RESOURCE DEVELOPMENT BRANCH

MANUSCRIPT REPORT

No. 68-3

Proposed Flow Control Scheme

Medway River

Queens County, Nova Scotia

by

J.M. Millen

April, 1968

FISHERIES SERVICE
DEPARTMENT OF FISHERIES AND FORESTRY OF CANADA
HALIFAX, N.S.

PROPOSED FLOW CONTROL SCHEME

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Maritimes Region

1. Summary This report presents an engineering proposal for the maintainence of summer flows, for the benefit of juvenile Atlantic Salmon rearing naturally in the Medway River system. The basis of design, and proposed layouts are given with cost estimates.

2. Introduction

2.1 Three previous reports provided the background for this study. These are:

Biological Report: L. Dominy, May, 1966

Interim Report: G. E. Jefferson, January, 1966

Engineering Report: G. T. Beaulieu, September, 1967

Generally data from the above are not repeated below, however, important results are summarized.

2.2 It is postulated that the capacity of the system to rear Atlantic Salmon is greatly reduced in low rainfall summers when the river virtually stops running. The two exceptionally dry summers of 1965 and 1966 are reported to have brought the 1967 parr population to a low level.

The assessment of benefits to the fishery from the flow control measures proposed, is beyond the scope of this report.

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2.3 This proposal is to augment the natural summer flows of the lower Medway River from storage at Molega Lake and Tupper Lake. Storage on Molega Lake is not new to the system. In 1950 the Department renovated an old lumber industry dam with the object of stabilizing summer flows. Unfortunately, due to a combination of design features, erratic operation and inadequate maintenance, the usefulness of the project was limited and short lived.

2.4 There are no obstructions to the ascent of salmon up the river to Harmony Mills generating plant. The present and envisaged salmon production occurs down river from this plant, or on other tributaries. Pollution is not a problem in this river system.

2.5 Further possibilities for the development of the Medway River, beyond the scope of this report should be noted. One is the clearance of two obstructions on the Pleasant River tributary to open the upper reaches to salmon. On the Main Branch the construction of a fish pass effective up and down stream at Harmony Mills generating plant would make the headwaters available to salmon. This would need to be accompanied by the clearance of old timber dams, no longer used, in the headwaters. Logging operations have also caused heavy damage to

stream beds in this area. The possibility of the eventual closure of the Harmony Mills generating plant (1200 H.P.) is worth recording. This would make the storage at McGowan Lake available for flow control and would make the restocking of the headwaters a more attractive project.

3. Hydrology

3.1 Low Flows. Long term flow records (over 40 years) of the Medway River at Charleston and Harmony Mills have provided the basis of a comprehensive study of the river's discharge characteristics. The summer flows are extremely erratic. Whereas the long term average for August (the lowest month) is about 320 c.f.s., there is a 50% chance that the daily minimum each year will be less than 80 c.f.s. One year in four the daily minimum is less than 40 c.f.s. See Fig. I. Because the river contains many stillwaters which do not dry up even at very low flows, the daily mimimum may not be the most significant indicator of the severity of a drought. Considering the mean flow for a calendar month the record shows a 50% probability that the lowest mean flow for a calendar month will be less than 160 c.f.s. each year. One year in four, the mean flow of the driest month is less than 100 c.f.s. See Fig. II

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The typical drought year pattern, likely to occur one year in four, is as follows. The river discharge at Charleston drops below 200 c.f.s. in the third week in July, and falls rapidly to below 100 c.f.s. in fifteen days. If no rain falls the discharge is reduced to 35 c.f.s. by the later part of August. More usually rain showers supplement the natural storage, and the minimum discharge, often between 10 and 40 c.f.s., is reached in mid September. Usually fall rains carry the river back to normal levels in October, though drought conditions have extended into the third week in October. See Fig. III.

3.2 Minimum discharge and storage requirements

A flow of 100 c.f.s. has been established as minimum for access of adult salmon to the upper river (Jefferson). It is reported that anglers favour flows above 500 c.f.s. for good fishing. Measurements have shown that on the lower river, about 150 c.f.s. is required to cover most of the river bed. This figure of 150 c.f.s. has been adopted as the design minimum under flow control. An examination of the worst drought years on record show that a supplement of 9000 c.f.s. days storage would be required (return period 50 years) to maintain a minimum flow of 150 c.f.s. See Fig. IV.

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3.3 Possible storage locations

The Main Branch of the Medway River is dammed at McGowan Lake for generation of hydro power at Harmony Mills. Despite the provision of a fishway, salmon production has ceased above this point. While the operation of this plant helps to conserve spring run-off, in a dry year the plant will be shut down by mid summer and the discharge below the plant reduced to a few c.f.s. Storage above this point would not be of value to the fishery under these circumstances.

Tupper Lake, feeding the Medway River through the Westfield River tributary is suitable for a small storage scheme which offers minor benefits to the lower river but which has been developed as a proposal because of the importance of the Westfield River itself as a spawning and rearing area (Dominy).

Molega Lake on the Wildcat tributary is a suitable site for providing storage sufficient to meet the requirements of this project. This tributary enters the Medway River five miles downstream from the confluence of the Westfield and Main Branches thus leaving those reaches unprotected if the Tupper Lake storage is not included in the scheme.

Ponhook Lake would be suitable for providing storage for the lower river, but its shore is relatively occupied with residences and summer cottages and the outlet is not a good dam site. Control structures are proposed at

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the outlets of Tupper and Molega Lakes. These two dams are not alternatives but are complementary. See Drawing M-F-467.

3.4 High flow conditions

The maximum recorded discharge of the Medway River at Charleston is 22,600 c.f.s. (1956). Compared with the forty years of record this flood has a return period of about 1400 years. This flood has been adopted as the design flood for the scheme. Flows of the Westfield and Wildcat tributaries have been assessed (Beaulieu) as respectively 10% and 24% of the flow at Charleston. Design flood for the Tupper Lake scheme has thus been set at 2260 c.f.s. and for the Molega Lake scheme at 5500 c.f.s.

The use of the proposed dams for flood control is not recommended for the following reasons.

a/ As only 35% of the catchment would be under the Department's control with both dams completed, peak discharges on the lower river could not be significantly altered by any operation of these control works.

b/ Provision for flood control would require large gates with relatively expensive gate structures, and frequent servicing visits during the high flow period from November to May.

c/ The relatively slight gradients of the river keep velocities down and minimizes damage to the river

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bed during floods.

However, it is feasible to provide some measure of flood protection to the Westfield River below Tupper Lake. Should this be proved desirable the gate sizes could be increased with some increase in cost.

4. Molega Lake storage dam

4.1 Site Selection. The site chosen for the proposed Molega Dam is a few hundred feet upstream from the old dam. The new site is narrower between the high ground than the old, and farther removed from the summer camp of the owner of the land on which the North abutment must lie. Three test bores at this site show an average depth of 16 feet of sandy gravel overburden to bedrock. See Drawing M-B-716.

4.2 Proposed Dam Structure. A sheet pile cut off with concrete cap and heavy rip-rap protection is proposed. The spillway is designed to carry 5500 c.f.s. at a depth of 4.5 feet. The 6 foot by 4 foot slide gate will pass 120 c. f. s. at minimum water levels and a maximum of about 400 c. f. s. The three bay vertical slot fishway provides for fish passage at all stages of storage and discharge. See Drawing M-A-717.

4.3 Access. The only existing access to the Molega Dam site is by water. It is proposed to build a road on the true left of the Wild Cat River from the Molega Village road. About two miles of road will be necessary. It is considered that road access is vital to the economic construction

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and adequate maintenance and operation of the facility.

4.4. Black Rattle Dam. At higher levels Molega Lake flows out through Black Rattle Lake. A timber crib and rock filled dam used in the past to control this back flow is at present in poor repair. It is proposed to make repairs to the old structure and to raise it so that it is not overtopped until there is 2'-0" flowing over the Molega Dam spillway. A vertical slot fishway will be built of treated timber to accommodate the run of gaspereaux.

4.5 Estimated Costs Summary

Molega Storage Dams	$
Excavations and river diversion	7,000
Dam structure (sheet pile, concrete crest)	28,500
Gates and fishway structure	28,000
Rip rap protection work	7,000
Access Road	10,000
Repairs to Black Rattle Dam	5,000
Land aquisition	1,500
TOTAL:	$87,000

Note: These are at 1968 expected rates and should be reviewed if construction is at a later date.

5. Tupper Lake storage dam

5.1 Storage requirement. It is proposed to provide sufficient storage to maintain a minimum flow of 30 c.f.s. in the Westfield River for a sixty day drought. This amounts to 3600 acre feet, or 2.7 feet live storage on Tupper Lake.

5.2 The site chosen is several hundred feet down stream from the outlet of the lake. Investigation drilling has shown bedrock at about five feet below the normal bed of

the stream at this point. It is proposed to obtain the necessary storage by drawing down the lake 1.5 feet below present minimum levels. Present maximum levels will not be exceeded. Access to the site is from an adjacent highway.

5.3 Proposed dam structure. A concrete gravity dam founded on bedrock will be required. An eight foot radial gate will control the flow a small fishway will be required. See Drawing M-C-718.

5.4 Estimated Cost Summary

Tupper Lake Dam	$
Dredging, excavation	3,000
Concrete Dam	12,500
Gate, Fishway & misc. metalwork	9,500
Land aquisition	1,000
	$26,000

G9-24
LOGARITHMIC PROBABILITY
MADE IN CANADA

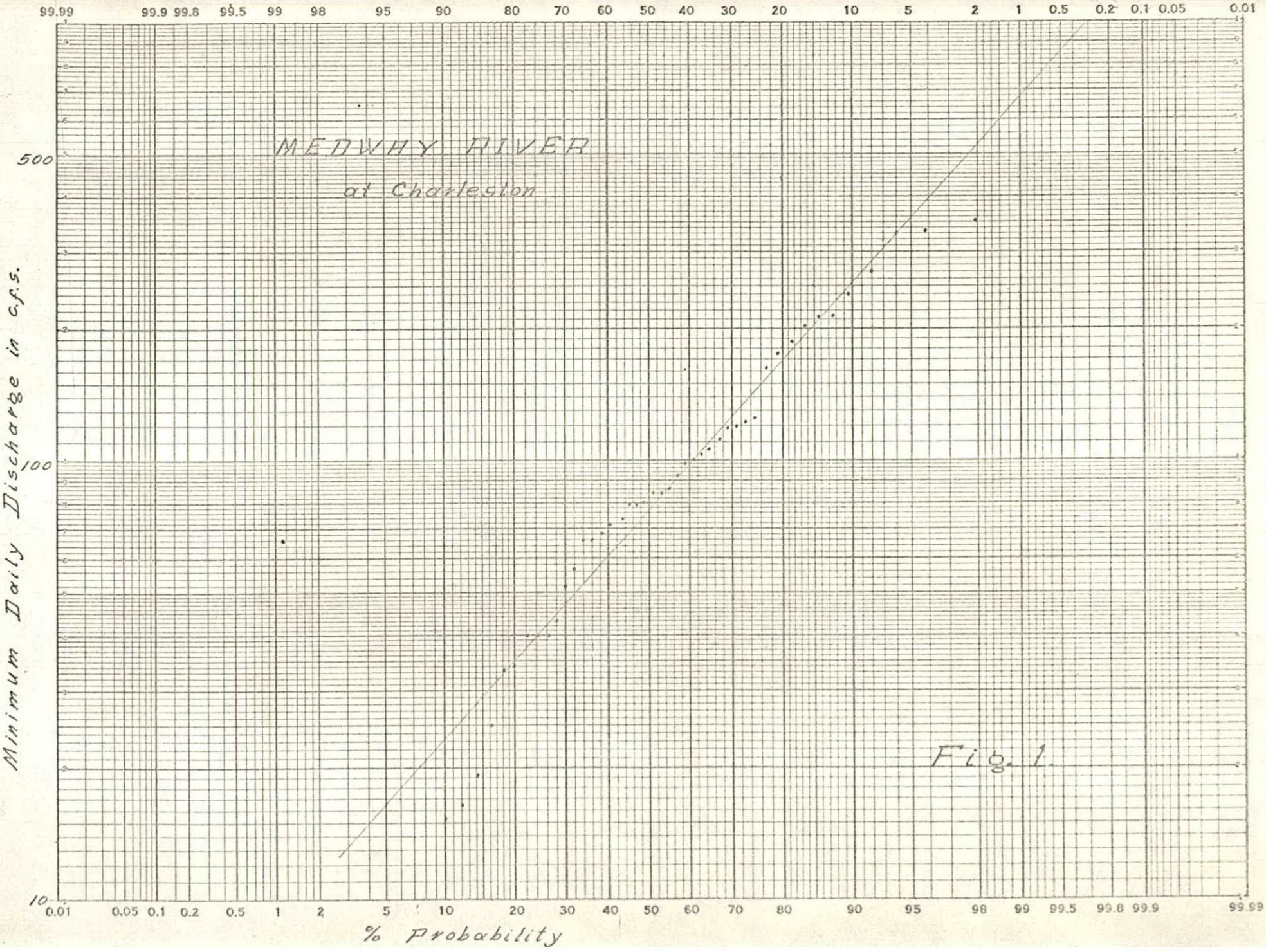


Fig. 1

G9-24
LOGARITHMIC PROBABILITY
MADE IN CANADA

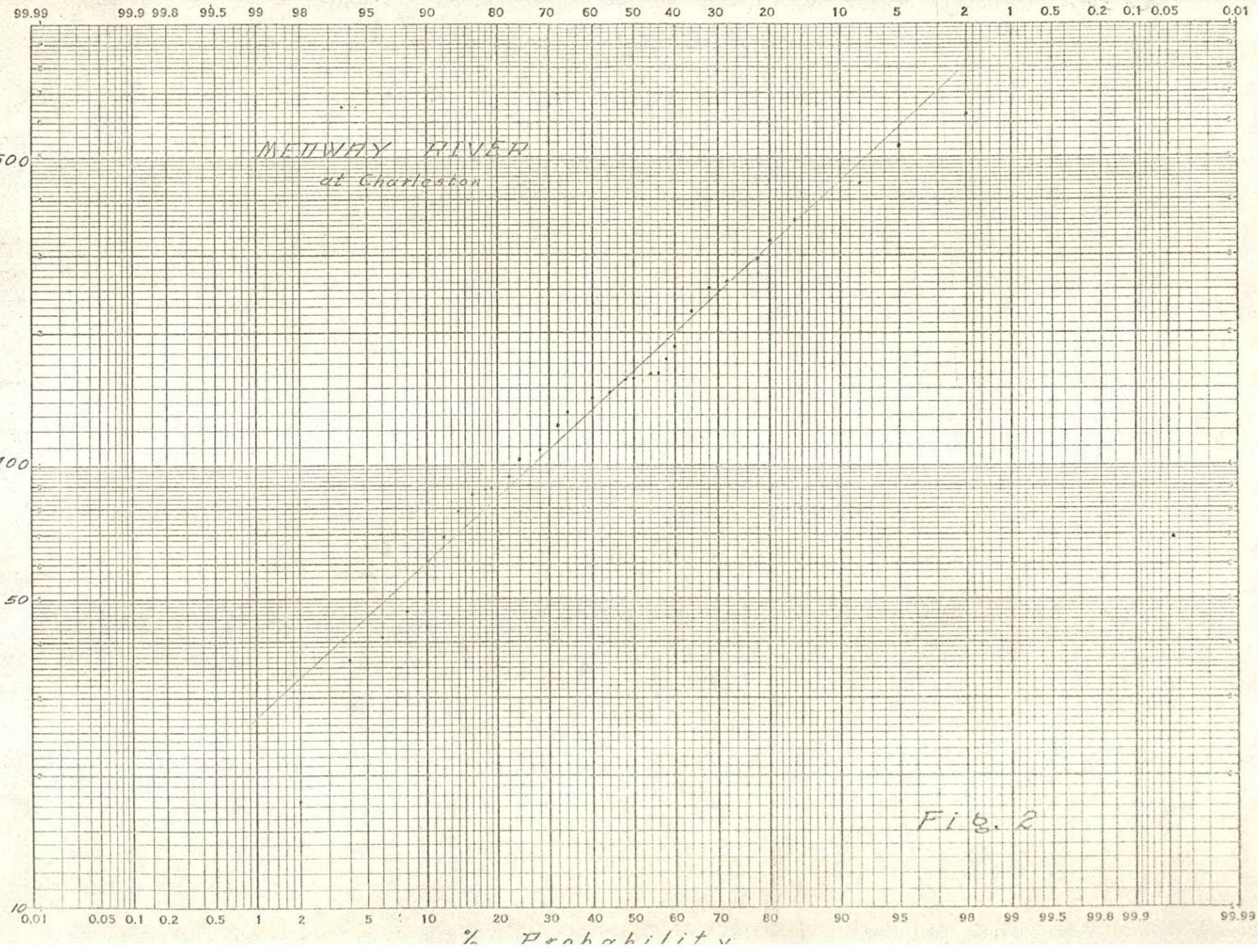
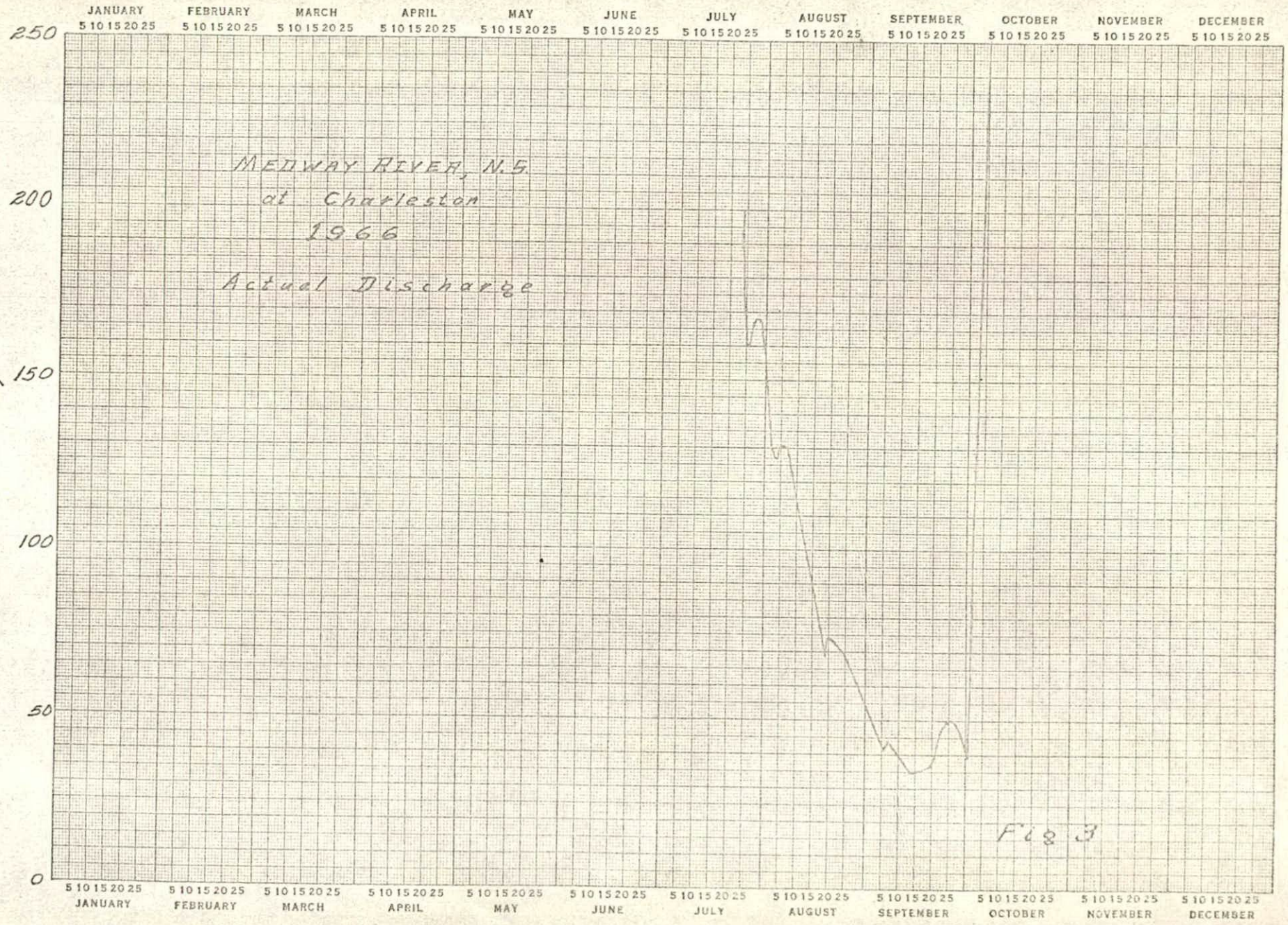


Fig. 2

K+E 1 YEAR BY DAYS 46 2893
X 250 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.



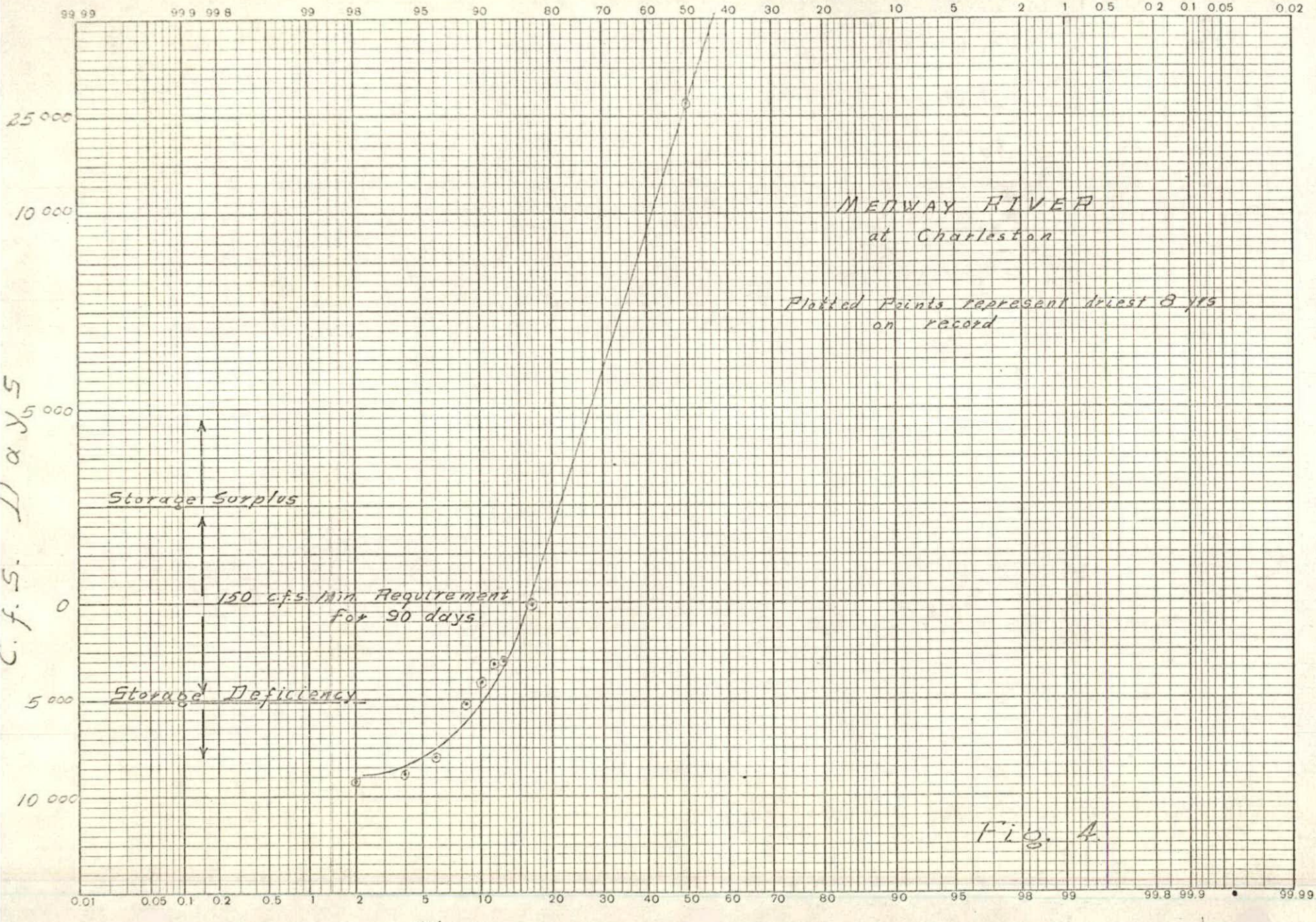


Fig. 4.

MEDWAY RIVER

TOTAL SQ. MI. 545.9

BURNABY LAKE	— 520	ACRES
EIGHT MILE "	— 560	"
CROOKER "	— 610	"
LONG "	— 550	"
PONHOOK "	— 7950	"
CHRISTOPHER "	— 1330	"
MOLEGA "	— 8050	"
SHINGLE "	— 1420	"
TUPPER "	— 1000	"
HARMONY "	— 600	"
McGOWAN "	— 1330	"
ALMA "	— 580	"

DRAWN: B.F.H.	DEPARTMENT OF FISHERIES, CANADA	DATE: Jan 12 66
CHECK: [illegible]	MEDWAY RIVER SYSTEM NOVA SCOTIA	SCALE: 1" = 4 Miles
APPROVED: D.C. Riley		DWG. No.: M-F-467

M-F-467