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Mechanical Hydrilla Control in Orange Lake, Florida

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ABSTRACT

For the past several years hydrilla (*Hydrilla verticillata* (L.F.) Royle) has progressively spread over Orange Lake, Florida, severely reducing lake utilization. The U. S. Army Engineer District, Jacksonville sponsored preliminary investigations into available mechanical systems to control aquatic vegetation by the U. S. Army Engineer Waterways Experiment Station during the summer of 1976. Based on the results of these tests, the Jacksonville District designed and conducted a mechanical operational hydrilla control program in Orange Lake during the summer of 1977. Aquamarine Corporation's Aqua-Trio equipment maintained a total of 65 hectares of water in a useable condition for a four month period, including 42 kilometers of trail and 14 use areas. During this period 1100 loads of hydrilla were cut and disposed of either in open-water disposal areas or on the upland. Load weights ranged from 680 to 1860 kilograms with a mean of 1320 kilograms. Total cost was approximately $73,200.00. Cost per hectare for the full period was approximately $1,125.00.

INTRODUCTION

Hydrilla has been in Florida for approximately 18 to 20 years. It has rapidly spread over the State causing considerable problems with usage of the affected water areas. Because of the widespread nature of the problem and its economic impact, the U. S. Army Corps of Engineers has become involved in the control of this species. The Corps' programs will carry on hydrilla control from an integrated approach using chemical, biological, and mechanical methods where each is best suited. Several chemicals or combinations of chemicals have proven their effectiveness in the control of hydrilla and are currently labeled for use. No pathogens are yet operational for hydrilla control. The plants' ability to regenerate from fragments has dampened efforts towards development of mechanical control methods in the past. Once a water body becomes 80 to 90 percent infested with hydrilla, the good accomplished by opening the water body by mechanical means may very well outweigh the potential acceleration of the spread of the plant over the remaining area.

Orange Lake is located in north central Florida bounded by Marion and Alachua Counties and has a surface area of approximately 5,261 hectares. It is historically a prime fishing lake for largemouth bass (*Micropterus salmoides floridanus*, Lacepede) and bream (*Lepomis* sp.). The lake was over 90% infested with hydrilla in 1976 when the Corps' mechanical control testing was performed in the lake. The equipment was successful at cutting, transporting, and removing the hydrilla in the tests by the Waterways Experiment Station.

A plan was formulated to operationally test the use of the Aqua-Trio to clear a series of trails and fishing use areas during the 1977 growing season, based on the previous year's experience. A series of trails and use areas was designed that would best serve the needs of the users and would be within the capability of the machinery to maintain. The original plan was for 19 double width cut (4.5 meters) trails totaling 28 kilometers and 4 use areas of approximately 1.2 hectares each. Total area to be maintained was approximately 18 hectares.

Input from the Florida Game and Fresh Water Fish Commission Regional Botanist and the local residents was used to lay out the trails and use areas. The sequence of cutting was established to follow the normal order of hydrilla growth or causing difficulties to recreation. Permits were secured from landowners around the lake for use of their property for equipment launching and retrieval and for the transport and disposal of the cut vegetation.

METHODS

The equipment used was the Aqua-Trio manufactured by Aquamarine Corporation, Waukesha, Wisconsin.[1] It consisted of four separate units: the harvester, transporter, shore conveyor, and a flat-bed dump truck.

During a portion of the contract, portable truck scales were set up and the weight of various loads of cut plants was determined. Two scales were used and the total weight was computed by the addition of the front and rear axle weights. The empty truck with driver was weighed at the beginning and end of each day and several times during the day to determine the tare weight. Immediately after loading with a harvester-load of plants, the truck was weighed. By the time the cut plants had been transported to the shoreline point most of the free water had already drained off. The determination of area for trails and user areas was made by scaling from controlled aerial photographs.

RESULTS

There were many conditions that arose during the course of the work which affected the manner in which the work was performed and the overall results. The level of the

[1]The work was performed for the Corps by General Development Corporation of Port Charlotte, Florida, under contract.

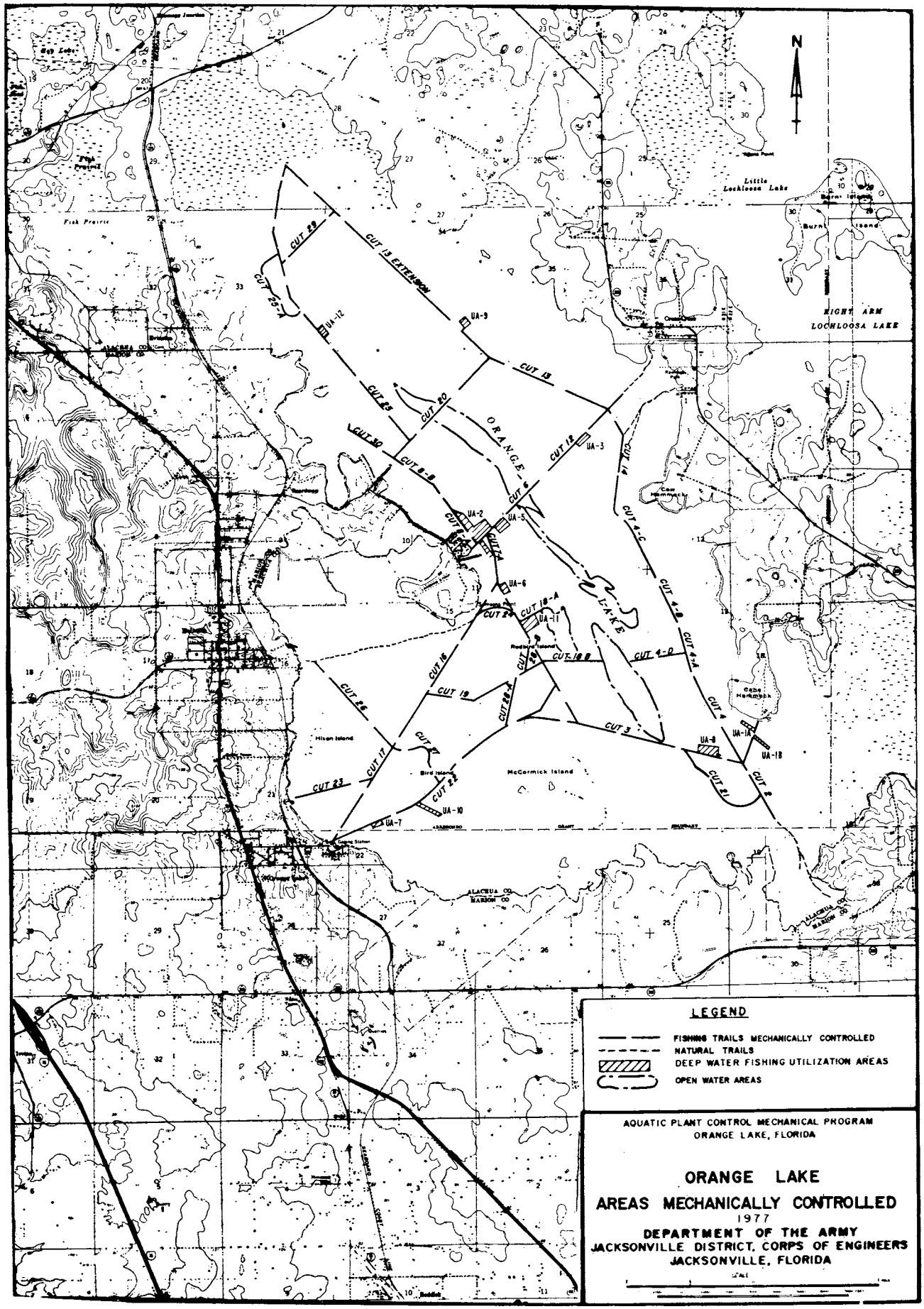

Figure 1. Map of the mechanical harvesting project on Orange Lake, FL 1977.

water was quite low at the beginning of the contract and continued to fall during the performance of the work. At project initiation all the cut material was to be disposed of on the upland. Transfer and disposal sites had been strategically located on the lake shore for this purpose. The receding water made all but two of the transfer sites too shallow for use. The transfer time became so great that it drastically reduced production. To overcome this problem we began disposing of the plants in the lake shallows in dense *Nuphar* stands. The effect of this change of procedure was an appreciable increase in production. Since this was not a research project we did not have sufficient data to give exact figures for increases in production. The difference in the total loads harvested per day, however, gives an indication of the increased efficiency. We placed 582 loads on the upland in 53 days and 518 loads in the lake in 27 days. The average in lake disposal of 19.19 loads per day was almost twice the average upland disposal of 10.98 loads per day.

Another of the difficulties was in trying to make successive adjacent cuts with the harvester in spotty vegetation. When the operation first began the hydrilla was sporadically to the surface making the first cut along the buoy line difficult. When the second or third successive cut was being harvested there was no guideline to follow so that the overlap of successive cuts varied and often strips were left uncut. After the hydrilla grew to the surface, or at least was all visible from the surface, the edge of the previous cut could be used as a guideline.

The original plan was figured conservatively from previous data under test conditions and on the assumption that all of the material would be removed to the upland. As the project progressed the operators became more proficient and progressively more of the material was disposed of near the harvester. This permitted the expansion of the amount of trails and use areas that could be maintained. Figure 1 is a map of the final configuration of the project. There was a total of 47 kilometers of trail that were cut and maintained for navigation use. The trails varied in width. Originally, the trails were to be 4.6 meters wide. We later found that wider trails were possible and allowed safer navigation. Most of the trails were finally approximately 9 meters wide. Total area of trails was therefore 43 hectares. Fourteen separate use areas were cut. The largest was 3.4 hectares and the smallest was 0.7 hectare with an average size of approximately 1.6 hectares. The total area of use areas cut was 23 hectares. Total area maintained open for navigation and use, including trails and use areas, was 65 hectares. This does not include areas naturally open that were accessed by the trail system or other areas chemically treated by the Florida Game and Fresh Water Fish Commission.

Operations under the contract were begun on 22 June 1977 and were complete on 28 October 1977. Of the 130 calendar days, 94 were available for work. Of the total 752 hours, 523 hours or 70 percent of the time was spent in productive operations. Lay time for adverse weather constituted 102 hours or 14 percent. Lost time for mechanical failures or other nonproductive time totaled 127 hours or 17 percent. Most of the lay time occurred in small increments over the course of the project. However, three work days were lost because of wind and rain. Five days were lost trying to get replacements for a hydraulic cylinder for the cutterhead and one day to get a cutter bar cable.

The harvester cut 1100 total loads during the project. The transporter handled 1079 loads (98%). The shore conveyor handled 582 loads (53%). The number of loads removed in a full work day varied from a low of 7 to a high of 33. The computed average was 13.8 loads per day. There were 582 loads (53%) placed on the upland and 518 loads (47%) placed in the lake shallows. There were 21 loads that were not handled by the transporter. Ten of the loads were transported by the harvester to the conveyor and 11 loads were deposited in shallow water by the harvester.

During the period when weights were taken and recorded, 128 cut loads were weighed. The lightest load weighed 776 kilograms and the heaviest was 1869 kilograms. In most cases, over 50 percent of each day's loads were within a 227 kilogram range. Average weight of the loads was 1320 kilograms. Based on this average 1,452,500 kilograms of hydrilla was removed from the trails and use areas.

A special area was set aside to determine the difference in density of recut vegetation. The initial cutting of the use area, UA-5, was ten loads of vegetation that weighed 10,800 kilograms. Twenty days later the hydrilla was beginning to show at the surface again and another cut was made. This time two harvester loads weighing a total of 1380 kilograms were removed from the same area. The recut removed was 13% as much weight as the first cutting and 20% as much volume. The recuts throughout the lake were similarly much less dense than the first cuts. The number of times a specific area had to be recut varied greatly. The most frequent was Cut 4, which was recut six times, an average of once each 15 days. The least frequent was Cut 13, which was only cut once in 56 days. We have no explanation for the difference.

Cost of the project was $73,156.52 including payment to the contractor and the Corps' inspection costs. Contract payment costs were $61,964.32. Corps inspection costs, including District Office personnel visits, labor, truck rental and airboat rental was $11,192.20. This was for the original cutting of the trails and maintaining them open for navigation usage for the duration of the growing period. Payment was not made to the contractor for periods that the equipment was not mobilized in satisfactory working order. With the maintained area of 66 hectares the cost for maintenance for the season was $1122.72 per hectare.

CONCLUSIONS

Mechanical control of hydrilla in Orange Lake using the Aqua-Trio was a success. Trails for navigation from access points in the lake to natural open water fishing areas and cut fishing areas were maintained useably free of hydrilla at a cost that was competitive with chemical methods of control. This was the Corps' first totally operational test of a mechanical system for hydrilla control. We learned that disposing of the cut vegetation in the lake shallows and longer times between recuts can effectively double the

amount of work that can be performed. Mechanical control is not the answer to hydrilla control under all conditions. However, in areas of almost complete infestation, mechanical systems such as the Aqua-Trio will be an effective tool in the integrated control of hydrilla. The action of the equipment is direct and gives immediate results.