Deep Creek Lake

Harvester Feasibility Pilot Study Report

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Prepared For

Maryland Park Service

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Introduction

The Deep Creek Lake Natural Resource Management Area, located in Garrett County, Maryland, lies just west of the Allegheny Front on a broad plateau known as the Tablelands or Allegany Highlands. Deep Creek Lake was created in 1925 with the construction of the Deep Creek Hydroelectric Project by the Youghiogheny Hydroelectric Company. At full pool elevation (2,462 feet), the lake spans approximately 3,900 acres, contains 106,000 acre-feet of water, and has a drainage area of 64.7 square miles. With 65 miles of shoreline and depths reaching up to 75 feet, it stands as Maryland's largest inland body of water.

Initially developed for hydroelectric power generation, the lake and its surrounding lands have evolved into a hub for recreation, tourism, and wildlife conservation. The Maryland Department of Natural Resources (DNR) assumed ownership and management of Deep Creek Lake and its Buffer Strip in 2000, following acquisition from the Pennsylvania Electric Company for $17 million.

Today, the Maryland DNR manages Deep Creek Lake to balance recreational opportunities such as boating, fishing, kayaking, hiking, and swimming with ecological preservation and community interests. Effective management requires maintaining ecological integrity while supporting these diverse uses. Key ecological priorities include protecting water quality, benthic communities, fisheries, wildlife, sediment balance, submerged aquatic vegetation, and the equilibrium between native and invasive species.

Ecological Benefits of Submerged Aquatic Vegetation (SAV)

Submerged aquatic vegetation (SAV), composed of rooted underwater plants, is a critical component of healthy freshwater ecosystems and provides a wide range of essential ecological functions. Through photosynthesis, SAV produces oxygen necessary for sustaining aquatic life and helps maintain balanced dissolved oxygen levels within the water column. SAV beds are important habitat and nursery areas for numerous fish and invertebrate species and provide an essential food source for waterfowl. In addition to supporting aquatic life, SAV contributes to water quality improvement by absorbing excess nutrients, which reduces the likelihood of algal blooms. Dense vegetation also stabilizes bottom sediments, decreases turbidity, and improves overall water clarity. The structural complexity of SAV beds dampens wave energy, reducing shoreline erosion and protecting nearshore habitats. Furthermore, healthy native SAV communities can inhibit the establishment and spread of aquatic invasive species (AIS), such as *Myriophyllum spicatum* (Eurasian watermilfoil), *Hydrilla verticillata* (hydrilla), and *Potamogeton crispus* (curly pondweed), further supporting the ecological integrity of the lake.

Purpose of Study

The purpose of this study is to evaluate mechanical harvesting of SAV as an additional management strategy for SAV control in Deep Creek Lake. While SAV provides important ecological benefits, excessive growth can become a nuisance in shallow nearshore areas, where dense vegetation interferes with boating and swimming. Current management options are limited to mechanical removal (raking) or the installation of benthic mats to control nuisance SAV surrounding docks.

This study aims to evaluate the effectiveness and potential ecological impacts of using an aquatic vegetation harvester to manage SAV in Deep Creek Lake. An aquatic vegetation harvester is a specialized machine designed to cut, collect, and remove unwanted aquatic plants and algae from aquatic systems. Operating similarly to an underwater lawn mower, it uses cutting blades and conveyor systems to gather vegetation and transport it for offloading and disposal. The goal is to ensure that management actions maintain ecological integrity while allowing for safe and enjoyable recreational use of Deep Creek Lake.

Considerations

In evaluating the feasibility of using a mechanical harvester, several key ecological and management considerations were identified. Aquatic Invasive Species (AIS) pose a significant threat to the ecological balance of Deep Creek Lake, as non-native plants could outcompete native vegetation, alter habitat structure, and degrade water quality and recreational value. Preventing the introduction and spread of AIS is a top management priority.

Fisheries impacts are another key consideration. SAV provides essential habitat for spawning, foraging, and shelter for many fish species. Management actions must be designed to promote a healthy and diverse fish community by maintaining suitable habitat conditions.

Additionally, the protection and enhancement of native SAV are central to sustaining ecological integrity. Control efforts targeting nuisance vegetation must be carefully implemented to avoid unintentionally diminishing the ecological integrity of native vegetation.

Harvester Equipment Description

For this study, an H5-200 Aquatic Plant Harvester was used (Figure 1). The H5-200 is a stainless-steel, self-propelled machine designed for the removal and collection of aquatic vegetation. The harvester hull is a flat-bottom design reinforced with ultra-high-molecular-weight (UHMW) polyethylene skids to provide abrasion resistance and protection during shallow-water operation.

The H5-200 has an overall length of approximately 33 feet 1 inch, an operating width of 11 feet 7 inches, and a height from the waterline of about 7 feet 6 inches.

The harvesting head provides a cutting width of 5 feet and a maximum cutting depth of 5 feet 6 inches. The cutting system includes horizontal and vertical reciprocating knives with a three-inch stroke, powered by direct-drive hydraulic motors. This configuration enables efficient cutting of dense aquatic vegetation while maintaining controlled operation. The swinging pivot suspension system provides impact absorption and allows the cutting head to adjust to uneven underwater surfaces.

The storage and unloading system are designed for high-capacity handling and rapid discharge of collected material. It includes dual conveyors with an articulating off-loading section that allows discharge of harvested vegetation onto shore or into support barges. The conveyor bed measures 3 feet 7 inches in width and includes a 6-foot overhang. The system can hold as much as 200 cubic feet of material or approximately 3,000 pounds of biomass. The conveyor is constructed of galvanized steel mesh, driven by direct hydraulic motors, and operates with variable speed control. Average unloading time is approximately sixty seconds, depending on load conditions.

Overall, the H5-200 Aquatic Plant Harvester integrates durable stainless-steel construction, hydraulically driven cutting and conveying systems, and high-capacity material handling into a compact and transportable platform suitable for large-scale aquatic vegetation management.

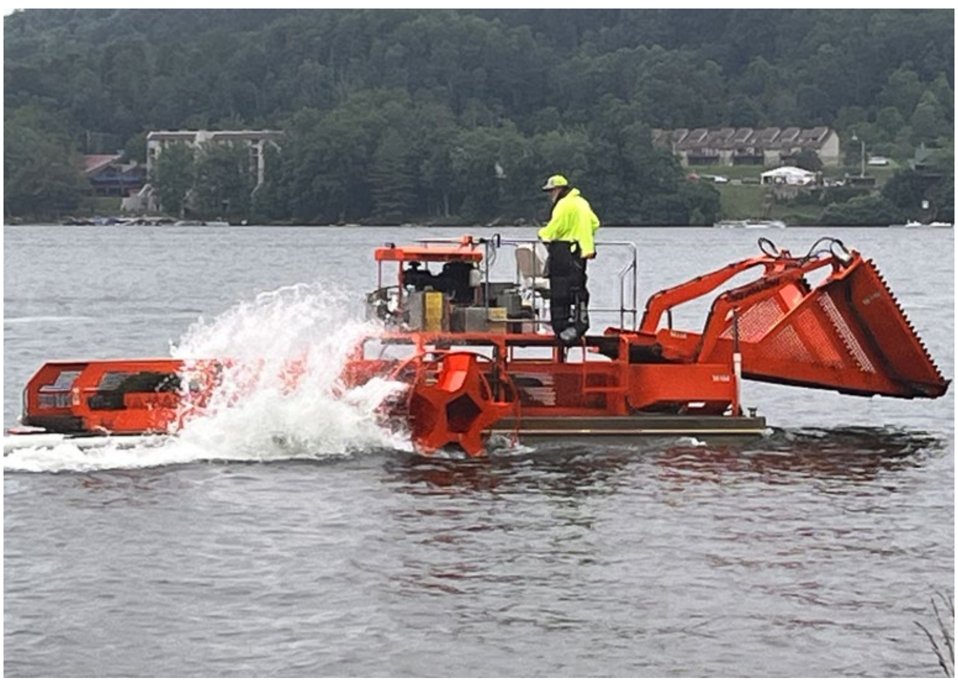

Figure 1: Model H5-200 aquatic vegetation harvester on Deep Creek Lake.

Site Descriptions

Three study sites were selected within Deep Creek Lake to represent varying water depths and corresponding SAV conditions (Figure 2). The sites included a shallow location (approximately 3.3 feet deep), an intermediate location (approximately 6.6 feet deep), and a deep location (approximately 13.1 feet deep). These depth ranges were chosen to evaluate differences in SAV density, species composition, and management effectiveness across depth gradients. All study areas were carefully selected to ensure they were located away from private and commercial docks to minimize potential interference and human disturbance during data collection.

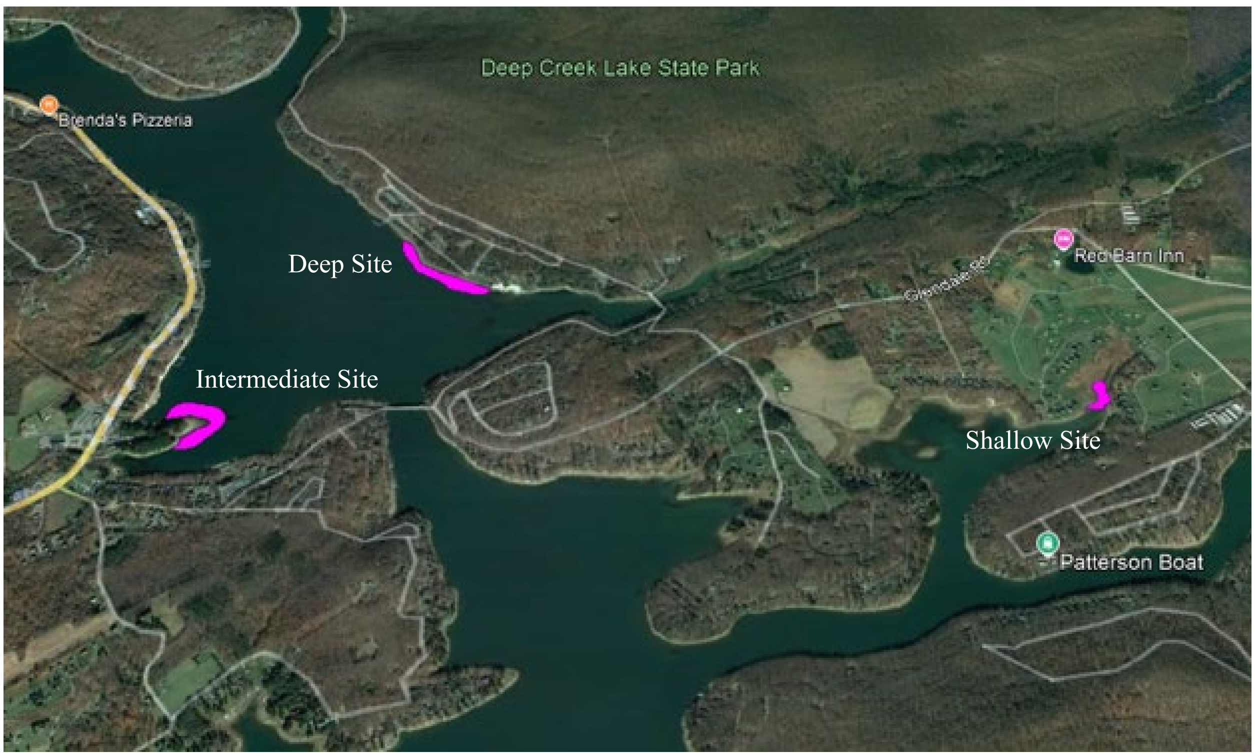

Figure 2: Map of study sites.

Methods

SAV Surveys

At each study site, SCUBA divers installed PVC pipes and floats to mark two transects: one control transect (uncut) and one experimental transect (cut). This was designed to allow for comparative analysis. SAV surveys were conducted pre- and post-harvest during two separate harvests, with survey efforts occurring in mid-August 2025 and again in late September through early October 2025, to evaluate changes in SAV metrics attributable to cutting activities.

Beginning at the near shore transect origin and proceeding at equal intervals, divers placed two replicate 0.25 m^2 quadrats on opposite sides (left and right) of the transect tape. Within each quadrat, divers recorded total percent SAV cover, percent cover by individual SAV species, and SAV canopy height.

Sampling intervals varied by site depending on transect length; however, data were consistently collected from two replicate quadrats at eleven points along each transect, including the beginning and end points.

At the Shallow and Intermediate sites, transects extended 100 feet, with sampling conducted every 10 feet. At the Shallow site, the first sampling point occurred at 10 feet rather than at the transect origin due to extremely shallow water conditions. Although SAV was present at the starting point, water depth was insufficient for effective harvester operation.

At the Deep site, the transect extended only 50 feet because water depth increased rapidly and vegetation did not reach the surface, limiting harvester effectiveness. To ensure sufficient representation, quadrat sampling at this site was conducted every 5 feet.

Survey efforts for the second iteration of harvesting followed the same methodology, except for the Intermediate site, which was removed prior to subsequent harvesting activities following the observation of hydrilla (*Hydrilla verticillata*), an invasive species near the study site.

Harvester

The aquatic vegetation harvester was deployed on two occasions, on August 19 and September 30, 2025, corresponding with the two harvesting iterations evaluated in this study. During each deployment, the harvester completed three passes along each experimental transect, resulting in a 10-foot-wide cut corridor centered on the transect line and extending equally on both sides. This was completed at all three sites, except for the Intermediate Site during the September 30, 2025, deployment due to the observation of hydrilla (*Hydrilla verticillata*).

As the aquatic vegetation harvester cut SAV, the severed plant material was collected via an onboard conveyor belt system (Figure 3). The biomass piles were separated by study site during harvesting operations to allow harvested material to be offloaded and sorted by site at an approved offsite disposal location to evaluate potential fisheries impacts.

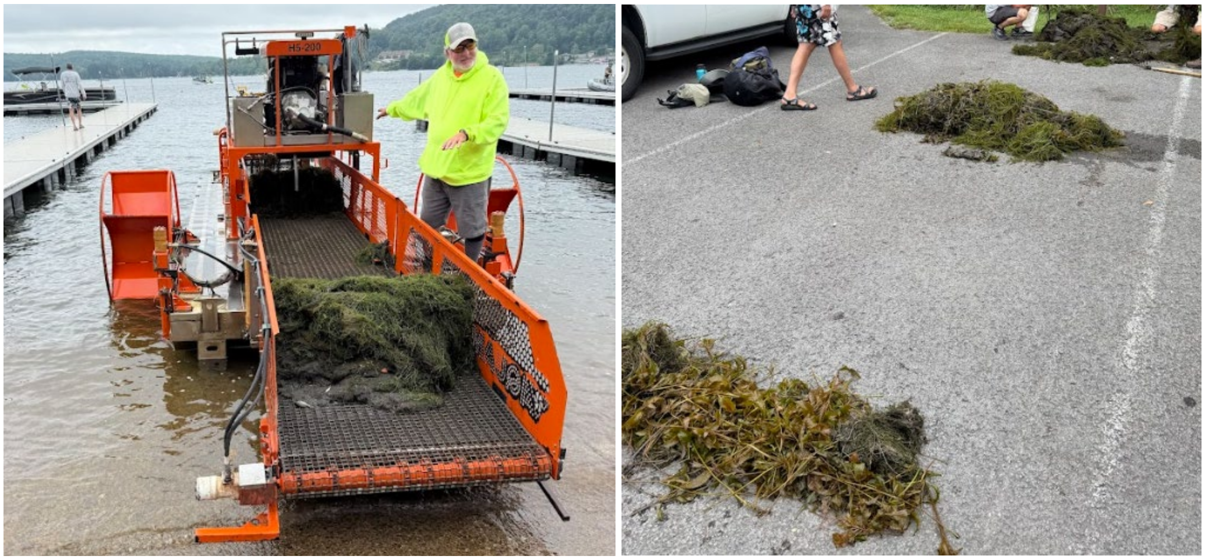

Figure 3: Harvester conveyor system and biomass of clippings by site.

Results

Site Specific SAV Diversity

At the shallow site, five species of SAV were observed: *Elodea*, Eurasian watermilfoil, *Potamogeton* spp., broadleaf pondweed, and *Nitella*. The dominant SAV species was *Elodea*, which exhibited the highest percent cover among all species, reaching 100% cover within several quadrats along the transects. Eurasian watermilfoil was the second most abundant species but occurred only at low densities. All remaining species were rare and contributed minimal overall cover.

The intermediate depth site supported six SAV species: *Elodea*, *Sagittaria*, *Potamogeton amplifolius*, slender pondweed, and *Najas minor*. *Sagittaria* accounted for the majority of percent density and was present at most sampling points; however, this species does not reach heights that interfere with recreation and is below harvester cutting capabilities. *Potamogeton amplifolius* and *Elodea* were the primary species harvested. *Potamogeton amplifolius* occurred at moderate densities and reached canopy heights which can impede recreational use. Other species, including *Elodea* and slender pondweed occupied intermediate canopy heights. This site was removed from further monitoring during the September/October survey period following the detection of the invasive species hydrilla near study transects.

At the deep site, three SAV species were observed: *Vallisneria americana*, *Sagittaria*, and *Potamogeton amplifolius*. Compared to the shallow and intermediate sites, SAV diversity was lowest at this site. *Vallisneria americana* was the most consistently present along transects and exhibited the greatest density compared to the other species. Harvested material consisted of *Potamogeton amplifolius* and *Vallisneria americana*, as *Sagittaria* does not grow tall enough to be affected by harvesting.

Comparison of Pre- and Post-Cutting Conditions

The comparative results from the mechanical harvesting pre- and post-cutting data were inconclusive. Experimental plots exhibited post-cutting canopy heights similar to those measured pre-cutting, which is inconsistent with expected post-harvest responses. Conversely, control plots showed a reduction in vegetation height the following day, despite not being scheduled for cutting. These inconsistencies suggest that harvesting activities may not have strictly adhered to the experimental design. Limitations in maneuverability could have made it difficult to consistently maintain precise harvests within the designated site boundaries, potentially resulting in unintended impacts to both experimental and control areas. These findings were further corroborated by fisheries sonar data, which also indicated unexpected changes in vegetation structure across treatment and control sites.

Fisheries

This pilot study examines the potential impacts of vegetation harvesting on fisheries in Deep Creek Lake, focusing on a small sample of local aquatic ecosystems meant to cover the available habitats in the lake. The aquatic harvester's conveyor system allowed harvested plant material to be separated by site. Cut vegetation was transported offsite and offloaded into site-specific piles where any fisheries bycatch was identified and recorded. Fisheries data was collected post-cut following August 19 and September 30, 2025, harvesting.

Preliminary observations indicate that vegetation plays a vital role in supporting fish populations, particularly by providing shelter for young gamefish and panfish in shallow, heavily vegetated areas (Table 1). Bluegill (Adult and Young of Year) were the most common species found at all sites and provide a significant forage base to the overall food web of Deep Creek Lake. Bluegill are also popular among anglers to catch and harvest.

Although the small sample size limits the ability to extrapolate these findings, this study offers initial insights into how vegetation harvesting may influence fish species at a larger scale across the lake. Impacts are likely to include both direct impacts (habitat loss/modification and fish mortality) as well as indirect impacts to predatory fishes via trophic web disruption (reduction in forage species and declines to the fishery).

Table 1: Counts of fish collected from harvested material during both iterations of vegetation harvesting efforts on Deep Creek Lake, 2025. Location specifies the site by depth (Shallow, Intermediate, Deep); age of individuals was determined as either Adult or Young of the Year (YOY); count represents the total number of individuals by species and age category.

Species	Location	Sample Date	Age	Count
Pumpkinseed (*Lepomis gibbosus*)	Shallow Site	August 19, 2025	Adult	1
Bluegill (*Lepomis macrochirus*)	Shallow Site	August 19, 2025	Adult	29
Bluegill (*Lepomis macrochirus*)	Shallow Site	August 19, 2025	YOY	12
Bluegill (*Lepomis macrochirus*)	Intermediate Site	August 19, 2025	YOY	18
Yellow Perch (*Perca flavescens*)	Shallow Site	August 19, 2025	YOY	2
Largemouth Bass (*Micropterus salmoides*)	Shallow Site	August 19, 2025	YOY	2
Yellow Bullhead (*Ameiurus natalis*)	Shallow Site	August 19, 2025	YOY	6
Bluegill (*Lepomis macrochirus*)	Shallow Site	September 30, 2025	Adult	20
Bluegill (*Lepomis macrochirus*)	Shallow Site	September 30, 2025	YOY	20
Yellow Bullhead (*Ameiurus natalis*)	Shallow Site	September 30, 2025	YOY	4
Brown Bullhead (*Ameiurus nebulosus*)	Shallow Site	September 30, 2025	YOY	4
Yellow Perch (*Perca flavescens*)	Shallow Site	September 30, 2025	Adult	1

In addition, side-scan sonar surveys were conducted before and after harvesting to assess potential impacts to fisheries habitat; however, it was difficult to distinguish harvested areas, as cutting did not result in an obvious path through the SAV.

Discussion

Accurate collection of pre- and post-cut data for comparative analysis during the harvester pilot project proved challenging due to difficulties in identifying clear cutting paths, limited visibility, and restricted mobility for the harvester. Lake levels during the summer of 2025 did not drop significantly, so SAV beds did not reach the water surface in most places. Of the areas cut for this study, only the shallow site would have been a likely candidate for mechanical harvesting.

Nevertheless, the project provided observational confirmation that the aquatic harvester possesses sufficient capacity and operational capability to effectively remove SAV in Deep Creek Lake. The mass of cuttings at the shallow and intermediate sites was substantially greater than at the deep site, indicating a reduction in harvesting ability with increasing depth. Observations also indicated that benthic impacts were more pronounced at the shallow site, where the soft silt/clay substrate and thick mats of filamentous algae made it difficult for the operator to locate the true bottom, resulting in scraping of all vegetation along the substrate; this site notably also had the most mortality for fish species. These findings suggest that, while quantitative assessment remains constrained under current conditions, the harvester is functionally suitable for SAV management, particularly in shallower areas, though care is warranted in soft-bottom habitats to minimize benthic disturbance. Additionally, while benthic surveys are valuable for detecting the presence of invasive species and assessing overall plant distribution, they may not be the most effective indicator for determining the need for mechanical cutting. Surface SAV density can be substantially greater as SAV forms dense mats at the surface, directly impacting recreational use even when benthic coverage remains relatively low.

During the post-cut dive survey in August 2025, staff observed fragments of hydrilla along the shoreline of the intermediate site. Hydrilla effectively spreads via fragmentation of smaller, floating plant segments that can take root in other areas of the lake, which is counterproductive to existing control efforts for this invasive species. If the mechanical harvester was used in an area with hydrilla, there was potential for fragmentation and further spread of hydrilla in the lake. Following this observation, extensive dives were conducted around the site, resulting in the discovery of a previously undocumented bed of hydrilla. Notably, pre-cut dive surveys in the area had been extensive, and no hydrilla was detected within the cutting zone; however, the new bed was found in close proximity. This finding underscores the critical importance of conducting thorough surveys prior to approving harvesting operations to ensure that invasive species are not inadvertently dispersed.

Fisheries impact findings showed that even though the harvester conveyor had grates installed to minimize bycatch of aquatic fauna, juvenile fish were still observed within the clipping piles. This observation highlights that, despite engineering controls designed to reduce fisheries impacts, some incidental capture or disturbance of small fish can occur during harvesting operations, emphasizing the need for careful operational planning and monitoring to mitigate potential effects on local aquatic populations.

A key consideration in SAV management is balancing the ecological benefits of native SAV with the need to control areas where plant densities hinder recreational use. Native SAV provides critical habitat, supports water quality, and contributes to overall ecosystem health; however, dense growth can interfere with boating, swimming, and other recreational activities. Management strategies should therefore target high-density areas that impede recreation while preserving native SAV in lower density areas to maintain ecological function.

Recommendations

Current SAV management on Deep Creek Lake is limited to mechanical removal (raking) and benthic mat installation. It is recommended that Buffer Strip Use permit holders be allowed to use mechanical harvesters to manage SAV around their docks, limited to the same footprint currently authorized for mechanical raking and benthic mat applications. Because the environmental footprint associated with raking and benthic mats has already been evaluated, harvester use should be restricted to these same spatial limits; specifically, up to 260 square feet per slip for common or commercial dock facilities and up to 520 square feet for Type A docks. Additionally, the presence of docks and moored vessels already inhibits SAV growth through shading of the water column, which reduces light availability and limits photosynthesis.

To support this approach, a Special Permit application process should be required for all harvester use. Permit approval would be contingent upon Lake Management Office staff conducting advance site inspections to confirm the absence of invasive species and to proactively reduce the risk of unintended spread. Implementation of this program would require designation of specific staff to manage the anticipated increase in workload. Current SAV management on Deep Creek Lake is otherwise limited to mechanical removal (raking) and benthic mat installation, making this recommendation a logical extension of existing, evaluated management practices. To help maintain the integrity of SAV growth, it is recommended that SAV harvesting is only completed between July 7 - October 1 and be limited to two harvests per permit period.

Since aquatic harvesters are not intended to cut vegetation entirely to the substrate, their use may result in reduced ecological impacts compared to other SAV management methods like benthic mats and raking. Residual vegetation and intact root systems remain, allowing continued SAV growth, whereas alternative methods often smother vegetation or remove root systems entirely.

Because this additional management method increases the workload required of Lake Management Office staff to conduct site surveys and issue Special Permits, it is recommended that harvesting activities be performed by approved contractors at the expense of the individual property owner. All vegetation clippings must be removed and transported off the Buffer Strip and may be disposed of in the same manner as other yard waste, to minimize nutrient inputs, reduce visual impacts, and prevent inadvertent disturbance to any rare, threatened, or endangered species that may be present within the Buffer Strip.

The Freshwater Fisheries and Hatcheries Division recommends that additional research be conducted to fully understand the potential ecological and fisheries related impacts of vegetation harvesting before any larger scale harvesting efforts are considered. The current recommendation from this report is intentionally small and controlled by allowing permit holders to manage SAV around their area of use, which occupies the same ecological footprint that has already been approved for other mentioned methods of SAV management. While the recommended approach provides a desirable management option for individual permit holders, it does not address vegetation removal from coves throughout Deep Creek Lake that may be overrun by vegetation or areas where SAV growth extends beyond a property owner's authorized area of use. Expanding this effort to remove SAV from entire coves would be very different. Instead of small patches of clearings, large areas of vegetation could be removed at once, which may eliminate much of the habitat that fish depend on and alter water quality parameters.

In order to address broader, large-scale concerns, it is recommended that Lake Management Office staff conduct an additional study starting with a systematic survey of the lake to identify coves with significant SAV density and collect data to establish a threshold value for SAV that has grown to the extent that it becomes matted on the surface. The intent of this effort is to develop data driven criteria to determine when state-led harvesting outside of a Buffer Strip Use Permit holder's area of use is appropriate, taking into consideration factors such as recreational use, potential impacts to fisheries, water depth, and cutting depth. In cases where SAV growth exceeds established thresholds and is determined to warrant management, the Lake Management Office may hire a contractor to conduct harvesting activities; however, consistent with the ecological considerations emphasized throughout this report, SAV would not be considered for harvesting unless density thresholds are met and impacts to ecological function are minimized.

Although a single harvester model was used during this study, the experimental design and evaluation metrics were intentionally structured to be broadly applicable to mechanical SAV harvesting operations in general. As such, the findings are relevant across a range of harvester types with similar cutting and collection capabilities, rather than being limited to the specific equipment deployed during this study.