PROPOSED MITIGATION FOR SUSITNA RIVER FISH STOCKS

SUSITNA HYDROELECTRIC PROJECT

JUNE 1982

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Mitigation of Impacts on Fish Resources

Under pre-project conditions, fish in the Susitna River are subject to highly variable stream conditions. These conditions are controlled by the extremes in weather and climate of the region. During the summer months, high flows are caused by melting glacial ice, and even higher peak flows occur when a storm coincides with the already high summer flows. In the winter, neither of these events take place, and the flow is reduced to less than 5% of it's summer volume. These circumstances, in conjunction with the streambed and sediment conditions that accompany them, make the Susitna mainstem a less than ideal fishery habitat. In fact, most salmon spawning activity is confined to tributaries and slough environments.

The primary impact areas of the hydroelectric development are the reservoir areas and the Susitna River from Talkeetna to Devil Canyon. The dams themselves will not curtail the migration of any anadromous species because Devil Canyon is, even now, a natural barrier to such migration. The project will, however, alter in many ways the conditions to which fish are subject.

The degree to which the project will change conditions and the impacts accompanying those conditions will also vary by project stage and location. The stages considered are construction, including filling, and operation and maintainence. The project locations are the Devil Canyon and Watana impoundments, the Susitna reach downstream to Talkeetna, the reach between Talkeetna and Cook Inlet, and the access roads and tranmission line routes.

For both the project stage and locations, various mitigation methods are available. These approaches have been examined with close attention to the following order: avoiding the impact, minimizing the impact, rectifying the impact, reducing or eliminating the impact over time, and compensating for the impact. Reducing or eliminating impacts includes basic monitoring both of the resources as impacts develop and of the planned mitigation measures.

Mitigation dealing with the project's impacts can be catagorized in several ways. Operational procedure is one such category. Operational procedures are an important aspect of this mitigation plan. Regulation of downstream flow would be the primary operational procedure for mitigative purposes.

Construction or design procedures can also avoid adverse impacts or, at least minimize them. These include the use of special valves for spilling excess water to avoid or minimize dissolved gas supersaturation and the use of multilevel intakes to regulate water temperature.

Modification of the existing stream by excavating or by adding gravel to build spawning areas is another type of mitigation opportunity. The placement of the dams on the Susitna River will act to control the extreme conditions that occur naturally and, as will be discussed, may make the conditions in the stream more favorable for fish.

Such modification of the stream, side channels, or sloughs could protect, replace or even increase the amount of usable habitat. The construction of artificial spawning channels or hatcheries can also be used as a mitigative measure to compensate for loss of fish production, but maintaining existing habitat or creating new habitats by way of the modifications just mentioned are more promising options.

A final category of possible mitigation is the management of existing fishery resources to increase their productivity.

- Impoundments

The impacts associated with construction will be of short duration and will be masked by inundation of the area. Intensive management of the recreational fishery in the tributaries above the impoundment water level during the construction stage, however, could protect the grayling populations not directly affected by the construction activities. In addition, insuring that effluent discharges from the sewage treatment facilities are compatible with the stream's water quality, or that they are not discharged into any small tributaries above the impoundments upper water level would protect the grayling fishery that will remain after inundation.

For the resident fish, the inundation of the mainstem will probably result in the formation of new habitats that are as hospitable to the fish as the former habitats. Furthermore, since no anadromous fish occur above Devil Canyon, no impacts on anadromous fish are associated with athe actual impoundments.

Avoiding or minimizing impacts accociated with operation and maintainence of the Watana impoundment is restricted by engineering and economic aspects of the project. For example, fluctuations of the water level and the storage of water is necessary to provide needed power during the cold months, which are also the periods of low flow. On the other hand the annual fluctuations of approximately 27m (90 ft.) in Watana will inhibit the formation of a littoral zone, which is a general requirement for cover and food for rearing fish in lakes; for some species it is also a necessity for spawning habitat.

Adverse impacts may be rectified by managing the stream areas not inundated or by developing a resident sport fishery in the reservoirs, the latter of which could provide a replacement for lost stream fishery habitat. Development of a resident reservoir fishery may be limited by post-project water quality of the reservoirs.

The ability to establish a fishery in the reservoir will depend on the water quality characteristics that develop. Although fisheries in other glacially fed lakes in this region have not been very productive, indications are that a least a limited fishery could be established in the reservoirs. A clear, productive upper layer in the reservoir will aid in the development of such a fishery. Initial investigations on the settling rate of incoming sediment, combined with the length and depth of the Watana reservoir, indicate that the necessary clear layer could develop. The fraction of incoming sediment measuring two microns or less, however, may cause the reservoir to remain cloudy in summer and, thus, limit the prospects for establishing a good reservoir fishery.

Gas balance of nitrogen and oxygen in the Devil Canyon reservoir is another impact that can be controlled. Installing cone-type valves for spilling instead of using conventional spillways will solve the problems of entraining nitrogen ang oxygen and thus eliminate a problem for fish in the Devil Canyon reservoir and downstream. The valve discharges will not plunge more that .6m, on the average, below the surface. This would keep the levels at or less than those that occur naturally. These measures are part of the proposed design.

As previously mentioned, the placement of the Devil Canyon facility at he upper limit of the salmon mitigation is a positive factor in the design of the project. No the present range or habitat of the five species of Pacific Salmon is excluded by the project. Although it is not within the scope of this study to evaluate the enhancement potential of the upper Susitna River basin above Devil Canyon, whether or not the project precludes this possible enhancement can be evaluated on a preliminary basis. For example, to permit salmon access farther into the upper basin, the natural barrier of Devil Canyon (without the project) or the barrier represented by the dams (with the project) would need to be circumvented in some manner.

More significant, however, is the consideration that any enhancement plans for the basin above Devil Canyon requiring the use of the Susitna for outmigration would be made more difficult by the downstream passage problems presented by the dams. A suggestion has been offered in the past that for enhancing the salmon resources of the upper basin by connecting Lake Louise to the Copper River drainage. Such enhancement, while never entertained by the present study, would not be precluded by the Susitna project. Of course, any proposed action to permit salmon access to the reaches of the upper basin where they do not occur naturally would have other environmental implications that would need to be evaluated.

- Downstream

Mitigation activities associated with downstream impacts during the construction stage would be minimal. Avoiding or minimizing impacts could be accompolished princpally by close inspection of the work to see that all prudent measures are undertaken to reduce turbidity or to prevent any toxic material from entering the river.

o - River Mouth to Talkeetna

Below the confluence of the Chulitna, Susitna, and Talkeetna rivers, the contribution of waters from the Chulitna and Talkeetna rivers is expected to greatly reduce or to eliminate the potential for impacts resulting from flow alteration in the upper river. In addition, the load contribution from the Chulitna River will probably mask any reduction in suspended material caused by settling behind the dams. As one progresses dowmstream, the differences between pre- and post-project conditions will be less and less apparent until, eventually, any change will be well within the range of natural fluctuations. No adverse water quality changes are expected in the lower Susitna River. Possibly the changes in flow below Talkeetna could lower the stage in certain areas and thus limit access to some of the sloughs and side channels for spawning. Should this happen then a mitigation measure that would avoid impacts or minimize them would consist of some alteration of at the mouths of the sloughs, side channels, and tributaries.

Reducing or eliminating impacts through stream stocking and lake fertilization may also be used. This technique would be applicable to impacts in any reach of the Susitna. Several lakes in ths Susitna drainage that have management potential have already been identified by the Fisheries Rehabilitation Enhancement Division (FRED) of ADF&G.

o - Chulitna Confluence to Devil Canyon

The most profound impacts of the Susitna Hydroelectric Project on anadromous fish will occur in the Chulitna to Devil Canyon reach of the Susitna River. Likewise a major part of the mitigation effort is concentrated in this area.

With the beginning of the filling period of Watana Dam, there will be alterations in the natural stream runoff patterns of the Susitna River below the dam. The data from the 1981 field investigations show that these modified stream flows will also alter the flow patterns in the sloughs frequented by the salmon for spawning, incubation of eggs, and the initial rearing of fry. The reduction in river flow will also modify the existing natural water temperatures regimes. These will be influenced by by the water that enters and is stored and discharged from the Watana reservoir and, sussequently, when the two-dam project is completed, through the Devil Canyon retension basin to the river.

Water quality changes will occur, principally by the reduction in the amount of silt and bed load now occurring in and passing through this section of the river. The project will reduce both silt and bed load but this is not considered as important as flow and temperature in the effective production of fish in the side sloughs. Impacts associated with downstream temperature regimes could be avoided during some periods of the year and minimized during other periods by the use of multilevel intakes which would provide a mixed flow with water temperatures equal or near to natural conditions. The appropriate multilevel intakes, if included in the design, will allow for temperature regulation of discharged waters. Downstream water temperatures can then be regulated to provide the most desirable temperature for the fish resources. Stream reaches that have correct temperature conditions for egg development and emergence at the proper time could be considered for management of salmon fisheries and modifications to provide additional habitat.

A purpose of mitigation is to maintain the sloughs as fish producers by providing: 1) adequate water flowing through the sloughs from either their upper or lower ends to maintain the necessary water depth for transportation of adult salmon to the spawning grounds; 2) water of the necessary temperature and oxygen levels for those fish that have entered the sloughs, as their spawning success depends upon the upwelling water areas in the sloughs; and 3) suitable environment for the eggs to incubate, the alevins to form, and the fry to emerge from the gravel at the proper time of the year.

At present, the upwelling water is of insufficient volume to insure the necessary transport depth required for the adults to enter the sloughs, to pass the spawning grounds and to remain thereon during their stream life.

At present, the flows entering the upper ends of the sloughs are controlled by the river's stage during the migrating and spawning season and by the provision of the necessary support flows. Egg survival is dependent upon the natural temperature regime of the upwelling water, as river inflow generally ceases before the end of the incubation period. Until approximately the first week in October, temperatures above 6 C. are required. Under present conditions the temperature of the stream water varies between about 11 and 14 C. at the time of maximum spawning, and then gradually cools to not less than 6 C. by the first week in October.

Although the source of upwelling water has not yet been determined, it is assumed that it contains sufficient oxygen for final embryo development. There are two areas providing the necessary aquifers: 1) the major land source above the sloughs, and 2) the island between the slough and the main channel. In the latter case, the difference in elevation between the water level in the main Susitna channel and the thalweg level of the sloughs gives the hydraulic head to provide the necessary drop for water to percolate through the island gravel into the slough area. Until the ground water surveys proposed for these areas are completed, the contribution from this source cannot be quantified. This study is underway.

Various project operating flows for power have been proposed, ranging from 10,400 cfs to 13,400 cfs during the winter generation period. These flows are below the natural expected summer flows, but many times greater than the natural winter flows.

The winter temperature regime may be such that at least a part of the river channel will be free from ice above Talkeetna because of the discharge of warmer water from the Watana or Devil Canyon reservoirs. During the spring breakup of 1982 it was reported that some of the sloughs were wetted owing to the backup from ice jams, creating extraordinary heads and diverting water into the side sloughs. This flow, plus the spring warming trend, may be the conditions that trigger the young fish to move outward from the sloughs. Under project conditions, if the ice jams are eliminated, short bursts of water may be required to trigger the outward migration of young fish from the sloughs. This is physically possible and would become part of the mitigation procedures proposed if the observationsof 1982 are typical.

The river work reported by R&M Consultants the various river cross sections above Talkeetna. The information obtained from the described reach areas has been used to develop an approach for mitigation to prevent loss of the sloughs by the elimination of higher flows.

The cross sections in the sloughs established and recorded by the Alaska Department of Fish and Game (ADF&G) and equated to the survey data of R&M have made it possible to examine the existing gradients within sloughs 9, 19, and 21 (tables 1,2,and 3). The water surface elevations of the shorelines of the islands on the main channel side was obtained for sloughs 9 and 21 by utilizing R&M cross-sectional data and a streight-line channel loss of head (figures 1 and 2).

The purpose of this approach was to determine whether there can be an intergravel flow to the sloughs with the river discharges at the proposed project flows in order to retain the existing spawning areas and the existing upwelling flows, or if it is possible to improve the sloughs by increasing the existing spawniing areas and the quantity of upwelling flows. The steps taken to demonstrate this type of mitigation are shown by tables 1, 2, and 3, figures 1 and 2 and Appendices A, B, and C.

Tables 4 and 5 list the areas used by the spawning fish, including the slough areas, from Talkeetna to Devil Canyon. The data source is the ADF&G. The slough areas were further examined from overflight pictures provided by R&M.

The ADF&G data shown on tables and in the appendices give pertinent information on needed wetted areas, upwelling flows and other physical data on the sloughs which have been needed to define the pervailing physical conditions. The R&M overflight pictures are not provided as a part of this section, but are available. On these overflight pictures are drawn the channel transects which provide the cross-sectional data utilized. These data give a means of approximating the river profiles and, with an assumed streight-line relationship, make it possible to estimate the elevation of the shoreline on the river side if the islands that form the sloughs under study.

Interpretation of the various levels affecting sloughs 9 and 21 are shown in Figures 1 and 2. They show an invert elevation profile of the slough and an equivalent elevation of the main river surface; if such cross sections were to be extended across the island area to the river channel, they would give an approximate hydraulic head across the island. The river stage and elevation obtained from R&M data sources have been combined with the project level of the slough entrance and these are shown on Figures 1 and 2.

Using this combination of data, a new channel level at the upper ends may be projected to provide the necessary flows in the sloughs at river flows of 13,400 cfs measured at Gold Creek. These will furnish the necessary water depth for transporting and spawning. On Table 6 is shown the minimum excavation required to provide the new entrance levels needed.

The purpose of this approach was to determine the level of a flat broad-crested weir as one means of control. The required flow was based on a stated depth for transportation of adult salmon into the slough and to provide the depth required during the spawning period. This is shown on figures 1 and 2. An estimation can be made of the required quantity of excavation for a first approximation of cost and type of construction equipment needed. Operational procedures can be developed to assure that the physical alterations of the channel entrances can be maintained in accordance with the new flow regimes.

The stability of the channels is of the utmost importance as they can not be permitted to be scoured by the fluctuating flows brought about by storm events during the summer and fall. The data for this study show that the stability of beds is affected at flows above 750 cfs in slough 9 and 54 cfs in slough 21 (Table 7). From the studies, it is showm that the channels would become unstable and that a control works would be required. A number of methods could be employed here to insure the effectiveness of controls at the upper ends of the sloughs.

To insure that there would be sufficient water to provide the necessary oxygen to hatch the eggs and develop the alevins and fry, one of two approaches is indicated, if the ground water studies show that the gravels are permeable and that the principal source of upwelling water is the river. It would be possible to recharge such an aquifer through a surface pooling on an island if the hydraulic head was not sufficient to allow for the necessary percolation rate to recharge the aquifer from the river flows. If the principal source of water is from the major land side, this source would remain unaltered and would be subjected only to natural or climatic changes and generally would be unaltered by stream flow modifications.

The upwelling provides the necessary water flow, oxygen, and temperature for incubation. It appears that the groundwater tempeature in the slough will vary from approsimately 2.7 to 3.1 C. and will be modified to some extent by the stream temperature, making it suitable for the development of eggs. Under project operating conditions, with the major source of silt removed and with an opportunity to draw water of various temperatures, it would be possible to use river water of the same temperature as the ground water in the winter. A decision on this is not required until the ground water surveys are completed, the source of the upwelling is identified, and the need for further augmentation is established.

The number of fish to be mitigated for will depend upon the return of any year-class, and is variable. To further understand the relationship of the sloughs to the number of spawning fish, Tables 8, 9, and 10 have been prepared They show the escapement expected to occur in the slou h in proportion to that of existing areas. The wetted area can be computed in square feet, which may be translated into useful area for spawning fish, as shown in Tables 11 and 12. Under natural conditions the river inflow ceases through the sloughs when the main river reaches the elevation at which the sloughs are dried, which is variable. Under the proposed mitigation conditions the sloughs could remain wetted most of the time, and hence, their useful areas would be enhanced. The usefullness would be increased under mitigation conditions as compared with natural conditions when the same criteria were applied. In some years the sloughs would be underused, and in some years they would be overused. Under mitigation conditions, if the runs were to be built to the maximim space available, the run size would ultimately increase.

The immediate concern is to insure that the existing populations would have available to them at least a equivalent amount of space as now exists. The percentage of used area, however, might drop if the useful areas were to be increased without an increase in run size. This comparison of conditions is shown on Tables 8, 9, and 10.

This is not intended to be augmentation but only mitigation, as the mechanics of a slough's relationship to the rearing of young has not yet been fully established. If the space remains equal or greater than now existing that relationship would not be reduced.

It has been noted that the water flow is important in the development of eggs and young and may be a limiting factor in their development, not only because of space but because of the oxygen needs of the fish. Unless sufficient oxygen can be supplied to support the embryos, added space or added overflows to permit transportation would not in themselves be sufficient. Table 13 shows the oxygen demands of alevins and eggs from which a minimum flow level can be extablishes when the saturation level of the water is known.

If a sufficient volume of oxygenated water were not available, the productiveness of the spawning area would be limited. This becomes a final check in the development of any plans for altering the sloughs or their upwelling water supplies.

Backup data required to develop the tables and figures presented in this report are included in the appendices.

In summary, mitigation is required for the fish using the sloughs existing in the Susitna River from Talkeetna to Devil Canyon. The number utilizing these sloughs in 1981 have been estimated and are shown in the tables. It is expected that these numbers will be exceeded in the future, particularly the by dominant pink salmon runs that occur in the even years.

Mitigation is required because the flow alteration will drop the water level below that which is required to wet the sloughs to allow the adults to enter the sloughs, transport themselves to the spawning areas, spawn and either die or go back to the main river. The storage of water in the Watana Reservoir will alter not only the flow, but the water temperature, and will reduce the turbidity load throughout most of the year. With the two-dam development water will be delivered below the Devil Canyon retention basin, further modifying the stream temperature. The entrance or throat of the sloughs must be lowered to permit the required flow to enter the sloughs at project operational levels in order to provide the necessary depth for transportation and spawning by adult salmon. The slough beds must remain stable at this lower level, although they may be subjected to increased flows or flood flows that are not completely regulated by the Watana reservoir. An entrance control works will be needed to insure the safety of these sloughs under the expected flood conditions.

If the present conditions in the sloughs are to be maintained, the source of the aquifers supplying the upwelling water must be identified to be sure that they will be recharged on an annual basis and that they will supply the required flows for egg and alevin development.

The useful wetted areas of these sloughs may be enhanced, but this should not be assumed to be augmentation, as the relationship of their rearing habits and needs have not been established and related to the physical conditions within the existing sloughs. The current relationships would be adversely affected.

An estimate is given of the minimum excavation volumes needed to reduce the levels to the entrance channel beds to a point where they can accept water at lower river flows than have existed under natural river conditions at spawning times.

It is concluded that it is feasible to examine in detail the mitigation which will sufficiently alter the entrances of the sloughs to provide water at lower levels of discharge in the main river than now occur naturally at spawning times but which will occur under project conditions. Careful design will be required to insure the stability of the channels.

It is suggested that this type of mitigation is preferable over the development of artificial spawning beds or hatchery systems at this time.

- Access Road - Borrow Areas - Transmission Lines

A majority of the potential impacts associated with the construction, operation, and maintainence of access roads, borrow areas, and transmission lines can either be reduced significantly or eliminated completely. A major portion of the impacts associated with public access and stream sedimentation will be avoided if the mitigation measures already described by Acres are implemented (Acres Amewrican Access Route Selection Report 1981). For example it is assumed that that the access road will be controlled as a private road during construction and that management policies will be extablished for future use of the road. Furthermore, many potential ~~impacts~~ can be avoided if restrictions on off-road vehicle use are imposed and if some restrictions are placed on public access beyond Devil Canyon. Additionally, it is assumed that, whenever feasable, borrow sites will have a buffer strip between them and any aquatic habitat.

o - Road Design and Construction

Road design and construction can incorporate measures to minimize mass-movwement erosion of sediment into streams represented by soil creep, slump earth flows, debris avalances, and debris torrents. Control of these phenomena can be accompolished by avoiding placing roads on the midslope of steep, unstable slopes; by reducing excavation to a minimum; in conjunction with balanced earthwork design, by designing cut and fill slopes at proper angles; by providing vegetative or artificial stabilization of cut and fill slopes; and by constructing retaining walls to contain unstable slopes. Except at stream crossings, roads can be situated to provide a buffer strip of undisturbed land between the road and any streams. In addition, if bridges and arch culverts are used for stream crossings where anadromous fish or migratory resident fishes are present, the potential for impact on these species will be minimized. It is assumed that culverts will be of appropriate size and design and will be installed properly to permit fish passage. Any low water crossings may cause impacts if downstream fisheries are present. Where such low water crossings are used, impacts can be reduced if the crossings are properly maintained and used only by light vehicles.

Some potential impacts can be avoided if the construction work within or adjacent to streams is not attempted -ing periods of high streamflow, intensive rainfall, when mi atory fish are spawning, or during crucial rearing times. .nis mitigation approach applies to transmission line construction as well as to access road construction.

Oil residue from construction equipment and possible bacterial and nutrient contamination of aquatic habitats resulting from the presence of construction personnel can be minimized by following the standard precautions of the construction industry. It is assumed that oil from machinery will be disposed of properly and not buried at the site. Portable chemical toilets will elilminate possible bacterial contamination.

Table 1 Physical dimensions of Slough 9

Transect no.	Minimum elevation (ft)	Average bank-full elevation (ft)	Average high water elevation (ft)	Distance between transects (ft)	Slope	Thalweg depth at bank-full (ft)	Section width (ft)
1	602.16	604.51	607.34			2.83	406.4
				850	.0009		
2	601.43	602.89	607.70			4.81	271.1
				2,350	.0032		
3	594.02	596.66	603.30			3.64	242.1
				1,700	.0014		
4	591.66	593.63	597.71			4.08	145.1
				1,250	.0011		
5	590.28	592.60	598.11			5.51	229.4
1-5				6,150	.0019		

Data Source: R&M and ADF&G field data.

Table 2 Physical dimensions of Slough 19

Transect no.	Minimum elevation (ft)	Average bank-full elevation (ft)	Distance between transects (ft)	Slope	Section width (ft)
1	718.79	720.36			50.9
2	718.77	720.58			111.1
3	718.73	720.68			99.6
4	718.81	720.98			52.4
10	721.89	722.56			10.1
1-10			1,100	.0020	

Data Source: R&M and ADF&G field data.

Table 3 Physical dimensions of Slough 21

Transect no.	Minimum elevation (ft)	Average bank-full elevation (ft)	Average high water elevation (ft)	Distance between transects (ft)	Slope	Thalweg depth at bank-full (ft)	Section width (ft)
1	753.72	755.14	756.25			1.11	133.8
				297.0	.0054		
2	752.12	753.47	755.03			1.56	100.0
				440.0	.0087		
3	748.29	751.52	755.00			3.48	108.0
				215.5	.0027		
4	749.67	750.93	753.40			2.47	92.6
				206.5	.0093		
5	747.75	749.52	751.34			1.82	71.0
				105.5	.0065		
6	747.06	748.50	751.28			2.78	92.0
				139.0	.0053		
7	746.32	748.32	751.56			3.24	114.7
				213.5	.0037		
8	745.53	746.97	750.32			3.35	77.5
				203.0	.0035		
9	744.81	746.59	751.24			4.65	97.5
				314.0	.0022		
10	744.11	746.11	750.39			4.28	107.5
				126.0	.0021		
11	743.85	746.33	750.50			4.17	108.0
				118.0	.0035		
12	743.44	746.42	750.64			4.22	112.0
				82.0	.0035		
13	743.15	745.46	750.41			4.95	136.0
1 - 13				2600	.0041		

Data Source: R&M and ADF&G field data.

Table 4 Calculated escapement of sockeye, chum and pink salmon to spawning areas between Talkeetna and Curry, 1981

Slough no. or stream name		Calculated escapement (1981)[1,2]		
		Sockeye	Chum	Pink
Slough 1	(RM 99.6)	0	~6	0
Slough 2	(RM 100.4)	0	~27	
Slough 3B	(RM 101.4)	~2	0	0
Slough 3A	(RM 101.9)	~7	0	~2
Slough 6A	(RM 112.3)	~2	~11	0
Slough 8	(RM 113.7)	0	513-983	~25
Whiskers Creek	(RM 101.4)	0	10	10
Chase Creek	(RM 106.9)	0	7	253
Total calculated escapement to sloughs and streams between Talkeetna and Curry		~11	~574-1044	~290

[1] Total escapement (by species) to slough = total area under curve (number surveyed x days lapsed between surveys/stream life). Stream life for chum 10 days, sockeye 12 days. (See Appendix)

[2] Total escapement (by species) to stream = peak total count per mile) x (estimated stream length accessible).

Data source: Final report of ADF&G, Adult anadromous investigations, sockeye, pink, chum and coho. 1981.

Table 5 Calculated escapement of sockeye, chum and pink salmon to spawning areas above Curry, 1981.

Slough no. or stream name		Calculated escapement (1981) [1,2] Sockeye	Chum	Pink
Moose Slough	(RM 123.5)	0	310	0
Slough A[1]	(RM 124.6)	0	157	0
Slough A	(RM 124.7)	0	69	0
Slough 8A	(RM 125.1)	269	387	0
Slough 9	(RM 128.3)	16	230	0
Slough 9B	(RM 128.3)	225	213	0
Slough 9A	(RM 133.3)	~2	302	0
Slough 11	(RM 135.3)	1,762	916	0
Slough 13	(RM 135.7)	0	~4	0
Slough 17	(RM 138.9)	10	106	0
Slough 19	(RM 139.7)	69	~3	0
Slough 20	(RM 140.1)	~2	~12	0
Slough 21	(RM 141.0)	68	667	0
Slough 21A	(RM 145.5)	0	~8	0
4th of July Creek	(RM 131.0)	0	1,800 (5 mi @ 90/.25 mi)	580 (5 mi @ 29/.25 mi)
Skull Creek	(RM 124.7)	0	100 (5 mi @ 10/.5 mi)	80 (5 mi @ 8/.5 mi)
Sherman Creek	(RM 130.8)	0	180 (5 mi @ 9/.25 mi)	120 (5 mi @ 6/.25 mi)
Indian River	(RM 138.6)	0	2,400 (15 mi @ 40/.25 mi)	120 (15 mi @ 2/.25 mi)
Jack Long Creek	(RM 144.5)	0	0	7 (5 mi @ 1/.75 mi)
Total calculated escapement to sloughs and streams above Curry		2,413	7,864	907
Total estimated escapement past Curry (ADF&G data)		2,812	12,934	1,052
Difference in estimated escapement past Curry and calculated escapement to sloughs & streams		399	5,070	145
Percent of estimated Curry escapement accounted for in the sloughs & streams above Curry		85.8	60.8	86.2

[1] Total escapement (by species) to slough = total area under curve (number surveyed x days lapsed between surveys/stream life). Stream life for chum 10 days, sockeye 12 days. (See Appendix)

[2] Total escapement (by species) to stream = peak total count per mile) x (estimated stream length accessible).

Data source: Final report of ADF&G, Adult anadromous investigations, sockeye, pink, chum and coho. 1981.

Table 6 Proposed channel dimensions and estimated excavation for diversion of required flows from the mainstem Susitna through the head end of Sloughs 9 and 21 for spawning salmon and incubating eggs/alevins, at a project flow regime of 13,400 cfs.

Slough no.	Required Q through head end (cfs)	Dimensions of channel excavation to deliver required Q (ft)			Estimated excavation (cubic yards)
		Av. width	Av. depth	length	
9					
Transect 1 to a point 920' downstream in slough	268	74.0	3.59	920	9,052
Transect 1 out to a point 700' toward the mainstem		74.0	3.0	700	5,756
					Total = 14,808
21					
Transect 1 to a point 300' downstream in slough	54	20.0	1.89	300	422
Transect 1 out to a point 500' toward the mainstem		20.0	1.83	500	681
					Total = 1,103

Table 7. The size and eroding velocity of rock material as related to bottom stability.[1,2]

Diameter (inch)	Diameter (ft)	Weight (lb)	Curve[3] (fps)	Test[4] data (fps)
0.25	0.020	0.001	1.0	
1.00	0.083	0.050	2.5	2
1.50	0.125	0.200	3.0	
2.00	0.166	0.350	3.5	3
2.50	0.210	0.700	4.0	
3.00	0.250	1.000	4.5	
4.00	0.330	3.000	5.0	4
6.00	0.500	10.000	6.2	

The above is in beds or dumped for closure as an isolated cube.

1.0 inch = 1.8 fps
2.0 inch = 2.8 fps
4.0 inch = 3.8 fps

Using above figures and .6 average velocity ($\bar{v}$) for bottom velocity in a shallow stream.

$$\bar{v} = \frac{2}{.6} = 3.3 \text{ fps for 1-inch material}$$

$$\bar{v} = \frac{3}{.6} = 5.0 \text{ fps for 2-inch material}$$

$$\bar{v} = \frac{4}{.6} = 6.6 \text{ fps for 4-inch material}$$

---

[1]Reference: U.S. Army Corps of Engineers, Hydraulic design criteria, Vol. 2. Waterways experiment station, Vicksburg, Miss. Prepared for Office Chief of Engineers.

[2]Weight of rock = 165 lbs per cubic foot.

[3]Measured from bed material in place.

[4]Measured from material of an isolated cube.

Table 8 Estimated potential salmon egg deposition in Sloughs 9, 19, and 21 under 1981 natural conditions and mitigation conditions and estimated potential increase under mitigation.

Slough no.	9	19	21
Estimated total egg deposition under natural conditions (see Tables 9 & 13)	10,472,400	170,000	2,355,000
Estimated total egg deposition under mitigation conditions (see Tables 10 & 13)	25,944,200	1,032,500	2,912,200
Estimated potential increase in slough production under mitigation	15,471,000 (248%)	862,500 (607%)	557,200 (124%)

Data source: ADF&G field data and final reports, 1981 and 1982.

Bell, Milo C., Fisheries handbook of engineering requirements and biological criteria. Army Corps of Engineers, North Pacific Division, Portland, Oregon. 1973.

Table 9 Carrying capacity of Sloughs 9, 19 and 21 as calculated from 1981 field data using population estimates, spawning areas and 0^2 requirements and potential carrying capacity under natural conditions.

Slough no.	9		19		21	
Estimated useable wetted area under natural conditions (see Table 11)	104,725 sq ft (10/14/81)		1,700 sq ft (9/26/81)		23,550 sq ft (8/25/81)	
	Chum	Sockeye	Chum	Sockeye	Chum	Sockeye
Estimated 1981 escapement (see Table 4)	230	16	3	69	667	68
Estimated spawning pairs/ females (1981)	115	8	1	34	333	34
Average no. eggs per female (see Table 13)	3,000	3,000	3,000	3,000	3,000	3,000
Estimated total egg deposition (1981)	345,000	24,000	3,000	102,000	99,000	102,000
Potential egg deposition @ 100 eggs/sq ft in total wetted area (carrying capacity)	10,472,000		170,000		2,355,000	
Percent utilization of useable area estimated deposition / potential deposition	3.5		61.8		46.8	
Estimated alevins resulting from potential egg deposition in total wetted area (carrying capacity)	4,188,960		68,000		942,000	
0_2 required for 100 alevins per hour (mm^3) (see Table 13)	5,900		5,900		5,900	
Estimated 0_2 required for potential alevins in total wetted area	$2.5x10^8 mm^3/hr$		$4.0x10^6 mm^3/hr$		$5.6x10^7/mm^3/hr$	

Data source: ADF&G field data and final reports, 1981 and 1982.

Bell, Milo C., Fisheries handbook of engineering requirements and bioligical criter a. Army Corps of Engineers, North Pacific Division, Portland, Oregon. 1973

Table 10 Carrying capacity of Sloughs 9, 19 and 21 as calculated from 1981 field data with an assumed upwelling rate and using depth, velocity, slough flow and physical multiple spawning requirements (per pair and per 100 eggs) under mitigation conditions.

Slough no.	9		19		21	
Estimated useable wetted area under mitigation conditions (see Table 12)	259,442 sq ft		10,325 sq ft		29,122 sq ft	
	Chum	Sockeye	Chum	Sockeye	Chum	Sockeye
Wetted area allocated (sq ft)	241,281	18,161	9,602	733	27,083	2,039
Wetted area allocated (per cent)	93	7	93	7	93	7
Area required per pair (sq ft)	99	72	99	72	99	72
Total pairs/ females	2,484	252	97	10	274	28
Average no. eggs per female	3,000	3,000	3,000	3,000	3,000	3,000
Total eggs deposited	7,453,061	756,706	290,977	30,115	820,710	84,939
Total advanced alevins produced (survival rate .4)	2,981,224	302,682	116,391	12,046	328,284	33,976
O_2 required for 100 alevins (mm^3/hr)	5,900	5,900	5,900	5,900	5,900	5,900
O_2 required for total alevins produced (mm^3/hr)	$1.8x10^{10}$	$1.8x10^{8}$	$6.9x10^{8}$	$7.1x10^{7}$	$1.9x10^{9}$	$2.0x10^{8}$
Maximum potential egg deposition @ 100 eggs per sq ft	$2.40x10^{7}$	$1.8x10^{6}$	$9.6x10^{5}$	$7.2x10^{4}$	$2.7x10^{6}$	$2.0x10^{5}$
O_2 required for alevins produced from maximum potential egg deposition (mm^3/hr)	$5.6x10^{10}$	$4.3x10^{9}$	$2.3x10^{9}$	$1.7x10^{8}$	$6.4x10^{9}$	$4.8x10^{8}$
Estimated no. spawning waves	3	2	3	2	3	2

Data source: ADF&G field data and final report, 1981 and 1982.

Bell, Milo C., Fisheries handbook of engineering requirements and bioligical criteria. Army Corps of Engineers, North Pacific Division, Portland, Oregon. 1973.

Table 11 Calculated useable wetted area for salmon spawning in Sloughs 9, 19 and 21 under 1981 natural conditions.[1]

Slough no.	9	19	21
Transect no.	3-4	Below 5 to mid-point of 7 and 8	3-12
Date of data collection by ADF&G	10/14/81	9/26/81	8/25/81
Calculated wetted area (sq.ft.)[2, 3]	104,725	1,700	39,252
Estimated percent of calculated wetted area useable for spawning	10%	100%	60%

[1] Data source: ADF&G field data and planometric maps

[2] See Appendix D

[3] With no surface inflow from river at upper end

Table 12 Calculated useable wetted area for spawning salmon in Sloughs 9, 19 and 21 under mitigation conditions.

Slough no.	9	19	21
Average width ($\bar{w}$)	74 ft	51 ft	40 ft
Average depth ($\bar{d}$)	1.50 ft	2.62 ft	1.50 ft
Estimated wetted perimeter (P)	74 ft	52 ft	40 ft
Cross section area (A)	110 sq ft	136 sq ft	60 sq ft
Length of section (L)	6,150 ft (1-5)	283 ft (1-4)	1,195 ft (6-13)
Total wetted area of section (wetted P x wetted L)	455,160 sq ft	14,750 sq ft	48,540 sq ft
Estimated percent of total wetted area useable for spawning salmon	57%	70%	60%
Estimated wetted area available for spawning	259,440	10,325 sq ft	29,120 sq ft

[1] Estimated average depth, wetted perimeter, area and length when river stage equals 13,400 cfs and water surface elevation at slough equals 721.32 ft above sea level (transects 1-4).

	Width	$\bar{P}$	$\bar{d}$	Distance	Wetted area of section
Transect 1 (51 to 64 ft)	13 ft				
		49.5 ft	2.57 ft	79 ft	3,910 sq ft
2 (9 to 95 ft)	86 ft				
		81.5 ft	2.65 ft	100 ft	8,109 sq ft
3 (9 to 86 ft)	77 ft				
		26.0 ft	2.62 ft	105 ft	2,730 sq ft
4 (25 to 51 ft)	26 ft				
					14,750 sq ft

[2] See Appendix D

[3] Depth was assumed to be the limiting physical parameter for spawning in Slough 19 as maximum velocity of the average cross section in transects 1-4 does not exceed that required for spawning. Approximately 30% of the wetted perimeter is not available as it is $\leq .75$ ft.

Table 13 Selected data used to define spawning and intragravel requirements of Pacific Salmon.[1]

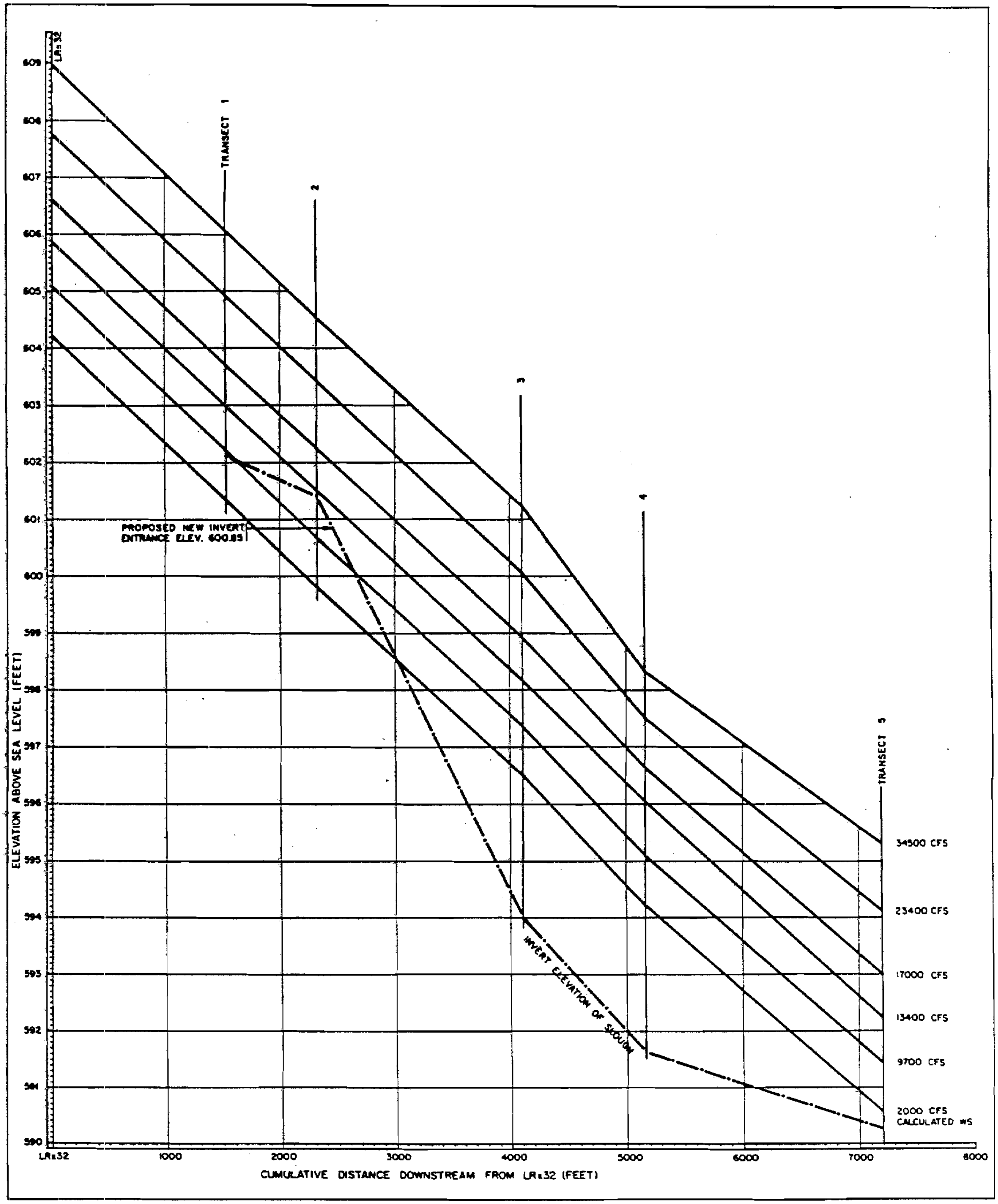
Range of stream width (ft)	8 or more
Range in size and percent composition of substrate of spawning beds	80% .5 inch to 2.0 inch, balance > 2.0 inch.
Average depth of spawning substrate (ft)	1.5
Average depth and size of material in under-bed	≥ 2 ft coarse gravel (≥ 3.0 inch diameter)
Average velocity (ft/sec) over beds	1.5
Velocity of intragravel water (percolation rate)	3.61 ft (1,100 mm) per hr
Average depth of water over spawning bed (ft)	1.5
Average slope of a good spawning area	.0006
Range of roughness factor of spawning bed (Manning's number)	n = .023 to .025
Average spawning flows	2.25 cfs per ft of mean channel width
Average incubation flows	≥ 1.5 cfs per ft of mean channel width
Average fry removal flows	> 3.0 cfs per ft of mean channel width
Dissolved oxygen demand per 100 alevins	5,900 mm^3 per hr @ 10°C
Number of eggs per area of spawning bed (range)	100 to 200 eggs per sq ft

Area of spawning beds and defense area (sq ft) and fecundity

Species	Area	No. eggs per female
Chinook	216	5,500
Coho	126	3,500
Chum	99	3,000
Sockeye	72	3,000
Pink	60	2,000

[1] Data source: Bell, Milo C., Fisheries handbook of engineering requirements and biological criteria. Army Corps of Engineers, North Pacific Division, Portland, Oregon. 1973.

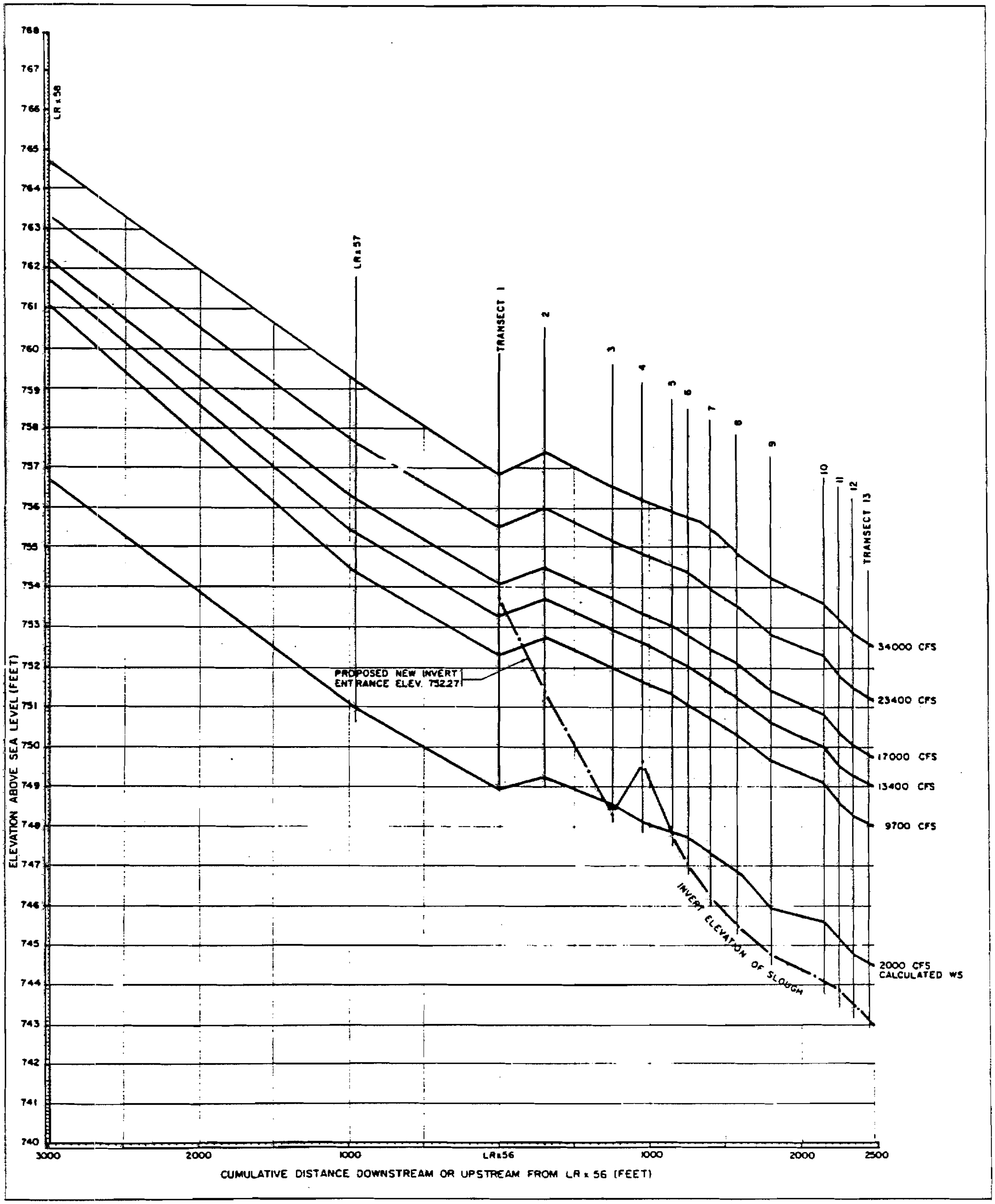
[2] Data source: Hayes, F. R., I. R. Wilmot and D. A. Livingstone. The oxygen consumption of the salmon egg in relation to development and activity. Journal of Experimental Zoology 116(3). April, 1951.



COMPARISON OF MINIMUM TRANSECT ELEVATIONS WITHIN SLOUGH 9 WITH CALCULATED WATER SURFACE ELEVATIONS (PERPENDICULAR TO SLOUGH TRANSECTS) AT THE LEFT BANK OF THE MAINSTREAM SUSITNA.

DATA SOURCE: R & M AERIAL PHOTOGRAPHS AND ADF & G TRANSECTS

FIGURE 1



COMPARISON OF MINIMUM TRANSECT ELEVATIONS WITHIN SLOUGH 21 WITH CALCULATED WATER SURFACE ELEVATIONS (PERPEDICULAR TO SLOUGH TRANSECTS) AT THE LEFT BANK OF THE MAINSTREAM SUSITNA.

DATA SOURCE: R & M AERIAL PHOTOGRAPHS AND ADF & G TRANSECTS

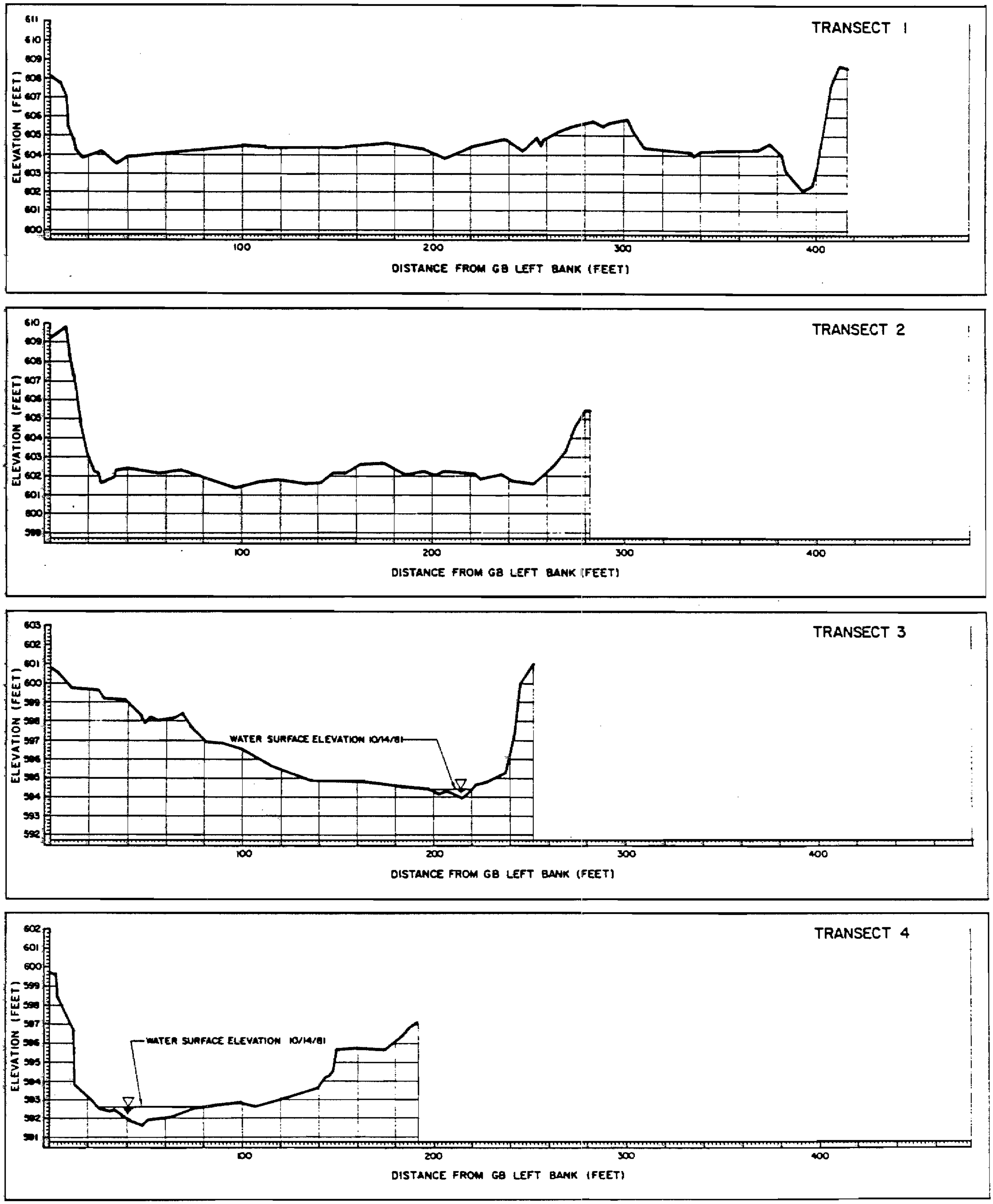
FIGURE 2

Appendix A Estimated hydraulic head differences between mainstem water surface elevations and minimum thalweg elevations of transects within Sloughs 9 and 21 at various river flows[1]

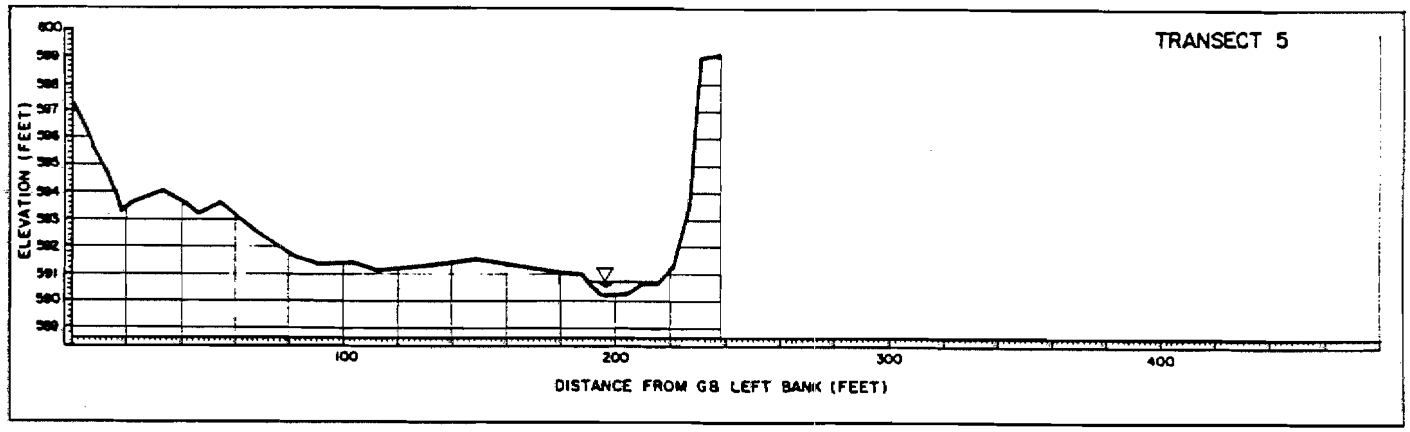
Slough no.	Date	Transect no.	Q at transect	River discharge	Mainstem water surface elevation[1]	Transect minimum thalweg elevation[1]	Hydraulic head difference Δ h	Perpendicular distance mainstem to transect
9	6/24/81	3	2.86	17,600	599.0	594.02	5.0	1,750
	7/21/81	3	714	42,600	601.5	594.02	7.5	1,750
	9/30/81	3	1.46	8,000	597.0	594.02	3.0	1,750
	10/14/81	3	1.17	13,600	598.2	594.02	4.2	1,750
	10/14/81	5	3.87	13,600	592.3	590.28	2.0	1,350
21	6/23/81	8	3.20	17,500	751.4	745.53	6.0	1,000
	7/22/81	10	142.0	37,700	754.0	744.11	11.0	1,000
	8/27/81	tributary above 2A	.56	25,600	N/A	752.39		N/A
	8/27/81	5A	2.10	25,600	N/A	746.15		N/A
	8/27/81	7	5.12	25,600	753.5	746.32	7.2	1,000
	9/5/81	11	6.3	17,000	750.4	743.85	6.6	1,000
	9/29/81	6	.428	8,400	750.3	747.06	3.2	1,000
	9/29/81	11	2.57	8,400	748.0	743.85	4.1	1,000
	3/18/82	9	1.09	1,520	746.2	744.81	1.4	1,000

1 See Figures 1 & 2

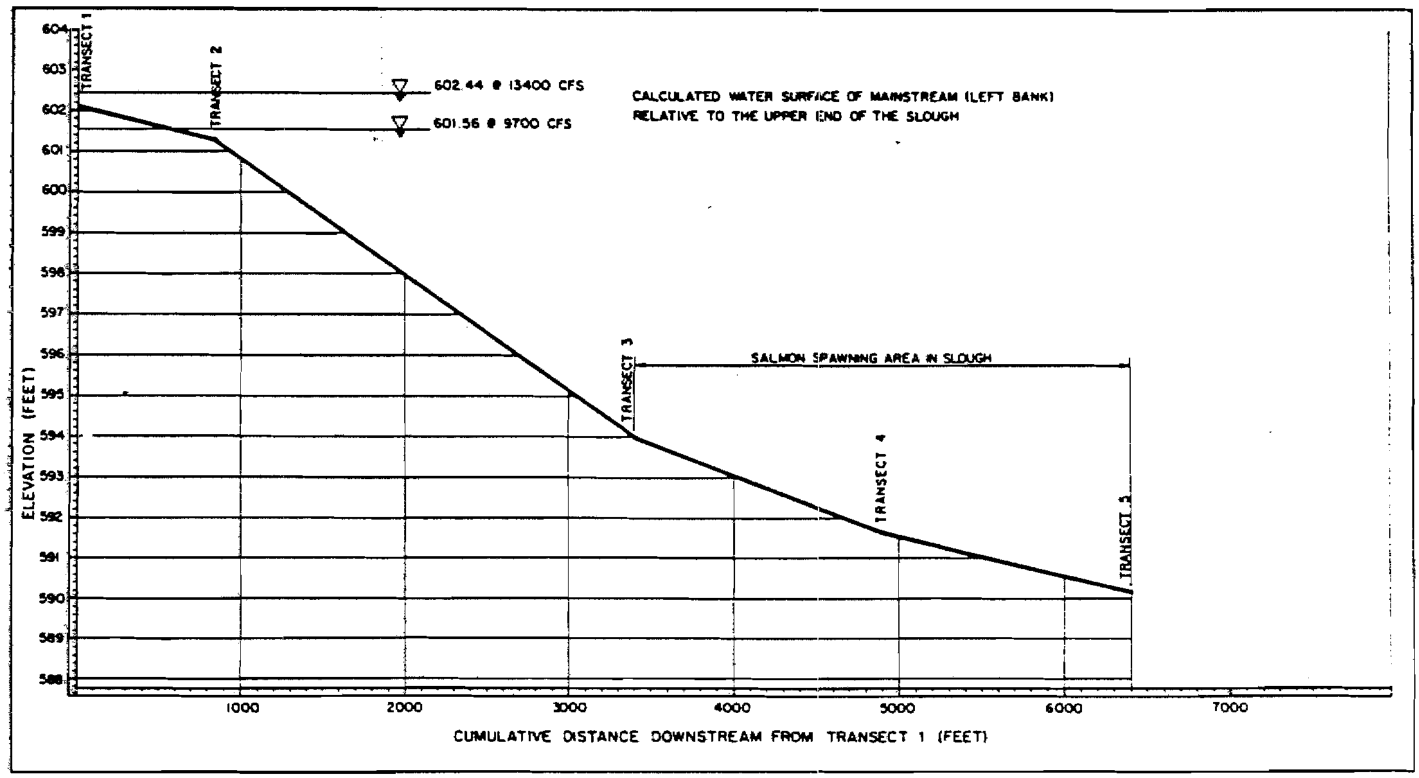
Appendix B, Slough 9 - Cross sections of transects 1-5
and profile of minimum bottom elevations



CROSS SECTIONS OF TRANSECTS 1 – 4
SLOUGH 9

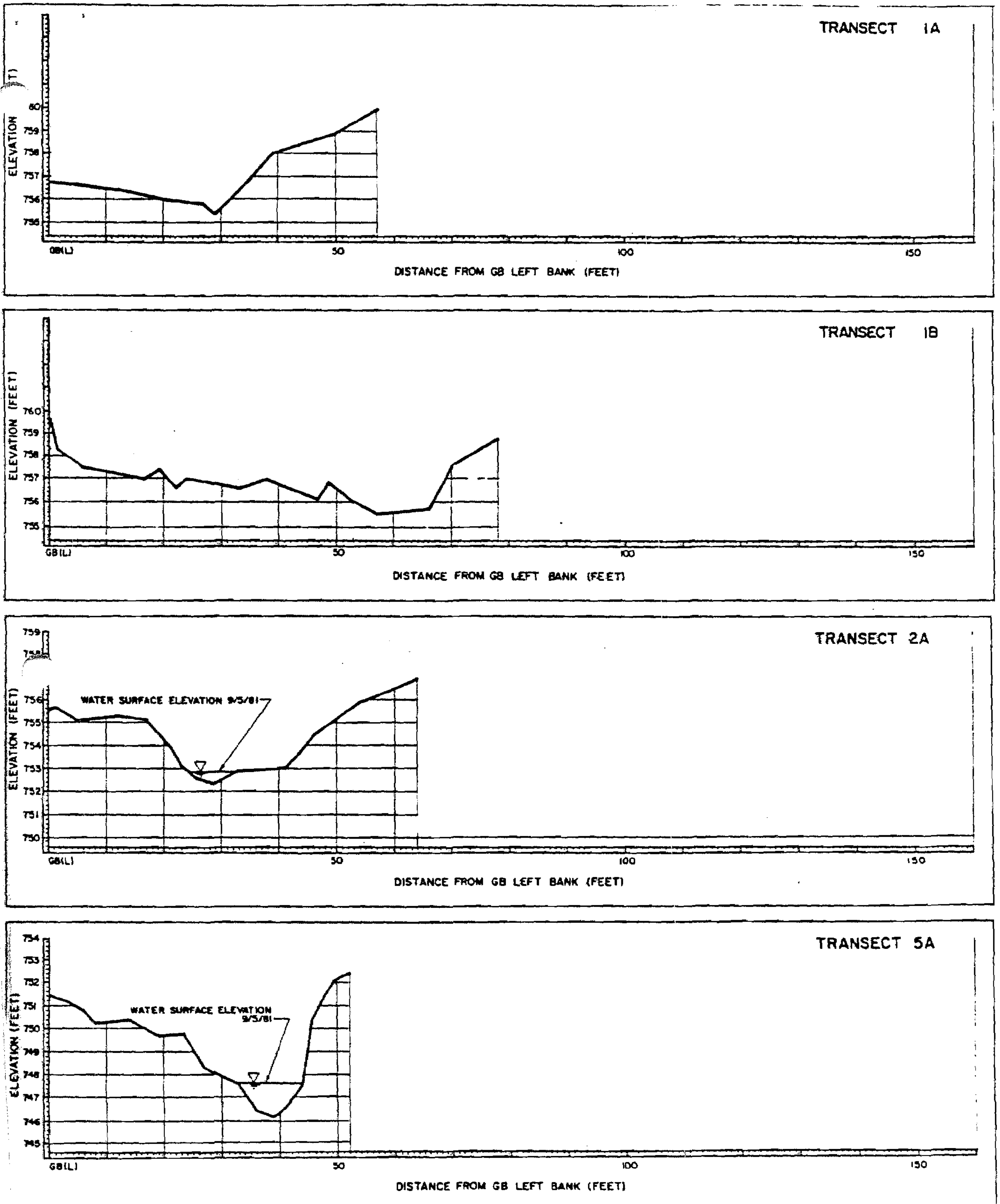


CROSS SECTION OF TRANSECT 5
SLOUGH 9

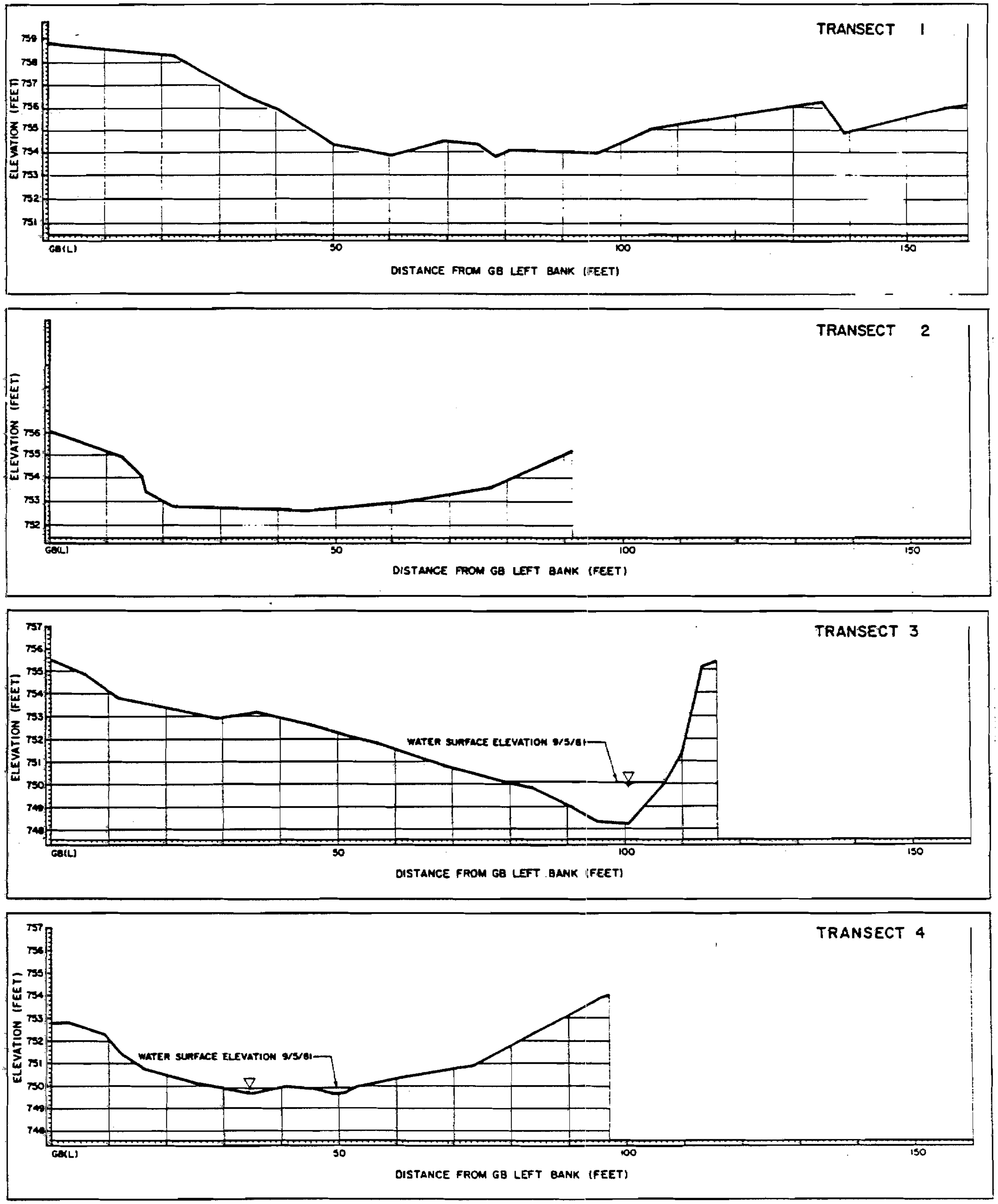


PROFILE OF MINIMUM BOTTOM ELEVATIONS
SLOUGH 9

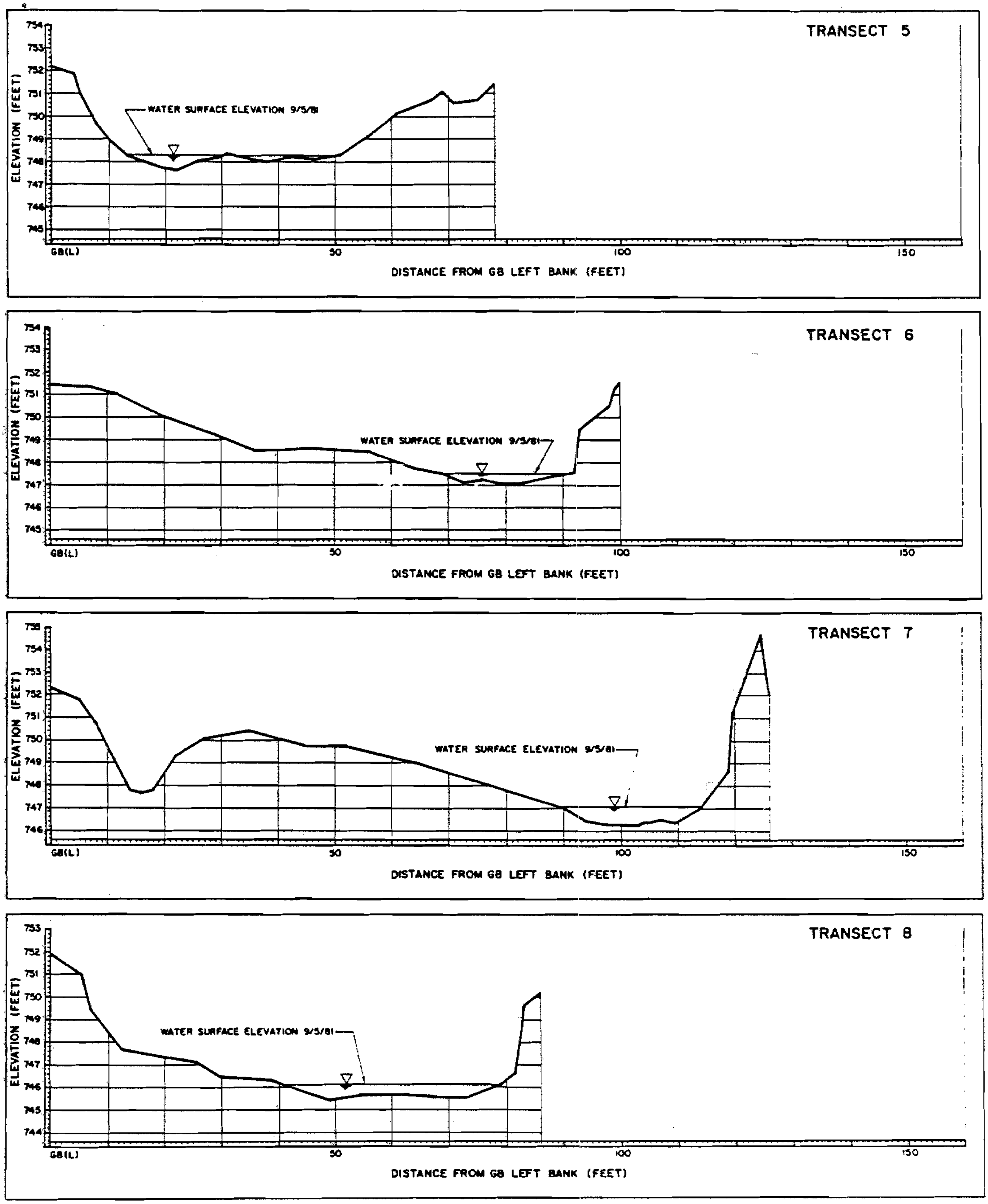
Appendix C, Slough 21 - Cross sections of transects 1-13 and 1A-5A, and profiles of minimum bottom elevations



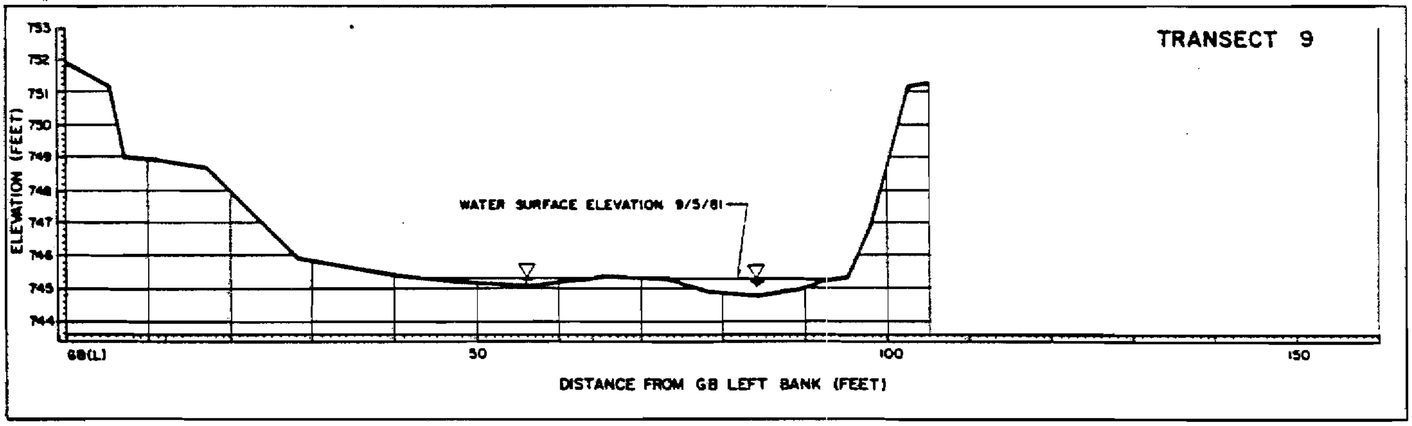
CROSS SECTIONS OF TRANSECTS 1A – 5A SLOUGH 21

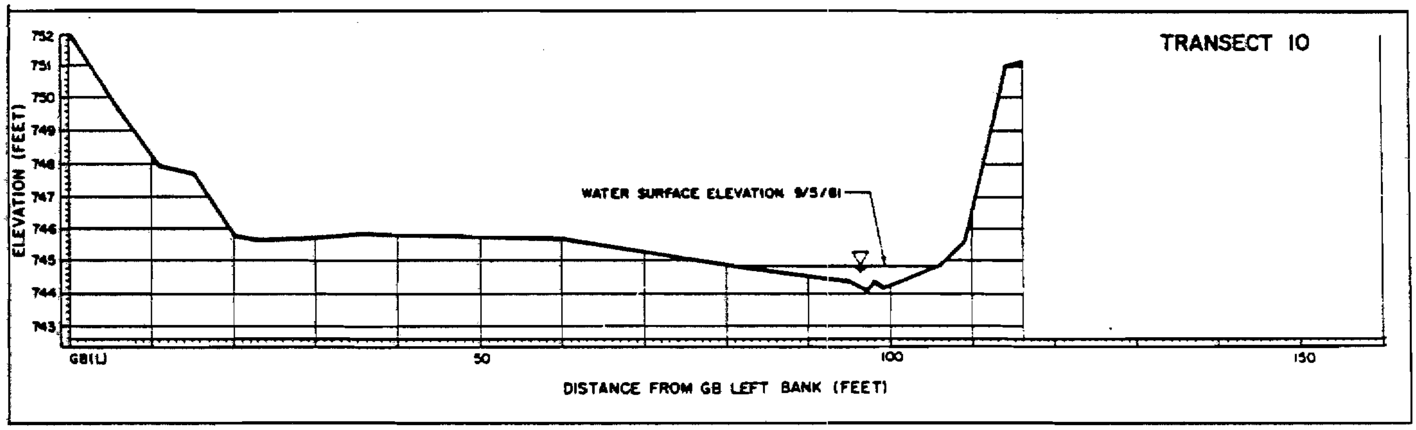


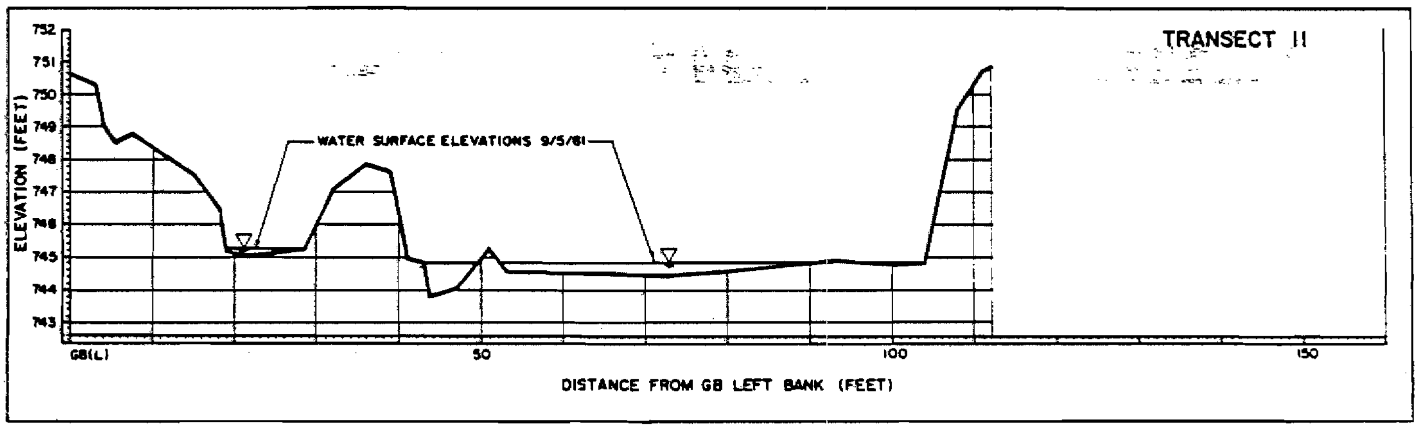
CROSS SECTIONS OF TRANSECTS 1 – 4
SLOUGH 21

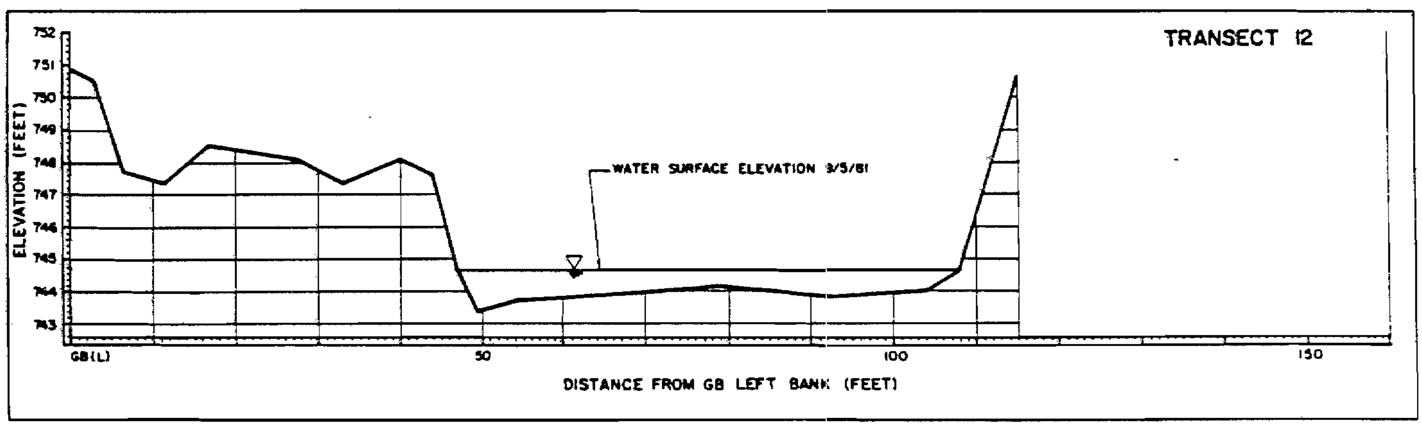


CROSS SECTIONS OF TRANSECTS 5 - 8
SLOUGH 21

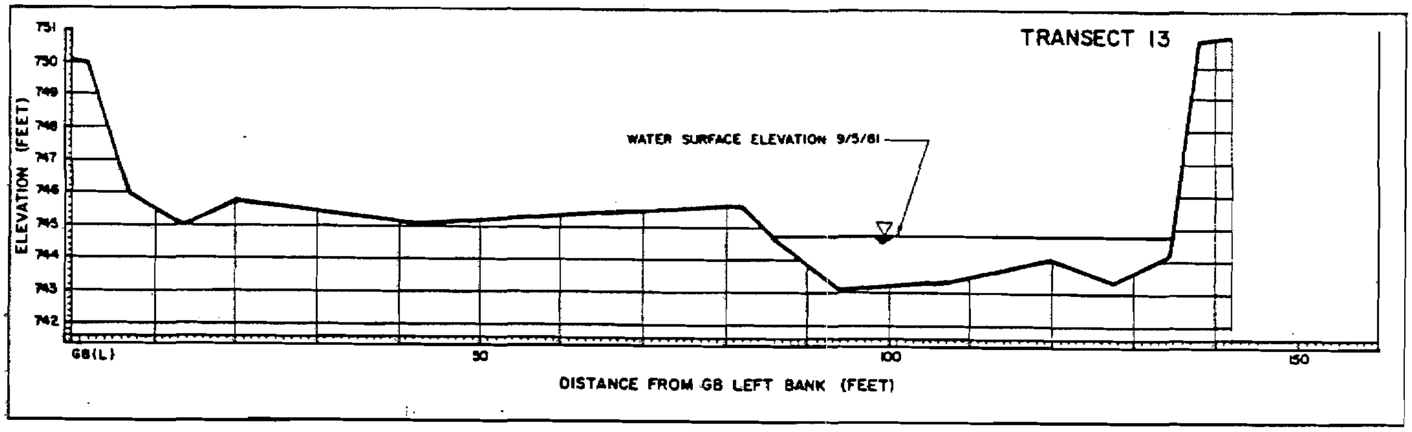




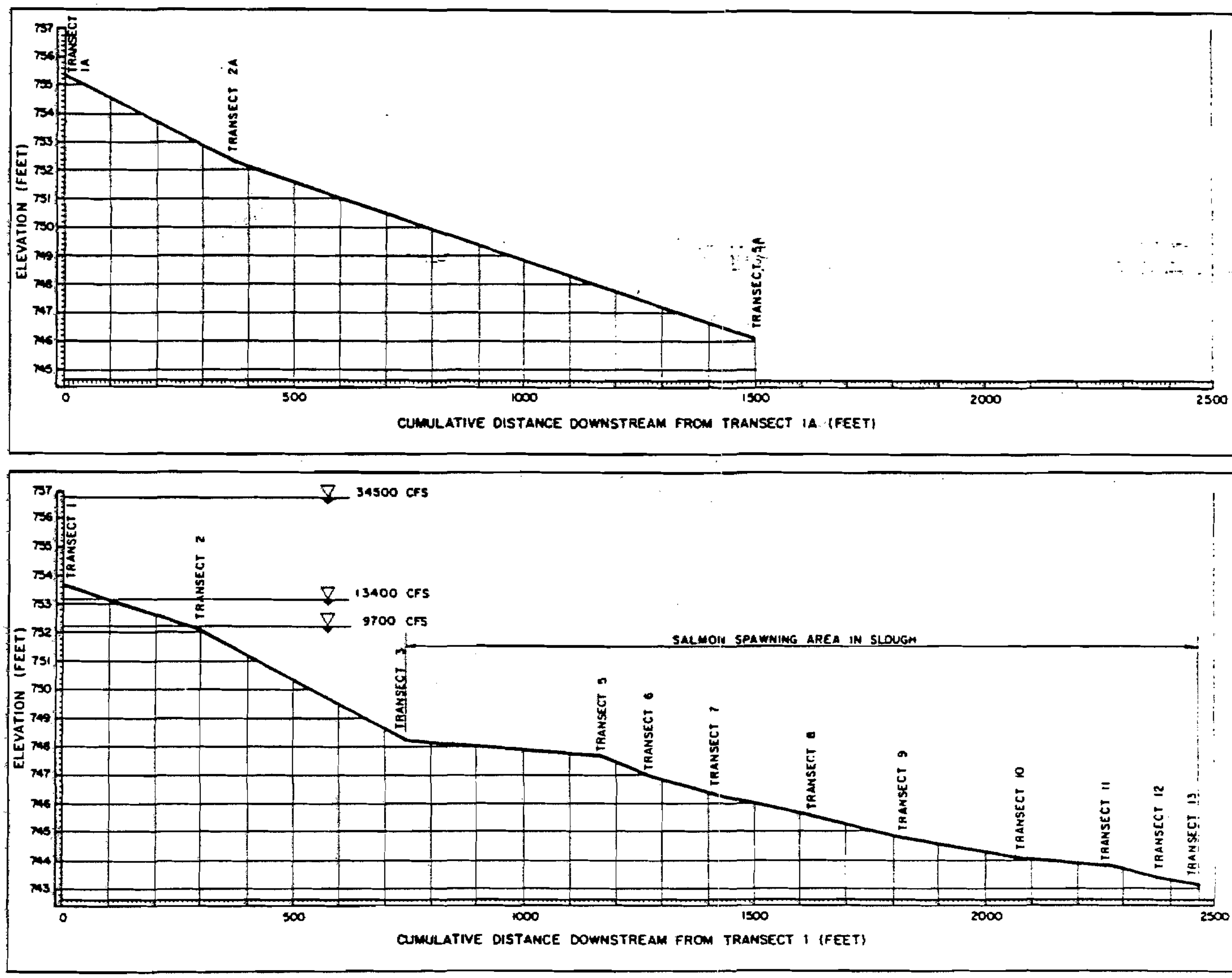




CROSS SECTIONS OF TRANSECTS 9 - 12
SLOUGH 21



CROSS SECTION OF TRANSECT 13
SLOUGH 21



PROFILES OF MINIMUM BOTTOM ELEVATIONS
SLOUGH 21

Appendix D Estimates based on calculations of wetted area in Sloughs 9, 19 and 21 under 1981 natural conditions.[1]

Slough no.	Section (transect x-y)	Calculated wetted area of section (sq ft)	Total calculated wetted area of slough (sq ft)
9	3 to 4	60,350	
	4 to 5	44,375	
			104,725
19	Below 5 to mid-point of 7 and 8	1,700	1,700
21[2]	Above 3 to 3	186.7	
	3 to 4	2,993	
	4 to 5	5,547	
	5 to 6	1,931	
	6 to 7	4,551	
	7 to 8	5,639	
	8 to 9	7,152	
	9 to 10	3,850	
	10 to 11	4,851	
	11 to 12	2,551	
			39,252

[1] Data source: ADF&G field data and planimetric maps.

[2] See Appendix C

Appendix E Methodology used in calculating estimates of total salmon escapement to sloughs and streams.

Methodology for sloughs

Total spawning escapement = Calculated area under the curve/stream life.

Example for calculation of area under the curve and escapement to slough

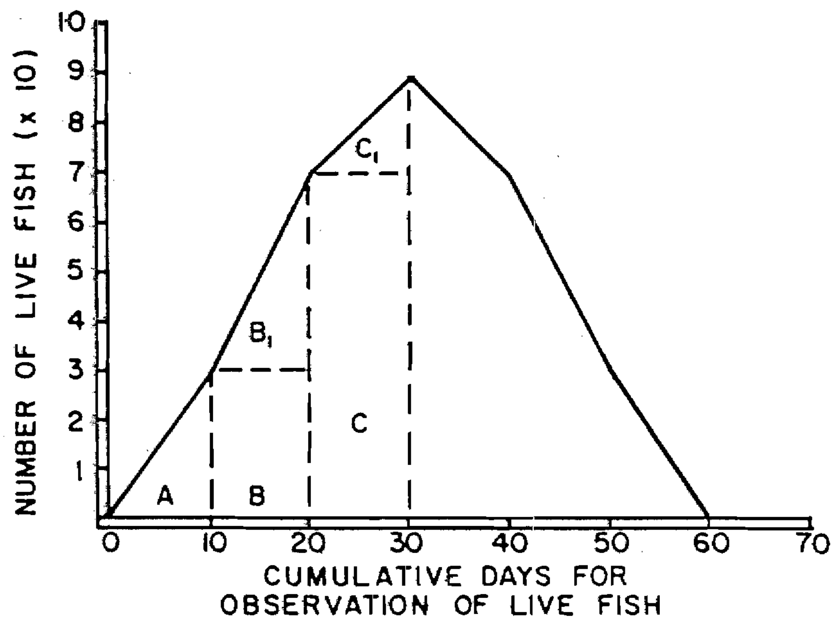


FIGURE I

Total area under the curve = $2 (A + B + B_1 + C + C_1)$

Where: $A = \frac{30 \times 10}{2} = 150$

$B = 30 \times 10 = 300$

$B_1 = \frac{40 \times 10}{2} = 200$

$C = 70 \times 10 = 700$

$C_1 = \frac{20 \times 10}{2} = 100$

Total area = 2(1450) = 2900

Example for estimating stream life of a salmon wave

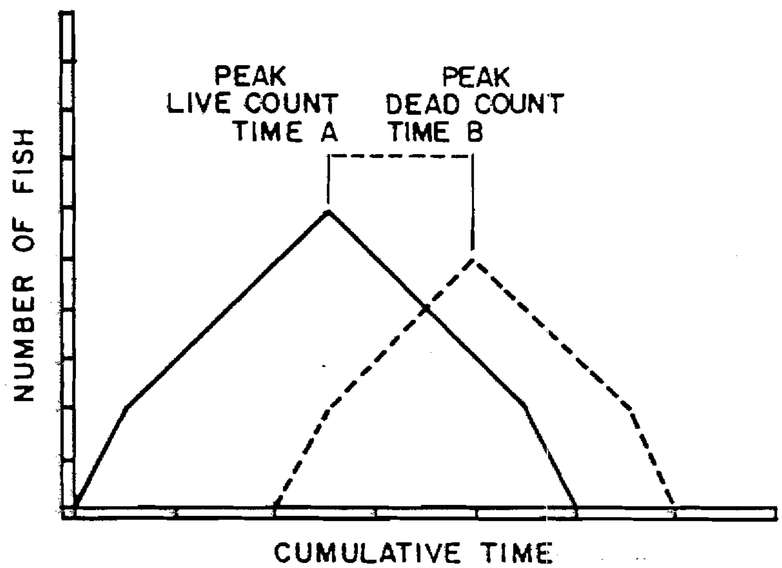


FIGURE 2

Time lapsed between peak live (A) and dead counts (B) approximately equals the stream life of a wave

Case 1: Sockeye

Where stream life = 12 days

Estimated escapement = $\frac{2900}{12}$

= 242 fish

Case 2: Chum

Where stream life = 10 days

Estimate escapement = $\frac{2900}{10}$

= 290 fish

Methodology for Streams

Total spawning escapement = (Peak total fish count/mile) x (Estimated miles of stream length utilized).

Example of calculating stream escapement -

Total number live and dead fish observed per .5 miles = 10 fish

Total count per mile = 20 fish

Total miles utilized = 5 miles

Thus total estimated spawning escapement = (20 fish/mile) x (5 miles)
= 100 fish

References: Atkinson, C.E., The problem of enumerating spawning populations of sockeye salmon. International Pacific Salmon Fisheries Commission, New Westminster, B.C. 1973.

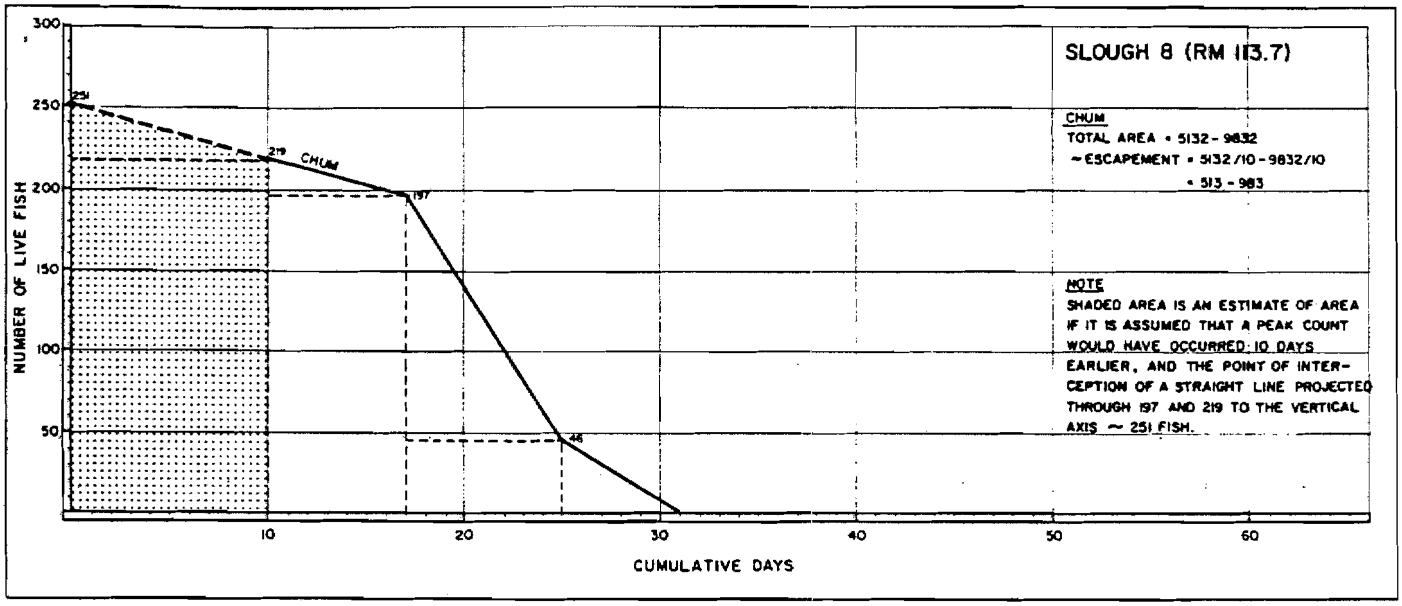
Washington Department of Fisheries, 1979 Puget Sound methods for escapement estimation and proposed escapement goals for natural chum salmon stocks. Prepared by the Harvest Management Division. 1979.

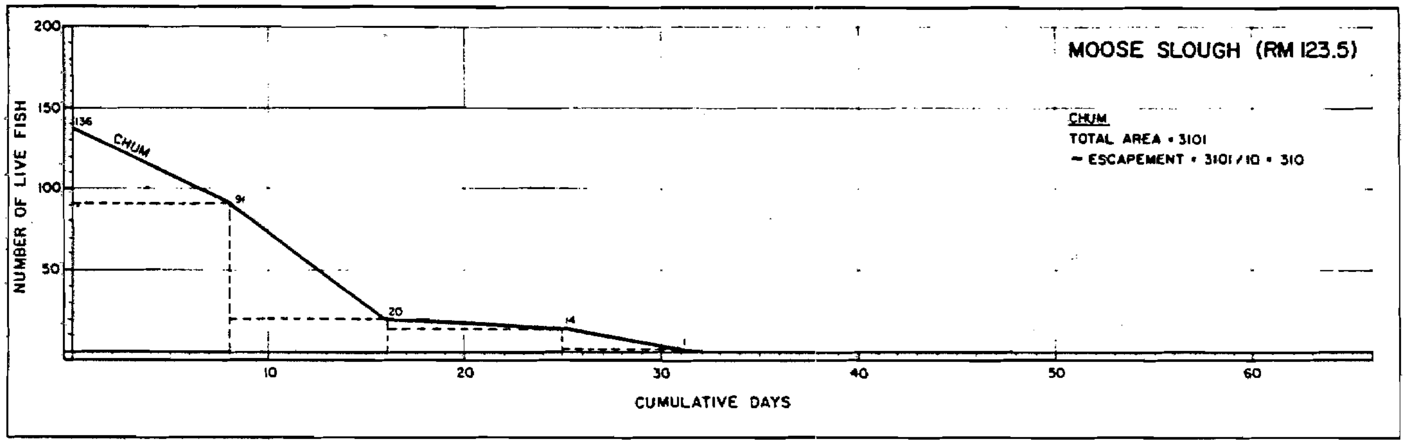
Ames, J. Personal communication. April 1982

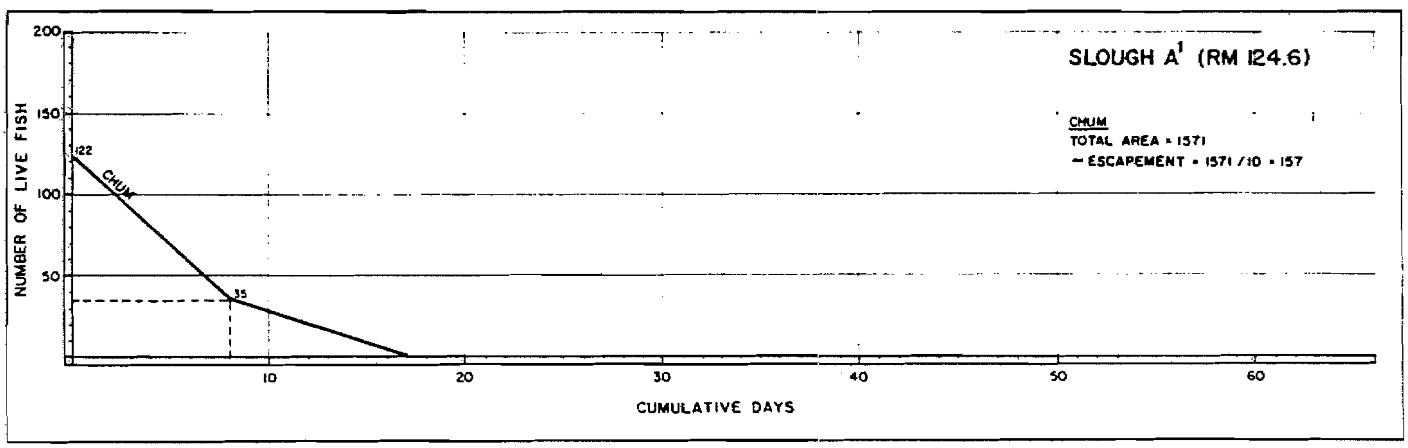
Appendix F - Graphic presentations used in determining sockeye and chum salmon escapement to slough areas above Talkeetna, by area under the curve methodology[1, 2]

[1] See Appendix E

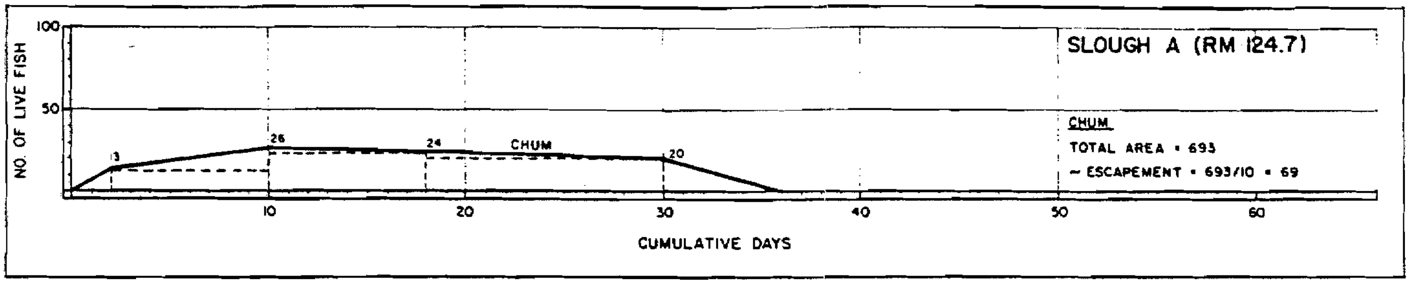
[2] Data source: 1981 ADF&G salmon spawning surveys (see Appendix H)

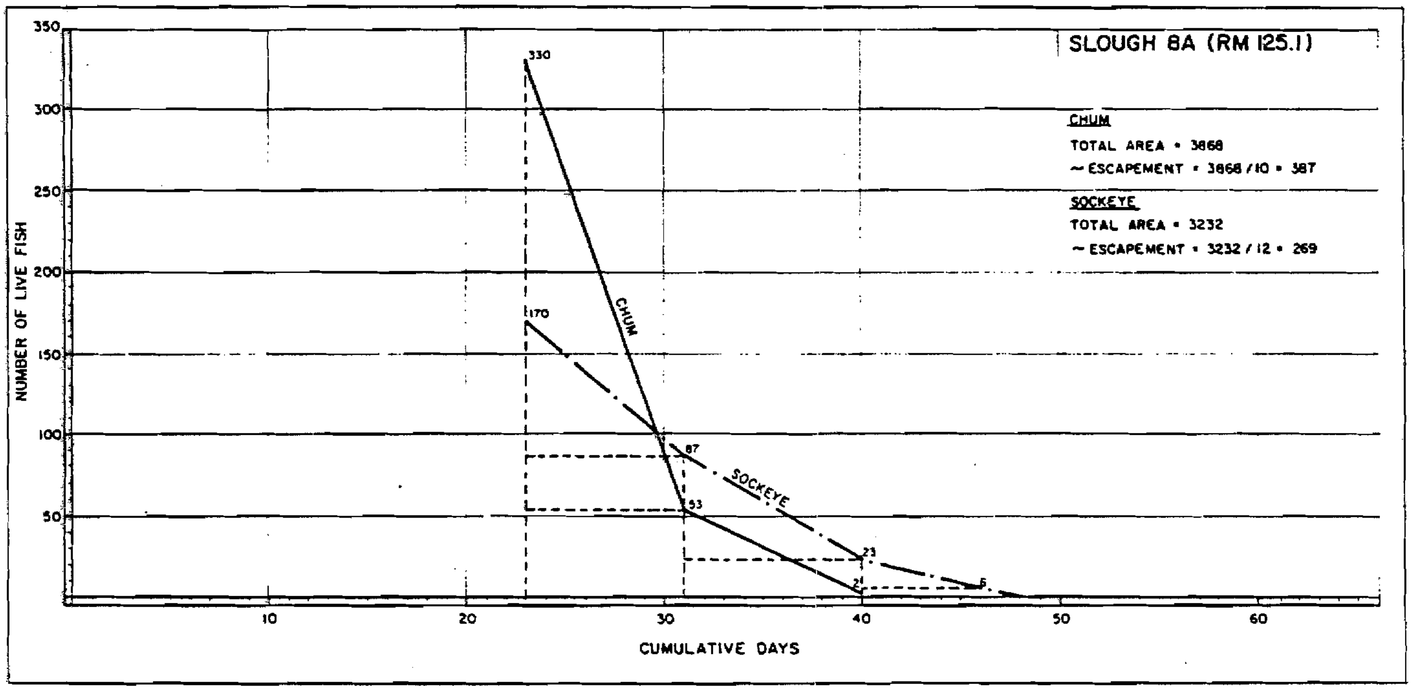


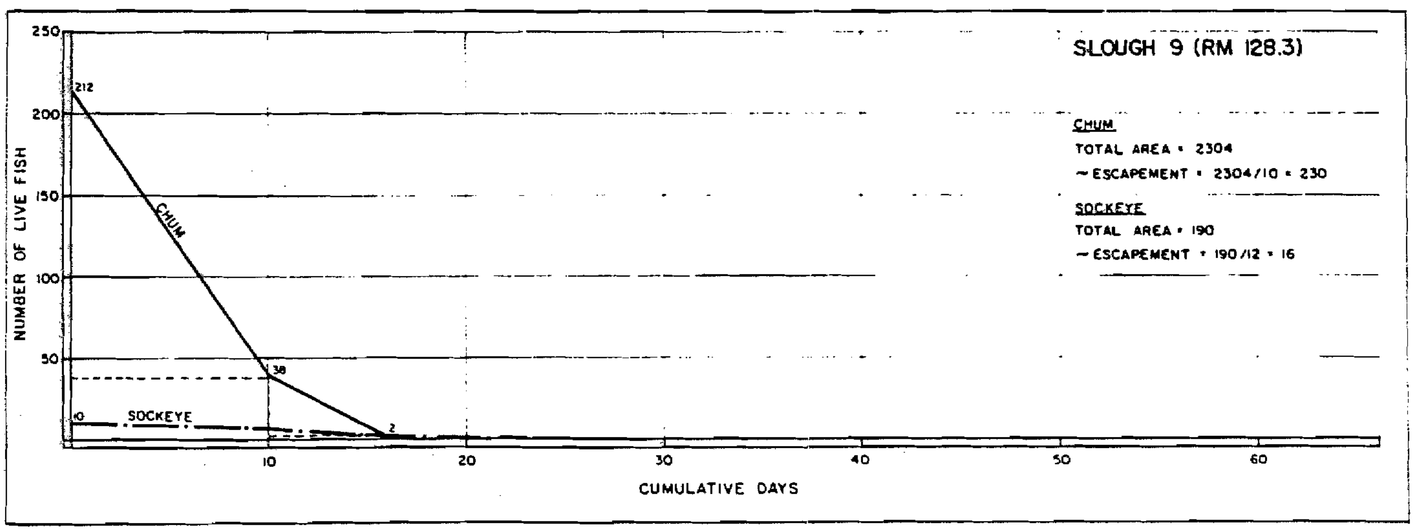




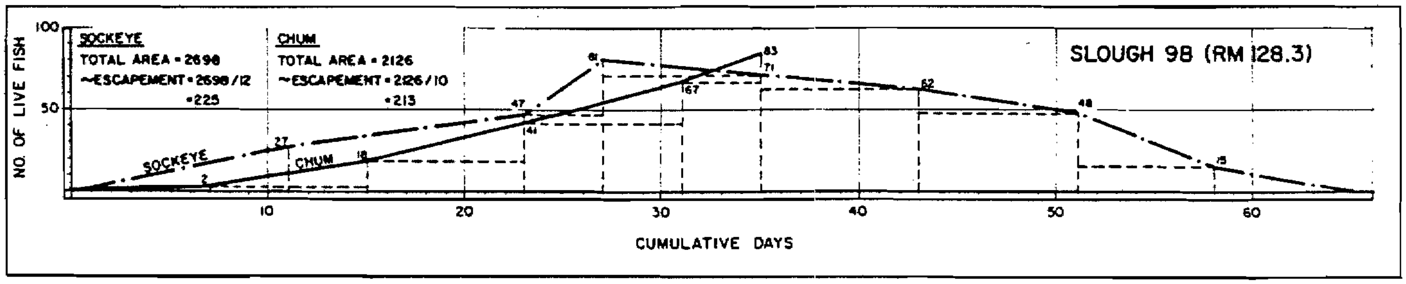
ESTIMATED FISH ESCAPEMENT SLOUGH 8, MOOSE SLOUGH AND SLOUGH A'

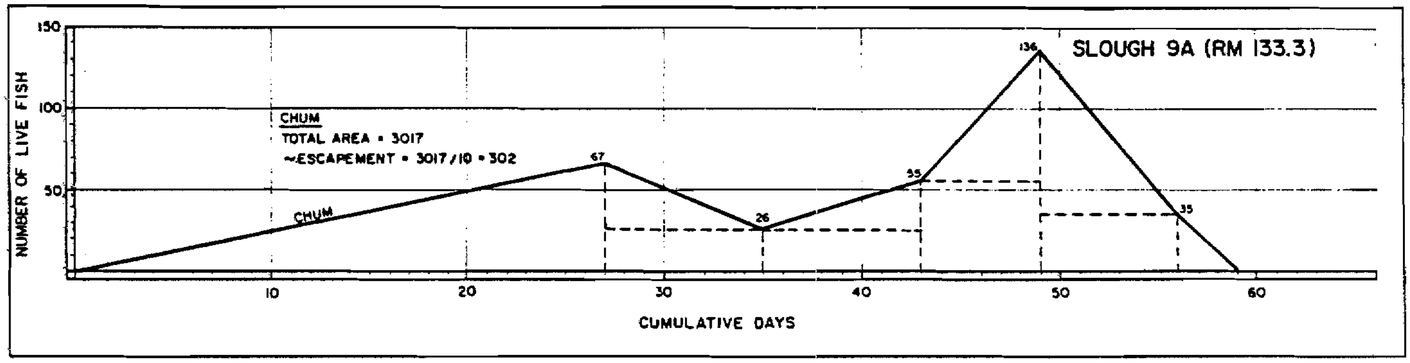


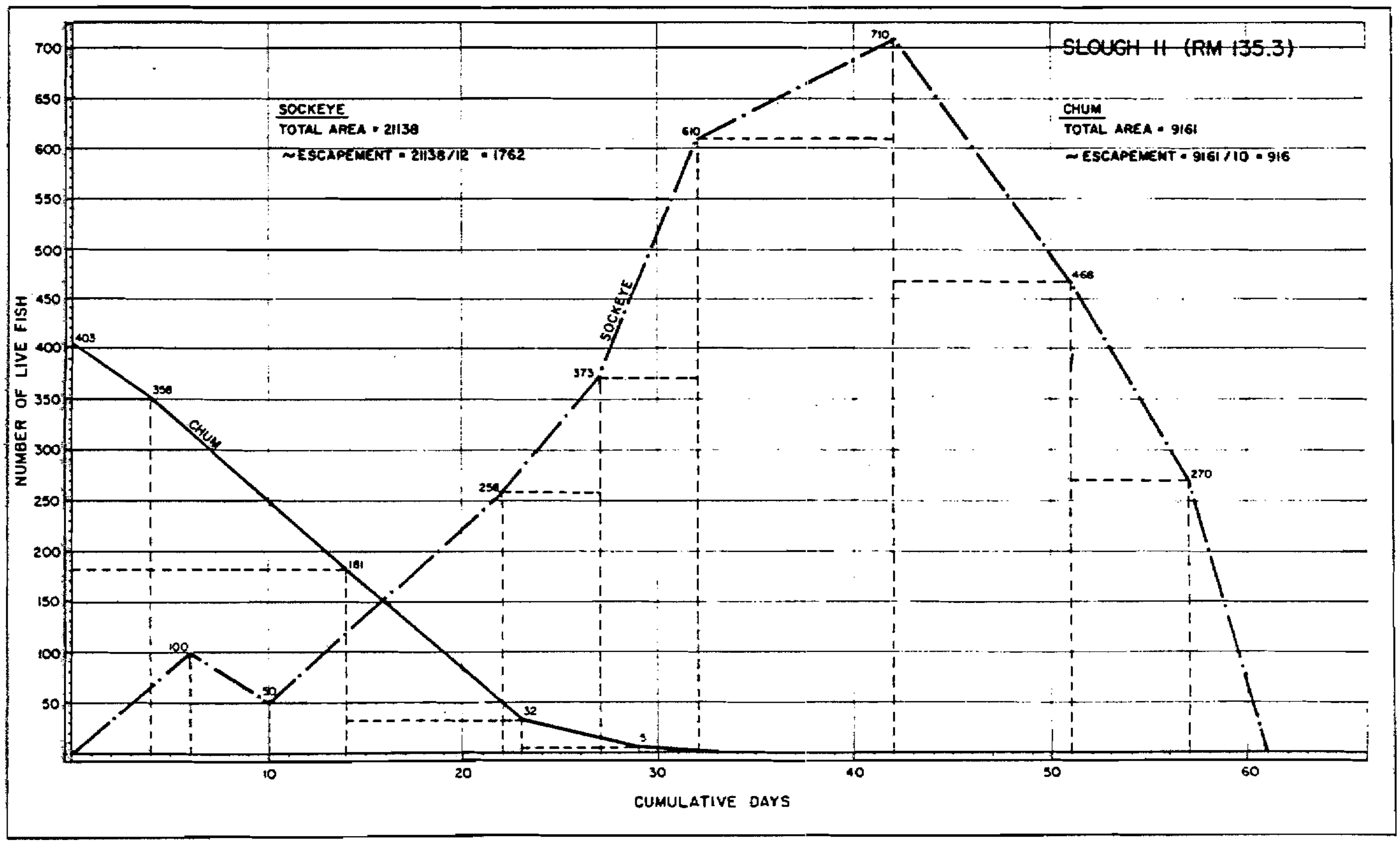




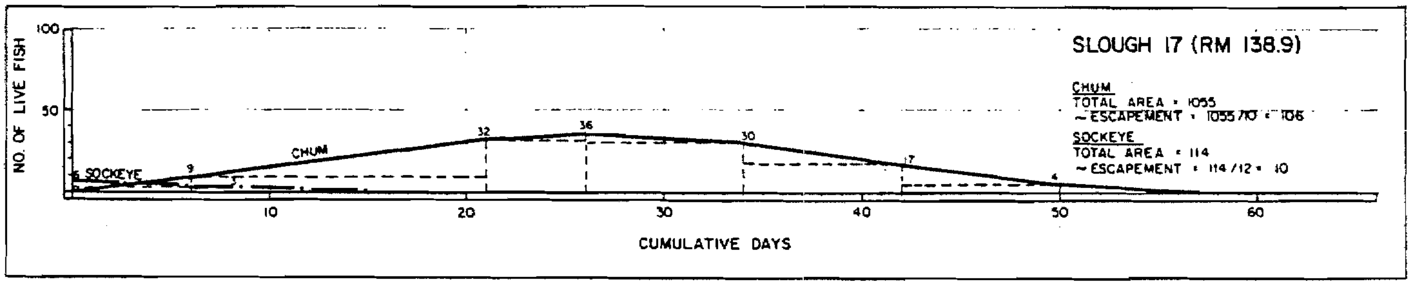
ESTIMATED FISH ESCAPEMENT
SLOUGHS A, 8A AND 9

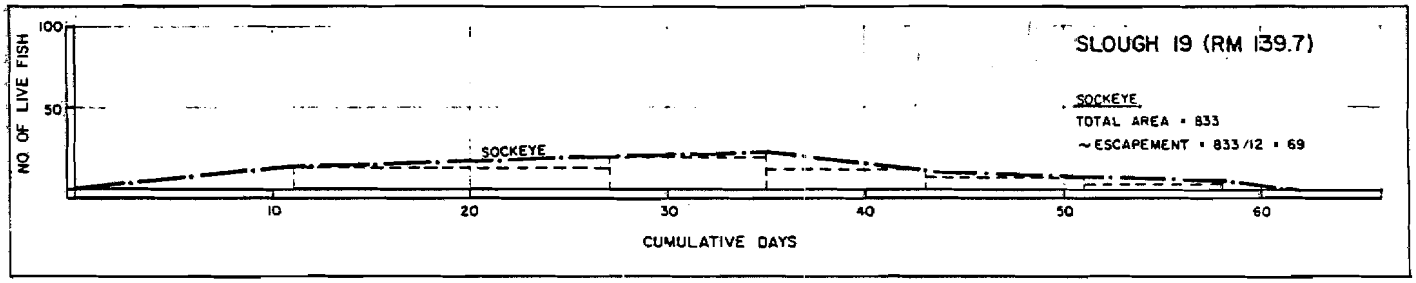


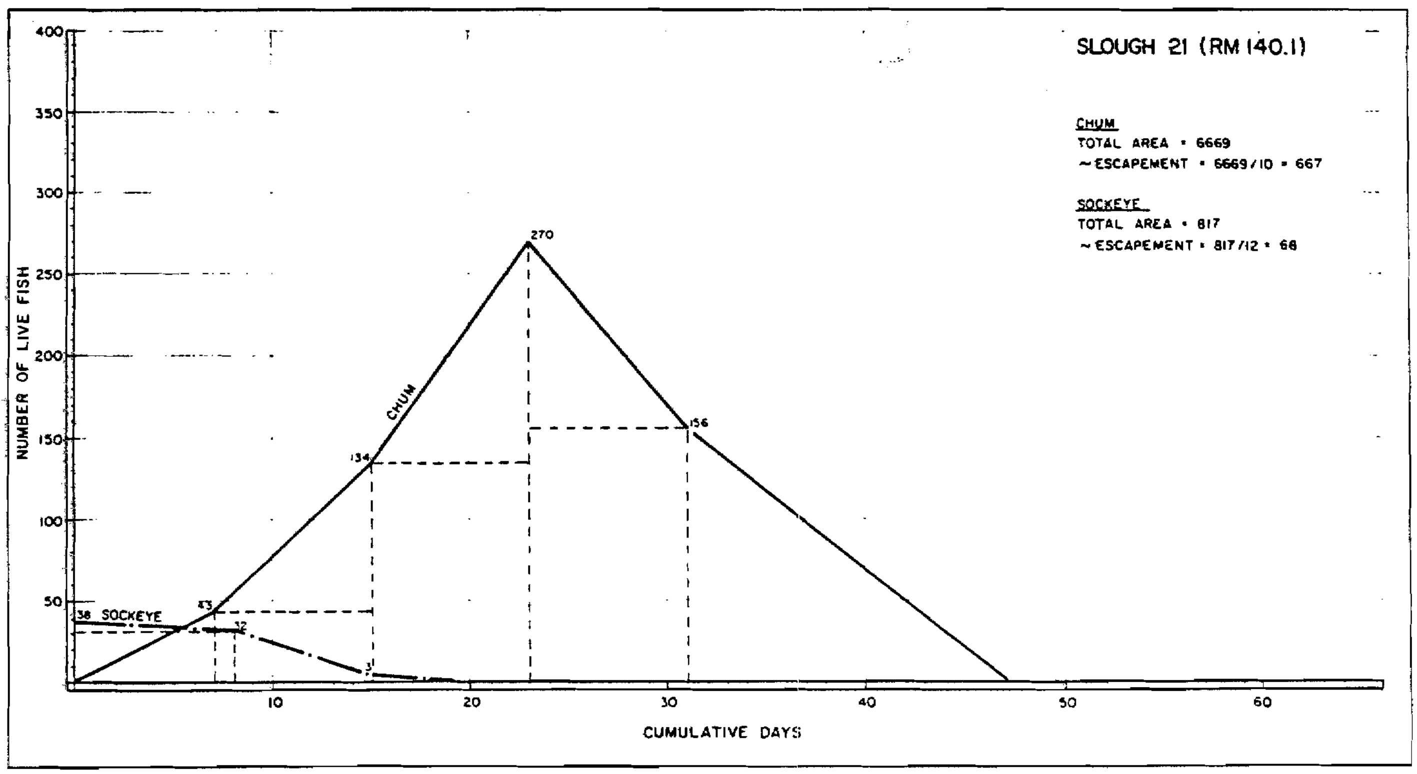




ESTIMATED FISH ESCAPEMENT SLOUGHS 9B, 9A AND 11







ESTIMATED FISH ESCAPEMENT SLOUGHS 17, 19 AND 21

Appendix G - Areas under the curve calculations used to determine sockeye and chum salmon escapement to slough areas above Talkeetna[1, 2]

[1]See Appendix F

[2]Data source: 1981 ADF&G salmon spawning surveys (see Appendix H)

Slough 8 (RM 113.7)

Chum

$$\frac{10 \times 219 + 10 \times 32}{2}: \quad 10x219 = 2,190$$

10x219 = 2,190
10x32 / 2 = 160
2,350

7x197 = 1,379
7x22 / 2 = 77
1,456

8x46 = 368
8x151 / 2 = 604
972

6x46 / 2 = 138

Total = 4,916x2 = 9,832 / 10 = 983

or

Total = 4,916-2,350 = 2,566x2 = 5,132 / 10 = 513

Chum escapement = 513-983

Moose Slough (RM 123.5)

$$\frac{8\times91}{} = 728$$
$$\frac{8\times45}{2} = \underline{180}$$
$$908$$

$$8\times20 = 160$$
$$\frac{8\times71}{2} = \underline{284}$$
$$444$$

$$9\times14 = 126$$
$$\frac{9\times6}{2} = \underline{27}$$
$$153$$

$$6\times1 = 6$$
$$\frac{6\times13}{2} = \underline{39}$$
$$45$$

$$\frac{1\times1}{2} = 1/2$$

$$\text{Total} = 1{,}550.5\times2 = \frac{3{,}101}{10} = 310 \text{ chums}$$

Slough A[1] (RM 124.6)

$$\frac{8 \times 35 = 280}{}$$

$$\frac{8 \times 87}{2} = 348$$

$$628$$

$$\frac{9 \times 35}{2} = 157.5$$

$$\text{Total} = 785.5 \times 2 = \frac{1{,}571}{10} = 157 \text{ chums}$$

Slough A (RM 124.7)

$$\frac{2 \times 13}{2} = 13$$

$$8 \times 13 = 104$$
$$\frac{8 \times 13}{2} = \underline{52}$$
$$156$$

$$8 \times 24 = 192$$
$$\frac{8 \times 2}{2} = \underline{8}$$
$$200$$

$$12 \times 20 = 240$$
$$\frac{12 \times 4}{2} = \underline{24}$$
$$264$$

$$\frac{6 \times 20}{2} = 60$$

$$\text{Total } \frac{693}{10} = 69 \text{ chum}$$

Slough 8A (RM 125.1)

Sockeye

25 days

$$\frac{8\times87}{} = 696$$
$$\frac{8\times83}{2} = \frac{332}{1{,}028}$$

$$\frac{9\times23 = 207,\quad 9\times64 = 288}{2} = 495$$

$$\frac{6\times6 = 36,\quad 6\times17 = 51}{2} = 87$$

$$\frac{2\times6}{2} = 6$$

$$\text{Total} = 1{,}616\times2 = \frac{3{,}232}{12} = 269 \text{ sockeye}$$

Chum

$$\frac{8\times53 = 424,\quad 8\times277 = 1{,}108}{2} = 1{,}532$$

$$\frac{9\times2 = 18,\quad 9\times85 = 383}{2} = 401$$

$$\frac{1\times2}{2} = 1$$

$$\text{Total} = 1{,}934\times2 = \frac{3{,}868}{10} = 387 \text{ chum}$$

Slough 9 (RM 128.3)

Sockeye

$$\frac{8 \times 6 = 48 \quad 8 \times 2}{2} = 8 \quad 56$$

$$\frac{8 \times 2 = 16 \quad 8 \times 4}{2} = 16 \quad 32$$

$$\frac{2 \times 7}{2} = 7$$

$$\text{Total} = 95 \times 2 = \frac{190}{12} = 16 \text{ sockeye}$$

Chum

$$\frac{8 \times 38 = 304 \quad 18 \times 174}{2} = 696 \quad 1{,}000$$

$$\frac{8 \times 38}{2} = 152$$

$$\text{Total} = 1{,}152 \times 2 = \frac{2{,}304}{10} = 230$$

Slough 9B (RM 128.3)

Sockeye

$\frac{11x27}{2} = 148.5$

12x27 = 324
12x20 = 120
2 444

4x47 = 188
4x34 = 68
2 256

8x71 = 568
8x10 = 40
2 608

8x62 = 496
8x9 = 36
2 532

8x48 = 384
8x13 = 52
2 436

7x15 = 105
7x33 = 115.5
2 220.5

$\frac{7x15}{2} = 52.5$

Total = $\frac{2,698}{12}$ = 225 sockeye

Chum

$\frac{7x2}{2} = 7$

8x2 = 16
8x16 = 64
2 80

8x18 = 144
8x23 = 92
2 236

8x41 = 328
8x26 = 104
2 432

4x67 = 268
4x20 = 40
2 308

Total = 1,063x2 = $\frac{2,126}{10}$ = 213 chum

Slough 9A (RM 133.3)

Chum

$$\frac{27x67}{2} = 905.5$$

$$8x26 = 208$$
$$\frac{8x41}{2} = \underline{164}$$
$$372$$

$$8x26 = 208$$
$$\frac{8x29}{2} = \underline{116}$$
$$324$$

$$8x55 = 440$$
$$\frac{8x81}{2} = \underline{324}$$
$$764$$

$$7x35 = 245$$
$$\frac{7x101}{2} = \underline{353.5}$$
$$598.5$$

$$\frac{9x35}{2} = 52.5$$

$$\text{Total} = \frac{3{,}016.5}{10} = 302 \text{ chums}$$

Slough 11 (RM 135.3)

Sockeye

$$\frac{6x100}{2} = 300$$

$$4x50 = 200$$
$$\frac{4x50}{2} = 100$$
$$300$$

$$12x50 = 600$$
$$\frac{12x208}{2} = 1,248$$
$$1,848$$

$$5x258 = 1,290$$
$$\frac{5x115}{2} = 287.5$$
$$1,577.5$$

$$5x373 = 1,865$$
$$\frac{5x237}{2} = 592.5$$
$$2,457.5$$

$$10x610 = 6,100$$
$$\frac{10x100}{2} = 500$$
$$6,600$$

$$9x468 = 4,212$$
$$\frac{9x242}{2} = 1,089$$
$$5,301$$

$$6x270 = 1,620$$
$$\frac{6x198}{2} = 594$$
$$2,214$$

$$\frac{4x270}{2} = 540$$

$$\text{Total} = \frac{21,138}{12} = 1,762 \text{ sockeye}$$

Chum

$$\frac{4x403}{2} = 806$$

$$10x181 = 1,810$$
$$\frac{10x177}{2} = 885$$
$$2,695$$

$$9x32 = 288$$
$$\frac{9x149}{2} \quad 670.5$$
$$958.5$$

$$6x5 = 30$$
$$\frac{6x27}{2} = 81$$
$$111$$

$$\frac{4x5}{2} = 10$$

$$\text{Total} = 4580.5x2 = \frac{9,161}{10} = 916 \text{ chums}$$

Slough 17 (RM 138.9)

Sockeye

$$8 \times 3 = 24$$
$$\frac{8 \times 3}{2} = \underline{12}$$
$$36$$

$$7 \times 3 = 21$$

$$\text{Total} = 57 \times 2 = \frac{114}{12} = 10 \text{ sockeye}$$

Chum

$$\frac{6 \times 9}{2} = 27$$

$$15 \times 9 = 135$$
$$\frac{15 \times 23}{2} = \underline{172.5}$$
$$307.5$$

$$5 \times 32 = 160$$
$$\frac{5 \times 4}{2} = \underline{10}$$
$$170$$

$$8 \times 30 = 240$$
$$\frac{8 \times 6}{2} = \underline{24}$$
$$264$$

$$8 \times 17 = 136$$
$$\frac{8 \times 13}{2} = \underline{52}$$
$$188$$

$$8 \times 4 = 32$$
$$\frac{8 \times 13}{2} = \underline{52}$$
$$84$$

$$\frac{7 \times 4}{2} = \underline{14}$$

$$\text{Total} = \frac{1{,}054.5}{10} = 106 \text{ chums}$$

Slough 19 (RM 139.7)

Sockeye

$$11 \times 13 = 143$$

$$15 \times 13 = 195$$
$$\frac{15 \times 7}{2} = 52.5$$
$$247.5$$

$$8 \times 20 = 160$$
$$\frac{8 \times 3}{2} = 12$$
$$172$$

$$8 \times 12 = 96$$
$$\frac{8 \times 11}{2} = 44$$
$$140$$

$$8 \times 8 = 64$$
$$\frac{8 \times 4}{2} = 16$$
$$80$$

$$7 \times 4 = 28$$
$$\frac{7 \times 4}{2} = 14$$
$$42$$

$$\frac{4 \times 4}{2} = 8$$

Total $= \frac{833}{12} = 69$ sockeye

Slough 21 (RM 141.0)

Sockeye

$$\frac{8 \times 32 + 8 \times 6}{2}: \quad 8x32 = 256, \quad \frac{8x6}{2} = 24, \quad 280$$

8x32 = 256
8x6/2 = 24
Sum: 280

7x3 = 21
7x29/2 = 101.5
Sum: 122.5

3x4/2 = 6

Total = 408.5x2 = 817/12 = 68 sockeye

Chum

7x43 = 301

8x43 = 344
8x91/2 = 364
Sum: 708

8x134 = 1,072
8x136/2 = 544
Sum: 1,616

8x156 = 1,248
8x114/2 = 456
Sum: 1,704

15x156/2 = 2,340

Total = 6,669/10 = 667 chums

Appendix H - Alaska Department of Fish and Game salmon escapement surveys of streams and sloughs above Talkeetna[1]

[1] Data source: ADF&G Final Report 1982

APPENDIX EJ
ESCAPEMENT SURVEYS OF STREAMS AND SLOUGHS

Table EJ-1. Escapem . surveys conducted on Susitna River sloughs between Chulitna River and Devil Canyon, Adult A iromous Investigations, Su Hydro Studies, 1981.

SLOUGH NO./NAME	RIVER MILE	DATE	C('VEY :TIONS	PERCENT SURVEYED	SOCKEYE LIVE	SOCKEYE DEAD	SOCKEYE TOTAL	PINK LIVE	PINK DEAD	PINK TOTAL	CHUM LIVE	CHUM DEAD	CHUM TOTAL
					ADULT SALMON COUNTS								
Slough 1	99.6	8/21	r	50	0	0	0	0	0	0	0	0	0
		8/29	r	100	0	0	0	0	0	0	0	0	0
		9/6	d	100	0	0	0	0	0	0	2	4	6
		9/16	Ex lent	100	0	0	0	0	0	0	0	1	1
		9/24	Ex lent	100	0	0	0	0	0	0	0	1	1
		10/2	Ex llent	100	0	0	0	0	0	0	0	0	0
Slough 2	100.4	8/2	r	50	0	0	0	0	0	0	0	0	0
		8/21	r	100	0	0	0	0	0	0	0	0	0
		8/29	E lent	100	0	0	0	0	0	0	2	1	3
		9/6	E lent	100	0	0	0	0	0	0	25	2	27
		9/16	E lent	100	0	0	0	0	0	0	6	0	6
		9/24	E lent	100	0	0	0	0	0	0	1	4	5
		10/2	E llent	100	0	0	0	0	0	0	0	3	3
Slough 3B	101.4	8/5	r	100	0	0	0	0	0	0	0	0	0
		8/11	r	100	0	0	0	0	0	0	0	0	0
		8/21	r	100	0	0	0	0	0	0	0	0	0
		8/29	r	100	0	0	0	0	0	0	0	0	0
		9/6	E lent	100	1	0	1	0	0	0	0	0	0
		9/17	E lent	100	1	0	1	0	0	0	0	0	0
		9/24	E llent	100	0	0	0	0	0	0	0	0	0
		10/2	d	100	0	0	0	0	0	0	0	0	0
Slough 3A	101.9	8/4	E lent	100	4	0	4	0	0	0	0	0	0
		8/11	r	100	7	0	7	0	0	0	0	0	0
		8/21	E lent	100	3	0	3	1	0	1	0	0	0
		8/29	r	100	0	0	0	0	0	0	0	0	0
		9/6	r	100	1	0	1	0	0	0	0	0	0
		9/17	r	100	0	0	0	0	0	0	0	0	0
		9/24	d	100	0	0	0	0	0	0	0	0	0
		10/2	r	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continued.

SLOUGH NO./NAME	RIVER MILE	DATE	SURVEY CONDITIONS	PERCENT SURVEYED	SOCKEYE LIVE	SOCKEYE DEAD	SOCKEYE TOTAL	PINK LIVE	PINK DEAD	PINK TOTAL	CHUM LIVE	CHUM DEAD	CHUM TOTAL
Slough 4	105.2	8/4	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/11	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/22	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/29	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/6	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/16	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/24	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		10/2	Po[illegible]	100	0	0	0	0	0	0	0	0	0
Slough 4	105.2	8/4	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/11	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/22	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		8/29	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/6	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/16	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/24	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		10/2	Po[illegible]	100	0	0	0	0	0	0	0	0	0
Slough 5	107.2	8/7	Go[illegible]	100	0	0	0	0	0	0	0	0	0
		8/19	Fa[illegible]	100	0	0	0	0	0	0	0	0	0
		8/25	Go[illegible]	100	0	0	0	0	0	0	0	0	0
		8/28	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/22	Excel[illegible]nt	100	0	0	0	0	0	0	0	0	0
Slough 6	108.2	8/7	Exce[illegible]nt	100	0	0	0	0	0	0	0	0	0
		8/19	Fa[illegible]	100	0	0	0	0	0	0	0	0	0
		8/23	Fa[illegible]	100	0	0	0	0	0	0	0	0	0
		8/28	Po[illegible]	100	0	0	0	0	0	0	0	0	0
		9/22	Excel[illegible]nt	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continue

SLOUGH NO./NAME	RIVER MILE	DATE	SU Y CONI ONS	PERCENT SURVEYED	ADULT SALMON COUNTS SOCKEYE LIVE			PINK LIVE			CHUM LIVE		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 6A	112.3	8/19	Go	100	1	0	1	0	0	0	11	0	11
		8/23	Fa	100	0	0	0	0	0	0	9	2	11
		8/29	Fa	100	1	0	1	0	0	0	1	2	3
		9/22	Exce nt	100	0	0	0	0	0	0	0	0	0
Slough 7	113.2	8/7	Exce nt	100	0	0	0	0	0	0	0	0	0
		8/19	Po	100	0	0	0	0	0	0	0	0	0
		8/29	Exce nt	100	0	0	0	0	0	0	0	0	0
Slough 8	113.7	8/7	Po	100	0	0	0	0	0	0	0	0	0
		8/9	Po	100	0	0	0	0	0	0	0	0	0
		8/29	Exce nt	100	0	0	0	13	12	25	219	49	268
		9/5	Exce nt	100	0	0	0	0	0	0	197	105	302
		9/13	Exce nt	100	0	0	0	0	0	0	46	105	151
		9/21	Exce nt	100	0	0	0	0	0	0	0	96	96
		9/28	Exce nt	100	0	0	0	0	0	0	0	16	16
Slough 8D	121.8	8/1	Fa	100	0	0	0	0	0	0	0	0	0
		8/7	Exce nt	100	0	0	0	0	0	0	0	0	0
		8/20	Exce nt	100	0	0	0	0	0	0	0	0	0
		8/27	Exce nt	100	0	0	0	0	0	0	0	0	0
Slough 8C	121.9	8/1	Go	100	0	0	0	0	0	0	0	0	0
		8/7	Po	100	0	0	0	0	0	0	0	0	0
		8/20	Po	100	0	0	0	0	0	0	0	0	0
		8/27	Exce nt	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continue

SLOUGH NO./NAME	RIVER MILE	DATE	SI Y COND. ONS	PERCENT SURVEYED	ADULT SALMON COUNTS								
					SOCKEYE			PINK			CHUM		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 8B	122.2	8/1	Fa	100	0	0	0	0	0	0	1	0	1
		8/7	Pc	100	0	0	0	0	0	0	0	0	0
		8/20	Po	100	0	0	0	0	0	0	0	0	0
		8/27	Po	100	0	0	0	0	0	0	0	0	0
Moose Slough	123.5	8/27	Exce nt	100	0	0	0	0	0	0	136	3	139
		9/4	Exce nt	100	0	0	0	0	0	0	91	76	167
		9/12	Exce nt	100	0	0	0	0	0	0	20	133	153
		9/21	Exce nt	100	0	0	0	0	0	0	14	78	92
		9/27	Exce nt	100	0	0	0	0	0	0	1	3	4
Slough A[1]	124.6	8/27	Exce nt	100	0	0	0	0	0	0	26	13	39
		9/4	Exce nt	100	0	0	0	0	0	0	122	18	140
		9/12	Exce nt	100	0	0	0	0	0	0	35	57	92
		9/21	Exce nt	100	0	0	0	0	0	0	0	34	34
Slough A	124.7	8/7	Exce nt	100	0	0	0	0	0	0	20	0	20
		8/11	Po	100	0	0	0	0	0	0	0	0	0
		8/19	Exce nt	100	0	0	0	2	0	2	24	2	26
		8/27	Exce nt	100	0	0	0	0	0	0	26	8	34
		9/4	Exce nt	100	0	0	0	0	0	0	13	10	23
		9/2	Exce nt	100	0	0	0	0	0	0	0	23	23
		9/24	Exce nt	100	0	0	0	0	0	0	0	4	4
Slough 8A	125.1	8/7	Exce nt	20	0	0	0	0	0	0	16	0	16
		8/20	Po	100	0	0	0	0	0	0	0	0	0
		8/27	Po	100	0	0	0	0	0	0	0	0	0
		9/4	Exce t	100	170	7	177	0	0	0	330	290	620
		9/12	Exce t	100	87	18	105	0	0	0	53	258	311
		9/21	Exce t	100	23	15	38	0	0	0	2	5	7
		9/27	Excel nt	100	6	3	9	0	0	0	0	0	0

Table EJ-1. Continued

SLOUGH NO./NAME	RIVER MILE	DATE	S... EY CON... IONS	PERCENT SURVEYED	ADULT SALMON COUNTS								
					SOCKEYE			PINK			CHUM		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 9	128.3	8/7	Pr	10	0	0	0	0	0	0	0	0	0
		8/11	Fr	100	0	0	0	0	0	0	6	0	5
		8/20	Pr	100	0	0	0	0	0	0	0	0	0
		8/23	Exc ent	50	0	0	0	0	0	0	0	0	0
		9/4	Exc ent	100	10	0	10	0	0	0	212	48	260
		9/12	Exc ent	100	6	0	6	0	0	0	38	33	71
		9/20	Exc ent	100	2	8	10	0	0	0	1	15	16
		9/27	Exc ent	100	0	0	0	0	0	0	0	2	2
Slough 9B	129.2	8/11	Exc ent	100	27	0	27	0	0	0	68	0	58
		8/23	Exc ent	100	47	0	47	0	0	0	83	7	90
		8/27	Exc ent	100	81	0	81	0	0	0	67	4	71
		9/4	Exc ent	100	71	0	71	0	0	0	41	8	49
		9/12	Exc ent	100	62	0	62	0	0	0	18	8	26
		9/20	Exc ent	100	48	6	54	0	0	0	2	5	7
		9/27	Exc ent	100	15	20	35	0	0	0	0	0	0
Slough 9A	133.3	7/31	P	100	0	0	0	0	0	0	0	0	0
		8/20	P	100	0	0	0	0	0	0	0	0	0
		8/27	Exc ent	20	2	0	2	0	0	0	67	4	71
		9/4	Exc ent	20	1	0	1	0	0	0	26	36	68
		9/12	Exc ent	20	2	0	2	0	0	0	0	4	4
		9/12	P	80	0	0	0	0	0	0	55	5	60
		9/20	Exc ent	100	0	0	0	0	0	0	136	46	182
		9/27	Exc ent	100	0	0	0	0	0	0	35	59	94
Slough 10	133.8	7/31	Exc ent	100	0	0	0	0	0	0	0	0	0
		8/10	F	100	0	0	0	0	0	0	0	0	0
		8/20	Exc ent	100	0	0	0	0	0	0	0	0	0
		8/27	Exc ent	100	0	0	0	0	0	0	0	0	0
		9/20	Exc ent	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continue

SLOUGH NO./NAME	RIVER MILE	DATE	S Y CON IONS	PERCENT SURVEYED	ADULT SALMON COUNTS								
					SOCKEYE			PINK			CHUM		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 11	135.3	7/31	Exc nt	100	0	0	0	0	0	0	0	0	0
		8/6	F	100	100	0	100	0	0	0	0	0	0
		8/10	Exc nt	100	50	0	50	0	0	0	0	0	0
		8/20	P	100	0	0	0	0	0	0	1	0	1
		8/22	Exc nt	100	258	1	259	0	0	0	276	6	282
		8/27	Exc nt	100	373	5	378	0	0	0	403	8	411
		9/1	Exc nt	100	610	25	635	0	0	0	358	26	384
		9/11	Exc nt	100	710	183	893	0	0	0	181	162	343
		9/20	Exc nt	100	468	338	806	0	0	0	32	274	306
		9/26	Exc nt	100	270	333	603	0	0	0	5	27	32
Slough 12	135.4	7/31	P	25	0	0	0	0	0	0	0	0	0
		8/6	P	100	0	0	0	0	0	0	0	0	0
		8/20	P	100	0	0	0	0	0	0	0	0	0
		8/27	Exc nt	100	0	0	0	0	0	0	0	0	0
		9/4	P	100	0	0	0	0	0	0	0	0	0
		9/20	Exc nt	100	0	0	0	0	0	0	0	0	0
		9/26	Exc nt	100	0	0	0	0	0	0	0	0	0
Slough 13	135.7	7/31	P	15	0	0	0	0	0	0	0	0	0
		8/6	P	100	0	0	0	0	0	0	0	0	0
		8/20	P	100	0	0	0	0	0	0	0	0	0
		8/27	Exc nt	100	0	0	0	0	0	0	0	0	0
		9/4	F	100	0	0	0	0	0	0	4	0	4
		9/11	Exc nt	100	0	0	0	0	0	0	2	1	3
		9/20	Exc nt	100	0	0	0	0	0	0	0	0	0
		9/26	Exc nt	100	0	0	0	0	0	0	0	0	0
Slough 14	135.9	7/31	F	100	0	0	0	0	0	0	0	0	0
		8/6	Exc nt	100	0	0	0	0	0	0	0	0	0
		8/20	Exc nt	100	0	0	0	0	0	0	0	0	0
		8/27	Exc nt	100	0	0	0	0	0	0	0	0	0
		9/4	Exc nt	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continue

SLOUGH NO./NAME	RIVER MILE	DATE	SUR CONDI NS	PERCENT SURVEYED	ADULT SALMON COUNTS								
					SOCKEYE			PINK			CHUM		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 14 Cont'd.	135.9	9/19	Excel	100	0	0	0	0	0	0	0	0	0
		9/26	Excel	100	0	0	0	0	0	0	0	0	0
Slough 15	137.2	7/31	Goo	100	0	0	0	0	0	0	0	0	0
		8/6	Poo	100	0	0	0	0	0	0	0	0	0
		8/10	Fai	100	0	0	0	0	0	0	0	0	0
		8/21	Poo	100	0	0	0	0	0	0	0	0	0
		8/26	Excel	100	0	0	0	0	0	0	1	0	1
		9/3	Excel	100	0	0	0	0	0	0	0	0	0
		9/19	Excel	100	0	0	0	0	0	0	0	0	0
Slough 16	137.3	8/6	Poo	100	0	0	0	0	0	0	0	0	0
		8/10	Poo	100	0	0	0	0	0	0	0	0	0
		8/21	Poo	100	0	0	0	0	0	0	0	0	0
		8/26	Poo	100	0	0	0	0	0	0	0	0	0
		9/3	Fai	100	0	0	0	0	0	0	0	3	3
		9/19	Excel	100	0	0	0	0	0	0	0	0	0
		9/26	Excel	100	0	0	0	0	0	0	0	0	0
Slough 17	138.9	8/6	Excel	100	0	0	0	0	0	0	9	0	9
		8/10	Poo	100	0	0	0	0	0	0	3	0	3
		8/21	Excel	75	1	0	1	0	0	0	32	1	33
		8/26	Excel	100	0	0	0	0	0	0	36	2	38
		9/3	Excel	100	5	0	5	0	0	0	30	7	37
		9/11	Excel	100	6	0	6	0	0	0	17	13	30
		9/19	Excel	100	3	0	3	0	0	0	4	0	4
		9/26	Excel	100	0	0	0	0	0	0	0	0	0

Table EJ-1. Continued

SLOUGH NO./NAME	RIVER MILE	DATE	SUR CONDI IS	PERCENT SURVEYED	ADULT SALMON COUNTS								
					SOCKEYE			PINK			CHUM		
					LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL
Slough 18	139.1	8/6	Fair	100	0	0	0	0	0	0	0	0	0
		8/10	Poor	100	0	0	0	0	0	0	0	0	0
		8/21	Poor	100	0	0	0	0	0	0	0	0	0
		8/26	Excell	100	0	0	0	0	0	0	0	0	0
		9/3	Excell	100	0	0	0	0	0	0	0	0	0
Slough 19	139.7	8/6	Excell	100	0	0	0	0	0	0	0	0	0
		8/10	Fair	100	0	0	0	0	0	0	0	0	0
		8/21	Excell	100	13	0	13	0	0	0	3	0	3
		8/26	Excell	100	20	0	20	0	0	0	0	0	0
		9/3	Excell	100	23	0	23	0	0	0	0	1	1
		9/11	Excell	100	12	6	18	0	0	0	0	0	0
		9/19	Excell	100	8	0	8	0	0	0	0	0	0
		9/26	Excell	100	4	2	6	0	0	0	0	0	0
Slough 20	140.1	8/6	Poor	100	0	0	0	0	0	0	0	0	0
		8/10	Poor	100	0	0	0	0	0	0	0	0	0
		8/21	Poor	100	0	0	0	0	0	0	0	0	0
		8/26	Excell	100	2	0	2	0	0	0	10	1	11
		9/3	Excell	100	0	0	0	0	0	0	12	2	14
		9/11	Excell	100	0	0	0	0	0	0	0	0	0
		9/19	Excell	100	0	0	0	0	0	0	0	0	0
Slough 21	141.0	8/6	Poor	100	0	0	0	0	0	0	0	0	0
		8/10	Poor	100	0	0	0	0	0	0	0	0	0
		8/21	Poor	100	0	0	0	0	0	0	0	0	0
		8/26	Excel	50	1	0	1	0	0	0	156	13	169
		9/3	Excel	75	26	0	26	0	0	0	270	4	274
		9/11	Excel	100	38	0	38	0	0	0	134	2	136
		9/19	Excel	100	32	1	33	0	0	0	43	24	67
		9/26	Excell	100	3	0	3	0	0	0	0	0	0

Table EJ-1. Continued

SLOUGH NO./NAME	RIVER MILE	DATE	S Y CO IONS	PERCENT SURVEYED	SOCKEYE LIVE	SOCKEYE DEAD	SOCKEYE TOTAL	PINK LIVE	PINK DEAD	PINK TOTAL	CHUM LIVE	CHUM DEAD	CHUM TOTAL
					ADULT SALMON COUNTS								
Slough 21A	145.5	8/26	Pr	100	0	0	0	0	0	0	5	0	5
		9/2	Exc ent	100	0	0	0	0	0	0	8	0	8
		9/11	Exc ent	100	0	0	0	0	0	0	5	0	5

Table EJ-2. Escapemc survey counts of Susitna River tributary streams between Chulitna River and Devil Canyon, ult Anadromous Investigations, Su Hydro Studies, 1981.

					ADULT SALMON COUNTED											
					SOCKEYE			PINK			CHUM			COHO		
STREAM	RIVER MILE	DATE	C 'ER .TIONS	SURVEY DISTANCE (MILES)	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TOTAL	LIVE	DEAD	TO
Whiskers Creek	101.4	8/5	'oor	.50	0	0	0	0	0	0	0	0	0	0	0	
		8/11	'oor	.25	0	0	0	0	0	0	0	0	0	8	0	
		8/21	air	.50	0	0	0	0	0	0	0	0	0	43	0	
		8/29	'ood	.60	0	0	0	0	0	0	0	0	0	49	1	
		9/6	ood	.50	0	0	0	0	0	0	0	0	0	70	0	
		9/17	air	.50	0	0	0	0	1	1	0	1	1	9	0	
		9/24	ood	.50	0	0	0	0	1	1	0	0	0	16	2	
		10/2	ood	.50	0	0	0	0	0	0	0	0	0	6	5	
Chase Creek	106.9	8/4	ood	.75	0	0	0	5	0	5	0	0	0	0	0	
		8/11	ood	.75	0	0	0	38	0	38	1	0	1	23	0	
		8/17	air	.75	0	0	0	0	0	0	0	0	0	0	0	
		8/23	ellent	.75	0	0	0	0	0	0	0	0	0	13	0	
		8/29	ood	.75	0	0	0	0	0	0	0	0	0	49	0	
		9/7	ellent	.75	0	0	0	0	0	0	0	1	1	79	1	
		9/14	ood	.75	0	0	0	0	0	0	0	1	1	60	2	
		9/24	ood	.75	0	0	0	0	0	0	0	0	0	22	12	
		10/2	ood	.75	0	0	0	0	0	0	0	0	0	5	16	
4th of July Creek	131.0	7/31	oor	.25	0	0	0	0	0	0	1	0	1	0	0	
		8/7	air	.25	0	0	0	18	0	18	88	2	90	1	0	
		8/10	ood	.25	0	0	0	4	0	4	30	1	31	0	0	
		8/20	ood	.25	0	0	0	27	2	29	46	20	66	0	0	
		9/1	ellent	1.5	0	0	0	2	3	5	0	0	0	0	0	
		9/25	ellent	.30	0	0	0	0	0	0	0	1	1	1	0	
Gold Creek	136.7	8/25	air	.75	0	0	0	0	0	0	0	0	0	0	0	

Table EJ-2. Continue

STREAM	RIVER MILE	DATE	RI COND ONS	SURVEY DISTANCE (MILES)	ADULT SALMON COUNTED: SOCKEYE LIVE	SOCKEYE DEAD	SOCKEYE TOTAL	PINK LIVE	PINK DEAD	PINK TOTAL	CHUM LIVE	CHUM DEAD	CHUM TOTAL	COHO LIVE	COHO DEAD	COHO TOTA
Lower McKenzie Creek	116.2	8/23	Exc ent	.5	1	0	1	0	0	0	11	3	14	56	0	56
		8/29	Exc ent	.5	0	0	0	0	0	0	11	1	12	0	0	(
		9/5	Exc ent	.5	0	0	0	0	0	0	0	2	2	0	0	(
		9/13	Exc ent	.5	0	0	0	0	0	0	0	1	1	6	0	6
		9/21	Exc ent	.5	0	0	0	0	0	0	0	0	0	2	0	2
		9/28	Exc ent	.5	0	0	0	0	0	0	0	1	1	2	0	2
McKenzie Creek	116.7	8/11	Exc ent	.5	0	0	0	0	0	0	0	0	0	0	0	(
		8/23	Exc ent	.5	0	0	0	0	0	0	0	0	0	0	0	(
Deadhorse	120.9	8/11	Exc ent	.5	0	0	0	0	0	0	0	0	0	0	0	(
		9/25	Exc ent	.5	0	0	0	0	0	0	0	0	0	0	0	(
5th of July Creek	123.7	8/11	Exc ent	.5	0	0	0	2	0	2	0	0	0	0	0	(
Skull Creek	124.7	8/20	Exc ent	.5	0	0	0	8	0	8	0	0	0	0	0	(
		8/11	Exc ent	.5	0	0	0	0	0	0	10	0	10	0	0	(
		9/19	Exc ent	.5	0	0	0	6	0	6	0	0	0	0	0	(
Sherman Creek	130.8	7/31	r	.25	0	0	0	0	0	0	0	0	0	0	0	(
		8/7	l	.25	0	0	0	0	0	0	2	0	2	0	0	(
		8/10	d	.25	0	0	0	5	0	5	9	0	9	0	0	(
		8/11	Exc ent	.25	0	0	0	2	0	2	6	0	6	0	0	(
		8/20	Exc ent	.25	0	0	0	6	0	6	2	0	2	0	0	(
		9/25	Exc ent	.25	0	0	0	0	0	0	0	0	0	0	0	(

Table EJ-2. Continu

STREAM	RIVER MILE	DATE	CON	IONS	SURVEY DISTANCE (MILES)	ADULT SALMON COUNTED: SOCKEYE LIVE	SOCKEYE DEAD	SOCKEYE TOTAL	PINK LIVE	PINK DEAD	PINK TOTAL	CHUM LIVE	CHUM DEAD	CHUM TOTAL	COHO LIVE	COHO DEAD	COHO TOTAL
Indian River	138.6	8/6	Ex	lent	.25	0	0	0	0	0	0	22	0	22	0	0	0
		8/10		r	.25	0	0	0	0	0	0	4	0	4	0	0	0
		8/21		r	.25	0	0	0	2	0	2	33	1	34	0	0	0
		9/3	Ex	lent	.25	0	0	0	0	0	0	36	4	40	0	0	0
		9/11		r	.25	0	0	0	0	0	0	10	6	16	10	6	16
		9/15		d	15.0	0	0	0	0	0	0	0	0	0	85	0	85
		9/19		r	.25	0	0	0	0	0	0	0	3	3	10	0	10
		9/26		d	.25	0	0	0	0	0	0	0	0	0	0	0	0
Jack Long Creek	144.5	8/21		r	.25	0	0	0	0	0	0	0	0	0	0	0	0
		8/26	Ex	lent	.75	0	0	0	1	0	1	0	0	0	0	0	0
		9/24	Ex	lent	.50	0	0	0	0	0	0	0	0	0	0	0	0
Portage Creek	148.9	8/21		r	.25	0	0	0	0	0	0	0	0	0	0	0	0
		9/15		r	12.0	0	0	0	0	0	0	0	0	0	22	0	22
		9/24		d	.25	0	0	0	0	0	0	0	0	0	0	0	0
Gash Creek	111.6	9/23	E	lent	.75	0	0	0	0	0	0	0	0	0	141	0	141
		9/28	E	lent	.75	0	0	0	0	0	0	0	0	0	105	12	117
Lane Creek	113.6	8/19		r	.5	0	0	0	53	0	53	8	1	9	0	0	0
		8/23	E	lent	1.0	0	0	0	286	5	291	72	4	76	0	0	0
		8/29	E	lent	.5	0	0	0	26	17	43	9	8	17	0	0	0
		9/5	E	lent	.5	0	0	0	0	0	0	37	7	44	0	0	0
		9/13	E	lent	.5	0	0	0	0	6	6	2	22	24	0	0	0
		9/21	E	lent	.5	0	0	0	0	1	1	1	0	1	3	0	3
		9/28	E	lent	.5	0	0	0	0	0	0	0	0	0	1	0	1