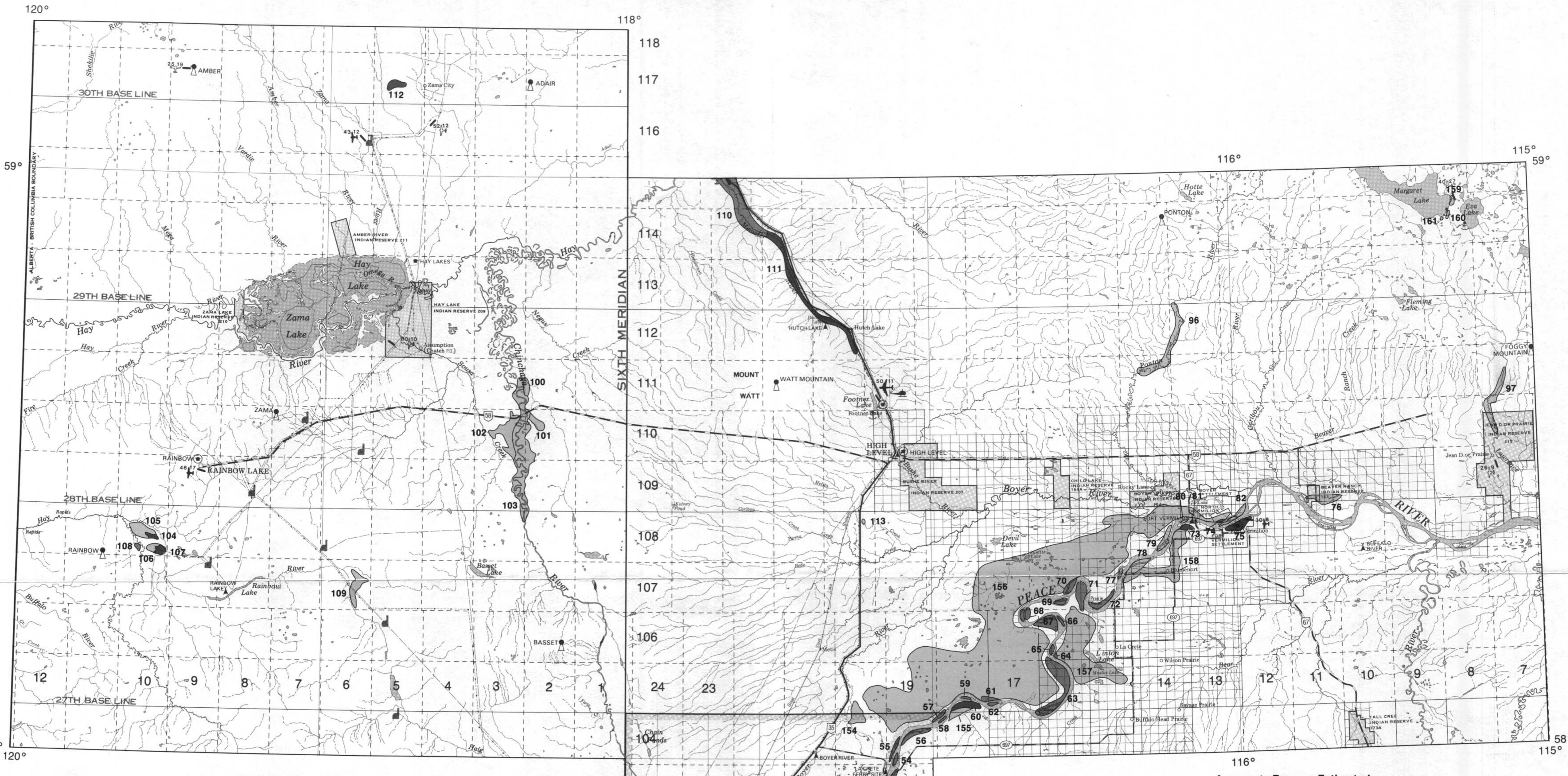


Aggregate Resource Potential

System for Ranking the Economic Potential of Sand and Gravel Deposits

On this map 161 sand and gravel deposits are classified. The potential economic value varies greatly over so many deposits; therefore, characteristics of the individual deposits have been recorded and their relative economic significance has been rated. The ranking system is believed to be a valid relative measure of the economic potential of a deposit under the prevailing geological conditions and the existing information base.

The relative economic potential of each deposit has been assessed using a combination of 6 geological factors and several subdivisions (tables). Each factor does not have equal importance and is not given equal weight in the ranking process. For example, predominant material is assigned the highest relative weighting at 8, overburden thickness and potential for water table problems are equally weighted at 4, and deposit area is least important at 2 (table 1).

Each geological factor has been subdivided into 2 or 3 classes. Some of these classes were determined purely subjectively, while others are based on values that are known to affect the economic nature of the particular geological attribute.

To determine the economic potential for an individual deposit, it is first necessary to choose the appropriate subdivision class value for each of the 6 geological factors. The class value for a particular geological factor is then multiplied by the weight that has been assigned to that factor. The resultant grade is the score that the individual deposit has for that particular geological factor. For example, a sand and gravel deposit that is 5 m thick would have a grade of 32 (4 x 8) for the predominant material and a grade of 21 (3 x 7) for the deposit thickness.

The economic potential of an individual deposit is determined by adding all grades from all geological factors. A high cumulative total grade indicates a high economic potential.

The geological factors used to measure and rank the economic potential of sand and gravel deposits are:

- predominant material
- deposit thickness
- overburden thickness
- potential for water table problems
- material variability
- deposit area

A description of the importance of these factors to the economic potential of deposits and a description of their subdivisions follows.

Predominant material
Three classes of material have been chosen: sand, sand plus gravel, and gravel. These terms are defined in a triangular diagram based on the Wentworth Classification System (legend). Values assigned to these classes are based on the potential range of uses for the aggregate material. The value of a deposit increases with the proportion of gravel to sand.

Deposit thickness
Deposit thickness was divided into 3 classes. Deposits less than 1 m thick were not mapped or tabulated during this study because such deposits are usually uneconomic. Within a given type of material, the thicker the deposits, the more valuable they become, partly because they are more economical to work.

Overburden thickness
Two classes of overburden thickness were delineated. Overburden less than 3 m thick usually proves to be of little problem to most pit operators. However, overburden deeper than 3 m may become very costly to remove because it often involves the use of special equipment. In this study, the overburden thickness was always equal to or less than the deposit thickness.

Potential for water table problems
Three classes were chosen, based on the probability of encountering a high water table. In most areas a high water table makes deposits economically unattractive because of the cost of specialized equipment used in extracting sand and gravel from below the water table. Exceptions include areas where aggregate is being extracted from active stream beds.

Material variability
Material variability refers to the change from place to place of the proportion of sand to gravel within a deposit. It affects the economic potential of a deposit in that highly variable deposits are more expensive to extract because the material must be sorted. A dune deposit has low material variability because it is typically composed mainly of fine sand, whereas the material in an alluvial deposit (especially from mountain streams) may vary considerably both vertically and horizontally. These subjective classes were chosen to represent material variability.

Deposit area
This study was conducted at an enhanced reconnaissance level (Edwards et al., 1985) in which deposits smaller than 30 hectares were not mapped. Subdivisions of this geological factor are: Class 1 for deposits of 30 to 79 hectares. These deposits could supply a small local market for only a short period of time. Class 4 for deposits of 80 to 200 hectares. This size of deposit could supply local needs of aggregate material for several years. Class 6 includes deposits over 200 hectares that are typically capable of supplying aggregate for many years to a region or sub-region.

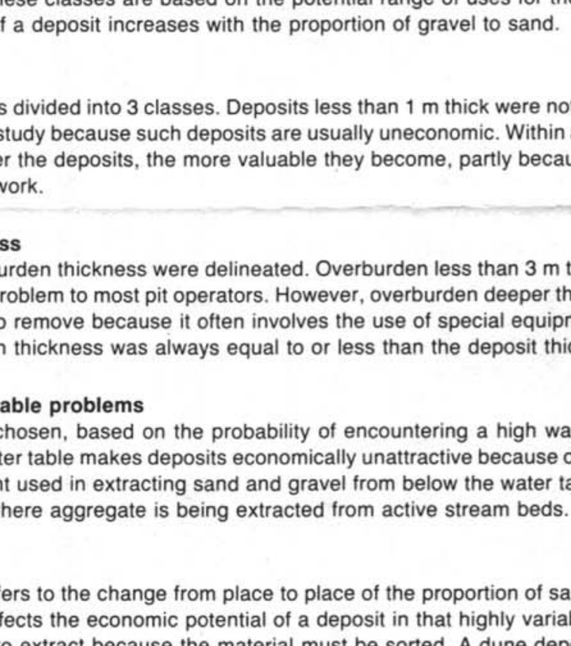
In general, large deposits and large operations tend to have a greater pro rata value than small deposits because of the economies of large-scale operations.

Reliability of information
Reliability refers to the amount and type of information and is not a factor used in the ranking of a deposit. Although the reliability of information is not reflected in the ranking process, it is an important criterion in the use of exploration data.

Reliability was rated (A) high - where information is available from ground observations, sample analyses, and drilling; (B) medium - where one or more sites have been visited on the ground but no other information is available; and (C) low - information based mainly on the interpretation of air photographs and similar data.

Table 1

Geological Factors	Factor Weight	Subdivision Class Value	Subdivision Class Description	Grade (Weight x Class)
Predominant material	8	6	Gravel	48
		4	Sand and gravel	32
		1	Sand	8
Deposit thickness	7	3	over 4 m	21
		2	2.5 to 4 m	14
		1	1 to 2.4 m	7
Overburden thickness	4	3	0 to 3 m	12
		1	over 3 m	4
Potential for water table problems	4	3	low	12
		2	medium	8
		1	high	4
Material variability	3	3	low	9
		2	medium	6
		1	high	3
Deposit area	2	6	over 200 ha	12
		4	200 - 80 ha	8
		2	79 - 30 ha	4



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- Aggregate Resources, NTS 84F, Bison Lake. Alberta Research Council, open file report 1985-22.
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- Aggregate Resources, NTS 84K, Mount Watt. Alberta Research Council, open file report 1985-21.
- Aggregate Resources, NTS 84J, Zama Lake. Alberta Research Council, open file report 1985-12.
- Aggregate Resources, NTS 84M, Bistcho Lake. Alberta Research Council, open file report 1985-13.

Table 2.

Deposit Potential Class	Deposit Description and Comments	Rank Score Range*
High	Generally gravel, wide variety of uses, few pit extraction problems	over 84
Medium	Generally sand and gravel, some pit extraction problems	84 to 75
Low	Mainly sand, limited uses, several pit extraction problems	less than 75

All Factor Ratings for Peace River - High Level Area Economic Potential - High Rating

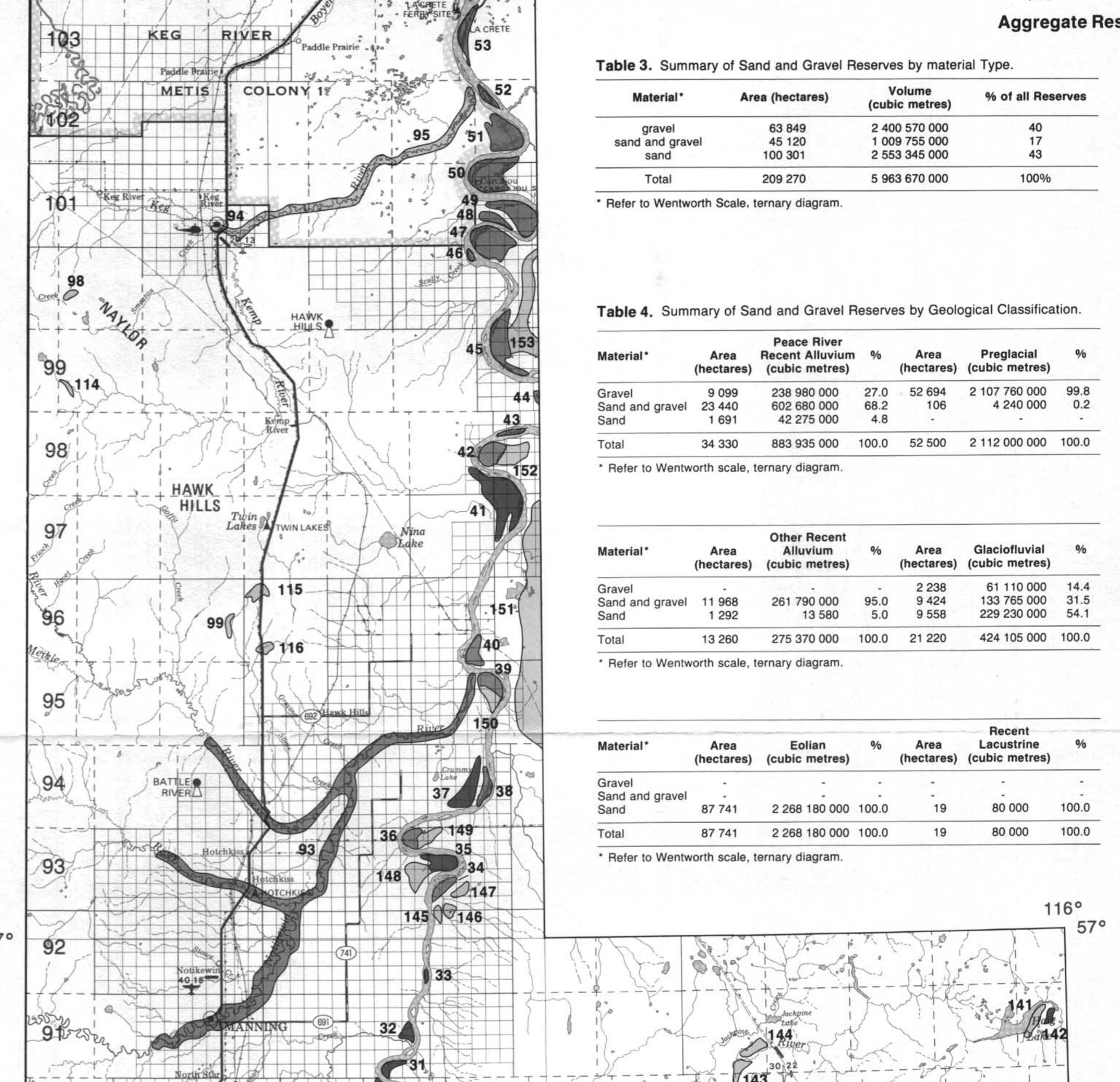
Deposit	Calculated Rating	Reliability of Data	Predominant Material	Deposit Area	Material Variability	Deposit Thickness	Overburden Thickness	Potential for Water Table Problems
1	90	C	6	1	3	1	3	3
2	100	B	6	4	2	2	3	2
3	94	B	6	4	3	3	1	1
4	110	A	6	6	3	3	3	3
5	95	B	6	6	2	3	1	1
6	110	C	6	6	3	3	3	2
7	103	A	6	6	2	3	3	1
8	104	A	6	6	1	3	3	2
9	92	A	6	6	2	2	1	2
10	91	A	4	4	2	3	3	2
11	96	A	6	6	3	1	3	2
12	107	A	6	6	3	2	3	3
13	85	C	6	6	2	1	1	2
14	88	A	6	4	3	1	3	1
19	85	C	6	4	2	1	3	1
20	86	C	6	4	1	1	3	2
21	107	B	6	6	3	2	3	3
24	96	C	6	4	3	1	3	2
25	92	C	6	4	3	1	3	2
26	107	A	6	6	3	2	3	3
27	92	C	6	4	3	1	3	2
28	88	C	6	6	3	1	1	2
30	110	A	6	6	3	3	3	2
31	95	C	6	6	3	2	1	2
32	89	A	6	6	2	1	3	1
33	85	C	6	4	2	1	3	1
35	88	B	4	6	2	2	3	3
37	88	B	4	6	2	2	3	3
41	88	B	4	6	2	2	3	3
60	95	B	4	6	2	3	3	3
70	99	B	4	6	2	2	3	3
73	95	B	4	6	2	3	3	3
75	95	B	4	6	2	3	3	3
83	102	A	6	6	3	3	1	2
84	102	A	6	6	3	3	1	2
85	94	A	4	4	3	3	3	3
104	94	A	6	1	2	2	3	3
107	108	A	6	6	1	3	3	3
111	100	B	6	6	2	2	3	2
112	88	A	6	4	2	2	1	2
142	97	A	6	4	1	2	3	3

All Factor Ratings for Peace River - High Level Area Deposit Potential - Medium Rating

Deposit	Calculated Rating	Reliability of Data	Predominant Material	Deposit Area	Material Variability	Deposit Thickness	Overburden Thickness	Potential for Water Table Problems
15	80	A	6	1	1	1	3	2
16	82	C	6	1	3	1	3	1
17	81	C	6	4	2	1	1	2
18	82	C	6	1	3	1	3	1
22	80	C	6	4	3	1	1	1
23	77	C	6	4	2	1	1	1
29	84	C	6	4	3	1	1	2
34	84	C	4	6	2	2	3	2
36	84	C	4	6	2	2	3	2
38	84	C	4	6	2	2	3	2
39	84	C	4	6	2	2	3	2
40	84	C	4	6	2	2	3	2
42	84	C	4	6	2	2	3	2
44	80	C	4	4	2	2	3	2
45	84	C	4	6	2	2	3	2
47	84	C	4	6	2	2	3	2
48	84	A	4	4	2	2	3	3
49	84	C	4	6	2	2	3	2
50	84	C	4	6	2	2	3	2
51	84	C	4	6	2	2	3	2
52	84	C	4	6	2	2	3	2
53	84	C	4	6	2	2	3	2
54	80	C	4	4	2	2	3	2
55	84	B	4	4	2	2	3	3
56	80	C	4	6	2	2	3	1
57	80	C	4	6	2	2	3	1
59	76	C	4	4	2	2	3	1
61	76	C	4	4	2	2	3	1
62	76	C	4	4	2	2	3	1
63	84	C	4	6	2	2	3	2
64	83	B	4	4	2	3	3	1
65	76	C	4	4	2	2	3	1
66	76	C	4	4	2	2	3	1
67	84	C	4	6	2	2	3	2
68	80	C	4	6	2	2	3	1
69	80	C	4	6	2	2	3	1
71	80	C	4	6	2	2	3	1
72	84	B	4	6	2	2	3	2
74	80	C	4	4	2	2	3	2
76	84	B	4	6	2	2	3	2
93	77	B	4	6	1	2	3	1
108	84	B	4	4	2	2	3	3
109	84	A	4	6	2	2	3	2
110	84	B	4	6	2	2	3	2
114	81	C	4	1	3	2	3	3
132	81	A	4	6	2	1	3	3
138	78	B	4	6	1	1	3	3

All Factor Ratings for Peace River - High Level Area Deposit Potential - Low Rating

Deposit	Calculated Rating	Reliability of Data	Predominant Material	Deposit Area	Material Variability	Deposit Thickness	Overburden Thickness	Potential for Water Table Problems
43	73	C	4	4	1	2	3	1
46	70	C	4	1	2	2	3	1
58	70	C	4	1	2	2	3	1
77	52	C	1	4	2	2	3	1
78	56	C	1	6	2	2	3	1
79	56	C	1	6	2	2	3	1
80	52	C	1	4	2	2	3	1
81	46	C	1	1	2	2	3	1
82	63	C	1	6	3	2	3	2
86	63	B	4	1	2	1	3	1
87	69	A	4	4	2	1	3	1
88	63	A	4	1	2	1	3	1
89	63	B	4	1	2	1	3	1
90	63	B	4	1	2	1	3	1
91	69	B	4	4	2	1	3	1
92	69	B	4	4	2	1	3	1
94	70	B	4	6	1	1	3	1
95	49	C	1	6	2	1	3	1
96	49	C	1	6	2	1	3	1
97	56	B	1	6	2	2	3	1
98	73	C	4	1	3	2	3	1
99	49	C	1	1	3	2	3	1
100	57	B	1	6	2	1	3	3
101	57	B	1	6	2	1	3	3
102	74	A	1	6	3	3	3	3
103	74	A	4	6	1	1	3	2
105	52	B	1	6	3	1	3	1
106	64	B	1	6	2	2	3	3
113	57	B	1	1	3	2	3	3
115	67	B	1	6	3	2	3	3
116	57	B	1	1	3	2	3	3
117	67	C	4	1	2	1	3	2
118	67	B	4	1	2	1	3	2
119	60	C	4	1	1	1	3	1
120	46	B	1	1	2	2	3	1
121	59	C	1	4	3	2	3	2
122	74	B	1	6	3	3	3	3
123	42	C	1	1	3	1	3	1
124	64	B	1	6	2	2	3	3
125	48	C	1	4	3	1	3	1
126	42	C	1	1	3	1	3	1
127	48	C	1	4	3	1	3	1
128	42	C	1	1	3	1	3	1
129	52	C	1	6	3	1	3	1
130	48	C	1	4	3	1	3	1
131	42	C	1	1	3	1	3	1
133	63	B	1	6	3	2	3	2
134	70	A	1	4	3	3	3	3
135	49	C	1	6	2	1	3	1
136	56	B	1	6	2	2	3	1
137	74	B	4	4	1	1	3	3
139	63	C	4	1	2	1	3	1
140	63	B	4	1	2	1	3	1
141	74	C	4	4	1	1	3	3
143	49	C	1	6	2	1	3	1
144	56	C	1	6	3	1	3	2
145	53	C	1	1	3	2	3	2
146	59	C	1	4	3	2	3	2
147	63	C	1	6	3	2	3	2
148	63	B	1	6	3	2	3	2
149	63	C	1	6	3	2	3	2
150	67	C	1	6	3	2	3	3
151	66	C	1	6	3	3	3	1
152	59	C	1	6	3	2	3	1
153	59	C	1	6	3	2	3	1
154	59	C	1	6	3	2	3	1
155	67	B	1	6	3	2	3	3
156	63	C	1	6	3	2	3	2
157	63	C	1	6	3	2	3	2
158	67	C	1	6	3	2	3	3
159	42	C	1	1	3	1	3	1
160	42	C	1	1	3	1	3	1
161	42	C	1	1	3	1	3	1



Aggregate Reserve Estimated

Table 3. Summary of Sand and Gravel Reserves by material Type.

Material*	Area (hectares)	Volume (cubic metres)	% of all Reserves
gravel	63 849	2 400 570 000	40
sand and gravel	45 120	1 009 755 000	17
sand	100 301	2 553 345 000	43
Total	209 270	5 963 670 000	100%

* Refer to Wentworth Scale, ternary diagram.

Table 4. Summary of Sand and Gravel Reserves by Geological Classification.

Material*	Area (hectares)	Peace River Recent Alluvium (cubic metres)	%	Area (hectares)	Preglacial (cubic metres)	%
Gravel	9 099	238 980 000	27.0	52 694	2 107 760 000	99.8
Sand and gravel	23 440	602 680 000	68.2	106	4 240 000	0.2
Sand	1 691	42 275 000	4.8	-	-	-
Total	34 330	883 935 000	100.0	52 500	2 112 000 000	100.0

* Refer to Wentworth scale, ternary diagram.

Material*	Area (hectares)	Other Recent Alluvium (cubic metres)	%	Area (hectares)	Glaciofluvial (cubic metres)	%
Gravel	-	-	-	2 238	61 110 000	14.4
Sand and gravel	11 968	261 790 000	95.0	9 424	133 765 000	31.5
Sand	1 292	13 580	5.0	9 558	229 230 000	54.1
Total	13 260	275 370 000	100.0	21 220	424 105 000	100.0

* Refer to Wentworth scale, ternary diagram.

Material*	Area (hectares)	Eolian (cubic metres)	%	Area (hectares)	Recent Lacustrine (cubic metres)	%
Gravel	-	-	-	-	-	-
Sand and gravel	-	-	-	-	-	-
Sand	87 741	2 268 180 000	100.0	19	80 000	100.0
Total	87 741	2 268 180 000	100.0	19	80 000	100.0

* Refer to Wentworth scale, ternary diagram.

Table 5. Reserve Estimates for the Sand and Gravel Resources of the Peace River Recent Alluvium

Deposit Number	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Estimated**** Reserves (cubic metres)
1	31	1	gravel	310 000
2	363	2.5	gravel	9 075 000
3	119	4	gravel	4 760 000
4	191	4	gravel	7 640 000
5	485	4	gravel	19 400 000
6	272	4	gravel	10 880 000
7	306	4	gravel	12 240 000
8	552	4	sandy gravel to gravel	22 080 000
9	339	2.5	gravel	8 475 000
10	182	4	sand and gravel	7 280 000
11	274	1	gravel	2 740 000
12	329	2.5	gravel	8 225 000
13	421	1	gravel	4 210 000
14	160	1	gravel	1 600 000
15	66	1	gravel	660 000
16	74	1	gravel	740 000
17	91	1	gravel	910 000
18	73	1	gravel	730 000
19	110	1	gravel	1 100 000
20	81	1	gravel	810 000
21	232	2.5	gravel	5 800 000
22	186	1	gravel	1 860 000
23	80	1	gravel	800 000
24	141	1	gravel	1 410 000
25	98	1	gravel	980 000
26	587	2.5	gravel	14 675 000
27	151	1	gravel	1 510 000
28	486	1	gravel	4 860 000
29	144	1	gravel	1 440 000
30	1745	4	gravel	69 800 000
31	312	2.5	gravel	7 800 000
32	330	1	gravel	3 300 000
33	88	1	gravel	880 000
34	392	2.5	sand and gravel	9 800 000
35	721	2.5	sand and gravel	18 025 000
36	209	2.5	sand and gravel	5 225 000
37	1647	2.5	sand and gravel	41 175 000
38	253	2.5	sand and gravel	6 325 000
39	454	2.5	sand and gravel	11 350 000
40	447	2.5	sand and gravel	11 175 000
41	2086	2.5	sand and gravel	52 150 000
42	633	2.5	sand and gravel	15 825 000
43	140	2.5	sand and gravel	3 500 000
44	154	2.5	sand and gravel	3 850 000
45	1636	2.5	sand and gravel	40 900 000
46	73	2.5	sand and gravel	1 825 000
47	1460	2.5	sand and gravel	36 500 000
48	106	2.5	sand and gravel	2 650 000
49	1504	2.5	sand and gravel	37 600 000
50	1336	2.5	sand and gravel	33 400 000
51	856	2.5	sand and gravel	21 400 000
52	242	2.5	sand and gravel	6 050 000
53	392	2.5	sand and gravel	9 800 000
54	124	2.5	sand and gravel	3 100 000
55	135	2.5	sand and gravel	3 375 000
56	392	2.5	sand and gravel	9 800 000
57	432	2.5	sand and gravel	10 800 000
58	73	2.5	sand and gravel	1 825 000
59	110	2.5	sand and gravel	2 750 000
60	523	4	sand and gravel	20 920 000
61	176	2.5	sand and gravel	4 400 000
62	106	2.5	sand and gravel	2 650 000
63	1585	2.5	sand and gravel	39 625 000
64	135	4	sand and gravel	5 400 000
65	102	4	sand and gravel	2 550 000
66	92	2.5	sand and gravel	2 300 000
67	582	2.5	sand and gravel	14 550 000
68	373	2.5	sand and gravel	9 325 000
69	315	2.5	sand and gravel	7 875 000
70	479	2.5	sand and gravel	11 975 000
71	754	2.5	sand and gravel	18 850 000
72	813	2.5	sand and gravel	20 325 000
73	223	2.5	sand and gravel	5 575 000
74	143	2.5	sand and gravel	3 575 000
75	454	4	sand and gravel	18 160 000
76	578	2.5	sand and gravel	14 450 000
77	117	2.5	sand	2 925 000
78	494	2.5	sand	12 350 000
79	403	2.5	sand	10 075 000
80	139	2.5	sand	3 475 000
81	59	2.5	sand	1 475 000
82	479	2.5	sand	11 975 000
Total	34 230			883 835 000

Table 6. Reserve Estimates for the Sand and Gravel Resources of the Recent Alluvium Deposits (other than Peace River Recent Alluvium).

Deposit Number	Location	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Reserves**** (cubic metres)
86		48	1	sand and gravel	480 000
87		98	1	sand and gravel	980 000
88	Smoky	55	1	sand and gravel	550 000
89	River	45	1	sand and gravel	450 000
90		20	1	sand and gravel	200 000
91		121	1	sand and gravel	1 210 000
92		80	1	sand and gravel	800 000
93	Notikewin River	8939	2.5	sand and gravel	223 475 000
94	Keg River	651	1	sand and gravel	6 510 000
95		1248	1	sand	12 480 000
96	Ponton River	1376	1	sand and gravel	13 760 000
97	Lawrence River	476	2.5	sand and gravel	11 900 000
98	Vesta Creek	59	2.5	sand and gravel	1 475 000
99	Slims Creek	44	2.5	sand	1 100 000
Total		13 260			275 073 000

* Approximate (1 hectare = 2.471 acres).
** Assumed (1 metre = 3.281 feet).
*** Refer to Wentworth Scale, ternary diagram.
**** 1 cubic metre = 1.308 cubic yards.

Table 8. Reserve Estimates for the Sand Resources of the Eolian Deposits.

Deposit Number	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Reserves**** (cubic metres)
145	66	2.5	sand	1 650 000
146	161	2.5	sand	4 025 000
147	205	2.5	sand	4 125 000
148	410	2.5	sand	10 250 000
149	333	2.5	sand	8 325 000
150	351	2.5	sand	8 775 000
151	4977	4	sand	199 080 000
152	556	2.5	sand	13 900 000
153	2093	2.5	sand	52 325 000
154	893	2.5	sand	22 325 000
155	509	2.5	sand	12 725 000
156	67435	2.5	sand	1 685 875 000
157	7626	2.5	sand	190 650 000
158	2126	2.5	sand	53 150 000
Total	87 741			2 268 180 000

Table 9. Reserve Estimates for the Sand Resources of the Recent (Postglacial) Lacustrine Deposits.

Deposit Number	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Reserves**** (cubic metres)
159	4	1	sand	40 000
160	2	1	sand	20 000
161	2	1	sand	20 000
Total	8			80 000

Table 10. Reserve Estimates for the Sand and Gravel Resources of Preglacial Deposits.

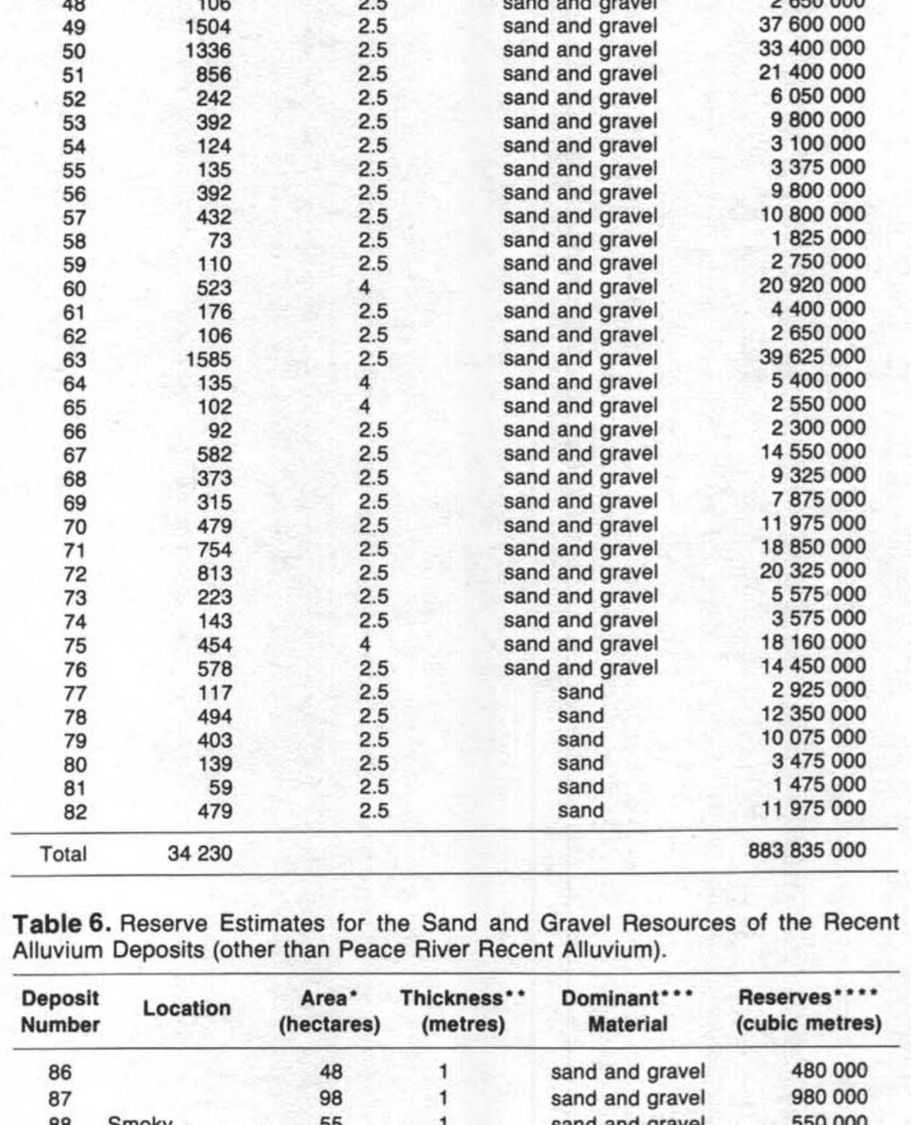
Deposit Number	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Reserves**** (cubic metres)
83	2 395	4	gravel	95 800 000
84	50 299	4	gravel (Grimshaw)	2 011 960 000
85	106	4	sand and gravel	4 240 000
Total	52 800			2 112 000 000

* Approximate (1 hectare = 2.471 acres).
** Assumed (1 metre = 3.281 feet).
*** Refer to Wentworth Scale, ternary diagram.
**** 1 cubic metre = 1.308 cubic yards.

Table 7. Reserve Estimates for the Sand and Gravel Resources of the Glaciofluvial Deposits.

Deposit Number	Area* (hectares)	Thickness** (metres)	Dominant*** Material	Reserves**** (cubic metres)
100	219	1	sand	2 190 000
101	257	1	sand	2 570 000
102	1511	4	sand (fine)	60 440 000
103	4226	1	sand and gravel	42 260 000
104	73	2.5	gravel	1 825 000
105	1200	1	sand	12 000 000
106	344	2.5	sand	8 600 000
107	344	4	gravel	13 760 000
108	139	2.5	sand and gravel	3 475 000
109	491	2.5	sand and gravel	12 275 000
110	1976	2.5	sand and gravel	49 400 000
111	1526	2.5	gravel	38 150 000
112	189	2.5	gravel	4 725 000
113	15	2.5	san	375 000
114	29	2.5	sand and gravel	725 000
115	263	2.5	sand, clean, fine	6 575 000
116	36	2.5	sand, med-fine, dirty	900 000
117	18	1	sand and gravel	180 000
118	18	1	sand and gravel	180 000
119	9	1	sand and gravel	90 000
120	63	2.5	sand (rusty)	1 575 000
121	141	2.5	sand	3 525 000
122	1231	4	sand	49 240 000
123	33	1	sand	330 000
124	586	2.5	sand, fine to med.	14 650 000
125	88	1	sand	880 000
126	66	1	sand	660 000
127	81	1	sand	810 000
128	65	1	sand	650 000
129	385	1	sand	3 850 000
130	108	1	sand	1 080 000
131	63	1	sand	630 000
132	1883	1	sand and gravel	18 830 000
133	607	2.5	sand	15 175 000
134	149	4	sand	5 960 000
135	345	1	sand	3 450 000
136	1073	2.5	sand	26 825 000
137	169	1	sand and gravel	1 690 000
138	257	1	sand and gravel	2 570 000
139	68	1	sand and gravel	680 000
140	10	1	sand and gravel	100 000
141	131	1	sand and gravel	1 310 000
142	106	2.5	gravel	2 650 000
143	264	1	sand	2 640 000
144	365	1	sand	3 650 000
Total	21 220			424 105 000

* Approximate (1 hectare = 2.471 acres).
** Assumed (1 metre = 3.281 feet).
*** Refer to Wentworth Scale, ternary diagram.
**** 1 cubic metre = 1.308 cubic yards.



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