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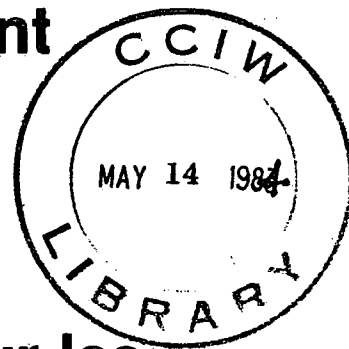


**Environment
Canada**

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Canada**

**National
Water
Research
Institute**

**Institut
National de
Recherche sur les
Eaux**



(Report No. 84-10)

**A NOTE ON THE
NWRI MICROLAYER SAMPLER**

by

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Burlington, Ontario

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THE NWRI MICROLAYER SAMPLER

INTRODUCTION

The thin, transitional water layer at the top surface of rivers or lakes can be an important reservoir of hazardous contaminants (Platford, 1982; Maguire et al, 1983), because it is often covered with a hydrophobic layer of lipid or other oily material. Sampling of this layer is difficult because it must, in effect, be two dimensional to avoid contamination by the underlying bulk water. Furthermore, if the sample is very thin, a large surface area must be removed in order to obtain a useable volume for analysis.

The most common microlayer samplers are usually screens or plates which are dipped into the water, then removed and drained or scraped to remove the adhering microlayer. These devices remove a surface layer anywhere from 0.01 microns (μ) to 100 μ in thickness depending on design and operating conditions (Norkrans, 1977; Platford, 1982). They all suffer from the same disadvantage, however, in that the individual operations collect such small volumes of surface sample that one litre of sample can hardly be collected in less than ten minutes. The rotating drum surface sampler described by Harvey (1966) combines the desirable features of an inactive inorganic

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surface with fast, simple operation. Our sampler is an enlarged version of Harvey's and can be operated by two men in a Boston Whaler. It can collect a one litre water sample representing 10 to 20 m² of surface area in about a minute.

Construction Details

The sampler is schematically illustrated in Figure 1 and critical data are shown in Figure 2. The sampler itself consists of a power driven ceramic covered cylinder which is rotated about its horizontal axis against the normal flow of water. The surface film adheres to the surface of the drum and is carried over the top and scraped off the back side, and then run into a sample bottle. The sampler and floats were supported from a frame which could be attached to the bow of a 17 foot Boston Whaler. The entire sampler (weighing 80 kg) could be raised clear of the water by means of a small winch, when in transit between stations.

The cylinder¹ was 100 cm long and 38 cm in diameter. The depth of immersion in the water was kept at about 2 to 3 cm by

¹ The cylinder was coated with ceramic by Clark Porcelain, 2440 Cawthra Road, Mississauga, Ontario.

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adjustment cranks communicating with the floats. The cylinder was rotated through a 1:10 reduction drive by a 1/8 hp 118 rpm DC motor whose speed was controlled by an SCR voltage controller. The control box also contained the rectifier so that power could be supplied by a 110 v AC generator.

The collected surface film was removed from the back side of the cylinder by a neoprene windshield wiper blade² which was arranged so that the water film ran into a metal trough the width of the cylinder, and then ran out a drain hole by gravity into the sampler bottle. Provision was made for pumping large samples from the trough to a bottle with a peristaltic pump, but this refinement could be eliminated at the cost of a slight decrease in convenience.

The Whaler was fitted with a 10 hp trolling engine and run at one to two knots during sampling. The power consumption for the cylinder drive was about 200 w and, for the pump, was about 120 w.

² Obtained in 1 m lengths from Tridon Limited, Burlington, Ontario.

Operation

If the cylinder rotates at 10 rpm (equivalent to a linear speed of 0.2 m sec^{-1}) and a microlayer 100μ thick adheres to it and is completely removed by the wiper blade, then a one litre sample should be collectible in about a minute. It is difficult to keep the boat speed this low, and, in practice, the higher speed through the water will result in some surface film being pushed aside or in the cylinder flooding with excess water. The estimated sampling rate was not unusually high, leading us to believe that cylinder flooding was not a problem.

REFERENCES

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APPENDIX

OPERATING INSTRUCTIONS FOR MICROLAYER SAMPLER

Note: This sampler is intended for use only on calm waters, relatively near shore.

Pre-Assembly Inspection

1. All parts contacting the sample water should be degreased, including drum trough and fittings.
2. Care should always be taken to avoid damaging the vitreous enamel surface of the drum. Chips and scratches should be coated with white enamel paint to prevent rusting and wiper damage.
3. Inspect wiper. Replace damaged wipers.
4. Inspect the upper jaws of the lifting frame clamps for loose or damaged rubber pads, and replace as necessary.

Assembly (see Figure 1)

5. Moor the Boston Whaler in a boat ramp or shallow water, the bow resting on land.
6. Two men are required to raise the lifting frame and slide the clamps over the gunwales of the boat. The foremost edges of the front clamps should be positioned flush with the joint of straight and curved sections of the gunwales.
7. Tighten the clamps by screwing down the wing nuts. An adjustable wrench should be used to grip the bolt head. Pull on the frame member connected to the clamps. If movement is apparent retighten clamps.
8. Slip the pusher arms and spacers on the pivot pins. Secure with hitch pins.
9. Bring the sampler into position. Slide the pusher arm rod ends onto the shafts provided on the sampler frame. Secure with hitch pins.
10. Pay out the wire rope on the winch and attach shackles to the lifting lugs on sampler the frame.

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11. For transport on the water, use the winch to raise the sampler and attach safety guy wires to the lugs provided on the lifting frame and pusher arms.

The sampler must not be transported at a position above that of the extended safety guy wires, otherwise the boat will become unstable.

During transport, check the condition of the lifting frame clamps. Retighten if necessary.

Sampling

12. Remove the dummy connector from the sampling drum motor and replace with the controller connector. Tube grease should be applied as required for easy removal or attachment of the watertight connections.
13. Attach tubing to the fitting provided on the end of the wiper trough on the sampler and then to the peristaltic pump. Run the pump discharge tubing to a reservoir or bottle. Attach the banana plug connectors to the terminals at the pump.

14. Before proceeding, check that the wiper is separated from the drum. If not, pull back on the trough and tighten the wing nut located on the right spring tension arm.

The entire surface of the drum must be wetted before contact is made with the wiper blade. A dry drum will cause excessive motor load as well as damage both drum and wiper.

15. Turn switches off and set speed control to zero on both drum motor controller and pump.
16. Start the two 300 w Honda generators. Do not attempt to straighten the DC line terminals. They are bent to mate with the DC supply receptacle.
17. Switch the drum motor controller on. Set the dial to the desired speed.
18. Allow the drum to complete at least one revolution before loosening the wing nut permitting the wiper to contact the drum.
19. Start the pump and adjust the speed to remove water flowing into the trough.

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20. Use a "kicker" to propel the boat at a low speed (about 1 to 2 knots).

If the pontoons begin to "dig" while sampling, tension should be applied to the winch's wire ropes.

Wiper contact pressure can be adjusted by increasing or decreasing the tension on the springs provided.

The drum can be levelled and its height adjusted relative to the water by using the level cranks provided.

Storage

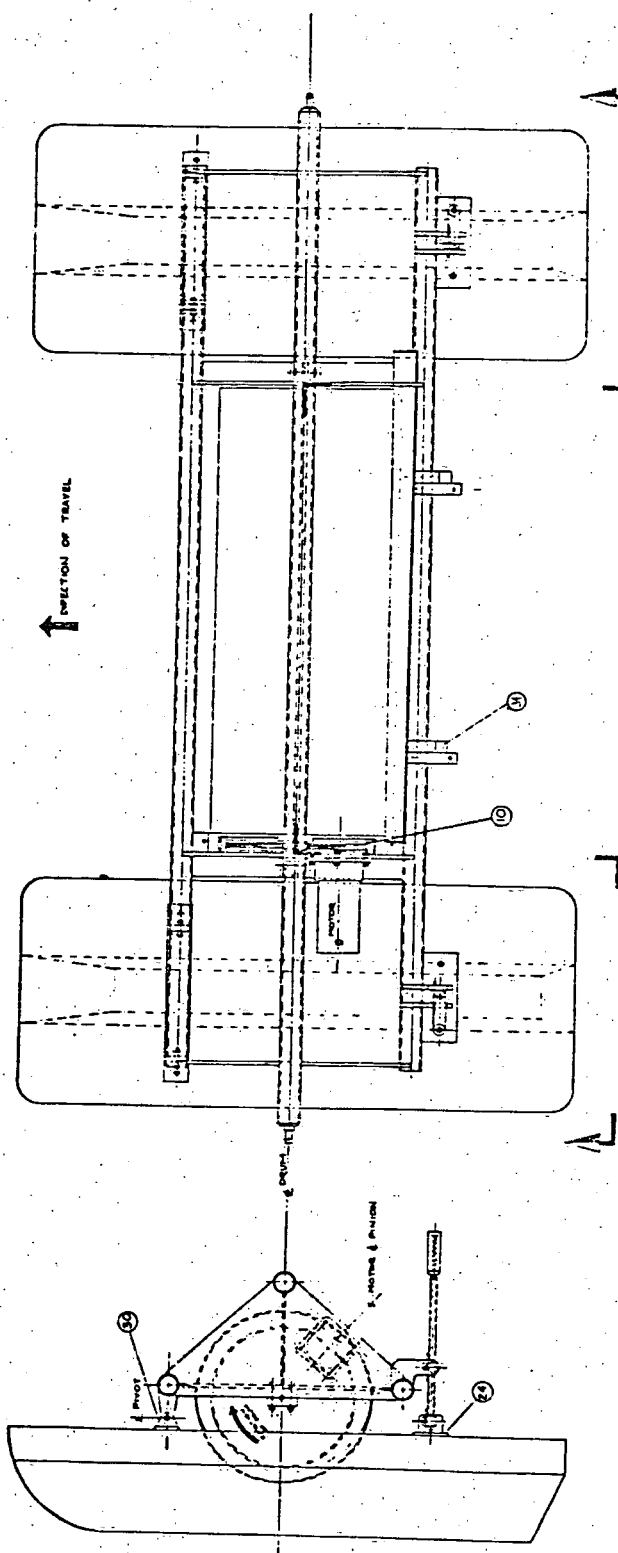
When not in use the wiper blade should be separated from the drum by tightening the wing nut on the spring tension arm.

The dummy electrical connector should always be replaced after use.

If being stored for a great length of time, the drum can be wrapped in cardboard to prevent damage.

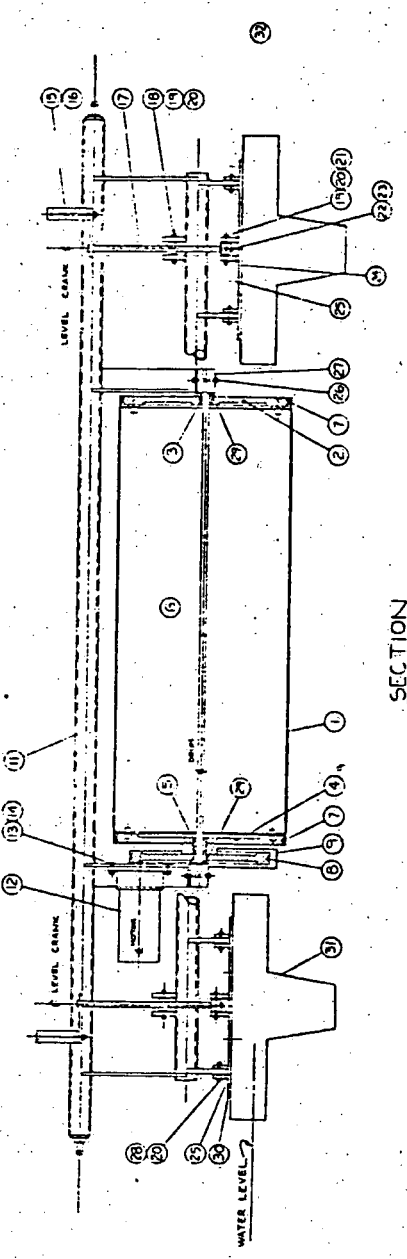
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3	1/8" Dia. Steel Rod
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33	1/8" Dia. Steel Rod
34	1/4" Dia. Steel Rod
35	1/8" Dia. Steel Rod

SURFACE SAMPLER
GENERAL ARRANGEMENT
 FIG. 1



ELEVATION

PLAN



SECTION

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