No. 2

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

TOPICAL REPORT NO. 98

YUKON RIVER DRAINAGE BASIN

DAM SITE INVESTIGATION

SITE No. 23

FRASER FALLS DAM SITE

(MAP AND PRELIMINARY REPORT)

BY

E. B. OWEN

OTTAWA

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FRASER FALLS DAM SITE

General Description

Fraser Falls dam site is located on Stewart River about 35 miles upstream from the community of Mayo Landing and 150 miles from its junction with Yukon River. The site can be reached from Mayo by shallow draft boats which can readily ascend the river to the base of the Falls. An excellent portage, about one-half mile in length, is located along the left (west) side of the river at the Falls.

The height of the proposed dam is about 250 feet. It will be relatively important in the development of hydro-electric power throughout the Yukon River drainage basin; not only will it provide sufficient storage to completely regulate Stewart River but will also provide a considerable amount of power.

At the site Stewart River flows in a northerly direction through a narrow gorge which is some 900 feet in length and varies in width from 50 to 250 feet. The drop in elevation of the river level at the site is about 16 feet. Bedrock consisting of quartz and sericite schists is exposed almost continuously along both walls of the canyon as well as on several small islands in the river. The right side of the gorge slopes steeply upward from the edge of the river to an elevation slightly greater than 2,000 feet. The right abutment of the proposed dam, the crest elevation of which will be about 1,915 feet, will be located on this slope. A narrow saddle, some 65 feet in width, occurs immediately behind (east) of the slope. The maximum elevation of the floor of the saddle is at its upstream end where it reaches 1,931 feet. The thickness of overburden on the floor of the saddle probably varies from 5 to 15 feet. It is suggested the spillway for a dam somewhat higher than the proposed structure could be located in the saddle.

Along the left side of the river a bedrock bluff rises almost vertically from the river to a height of about 60 feet. Above this bluff a gently sloping, alluvium-covered, bedrock terrace extends west to the toe of a steep, rocky bluff which rises beyond the limit of the area mapped. The proposed dam would extend across the terrace to this bluff in which the right abutment would be located. The bluff is covered chiefly with talus although till occurs on its upstream end.

About 8 miles upstream from Fraser Falls there is a sharp bend in Stewart River where it changes course from a westerly to northerly direction. Above the bend the river occupies a broad drift-filled valley and is readily navigable for a considerable distance. Between the bend and the Falls the river consists of a series of small rapids interspersed with broad, flat stretches; its banks are steep and rocky and its course relatively straight. From Fraser Falls to its mouth it is a wide, slow moving stream with occasional accelerations near the larger sand bars.

The topography in the vicinity of Fraser Falls suggests that the Stewart River is flowing in a relatively recent channel. At one time it may have drained through the valley of Watson Creek or through the valleys of Nogold, Francis and Talbot Creeks by which route it would join its present valley a few miles downstream from Mayo Landing. A third route may have passed through Mayo Lake. These suggested former courses of the river are important because reservoir water may leak through them. They should all be carefully investigated.

At the site there is evidence the river was formerly flowing at an elevation higher than present. During these times the alluvial deposits covering the bedrock terrace west of the river and the floor of the saddle east of the right abutment were laid down. On the floor of the saddle there are two rock scarps, each about 30 feet in height, over which the river once flowed.

The attitudes of striae at the site indicate the last ice crossing the area moved in a northerly direction. On the valley walls the striae consist of numerous parallel grooves about 1 inch in width, one-half inch deep and range up to 5 feet in length. Those on the valley floor close to the river are large grooves up to 3 inches deep, 6 inches in width and frequently continue for many feet. In both abutment areas the till left by the ice directly overlies bedrock.

There are unlimited quantities of silt, sand and till close to the site; all of which are potential construction materials. Bedrock is believed unsatisfactory as a source of rock fill or riprap. Suprapermafrost groundwater, i.e. groundwater which occurs above the frost line, was encountered in test pits in the areas where frozen ground exists. The frozen ground itself is believed to be sporadic and probably does not exist throughout the entire site area.

Unconsolidated Deposits

Four different types of unconsolidated deposits occur in the Fraser Falls dam site area. They are as follows:

1. Recent alluvium (silt, sand, minor gravel): This is material which has been and is being deposited by Stewart River in its present channel. In most places along the gorge the rock walls rise almost vertically from the river and have prevented the formation of floodplain deposits. The most extensive alluvial deposits exist along the sides of the river upstream and downstream from the canyon. In general, the Recent alluvium which consists of silt and sand with minor quantities of gravel is a dirty material and this along with the limited quantity available limits its use as a construction material.

2. Talus: Talus is material formed by the mechanical disintegration of adjacent bedrock. At Fraser Falls site it covers about 80 per cent of the left abutment slope and about 20 per cent of the right abutment. In the latter it occurs chiefly along the toe of the slope. The size and shape of the rock fragments depends, in general, upon the rock type from which they originated. The soft sericite schist breaks down into a fine talus which often resembles a residual soil. The material consists of platy, brown-weathered, schist fragments, up to 3 inches in diameter, in a brown, micaceous, sandy material chiefly of sericite and quartz grains. The talus from the more massive quartz schist contains numerous angular rock fragments, sometimes many feet in diameter, which have broken off along joint and foliation planes. These have frequently moved only a few feet from their source although in places where the slope is steep they have moved downward and accumulated along the base of the slope.

3. Alluvium (clay, silt, sand, minor gravel): This material covers the wide, sloping terrace which extends west from the river to the toe of the left abutment slope. East of the river it occurs as an irregular deposit up to elevation 1,780 and also on the floor of the saddle immediately beyond the east limit of the area mapped. The greater part of the material consists of fine- to medium-grained sand similar to that in sample No. 9. Irregular lenses of silty clay, as in sample No. 8, are sometimes interbedded with the sand. The presence of the clayey material would be harmful if the sand were to be used as fine aggregate. It is not known if all the overburden overlying bedrock on the terrace consists of alluvium. Sample No. 9 was taken 10 feet from ground surface whereas the maximum thickness of the overburden, as indicated by the seismic work is 17 feet. The sand, if washed, could be used either as drain material or fine aggregate. Its permeability as computed in

the field is 41.65 feet per day (recompacted material). Large quantities will undoubtedly be excavated during construction of the dam across the terrace. This material could be stock piled for future use. Grain size analyses curves for samples Nos. 8 and 9 as well as for materials taken from the floor of the saddle east of the site are included at the end of this report.

4. Till: The most extensive deposit of till in the area mapped occurs on the upstream end of the left abutment slope. A grain size analysis curve for a representative sample (No. 13) of this material is included at the end of this report. The till is a grey, silty, sandy material which contains angular rock fragments ranging from sand-size particles to boulders 14 inches in diameter. Most of the boulders consist of fine-grained, grey quartzite but other rock types such as black chert and quartz schist are also present. The schist was probably derived locally. The till is probably thin in places where it contains a high percentage of schist boulders.

Unlimited quantities of till exist close to the site area. Large, accessible deposits (sample No. 15) of the material occur about 3 miles northwest of the site as well as in other adjacent places. The till is usually situated along the lower parts of the sides of the valley and could be readily excavated and hauled to the site.

Bedrock

General Description.

Bedrock exposed at the site consists essentially of a hard, greenish, quartz schist. Alternated with these rocks is a softer, greenish, sericite schist which weathers easily to a brown, micaceous soil. The quartz schist constitutes about 80 per cent of the rock at the site. The rock knobs which project out from both walls of the gorge are formed of this rock whereas the valleys between these projections were formed by erosion of the softer, sericite schist. They are frequently continuous across the gorge. Numerous small irregular quartz veins occur in the sericite schist and to a lesser extent in the quartz schist. Drag folding is common in the softer sericite schist but seldom occurs in the more competent quartz schist.

Bedrock Structures

According to Bostock[1] a great, northwest-trending anticlinal structure crosses the area about 20 miles northeast of the site. Superimposed upon this main structure are several smaller folds trending in a westerly direction. In general throughout the greater part of its length Stewart River valley follows one of these latter folds. The course of the river at the site, however, is parallel to the main anticlinal structure.

The most prominent structure in bedrock at the site is the schistosity which intersects the proposed dam axis at angles varying from 17 to 47 degrees and dips upstream at 58 to 80 degrees. The bedding of which there are only traces remaining is almost parallel to the schistosity, diverging from it by about 5 degrees. It has a similar upstream dip.

Jointing is irregular. The most prominent set strikes between north and north 27 degrees east and, in general, is vertical or dips steeply to the west. This set intersects the dam axis at 40 to 67 degrees and dips into the left abutment. Other less prominent sets intersect the axis at 25 to 65 degrees and dip at relatively low angles in both upstream and downstream directions.

A large fault occurs in the left wall of the gorge near the centre

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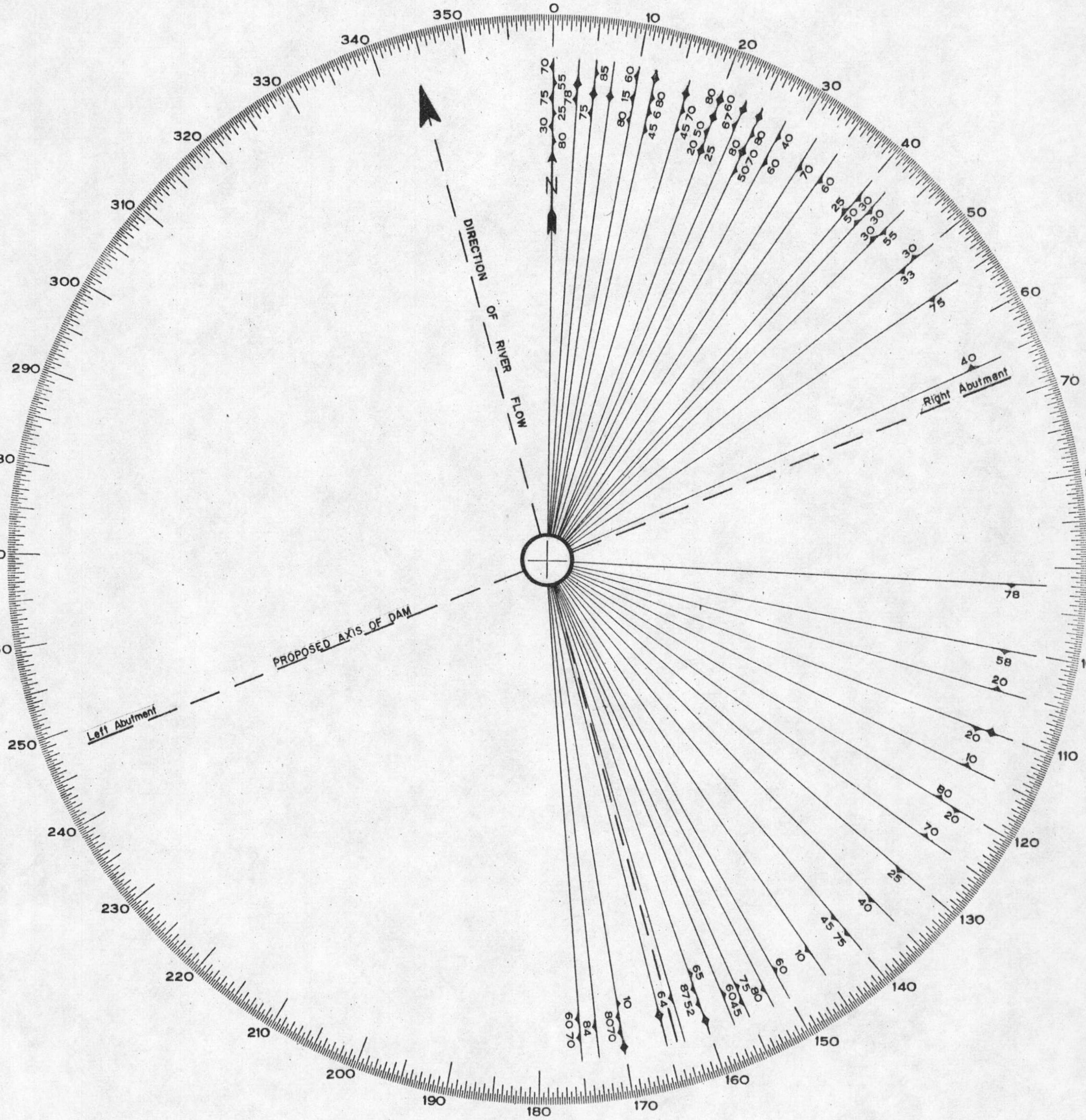
[1]Bostock, H.S.: Mayo, Y.T. Map 890A, Geol. Surv. Can., 1946.

of the site area. The shattered rock associated with the fault has been partly eroded by the fast-moving river water resulting in a narrow embayment which extends some 50 feet into the wall. The width varies from 15 feet close to the river to 1 foot at its other end. The gouge in the fault varies in thickness from 6 to 12 inches. It is sandy in character due to the considerable quartz in the schist in which the fault occurs. A 6-inch quartz vein closely parallels the fault on its hanging-wall side. The strike of the fault is almost due east and the dip is 62 degrees south (upstream). It intersects the river at about 30 degrees and projects into a wide, water-filled embayment on the right side.

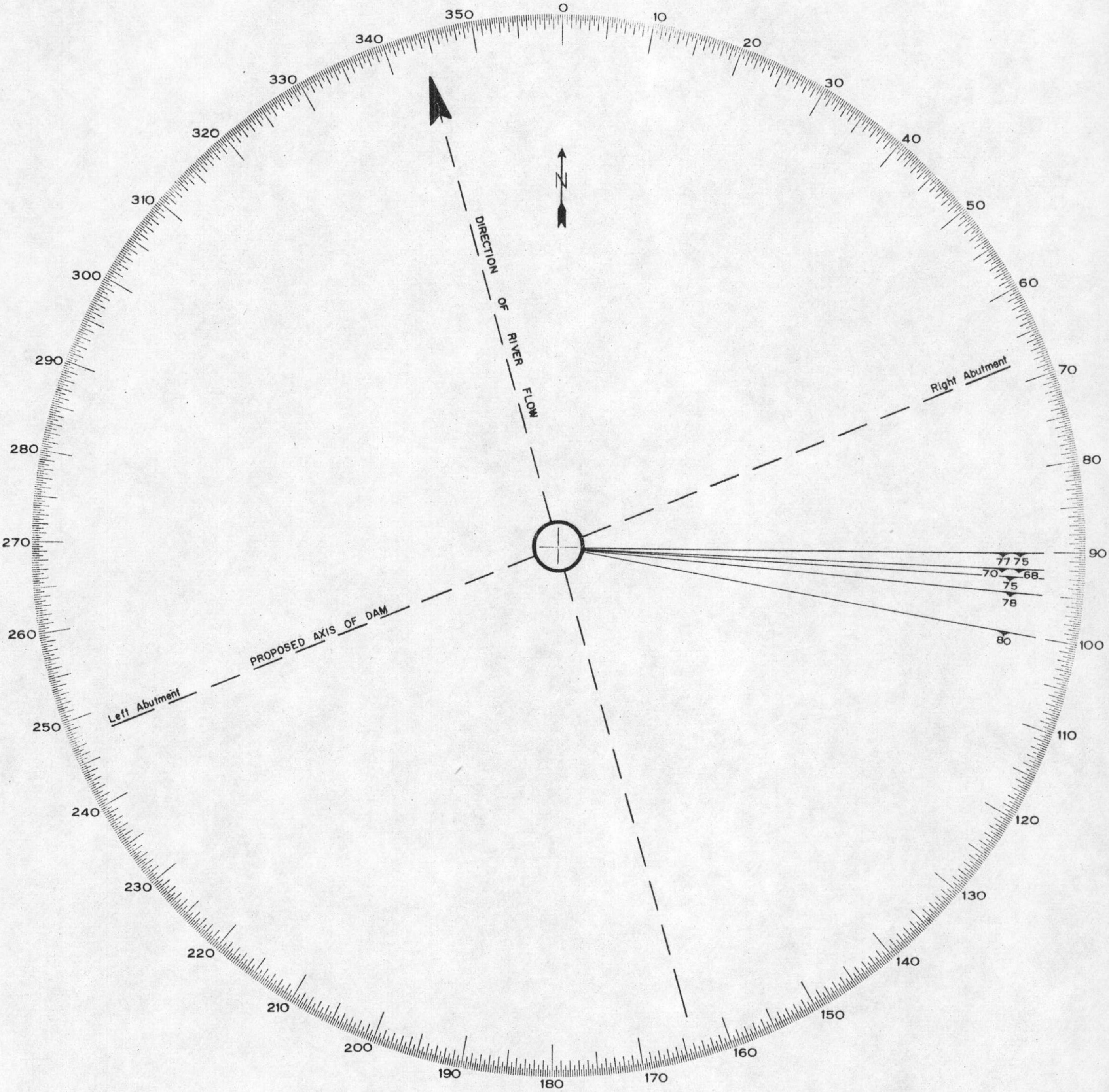
Quality of Bedrock

Schist is a finely foliated rock containing a large proportion of mica which controls its structure. Some schists may be composed almost entirely of quartz and be quite massive in structure. The quartz schist at the site, which is believed to be a competent rock, would fall into this category. The interbedded sericite schist, however, is more weak physically and will decrease the competency of the rock mass. The high percentage of mica in this rock could cause sliding in the foundations and abutments if the proper thrust conditions were present. On the other hand the presence of quartz would increase the coefficient of friction. The planes of schistosity would act as planes of weakness during blasting and consequently some of the schist would tend to break into platy fragments which are undesirable in rip-rap or rock fill. Fragments with the best shape will be obtained from the thicker beds of quartz schist. The permeability of the schist is believed low and it is relatively insoluble. Consequently caverns and solution channels should not exist within the rock.



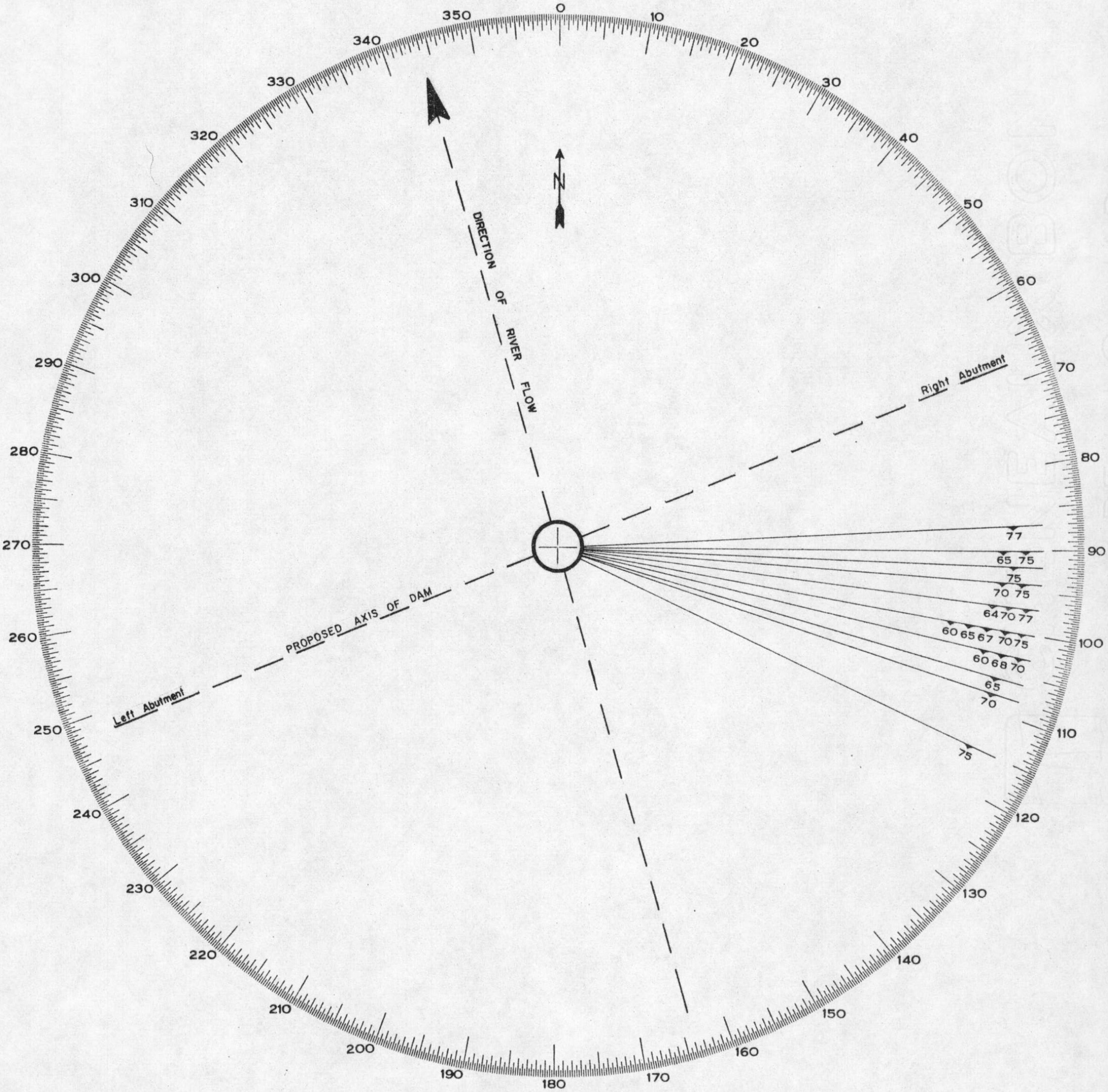
JOINT ROSETTE

The above illustration presents diagrammatically the direction and dip of the jointing in bedrock exposed at Fraser Falls site.



BEDDING ROSETTE

The above illustration presents diagrammatically the direction and dip of the bedding in bedrock exposed at Fraser Falls site.



FOLIATION ROSETTE

The above illustration presents diagrammatically the direction and dip of the schistosity in bedrock exposed at Fraser Falls site.

Engineering Considerations

Depth of Overburden

Overburden on the abutment slopes consists of talus and till along with minor quantities of yellowish-brown silt. The thickness of the talus and silt is nowhere believed to be greater than 10 feet. Data from seismic line No. 1 indicates the thickness of the till in the upstream end of the left abutment is about 11 feet. Other seismic information indicates the thickness of the overburden on the bedrock terrace west of the river varies from 8 to 17 feet. These figures seem reasonable. The presence of several bedrock islands in the river suggests the thickness of alluvium beneath the river in the gorge is not great. It is believed to be about 25 feet at the point where the proposed centre line crosses the river.

Abutments and Foundations

Bedrock throughout Fraser Falls is essentially the same. The only difference in the quality of the rock between any two areas is the quantity of soft, sericite schist present in relation to the amount of the more competent quartz schist. The upstream dip of the schistosity and its strike which closely parallels the dam axis are favourable for dam construction. Although diversion tunnels have not been considered in the proposed construction plan any such structures would have to be lined. Groundwater in any large quantity should not be encountered in a tunnel through these rocks. Grouting may be necessary to seal the numerous intersecting joint fractures. Some of these fractures, especially where they occur in the sericite schist, are three inches wide on bedrock surface. They may, however, be tight with depth. After the overburden has been removed considerable dental work will be necessary to remove the weathered rock from bedrock surface before fresh, solid rock against which concrete or dyke material can be placed will be exposed. The tendency of the schist to separate along the planes of schistosity would require that the spillway be lined to prevent erosion by the fast-moving water. It is believed bedrock exposed at Fraser Falls site will provide suitable foundation and abutment material for a dam. However, the unfavourable quality of some of the rock will necessitate precautions in the design and construction of the structures.

Construction Materials

Aggregate

There is a shortage of aggregate in the site area. The deposits from which samples Nos. 10, 11 and 16 were obtained are believed to be small. Test pitting will be necessary, however, to ascertain the quantity available. Small lenses of fine-grained gravel occur in the alluvium covering the terrace west of the river but the quantity is limited and it would be difficult to extract. The sand deposits from which samples Nos. 9 and 14 were taken contain unlimited quantities of uniform material which might be used as blending sand. Satisfactory aggregate could not be produced by crushing bedrock exposed at the site.

Impervious Material

The till which occurs in the abutment areas, represented by samples Nos. 12 and 13, is a potential source of impervious material for an earth or rock-fill dam. There are unlimited amounts of silty, sandy till beneath the terraces along both sides of Stewart River valley downstream from the site.

The material in sample No. 15 is representative of this type of till. Extensive deposits of glacio-lacustrine silt occur in the valley of Watson Creek about 2 miles north of the site. These deposits, probably laid down in a small, temporary glacial lake, are easily accessible from the site. The alluvial clay (sample No. 8) interbedded with the sand covering the terrace west of the river is another potential source of impervious material. The quantity available, however, is small and it is doubtful if there is sufficient volume available to be useful. The chief importance of the clay is its influence on the stability of the foundations of the dam structures if it were not removed.

Pervious Material

Pervious materials suitable for the pervious shells, drains and filters of an earth dam could be obtained from the natural materials described under the aggregate headings. It will probably be necessary to process these materials to obtain the specified gradation.

Riprap and Rock Fill

Satisfactory riprap or rock fill can probably be obtained from the more massive quartz schist occurring at the site. Soundness tests should be made on these rocks before any decision is reached. The most efficient use of the soft, easily weathered schist would be for road construction. According to Bostock[1] small intrusive bodies of diorite or gabbro occur east of Stewart River about 2 miles downstream from the site. These rocks should provide excellent riprap as they are hard and durable and have a relatively high specific gravity.

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[1]Bostock, H.S.: Personnal communication.

Groundwater

Seepages of groundwater were not observed in either of the abutments. However the thin coatings of calcium and iron carbonate on bedrock exposed in open joint fractures were probably deposited by circulating groundwater. This indicates these planes were once aquifers and could possibly transmit water in the future. In places the surface of the terrace west of the river is swampy due to local accumulations of suprapermafrost water overlying impervious frozen ground. Some of this water probably originated by thawing of the frozen ground and some by poor surface drainage of precipitation. In one place on the terrace where frozen ground did not exist near ground surface the water table was encountered at 11 feet.

Frozen Ground

There is no indication frozen ground exists beneath the entire site area. It was encountered in several test pits put down in the till on the terrace west of the site and on the left abutment. It was not encountered in the coarser-grained alluvial material covering the terrace except where there was a thick (18 + inches) cover of moss and decayed organic matter. It is doubtful if there is any frozen ground underlying the river at the site.

Further Investigations - Conclusions

It should be remembered this report is based upon a preliminary geological investigation designed to furnish the engineer with general geological information regarding the proposed dam site. The data compiled are only sufficiently precise to permit office studies and obtain general cost estimates.

It is believed bedrock exposed at the site is sufficiently competent to provide suitable foundation and abutment material for the proposed dam structures. Test borings should be put down to determine the quality of the rock at depth. The most satisfactory rock will be that which contains the greatest amount of quartz schist. The exact location of the centre line of the dam will be decided by the results of the borings. Test borings will also be required on the terrace west of the river and on the abutments to determine the thickness and quality of the overburden and to contour bedrock surface. In these borings soil samples should be taken and permeability tests conducted. More information is required on the fault which intersects the river some 500 feet downstream from the proposed centre line. This fault projects toward the right abutment. The zone of shattered rock associated with it could cause leakage both beneath the dam and through the abutment.

The relative softness of the sericite schist beds indicates bedrock will have to be protected where it is exposed to running water, i.e. in a diversion tunnel or spillway. The quartz schist beds are sufficiently strong but will be undercut by erosion of the softer sericite schist. There is a lack of aggregate and rock suitable for riprap in the site area. Large quantities of impervious material occur within reasonable haulage distance.

Chemical Analyses of Stewart River Water

Samples of Stewart River water were taken at three different locations along the river during July, 1963 and sent to the Industrial Waters Section, Mines Branch, Department of Mines and Technical Surveys for chemical analyses. The results are included in this report. For purposes of comparison analyses of samples taken in 1952 and 1953 are also included.

There is little change in the mineral content of Stewart River water between Fraser Falls and its mouth some 150 miles downstream. It is apparent

Chemical Analyses of Stewart River Water
(parts per million)

Location	Date	River Discharge	pH	SiO_2	Ca	Mg	Na	K	Fe	CO_3	HCO_3	SO_4	Cl_2	F	NO_3	Turbidity	Hardness as $CaCO_3$	Sum of Constituents
$1\frac{1}{2}$ mile upstream from junction with Yukon River	July 3, 1963	Medium	7.7	3.7	24.9	8.8	1.0	0.4	0	0	80.1	31.5	0.3	0.15	0.1	14	98.3	110
Porcupine dam site, 33 miles upstream from junction with Yukon River	July 5, 1963	Medium	7.5	3.7	24.8	7.8	0.9	0.4	0.02	0	78.5	31.4	0	0.11	0.1	23	93.9	108
Fraser Falls dam site, 32 miles upstream from Mayo Landing and 150 miles from junction with Yukon River	July 30, 1963	Medium	7.7	3.4	29.0	10.3	1.1	0.4	0.02	0	94.0	38.2	0.1	0.09	T.	2	115	129

Chemical Analyses of Stewart River Water at Mayo Landing, Y.T.*
(parts per million)

Date	River Discharge (cfs)	pH	SiO_2	Ca	Mg	Na	K	Fe	CO_3	HCO_3	SO_4	Cl_2	F	NO_3	Turbidity	Hardness as $CaCO_3$	Sum of Constituents
July 3, 1952	37,200	8.0	4.4	23.1	5.8	1.3	0.4	0.13	0	69.8	26.1	1.2	0.10	0.2	50	81.6	96.1
Oct. 15, 1952	13,800	8.0	4.4	33.0	11.4	3.4	0.9	0.09	0	107	43.6	1.2	----	0.4	20	129	151
Feb. 7, 1953	1,340	8,1	16	55.4	11.5	8.5	---	----	0	183	45.4	1.3	0	0.6	7	186	229
June 5, 1953	31,300	9.3	19	26.9	7.7	8.8	2.4	0.02	12.0	81.0	27.8	1.2	0.02	0.4	50	99.0	146

* Thomas, J.F.J.: Industrial Waters of Canada; Water Survey Rept. No. 8, Mines Branch, Canada, 1957.

the mineral content of the numerous streams, such as Macmillan and Mayo Rivers, which join the Stewart downstream from Fraser Falls is similar to that of the Stewart itself because the addition of their water makes little difference in the mineral content of the Stewart. Bicarbonate salts of calcium and magnesium constitute the chief mineralization of Stewart River water. There are no salts present in sufficient quantity to be harmful to the concrete or other parts of the dam structures which would be exposed to the water. The reported value of the turbidity should be considered only as indicative. Flash floods may cause a rapid increase in the sediment load. A proper sediment study, therefore, requires regular sampling, often in the case of flash flooding at hourly intervals.

Grain Size Analyses Curves

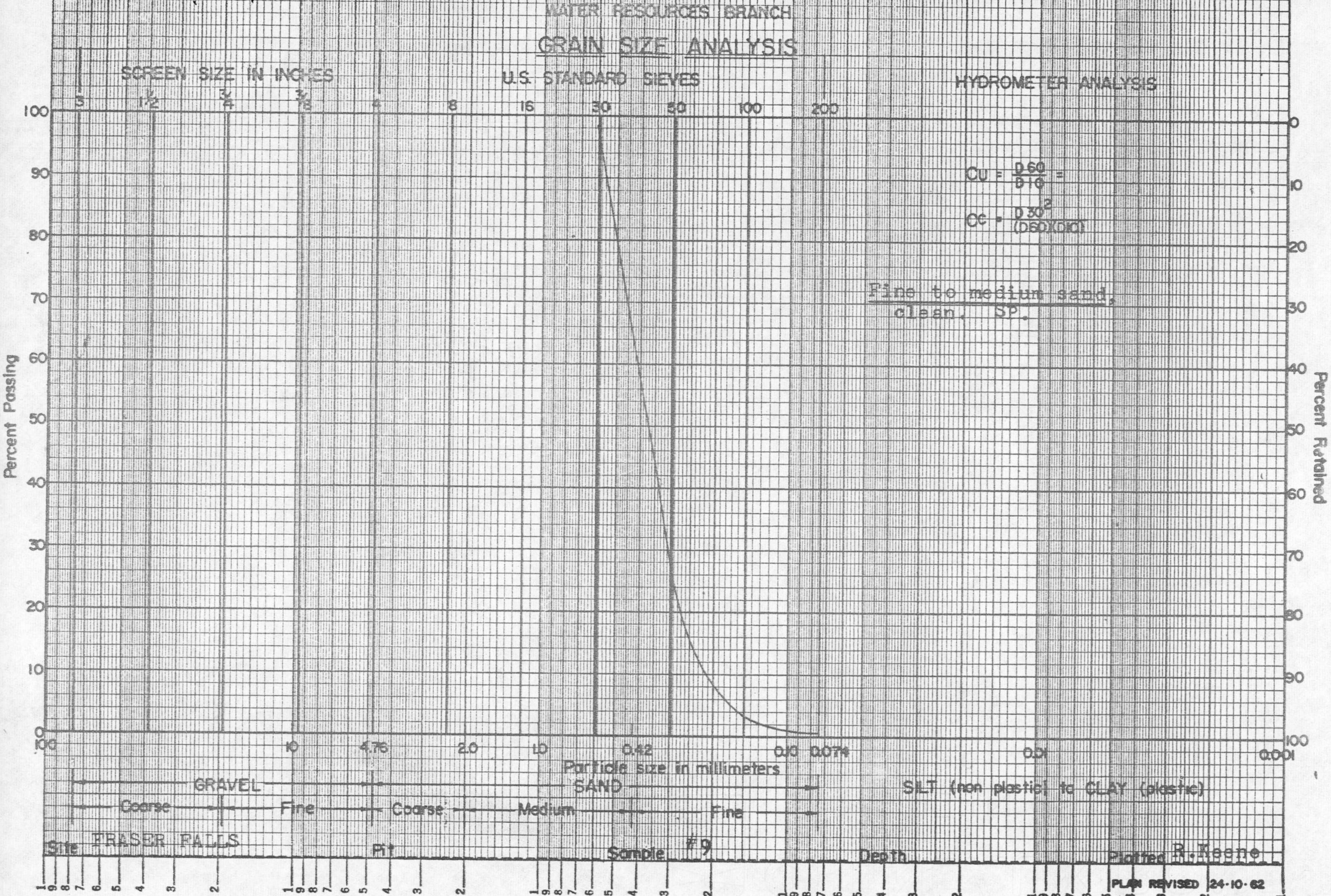
Eight soil samples, each weighing about 35 pounds, were taken of various potential constructions materials near the site and sent to the Soils Laboratory of the Water Resources Branch in Vancouver for testing. The grain size analyses curves included in this report were prepared in Vancouver. Time and the high cost of transporting the samples from the field to the laboratory precluded taking more than a minimum number. The samples taken are believed to be representative of the various types of materials located at the site or within a reasonable haulage distance.

The results of the analyses indicate that the gravelly sands and gravels could be processed to yield coarse aggregate. However the presence of deleterious material such as chert and weathered schist fragments may cause some of this material to be rejected, also the supply is small. The sand sampled could be used as blending material in aggregate, however it might not be possible to obtain all the required sizes because of the uniformity of the material. It is indicated the silty clay in sample No. 8 would be most suitable material for the core of an earth dam. It is doubtful if there is sufficient of this material available to satisfy the requirements of the project. The next best core material is the till covering the upstream end of the left abutment (sample No. 13).

Description of Potential Aggregate for the following Grain Size Analyses Curves

Sample Number	Location	Field Description of Material	Field Description of Overburden	Thickness of Deposit	Areal Extent (estimated)	Remarks
9	Bottom of farthest downstream blast hole, seismic line No. 2; 10 feet beneath ground surface; test pit was near toe of proposed dam	Sand: fine-to medium-grained, uniform, dark grey, very little silt, chief minerals are white to glassy quartz and black chert, not weathered.	None	11+ feet	Length - 700 yds. Width - 350 yds.	<u>Log of test pit</u> 0-4" - moss 4"-18" - silty sand 18-120" - sand as in No. 9 at 132" - frost line with supra-permafrost water Permeability computed in the field = 41.65 feet per day (on recompacted sample)
10	200 feet east of right abutment; in centre of natural spillway; 36 inches beneath ground surface.	Gravel: sandy, loose, fairly well graded, very little silt or clay, pebbles chiefly quartz and quartzite with minor schist, chert and sandstone.	None	Unknown	Not large, 300 square yards approx.	Low moisture content; no frozen ground; material grades into deposit for sample No. 11.

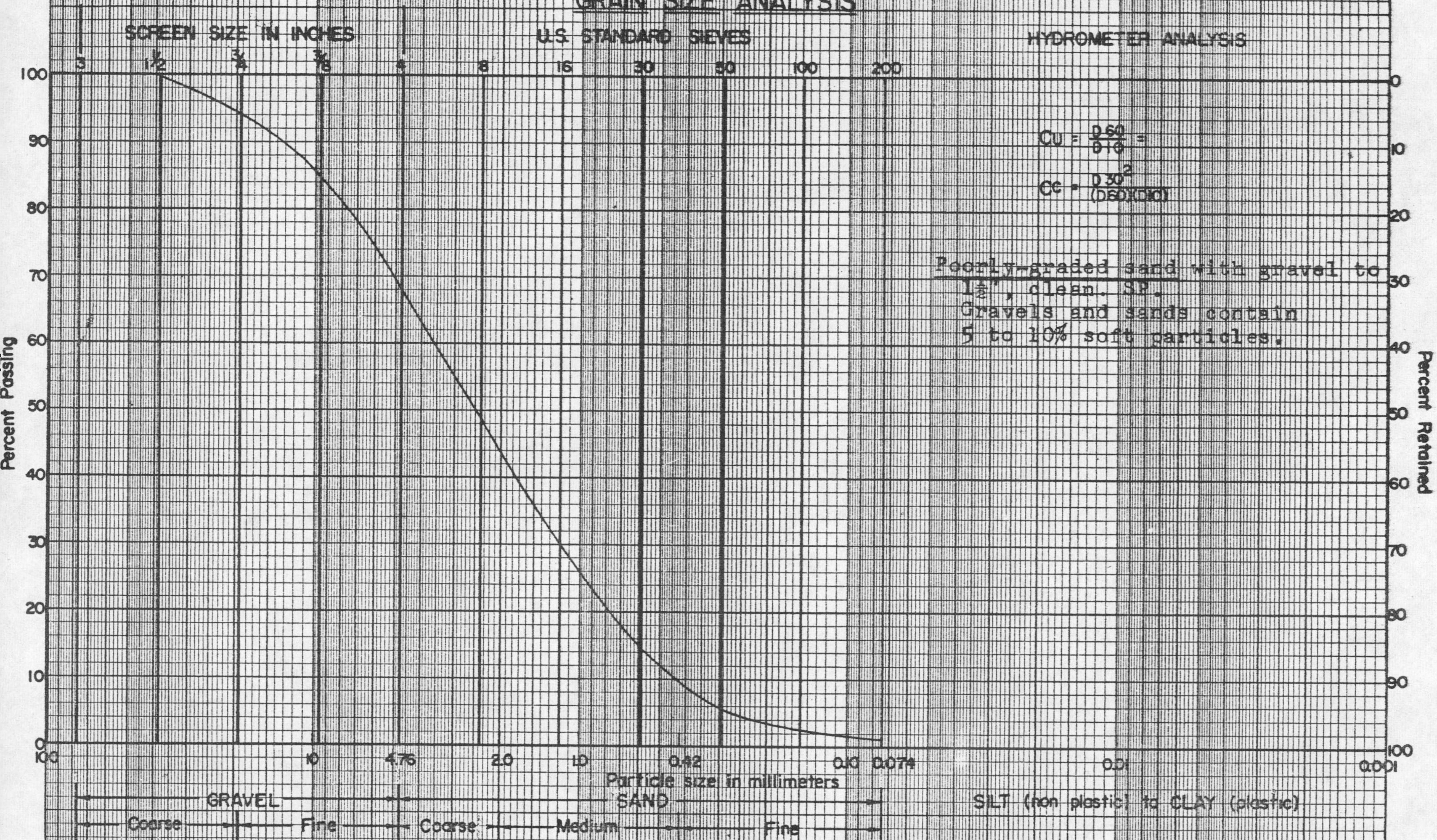
DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES



DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



Site FRASER FALLS Pit Sample #10 Depth Plotted R. Keene

PLAN REVISED 24·10·62

M-5

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

Description of Potential Aggregate for the following Grain Size Analyses Curves

Sample Number	Location	Field Description of Material	Field Description of Overburden	Thickness of Deposit	Areal Extent (estimated)	Remarks
11	200 feet east of right abutment; in south end of natural spillway; 36 inches beneath ground surface	Sand: gravelly, silty, loose, fairly well graded, pebbles chiefly quartzite but considerable black chert and schist.	None	Unknown	Not large, 1400 square feet approx.	High moisture content; frozen ground at 24 inches.
14	On terrace one mile N.W. of site; 30 inches beneath ground surface	Sand: fine-to medium-grained, grey, no silt or clay, loose	None	30 + feet	Unlimited, terrace extends for at least one mile	Material becomes finer grained towards the west.
16	Near top of steep bluff 120 feet above toe; 48 inches beneath ground surface; 4 miles downstream and 1 mile east of site.	Sand: gravelly, loose fairly well graded, very little silt or clay, cobbles up to 8 inches.	Unknown	120 + feet	About 60,000 cubic yards available.	

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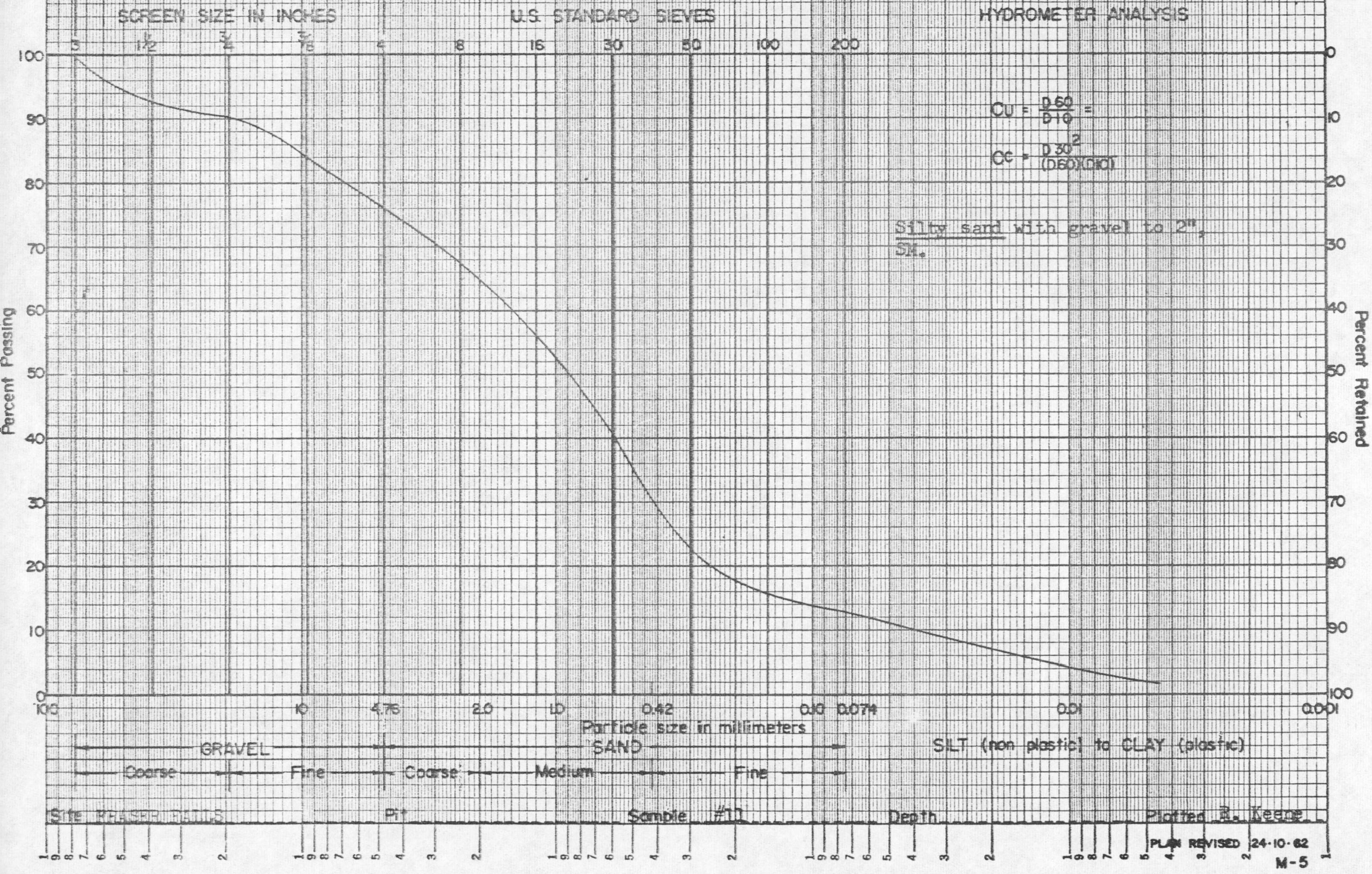
WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



Site FRASER FALLS Pit Sample #11 Depth Plotted R. Keene

PLAN REVISED 24-10-62

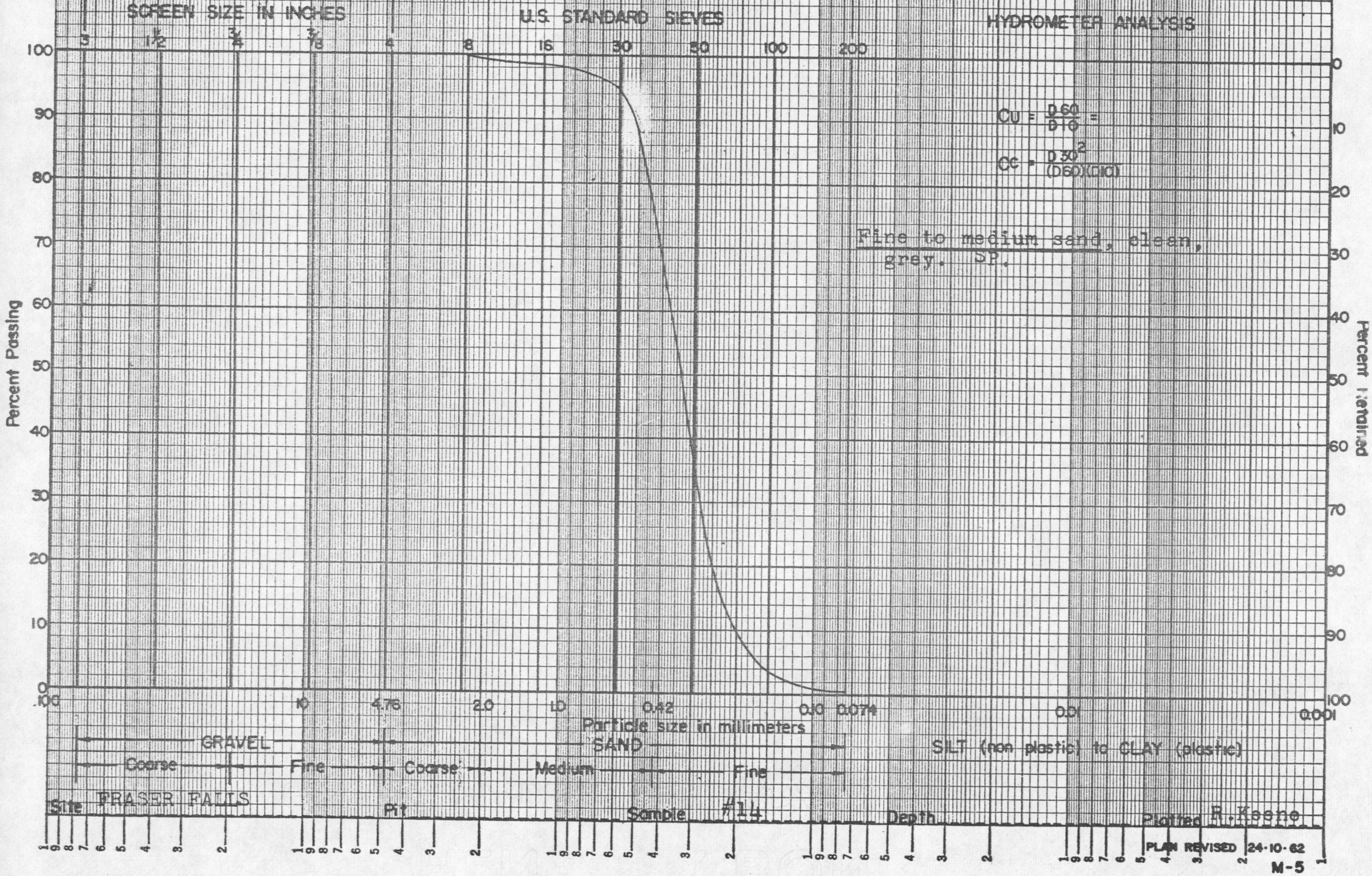
M-5

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



K+E SEMI-LOGARITHMIC 359-91G
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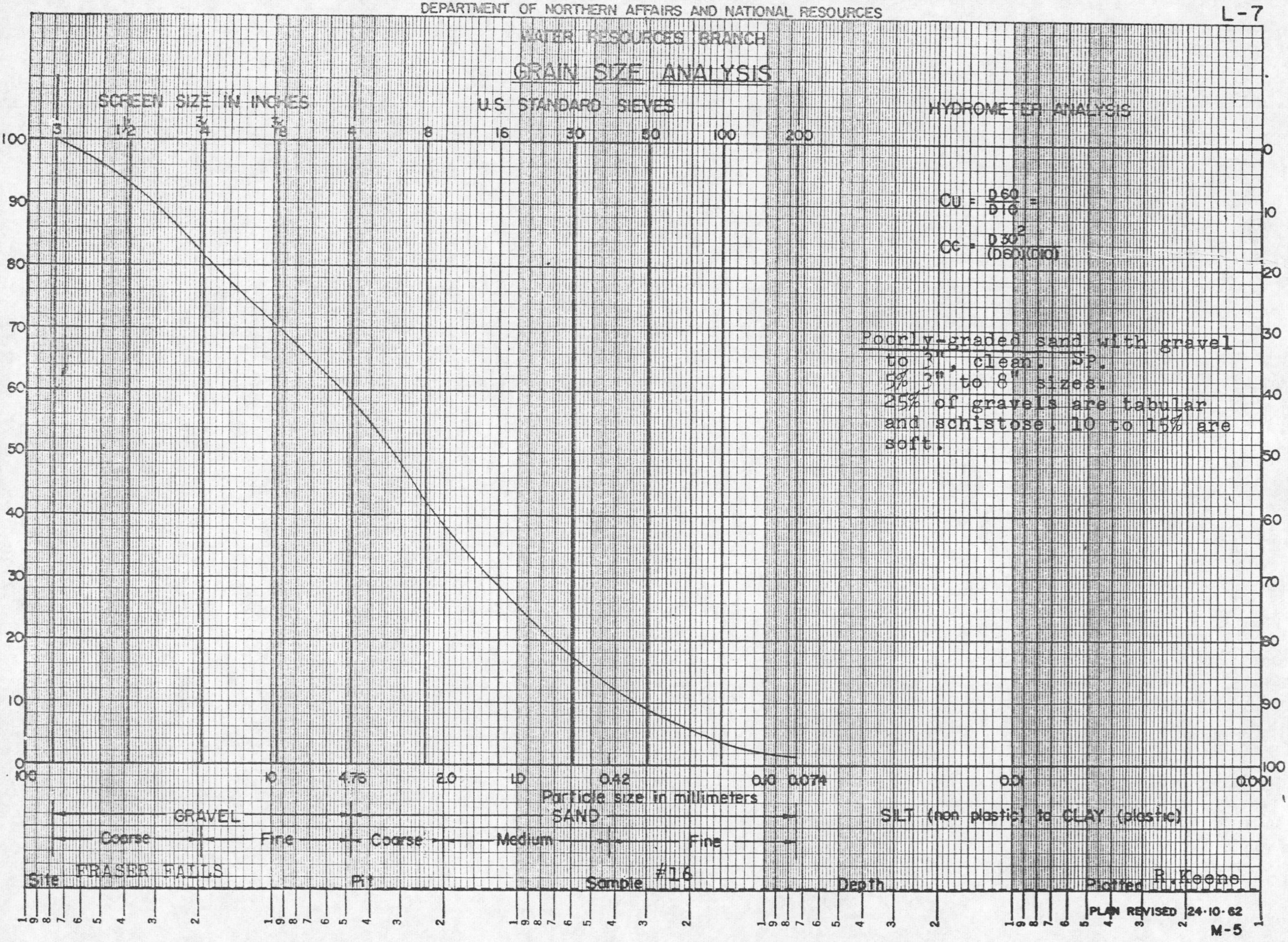

DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES
WATER RESOURCES BRANCH
GRAIN SIZE ANALYSIS
SCREEN SIZE IN INCHES
U.S. STANDARD SIEVES
HYDROMETER ANALYSIS
3 1½ ¾ ⅜ 4 8 16 30 50 100 200
Percent Passing
Percent Retained
$Cu = \frac{D60}{D10} =$
$Cc = \frac{D30^2}{(D60)(D10)}$
Poorly-graded sand with gravel to 3", clean. SP.
5% 3" to 8" sizes.
25% of gravels are tabular and schistose, 10 to 15% are soft.
100 10 4.76 2.0 1.0 0.42 0.10 0.074 0.01 0.001
Particle size in millimeters
GRAVEL
SAND
SILT (non plastic) to CLAY (plastic)
Coarse
Fine
Coarse
Medium
Fine
Site FRASER FALLS
Pit
Sample #16
Depth
Plotted R. Keene
PLAN REVISED 24·10·62
M-5

Description of Potential Impervious Material for the following Grain Size Analyses Curves

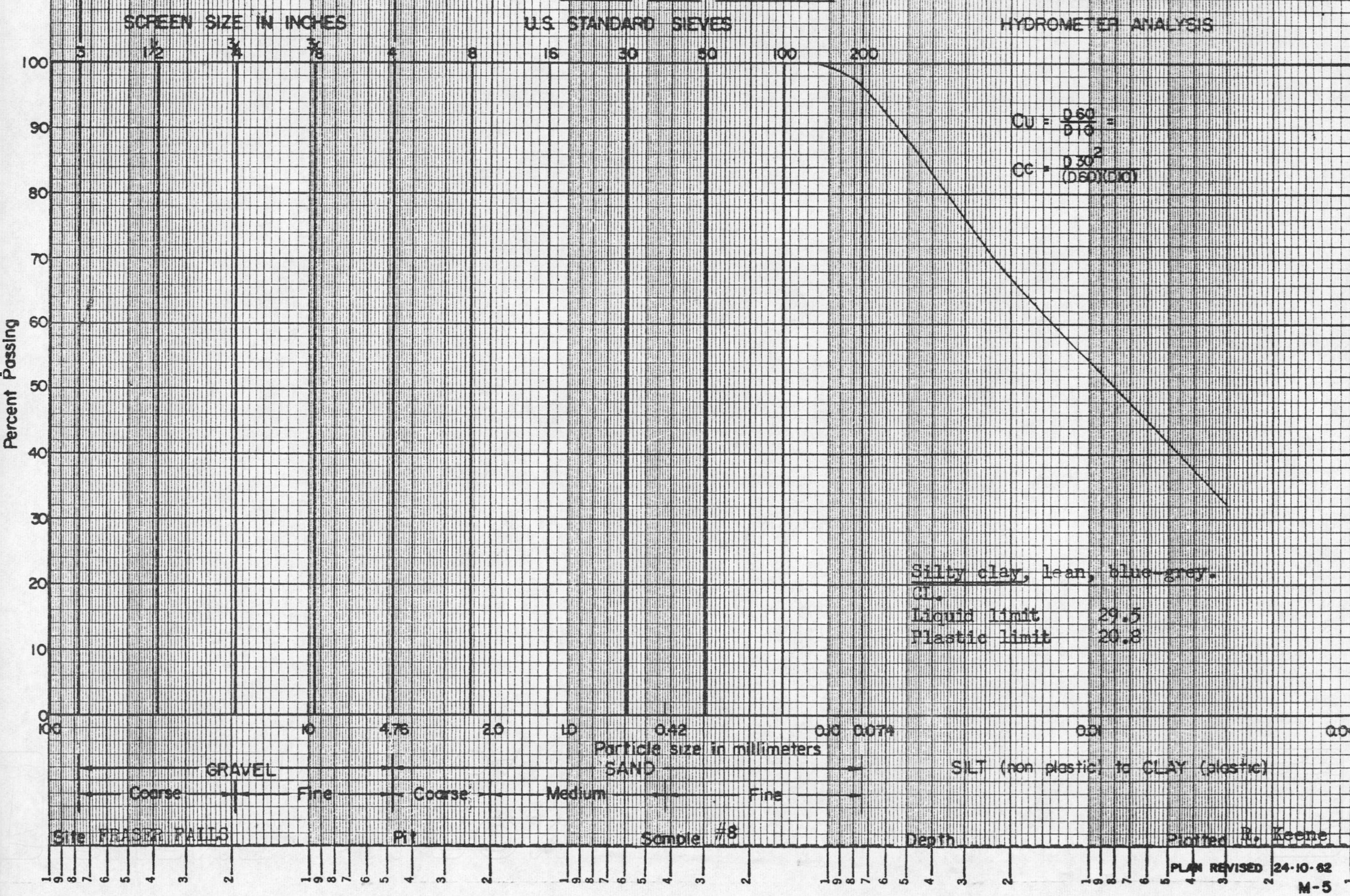
Sample Number	Location	Field Description of Material	Field Description of Overburden	Thickness of Deposit	Areal Extent (estimated)	Remarks
8	200 feet west of station No. A-5; 36 inches beneath ground surface	Clay: silty, blue-grey, soft	36 inches of sand and silty sand	12 inches	Unknown but believed limited	Log of test pit 0-24" - silty sand 24-36" - sand as in sample No. 9 36-48" - clay as in sample No. 8 48-96 - sand as in sample No. 9 Frozen ground or groundwater not encountered.
12	On sloping bedrock terrace 900 feet east of right abutment; 24 inches beneath ground surface	Till: silty, sandy, grey-brown, fairly dense, well graded.	None	Variable, up to 10 feet (approx.)	Limited, 500 to 1000 cubic yards available	Directly overlies bedrock

DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

L-7

WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



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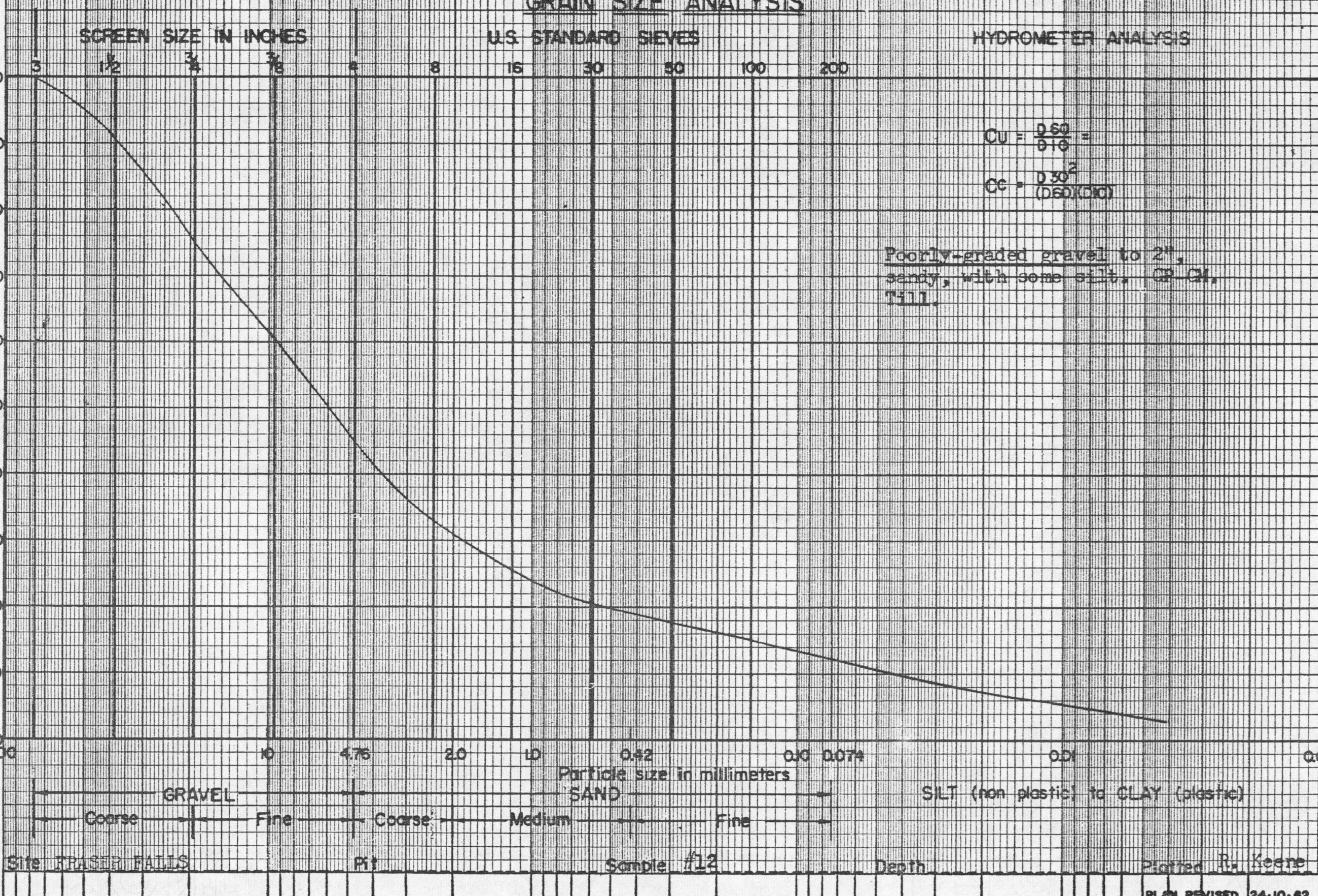
WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

Description of Potential Impervious Material for the following Grain Size Analyses Curves

Sample Number	Location	Field Description of Material	Field Description of Overburden	Thickness of Deposit	Areal Extent (estimated)	Remarks
13	Upstream end of left abutment area; at elevation 1830; 36 inches beneath ground surface	Till: silty, sandy, poorly graded, boulders to 14 inches, rock fragments chiefly quartzite with small quantities of black chert, quartz and schist.	None	Unknown but probably thin	Length - 300 yds. Width - 200 yds.	Sample 15 representative of all till on left abutment; test pitting required have to determine quantity available; frozen ground at 12 to 24 inches; material probably overlies bedrock.
15	On steep bluff below prominent terrace 3 miles N.W. of site; 100 feet above base of bluff; 24 inches beneath ground surface	Till: silty, sandy, fairly well graded, cobbles to 6 inches, pebbles are chiefly quartz and quartzite.	None	100 + feet	Unlimited	Accessible from site.

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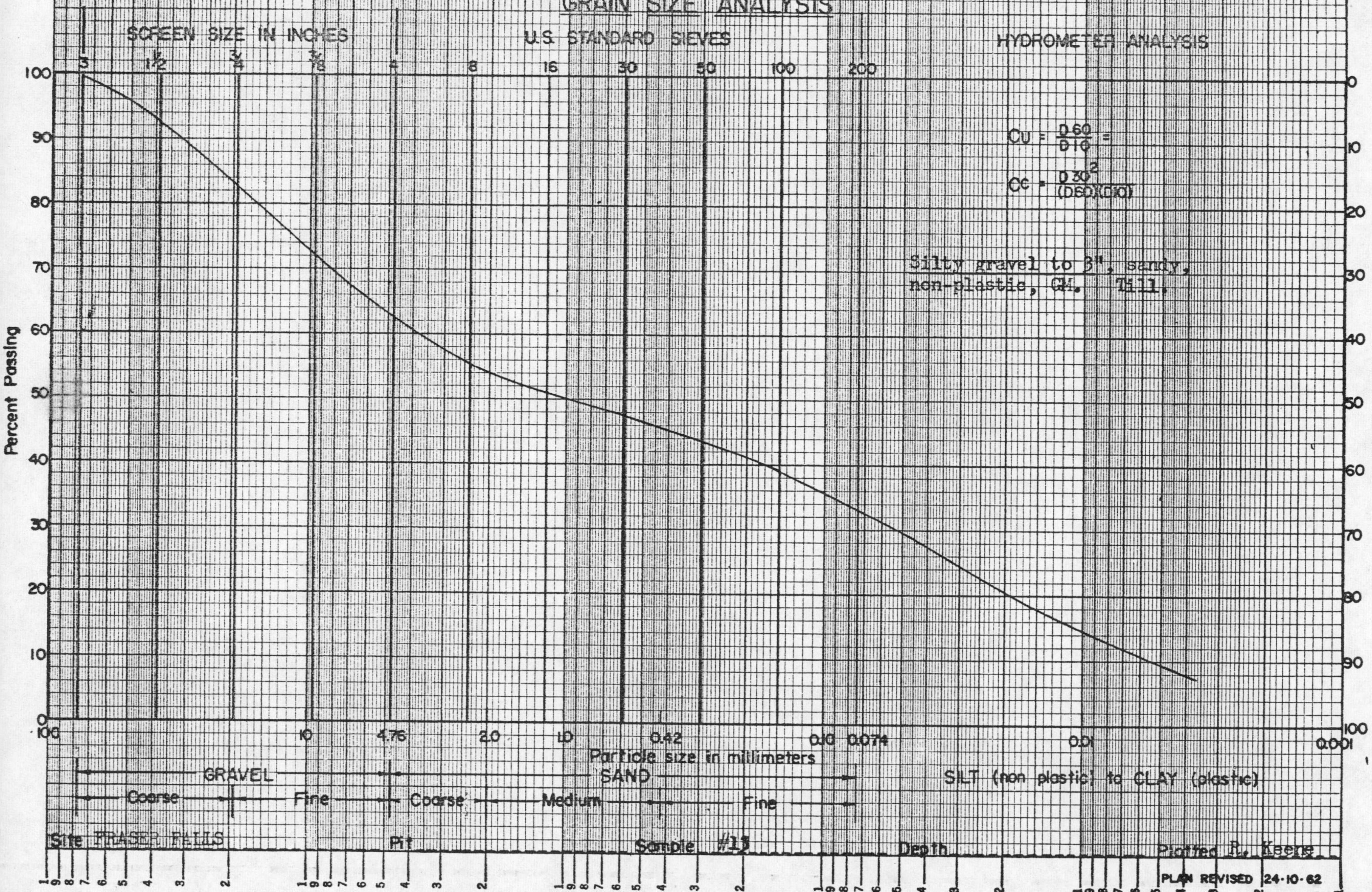
WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



Site FRASER FALLS Pit Sample #13 Depth Plotted R. Keene

PLAN REVISED 24-10-62

M-5

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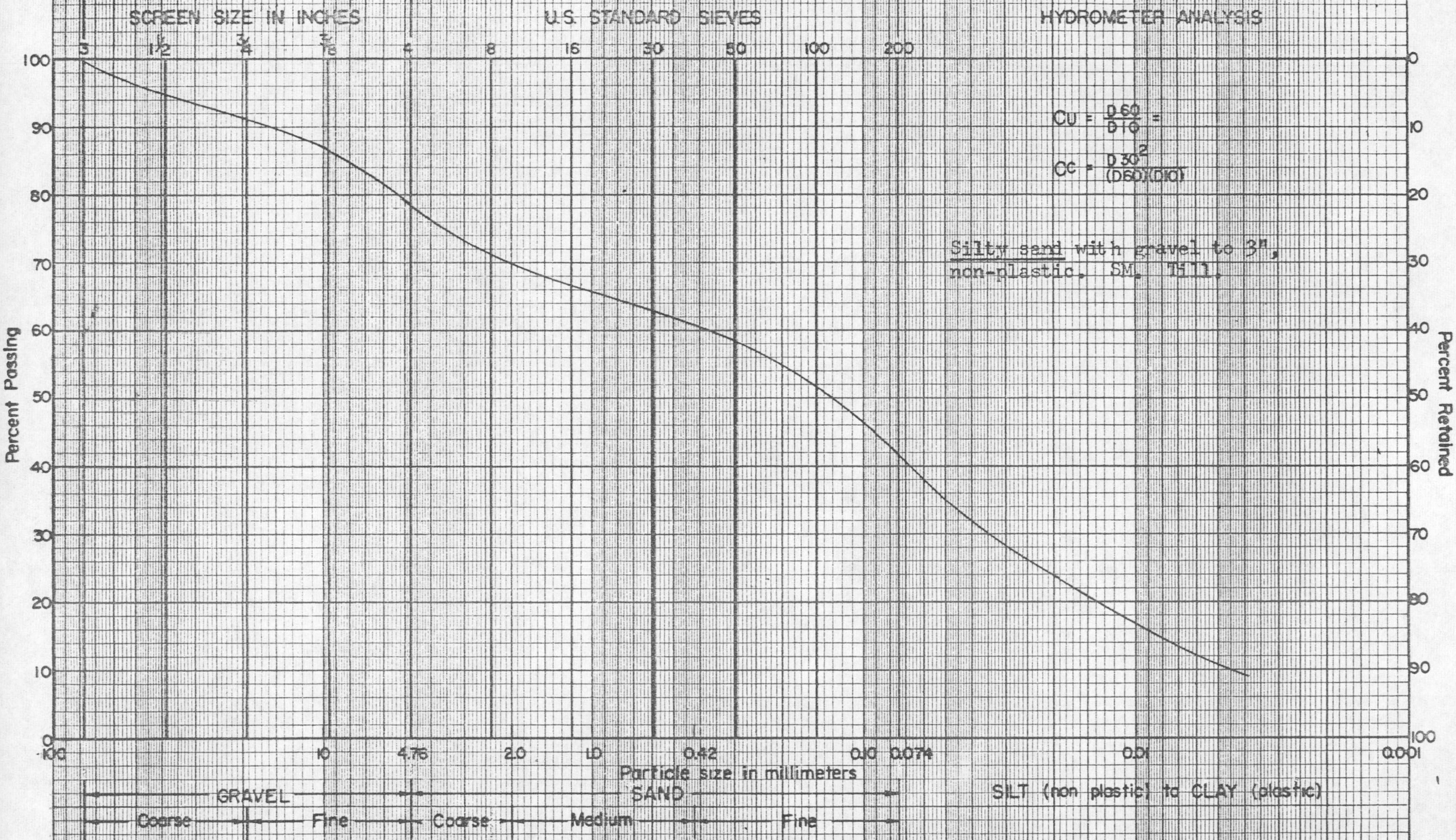
WATER RESOURCES BRANCH

GRAIN SIZE ANALYSIS



Site FRASER FALLS Pit Sample #15 Depth Plotted R. Keene

PLAN REVISED 24·10·62

M-5

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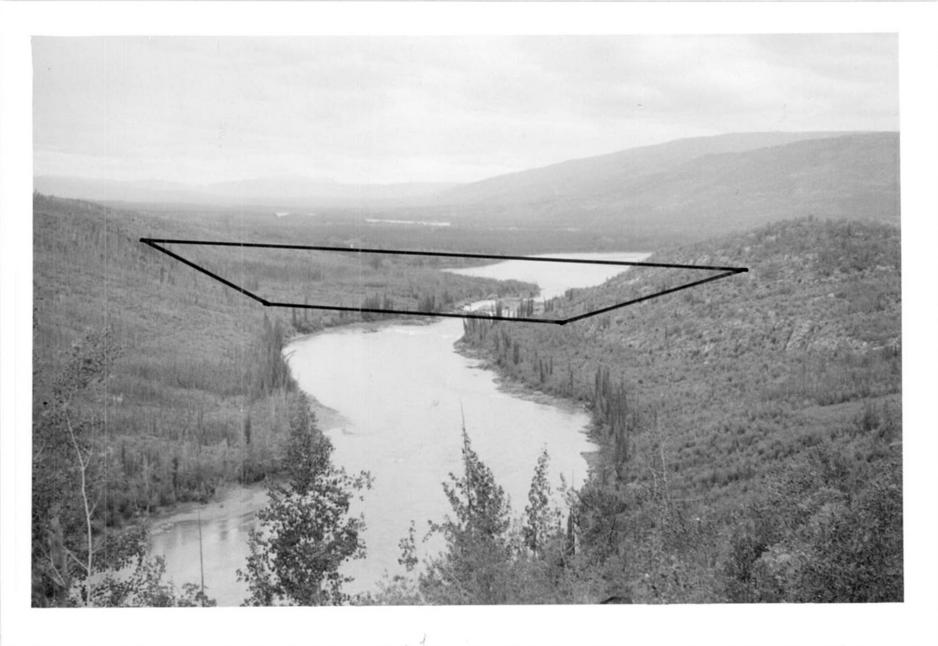


Plate 1

View looking downstream through Fraser Falls dam site area, approximate location of dam indicated by black lines.

G.S.C. 9-1-63

Plate 2

View from right abutment showing vertical, 50-foot high, rock bluff along left side of gorge.

G.S.C. 9-5-63

Plate 3

View of left abutment area from right abutment showing bedrock terrace extending west from left side of river to toe of abutment.

G.S.C. 9-4-63

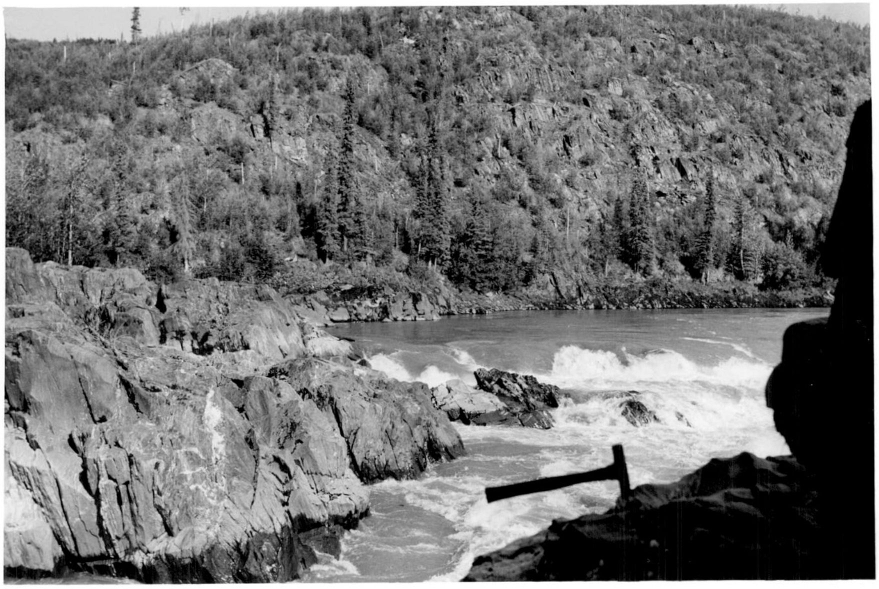


Plate 4

In the foreground the upstream end of the gorge at Fraser Falls dam site; in the background the rocky right abutment.

G.S.C. 8-3-63

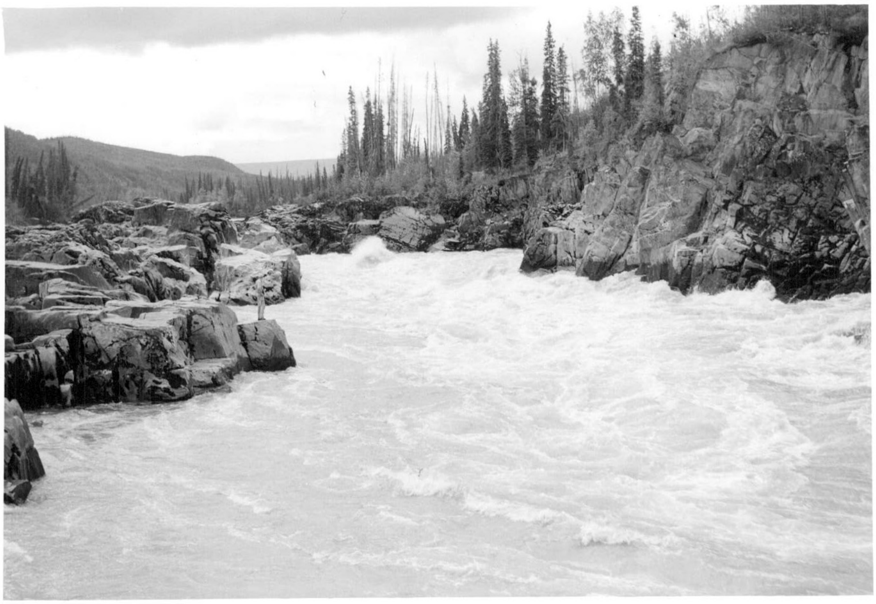


Plate 5

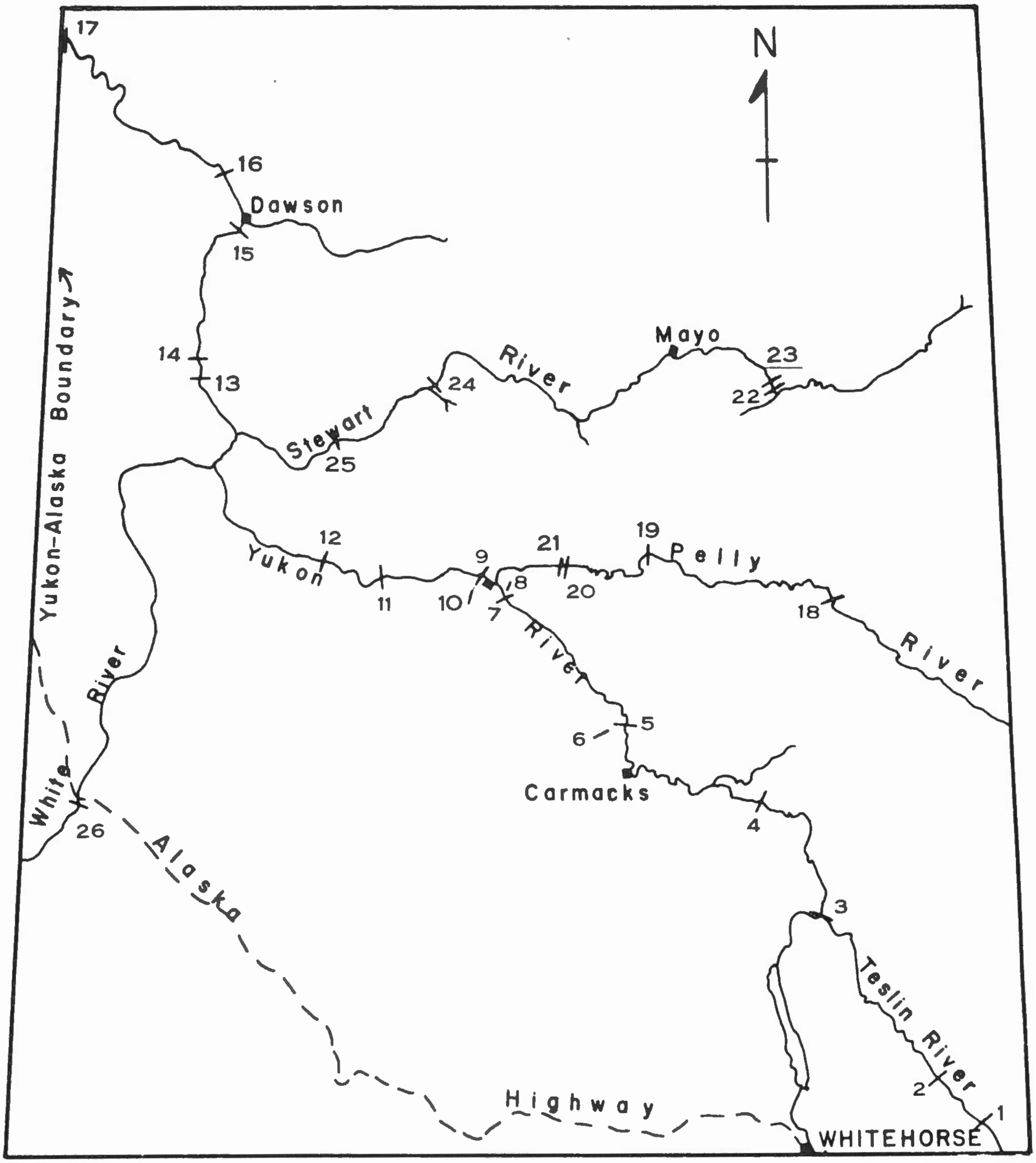
View upstream through gorge, Fraser Falls dam site.

G.S.C. 9-7-63

Plate 6

View of reservoir area immediately upstream from site, photograph taken from right abutment.

G.S.C. 9-6-63



LOCATION OF PROPOSED DAM SITES
YUKON RIVER DRAINAGE BASIN
Scale: 1 inch = 40 miles

Site No.	Name	Site No.	Name	Site No.	Name
1 —	Swift River	10 —	Fort Selkirk Draw	19 —	Granite Canyon
2 —	Northwest Power	11 —	Selwyn	20 —	Gerc
3 —	Hootalinqua	12 —	Britannia	21 —	Bradens Canyon
4 —	Big Salmon	13 —	Ogilvie no. 1	22 —	Five Mile Rapids
5 —	Five Finger Rapids	14 —	Ogilvie no. 2	23 —	Fraser Falls
6 —	Five Finger Draw	15 —	Upper Dawson	24 —	Independence
7 —	Wolverine	16 —	Lower Dawson	25 —	Porcupine
8 —	Wolverine Draw	17 —	Boundary	26 —	Lower Canyon
9 —	Fort Selkirk	18 —	Detour		