Flow Variations on the East Aishihik River and Their Affects on Fish Habitat and Populations

Clive Osborne, Fisheries Technician,
Fish and Wildlife Branch,
Renewable Resources
Government of Yukon

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Clive Osborne

Director, Fish and Wildlife Branch

Supervisor

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ABSTRACT

The East Aishihik River drains Canyon, Aishihik and Sekulman Lakes. Flow has been diverted from the river through a diversion canal to a power station south of Canyon Lake. This study's purpose was to assess the effect of eliminating the diurnal fluctuation of flows from 150 cubic feet per second (cfs.) to 25 cfs. while maintaining a constant flow of 25 cfs. through the summer months. The diurnal fluctuation in flows did not have a significant effect on either water levels or stream widths. The elimination of the 150 cfs. flow does not appear to result in significant effects to fish habitat.

East Aishihik River, Aesthetic Flows, Fish Habitat

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INTRODUCTION

The East Aishihik River drains Canyon, Aishihik and Sekulman Lakes. The Yukon Energy Corporation operates a 30 megawatt hydro-electrical generating station using these lakes as reservoirs. Control structures located at the south ends of Canyon and Aishihik Lakes regulate flows for hydro- electric power generation. Water is diverted through a diversion canal to the electrical turbines at a power station south of Canyon Lake (Figure 1).

The Yukon Energy Corporation wishes to store as much water as possible in Canyon and Aishihik lakes. Water is released through the Canyon Lake control structure to the East Aishihik River throughout the summer months. The terms of Water Licence Y3L5-0307 issued under the Northern Inland Waters Act have required that an "aesthetic flow" of 150 cfs. be released over Otter Falls during the summer daylight hours and a maintenance flow of 25 cfs. during the night.

The objective of this study was to assess the effects of terminating the aesthetic flow of 150 cfs. over Otter Falls. while maintaining a constant flow of 25 cfs. during the summer months.

METHODS

The East Aishihik River water levels were measured once a month at three sites between the Canyon Lake control structure and the confluence of the East and West Aishihik Rivers. Each of the sample sites was representative of a reach (Reach Boundaries are shown in Figure 1). The most upstream site was located on Otter Pond (S1), a second site in reach 2 (S2), 1.5 kilometers downstream of Otter Pond and 6.3 kilometers upstream of the confluence of the East and

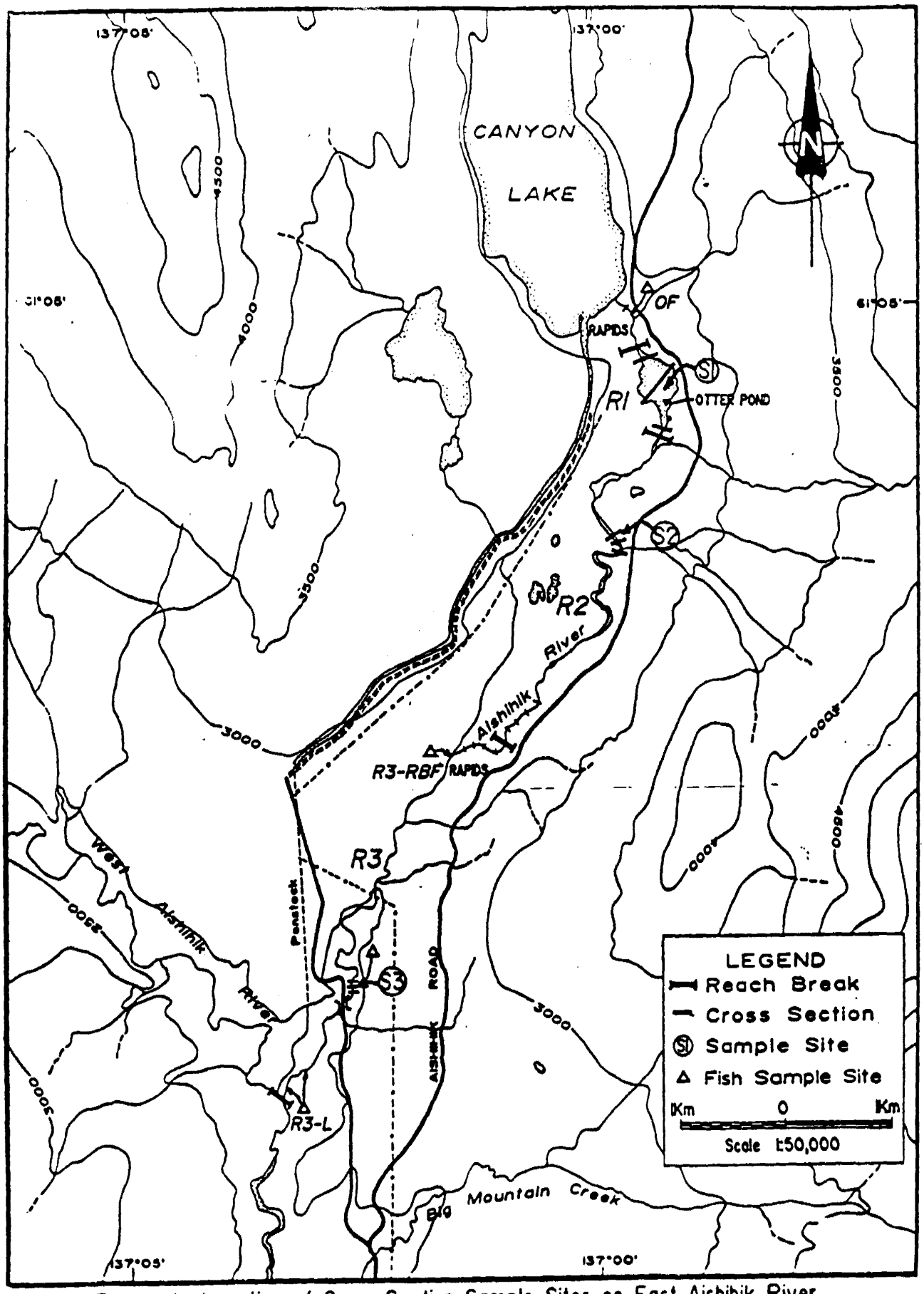


Figure 1. Location of Cross Section Sample Sites on East Alshihik River.

West Aishihik Rivers and a third station approximately 400 meters upstream of the road crossing (S3). Three cross sections were surveyed at each site using a engineers level and are illustrated in Figure 1. These cross sections were referenced (marked in the field) so that subsequent readings would be taken on the same line. Readings were taken across the river/pond width during the initial survey in June to produce a profile of the cross section. On subsequent surveys, readings were taken only at the water's edge for both the main and side channels. Cross sections (transects) were generally set perpendicular to flow. Transect location was chosen to sample riffle, run (glide) and pool habitat types where possible.

The three sites were sampled on the following dates

June 12-13
July 18-19
August 24

In August, the YEC received authorization to release a constant 25 cfs. save for periodic releases to complete this study. On September 7, YEC was authorized under their existing licence to terminate all flow over Otter Falls to East Aishihik River.

Water levels were measured as the vertical drop from a reference datum (0) on the east bank. A mean transect water level was computed by averaging the east and west bank water levels of the main and where appropriate, side channels. The distance from the east bank reference datum to the water's edge on both sides of the river was also measured.

The difference between water levels at 150 cfs and 25 cfs at each site and means of these values were then calculated. A further average of these figures was derived to give a difference in water levels between 150 and 25 cfs.

for each site for all survey periods over the summer. Differences in stream width were assessed by measuring the horizontal distance from the reference datum to the river's edge on both the left and right banks. Analysis methodology for stream width was similar to that of water levels.

Fisheries Investigations

Otter Pond and East Aishihik River were sampled for the presence of fish and their life stages. Sampling methods included electroshocking, gill netting, minnow trapping and observation. Fisheries investigation are described in Appendix III.

RESULTS

The difference between site water levels at 150 and 25 cfs. for the months of June through August are presented in Appendix I Table I. Mean difference between site water levels at 150 and 25 cfs. are presented in Figure 2. Mean differences in water levels showed a tendency to decrease with distance downstream from Canyon Lake.

The difference between site wetted widths for both banks for the months of June through August are presented in Appendix I Table II. Mean difference between site wetted widths at 150 and 25 cfs. are presented in Figure 3. The greater differences occurred on the left bank looking downstream from Otter Pond and for the reach 2 site. The thalwag (deepest part of the channel) was closer to the right bank in both cases. The site mean was not calculated for Otter Pond since there are significant differences in the lengths of the transects and each transect statistic is presented in table 1.

Fig. 2 Mean Difference in Water Levels

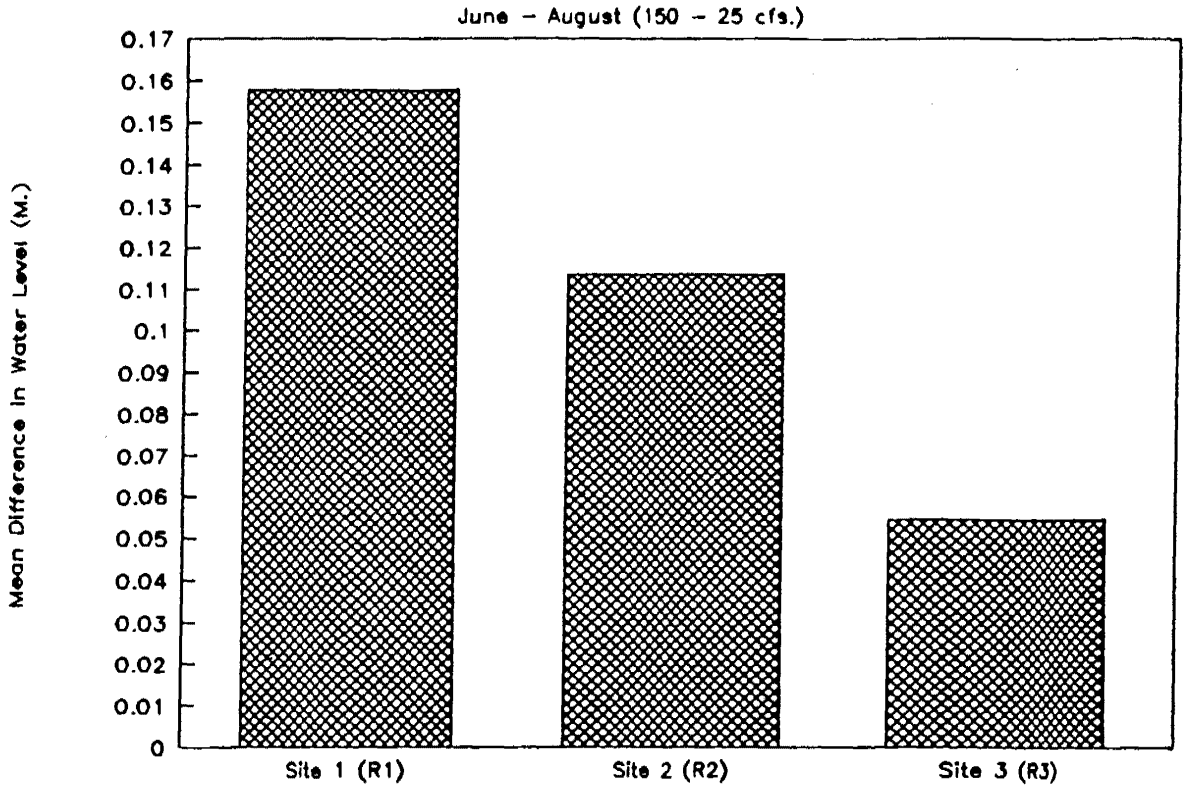


Fig. 3 Mean Difference in Stream Wetted Widths

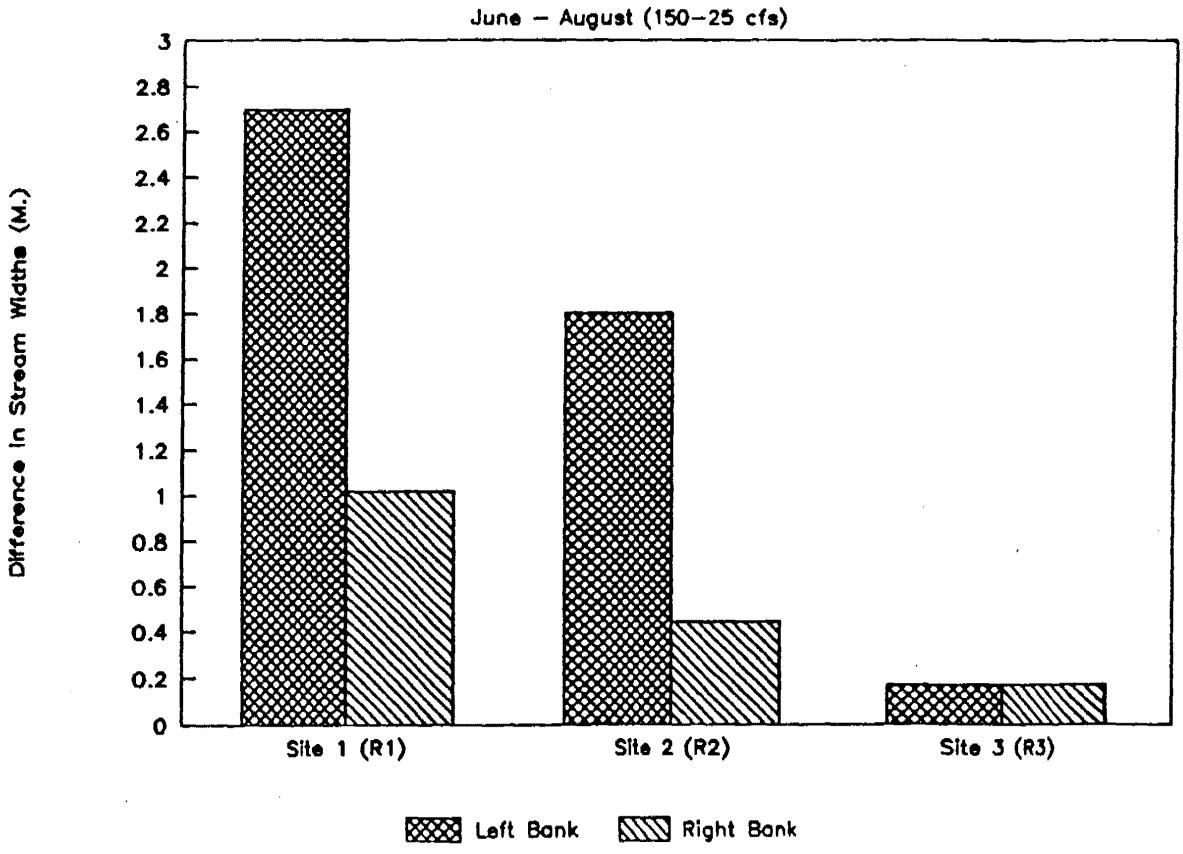


TABLE 1 MEAN DIFFERENCE IN WETTED WIDTH (PERIMETER) AS PERCENTAGE OF MAXIMUM STREAM WETTED WIDTH

Station	Left Bank %	Right Bank %
Otter Pond		
Transect A	11	2
Transect B	0.3	0.6
Transect C	6.4	2.2

Basin profiles, maximum and minimum water levels for all nine transects are presented in Appendix II.

DISCUSSION

Hydrology

The drop in the water depth, resulting from the diurnal regulation at the control structure, represents an decreasing percentage by volume of the total stream mean depth from Site 1 to Site 3. Reductions in wetted width also decrease with distance downstream. As 1991 was a very wet year, the dampening affect of flows from tributary run-off streams to the river were more pronounced than would generally be the case.

Heavy precipitation in the late summer of 1991 resulted in Aishihik Lake approaching it full licenced supply level. Excess water was allowed to flow over and through the Canyon Lake control structure at an estimated rate of approximately 34 cubic meters per second (1200 cfs.). It is not known to what degree this surging had on fish that might have been in the river.

Management Implications

The diurnal fluctuation in flows did not have significant effect on either water levels (stream depths) or on stream widths. There does not appear to be a significant gain in the quality and quantity of fish habitat with the retention of 150 cfs. aesthetic flows. It was difficult to ascertain the effects of fluctuating flows on fish populations due to their extremely low densities and restricted distributions in the river.

During the course of the study mass movement of surface layers of the soil (solifluction lobes) was observed on the south-west shore of Otter Pond. Standing water was also noted in the bush some distance from shore. This soil movement may be caused by seepage from the diversion canal into Otter Pond.

Appendix I

APPENDIX 1
TABLE 1 Difference in Water Levels in Meters

	June 150 to 25 cfs.	July 150 to 25 cfs.	Aug 150 to 25 cfs.	Mean
SITE 1 (R1)				
Transect A	0.1	0.27	0.12	
Transect B	0.16	0.14	0.23	
Transect C	0.1	0.11	0.19	
Mean	0.12	0.17	0.18	0.16
SITE 2 (R2)				
Transect A	0.2	0.17	0.04	
Transect B	0.43	0.04	0	
Transect C	0.13	-0.07	0.08	
Mean	0.25	0.05	0.04	0.11
SITE 3 (R3)				
Transect A	0.15	0.02	-0.03	
Transect B	0.08	0.04	-0.05	
Transect C	0.28	0.01	-0.01	
Mean	0.17	0.02	-0.03	0.05

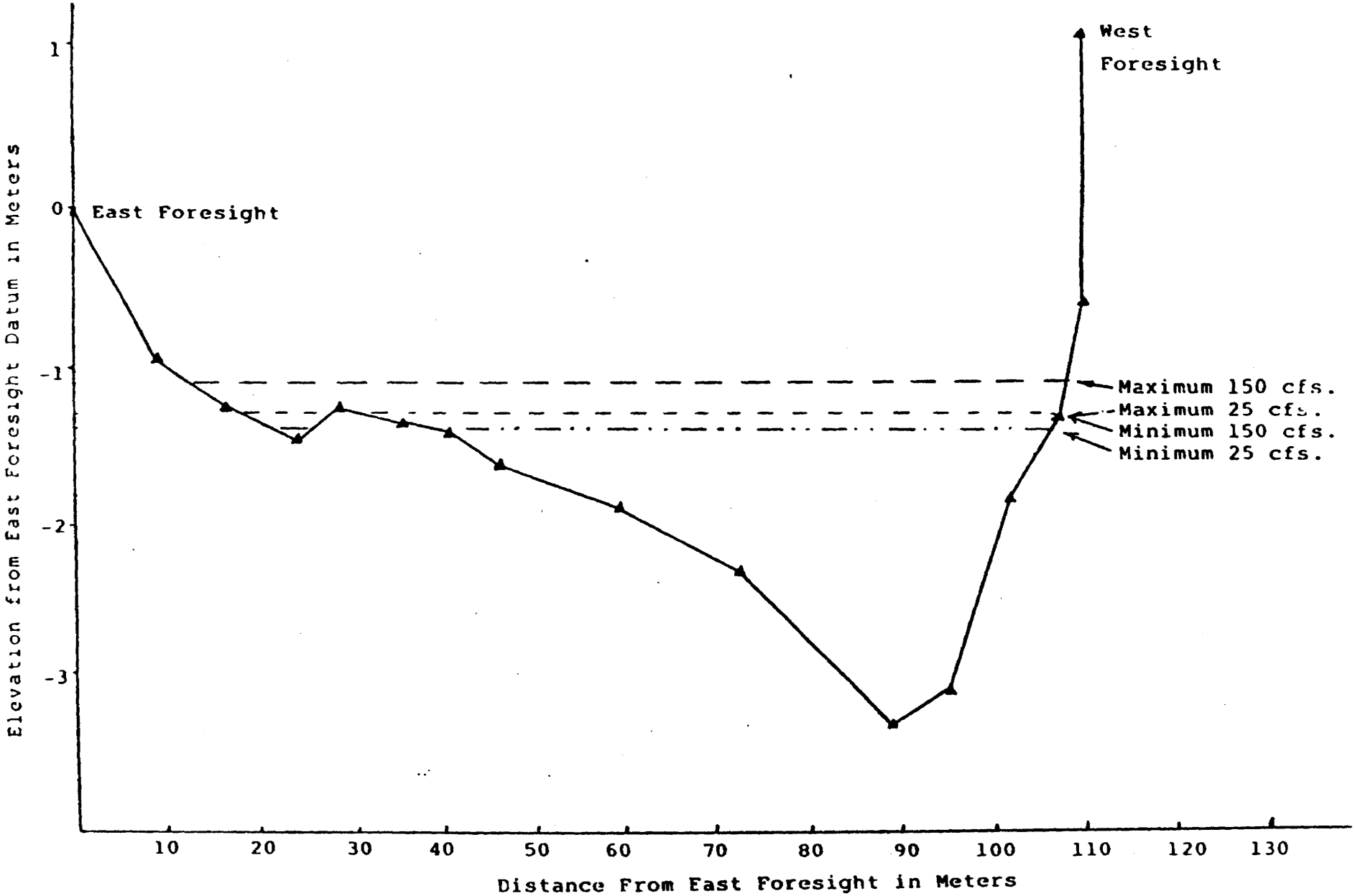
APPENDIX 1 Difference in Horizontal Distance To Water's
TABLE 2 Edge Measured From Foresight in Meters

	June		July		Aug		Mean	
	L.Bank	R.Bank	L.Bank	R.Bank	L.Bank	R.Bank	L.Bank June - Aug.	R.Bank
OTTER POND								
Transect A	8.8	0.2	-	2.1	-	-0.51		
Transect B	1.39	0.7	-0.3	2.7	0.87	1.12		
Transect C	0.25	0.35	-1.05	2.15	8.9	0.38		
Mean	3.5	0.4	-0.7	2.3	4.9	0.3	2.57	1.00
REACH 2								
Transect A	3.2	1.7	-	1.5	1.8	0.33		
Transect B	0.5	0.4	-	0.2	0.7	0.11		
Transect C	5.9	-0.4	-	0.15	0	0		
Mean	3.2	0.6	-	0.6	0.8	0.1	1.33	0.43
REACH 3								
Transect A	0.1	0.1	0.05	0.2	-0.07	-0.34		
Transect B	2.1	0.2	-0.7	1.05	-0.58	0.05		
Transect C	0.3	-0.1	0.1	0.4	0.25	0		
Mean	0.8	0.1	-0.2	0.6	-0.1	-0.1	0.17	0.20

Appendix II

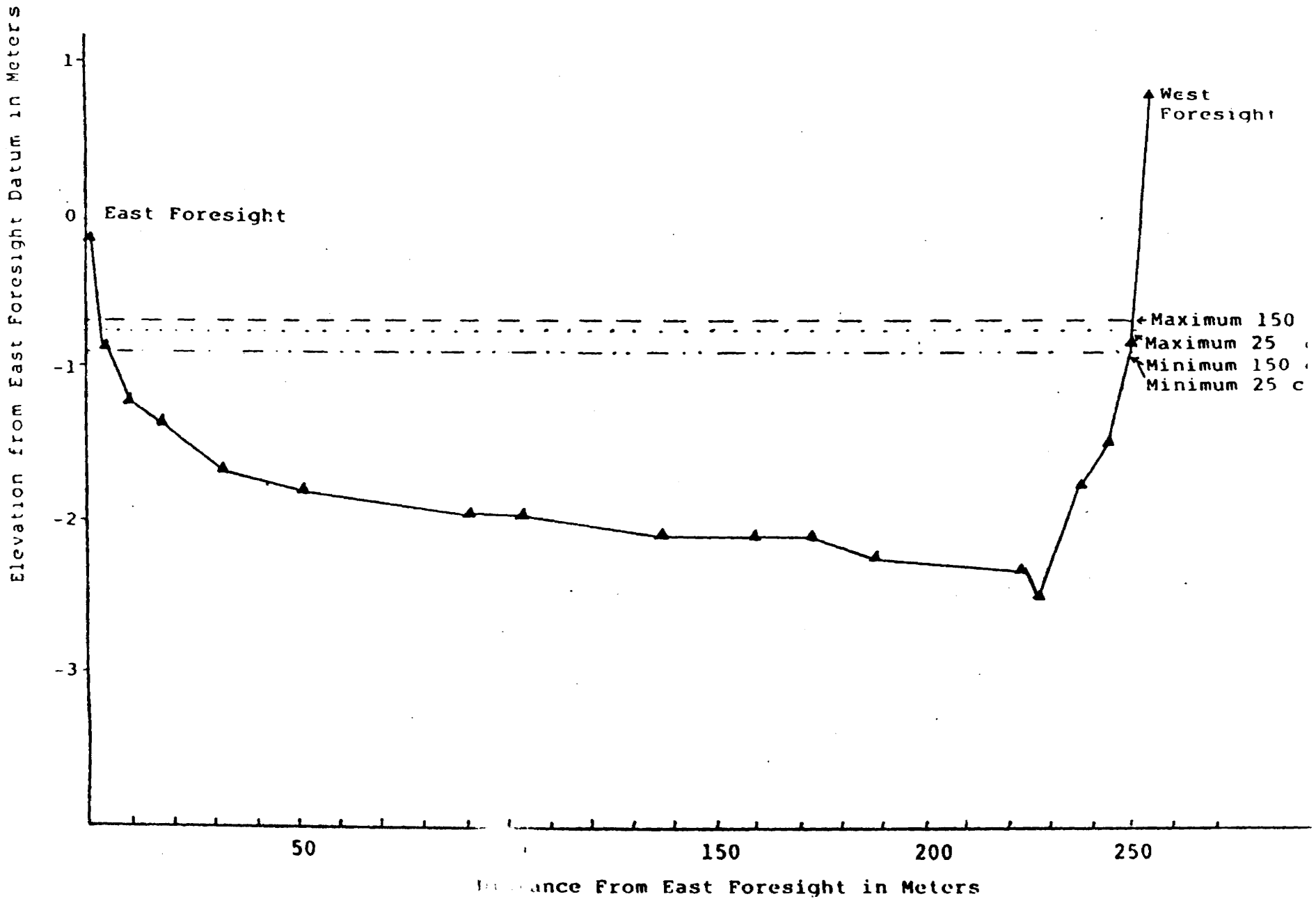
Basin Profile - Otter Pond

Transect A



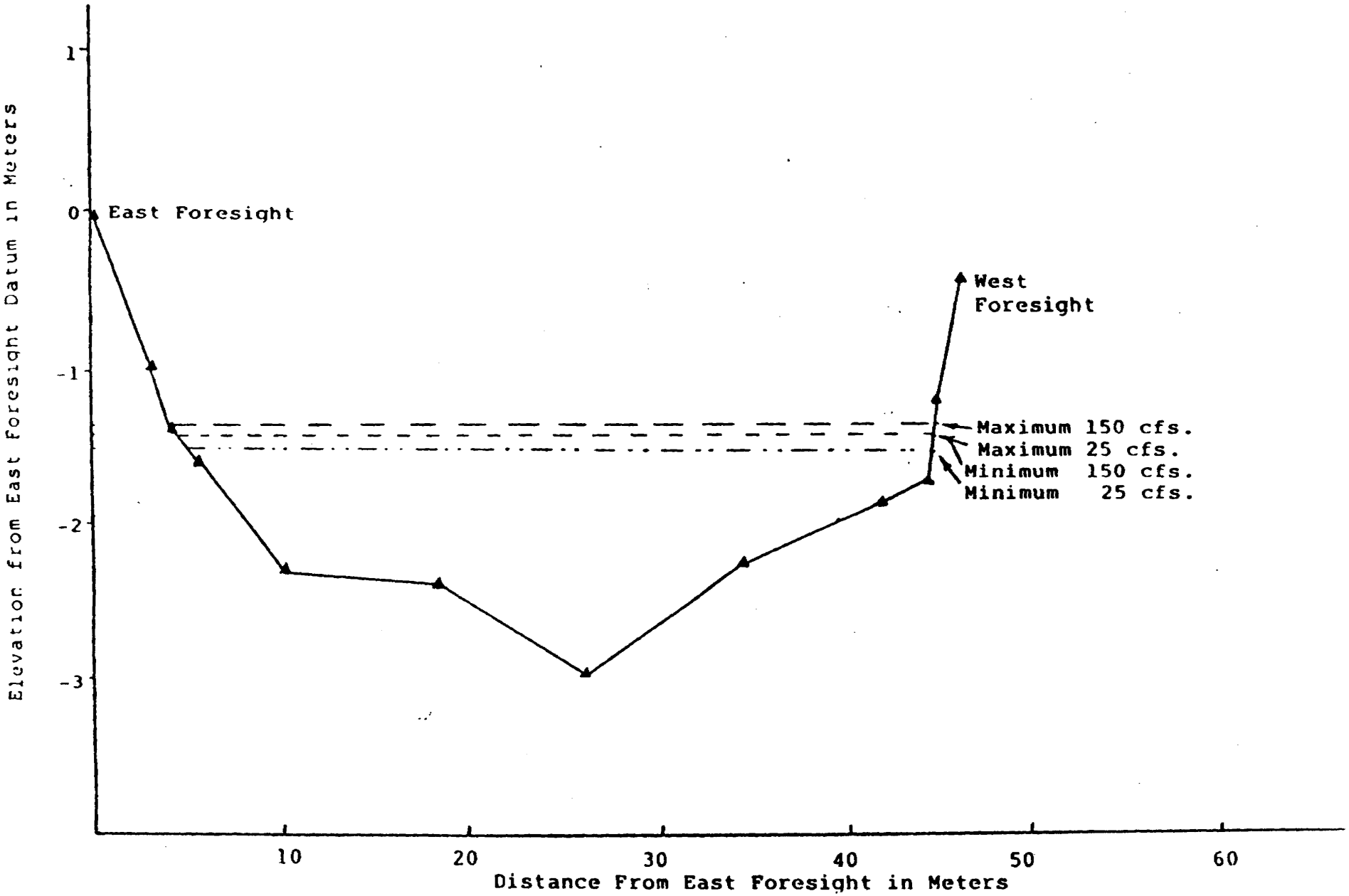
Basin Profile - Otter Pond

Transect B

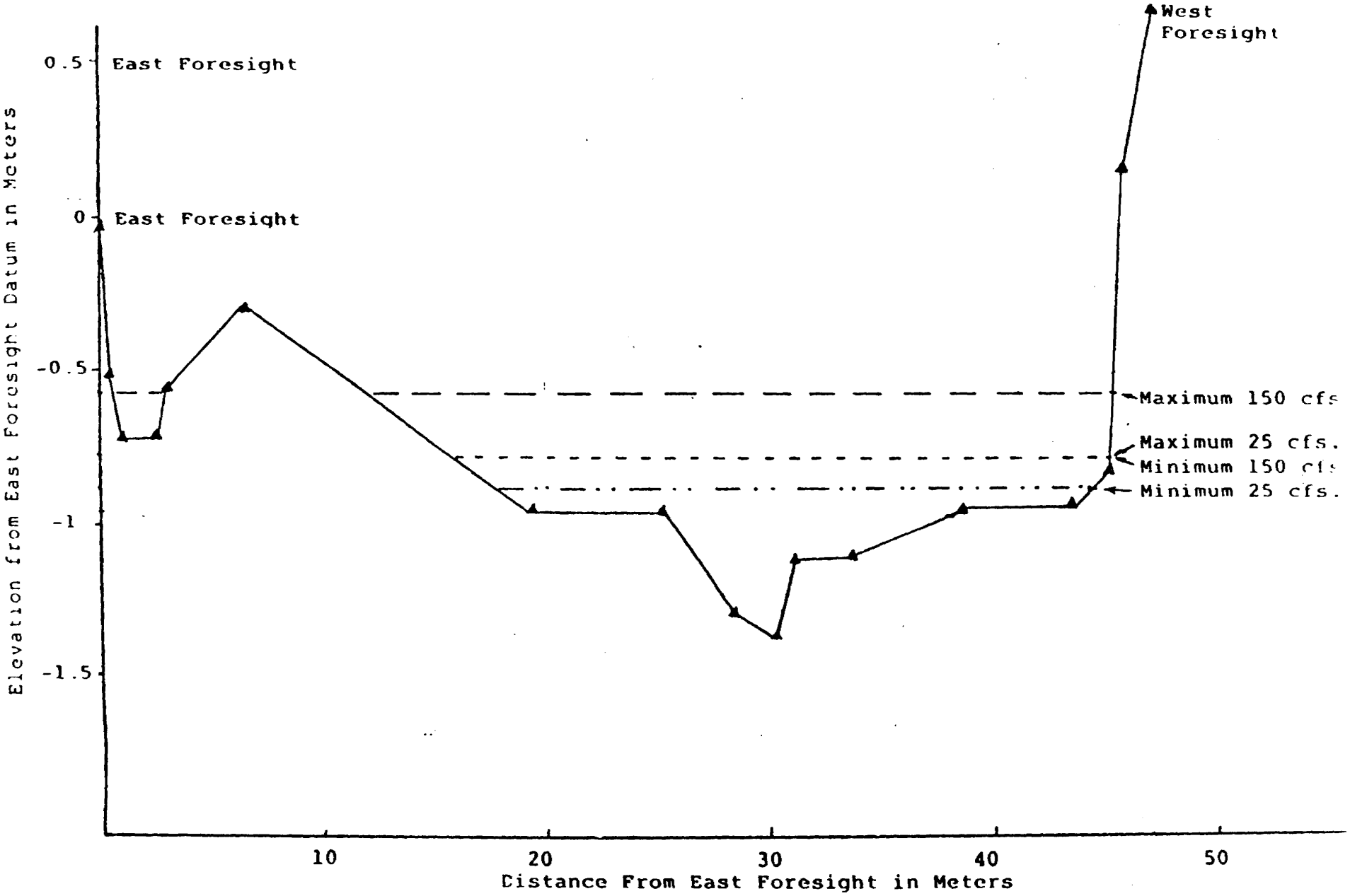


Basin Profile - Otter Pond

Transect C

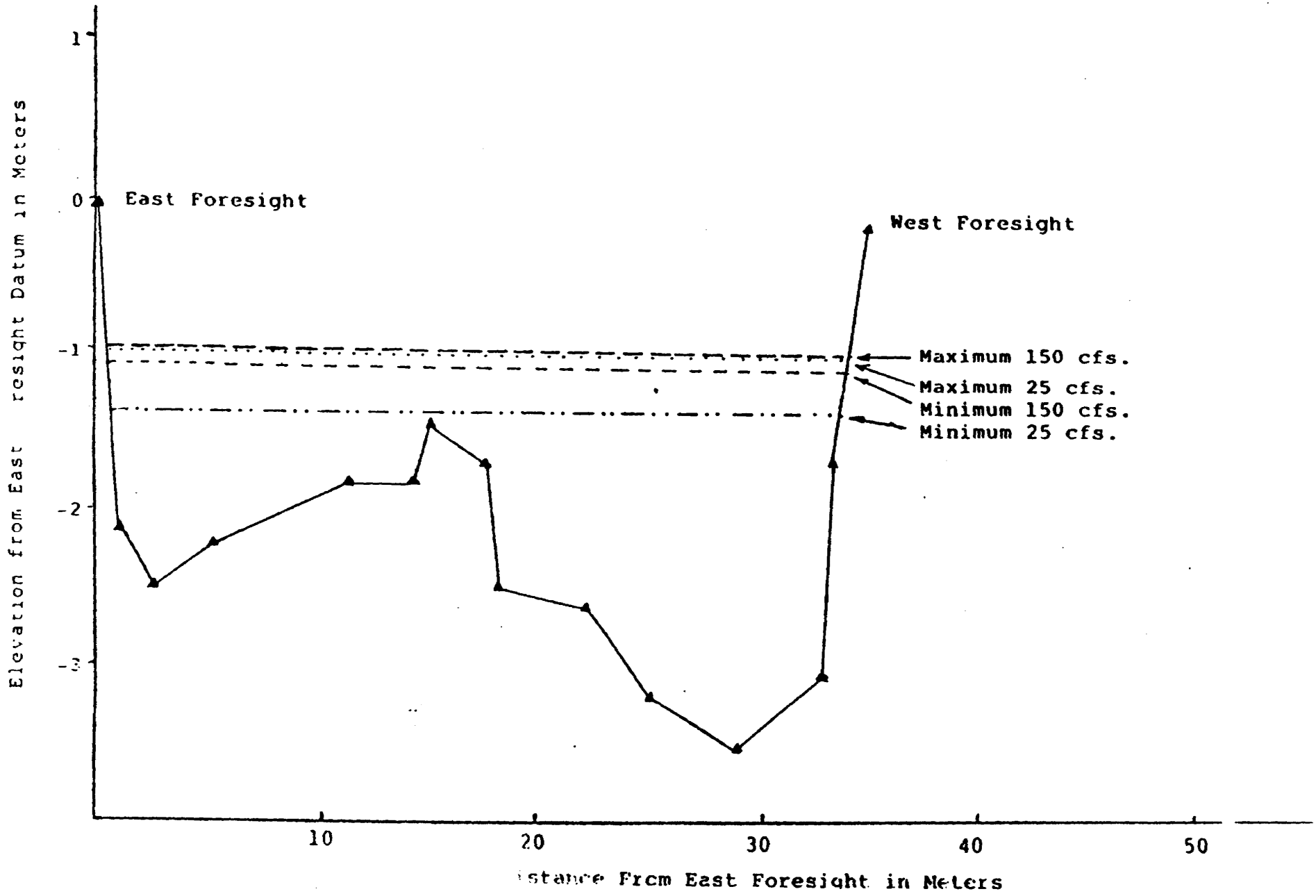


Basin Profile - East Aishihik River
Reach 2 Transect A



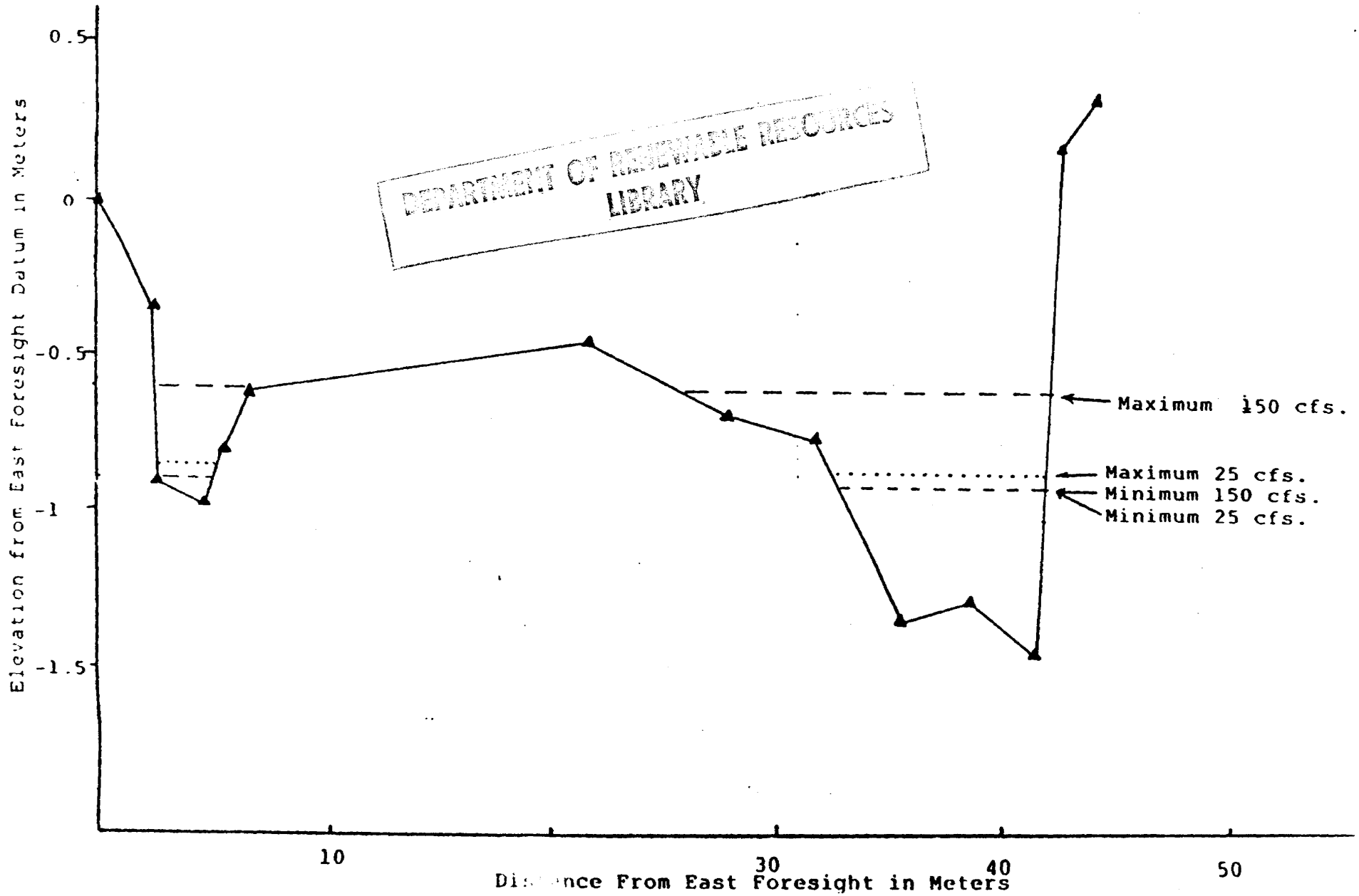
Basin Profile - East Aishihik River

Reach 2 Transect B



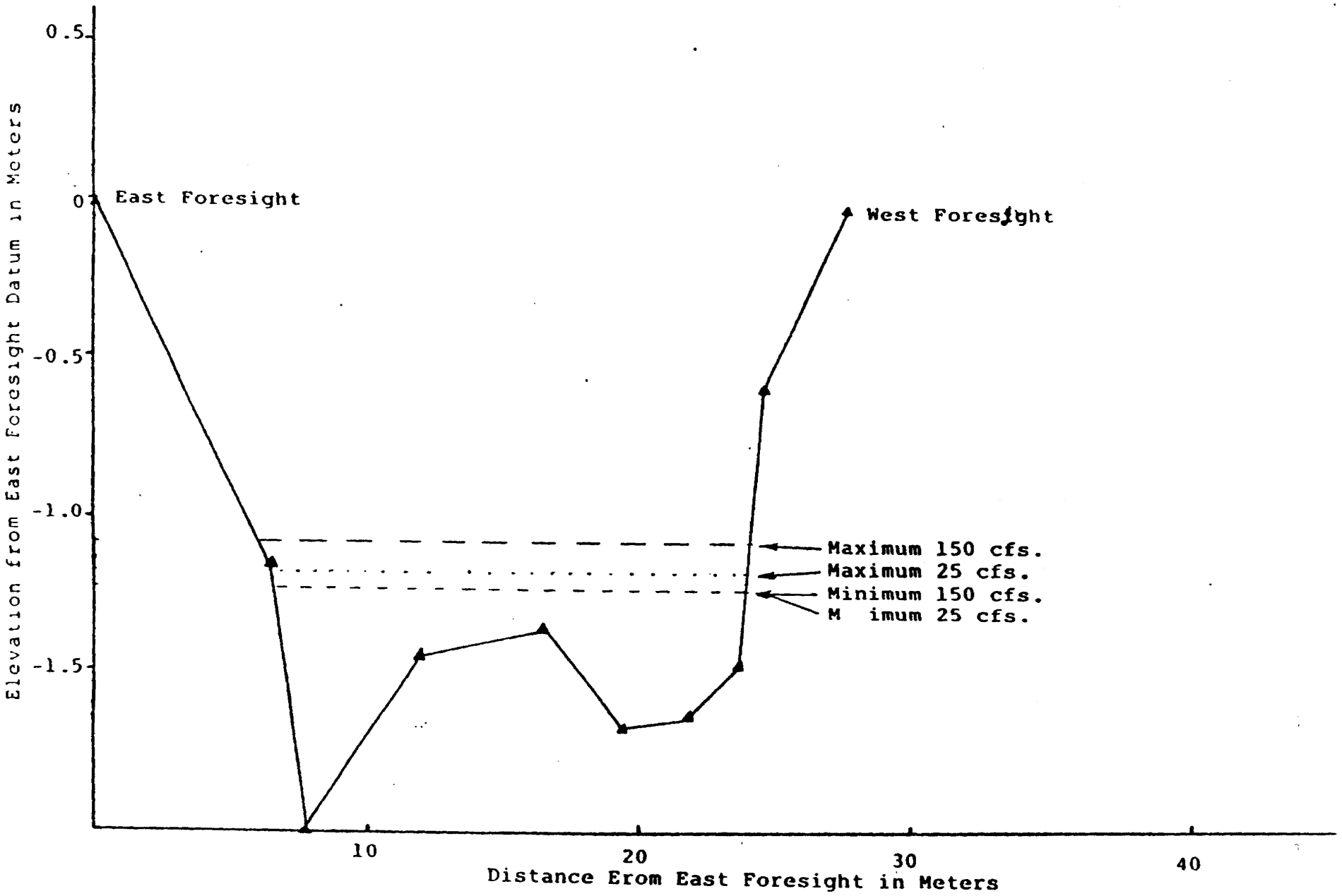
Basin Profile - East Aishihik River

Reach 2 Transect C



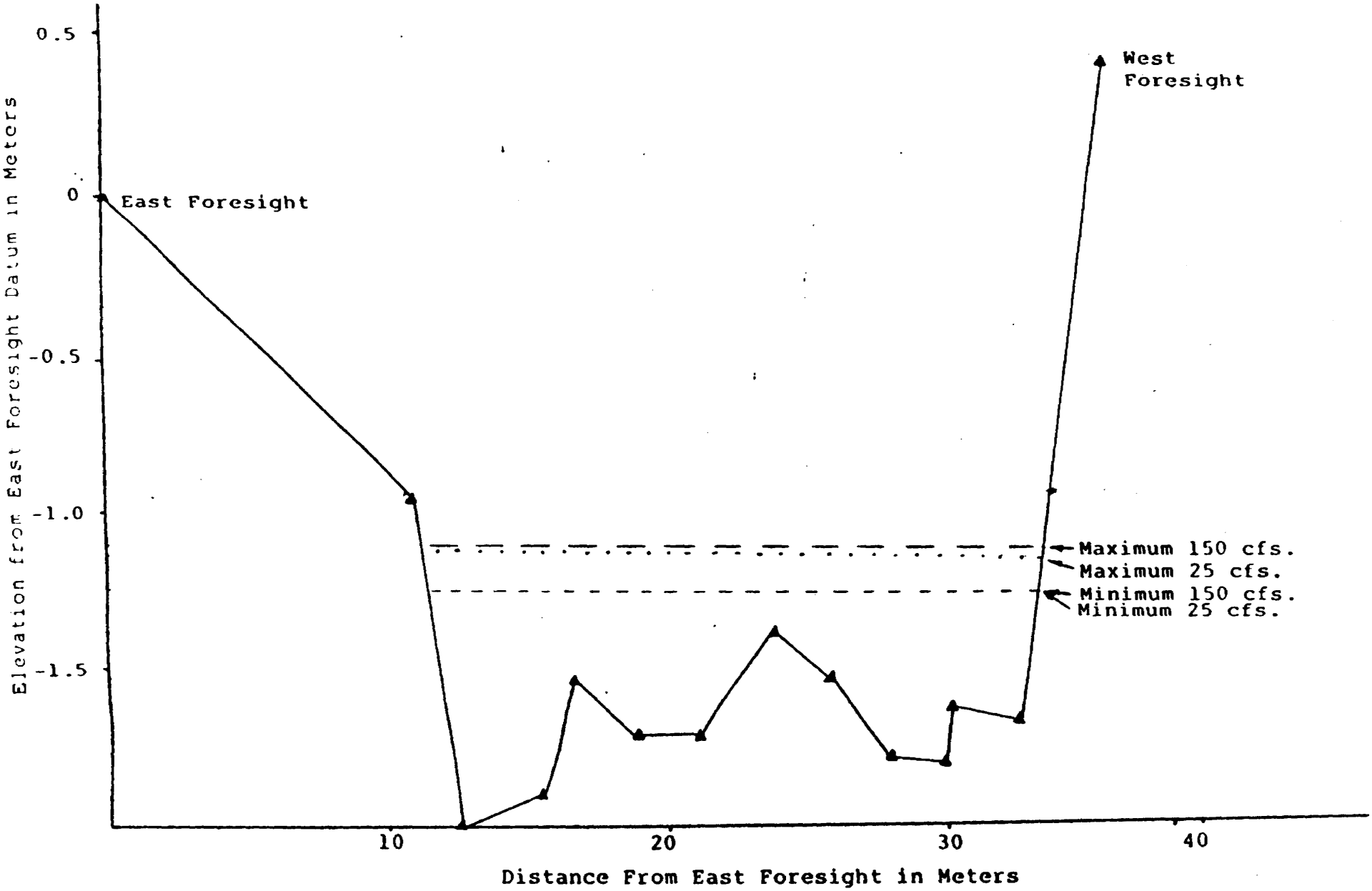
Basin Profile - East Aishihk River

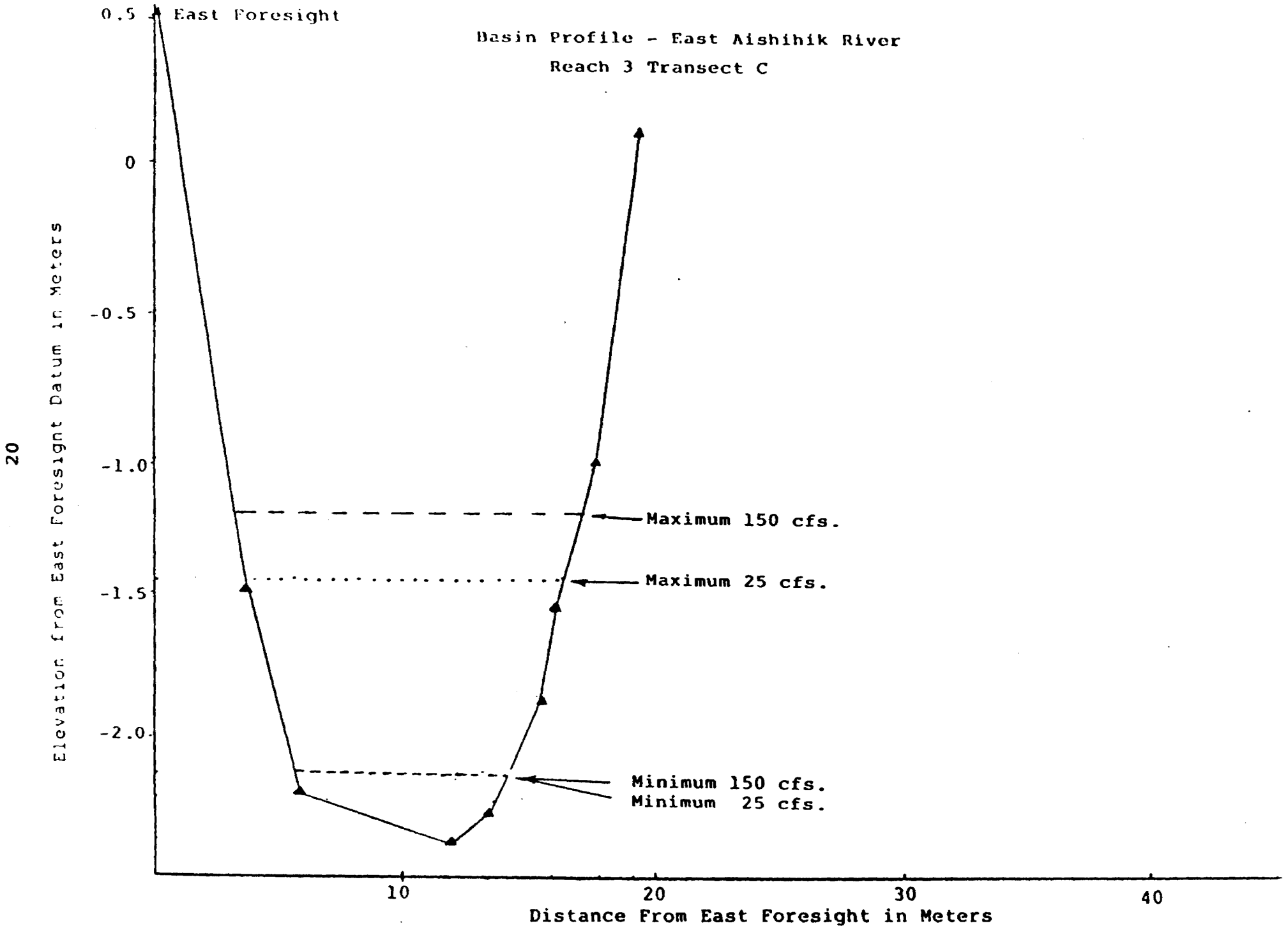
Reach 3 Transect A



Basin Profile - East Aishihik River

Reach 3 Transect B




Basin Profile - East Aishihik River
Reach 3 Transect C
0.5
East Foresight
0
-0.5
-1.0
-1.5
-2.0
Elevation from East Foresight Datum in Meters
Maximum 150 cfs.
Maximum 25 cfs.
Minimum 150 cfs.
Minimum 25 cfs.
10
20
30
40
Distance From East Foresight in Meters

Appendix III

APPENDIX III

Fisheries Investigations

Otter Pond was sampled during the June, July and August level surveys. During June and July, a gang of seven panels with mesh sizes ranging from 3.5 to 8.9 centimeters were set overnight. In June, the net was set for two nights at a different location each night while in July and August, the set was for one night only.

Six minnow traps were set immediately below Otter Falls (OF) and also at the S3 station during the June survey . Five minnow traps were set at the downstream end of Rainbow Falls (R3RBF) during the July survey. The traps were set in pool - back eddies along 200 meters of the east bank of the river at all three locations. The traps were baited with salmon row and left for a 23 hour period.

The mouth of the East Aishihik River was sampled using a Smith Root Type VIII electrofisher once in July and once again in August. In July, approximately 70 meters of stream were fished from the mouth moving upstream. Another 80 meters were sampled at a point 400 meters upstream of the mouth (R3L). This site was sampled more intensively in August using stop nets at both ends of the site. Upon completion of the electrofishing, a 7.6 cm. mesh gill net was set overnight to replace the downstream seine stop net.

Approximately 80 meters of stream were sampled at S2 in August using the electrofisher. One quarter inch fine mesh seine stop nets at the both the upstream and downstream ends of the sample section. Following the electrofishing sampling, a gill net gang consisting of two panels; one 3.8 cm. mesh, the other was 6.4 cm. mesh was set across the stream channel overnight.

RESULTS

Fish were captured at Otter Pond and at the mouth of the East Aishihik River. A record of fish captured detailing the date, species, location, method of capture, number of fish caught and length range is presented in Table 4. The location of the fish sampling sites is presented in Figure 1. Otter pond was gill net fished for 4 days and nights and 22 lake whitefish were captured, 20 of which were juvenile fish (young of the year).

Eight fish of 4 species were captured at the mouth of the East Aishihik River. Most of these fish were captured in July. Another 3 fish were observed but not captured. One slimy sculpin was electroshocked at R3L and at Rainbow Falls (R3RBF) and no fish were captured in gill net sets at S2 and R3L during August. One slimy sculpin was caught in the minnow traps at Rainbow Falls (R3RBF) and no fish were captured in minnow traps set at the other 2 locations.

The low catch per unit effort on Otter Pond and large proportion of young of the year in the catch indicates that Otter Pond probably does not support a self sustaining population of fish. These fish probably originate in Canyon Lake and drift through the control structure. The elimination of winter flows in the East Aishihik River would destroy overwintering capability of fish as Otter Pond freezes to the bottom

Fish captured at the mouth of the East Aishihik River in July were probably did not overwinter in the river. Sampling the same site in August did not produce fish suggesting that the river only sustains instream residents temporarily.

It is apparent that the cessation of flows may have a greater impact on the fisheries resource than the fluctuation of flows over the past summer. Maintaining flows of 25 cfs. during the summer is expected to have little impact on the stream inhabitants. Year round flows of between 10 to 25 cfs. would result in much improved over-wintering survival and hence much greater productivity of the river.

TABLE: 4 RECORD OF FISH ON THE EAST AISHIHIK RIVER SUMMER 1991

Date	Species	Location	Method	Number of Fish	Length (mm.)	Weight (gms.)
June 14	LKWF.	OP-Set2	Gill Net	1	-	-
Aug 2	LKWF.	OP-Set1	Gill Net	1	425	1000
Aug 2	LKWF.	OP-Set1	Gill Net	10	100	-
July 17	RWF	R3L	Elfsh.	3	270-277	-
July 17	RWF	R3L	Obs.	3	-	-
July 17	AG	R3L	Elfsh.	3	220-258	-
July 17	CCG	R3L	Elfsh.	1	60	-
July 17	BB	R3L	Elfsh.	1	300	-
Aug 24	LKWF.	OP-Set1	Gill Net	10	100	-
July 17	CCG	R3-RBF	Min.Trap	1	-	-

Abbreviations

Species

LKWF - Lake Whitefish
RWF - Round Whitefish
AG - Arctic Grayling
CCG - Slimy Sculpin
BB - Burbot

Location

OP - Otter Pond
R3L - Mouth of East Aishihik River
R3-RBF - Rainbow Falls

Method

Elfsh. - Electrofisher
Obs. - Observed
Min. Trap - Minnow Trap