **A.** | **Potential Tree Selection** | | |
| | **Scientific Name** | **Common Name** | **Specification** |
| | *Sabal Palmetto* | Sabal Palm | 16-18' ft |
| | *Taxodium distichum* | *Bald Cypress | 15 gallon |
| **B.** | **Bottom of the swale plants can withstand moderate periods of inundation** | | |
| | **Scientific Name** | **Common Name** | **Specification** |
| | *Cladium jamaicense* | Sawgrass | 1 gallon |
| | *Spartina bakeri* | Sand cordgrass | 1 gallon |
| **D.** | **Plant materials for the side slopes** | | |
| | **Scientific Name** | **Common Name** | **Specification** |
| | *Muhlenbergia capillaris* | Purple Muhly grass | 1 gallon |
| | *Spartina bakeri* | Sand cordgrass | 4" LN |
| | *Andropogon virginicus* | Bluestem | 4" LN |
| | *Hamelia patens* | Firebush | 1 gallon |
| | *Eragrostis spectabilis* | Purple Lovegrass | 1 gallon |
| **E.** | **Accent Materials in limited amounts** | | |
| | **Scientific Name** | **Common Name** | **Specification** |
| | *Iris virginica* | Blue Iris | 4" LN |
| | *Asclepias tuberosa* | Butterfly Milkweed | 1 gallon |
| | *Liatris chapmanii* | Gayfeather | Seed |
| | *Asclepias tuberosa* | Butterfly Weed | Seed |
| | *Coreopsis spp.* | Florida Tickseed | Seed |
| | *Salvia coccinea* | Scarlet Sage | Seed |

*Bald Cypress not recommend for swales less than 6' wide but can be used in wider swales.