

Cost and Effectiveness of Control of Weeds In Secondary Canals In Dade County, Florida

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In past years Dade County has removed weeds from the secondary canal system by both mechanical and chemical methods. In some cases, where there is not enough over-bank right-of-way or where property owners have placed fences, barbecue pits, patios, shrubs or trees in the maintenance easement and it is not possible to reach the canal with a dragline or truck there is no choice except to use an amphibious DUKW (ex-U.S. Army landing craft) or chemicals sprayed from a boat. The main objective is to keep the canal clean of aquatic weeds to carry its full capacity during floods. Canal maintenance for beautification only is desirable, but it is not considered a responsibility. Weed removal by chemicals does usually leave the canal in a more pleasing appearance than cleaning by dragline or DUKW; and, consequently, in residential areas we frequently use chemicals for weed removal because that reduces the number of complaints that we get from property owners.

We operate two spray boats and two trailer-mounted spray rigs. Our annual appropriation for chemicals is not great enough to keep all four spray crews at work 100 per cent of the time. This at times forces use of DUKWs where we would prefer to use chemicals. Before we make a final decision to use chemicals in a particular canal we put out a small test plot to see how long it is before weeds grow back. If we get control for less than three months, we use mechanical means of weed control. If we get control for more than three months, we ordinarily use chemicals. DUKW control costs less per mile than chemical control, and we can usually depend on three months control with DUKWs.

The amphibious DUKWs are used to plow the canals by dragging a toothed, metal A-frame along the bottom. This breaks weeds loose from the bottom. After floating to the surface the weeds are pushed to a collection point along the canal with a rake mounted on the DUKW. A dragline is then used to remove them from the canal and to load into trucks. This method does not remove the weeds along the slope of the canal but opens a channel in the center of flow of water. The use of chemicals gives better weed control, but we must continue to use DUKWs where chemicals do not perform satisfactorily or where the cost of chemicals is prohibitive. The number of miles of canals we clean by DUKWs in any one year is usually limited by our ability to keep the DUKWs in operating condition. We can remove weeds by DUKWs when there is considerable flow of water or clean the canal at the time of year when there is no flow. We will probably continue to use DUKWs until there are care chemicals that will control all types of aquatic weeds under all conditions, and at less than present costs.

In addition to amphibious DUKWs we also use draglines to remove aquatic growth from the canals and from

the banks. In addition this removes silt, cave-ins, material washed into the canal, and trash thrown into the canal. Trucks are used to haul away the material since there is usually insufficient room on banks to pile the debris. Although cleaning by dragline is listed as cleaning and cost records are kept this way the dragline cleaning nearly always results in some enlargement, some bank straightening or some deepening of the canal. Thus, overall benefits from using draglines are greater than the benefits from using either DUKW or chemicals.

We have three truck-mounted mobile units—two $\frac{1}{2}$ -yd. capacity and one $\frac{3}{4}$ -yd. capacity, and three $\frac{3}{4}$ -yd track-mounted machines. We also have one track-mounted gradall. These seven machines are used for canal maintenance, repair of culverts, installing or removing culverts, cleaning culverts, repair and maintenance of our salinity control structures, and removing trees, rubbish, junk cars, and other large objects that find their way into the canals. These are in addition to the draglines used for new excavation.

With draglines we get six to eight months control, and with amphibious DUKWs we get two to three months control.

We are using diquat for control of submersed and some floating weeds. We apply diquat in several ways—hosed on and surface spray for floating weeds and submersed weeds. If submersed weeds are infesting over 70 per cent of the canal, we surface spray the chemical or in some instances pour it in. This is done or has been done in small ditches where water is three inches to eight inches deep. We are using diquat for control of Florida elodea, naiad, bladderwort, pondweed, coontail, water hyacinth, water lettuce, duckweed and salvinia. We use Silvex and Kuron for control of alligatorweed and water pennywort. We use Karmex Urox 22 and Dowpon "C" for bank weeds. Our experience indicates that we cannot get satisfactory control of submersed weeds unless we treat or remove bank weeds at the same time.

There are two canals, Comfort Canal and Ludlam Glade Canal, that were treated with diquat at 0.5 ppmw in which we have had control for three and five years. These are the first two canals that we treated chemically for submersed weeds. They were treated in 1963 when we first found Florida elodea. Comfort Canal was treated May 8, 1963, and has had some spot treatment, but has not yet required complete retreatment. We also have three canals where maximum length of control is three months. One of these three has a flow of water at all times because of nearby well fields. We have not found the reason for the short control period in the other two canals. There is a canal across the street, which is connected to one of these canals by culverts in which we have control for one to one and one-half years. We have 21 canals under chemical

TABLE 1. AVERAGE CANAL CLEANING COSTS AND QUANTITIES FOR 3.5 YEAR PERIOD, OCT. 1964 TO MARCH 1968.

Type of Cleaning	Average Yearly Quantity Miles	Average Yearly Expend.	Average Cost per Mile Cleaned	No. of Times per Yr. for control ¹	Average Cost per Mile per Year
Chemical Spray, Floating Weeds	170.9	\$17,946	\$ 105	3	\$ 315
Chemical Spray Submersed Weeds	15.9	9,429	595	2	1,190
Drag with DUKWs	143.8	14,801	103	4	412
With Dragline	30.9	48,145	1,560	1.5	2,340

¹Number of times per year is estimated and is not based on records.

treatment, 17 of which are in residential areas where appearance is important or where there is no way to get draglines or trucks to the canal for cleaning.

We spend about \$35,000 per year to purchase chemical for weed control. Our total budget for operation, maintenance, repair, and construction is about \$550,000 per year. This does not include about \$190,000 for engineering and administration and about \$100,000 for capital improvements.

The annual cost for canal cleaning by each of four methods is presented in Table 1. Although canal cleaning by dragline is included, it is not comparable with the other three methods, due to the other benefits noted above. Draglines are used to remove weeds only in those places where chemicals have failed to give sufficient control and where it is impossible for an amphibious DUKW to gain access to the canal. We estimate that to keep a canal in satisfactory condition by dragline cleaning it must be cleaned one and one-half times per year or every eight months. There are some canals where conditions are such that use of draglines is the only satisfactory method for control of submersed weeds.

A canal would ordinarily be cleaned by dragline to remove silt and trash. When at the end of six, eight, or ten months the submersed weeds regrow, chemicals or DUKWs would be used for control; and draglines would not be used again in that canal for several years.

The floating weeds are controlled only by use of chemicals. We spend annually about \$27,000 for the chemical control of floating and submersed weeds. In addition we spend about \$35,000 per year for chemical control of weeds in ditches and on canal banks, so our total chemical weed control program is about \$62,000 per year.

We spend about \$15,000 per year for DUKW control of canal weeds (Table 1). We spend another \$50,000 per year

to mow canal and ditch banks. Thus our total mechanical weed control program (not including draglines) is about \$65,000 per year, and our total weed control program is about \$127,000 per year.

The costs of cleaning canals by DUKW and by chemicals are to some degree comparable. The chemical cleaning removes weeds from a larger portion of the canal and usually leaves the canal with a more pleasing appearance.

It usually costs about \$1200 per year to keep a mile of canal free of weeds by chemicals, and about \$400 per year to keep a canal free of weeds by use of DUKWs. It is for this reason that we use chemicals in about 16 miles of canal each year and DUKWs in about 140 miles of canal each year.

It is probable that as it becomes increasingly difficult to obtain DUKWs and more costly to keep them in good repair, we will shift to use of chemicals if it results in lower costs.

SUMMARY

It costs over \$2,000 per mile to keep an average canal free of weeds for one year by dragline. We use this method only where no other method is possible or where the benefits other than weed removal justify the cost.

It costs about \$1,200 to keep submersed weeds out of one mile of canal for one year by chemical spray. We use this method most often in places where appearance is important or where a greater proportion of weed removal is important.

It costs about \$400 to keep part of the submersed weeds out of one mile of canal for one year by DUKW. We use this method to remove submersed weeds from about three times the length of canal as we remove with chemicals and draglines combined because it is cheaper even though less effective.