# ADDENDUM

# LOWER WINOOSKI RIVER STUDY

SUMMER, 1975

## TABLE OF CONTENTS

## LIST OF TABLES AND FIGURES

### Time of Travel Section



### Biology Section

# PREFACE

This addendum of the report entitled "Lower Winooski River Study, Summer, 1975" is divided into two separate and distinct parts: Time of Travel Data and Biology. Although both are contained in this addendum, each could stand alone as a separate addendum and, hence, continuity between them was not attempted. That is, each has its own Table 1, 2, etc., and the reader should remember this when locating the referenced tables.

## TIME OF TRAVEL DATA

During November 4 - 6, 1975, EPA, Technical Studies personnel conducted a time of travel (T of T) study on the lower Winooski River. Initially, this second study was to verify the time of travel data at the four reaches discussed in the June, 1975, study during periods of power generation as well as during periods of nongeneration. Two things happened which made the completion of these objectives impossible. First, high flows in the river limited periods of nongeneration and caused some freeboards at GMP No. 18 Dam to be broken or lost; thus, ensuring flow below GMP No. 18 at all times. This, in effect, eliminated the accuracy of any nongeneration time of travel data in Reaches 1 and 2. It also biased on the low side the flow going past GMP No. 18 during generating times as only the flow through the penstock was computed. The second problem was equipment failure. Three pumps and two portable generators broke down, resulting in early termination of the study. This allowed time for only the lower three reaches to be dyed. The three reaches studied were the following:

| Reach | Description | Length Kilometers | Length Miles |
| --- | --- | --- | --- |
| 1 | Crib dam in Winooski at the U.S. Route 2 and 7 Bridge to the mouth of the river | 16.4 | 10.2 |
| 2 | Green Mountain Power Station No. 18 to crib dam in Winooski | 2.1 | 1.3 |
| 3 | Green Mountain Power Station No. 19 to Green Mountain Power Station No. 18. | 10.4 | 6.4 |

The data salvaged from the study is presented in Tables 1-3. Time of travel was determined by timing the passage of Rhodamine WT dye between two known distances using recording Turner fluorometers to detect the dye fluorescence. Sharp normal peaks occurred at all pickup stations, and the peaks were considered to be the dye centroid and the corresponding times to be the times of travel. Table 1 shows the total power produced, hours of generation and corresponding average daily flow rates during periods of power generation for each dam. The flow rates do not include seepage under and through the dams or the water lost through the damaged freeboards at GMP No. 18. There is no estimate of the amount lost through the damaged freeboards. Table 1 does show the daily average flow at the U.S. G.S. Gage 2.8 kilometers below GMP No. 19.

Table 2 shows the reach being studied, the dates and times of the dye dump and pick up, and the distance the dye travelled.

Table 3 states the reach or portion of reach studied, time of travel for the measured stretch of the reach, projected time of travel for the total reach, and corresponding velocities. These travel times and velocities are for periods of combined generation-nongeneration and/or generation only.

The flow rates through the dam penstocks were somewhat higher during November than June. Because of the higher flow rates and longer generation times, some of the river side channel loops which were dry during the June time of travel study could be flowing. This would make comparisons of times of travel at different flows difficult because the effective channel cross sectional area increases greatly at these places. A good example of this is the dual channels around the island immediately below GMP No. 18. During the June study, the southern channel was carrying most of the water. If the higher flows in November caused the northern channel to flow also, the time of travel could increase even though the river flow increased. No effort was made to determine what portion of the flow the north channel was carrying, however.

CONCLUSIONS

1. Hydraulics of the river and equipment failure produced inconclusive time of travel data.
2. Due to the physical characteristics of the river bed, the velocity might not necessarily increase nor the time of travel decrease with an increase in flow.
3. An additional time of travel study should be undertaken in the summer of 1976 during periods of low flow and corresponding long periods of non power generation. The four reaches should be studied for flows during periods of non power generation only and periods of generation only. Combined times could be studied if time permits.

TABLE 1

POWER GENERATION AND CORRESPONDING FLOW RATES AT GMP NO. 19 AND GMP NO. 18

| | GMP NO. 19 | | | GMP NO. 18 | | |
|---|---|---|---|---|---|---|
| Date | Daily Power Production (Megawatt) | Hours of Generation (Hours) | Average Flow Rate** During Generation (cms/cfs)*+ | Daily Power Production (Megawatt) | Hours of Generation (Hours) | Average Flow Rate During Generation (cms/cfs)*+ |
| 11/04/75 | 128.4 | 0000-0400<br>0600-2300 | 44.9/1588 | 64.5 | 0000-0530<br>0800-2400 | 41.6/1471 |
| 11/05/75 | 126.1 | 0530-2400 | 50.1/1770 | 58.6 | 0000-0200<br>0700-2400 | 42.8/1512 |
| 11/06/75 | 120.1 | 0500-2400 | 44.2/1560 | 61.5 | 0000-0400<br>0600-2400 | 38.8/1370 |

* Does not include seepage at each dam nor loss through faulty and missing flash boards at GMP No. 18.

\+ At GMP No. 19 - 3.85 kilowatt-hours = 1 cfs-hours = 0.0283 cms-hours.
At GMP No. 18 - 2.04 kilowatt-hours = 1 cfs-hours = 0.0283 cms-hours.

** Average daily flow at the U.S.G.S. Gage below GMP No. 19 is 39.1, 36.2, and 33.7 for November 4-6, respectively. These correspond to an average flow rate during generation of 44.7, 47.0, and 40.4 cms, respectively.

TABLE 2
REACH STUDIED, DATES AND TIMES OF DYE DUMP AND PICKUP, AND DISTANCE DYE TRAVELLED

| | Dye Information | | | | Distance Dye Travelled |
|---|---|---|---|---|---|
| | Dump | | Pickup | | |
| Reach | Date | Time (Hours) | Date | Time (Hours) | Kilometers/Miles |
| 1 | 11/04/75 | 0905 | 11/04/75 | 2200 | 11.5/7.2 |
| 2 | 11/05/75 | 0140 | 11/05/75 | 1025 | 2.1/1.3 |
| 3 | 11/06/75 | 0615 | 11/06/75 | 1500 | 10.4/6.4 |

TABLE 3

RESULTS OF THE NOVEMBER, 1975, TIME OF TRAVEL STUDY ON THE LOWER WINOOSKI RIVER, VERMONT

| (1) Reach | (2) Total Length Km/miles | (3) Distance Dye Travelled Km/miles | (4) Observed T of T (Hours) | (5) Observed Average Velocity 3 ÷ 4 mps/fps | (6) Hours of Generation (Hours) | (7) Corrected Observed T of T (Hours)* | (8) Corrected Average Velocity 3 ÷ 7 mps/fps | (9) Corrected T of T for the Entire Reach 2 ÷ 8 (Hours) |
|---|---|---|---|---|---|---|---|---|
| 1 | 16.4/10.2+ | 11.5/7.2 | 12.92 | 0.248/0.811 | 12.92 | 12.92 | 0.249/0.811 | 18.4 |
| 2 | 2.1/1.3 | 2.1/1.3 | 8.75 | 0.066/2.16 | 3.42 | 3.42 | 0.169/0.554 | 3.4 |
| 3 | 10.4/6.4++ | 10.4/6.4 | 8.75 | 0.330/1.08 | 8.75 | 8.75 | 0.330/1.08 | 8.8 |

* Using the assumption movement is neglible during periods of nonpower generation, the corrected t of t is that period within the observed t of t that power was being generated at the dam immediately upstream from the reach.

\+ The June t of t study indicates this reach as 16.2 km long. This is in error. 16.5 km is the length which should be used. The 0.2 km difference does not significantly affect the values of t of t and velocity given for the June study.

++ The June t of t study indicates this reach as 10.1 km long. This is in error but does not significantly affect the t of t and velocity given for the June study.

# BIOLOGY

## Benthos, chlorophyll _a_, sediment-oxygen-demand

A qualitative benthos survey was completed for ten stations on the lower Winooski River during July-August, 1975, by EPA Region I Biologists, from the mouth of the river on Lake Champlain to Jericho a distance of 26.1 miles. Field analysis of substrate composition was recorded for each station and sediments were collected for bench sediment-oxygen-demand rates (Figure 1, Table 3).

Phytoplankton blooms were prevalent on the river and probably caused by the high total phosphorus levels (.02 - .42 mg/l) at all water quality stations (Report of Data-Table 13). Chlorophyll _a_ values were mesotrophic (3-20 ug/l) for 75% of the water samples, and eutrophic (>20 ug/l) for 23% of the samples. Only 2% of the water samples had chlorophyll _a_ values that are oligotrophic (0-3 ug/l)(Report of Data-Table 13).

Mean sediment respiration rates were moderate at all stations (0.10-1.46 gm $O_2/m^2$/day) and indicates that organic nutrients are not accumulating in excessive amounts (Table 2).

High dissolved oxygen levels were prevalent in the lower Winooski River (4.7-12.0 mg/l) during a period of low flow in July and August (Report of Data-Table 13).

An extensive qualitative search for macroinvertebrates at each of the ten biology stations yielded abundant life and diversity living on and in the substrata of various composition.

Station WR14B in Jericho was the only station with a rock and stone substratum and was inhabited with a clean water variety of benthic life, including stoneflies (Acroneuria abnormis), mayflies (Stenonema interpunctatum, S. bipunctatum, Isonychia sadleri, Heptagenia sp.), several caddis flies of genus (Hydropsyche), riffle beetles (Psephenus herricki), limpet snails, planarians, alderflies, and crayfish (Table 1). Eighteen different kinds of animals were found at Station WR14B and comprised 22% of the total of 82 different invertebrates collected in the Winooski River at all stations (Table 2).

Gross polluted substrates from severe bottom decomposition populated with 'sewage fungus' such as Sphaerotilus natans or only one or two species of the pollution tolerant fauna of sludge worms (Tubificidae) and the red midgefly larvae (Chironomous) called 'blood-worms' was not found in the lower Winooski River.

Moderate or mild pollution from organic enrichment of the substratum downstream of the several waste water treatment plants is indicated by the benthic community collected with the pollution tolerant chironomids and tubificids in the sediments of moderate mean respiration rates.

Station WR10B is downstream of two waste water treatment plants (WT07, WT06) and the dominant chironomid larvae are associated with a diverse community of mayflies, caddis flies, riffle beetles, dragonflies, cladocerans and snails on a muddy sand substrate with a moderate mean respiration rate of 0.50 grams $O_2/m^2$/day.

Hydropsyche simulans a pollution intolerant net spinning caddis fly larvae was the dominant specie living on the sandy substrate with a fine layer of silt at Station WRO7B located downstream of two more waste water treatment plants (WTO5, WTO4). Associated with the caddis flies were the mayfly, Pseudocloen sp., blood-worm, Chironomous riparius, alderfly, Sialis sp., planarians, black fly larvae, Simulian sp., isopod, Asellus militaris, snail, Physa elliptica, and cyclopoid copepods. Biological analysis of water quality of Station WRO7B indicates the water column interfacing the substrate is well aerated to support the caddis flies, mayflies and alderflies, and with moderate enrichment of the substrate to supply nutrients for the other species in this community.

Moderate levels of organic contamination is indicated by the dominance of the facultative amphipod (Gammarus) in the benthic community on the brown mud substrate of Station WRO1B at the mouth of the Winooski River as it flows into Lake Champlain. The greatest number of kinds of benthos (21) and percent of total kinds collected for all ten biology stations (25) were living on the substrate of Station WRO1B. Mayflies, caddis flies, midgeflies, riffle beetles, isopods, clams, snails, mites and worms were in this abundant and diverse community.

Deposition of sediment from the Winooski River forms a large alluvial fan into Lake Champlain. Bench respiration of bottom soil from the shallow embayment (Sta. LC01S) are low, mean rate of 0.10 grams $O_2/m^2/day$, indicating that nutrient-bearing materials are not being deposited, but are probably transported into the deep waters of Lake Champlain.

PAGE NOT

AVAILABLE

DIGITALLY

## TABLE I

**Winooski River, Vermont**
**Qualitative Benthos Survey**
**July 30 - Aug. 6, 1975**

| Organisms | WR01B | WR02B | WR03B | WR04B | WR05B | WR06B | WR07B | WR10B | WR13B | WR14B |
|---|---|---|---|---|---|---|---|---|---|---|
| **Plecoptera (stoneflies)** | | | | | | | | | | |
| *Acroneuria abnormis* | - | - | - | - | - | - | - | - | - | x |
| **Ephemeroptera (mayflies)** | | | | | | | | | | |
| *Stenonema tripunctatum* | - | - | - | - | - | - | - | - | x | - |
| *Stenonema interpunctatum* | - | - | - | - | - | - | - | - | x | x |
| *Stenonema bipunctatum* | - | - | - | - | - | - | - | - | - | x |
| *Heptagenia sp.* | - | x | - | - | - | - | - | - | - | x |
| *Isonychia sadleri* | - | - | - | - | - | - | - | - | - | x |
| *Polycentropus centralis* | - | - | - | - | - | - | - | - | x | - |
| *Polycentropus cinerus* | - | - | - | - | - | - | - | - | x | - |
| *Neureclipsis sp.* | - | - | - | - | - | - | - | - | x | - |
| *Caenis sp.* | x | - | - | - | - | - | - | x | - | - |
| *Pseudocloeon sp.* | - | - | - | - | - | - | x | - | - | - |
| *Hexagenia bilineata* | - | - | x | - | - | - | - | - | - | - |
| **Trichoptera (caddis flies)** | | | | | | | | | | |
| *Hydropsyche simulans* | - | - | - | - | - | - | x | x | - | - |
| *Hydropsyche bifida* | - | - | - | - | - | - | - | - | - | x |
| *Hydropsyche bronta* | - | - | - | - | - | - | - | - | - | x |
| *Hydropsyche recurvata* | - | - | - | - | - | - | - | - | - | x |
| *Polycentropus remotus* | - | - | - | - | - | - | - | - | - | x |
| *Hydropsyche sp.* | - | - | - | - | - | - | - | - | x | - |
| *Leptocella candida* | - | - | - | - | - | - | - | x | - | - |
| *Leptocella sp.* | - | - | - | - | - | - | - | x | - | - |
| *Agraylea multipunctata* | x | - | - | - | - | - | - | - | - | - |
| *Limnephilus sp.* | - | - | - | x | - | - | - | - | - | - |

TABLE I (Con't.)

Winooski River, Vermont
Qualitative Benthos Survey
July 30 - Aug. 6, 1975

| Organisms | Stations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR01B | WR02B | WR03B | WR04B | WR05B | WR06B | WR07B | WR10B | WR13B | WR14B |
| Neuroptera (alderfly) | | | | | | | | | | |
| Sialis sp. | - | - | x | x | - | x | x | - | x | x |
| Odonata (dragonfly) | | | | | | | | | | |
| Aeschna sp. | - | - | - | - | - | - | - | x | - | - |
| Erpetogomphus sp. | - | - | - | - | - | - | - | - | - | x |
| Coenagrionidae | - | - | - | - | x | - | - | - | - | - |
| Coleoptera (beetles) | | | | | | | | | | |
| Gyrinus sp. | x | x | - | - | - | - | - | - | x | x |
| Psephenus herricki | - | - | - | - | - | - | - | - | - | x |
| Stenelmis sp. | x | - | x | - | - | x | - | x | - | - |
| Agabus sp. | - | - | - | - | - | - | - | x | - | - |
| Hydaticus sp. | - | - | - | - | x | - | - | - | - | - |
| Lepidoptera (caterpillar) | | | | | | | | | | |
| Synclita obliteralis | - | - | - | - | x | - | - | - | - | - |
| Diptera (flies) | | | | | | | | | | |
| Simulian sp. | - | - | - | - | - | - | x | - | - | - |
| Chrysops sp. | - | - | - | x | x | x | - | x | - | - |
| Microtendipes sp. | - | - | - | - | - | - | - | - | x | - |
| Crytochironomous sp. | - | - | x | - | x | - | - | x | x | - |
| Paralauterborniella sp. | - | - | - | - | - | - | - | - | x | - |
| Glyptotendipes sp. | - | x | x | x | - | x | - | x | - | - |
| Tanytarsus sp. | x | x | - | - | x | x | - | x | - | - |
| Procladius sp. | - | - | x | x | x | x | - | x | - | - |

TABLE 1 (Con't.)

Winooski River, Vermont
Qualitative Benthos Survey
July 30 - Aug. 6, 1975

| Organisms | WR01B | WR02B | WR03B | WR04B | WR05B | WR06B | WR07B | WR10B | WR13B | WR14B |
|---|---|---|---|---|---|---|---|---|---|---|
| **Diptera (flies) (Con't.)** | | | | | | | | | | |
| Chironomous riparius | x | - | - | - | x | x | x | - | - | - |
| Chironomous sp. | - | - | - | - | - | x | - | - | - | - |
| Polypedilum sp. | - | - | x | - | x | - | - | - | - | - |
| Alblabesmyia sp. | x | - | - | x | - | - | - | - | - | - |
| Probezzia sp. | - | - | x | - | - | - | - | - | - | - |
| Tanytarsus flavipes | - | x | - | - | - | - | - | - | - | - |
| Stilobezzia sp. | - | x | - | - | - | - | - | - | - | - |
| Glyptotendipes (polytomus) | x | - | - | - | - | - | - | - | - | - |
| Glyptotendipes (senelis) | x | - | - | - | - | - | - | - | - | - |
| Chironomous (cryptochironomous) | x | - | - | - | - | - | - | - | - | - |
| Polypedilum (tritum) | x | - | - | - | - | - | - | - | - | - |
| **Pelecypoda (clams, mussels)** | | | | | | | | | | |
| Sphaerium sp. | - | - | x | x | x | x | - | - | - | - |
| Pisidium sp. | x | x | x | x | - | - | - | - | - | - |
| Margaritifera margaritifera | x | - | - | - | - | x | - | - | - | - |
| Unionidae | - | - | x | - | - | - | - | - | - | - |
| **Gastropoda (snails)** | | | | | | | | | | |
| Ferrissia tarda | - | - | - | - | - | - | - | - | - | x |
| Ferrissia rivularis | - | - | - | - | - | - | - | - | x | - |
| Physa elliptica | - | - | - | - | x | x | x | x | - | - |
| Helisoma anceps | x | - | - | x | - | - | - | - | - | - |
| Bithynia tentaculata | - | - | x | - | - | - | - | - | - | - |

TABLE I (Con't)

Winooski River, Vermont
Qualitative Benthos Survey
July 30 - Aug. 6, 1975

| Organisms | Stations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR01B | WR02B | WR03B | WR04B | WR05B | WR06B | WR07B | WR10B | WR13B | WR14B |
| Gastropoda (snails) (Con't.) | | | | | | | | | | |
| Ferrissia sp. | - | x | - | - | - | - | - | - | - | - |
| Amnicola sp. | - | x | - | - | - | - | - | - | - | - |
| Gyraulus sp. | x | - | - | - | - | - | - | - | - | - |
| Physa sp. | x | - | - | - | - | - | - | - | - | - |
| Amnicola limosa | x | - | - | - | - | - | - | - | - | - |
| Amphipoda (scuds) | | | | | | | | | | |
| Gammarus sp. | x | - | x | x | x | - | - | - | - | - |
| Gammarus pseudolimnaeus | - | x | - | - | - | - | - | - | - | - |
| Isopoda - (sow bug) | | | | | | | | | | |
| Asellus militaris | - | - | - | - | x | x | x | - | - | - |
| Asellus sp. | x | x | - | - | - | - | - | - | - | - |
| Decapoda (crayfish) | | | | | | | | | | |
| Orconectes propinquus | - | - | - | - | - | - | - | - | - | x |
| Cladocera (water flea) | | | | | | | | | | |
| Daphnia sp. | - | - | - | - | x | - | - | x | - | - |
| Copepoda (copepods) | | | | | | | | | | |
| Cyclopoida | - | - | - | - | - | - | x | - | - | - |
| Ostracoda (seed shrimp) | - | - | - | x | - | x | - | - | - | - |
| Tricladida (planarians) | | | | | | | | | | |
| Dugesia tigrina | - | - | - | - | - | - | x | - | - | - |
| Dugesia sp. | - | x | - | - | - | - | - | - | - | x |

TABLE I (Con't.)

Winooski River, Vermont
Qualitative Benthos Survey
July 30 - Aug. 6, 1975

| Organisms | Stations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | WR01B | WR02B | WR03B | WR04B | WR05B | WR06B | WR07B | WR10B | WR13B | WR14B |
| Hydracarina (water mite) | | | | | | | | | | |
| *Hydrachna sp.* | x | x | - | - | - | - | - | - | - | - |
| Bryozoa (moss animalcules) | - | - | - | - | - | - | - | - | - | - |
| *Hyalinella punctata* | - | x | - | - | - | - | - | - | - | - |
| Hirudinea (leech) | | | | | | | | | | |
| *Placobdella parasitica* | - | x | - | - | - | - | - | - | - | - |
| Oligochaeta (aquatic worms) | | | | | | | | | | |
| Tubificidae | x | - | x | x | x | x | - | - | - | - |
| *Limnodrilus sp.* | - | x | - | - | - | - | - | - | - | - |
| *Fridericia sp.* | - | - | - | - | - | - | - | - | - | x |
| Branchiobdellidae | - | - | - | - | - | - | - | - | - | x |
| Total Kinds - 82    Station Kinds | 21 | 16 | 14 | 12 | 15 | 14 | 9 | 14 | 12 | 18 |

**TABLE 2**

Winooski River Study
Benthos and Substrate Data
July-Aug., 1975

| Station | Substrate | Dominant invertebrate | No. of Kinds | %Of Total Kinds* | Mean Respiration Rate gm $O_2/m^2$/day |
|---|---|---|---|---|---|
| LC01S | sand | - | - | - | 0.10 |
| WR01B | brown mud | amphipods | 21 | .25 | 0.94 |
| WR02B | sand, gravel fine layer sludge | midgeflies, amphipods | 16 | .19 | 1.20 |
| WR03B | brown mud fine sand | midgeflies | 14 | .17 | 1.46 |
| WR04B | fine sand | midgeflies | 12 | .14 | 0.72 |
| WR05B | sand, silt, clay | midgeflies, amphipods | 15 | .18 | 0.66 |
| WR06B | brown mud | red midge, tubificids | 14 | .17 | 0.96 |
| WR07B | silt over sand | caddis flies | 9 | .11 | 0.54 |
| WR10B | mud, sand | midgeflies | 14 | .17 | 0.50 |
| WR13B | sand, mud | mayflies | 12 | .14 | 0.68 |
| WR14B | rock, stone | mayflies | 18 | .22 | - |

*82 Total kinds collected from all stations.

TABLE 3

Winooski River Biology Stations
Latitude and Longitude

| Stations | Latitude | Longitude |
|---|---|---|
| WR01B | 44° 31' 30" | 73° 16' 21" |
| WR02B | 44 31 45 | 73 16 04 |
| WR03B | 44 31 40 | 73 14 44 |
| WR04B | 44 30 38 | 73 13 40 |
| WR05B | 44 30 13 | 73 12 32 |
| WR06B | 44 29 24 | 73 12 02 |
| WR07B | 44 29 17 | 73 10 58 |
| WR10B | 44 29 33 | 73 08 39 |
| WR13B | 44 28 53 | 73 04 54 |
| WR14B | 44 26 32 | 73 01 13 |
| LC01S | 44 31 45 | 73 16 39 |

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUBJECT: Errata for Report Entitled "Lower Winooski River Study, Summer, 1975"

DATE: April 8, 1976



FROM: 1AS

TO: See List Below

The following are the errata for the above referenced report as of March 31, 1976:

Table 1
- Presently: Lists classes A-D water quality criteria.
- Should be: Only classes A-C should be listed. Class D criteria should be deleted.

Table 4
- Presently: Water discharge at GMP No. 18 for 1000 hours on 08/06/75 does not show the corresponding flow in cubic meters per second (cms) for 980 cubic feet per second (cfs).
- Should be: 27.8 cms - 980 cfs.

Figure 3
- Presently: Graph of river elevation at Station WQ05 for 08/02/75 indicated a straight line at an elevation of ten inches.
- Should be: Beginning at 0945 hours, line should rise from ten inches to 31.5 inches at 1020 hours. Line should level off at 31.5 inches until 1155 hours at which time it should fall to an elevation of ten inches at 1255 hours.

Appendix I - Winooski River Cross Sections
- Presently: Scale-Horizontal 1 cm = 3.05 meters (1 inch = 10 feet).<br>Vertical 1 cm = 0.305 meters (1 inch = 1 foot).
- Should be: Scale-Horizontal 1 cm = 30.5 meters (1 inch = 100 feet).<br>Vertical 1 cm = 3.05 meters (1 inch = 10 feet).

Appendix II
Page II-1
- Presently: Length in meters of Reach No. 3 shown as 10,058 with corresponding feet as 33,000.
- Should be: 10,400 meters; 34,000 feet.

Table II-2

Presently:

| Reach | Hour of Dye Dump* | Observed Distance Travelled (meters) | Pick Up Time (hours) | Velocity (M/sec) | Calculated Time of Travel (hours) |
|---|---|---|---|---|---|
| 1 | 0920 | 15454 | 26.0 | 0.02 | 27.2 |

Should be:

| Reach | Hour of Dye Dump* | Observed Distance Travelled (meters) | Pick Up Time (hours) | Velocity (M/sec) | Calculated Time of Travel (hours) |
|---|---|---|---|---|---|
| 1 | 0920 | 15454 | 26.0(A) | 0.17 | 27.2 |

Table II-2

Presently: Last sentence in footnote (A) ends ". . . the entire reach 14.6 hours.".

Should be: ". . . the entire reach 14.8 hours."

Donald P. Porteous
Sanitary Engineer

TO: A. Ikalainen
W. Wirtanen
E. Hall
D. Fierra
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