OFFICE AIRPHOTO SEARCH FOR GRANULAR MATERIAL AND BEDROCK AGGREGATE PROSPECTS ADJACENT TO HIGHWAY NO. 3 BETWEEN KM 170 AND KM 237 SOUTH OF EDZO NORTHWEST TERRITORIES

J D MOLLARD AND ASSOCIATES LIMITED
CONSULTING CIVIL ENGINEERS AND ENGINEERING GEOLOGISTS

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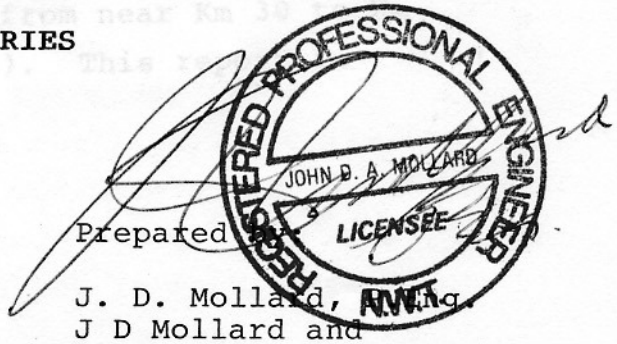

Prepared for:

Government of Northwest Territories
Northwest Territories Public Works
Highways Division
Design and Construction Section
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Attn: Mr. Peter Vician, Project Officer

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OFFICE AIRPHOTO SEARCH FOR GRANULAR MATERIAL AND BEDROCK AGGREGATE ADJACENT TO HIGHWAY NO. 3 BETWEEN KM 170 AND KM 237, JUST SOUTH OF EDZO, NWT

I. TERMS OF REFERENCE

An office based airphoto interpretation study is required to identify potential gravel and select borrow deposits and quarries near the Yellowknife Highway No. 3 route.

The location of the study extends from Km 170 on Yellowknife Highway No. 3 and continues to Km 237 on the same highway. Km 237 is just a few hundred metres south of the community of Edzo. Km 0 is the intersection of the Yellowknife Highway (No. 3) with the Mackenzie Highway (No. 1).

A previous study completed by E.B.A. Engineering Consultants Ltd. identified deposits from near Km 30 to Km 170 on the Yellowknife Highway (No. 3). This report is available for review if required.

The following specific work is required:

1. Carry out a high-level office airphoto study on a corridor 20 km wide along either side of the Yellowknife Highway (No. 3) (40 km total width) between Km 170 and Km 237. The study is to utilize airphoto coverage at the 1:60,000 scale. This coverage will total approximately 2680 square kilometres. The study will identify potential gravel deposits, select borrow material and exposed bedrock formations suitable for quarry work, which could be utilized in the reconstruction of the Yellowknife Highway (No. 3). Deposits outside of a 2.5 kilometre corridor should be annotated if they could provide at least 100,000 cubic metres of material.

2. Carry out a low-level office airphoto study on a corridor 2.5 km wide along either side of the Yellowknife Highway (No. 3) (5 km total width) between Km 170 and Km 237. The study is to utilize airphoto coverage at the 1:16,000 scale. This coverage will total approximately 335 square kilometres. Additional photo coverage is available at a 1:5000 scale, but is restricted to a 1 km corridor along the road alignment.

The study will identify potential gravel deposits, select borrow material and exposed bedrock formations which could be utilized in the reconstruction of the Yellowknife Highway (No. 3). Deposits should be annotated if they can provide at least 50,000 cubic metres of material. Select borrow deposits may be smaller (10,000 m^3). A priority on borrow deposits existing with 1 km of the highway is a major objective.

3. All deposits should be identified with the objectives of providing a series of deposits along the route with minimal access problems, limited environmental impact, large quantities of select material for immediate use or processing for embankment material, granular base material and gravel for use in asphalt concretes.

4. It is expected that the methodology will include but is not limited to:

   - Identifying potential permafrost conditions
   - Identifying probable access routing into any of the more promising prospect areas
   - Identifying drainage and vegetation characteristics of the more promising prospect areas
   - Preparing a suggested priority schedule and plan for a field testing program based on the proximity to the road and the rated potential (i.e. poor, fair, good, etc.) of each prospect.

5. Five (5) copies of the written report will be submitted. The report will include quality xeroxed airphotos showing each prospect area, a full size 1:250,000 key map and geology maps where available showing the location of all of the prospect areas, and a table listing each prospect with landform variety, priority rating and other comments. The original annotated airphotos and mosaics will also accompany the original report. Airphotos will be purchased by the contractor and returned to the Department upon completion of the study. Some airphotos may be supplied by the Department and must also be returned upon completion of the study.

6. The estimate shall be a final lump sum price for each of the high level and low level interpretations including but not limited to engineering, drafting and the preparation of the original report and copies. Out of pocket expenses will be paid at cost including but not limited to:

   - cost of airphotos
   - long distance phone calls
   - topographic and geology maps
   - courier services.

7. The contractor must complete the work and submit 5 copies of the final report to this office before March 31, 1986.

II MATERIALS STUDIED

Three sets of airphotos were examined in different levels of detail. Scales of the three sets of airphotos are 1:60,000, 1:16,000 and 1:5000. Each set of airphotos shows Highway No. 3, and each set is of good quality for purposes of interpretation. However, as it turned out, the 1:60,000 are by far the easiest to interpret confidently because they

show more geological information and less surface vegetation detail, which tends to obscure the geology and therefore influence the interpretation of landforms and surface materials.

After examining the three sets of photography it was decided to show all prospects on 1:60,000 scale strip mosaics because they show considerable terrain, hydrographic, vegetation, and land-use detail for purposes of the location of the aggregate prospects on airphotos and for ground and aerial reconnaissance.

Phone calls were made to the National Air Photo Library (NAPL) in Ottawa to obtain the 1:60,000 airphotos, and to the Lands Directorate to obtain soil map data, and to the Geological Survey of Canada (GSC) map office in Ottawa to obtain available bedrock geology and surficial geology maps.

The best available bedrock geology map is GSC Map 1372A titled Geology of the Horn River (Figure 1). The best available surficial soil map is the one prepared by John H. Day titled: "Soil Map of the Upper Mackenzie River Area, NWT" (Figure 2). The best available regional surficial geology map is the one prepared by Dr. Bruce G. Craig in 1957, which was also obtained (Figure 3).

All three maps (bedrock geology, agricultural soils, and surficial geology) are however very small in scale and cover large regions. They therefore show very little detail relating to specific areas to prospect in the field for sand and gravel and for bedrock quarry rock.

III BEDROCK GEOLOGY

The bedrock consists of widely scattered granitic rock outcrops in the north, shown as "gn" and "Afp," (the latter located farther south on the west side of Highway No 3). These rock prospects are mapped as GR (for granitic rock) on enclosed mosaic alignment sheets.

The bedrock geology map shows predominantly Paleozoic strata (Devonian, Ordovician, Cambrian) in the study-area. These strata consist mainly of (a) flat-lying carbonates (limestone and dolomite), (b) evaporites (gypsum, which is highly soluble and forms collapse sinkholes and numerous salty lakes and ponds), and (c) shale.

The shale (SC-LF) and gypsum beds (GC-CF) are unsuitable as highway aggregate (Figure 1). The carbonate strata may be thin-bedded (rather than thick and massive) and locally contains bitumen as well as silt and clay (argillaceous), making these bedrock strata less attractive as high quality natural road aggregate. Even so, all nearby CR-LB and CR-CL rock outcrops (Xs on mosaic alignment sheets) should be inspected carefully in the field. Small, freshly broken rock samples should be collected and taken into the laboratory for testing (freeze-thaw and/or magnesium sulphate tests).

IV SURFICIAL GEOLOGY

The entire study-area was modified by waters in glacial Lake McConnell following deglaciation. Examination of 50-ft contours indicates that prospects 37, 42 and 43 are located near 800 ft elevation, with prospect 42 extending to 900 ft. Prospects 38, 39, 40, 41 are situated around elevation 850 ft to 900 ft, and prospects 32 and 33 are around elevation 900 ft.

Most of the granular materials are expected to consist of sandy raised beaches or of shallow, rubbly, wave-eroded bedrock or till. Craig (Figure 3) shows no gravel in the area. Day (Figure 2) shows a number of areas of "stony gravel" and "stony loam" soils (Sa, Et and Es soil associations). The numbers after Sa, Et and Es refer to percentage of the large area containing these materials, as Sa4 equals 40% of the area is Sa and Et3 means 30% of the area is Et.

I believe that most of the raised beach ridges are oversanded (high content of uniform sand). But this cannot be taken for granted for all locations because (a) John Day shows a lot of occurrences of stony gravel, (b) limestone and dolomite rocks are situated near ground surface along escarpments, (c) the beach ridges show only minor wind erosion in the form of large shifting, unvegetated areas and extensive dune formation -- all common in areas of extensive uniform fine sand.

V DISCUSSION OF MAP LEGEND USED

A map legend has been set up to be as explanatory as possible. The legend used contains specific information on the following six elements, or components:

(1) The geologic landform at all identified aggregate locations.

(2) Type of aggregate material, whether it be granular or bedrock, and the expected gradation of granular material or the type of bedrock anticipated.

(3) A qualitative estimate of the thickness of granular material overlying bedrock.

(4) Envisaged constraints thought to affect prospects to be field checked first, and that influence overall prospect rating. They relate to inferred quality restrictions and limitations, such as deleterious material and material gradation, and other factors such as very long haul distance, recoverable depth, bedrock blasting and crushing costs, etc.

(5) Overall prospective rating on a relative basis.

Note that on Figures 5 and 6, the main figures, places to check for bedrock are coloured in pink and places to check for granular material (mostly sands expected) are coloured in lime green.

VI DISCUSSION OF INDIVIDUAL PROSPECTS

All prospects identified are described by the legend and in Appendix A. The more promising looking prospects are discussed in more detail in Appendix B. These appendices should be referred to along with Figure 5, the mosaic alignment sheets. There is little to be gained by discussing the doubtful prospects in much detail. They were mapped, realizing the chances of them being developed is very low. They could also be called poor to very poor.

The following individual prospects offer the best chance of finding material during aerial and ground reconnaissance. Only the more promising of these may appear attractive enough to warrant testing with heavy equipment. This should probably not be done (i.e. necessitating cutting access roads) until a fairly detailed auger and/or hand test-pitting program has been carried out at places marked on the airphotos for field reconnaissance observation.

These, then, in my judgement are the above-average prospects that I have identified in the airphotos:

> 1, 8, 9, 12, 13, 14, 17, 24, 25, 26, 31, 32, 38, 42 (see Figure 5, Sheets 1, 2, 3 and 4 and Figure 6 with individual prospects outlined.)

Of these 14 prospects, I favor prospects 8, 9, 25, 32 and 42.

VII DRAINAGE, VEGETATION, AND PERMAFROST CONDITIONS AT PROSPECTS

All granular material prospects are well-drained, covered with trees, and contain sporadic permafrost in the clean granular surface layer. Rock outcrops -- as at 8A, 8B, 17E, 24, 25, 31, 32 and 42 -- are bare or sparsely wooded. Bare rock areas, marked X, are quite small and usually located on or near escarpments. Exceptions are the granitic rock knobs at prospects 8A, 8B and 25.

Thus drainage of the granular surface layer is generally good and the tree cover tends to be quite dense.

VIII ACCESS ROADS TO PROSPECTS

I have shown haul roads on the strip mosaics of Figure 5. Their location may change depending on a field reconnaissance appreciation of the prospects, and a better feeling for costs of development. You should take special note of any access roads crossing whitish to rusty or orange coloured ponds. These can be seen easily in the airphotos and mosaics. Some are solution karst depressions (dissolved gypsum or, less often, carbonates) or thermokarst in peaty areas. The whitish and orangy areas are usually extremely soupy, and will tolerate almost no load unless they are frozen to appreciable depth. The orange colour probably comes from algae growing in saline ponds.

Note that kilometre post markers are not shown on the strip mosaics of Figure 5. There is sufficient scale variation that these cannot be identified accurately unless a good topographic map is available.

IX CONCLUSIONS AND RECOMMENDATIONS

1. A larger area than originally discussed was examined in 1:60,000 B&W panchromatic airphotos. All prospective aggregate sources (granular and bedrock) were identified. A total of 42 main prospects were marked. In a few instances, several small and scattered prospects related to a single prospect are outlined and described.

2. Prospects situated nearest Highway No. 3 were transferred to the 1:16,000 strip mosaics for viewing in 3-D. However, the prospects are not nearly as easily evaluated on the 1:16,000 photos (or on the 1:5000 photos) as on the smaller scale 1:60,000 airphotos. Thus, strip photomosaics of lines 1 to 8 contain all identified prospects along with their description for use during aerial or ground reconnaissance. The better prospects are shown on smaller 8 1/2" x 11" pages and on 1:50,000 NTS mapsheets.

3. Of the 42 main prospects outlined, these prospects are rated fair or better: 1, 8, 9, 12, 13, 14, 17, 24, 25, 26, 31, 32, 38, 42 (see Figure 5, sheets 1 to 4, and Figure 6 with individual prospects).

4. Economics of haul distance, depth of recoverable material, quality of material (durability under freeze-thaw cycles), cost of processing (blasting and crushing and sizing, etc.) -- all these influence which one or two of the prospects that one chooses to develop.

I think one should take a close look at Prospects 8 and 25 because one can obtain all of the coarse aggregate material that is required from these two good bedrock sources. They offer the advantage of uniform and consistent quality product with virtually no surprises. Average haul distance from Prospect 25 is 12 miles for the north segment and 9 or 10 miles for the south section. Crushing costs have to be weighed against shorter average hauls but possibly poorer quality material, and the relation of this to maintenance costs.

5. I have shown access road locations into all of the significant prospects. Where the route follows sandy beach deposits the material will be well drained and dry. But if the sand is loose and uniform it will punch out under heavily loaded gravel trucks.

6. I think of checking the several prospects identified by skidoo or from a helicopter, but you will know this better than I do. There are few places one can land with a chopper. On the other hand, it will be easy to get lost on a skidoo or 3 wheeler in tall dense trees.

7. The map by John Day (Figure 2) indicates substantial areas of "stony gravel." But the impression I get from study of the high-level, small-scale airphotos is that most of the surficial material is uniform sand, with little or no rock content. Accordingly, for areas of crushable material near Highway No. 3, the best prospects are (see Figure 5, Sheets 1 to 4 and Figure 6 with indvidual prospects):

   (a) Prospect 8. Granitic bedrock material plus any nearby associated frost-shattered surface rubble, locally wave-reworked -- as in vicinity of Prospect 9 (at 8B).

   (b) Prospect 25. Granitic bedrock material and, again, any associated frost-shattered rubble, locally reworked by waves.

   (c) Prospect 32. I would examine the cliff face of carbonate rocks, selecting the thickest, most massive, purest looking beds for collecting samples for lab tests to see whether the carbonates stand up under cyclic freeze-thaw. Look for coarser surface granular deposits to the west of the outcrop as these may be coarser than at other locations.

(d) Prospect 42. I would check for small area exposures of carbonate rock. Good access road. Dry and treed. Little permafrost. Similar to 32.

(e) Prospect 24. Looks similar to 32 and 42, but necessitates a longer and more difficult summer haul.

8. Field reconnaissance may be a significant cost item because of the dense forest cover in better drained raised beach areas. Where raised beach ridges (rb) occur in the vicinity of larger, rougher rock outcrops, they should be inspected carefully on the ground in search of scattered surface and near-surface subrounded pebbles and cobbles that may indicate a coarser (i.e. gravelly) deposit nearby.

Again, good prospects to check for this are prospects 8, 24, 25, 31, 32 and 42.

APPENDIX A

MATERIAL VOLUME AND PROSPECT RATING

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m^3/m depth	Prospect Rating
1	8	Dolomite rock	1,642,500	Doubtful
2	8	Granitic rock knobs	(1)135,000	Doubtful
		Granitic rock knobs	(2) 45,000	Doubtful
		Granitic rock knobs	(3) 45,000	Doubtful
		Granitic rock knobs	(4) 90,000	Doubtful
		Granitic rock knobs	(5)135,000	Doubtful
		Granitic rock knobs	(6) 45,000	Doubtful
		Granitic rock knobs	(7)157,500	Doubtful
		Granitic rock knobs	(8) 45,000	Doubtful
		Granitic rock knobs	(9) 67,000	Doubtful
		Granitic rock knobs	(10)247,500	Doubtful

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m^3/m depth	Prospect number
3	8	Sands	1,080,000	Doubtful
4	7 & 8	Sand, possibly gravel	1,507,500	Remote. Doubtful
5	7	Dolomite	(1) 6,030,000	Doubtful
		Dolomite	(2)14,400,000	Doubtful
6	7	Shale, carbonates	(1) 247,500	Doubtful
			(2) 832,500	Doubtful
7	7	Sand; some gravel(?)	(1) 337,500	Doubtful to maybe fair(?)
			(2) 90,000	Doubtful to maybe fair(?)
			(3) 90,000	Doubtful to maybe fair(?)
			(4) 202,500	Doubtful to maybe fair(?)
			(5) 90,000	Doubtful to maybe fair(?)
			(6) 45,000	Doubtful to maybe fair(?)
			(7) 45,000	Doubtful to maybe fair(?)

Prospect number	Flight line number	Type of materials(s)	Average area (m^2) = volume in m^3/m depth	Prospect rating
8 A & B	6	Granitic rock knobs	A 720,000 B 90,000	Good if crushing costs competitive
9	6	Granular possibility	135,000	Fair (?)
10	6	Sands	(1) 1,350,000	Doubtful
			(2) 180,000	Doubtful
11A	6	Shale and dolomite rock	8,730,000	Doubtful
11B	5 & 6	Shale and dolomite rock	7,200,000	Doubtful
11C	6	Granitic rock	472,500	Doubtful
12	6	Sand, gravel(?)	3,780,000	Fair
13	6	Sand, gravel(?)	922,500	Fair
14	6	Sand, gravelly	(1) 157,500	Fair
			(2) 225,000	Fair
15	6	Sand, gravelly	1,035,000	Doubtful
16	5	Sand, gravel(?)	3,487,500	Doubtful
16A	5	Gravel on bedrock	810,000	Doubtful

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m^3/m depth	Prospect rating
17A	5	Sand, spotty gravel/rock	157,500	Doubtful
17B	5	Sand, spotty gravel/rock	1,125,000	Doubtful
17C	5	Sand, spotty gravel/rock	1,530,000	Doubtful
17D	5	Sand, spotty gravel/rock	675,000	Doubtful
17E	5	Sand, spotty gravel/rock	1,687,500	Doubtful
18A	5	Sand over gypsum + limestone	450,000	Doubtful
18B	5	Sand over gypsum + limestone	202,500	Doubtful
19A	5	Sand over gypsum + limestone	562,500	Doubtful
19B	5	Sand over gypsum + limestone	1,395,000	Doubtful
20A	5	Sand	405,000	Doubtful
20B	5	Sand	90,000	Doubtful
20C	5	Sand	135,000	Doubtful

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m^3/m depth	Prospect Rating
20D	5	Sand	360,000	Doubtful
21	4	Sand	405,000	Doubtful (remote)
22A	4	Granitic rock knob	832,000	Doubtful (remote)
22B	4	Granitic rock knob	1,372,500	Doubtful (remote)
22C	4	Granitic rock knob	337,500	Doubtful (remote)
22D	4	Granitic rock knob	652,500	Doubtful (remote)
22E	4	Granitic rock knob	1,710,000	Doubtful (remote)
23A	4	Gypsum + carbonate rock	652,500	Doubtful
23B	4	Gypsum + carbonate rock	225,000	Doubtful
23C	4	Gypsum + carbonate rock	630,000	Doubtful
24	4	Possibly gravelly plus limestone rock	2,565,000	Fair to good
25	4	Granitic rock knob	202,500	Good
26	4	Gravelly(?)	292,500	Fair to good

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m 3/m depth	Prospect Rating
27A	4	Sand	2,025,000	Doubtful
27B	4	Sand	922,500	Doubtful
28	4	Sand	1,147,500	Doubtful
29A	3	Sand/lime-stone	1,012,500	Doubtful
29B	3	Sand/lime-stone	607,500	Doubtful
30	3	Sand, some gravel	945,000	Doubtful
31	3	Sand, some gravel(?) over lime-stone	18,000,000	Fair to good
32	3	Sand or gravel over lime-stone	2,407,500	Fair to good
33	3	May con-tain gravel	2,250,000	Fair
34	3	Sand	472,500	Doubtful
35	3	Sand	270,000	Doubtful
35A	3	Gravelly(?)	1,360,000	Doubtful
36	2	Sand	382,500	Doubtful
37	2	Sand, some gravel	2,677,500	Doubtful
38	2	Sand, some gravel over lime-stone	13,500,000	Fair to good

Prospect number	Flight line number	Type of material(s)	Average area (m^2) = volume in m^3/m depth	Prospect Rating
39	2	Sand	(1)4,027,500	Doubtful
			(2) 405,000	Doubtful
40	2	Sand	2,565,000	Doubtful
41	2	Sand	945,000	Doubtful
42	1	Sand, some gravel(?)/ limestone	9,967,500	Fair to good
43	1	Sand or gravel	3,667,500	Doubtful

APPENDIX B

SUMMARY OF BETTER PROSPECTS WITH REMARKS TO GUIDE FIELD RECONNAISSANCE INVESTIGATIONS

Prospects 8 A&B

Located close to the highway. Good granitic rock. Cost of crushing is only constraint; otherwise this is a good prospect. Requires careful economic appraisal.

Prospect 9

Very difficult to evaluate from airphotos. Expect thin gravel over bedrock. Check closely because of its proximity to Highway No. 3 and the possibility of granitic rock fragments (frost-shattered), reworked by wave action.

Prospect 10

Located along Highway No. 3. Low ridges resemble sand dunes derived from sandy raised beaches. Should be checked only because of location on the R/W.

Prospects 12 and 13

Large deposits. Probably oversanded (uniform sand?). Worth auger testing at few spots.

Prospect 14

Remote and shallow, but worth a quick helicopter check. Auger holes only.

Prospect 17A-E

Thin raised beaches over highly soluble gypsum (see salt lakes and ponds) and carbonate strata (limestone and dolomite). Fair to doubtful (mostly). Check rock outcrops at X's. May be a surprise (some gravel); but this is difficult to tell from the photos.

Prospect 24

Shown as a fair to good prospect because of a possibility of gravel plus limestone. Check for (a) gravel in beach ridges and (b) limestone, which, even if it looks competent to the eye, may still contain silt and clay and break down under repeated freeze-thaw cycles. Quality may or may not be evident from rock outcrops. Carbonate rock testing for durability is necessary.

Prospect 25

This prospect should be examined very carefully as a possible single source of uniform quality, crushed rock aggregate that is relatively centrally located, thereby reducing average haul (i.e. a single set). The only detracting factor is the cost of crushing. Can one obtain competitive prices, say against possibly longer hauls and poorer quality material.

Prospect 26

The slender hope here is to find wave-washed gravel sizes derived from a frost-shattered granitic knob to the north.

Prospect 31

A very large deposit of mostly reworked sand with, possibly, some scattered gravelly pockets overlying limestone that contains silt and clay (argillaceous). The prospect should be checked carefully at the places marked because of proximity to highway.

Prospect 32

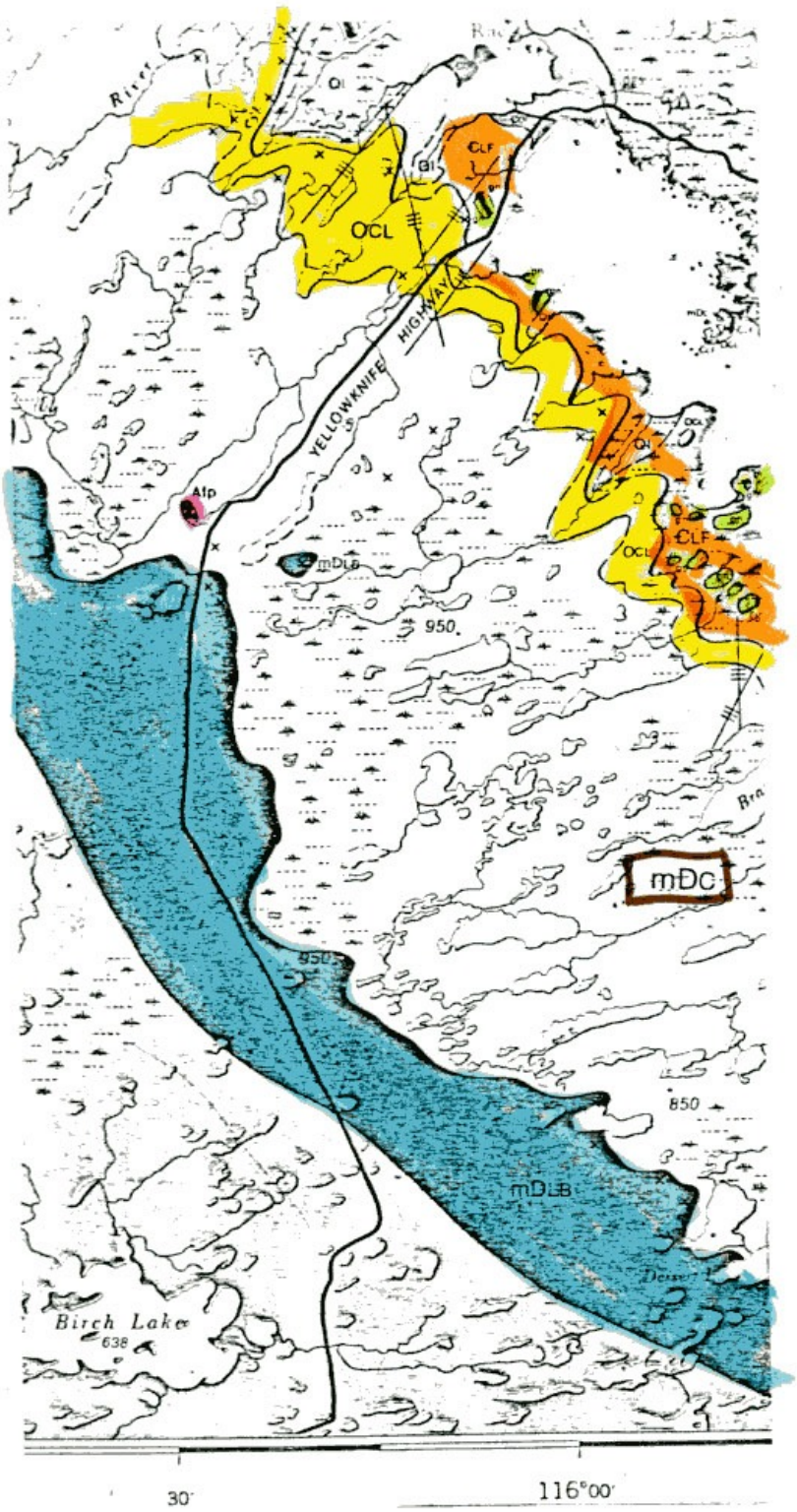
Check the quality of bituminous, argillaceous limestone exposed on cliff faces. Check, also, to see if a nearby surficial granular layer contains gravel sizes. Fair to good prospect because of location.

Prospect 38

Large volume. Near the highway. Sandy but may contain pockets of coarser material.

Prospect 42

Check the X areas for limestone outcrop. Located near the south end of Highway No. 3. Fair to good prospect.



PALEOZOIC

MIDDLE DEVONIAN

mDLB — *LONELY BAY FORMATION*: dark brown, bituminous argillaceous, nodular, fine-grained limestone

mDC — *CHINCHAGA FORMATION*: white and grey gypsum; thinly bedded grey and brown limestone and dolomite; limestone and dolomite breccia

MIDDLE DEVONIAN AND ? OLDER

MIRAGE POINT FORMATION: red and purplish red dolomite, sandy dolomite; red and green shale; gypsum

ORDOVICIAN

OCL — *CHEDABUCTO LAKE FORMATION*: massive to finely vuggy, fine-grained, brown dolomite, cherty dolomite, sandy dolomite; grey shale

CAMBRIAN

CLF — *LA MARTRE FALLS FORMATION*: green and red, soft shale; thin-bedded, argillaceous and silty dolomite; salt crystal casts

PROTEROZOIC

APHEBIAN

Alp — Feldspar porphyry, quartz feldspar porphyry

gn — Undifferentiated granitic rocks

x rock outcrop

BEDROCK GEOLOGY

MAP 1372A

GEOLOGY

HORN RIVER

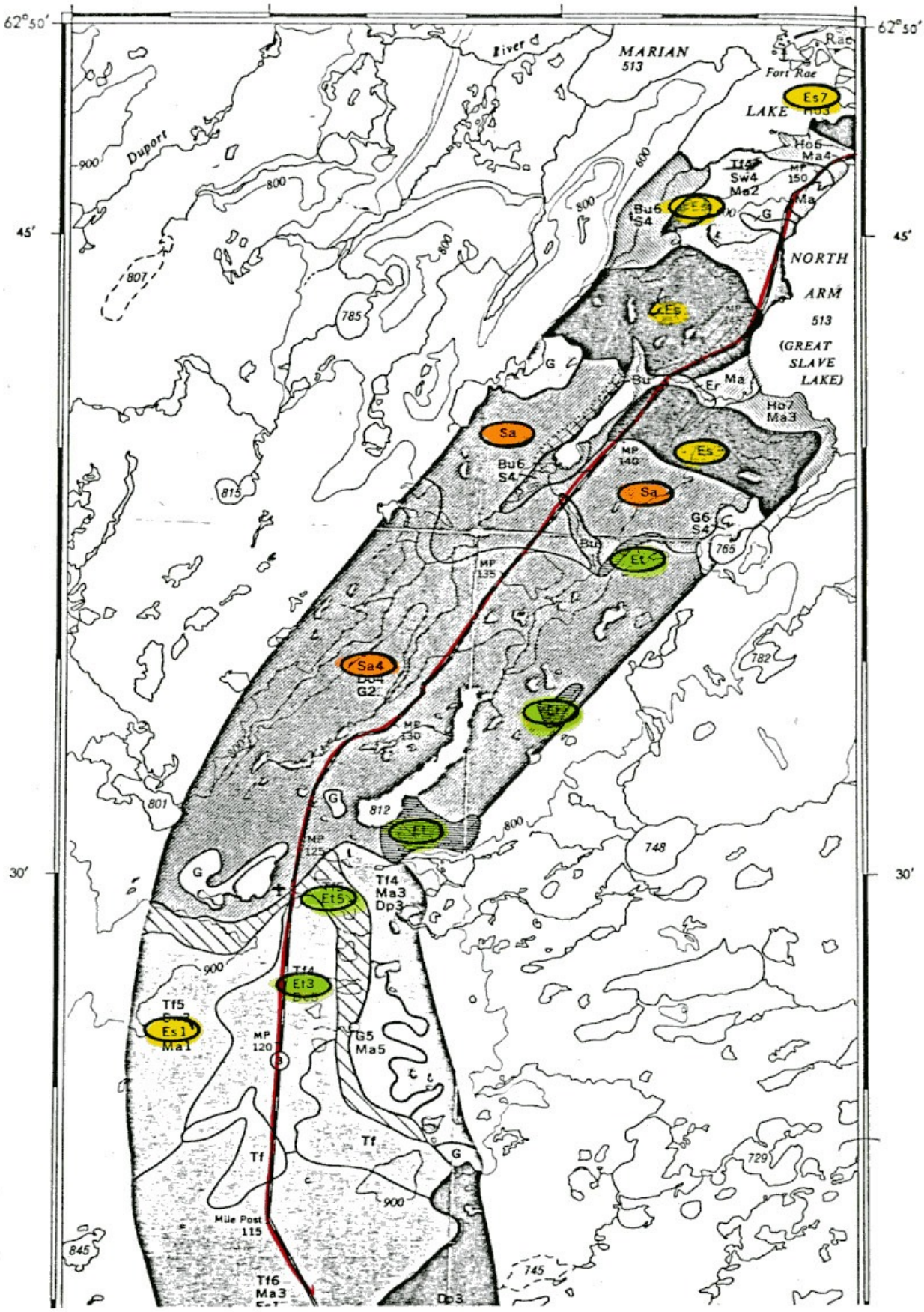
DISTRICT OF MACKENZIE

Scale 1:500,000

Miles 8 0 8 16 24 Miles

Kilometres 12 0 12 24 36 Kilometres

FIGURE 1



NOTE: Mile posts on Day map

So Gravelly soils are So, Et, Es on bedrock

SOIL SURVEY MAP UPPER MACKENZIE RIVER AREA, NWT
0 (after J.H. Day) 12 MILES

FIGURE 2

NOTE: No gravel deposits shown on Craig map

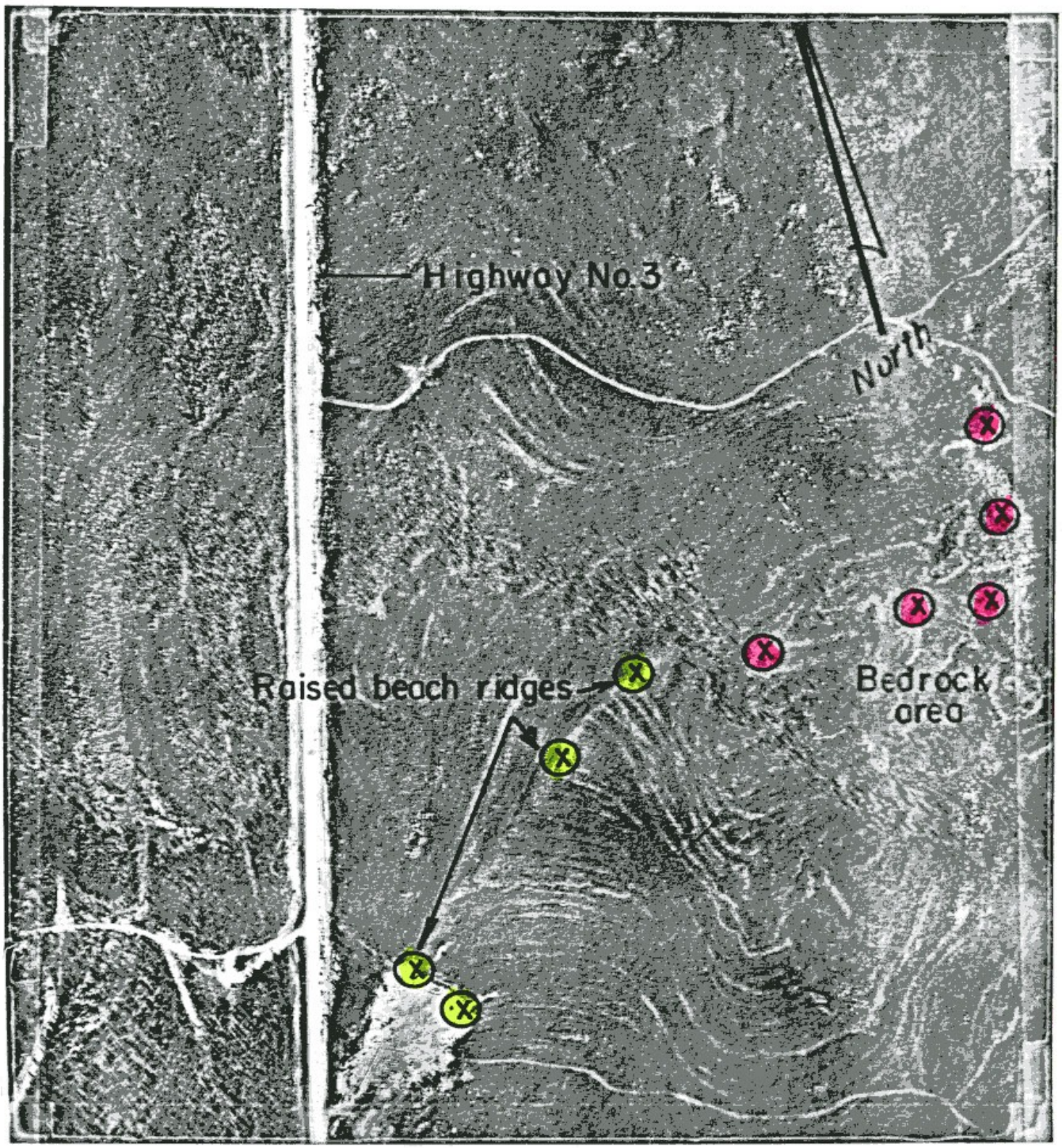
Ice flow direction

SURFICIAL GEOLOGY MAP
From GSC Bull 122
by B.G. Craig, 1957

Miles 16 0 16 32 Miles

Kilometres 25 0 25 50 Kilometres

FIGURE 3



X Places to field check in raised beach ridges and exposed carbonate rock area

Granular deposits

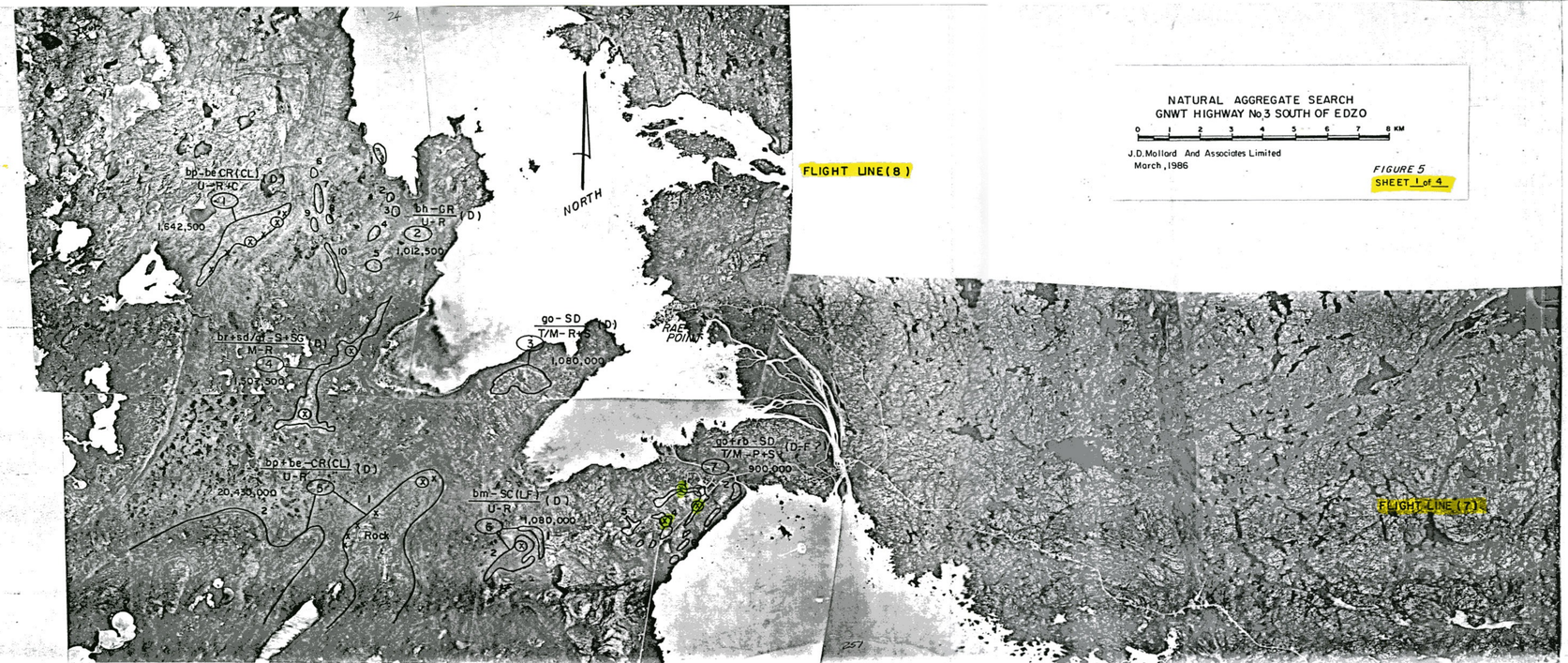
Bedrock

PROSPECT No. 32

0 400 Metres

RAISED BEACH RIDGES AND EXPOSED CARBONATE ROCK

FIGURE 4



NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No.3 SOUTH OF EDZO

0 1 2 3 4 5 6 7 8 KM

J.D.Mollard And Associates Limited
March, 1986

FIGURE 5
SHEET 1 of 4

MAP LEGEND
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY NO. 3 SOUTH OF EDZO

LANDFORM

be	Bedrock escarpment
bh	Bedrock hill or knob
bp	Bedrock plateau
gf	Glaciofluvial mounds or ridges
go	Glacial outwash delta
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sd	Sand dunes, mostly poorly expressed
/R	Indicates thin overburden over bedrock
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SG	Sand and gravel (undifferentiated)
GR	Granitic bedrock
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(?)	Indicates questioned

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T	Thin (< 1 m on average)
M	Moderate (mostly 1-3 m)
D	Deep (> 3 m on average)
U	Unlimited (bedrock)
T,M	Intermingled areas of T and M

Rock

Granular material

DEVELOPMENT CONSTRAINT QUALIFIER

S	Shallow. May be too thin to be developed economically
P	Expect prospect to be poorly graded, over-sanded, or both
D	Possibly contains deleterious material owing to content of gypsum, silt or clay
R	Remote. Excessive haul distance
C	Cost of crushing hard bedrock is higher
S+P	Shallow, poorly graded and oversanded
?	Indicates questioned

PROSPECT RATING FOR DEVELOPMENT PURPOSES

G	Good
F	Fair
D	Doubtful because of constraints
F/G	Fair to good prospect
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LEGEND CODING ARRANGEMENT AND SYMBOLOGY EXPLANATION

Landform — Aggregate type — Prospect rating
rb/R - SG/CR(LB) (F)
Thickness qualifer — Inferred constraint qualifier

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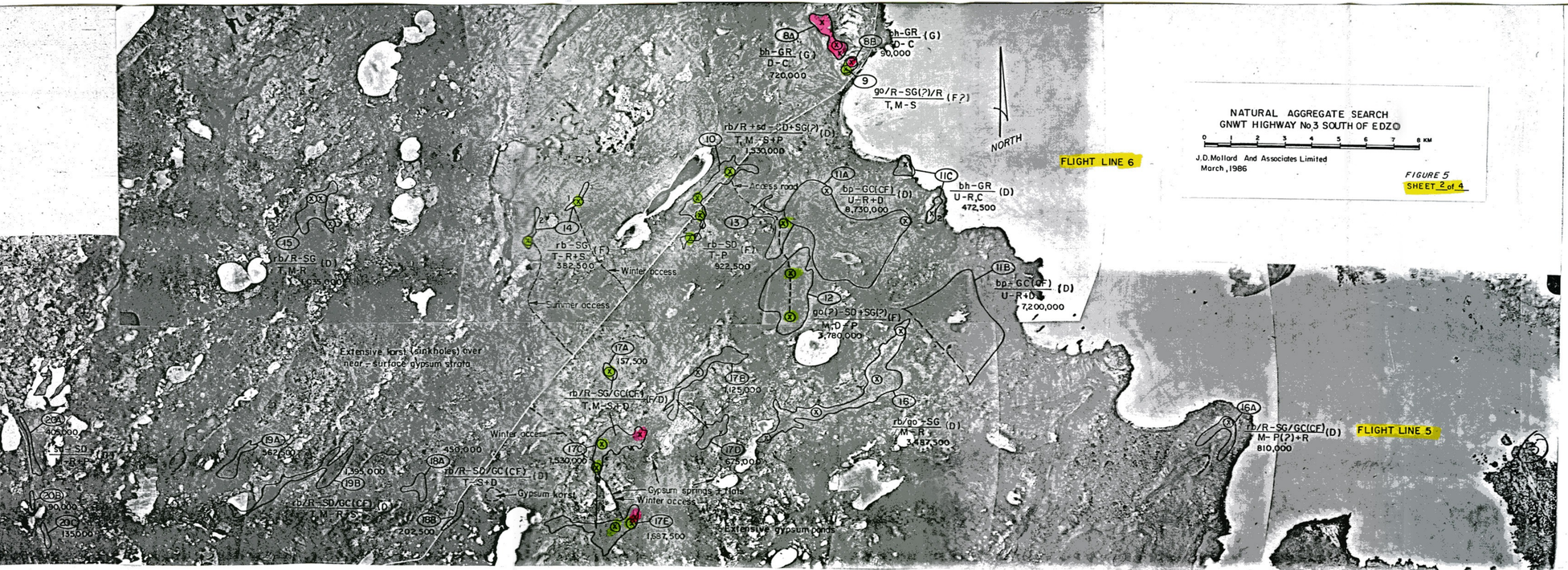
16A,16B	Closely related prospects near each other are sometimes shown as A and B
(2) 1,2,3	Main area prospect numbers are shown within an oval. Related scattered, small, individual areas covered in the volume estimate table are not circled

FIGURE 5



MAP LEGEND
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY NO. 3 SOUTH OF EDZO

LANDFORM

be	Bedrock escarpment
bh	Bedrock hill or knob
bp	Bedrock plateau
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Rock

Granular material

DEVELOPMENT CONSTRAINT QUALIFIER

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P	Expect pr poorly gr sanded, o
D	Possibly deleterio owing to gypsum, s
R	Remote. H distance
C	Cost of d bedrock l
S+P	Shallow, and overs
?	Indicates

PROSPECT RATING FOR DEVELOPMENT PURPOSES

G	Good
F	Fair
D	Doubtful constrain
F/G	Fair to g
?	Indicates

LEGEND CODING ARRANGEMENT AND SYMBOLOGY EXPL

Landform — Aggregate type — Prospect ra
rb/R - SG/CR(LB) (F)
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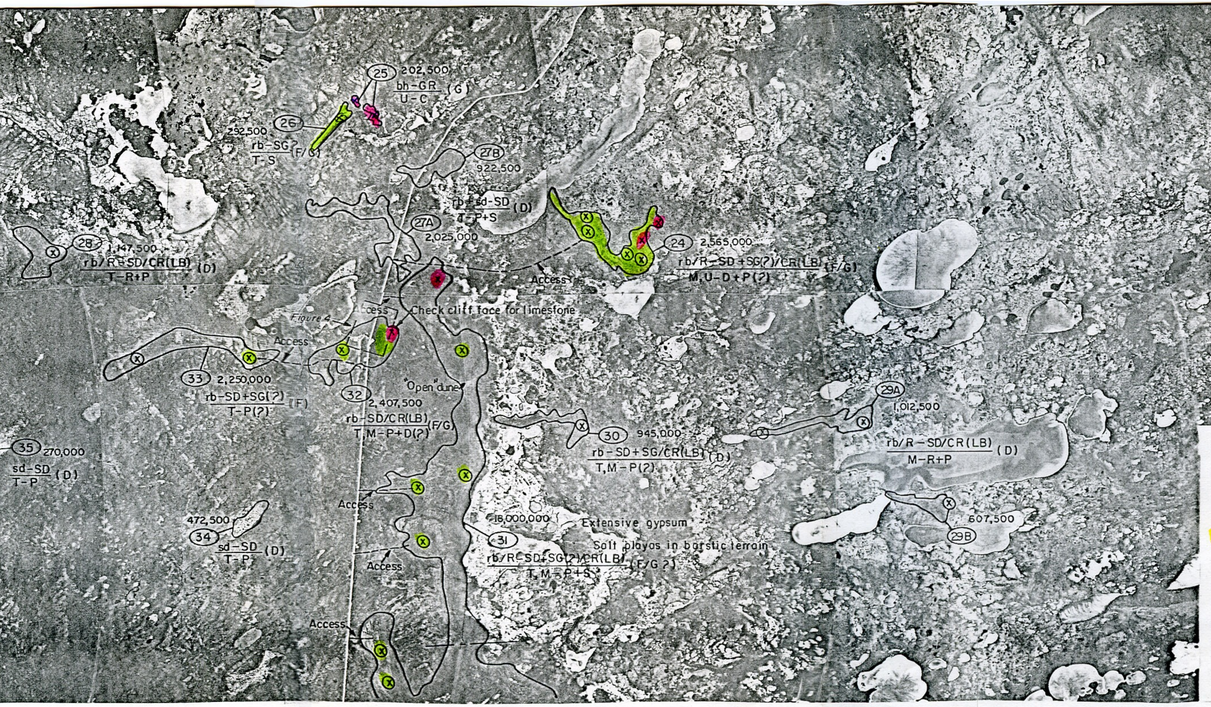

NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No.3 SOUTH OF EDZO

0 1 2 3 4 5 6 7 8 KM

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March, 1986

FIGURE 5
SHEET 3 of 4

MAP LEGEND
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY NO. 3 SOUTH OF EDZO

LANDFORM

be	Bedrock escarpment
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bp	Bedrock plateau
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Rock

Granular material

DEVELOPMENT CONSTR

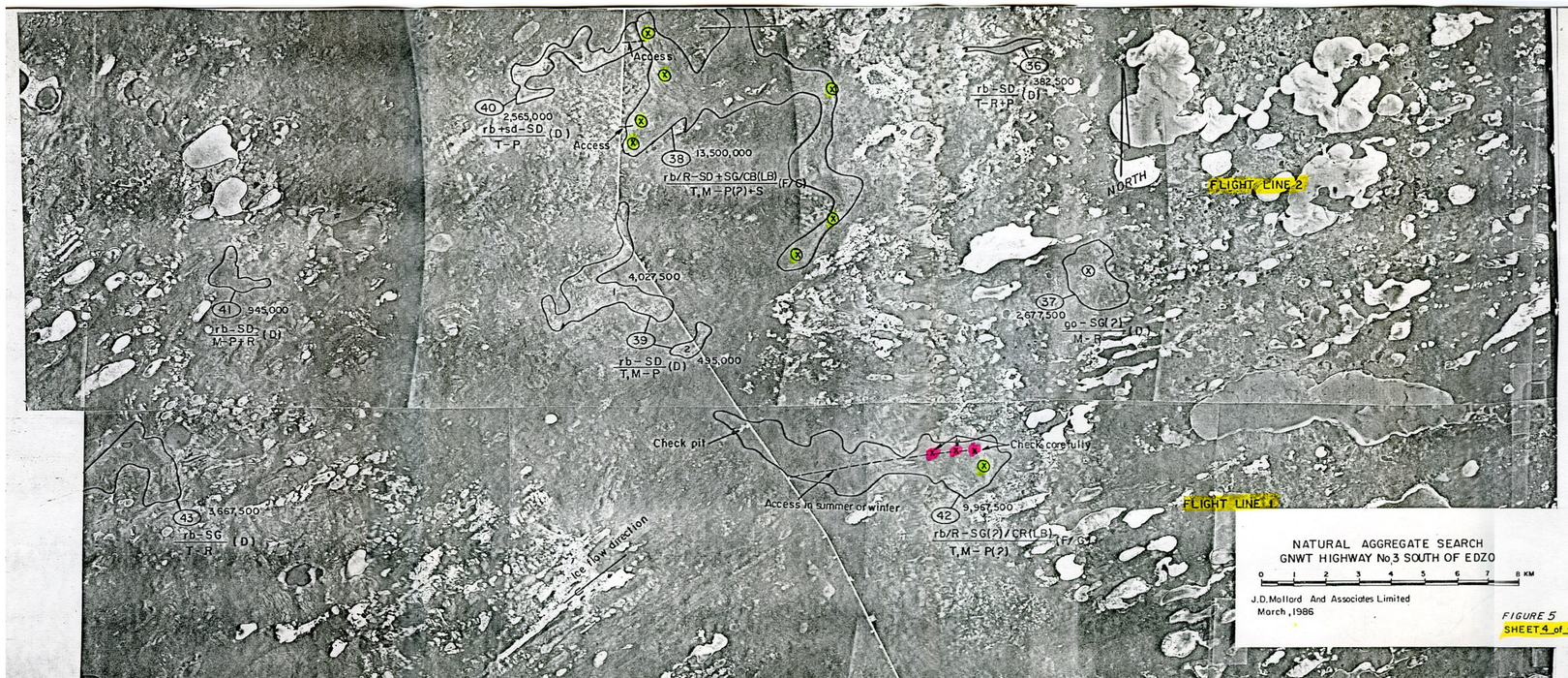
S	
P	
D	
R	
C	
S+P	
?	

PROSPECT RATING FO

G	
F	
D	
F/G	
?	

LEGEND CODING ABBR

Landform	Aggr
	rb/R
Thickness qualifier	
/	Slash u means " Slash u as rang
,	Comma u -- as i thin to
+	Plus us indicat questio
?	Questio map uni
(x)	Place t over t helicop
()	Parenth formati rating arrange
135,000	Large estima terms
16A,16B	Closely shown
(2) 1,2,3	Main a Relate the vo



NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No.3 SOUTH OF EDZO

0 1 2 3 4 5 6 7 8 KM

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March, 1986

FIGURE 5
SHEET 4 of 4

Rock

Granular material

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GNWT HIGHWAY NO. 3 SOUTH OF EDZO

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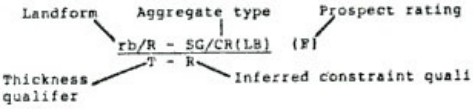
LEGEND CODING ARRANGEMENT AND SYMBOLOGY EXPLANATION



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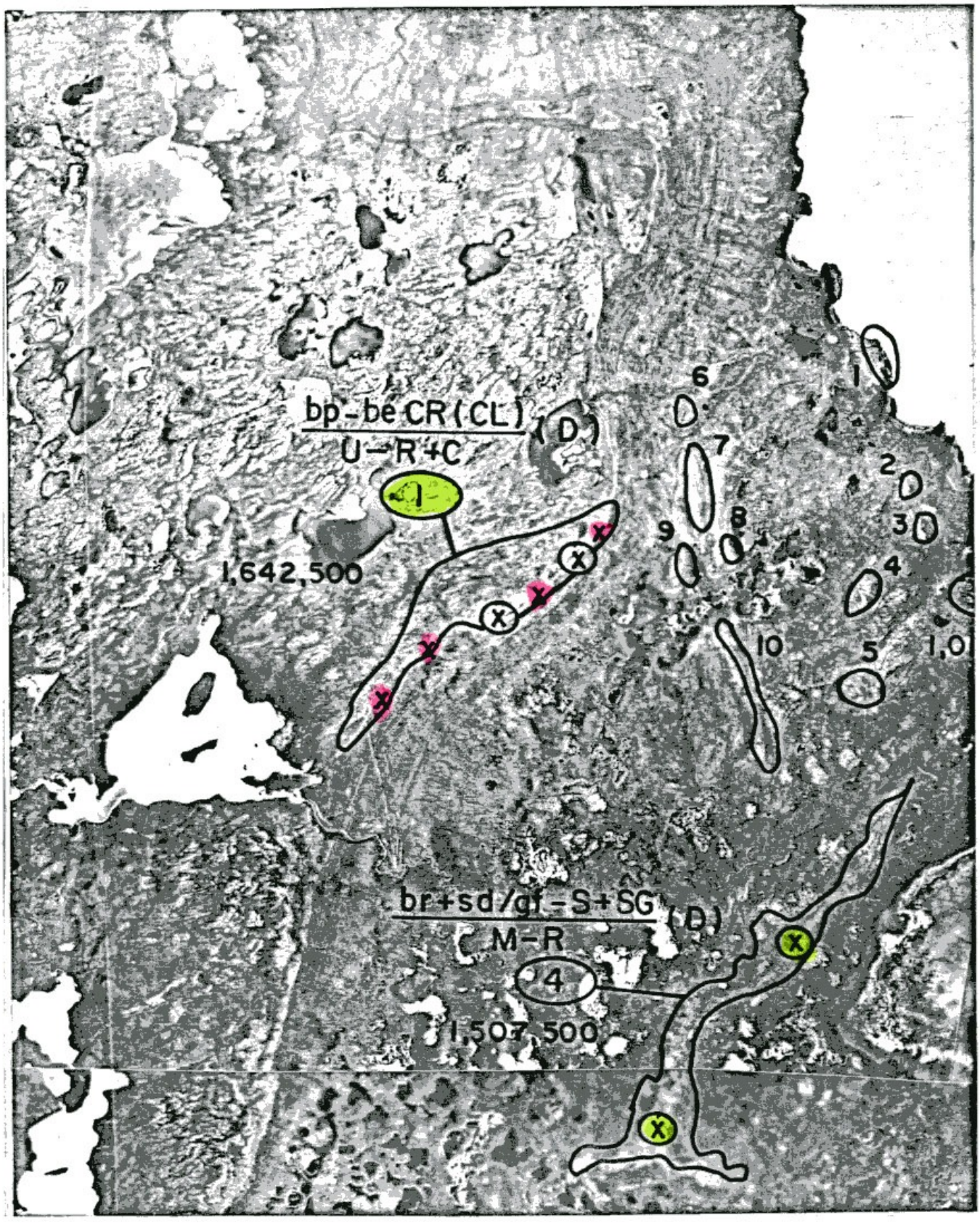

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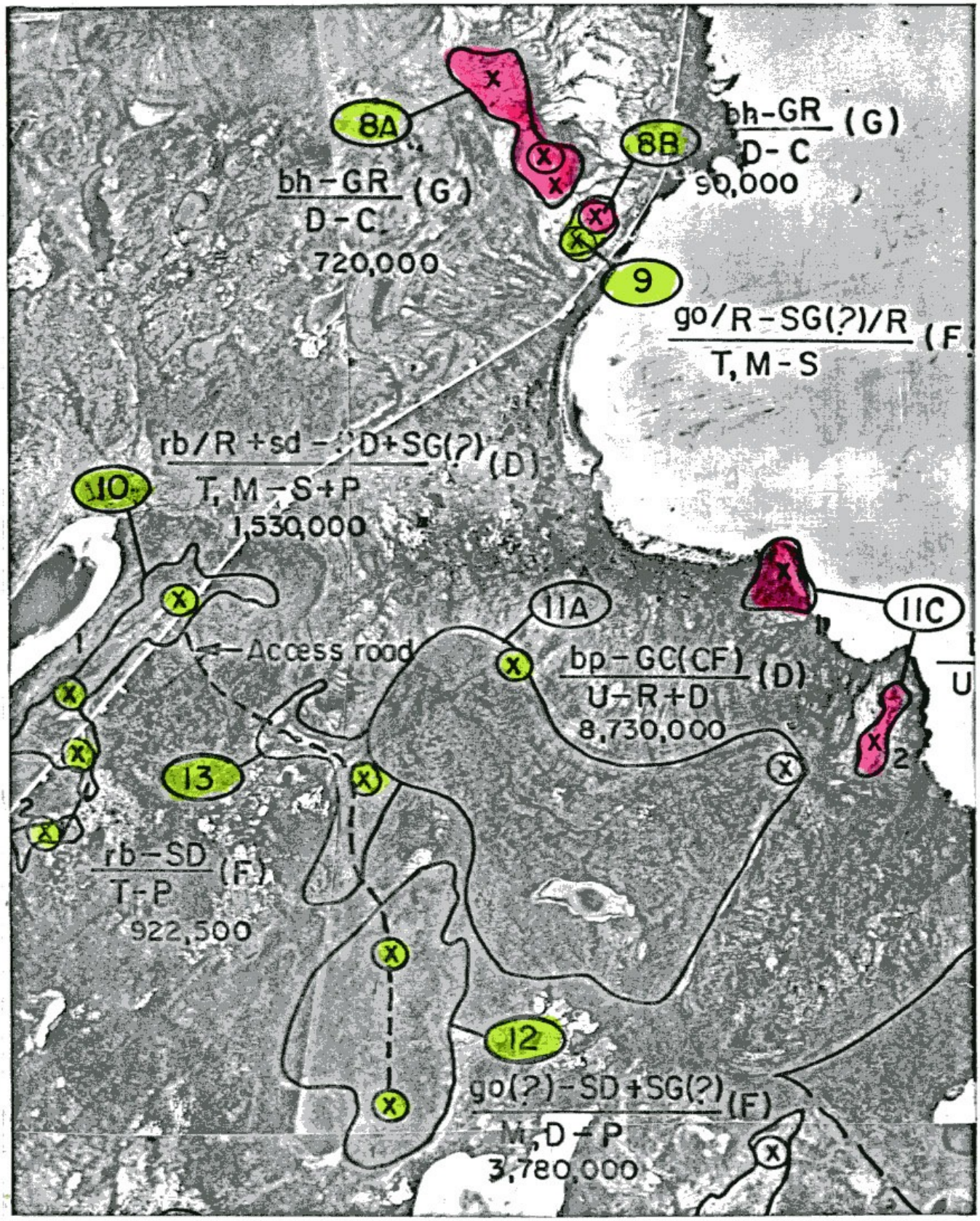
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT(S) 1

FIGURE 6



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NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT(S) 8A, 8B, 9, 12, & 13

FIGURE 6

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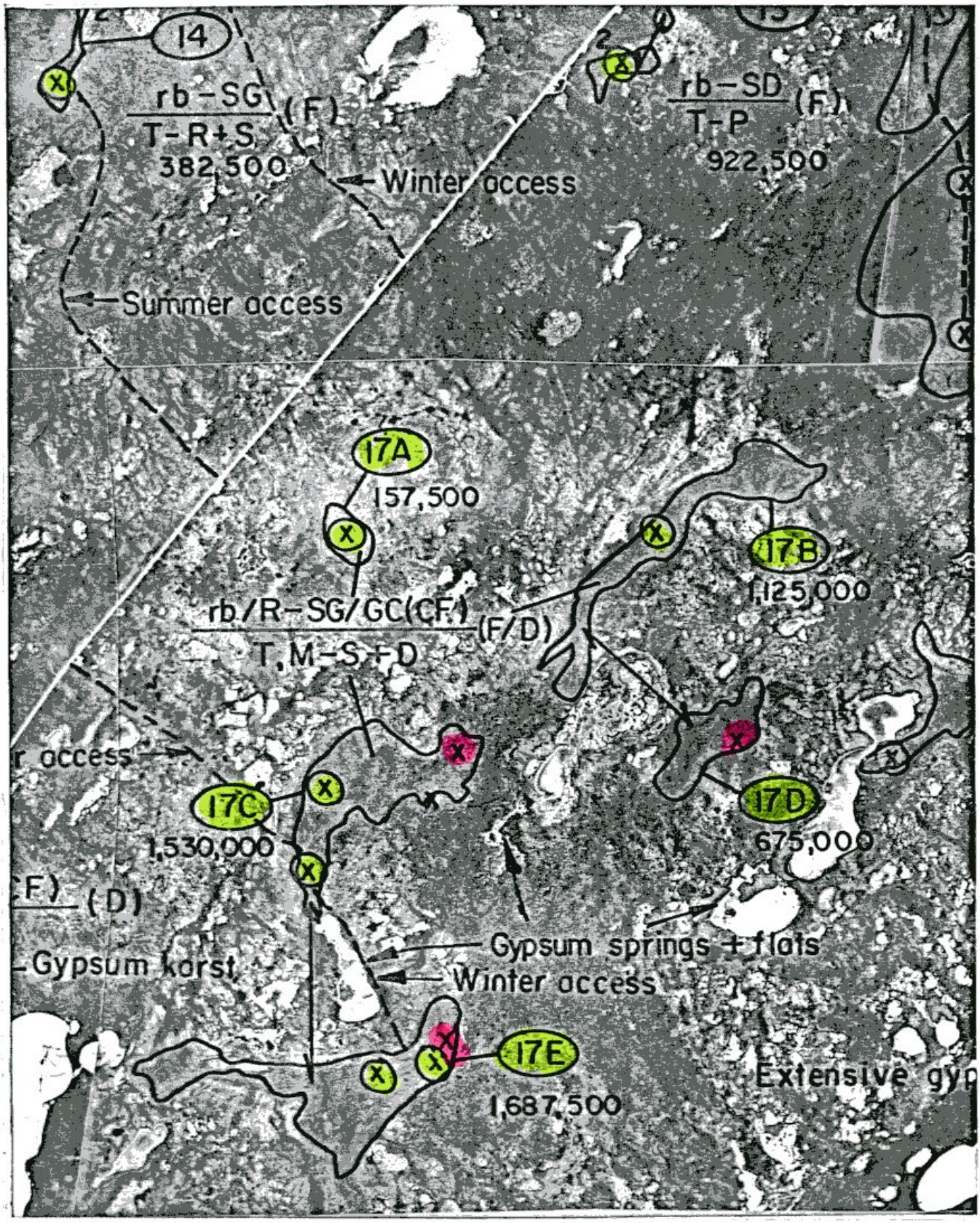
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT (S) 14

FIGURE 6



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NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT(S) 17A, 17B, 17C, 17D, & 17E

FIGURE 6

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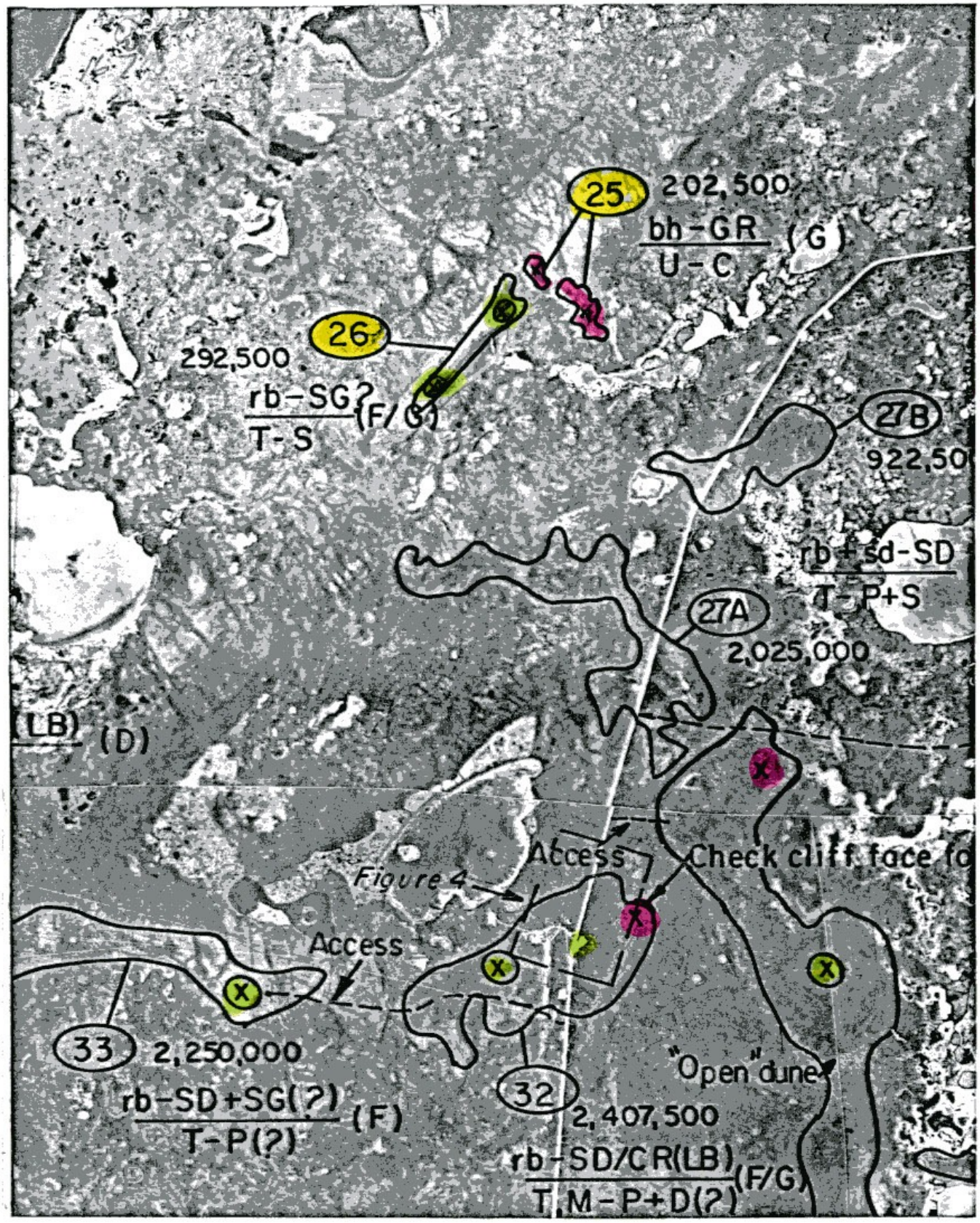
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT(S) 24

FIGURE 6



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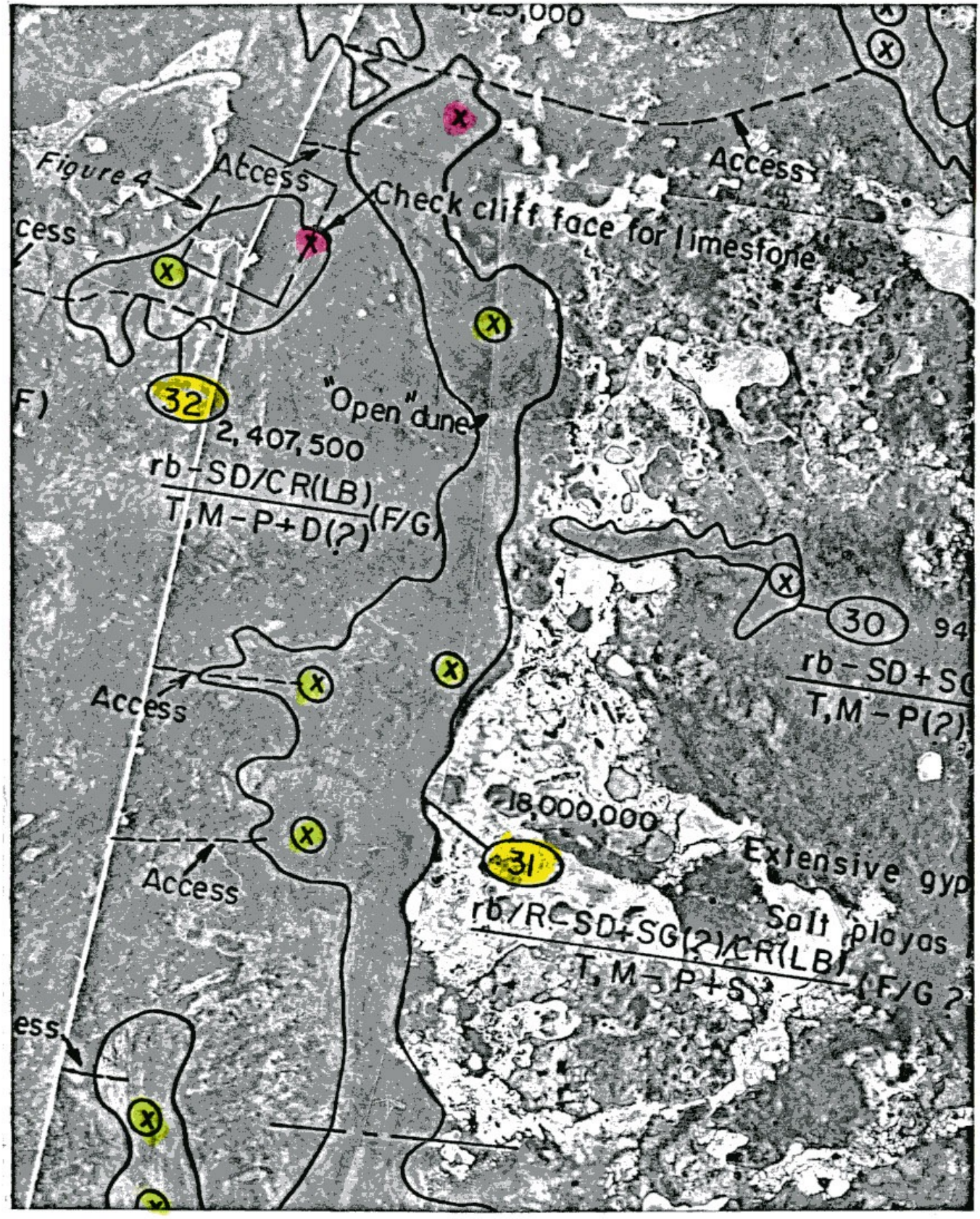
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6Km

PROSPECT(S) 25 & 26

FIGURE 6



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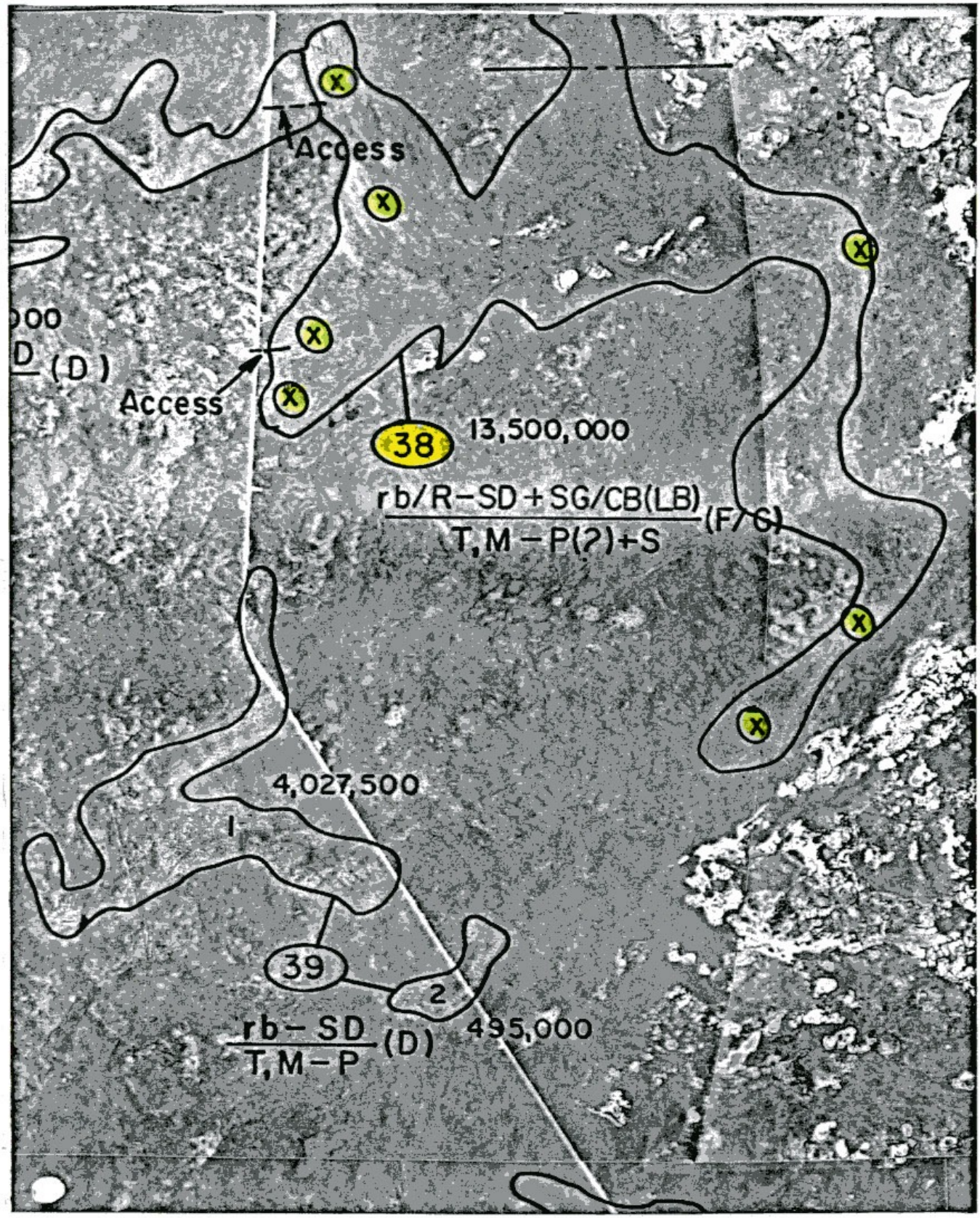
NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT(S) 31 & 32

FIGURE 6



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NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT (S) 38

FIGURE 6

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NATURAL AGGREGATE SEARCH
GNWT HIGHWAY No 3 SOUTH OF EDZO

0 1 2 3 4 5 6 Km

PROSPECT (S) 42

FIGURE 6

END OF REPORT