CAREY'S POINT-DYKING PROPOSAL

BENEFIT STUDY

Planning Division
Water Planning and Operations Branch

Report to the Fraser River
Joint Program Committee
March 24, 1971

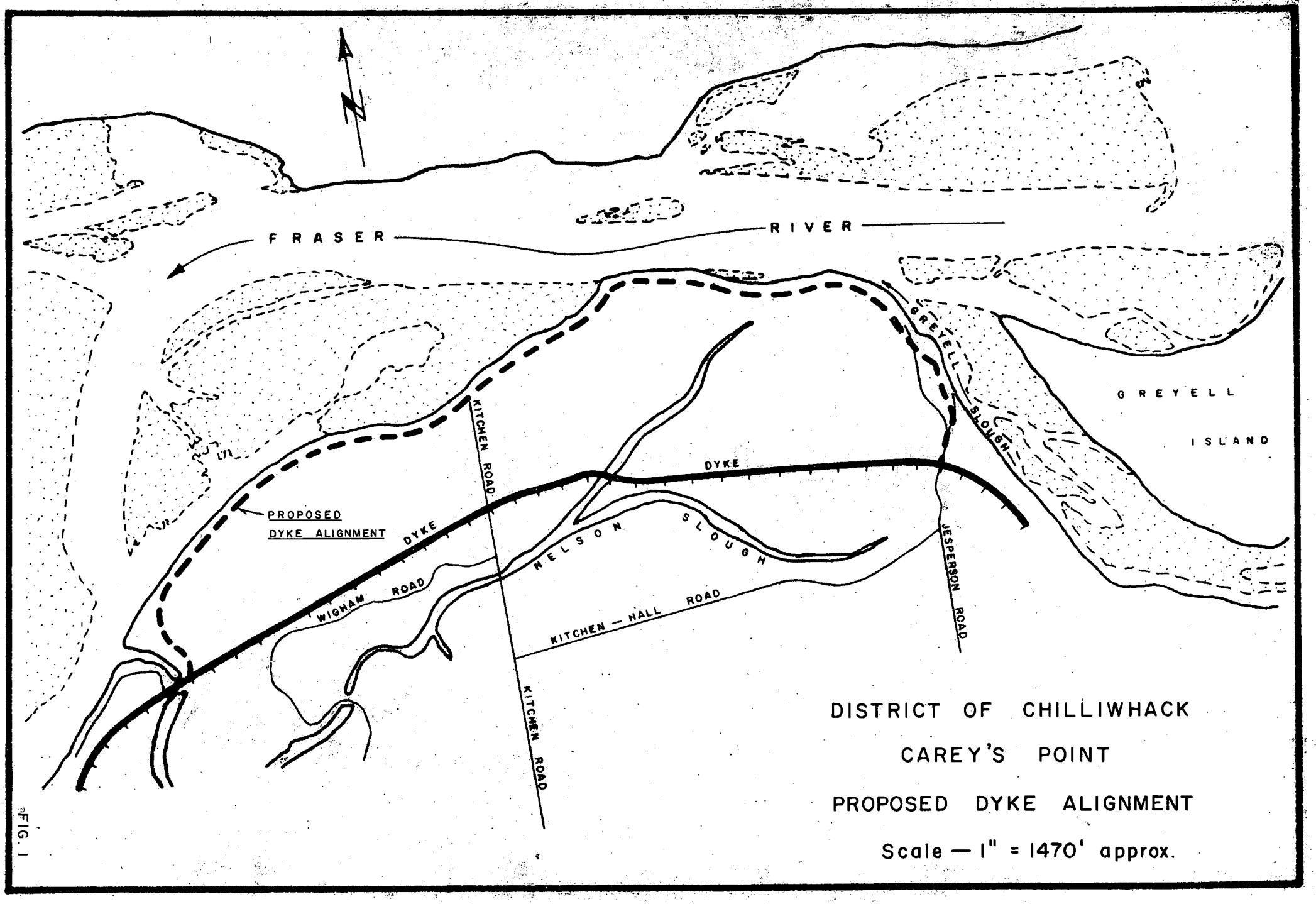

N
FRASER RIVER
GREYELL SLOUGH
GREYELL ISLAND
KITCHEN ROAD
DYKE
PROPOSED DYKE ALIGNMENT
DYKE
WIGHAM ROAD
NELSON SLOUGH
KITCHEN — HALL ROAD
JESPERSON ROAD
KITCHEN ROAD
DISTRICT OF CHILLIWHACK
CAREY'S POINT
PROPOSED DYKE ALIGNMENT
Scale — 1" = 1470' approx.

FIG. 1

Carey's Point Dyking Proposal

Stage One Preliminary Feasibility Study

Summary

Objective: To evaluate flood control alternatives to obtain maximum net benefits in the Carey's Point area and to provide benefit-cost comparisons of alternatives to assist in indicating the relative ranking of the alternatives.

Results of Study

Since the area is entirely agricultural and flood damage is fairly uniformly dispersed over the entire area, only one alternative has been examined. This alternative is that the area be dyked according to the alignment depicted in Figure 1a. The benefit-cost ratio associated with this alignment is shown in table 1.

Table 1

Benefit-Cost Relationships - Carey's Point Flood Control Proposal

Alternative	Benefits	Cost	B/C Ratio
Dyke Entire Area	$112,000	$990,328	0.1
Do not Dyke Area	-	-	-

Benefit Study - Carey's Point Dyking Proposal

A) Objective: To examine possible benefits that might be derived from flood control projects in the Carey's Point area.

B) Scope: Since the area is entirely agricultural and since there is no section of the area with a high flood damage potential, this report includes only the estimates of the costs of one dyke alignment and its derived benefits.

C) Alternatives:

1) Dyke the area according to the alignment given in Fig. 1.

2) Maintain the existing dyke alignment and leave Carey's Point unprotected.

D) Assumptions

1) The area has limited growth potential. It offers no residential or industrial advantages. It will remain under agricultural use whether or not it is protected.

2) The discount rate is 8% per annum

3) The economic life of the dyke is 25 years (Within 25 years, some 87% of the possible benefits are realized if an 8% discount rate is assumed).

E) Damage Criteria

1) Damage to Houses and Loss of Use:

Houses in the Carey Point area are second class houses. Flood damage to contents and structure are estimated as follows on the basis of Acres Ltd. Report (Acres Ltd., Guidelines For Analysis, Vol. 2 Flood Damages, Niagra Falls, 1968)

Damage $	Flood Level Above Main Floor
1,100	1 ft.
1,600	2 ft.
1,700	3 ft.
1,800	4 ft.
2,200	5 ft.
2,600	6 ft.

The average value of houses on Carey's Point is estimated at $16,000 -

Assumptions: a) Houses have main floors over 2 ft. above ground level.
b) Floods of return periods of 10 years cause disoccupation of flooded houses for 15 days.
c) Floods of return periods of 50 and 150 years cause disoccupation of flooded houses for 30 days.
d) The loss of use of the houses is estimated to be 1% of the market value of the house per month.

2) Crop Damage:

On the basis of cost estimates prepared by the Chilliwack District Agriculturalist (Pea Crop - 1970) flood damage to vegetable crops is estimated to be $180/acre. The flood damage to 'pasture - hayland' crops is estimated at $55 per acre, based on an updating of flood damage data included in the 1961 Benefit Study (by A.R.D. Robertson).

The Carey's Point area is estimated to have a mixture of 70% pasture-hayland and 30% vegetables. Thus, it is estimated that, on the average, one flooded acre in the area represents a loss of $90.

3) Damage to Barns and Outbuildings

As in the 1961 report, damage to barns is estimated at $100 per barn and damage to outbuildings is $25 per building.

4) Livestock Losses

Estimations: a) There are 200 beef cattle in the area that will have to be evacuated in floods with return periods of 50 and 150 years.
b) They will have to be evacuated for 45 days each flood (1961 Benefit Study)
c) Cattle lose 1.5 lbs. per day per animal (1961 Benefit Study).
d) Since average beef in 1970 was sold at 54¢ per lb. (Fed. Dept. of Agric.), the total loss for each flood would be $5,300.

5) Damage to Roads and Utilities

Average damage to roads is estimated at $1,500 per mile (Figure from Engineering Division Report on Squamish).

F) Flood Stages, Frequency, and Damage Estimates

Flood stages and frequency were supplied by the Engineering Division and are included in Appendix 2.

Damage for floods of return periods of 2.5, 10, 50 and 150 years was calculated on the basis of the flood stage charts found in the appendix. The information is shown in Appendix 1.

On the basis of this data, a Frequency-Damage Curve was constructed (Fig. 1a).

G) Flood Protection Benefits

The average annual damage that could be prevented with the construction of the dyke proposed in Appendix 3 is $10,500 (see Fig. 1a). The present value of $10,500 annually at 8% over 25 years is $112,000.

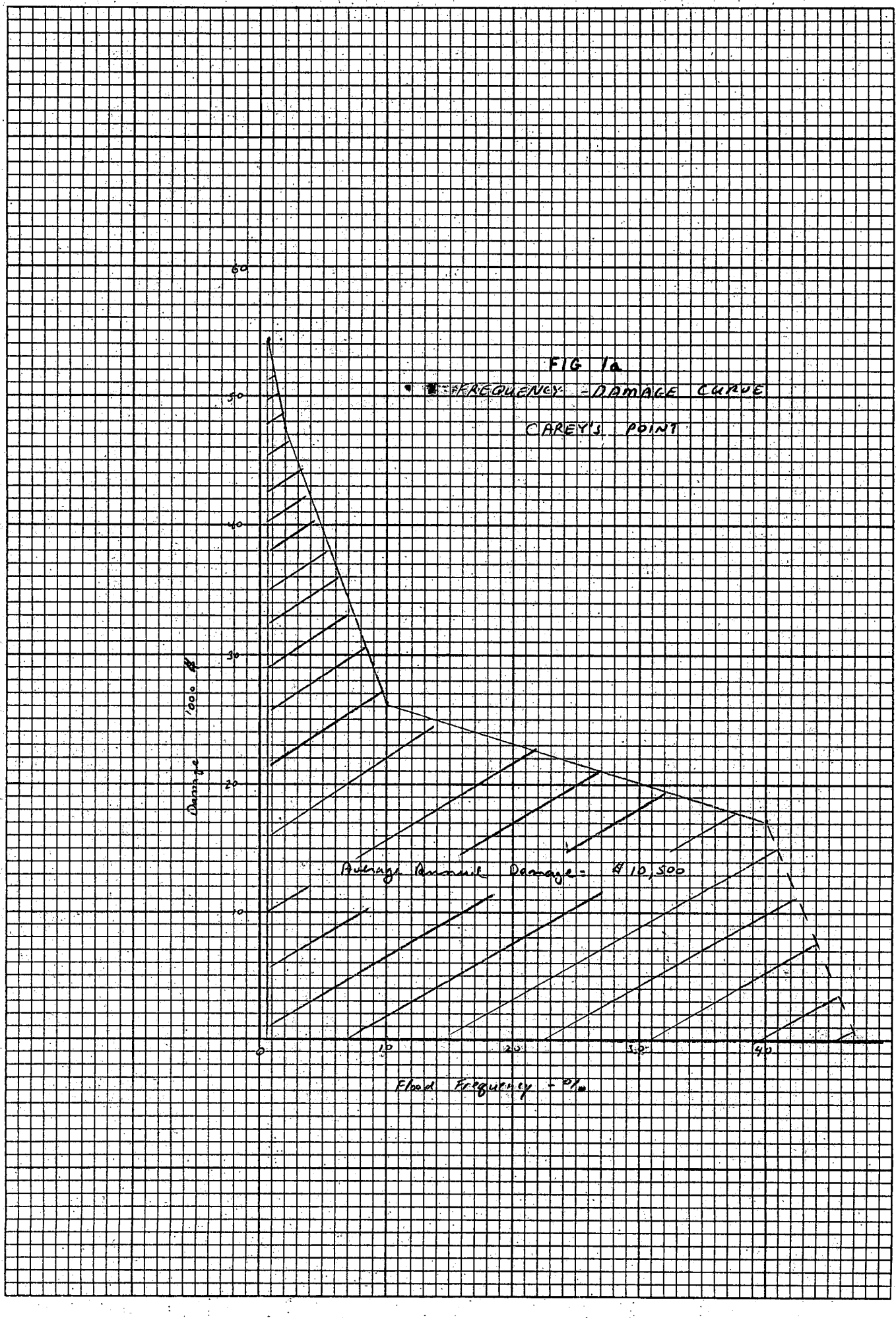
H) Costs of Dyke Construction

Dyking costs are given in Appendix 3. It should be noted that these costs do not include annual maintenance or land acquisition costs and represent only total construction costs.

I) Benefit-Cost Analysis

The benefit-cost ratio, based upon parts G and H above, is:

$$\frac{\text{Present Value of Benefits}}{\text{Additional Cost of Carey Point Dykes}} = \frac{112,000}{990,328} = 0.1$$



APPENDIX 1

Possible Flood Damage - 1971: Carey's Point Area

	Farmland		Houses Number Loss of Use ($)/$Direct Damage Total Damage ($) Flood Depth Above Main Floor (ft)					($) Damage			Loss to Livestock	Total Damage
	Acres	Loss $	1	2	3	4	6	Barns No/$ Damage	Out Bldg. No/$ Damage	Roads $	$	$
)	185	16,650						-	-	400	-	$17,050
	255	21,850	3 240/3300 3540					1/$100	4/$100	600	-	$26,190
	335	30,150	3 480/3300 3780			3 480/7200 7680		2/$200	5/$120	600	5300	$47,830
·)	340	30,600		2 320/3200 3520	3 480/5100 5580		3 480/7800 8280	3/$300	5/$120	600	5300	$54,300

Report on Flood Elevations and Frequencies in the Carey's Point area of Chilliwhack.

Objective to provide data on water surface elevations for floods of various return periods in the Carey's Point area to facilitate evaluation of the possible benefits of flood protection.

Available Data Flood elevation recorded in the area in 1948, 1964, 1967 and 1968 were available, together with profiles derived from these data. The Engineering Division reports "Fraser River Flood Profiles", May 1969, and "Flood Frequencies of the Lower Fraser River", June 1969, were also used. Various contour maps and air photographs were available.

Results Elevations resulting from a flood with a return period of 150 years, equivalent to the 1894 flood in this area, are shown on Figure 1. Elevations resulting from 50, 10 and 2.5 year floods are shown on Figures 2,3 and 4 respectively. These figures are drawn to a small scale for convenience of illustration. Rough working data plotted to a scale of 400 feet to one inch on maps showing ground contours at 5 foot intervals are available for detailed study.

In view of the preliminary nature of the benefit study no stage-duration data was prepared.

Engineering Division, Pacific Region
Water Planning and Operations Branch
24 March, 1971

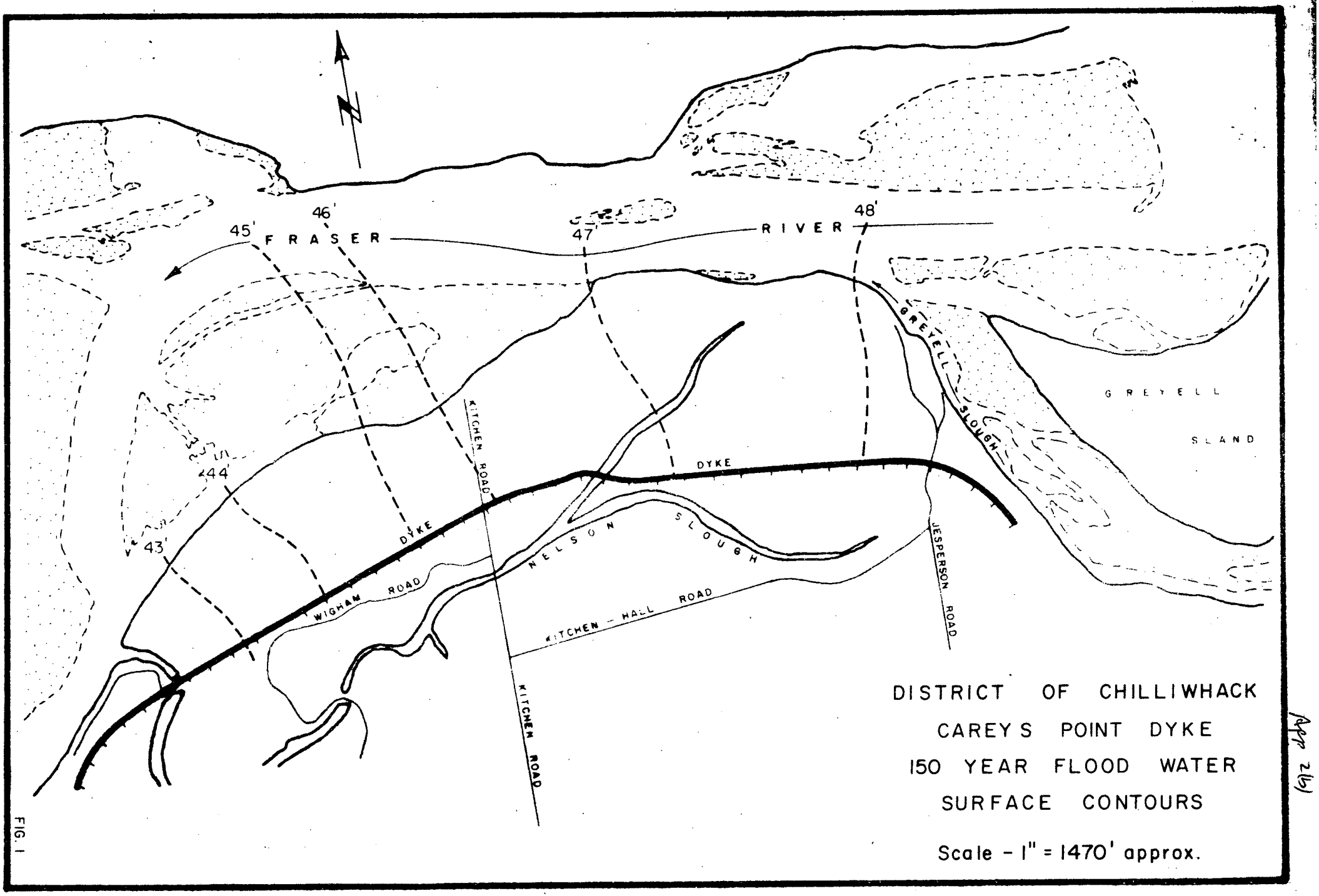

45'
46'
47'
48'
FRASER
RIVER
GREYELL SLOUGH
GREYELL
SLAND
KITCHEN ROAD
DYKE
44'
43'
DYKE
NELSON SLOUGH
WIGHAM ROAD
KITCHEN - HALL ROAD
JESPERSON ROAD
KITCHEN ROAD
DISTRICT OF CHILLIWHACK
CAREY'S POINT DYKE
150 YEAR FLOOD WATER
SURFACE CONTOURS
Scale - 1" = 1470' approx.

FIG. 1

Appx 2(g)

App 2(c)

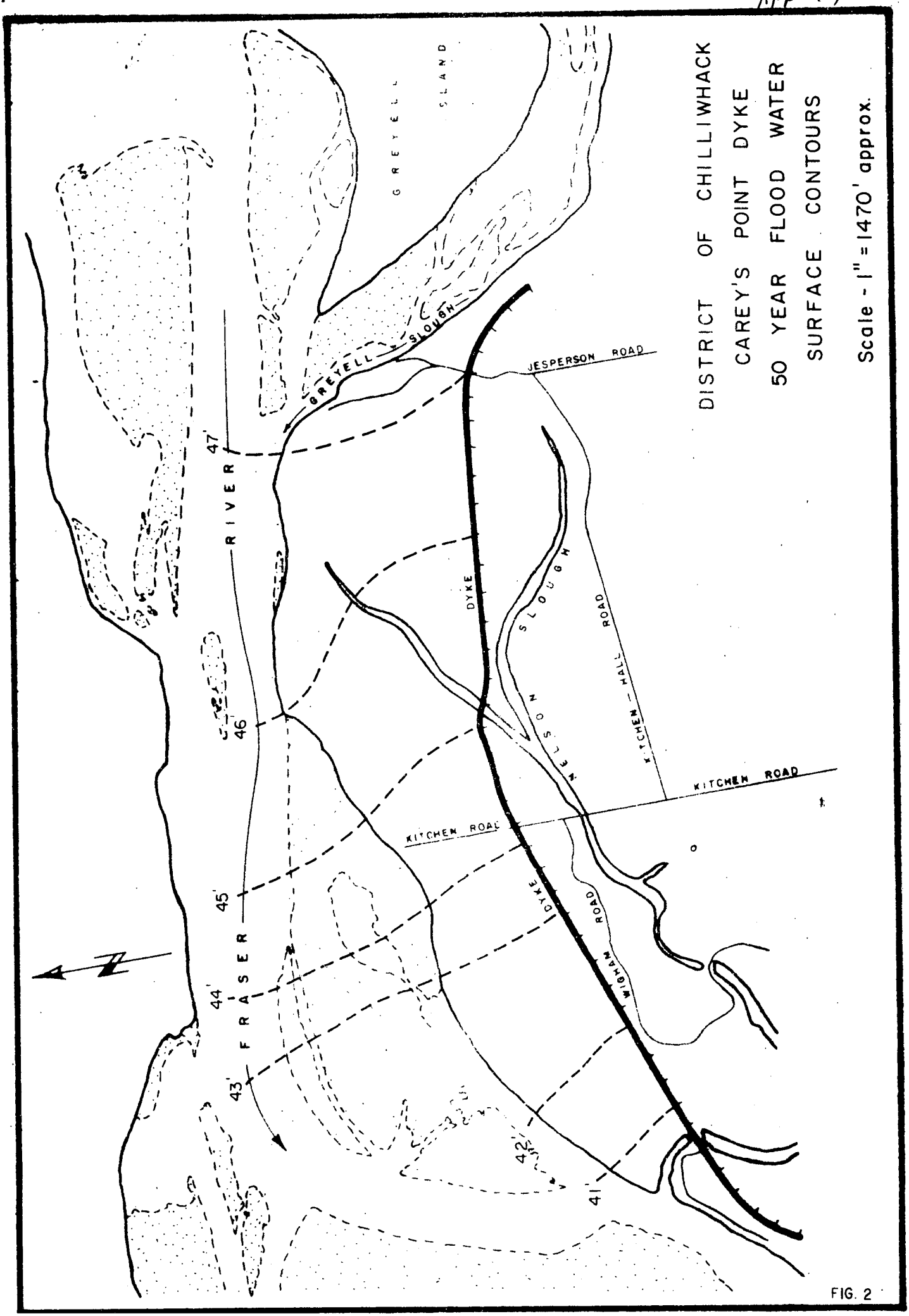
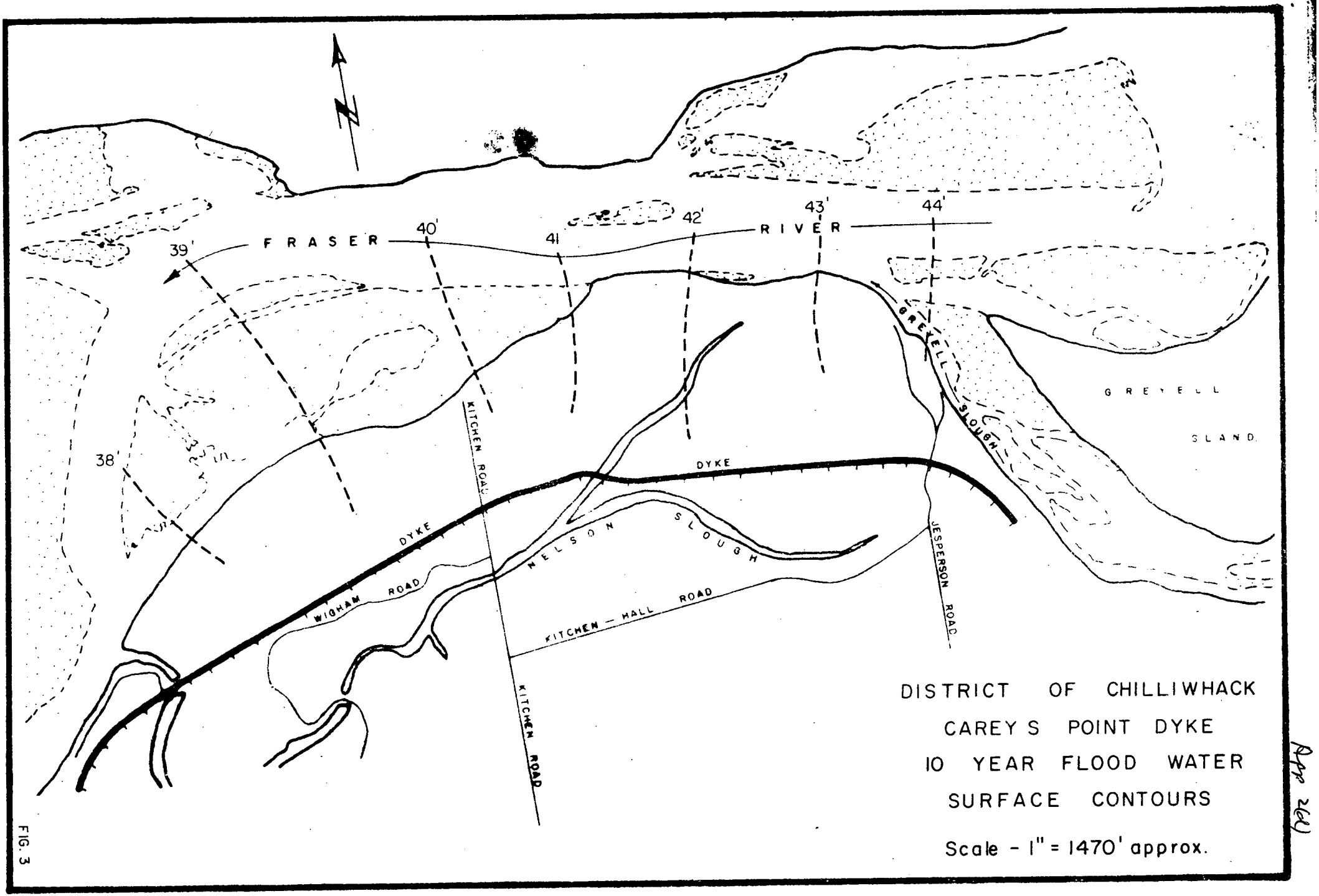

DISTRICT OF CHILLIWHACK
CAREY'S POINT DYKE
50 YEAR FLOOD WATER
SURFACE CONTOURS
Scale - 1" = 1470' approx.
GREYELL SLAND
GREYELL SLOUGH
JESPERSON ROAD
47'
RIVER
46'
45'
FRASER
44'
43'
42'
41'
DYKE
NELSON SLOUGH
KITCHEN - HALL ROAD
KITCHEN ROAD
KITCHEN ROAD
DYKE
WIGHAM ROAD
N

FIG. 2



DISTRICT OF CHILLIWHACK

CAREY S POINT DYKE

10 YEAR FLOOD WATER

SURFACE CONTOURS

Scale - 1" = 1470' approx.

FIG. 3

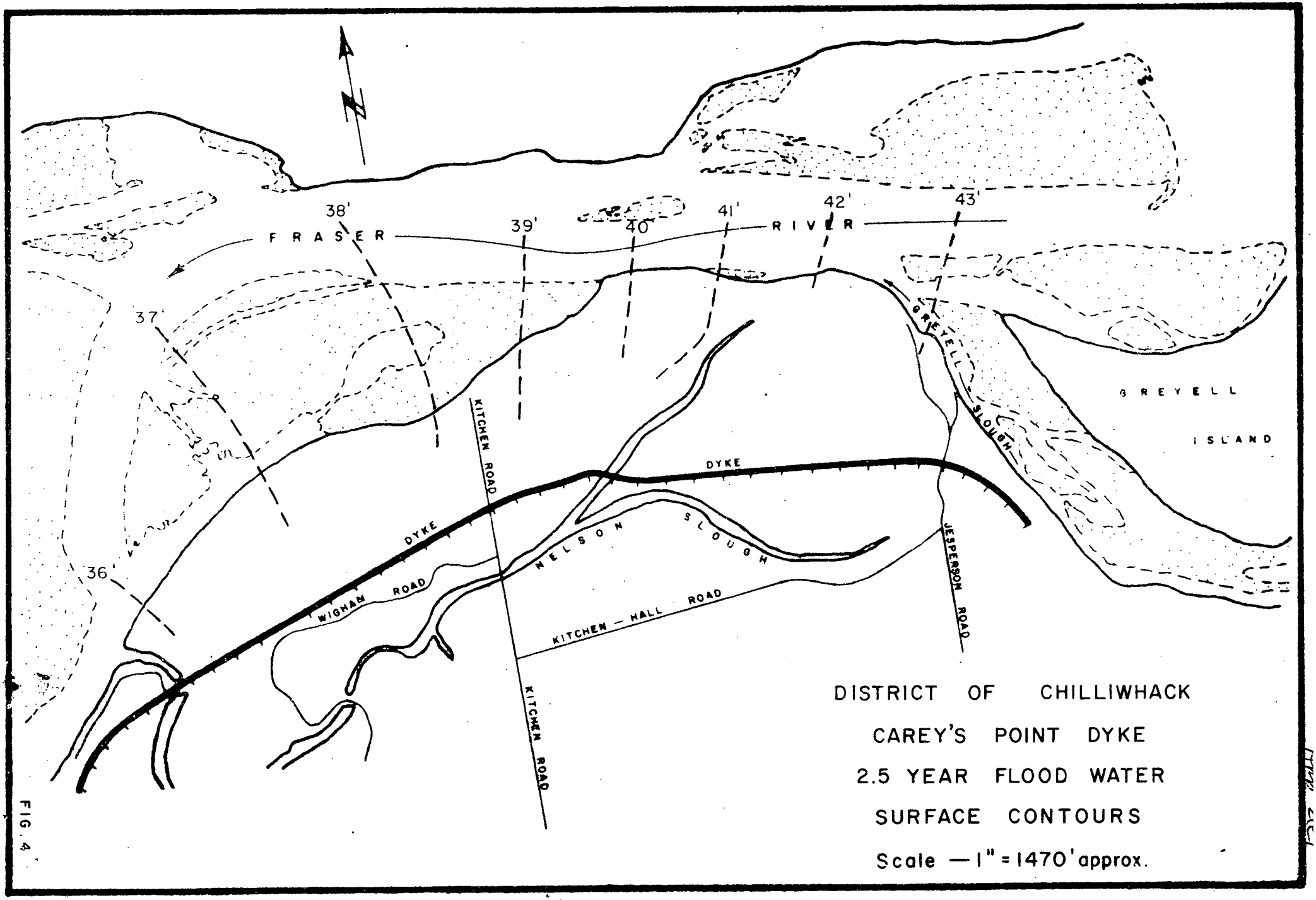

N
38'
39'
40'
41'
42'
43'
FRASER RIVER
37'
36'
KITCHEN ROAD
DYKE
GREYELL SLOUGH
GREYELL ISLAND
DYKE
WIGHAM ROAD
NELSON SLOUGH
KITCHEN — HALL ROAD
JESPERSON ROAD
KITCHEN ROAD
DISTRICT OF CHILLIWHACK
CAREY'S POINT DYKE
2.5 YEAR FLOOD WATER
SURFACE CONTOURS
Scale — 1" = 1470' approx.

FIG. 4

APPENDIX 3

16 March 1971

DYKE WORK GROUP REPORT - PROJECT NO. 5 - TOWNSHIP OF CHILLIWHACK

CAREY'S POINT - ENGINEERING COST ESTIMATE

1. The Dyke Work Group has estimated the additional cost to construct Carey's Point dykes, bank protection and drainage as $990,328.00. Attached in support of this estimate is the typical design and the schedule of approximated quantities and unit prices.

2. The cost to rehabilitate the dykes on the existing alignment was supplied by Willis, Cunliffe, Tait & Co. Ltd. at $113,175.00.

3. The cost of rip rap was estimated by the Bank Protection Work Group as $150,000.00.

4. Basic assumptions were as follows:

   a. The new dyke is close to the river and therefore the relief ditch should be continuous and the relief wells at sloughs should be at 25 ft. intervals.

   b. Only three sectors will be treated as sloughs demanding relief wells.

   c. Passing places will be required at 2,000 ft. intervals.

   d. No alternative alignments need be considered.

   e. No costs for increasing other dyke grades due to narrowing of the river need be considered at this time.

5. Calculations of any particular quantity estimate can be made available on request.

A. A. McPherson, P.Eng.
Member,
Dyke Work Group.

AMP/fg
encls.

PROJECT NO 5 - TOWNSHIP OF CHILLIWHACK

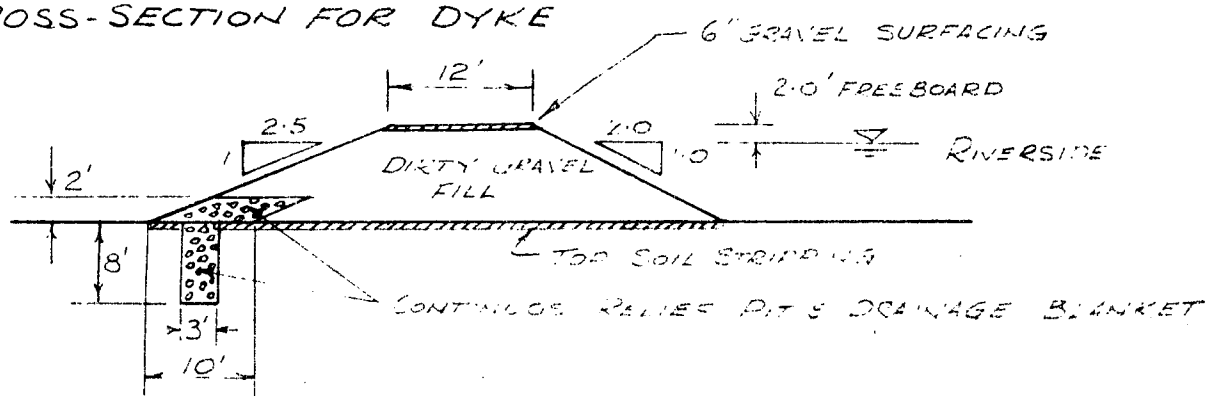
CAREY'S POINT DYKES

DYKE WORK GROUP

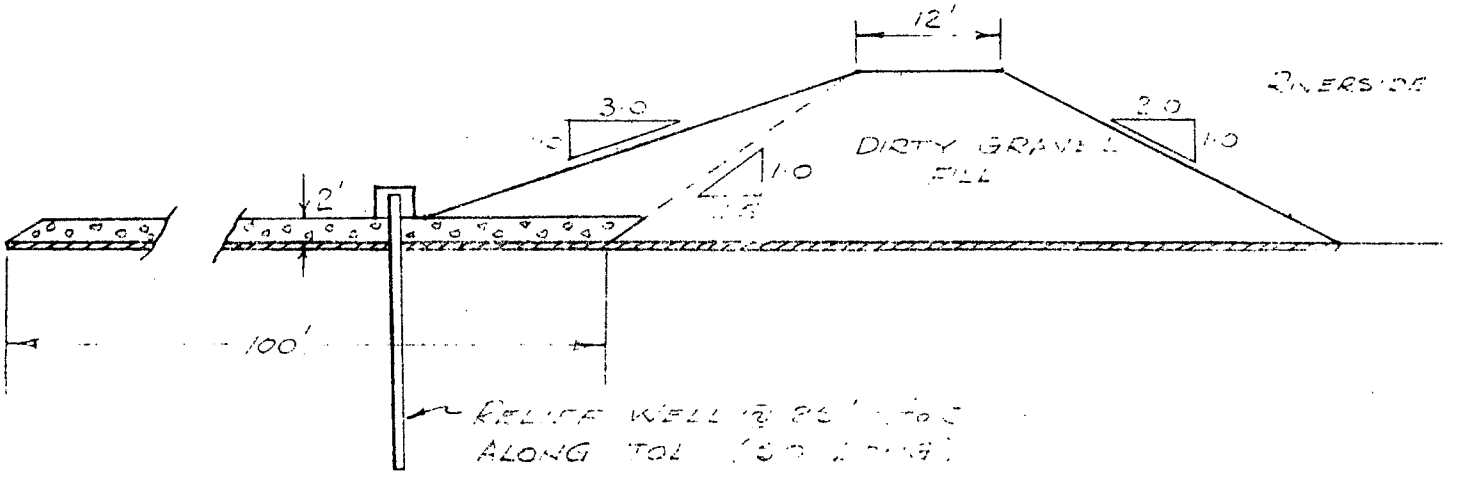
MARCH 1971

PROPOSED CROSS-SECTIONS FOR DYKES

1. CROSS-SECTION FOR DYKE



2. SLOUGH CROSSING



3. PASSING AREA - 8' X 100' @ 2000' INTERVALS.

PROJECT NO 5

CAREY POINT DYKES
(0+00 to 140+00)

Schedule of Approximate Quantities and Unit Prices

ITEM NO	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE	AMOUNT $	¢
1.	Clearing and grubbing (heavy brush or treed areas	Acre	10.25	600.00	6,150	00
2.	Stripping	s.y.	41,120	0.30	12,336	00
3.	Relief pit excavation & compaction of excavated material on dyke	c.y.	11,260	2.50	28,150	00
4.	Fill compacted in place:					
	(a) Bulk fill of dirty gravel	c.y.	229,000	2.00	458,000	00
	(b) Relief pit	c.y.	11,260	2.40	27,024	00
	(c) Drainage blanket	c.y.	9,400	2.00	18,800	00
	(d) Slough drainage blanket	c.y.	9,860	3.00	29,580	00
5.	Common excavation ditches and culverts	c.y.	3,100	1.00	3,100	00
6	Gravel surfacing	c.y.	3,200	4.00	12,800	00
7.	Fencing	LF	14,000	0.60	8,400	00
8.	Supply & install gates	each	5	100.00	500	00
9.	Installation of relief wells	LF	2,850	8.00	22,800	00
10.	Culverts, intake, outlet, supply, installation backfill				22,000	00
11.	Rip rap protection				150,000	00
12	Contingency @ 20%				159,928	00
			Sub total		959,568	00
			Engineering supervision @ 15%		143,935	00
					$ 1,103,503	00
	Less the cost of rehabilitating the existing dyke sector				113,175	00
	Additional cost to construct the Carey Point dykes				$ 990,328	00