4.23. Lake Spring

Background

Physical and chemical characteristics specific to Lake Spring are presented here in the context of relevant regulatory criteria and requirements (Table 4-46). Lake Spring (WBID 1521G1) is a headwater lake located in the WHCL Southern Chain and is hydrologically connected to Lake Mirror via a constructed navigable canal (Photo 4-26, Figure 4-94). Lake Spring has not been declared verified impaired; therefore, a TMDL is not required. However, the NNC are performance based, and an exceedance more than once every three years results in non-compliance. The annual geometric chlorophyll *a* and TN mean in 2005 and 2006 were above the NNC. Insufficient data were available to evaluate TP in comparison to the NNC target based on the EPA data requirements. The TN and chlorophyll *a* geometric mean for Lake Spring for the period of 1997 to 2007 and corresponding EPA NNC water quality targets are listed in Table 4-46. To comply with the NNC, concentration reductions of 9 percent for chlorophyll *a* are required.

A summary of water quality statistics for Lake Spring is presented in Table 4-47. The median recorded chlorophyll *a* and TP concentrations exceed the NNC targets provided by EPA for Lake Spring while the TN concentrations are below the target. Chlorophyll *a* concentrations in Lake Spring fluctuate but have remained consistently elevated above 20 µg/L (Figure 4-95). A statistically significant trend in chlorophyll *a* concentrations from 1983 to 2007 was not observed (seasonal Kendall-Tau, $p > 0.10$). *Hydrilla* eradication projects have been implemented regularly since 1990 treating greater than 40 percent of the lake surface area in some years. No water quality improvement projects have been implemented in Lake Spring to restore water quality. Lake Spring is an intermediate lake hydrologically connected to Lake Mirror, therefore, improvements in water quality of the lake could result in some benefit farther downstream.

The Lake Spring watershed is 93 acres in size and includes 87 acres (93 percent) of developed lands compared to 6 acres (3 percent) of undeveloped lands. The 2000-2007 median color value (15 PCU) was below 40 PCU indicating it is a clear (non-colored) lake and specific conductivity data indicate the lake is alkaline. The lake area, perimeter, water depth, and volume statistics are based on a water level elevation of 129 feet in June 2007. Bathymetry data are available for Lake Spring for the June 2007 water level elevation (Figure 4-96). A water level of 130 feet was reported in August 2010, reflecting a 1.0 foot increase in water elevation when compared to 2007. The subsequent changes in overall surface area, water depth, and volume of the lake should be considered during the development and implementation of water quality restoration projects.

Water Quality Restoration Project Selection and Priorities

Based on Lake Spring water quality and the surrounding watershed characteristics, five potential water quality restoration projects were identified using the WHCL WQMP decision key (Figure 4-97). The decision key presents the factors on which yes/no decisions were based and used to identify and select water quality improvement projects. Projects to address water quality, nutrient and sediment loading, and reduced lake levels are proposed. The projects are listed in order of priority, based on expected water quality improvements. A detailed discussion of the potential water quality restoration implications for each project can be found in Section 3.0.

- Project 1: Stormwater Infiltration Areas (SIAs)
- Project 2: Sediment Removal/Inactivation
- Project 3: SAV Planting/Management or FTWs
- Project 4: EAV Planting/Management
- Project 5: Artificial Circulation

Table 4-46. Physical, chemical, and regulatory characteristics of Lake Spring.

Physical			
Location in chain	Southern	**High infiltration soils (acres)**	58 (62 percent)
Relation to other lakes	Headwater	**Developed land (acres)**	87 (93 percent)
Watershed area (acres)	93	**Undeveloped land (acres)**	6 (3 percent)
Lake area (acres)*	25	**Median water depth (feet)***	3.2
Perimeter (feet)*	4,176	**Maximum water depth (feet)***	18.7
Surface area: lake volume ratio*	0.10	**Volume (acre-feet)***	240
Watershed to surface area ratio*	3.72		
Water Chemistry			
Locally-derived: acidic or alkaline	Alkaline	**Clear or colored**	Clear
Geometric mean chlorophyll *a* (µg/L)	22	**NNC chlorophyll *a* target (µg/L)**	20
Geometric mean TN (mg/L)	0.93	**NNC TN target (mg/L)**	1.00
Geometric mean TP (mg/L)	ID	**NNC TP target (mg/L)**	0.030
Regulatory Data			
Impaired	Yes	**TMDL status**	NA
Chlorophyll *a* trend	No trend**	**TP concentration reduction required**	ID

*at a water level elevation of 129 feet
**presented in section 5.0

NA- Not applicable
ID- Insufficient Data

Photo 4-26. North view of Lake Spring.

Table 4-47. Lake Spring water quality summary for 1997 to 2007.

Parameter	N	Minimum	Median	Maximum
Chlorophyll *a* (µg/L)	32	8.81	21	64
Color (PCU)	23	10	15	25
Conductivity (µmhos/cm)	21	185	207	244
Dissolved oxygen (mg/L)	21	4.72	8.66	10.88
pH	21	6.87	7.76	9.23
Secchi depth (feet)	34	1.1	2.7	5.3
Total nitrogen (mg/L)	34	0.57	0.94	2.2
Total phosphorus (mg/L)	30	0.014	0.039	0.094

Figure 4-94. Lake Spring and associated watershed.

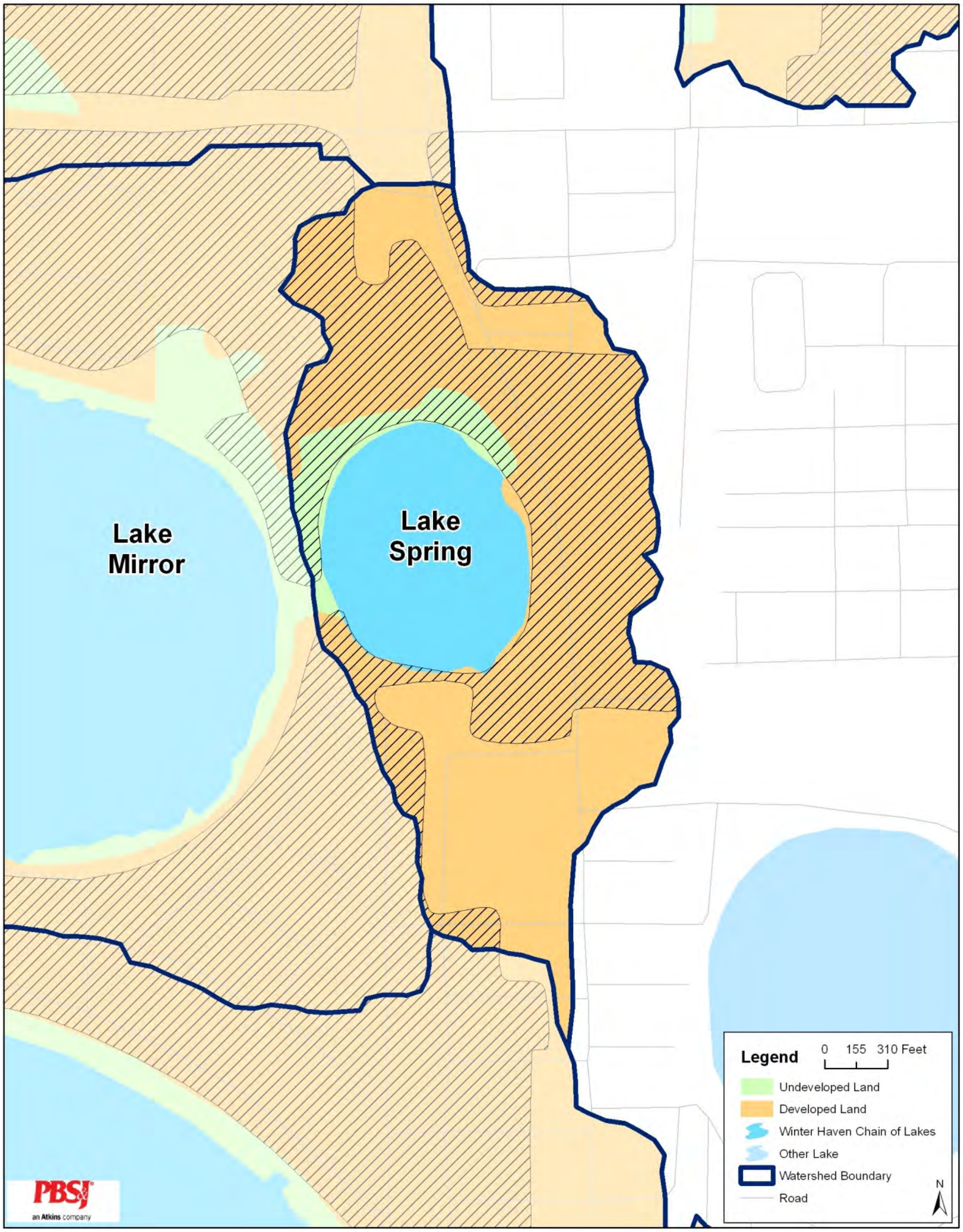


Figure 4-95. Lake Spring chlorophyll *a* concentrations and *Hydrilla* treatment history using available data from 1983 to 2007.

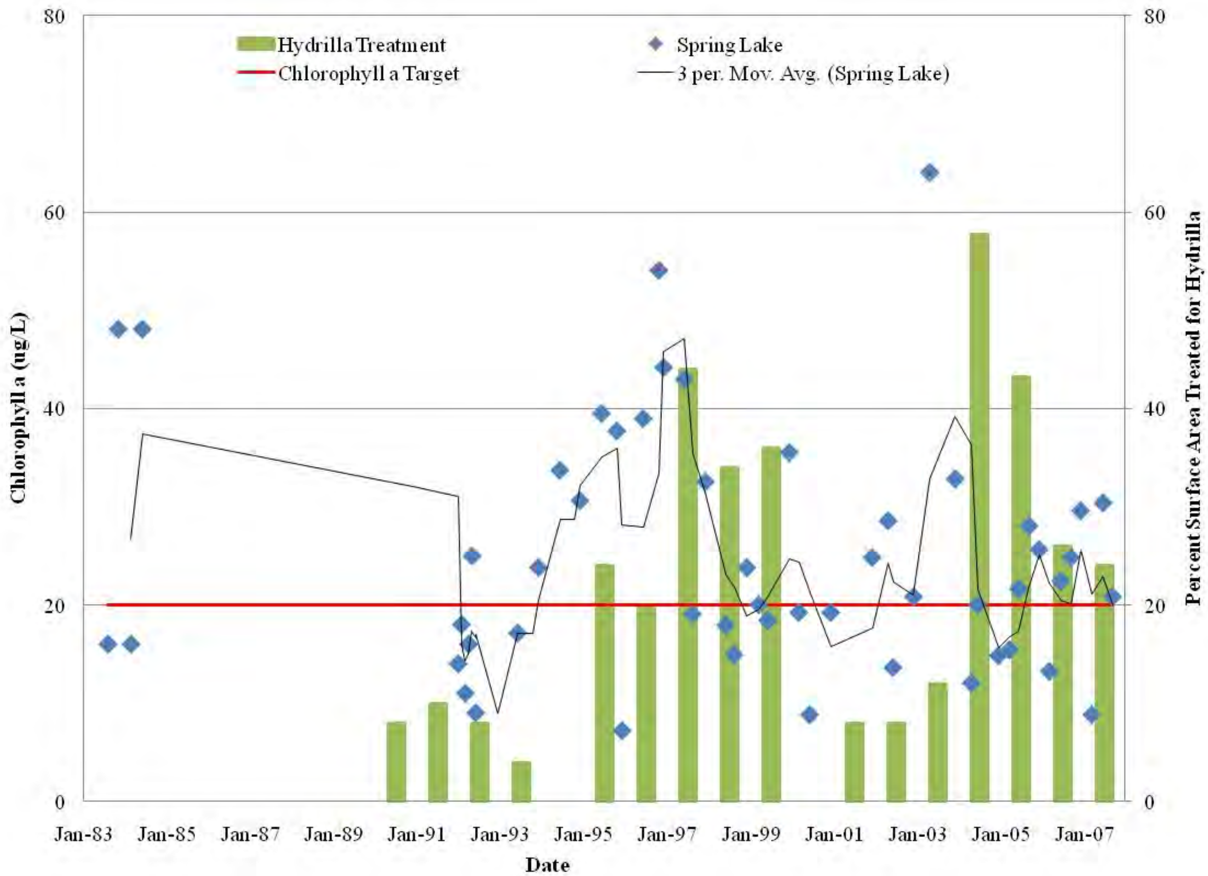


Figure 4-96. Lake Spring bathymetry (June 2007) at water level elevation = 129 feet (Polk County Water Atlas).

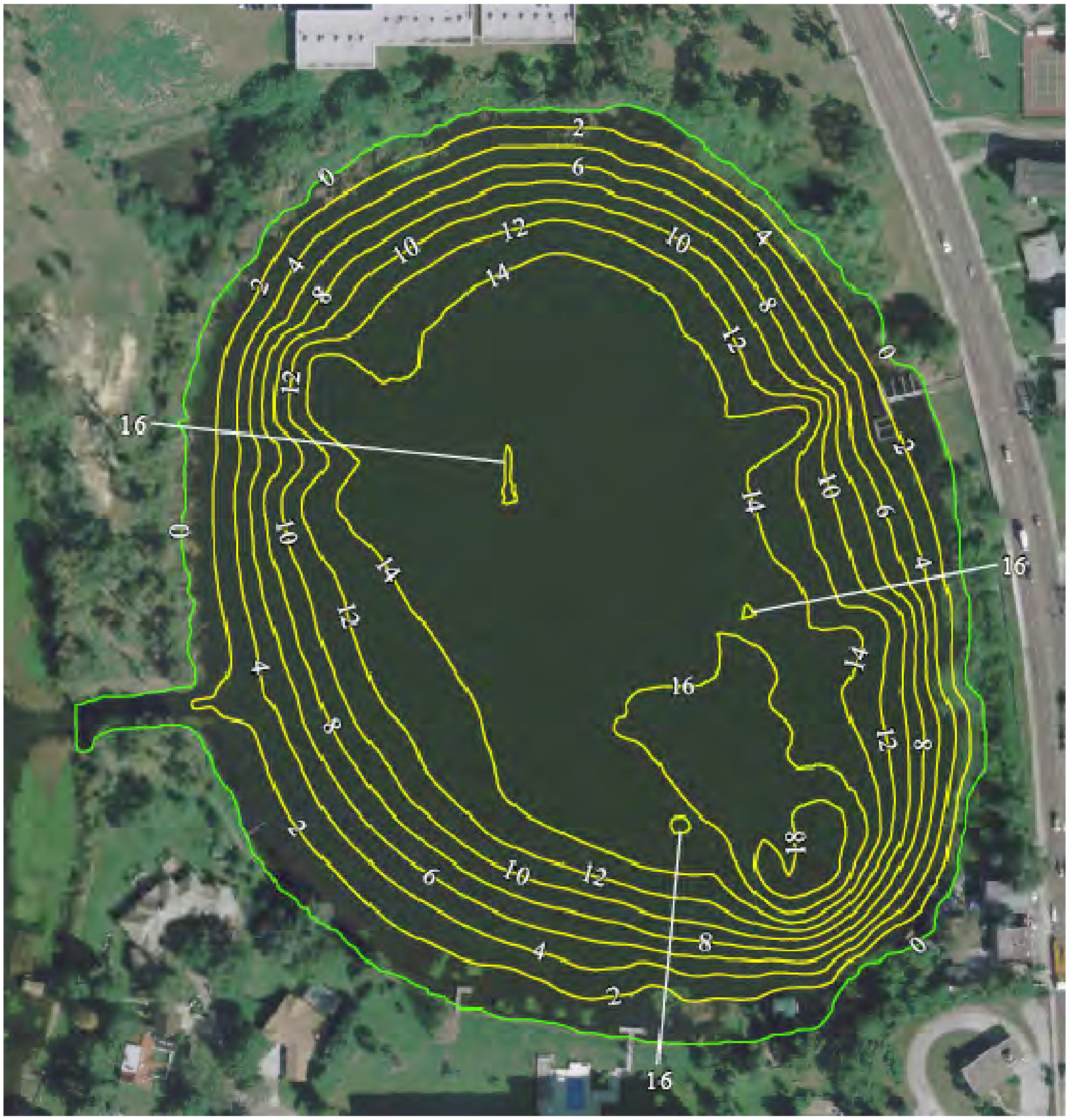
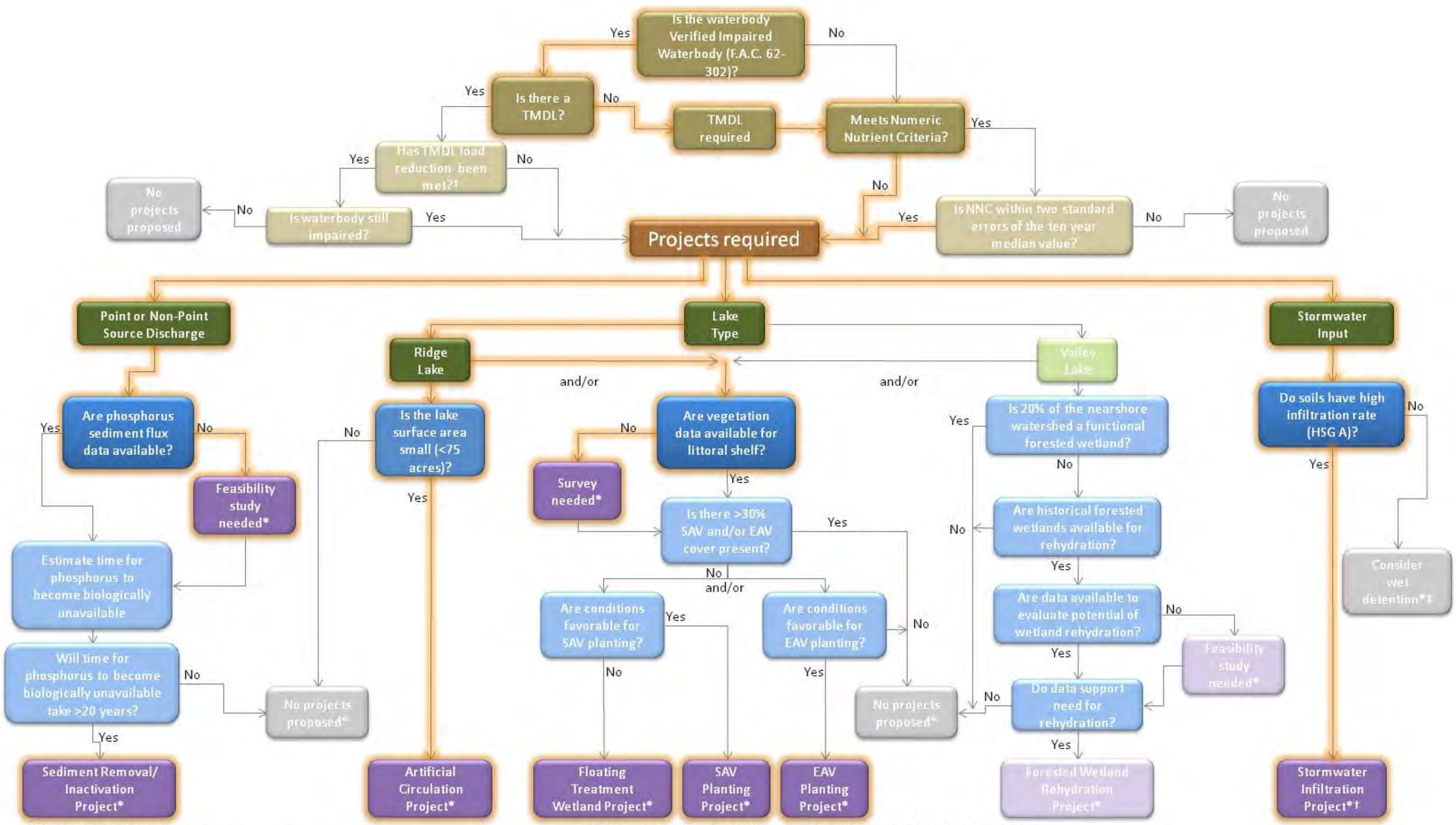


Figure 4-97. Lake Spring decision key: highlighted path shows decision process.



•Consider alternative projects

‡Wet detention may also be required if sufficient area is unavailable for dry retention

† Stormwater Infiltration projects could satisfy required TMDL Load reduction

Project 1: Stormwater Infiltration Areas (SIAs)

The Lake Spring watershed has approximately 58 acres (62 percent of the watershed) classified as high infiltration soils. Lake Spring does not have a TMDL, therefore, SIA acres estimates were calculated using data from the PLRG (USF 2005). Based on the water quality conditions modeled in the PLRG, a TP load reduction for Lake Spring is not required to achieve a TSI of 60. Additionally, insufficient data were available to estimate the required load reduction to mee the NNC. As such, SIA design should be focused on recharging the surficial aquifer. SIA implementation could have the additional benefit of increasing storage to supplement dry season lake levels and a reduction in stormwater loads that can be later applied to the required TMDL TP load reduction.

Project 2: Sediment Removal/Inactivation

Non-point source discharges to Lake Spring may have resulted in substantial internal nutrient loads due to phosphorus release from sediments. Presently, sufficient data are not available to evaluate the internal phosphorus load and calculate the phosphorus decay rate and the time at which the phosphorus will ultimately become biologically unavailable in the lake sediments. A feasibility study is required to determine whether sediment removal/inactivation is necessary to reduce internal phosphorus loads to the lake.

Cost Estimate: $10,000.

Project 3: SAV Planting or FTWs

SAV Planting

In Lake Spring, *Hydrilla* eradication has been completed over as much as 58 percent of the lake surface area attributing to the continued degradation in water quality. A survey of existing SAV cover in Lake Spring is recommended due to the lack of sufficient data to calculate percent lake cover. Based on the results of the SAV survey, conclusions regarding SAV planting can be determined. If SAV cover is less than 30 percent, lake conditions should be evaluated to assess if additional SAV is viable based on the soil condition, water clarity and water depth. *Hydrilla* harvesting may be required for successful establishment of selected SAV plants.

SAV plants should not be planted in water depths greater than 4 feet based on the median secchi depth values. The median secchi depth from 1997-2007 in Lake Spring was 2.7 feet. The maximum planting effort could result in vegetation cover of approximately 22 percent of the lake bottom (6 acres).

Cost Estimate: $35,000 (estimate based on previous purchase and installation cost of $0.90 per plant provided by EarthBalance®, additional funds included for maintenance)

FTWs

If the feasibility study indicates that more than 30 percent of Lake Spring has SAV cover, FTW may be considered. The installation of floating mats with appropriate aquatic vegetation would be expected to assimilate nutrients from the water column.

Project 4: EAV Planting

A survey of existing shoreline vegetation surrounding Lake Spring is recommended due to the lack of sufficient data at this time. Based on the results of the shoreline survey, conclusions and recommendations regarding emergent aquatic or woody vegetation planting can be determined. If limited shoreline vegetation is present, shoreline conditions should be evaluated to assess if vegetation planting is viable based on the soil conditions, slope, water level and inundation frequency and wave disturbance.

Project 5: Artificial Circulation

The project design is based on the assumption that the system configuration developed by SolarBee® for Lake Blue is applicable for Lake Spring. Each circulation pump is assumed to effectively circulate 16 to 20 acres. The surface area of Lake Spring is 25 acres requiring the purchase and installation of one SB10000 v 18 machines.

Cost Estimate: $55,000 (estimate based on cost provided for Lake Blue by SolarBee®).