

INTRODUCTION

Increased activity of the oil and gas industry in northeast British Columbia has resulted in a need for more surficial geology and aggregate potential data for the region. The Resource Development and Geoscience Branch (RDGB) is currently conducting a program focusing on identifying new local sources of construction aggregate to support the development and maintenance of all-season petroleum development roads (PDR).

This report outlines several glaciofluvial terraces along the East Kiskatinaw River (EKR) that are considered to have high potential to host sand and gravel deposits. Deposits are well situated to service the Noel, Kelly and Cutbank gas fields as well as the Hour Glass, Noel, Loop, Blackhawk, Windsor, Borden and Kiskatinaw Forest Service roads.

The EKR is located in the eastern portion of NTS map sheet 93P, approximately 40 km south of Peace Crater (north of map area) and 50 km east of Tumbler Ridge (west of map area). The river flows east from its head waters at Bearhole Lake (west of map area), then turns north paralleling Highway 52 before swinging west to join the West Kiskatinaw River. The EKR is approximately 70 km long from Bearhole Lake to its confluence with the West Kiskatinaw River, after which both combine to form the main Kiskatinaw River.

SCOPE OF STUDY
This was a reconnaissance study of terraces along the EKR. The purpose of the study was to ground truth the terraces along the valley and investigate their potential for development, thereby providing aggregate producers with prospective targets for further evaluation. All test holes were hand dug so aggregate thickness, quality, and volume are speculative until a comprehensive test pitting program is conducted.

PREVIOUS WORK
Several studies have been completed in the area. Regional studies by Mathews (1978, 1980) provide a framework for the glacial history of northeastern British Columbia and northwestern Alberta. Reimchen (1980) mapped the surficial geology of the Dawson Creek map sheet (NTS 93P) at 1:250 000-scale. Catto and Thistle (1993) mapped the surficial geology of NTS map sheets 93P/01 and 93P/08 at 1:50 000-scale. Unfortunately this mapping did not extend to the EKR. Lister (1988, 1990) conducted terrain and aggregate evaluations for the Highway 52 and the Upper Cutbank areas. Savinoff (2004) mapped the aggregate potential of an extensive area of 93P and portions of 93I and 94A at 1:200 000-scale. He delineated many of the terraces in this report, but indicated only low to moderate potential based on his classification scheme. Given the general scarcity of gravel in the area, some of these terraces represent excellent sources of gravel and warrant further evaluation.

QUATERNARY HISTORY
Surficial materials in the area have a glacial origin. The area was inundated by ice during the Late Wisconsinan (ca. 22 000 years ago). Deglaciation of the area was well under way by approximately 10 000 years ago (Catto et al., 1996). At this time the Cordilleran ice Sheet retreated to the west and the Laurentide ice Sheet retreated east, blocking regional drainage and impounding a large glacial lake that flooded much of the Peace River valley and surrounding area (Mathews, 1980). During this phase of deglaciation, glaciofluvial silt and clay was deposited in submerged valleys (Phase I in Fig. 1). Several raised benches and remnant shorelines of this lake are found in the hills to the north and east of the map area. During Phase II of deglaciation, glaciofluvial meltwater, likely derived from westward retreating ice, incised and deposited outwash that filled a portion of EKR Valley. The Holocene was dominantly a time of erosion. However, terraces approximately 5 m above the river level (river level is from low water, September, 2005) were likely deposited during Phase III as the EKR shifted across the valley. The modern EKR has incised the Holocene deposits (Phase IV) and now meanders across its present floodplain which consists of point bars, abandoned meanders, and marshy areas that are periodically inundated during flooding.

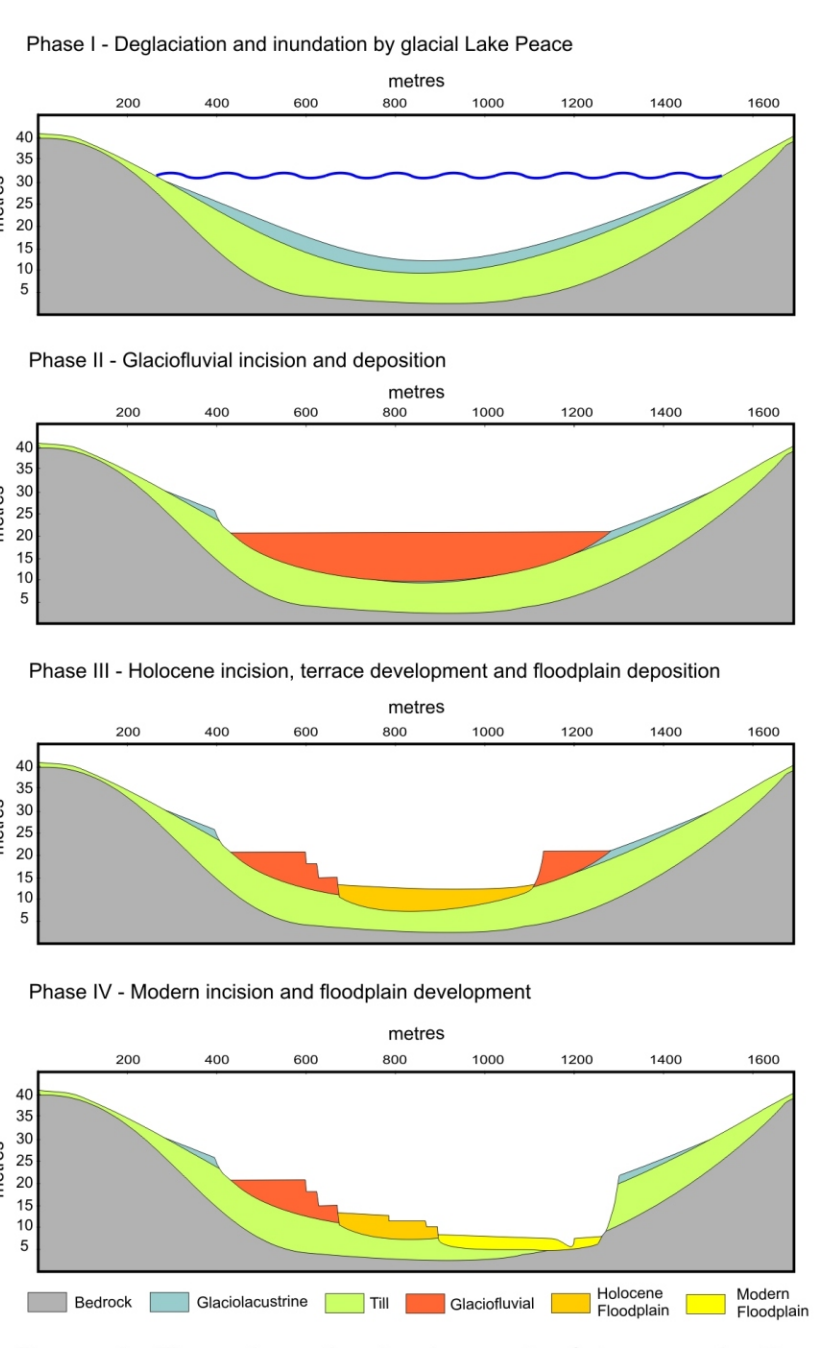


Figure 1. The schematic development of terraces in the Kiskatinaw River valley. Glaciofluvial terraces have the highest prospective and are the primary targets of this study.

Glaciofluvial and early Holocene terraces are the most prospective aggregate occurrences whereas glaciofluvial benches and modern fluvial terraces are the least prospective. Higher benches (e.g. 30 m above river level), particularly towards the confluences of the EKR and West Kiskatinaw River, formed when the Glacial Lake Peace occupied the area. Eventually the lakes drained or shifted position, following the eastward retreating ice front. Consequently, the glaciofluvial sediments and underlying till were incised by draining lakes or meltwater. The resulting remnant benches consist of clay and silt with minor stones (ice rafted debris and dropstones), commonly underlain by till. The next level of benches occur approximately 10-25 m above present river level and are interpreted as glaciofluvial terraces. The upper portions of these terraces commonly consist of sand and gravel and are the most prospective targets in the area (Fig. 2). Gravel beds may be several metres thick, though typically do not exceed 3 m. Clasts range in size from pebbles to cobbles and are commonly in a sandy matrix. The tops of Holocene terraces are rarely more than 8 m above the present river level and commonly consist of sand or gravel. These terraces tend to have a finer modal grain-size compared to glaciofluvial terraces. Shallow water table and overbank silt and fine sand often impede the development of these terraces as a gravel source. The lowest terraces are generally part of the modern floodplain and are represented by point bars and abandoned meander channels. These deposits typically consist of sand and silt with minor gravel. In places they may be prospective, however, proximity to modern river, shallow water table, and limited volume make these deposits less appealing aggregate targets than the higher terraces.

Figure 2. Gravel exposed in a glaciofluvial terrace on the EKR.

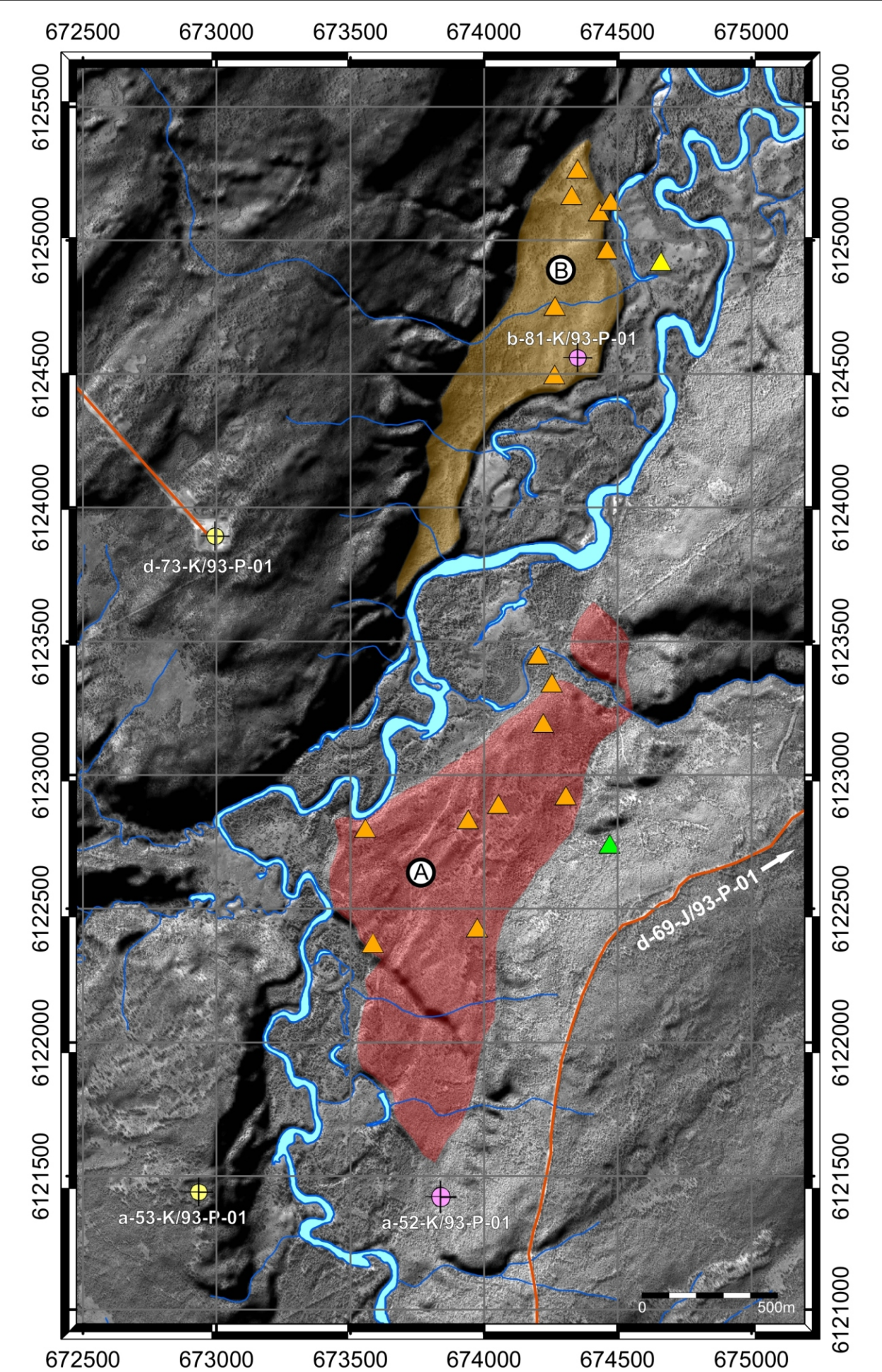


Figure 3. Sand and gravel from a hand dug test hole on the highly prospective polygon in Area 1.

AREA 1
Area 1 consists of two terraces: 1) a highly prospective glaciofluvial terrace located on the east bank of the EKR with an upper elevation of approximately 20 m above present river level (red area, labelled A), and 2) a moderately prospective terrace located on the west bank of the EKR approximately 5-8 m above the river level (orange area, labelled B).

Both terraces were visited in the field. At surface, the highly prospective terrace (A) contained pebble to cobble-size gravel with rare boulders in a sandy matrix. The estimated modal size of the gravel clasts is approximately 5 cm (~2 in.). Over-bank sand and possibly aeolian silt occasionally cap the gravel. Clasts are generally well rounded and the larger clasts are dominantly quartzite (Fig. 4). The moderately prospective terrace (B) is lower in elevation and consists of slightly smaller pebble to cobble-size gravel with rare boulders in a sandy matrix (Fig. 4). Water table in this terrace was estimated to be 3 m below the high point of the terrace, based on standing water in depressions.

Both of these terraces represent excellent candidates for further evaluation. The highly prospective terrace was accessed on foot from the 469-J093-P-01 lease road approximately 2 km from where it spurs from Noel Road. The moderately prospective terrace was accessed by foot from a seismic line that passes south of well site d-73-K93-P-01. The well site was accessed by truck from a lease road that spurs east from the Loop Road.

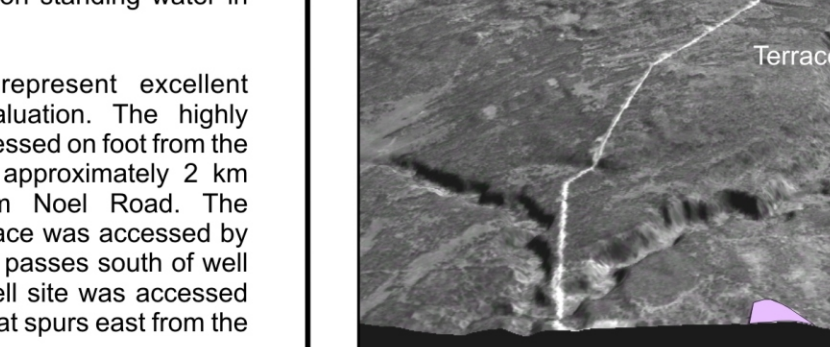


Figure 4. Sand and gravel from hand dug test hole on the moderately prospective polygon in Area 1.

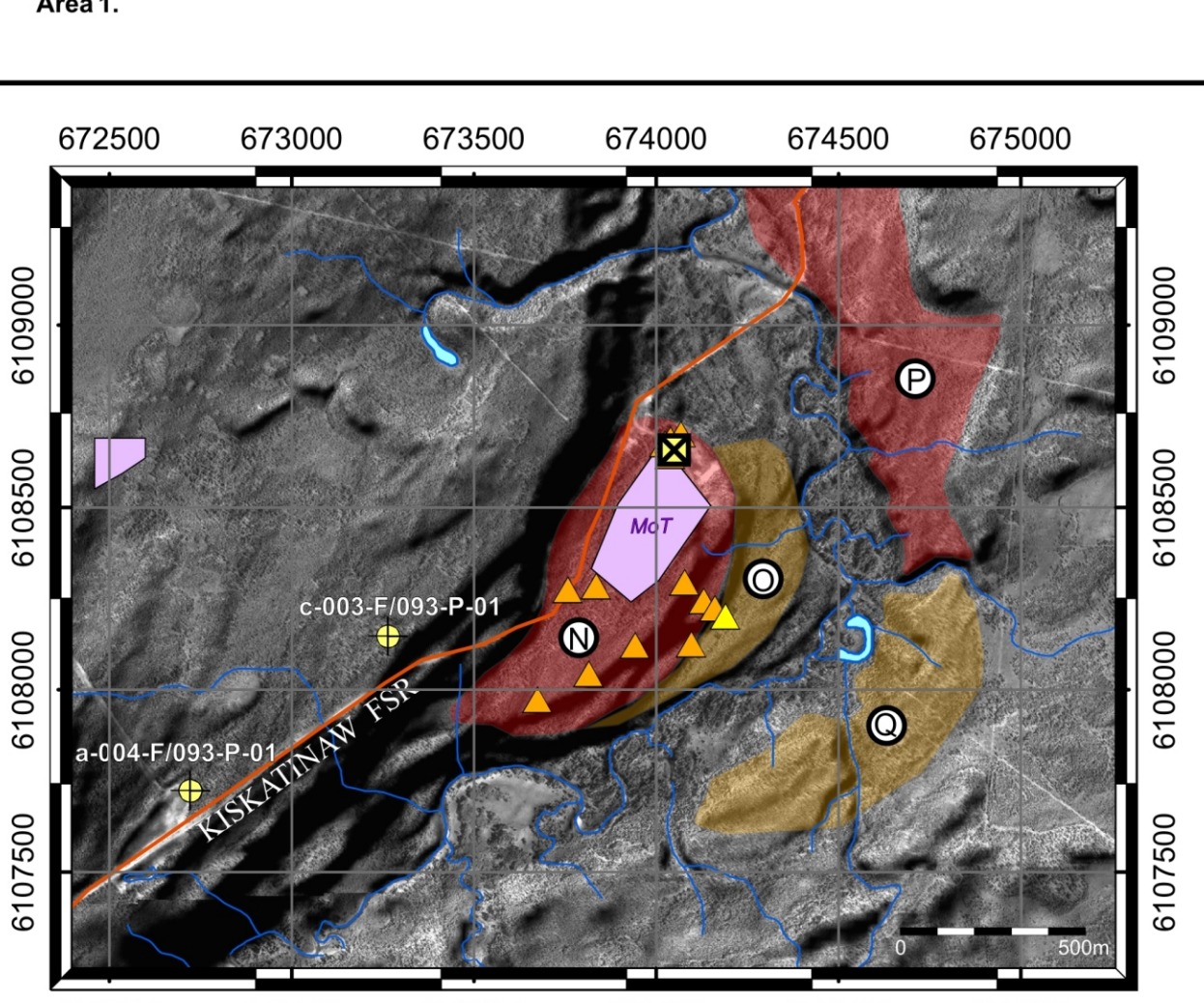


Figure 5. Digital elevation model of Area 2 draped with an orthophoto. The view is to the north and shows the terraces on the eastern bank of the EKR. The purple regions refer to the tenured areas shown on the map above.

AREA 2
Area 2 consists of four highly prospective terraces (red areas, labelled C to F) and four moderately prospective terraces (orange areas, labelled G to J), all on the east bank of the EKR with the exception of Terrace-E on the west bank. None of these terraces were visited in the field; however, the morphology and elevation of these terraces suggest the sites warrant further evaluation (Fig. 5). In addition, terraces on the east side of the EKR (tenured to Ministry of Transportation) were developed in the past and are now depleted suggesting similar terraces have aggregate potential. The highly prospective terraces (C to F) range in elevation from 14-25 m above present river level. The eastern portion of Terrace-C contains a swampy area that may be an abandoned channel and now contains abundant silt and organics with a high water table. Consequently, this portion of Terrace-E may be sterilized for aggregate production and has not been included in the volume calculations. It is not clear if the eastern portion of Terrace-D is a glaciofluvial terrace or a glaciofluvial bench and needs to be evaluated. The moderately prospective areas (G to J) range from 6-8 m above present river level.

At present, one tenure covers a portion of highly prospective Terrace-F. It is currently licensed to the MoT.

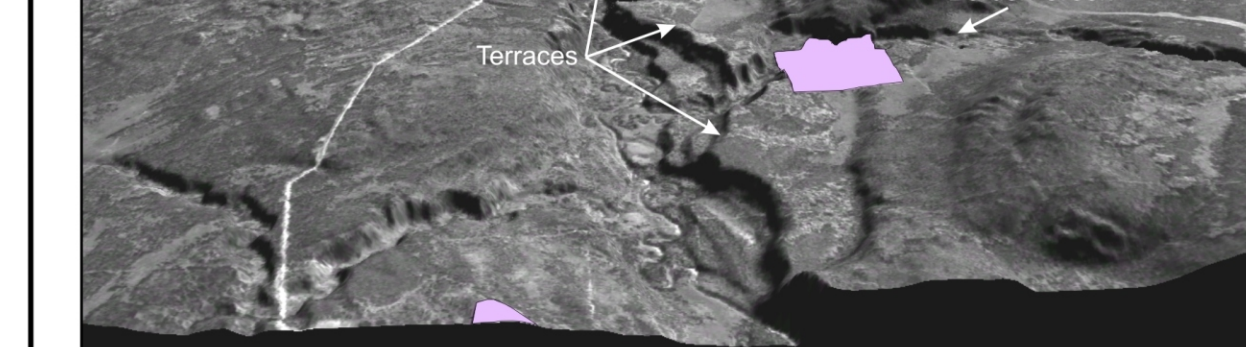


Figure 6. Pit run stockpile from high potential Terrace-K. The gravel is approximately 2 m thick and overlies sandy silt. A perched water table was encountered at 2 m. This area is located southeast of well site c-72-F93-P-01.

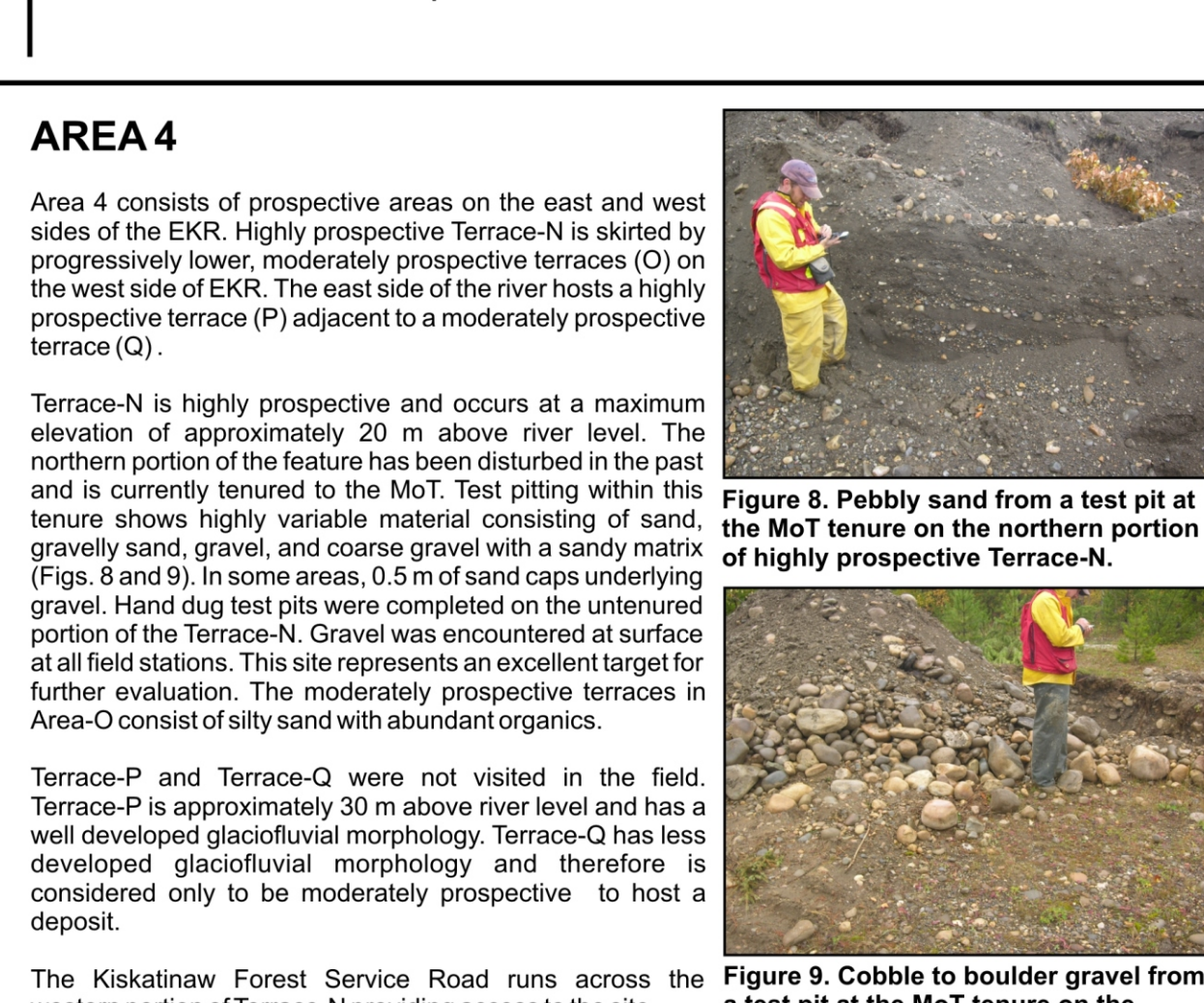


Figure 7. Closer view of terrace gravel (Fig. 6). The deposit coarsens upwards from sand to gravel.

AREA 3
Area 3 focuses on one large highly prospective terrace (red area, labelled K) and two moderately prospective terraces (orange areas, labelled L and M). Additional terraces in the southern portion of Area 3 presently host four tenures. A new pit on the tenured portion of Terrace-K opened and produced in the summer of 2005 (Figs. 6 and 7). The material processed consisted of oxidized pebble to cobble-size gravel in a sandy matrix. The modal clast size was approximately 2 cm (~1 in.). The gravel was well stratified with sandy beds as well as open framework gravel.

The highly prospective area (K) encompassing the pit was mapped south to include areas of similar elevation and morphology. As this terrace is a past producer, the untenured portion of this terrace remains prospective and should be evaluated further.

The two moderately prospective terraces (L and M) occur on either side of the EKR near its confluence with Sunderman Creek. These terraces are lower and may have a higher fines content than the high terraces. Despite this, they provide additional resources for the area.

Terrace-K was accessed from a lease, and former gravel haul road that branches south from the Noel Road on the west bank of the EKR. The road passes through the depleted MoT tenures noted in Area 2.

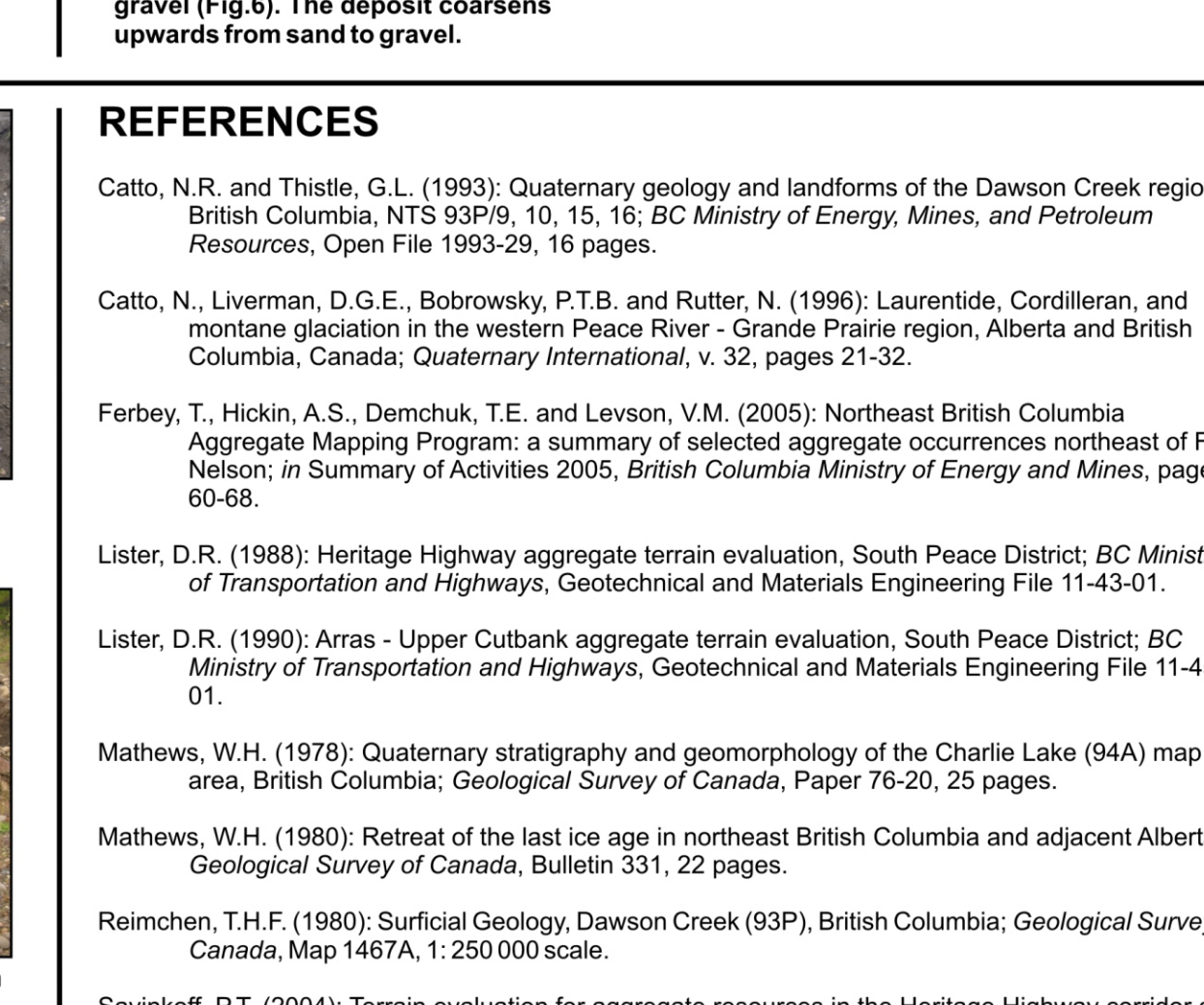


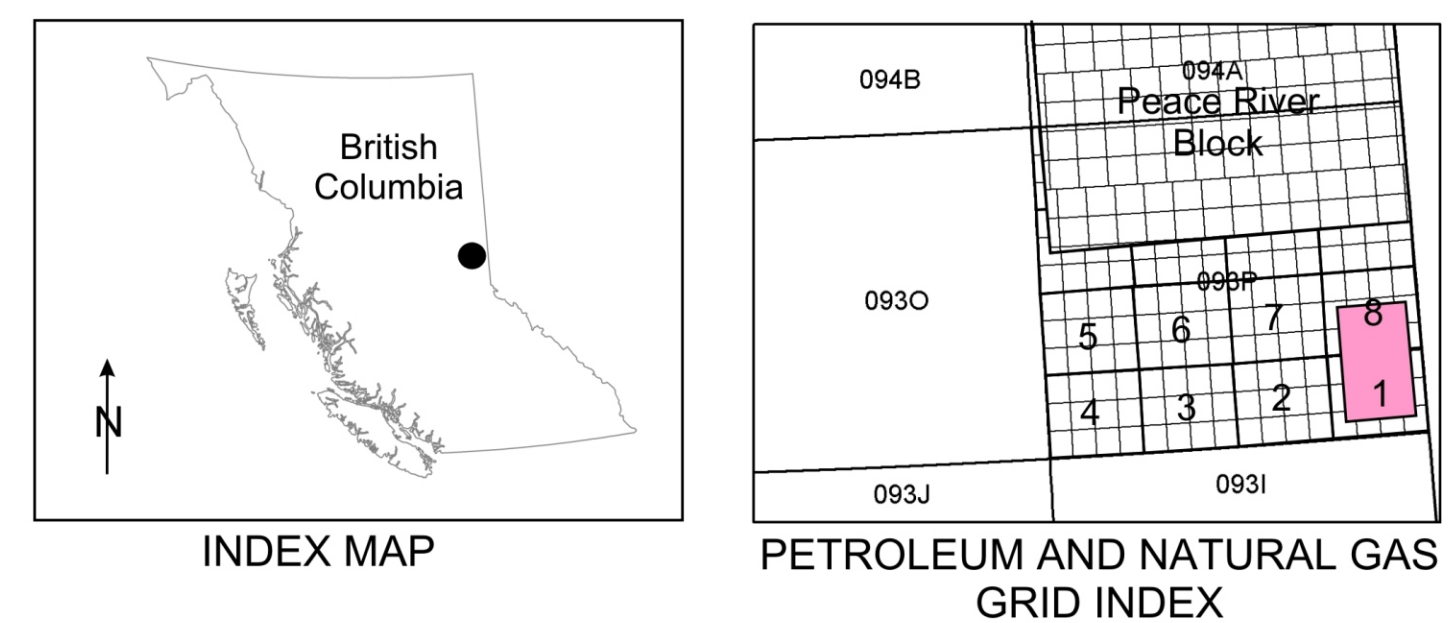
Figure 8. Pebbly sand from a test pit at the MoT tenure on the northern portion of highly prospective Terrace-N.

AREA 4
Area 4 consists of prospective areas on the east and west sides of the EKR. Highly prospective Terrace-N is skirted by progressively lower, moderately prospective terraces (Q) on the west side of EKR. The east side of the river hosts a highly prospective terrace (P) adjacent to a moderately prospective terrace (Q).

Terrace-N is highly prospective and occurs at a maximum elevation of approximately 20 m above river level. The northern portion of the feature has been disturbed in the past and is currently tenured to the MoT. Test pitting within this tenure shows highly variable material consisting of sand, gravelly sand, gravel, and coarse gravel with a sandy matrix (Figs. 8 and 9). In some areas, 0.5 m of sand caps underlying gravel. Hand dug test pits were completed on the untenured portion of the Terrace-N. Gravel was encountered at surface at all field stations. This site represents an excellent target for further evaluation. The moderately prospective terraces in Area-Q consist of silty sand with abundant organics.

Terrace-P and Terrace-Q were not visited in the field. Terrace-P is approximately 30 m above river level and has a well developed glaciofluvial morphology. Terrace-Q has less developed glaciofluvial morphology and therefore is considered only to be moderately prospective to host a deposit.

The Kiskatinaw Forest Service Road runs across the western portion of Terrace-N providing access to the site.



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RECOMMENDED CITATION:
Hickin, A.S. (2006). Aggregate potential of selected glaciofluvial terraces on the East Kiskatinaw River, Northeastern British Columbia; BC Ministry of Energy Mines and Petroleum Resources, Aggregate Prospect Report 2006-1, 1:50 000 scale map.

LEGEND

AGGREGATE POTENTIAL OF TERRACES

- Highly Prospective Terraces (upper)
- Moderately Prospective Terraces (lower)
- Aggregate Tenure (June 2006)
- Area of Interest

FIELD STATIONS

- ▲ Glaciofluvial
- ▲ Fluvial
- ▲ Glacial Diamict (till)
- ⊗ Excavation Test Pit

OIL AND GAS WELLS (JUNE 2006)

- Wells (active or abandoned)
- Wells (well authorized granted)

Other Features:

- Highway
- Secondary Road
- Access Road
- River - Definite
- River - Indefinite
- Lake
- Contours (20m interval)

Note: Orthophotography from 1997

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