Current Research (1995) Newfoundland Department of Natural Resources, Geological Survey, Report 95-1, pages 105-112

AGGREGATE-RESOURCE ASSESSMENT PROJECTS, NEWFOUNDLAND AND LABRADOR

F.T. Kirby, P. Geo.
Mineral Lands Division

ABSTRACT

This report summarizes the results of the 1994 field program to assess the aggregate-resource potential of, 1) the area between Springdale Junction and Baie Verte Junction, 2) the Codroy Valley, 3) Happy Valley–Goose Bay, and 4) the municipal planning areas at Stephenville Crossing, St. Georges, Forteau, Pinware and West St. Modeste. The project is to identify areas of high-quality surficial aggregate, which can be protected to be made available to meet the aggregate needs of these areas. The results of these studies are based on airphoto interpretation, ground traversing, grain-size analysis, petrographic analysis and hammer seismic profiles. A total of 133 sand, gravel and till samples were collected and analyzed; also 69 hammer-seismic profiles were taken.

INTRODUCTION

In 1982, a detailed aggregate-resource assessment program was initiated to provide data on the aggregate-resource potential of areas where municipal and other plans were being developed, or where detailed aggregate information is required to meet specific needs (e.g., highway construction and land-use conflicts). The existing aggregate-resource maps (Kirby *et al.*, 1983) and database (Ricketts, 1993) have been useful in defining potential land-use conflicts, but in most cases does not provide enough detailed information on the aggregate resources themselves, which are necessary to resolve these conflicts. Detailed studies, such as these, should provide the necessary information (grain size, petrographic and location data) required to identify high-quality aggregate reserves or to resolve various land-use conflicts (e.g., housing developments versus a high-quality aggregate deposit).

The 1994 field program was conducted in three areas of the province, 1) Springdale Junction to Bay Verte Junction (NTS 12H/8), 2) Codroy Valley (NTS 11O/14, 15) (Figure 1), and 3) Happy Valley–Goose Bay (NTS 13F/2, 3, 6 to 9) (Figure 2). Reviews of the municipal plans were conducted in St. Georges (NTS 12B/7 and 8), Stephenville Crossing (NTS 12B/8 and 9) (Figure 1) and Forteau (NTS 12P/7), West St. Modeste (NTS 12P/10) and Pinware (NTS 12P/10) (Figure 2).

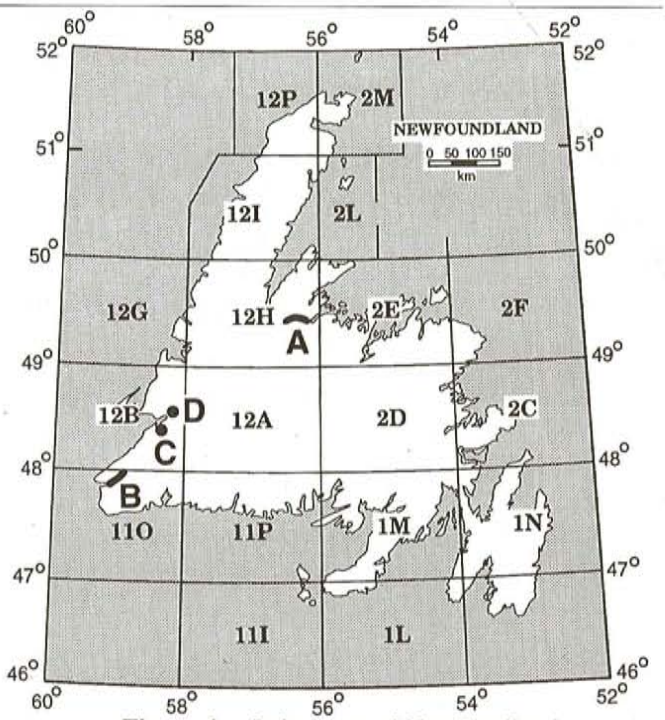

Figure 1. *Index map of Newfoundland.*

FIELD PROGRAM

Potential areas for detailed assessment were selected based on existing aggregate-resource and surficial data. The first phase of the field work involved site inspections along all roads and trails to verify and update data on previously sampled deposits, and to examine and sample any previously unsampled deposits. The location of all gravel pits, barrow pits and rock quarries was plotted on 1:50 000-scale field maps and any developments that would restrict potential quarry developments were also noted.

In areas of potential high-quality aggregate, foot traverses were conducted to select sample sites. Samples were taken from natural and man-made exposures, shallow hand-dug pits and excavator-dug test pits. Where hammer seismic surveys were conducted, survey locations were based on existing sample and surficial data and on access.

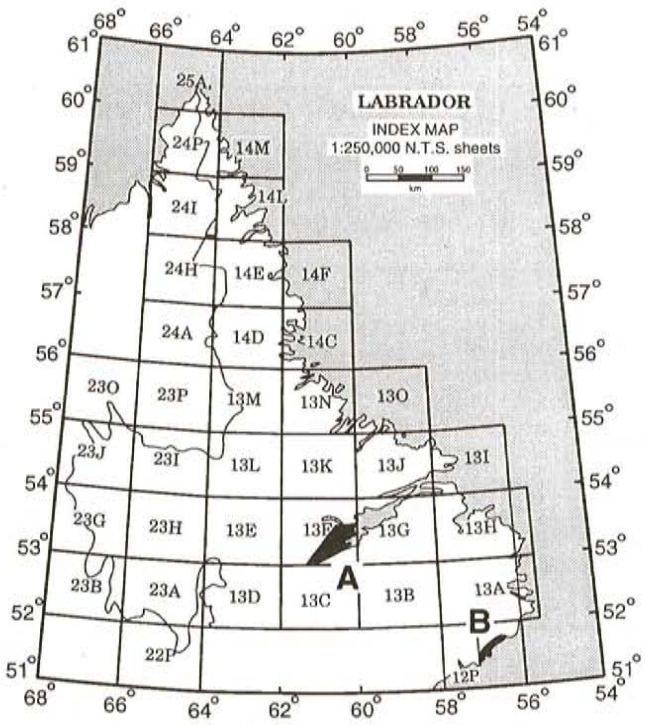

Figure 2. *Index map of Labrador.*

All sample locations were plotted on 1:50 000-scale topographic base maps. Where sample densities were high, samples were plotted on 1:12 500-scale coloured aerial photographs or 1:8 000-scale black and white aerial photographs, and later transferred to base maps. All field observation and sieve data were written on standardized field forms.

During the 1994 field program, 133 aggregate samples were collected. Samples of unconsolidated aggregate, containing greater than 8 mm size material, were sieved in the field using a bank of 4 sieves (63, 31.5, 16 and 8 mm). A split of the finer than 8 mm fraction were retained for laboratory sieve analysis (see Kirby *et al.*, 1983). A split (about 100 pebbles) of the 16- to 31.5-mm pebble fraction was retained for field lithological and petrographic analysis (see Bragg, 1986). All grain-size and petrographic data collected during this field program and since 1977 are stored on a disk (see Ricketts, 1993) and are available upon request.

In this paper, any observations made on deposit quality are based primarily on standards obtained from the Newfoundland Department of Works, Services and Transportation specifications book (Specifications Book, 1987), which are based on ASTM standards for granular materials. The highest petrographic number for concrete is 130 (Specifications Book, 1987) whereas asphaltic pavement is 135 (T. Wall, personal communication, 1995).

STUDY RESULTS

BAIE VERTE JUNCTION TO SPRINGDALE JUNCTION

The objective of this study is to identify areas of high-quality aggregate in an area where there is a high demand for cottage development. By identifying and protecting these aggregate sources, they will be available to supply high-quality aggregate to meet the local demand in the future (e.g., highway reconstruction).

The study area is confined to a narrow corridor bounded by Indian River and Indian Pond to the north, the Trans-Canada Highway to the south, Baie Verte Junction to the west and Springdale Junction to the east (Figure 3), and is found on NTS map area 12H/8. Glaciofluvial terraces and fans consisting of sand and gravel form the surficial deposits of the area (Liverman *et al.*, 1991b). However, much of the study area is excluded from quarry activity because of a 90-m protected road buffer along the Trans-Canada Highway, a 50 m buffer along Indian Pond and Indian Brook and the existing cabin developments.

Two aggregate-resource sites have been identified as having the best potential to supply high-quality aggregate well into the future. Area 1 (Figure 3) has been interpreted as a glaciofluvial fan deposit composed of stratified sand and gravel (Liverman *et al.*, 1991a). Analysis of four samples indicate an average grain-size occurrence of 72.9 percent gravel, 25.9 percent sand and 1.2 percent silt–clay. Petrographic numbers for these samples range from 121 to 148 having an average of 143. The 16 to 32 mm fraction used for petrographic analysis is made up of granite, and basic and acid volcanic rocks. These pebble types are of excellent quality, but the presence of a small number of badly weathered indeterminate rocks has caused an increase in the petrographic number. Generally, the quality is excellent for most high-grade aggregate uses (e.g., concrete, asphaltic pavement).

Area 2 (Figure 3) is interpreted as a glaciofluvial terrace (Liverman *et al.*, 1991a) and consists of stratified sand and gravel (Plate 1). Although previously quarried, large reserves have been located both east and west of the existing quarry. Analyses of five samples collected in Area 2 indicate an average grain-size occurrence of 71.8 percent gravel, 27.6 percent sand and 0.6 percent silt–clay. Petrographic numbers for these samples range from 125 to 155 having an average of 136. The pebble fraction is composed dominantly of granite, and basic and acid volcanic rocks, but the presence of a small number of badly weathered indeterminate rocks and some moderately weathered granite has caused a slight increase in the petrographic number, nevertheless, it is still an excellent source of gravel for most high-grade aggregate uses. Based on sample data, both areas appear to be composed

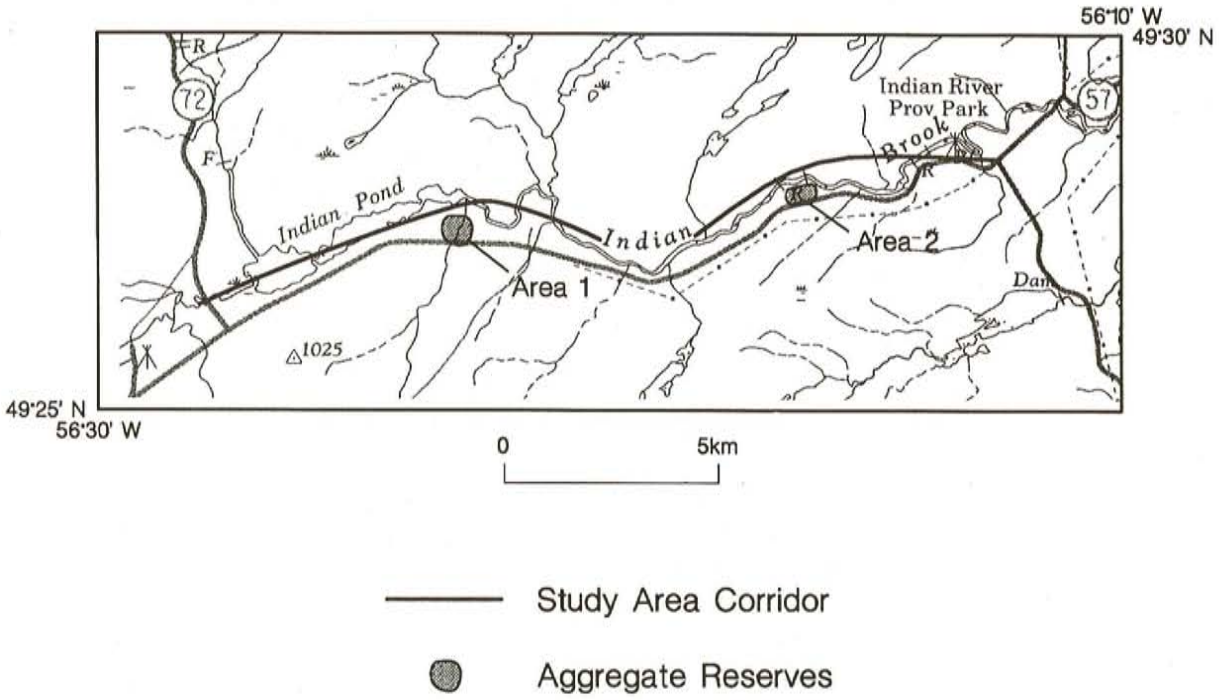

Figure 3. *Proposed aggregate reserve areas within the Springdale to Baie Verte Junction study area.*

Plate 1. *Stratified sand and gravel in 6 m quarry exposure.*

of high-quality sand and gravel. These two areas will be identified and protected from other land uses to meet future aggregate demands.

CODROY VALLEY

The Codroy Valley is situated in NTS map areas 11O/14 and 15. Extensive agricultural activity and cabin development has made large areas unavailable for future aggregate extraction. The aim of this study was to identify areas within the valley that contain large reserves of high-quality aggregate that has not been sterilized by conflicting land uses.

The study area is confined to a strip centred on the Trans-Canada Highway and bounded by the Grand Codroy River to the northwest and the Long Range Mountains to the southeast (Figure 4). Aggregate-resource mapping in 1979 (Kirby *et al.*, 1983) outlined large areas of sand and gravel but did not document conflicting land uses, making access to these deposits difficult.

Field work identified three aggregate areas that have the potential to supply high-quality aggregate to meet local demands (Figure 4). Area 1 contains a quarry showing exposures of stratified sand and gravel (Plate 2). This deposit has been used extensively in the past and is presently about 50 percent depleted. Future expansion of this quarry may be hindered by the presence of conflicting land uses southwest and northeast of the deposit. Results of the grain-size and petrographic analyses conducted on three samples collected in Area 1 gave an average grain-size occurrence of 53.3 percent gravel, 44.9 percent sand and 1.8 percent silt–clay. Petrographic numbers for these samples range from 231 and 233 and have an average of 232. Over 50 percent of the 16 mm pebble fraction is composed of granite and gabbro whereas the remainder are made up of gneiss, amphobolite, siltstone, sandstone and some undefined rocks. Poor petrographic quality of these samples resulted from moderate to highly weathered rocks. Further testing including Los Angeles abrasion testing, will have to be conducted to determine if this material is suitable as a source of aggregate for concrete or asphaltic pavement.

Area 2 is composed of stratified sand and gravel having numerous silt lenses and wedges as determined from quarry exposures. Much of the area is heavily forested and hummocky. The average grain size from these samples indicates an average of 66 percent gravel, 33 percent sand

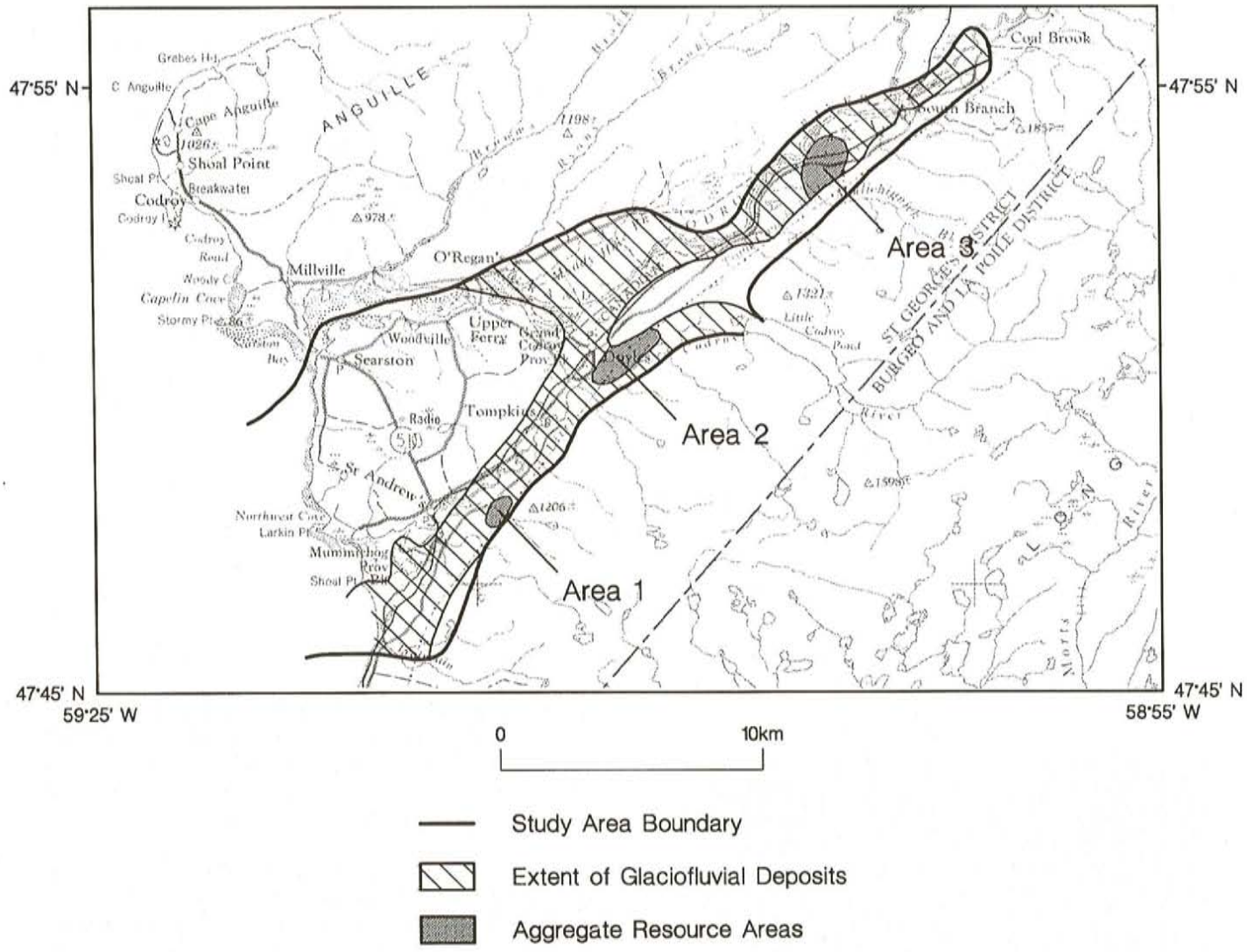

Figure 4. *Proposed aggregate reserve areas within the Codroy study area.*

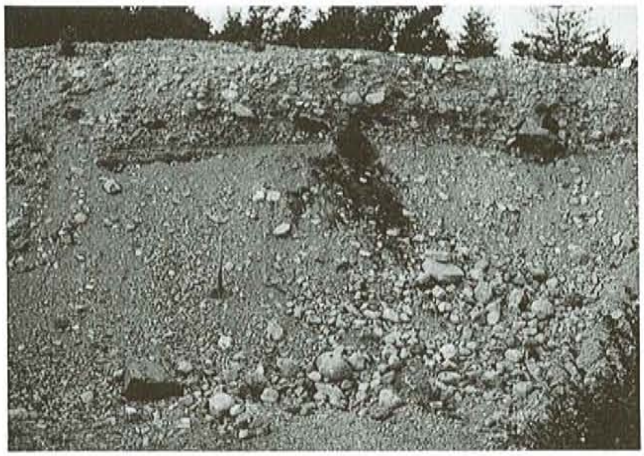

Plate 2. *Stratified sand and cobble gravel in 4 m quarry exposure.*

and 1 percent silt–clay. Petrographic numbers ranged from 191 to 272 and have an average of 227. The pebble fraction is composed dominantly of granite and gabbro with some gneiss, siltstone and sandstone present. The presence of moderate to highly weathered rocks has caused an increase in the petrographic numbers. Further testing would have to be conducted to determine if the aggregate is suitable for concrete or asphaltic pavement.

Area 3 is composed of stratified sand and gravel in a series of forested hummocks and ridges and is divided by the Trans-Canada Highway (Figure 4). Grain-size analysis of the material from this area give an average grain-size occurrence of 65 percent gravel, 34 percent sand and 1 percent silt–clay. Petrographic numbers range from 161 to 235 having an average of 191. The pebble fraction is dominated by granite and gabbro and smaller quantities of gneiss, sandstone and siltstone. The presence of moderate to highly weathered rock types have elevated the petrographic number for this deposit.

HAPPY VALLEY–GOOSE BAY AND NORTH WEST RIVER

Three aggregate-resource surveys have been conducted in the Happy Valley–Goose Bay and North West River areas in the past eight years. The first was conducted in the Happy Valley–Goose Bay and North West River municipal planning areas in 1986 (Kirby, 1987). This survey did identify three small gravel deposits within the Happy Valley–Goose Bay planning area, but these have since been mined out. A large sand and gravel deposit was identified at Sunday Hill in the North West River planning area. This area is presently the only source of sand and gravel supplying the whole region with concrete-grade surficial aggregate.

The discovery of cultural artifacts near the quarries at Sunday Hill, in 1987, resulted in the local town council requesting that the Sunday Hill quarries be closed down. As a result, in 1988, a test-pitting program was conducted on Birchy Hill, North West River (Kirby, 1989) in an attempt to locate a source of high-quality aggregate to replace the deposits at Sunday Hill. This test-pitting program failed to locate any high-quality aggregate on Birchy Hill, thereby leaving Sunday Hill as the only source of high-quality aggregate in the region.

In 1989, another aggregate study was undertaken in the area because of the continued conflicts at Sunday Hill, North West River (Kirby, 1990). This study was confined to a 50 km radius around Happy Valley–Goose Bay. It did identify additional sources of sand and gravel but the small deposit size and distance from the market area, and poorly maintained woods roads made exploitation highly unlikely.

The most recent survey, conducted in 1994, was undertaken because the town of North West River requested the closure of the Sunday Hill quarries when the existing quarry permits expire. The main aim of this project was to identify potential gravel deposits buried within the predominantly sand, glaciomarine–glaciofluvial terrance system that underlie much of the Happy Valley–Goose Bay area. As a result of the continued upgrading of the Trans-Labrador Highway, the scope of the study was also increased to 90 km from Happy Valley–Goose Bay (Figure 5).

In the past, these buried deposits supplied much of the aggregate used in the construction of the Goose Bay air base. The search for buried gravel deposits was conducted using a Huntec FS-3, Portable Facsimile Seismograph (hammer seismic) (Plate 3). A total of 69 seismic profiles were taken within a two and one half week period. The results were interpreted in the field and, where warranted, test pitting was conducted to determine the cause of any deflections in the seismic profile within 5 m of the surface.

Fifty-three test pits were dug to an average depth of 4 m. Of the 53 test pits, 18 were dug in areas where the seismic profiles indicated a change in the subsurface material within 5 m of the surface. Test pits failed to reveal any changes in the composition of the subsurface material. All test pits revealed medium to fine sand with numerous dark bands of heavy minerals. The deflections noted on the seismic profiles were interpreted to be a combination of the water table, an increase in density and an increase in the heavy mineral concentration at depth (Plate 4). The remaining 35 test pits were dug in areas where surface exposures indicated the presence of gravel. In the majority of cases, the test pits revealed a 1 to 2 m of sandy pebble gravel over sand. The only substantial gravel deposit test pitted was the Peters River deposit (Figure 5). This deposit was previously identified in 1989 (Kirby, 1990) and is located approximately 40 km west of Happy Valley–Goose Bay. Access is by a poorly maintained woods road. Nine test pits were dug to an average depth of 3.1 m. Analyses conducted on nine samples collected give an average grain-size occurrence of 61.2 percent gravel, 37.6 percent sand and 0.8 percent silt–clay. Petrographic number ranges from 147 to 187 and have an average of 164. The pebble fraction is composed dominantly of granite and gneiss. The moderately high petrographic number is mainly caused by the presence of moderate to highly weathered genesis and a number of highly weathered undefinable rock types. Detailed analysis would have to be conducted including Los Angelas abrasion to determine if this deposit is suitable to meet concrete specifications.

A number of small gravel showings were noted at Lower Brook approximately 41 km west of Happy Valley–Goose Bay, and near the Pinus River approximately 85 km west of Goose Bay. Analyses of sampled material indicate an average grain-size occurrence of 57 percent gravel, 42 percent sand and less than 1 percent silt–clay. Petrographic numbers range from 132 to 134, having an average of 133. These deposits are thin, generally less than 2 m, are underlain by sand or bedrock, and could not supply large volumes of high-quality aggregate.

In the immediate area surrounding the Goose Bay air base and a number of abandoned dump sites, information on thirty-three confidential drill logs, supplied by the Department of National Defence (1994), was used to get information on the underlying stratigraphy in these areas. The depth of the holes ranged from 5 to 30 m with none of the holes intersecting gravel.

MUNICIPAL PLAN REVIEWS

Municipal plan reviews were conducted in the St. Georges, Stephenville Crossing (Figure 1), and the Forteau, Pinware, and West St. Modeste (Figure 2) municipal planning areas. In the St. Georges and Stephenville Crossing municipal planning areas, field work involved a one-day field inspection of aggregate-reserve areas previously identified in 1986 (Kirby, 1987). Inspections were conducted to ensure that the status of the aggregate-reserve area has not changed since they were included in the municipal plan for these areas.

In the Forteau, Pinware and West St. Modeste, the assessment failed to locate any sources of high-quality aggregate. Surficial aggregate materials in these areas are

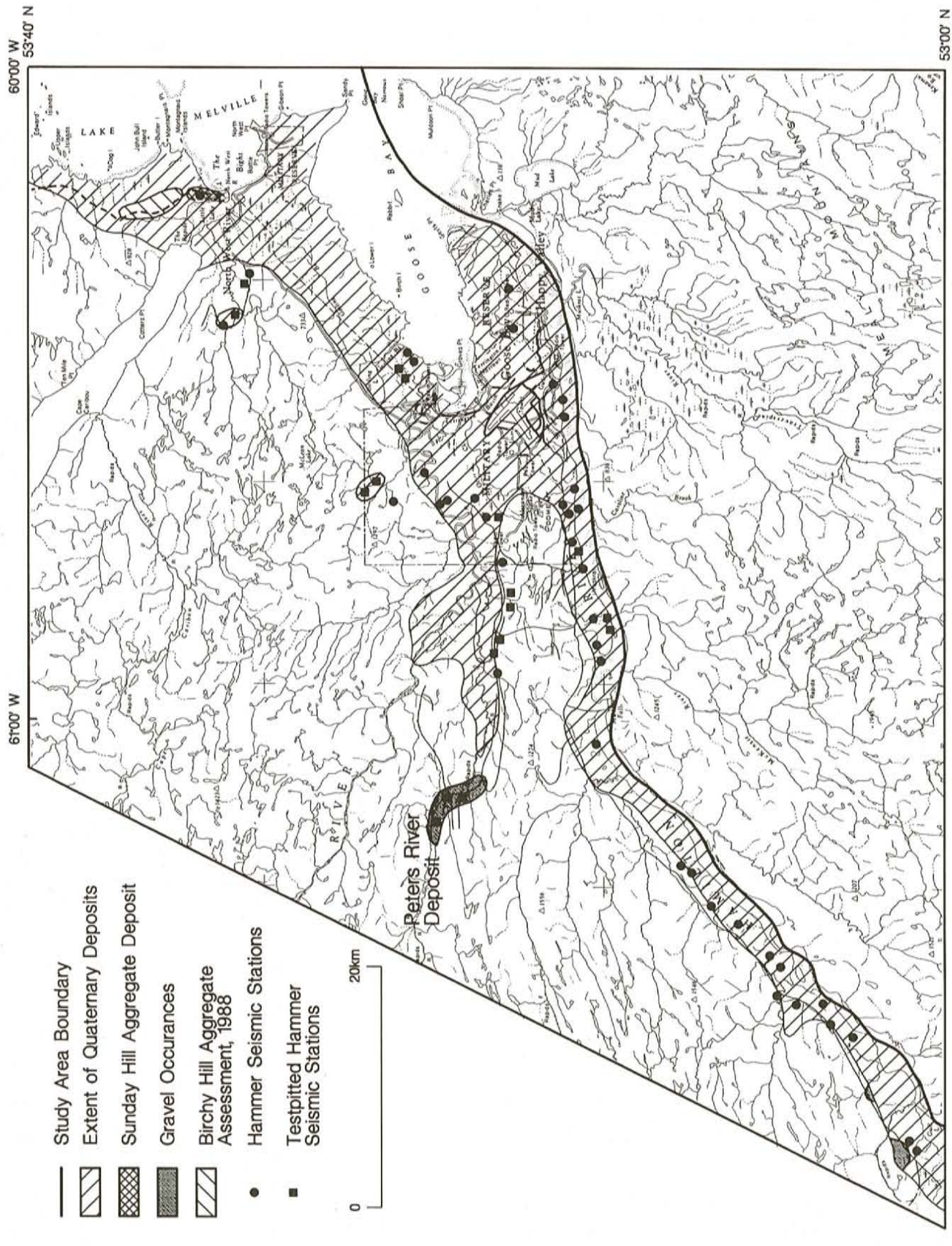

Figure 5. *Happy Valley-Goose Bay study area.*

Plate 3. *Huntec FS-3, Portable Facsimile Seismographic set up.*

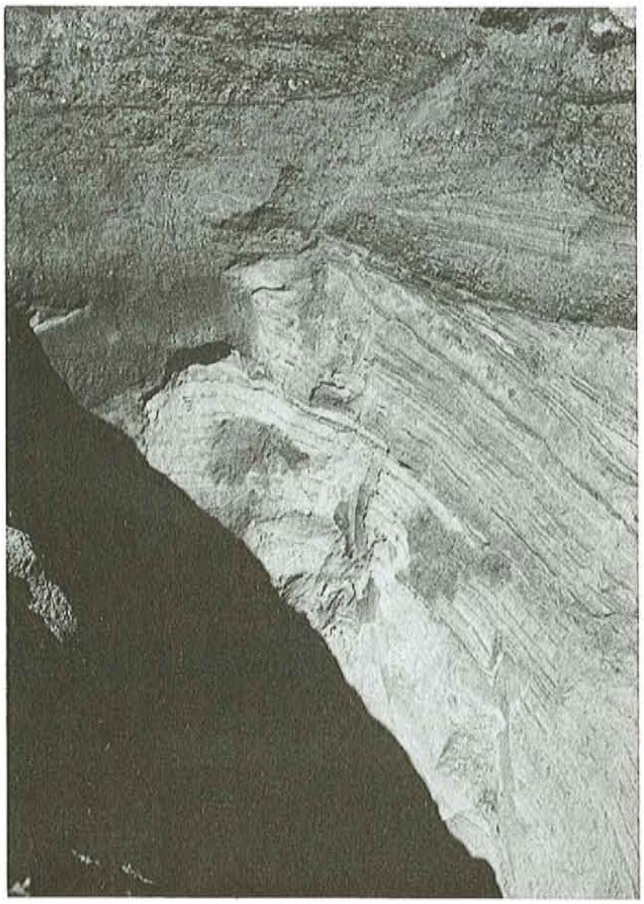

Plate 4. *Excavator dug test pit in sand, note dark banding of heavy minerals.*

derived from thin raised marine deposits consisting of thin veneers over bedrock. The material is of poor quality because of iron staining, a high organic content and poor petrographic characteristics having an average petrographic number of 225. These deposits are used exclusively as a source of fill material only. The locations of all existing quarries were mapped, and those deemed to have potential for future extraction were noted and will be identified in the municipal plans for these areas to protect them from conflicting land uses.

SUMMARY

A total of 134 aggregate samples were collected and analyzed, and sixty-nine hammer seismic profiles were conducted and interpreted during the 1994 field season.

Work conducted in the Baie Verte Junction to Springdale Junction areas has identified two areas that should be reserved for regulated aggregate extraction. Both sites have the potential to meet the aggregate needs of this area well into the future. Both site locations will be forwarded to the Crown Lands Division to prevent cabin development from occurring in these areas.

In the Codroy Valley, three areas were identified as having the potential to supply the area with high-quality aggregate to meet local demand. The site locations of these three areas will be forwarded to the Crown Lands Division for inclusion in the Land Use Atlas.

In the Happy Valley–Goose Bay area, extensive hammer seismic profiling and backhoe test pitting failed to locate any buried gravel deposit in close proximity to the town. Shallow deposits were located along the Trans-Labrador Highway but their small size and distance from market would make their development highly unlikely. A relative large deposit was sampled at Peters River, approximately 40 km west of Goose Bay. Due to a relatively high petrographic number, extensive laboratory testing would be required to determine its suitability as a source of concrete aggregate. Also, access to the site is by poorly maintained woods road that would need extensive upgrading before any thought could be given to developing this deposit as an aggregate source for the Happy Valley–Goose Bay market.

Municipal plan reviews were conducted in St. Georges, Stephenville Crossing, Forteau, Pinware and West St. Modeste. The results of these surveys will be forwarded to the Department of Municipal and Provincial Affairs for inclusion in the municipal plans for these areas. By identifying these resources in the plan, they can be protected from conflicting land uses, which could prevent aggregate extraction.

ACKNOWLEDGMENTS

The author thanks Floyd House for his very capable assistance in the field. Gerry Kilfoil is thanked for teaching me the operation of the hammer seismic unit and data interpretation. Ted Hall and Wayne Tuttle provided logistical support. Jerry Ricketts is thanked for critically reviewing this paper.

REFERENCES

Bragg, D.

1986: Reconnaissance study of bedrock aggregate potential for offshore and industrial use. *In* Current Research. Newfoundland Department of Mines and

Energy, Mineral Development Division, Report 86-1, pages 297-301.

Department of National Defence
1994: Drill logs of soil in and around Goose Bay air base. Confidential report to the Department of National Defence, Goose Bay.

Kirby, F.T.
1987: Detailed aggregate resource assessments, Newfoundland and Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 87-1, pages 49-56.

1989: Results of aggregate resource assessments, Birchy Hill, North West River, Labrador. Newfoundland Department of Energy, Mines and Resources, Mineral Resource Management Branch, Open File Report 13F (4), 18 pages.

1990: Detailed aggregate resource assessment project, Newfoundland and Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 90-1, pages 19-26.

Kirby, F.T., Ricketts, R.J. and Vanderveer, D.G.
1983: Inventory of aggregate resources in Newfoundland and Labrador. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 83-2, 35 pages.

Liverman, D., Scott, S. and Vatcher, H.
1991a: Landform classification and surficial geology of the Springdale map sheet, (NTS 12H/8). Newfoundland Department of Mines and Energy, Mineral Development Division, Open File 1216.

1991b: Quaternary geology of the Springdale map area (12H/8). *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 91-1, pages 29-44.

Ricketts, M.J.
1993: Aggregate resources graph program (Graph V3). Newfoundland Department of Mines and Energy, Mineral Development Division, Open File Report, Newfoundland 2270.

Specifications Book
1987: Newfoundland Department of Transportation, tendering section, St. John's, Form 904, 8 pages.