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AGGREGATE-RESOURCE ASSESSMENT PROJECTS, INSULAR NEWFOUNDLAND

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ABSTRACT

This report summarizes the results of the 1995 aggregate-resource field program in the Wesleyville area, Great Northern Peninsula, and in various municipal-plan areas throughout the province. The project identifies areas of high-quality surficial aggregate, which can be protected, and thereby made available to meet the future aggregate needs of these areas.

Field work resulted in backhoe-testpitting programs in three areas. Two of the areas tested lacked sufficient quantities of sand, and reserves were small, whereas the third, although of high petrographic quality, is shallow and, has a very high shell content. In the Wesleyville area, four areas were identified. One contained a large reserve of blending sand while the other three contained gravel. Petrographic analyses of the samples in these areas gave a high petrographic number indicating that the gravel may not be suitable for most concrete applications. The work within municipal planning areas involved updating the existing information in these areas, to ensure that the Mines Branch concerns are addressed in the municipal plan reviews.

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 (e.g., grain size, petrographic and location data) required to identify high-quality aggregate reserves or to resolve various land-use conflicts (e.g., housing developments verses a high-quality aggregate deposit).

The results of these studies are based on airphoto interpretation, ground traversing, test pitting, grain-size and petrographic analyses. A total of 63 sand, gravel and till samples were collected and analyzed.

Deposit quality is based primarily on standards obtained from the Newfoundland Department of Works, Services and Transportation specifications book, which are based on ASTM standards for granular materials. The highest petrographic number permitted for use in concrete is 130, whereas in asphaltic pavement, it is 135 (T. Wall, personal communication, 1995, and Newfoundland Department of Works, Services and Transportation, 1987).

In 1995, mapping was concentrated on (A) tip of the Great Northern Peninsula (NTS 2M/5 and 6, 11 and 12, and 12P/8 and 9) and (B) Wesleyville area (NTS 2F/4 and 5). Municipal plan reviews were conducted in (C) Point Leamington (NTS 2E/6), (D) Botwood (NTS 2E/3), (E) Bishops Falls (NTS 2E/3,4, 2D/13), (F) Glovertown (NTS 2D/9), (G) Traytown (NTS 2C/12), (H) Long Harbour (NTS 1N/5), (I) Cape Broyle and (J) Ferryland (NTS 1N/2) (Figure 1).

FIELD PROGRAM

Potential areas for detailed assessment were selected based on airphoto interpretation and the 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 locations of gravel pits, borrow pits and rock quarries were plotted on 1:50 000 field maps with the aid of a Magellia – Trailblazer XL GPS unit. Any developments that would restrict potential quarry developments were also plotted, (i.e., fox farms, housing, etc.).

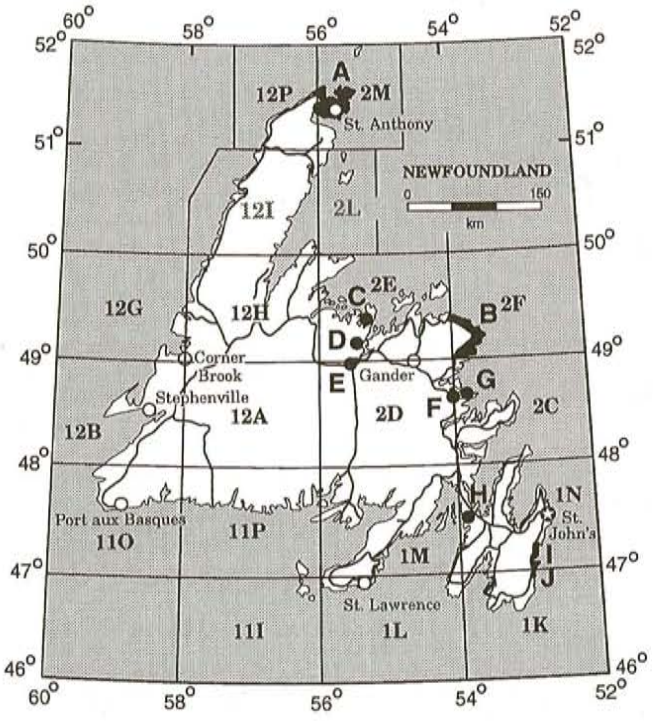

Figure 1. *Index map of field areas. A – tip of the Great Northern Peninsula; B – Wesleyville area; C – Point Leamington; D – Botwood; E – Bishop's Falls; F – Glovertown; G – Traytown; H – Long Harbour; I – Cape Broyle; J – Ferryland.*

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. 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. All field observations and sieve data were recorded on standardized field forms.

During the 1995 field program, 63 aggregate samples were collected. Samples of unconsolidated aggregate, containing greater than 8mm size material, were sieved through a bank of 4 field sieves (63, 31.5, 16 and 8mm). A split of the finer than 8mm fraction was retained for laboratory sieve analysis, which follows the procedure outlined by Kirby *et al.* (1983). A split (about 100 pebbles) of the 16 to 31.5mm pebble fraction was retained for field lithological and petrographic analysis, following procedures outlined by Bragg (1986). All grain-size data and petrographic numbers, determined from analysis of samples collected during the 1995 field program and previous aggregate-resource programs, are stored on a microcomputer program (Ricketts, 1993) and is available upon request.

STUDY RESULTS

THE TIP OF THE GREAT NORTHERN PENINSULA

With the discovery of two rare plant species on Burnt Island in 1994 and the subsequent push to have the island declared an ecological reserve, it was decided to allow the existing quarry permit on Burnt Island to lapse after the August 1995 expiration date. As a result of the quarry closure, the only known source of surficial concrete aggregate available to meet the local demand on the tip of the Great Northern Peninsula was eliminated. Therefore, it was decided to conduct a field program in the area in an attempt to identify an alternate source of surficial concrete aggregate within a 50 km radius of St. Anthony, the main population centre.

Prior to the opening of the Burnt Island quarries, the main source of concrete aggregate was the limestone barrens in the Cook's Harbour area and the raised marine deposits at Shallow Bay. The Cook's Harbour deposits are composed of thin veneers of weathered limestone over limestone bedrock (Plate 1). The Shallow Bay deposit (Figure 2) is composed of sand and gravel in a raised marine beach deposit. This deposit supplied both concrete aggregate and winter sand to the region. With the near exhaustion of the gravel deposits at Shallow Bay and Cook's Harbour, development began on the raised marine deposits on Burnt Island in 1982 (Plate 2).

Plate 1. *Limestone barrens near Cook's Harbour.*

Three aggregate-resource surveys have been conducted in the study area. Kirby (1985) conducted an aggregate survey within the St. Anthony municipal planning area. This survey outlined a number of areas suitable for common fill materials but was unable to locate high-quality aggregate sources. Kirby (1991) conducted an aggregate survey within the Raleigh municipal planning area. This survey outlined the

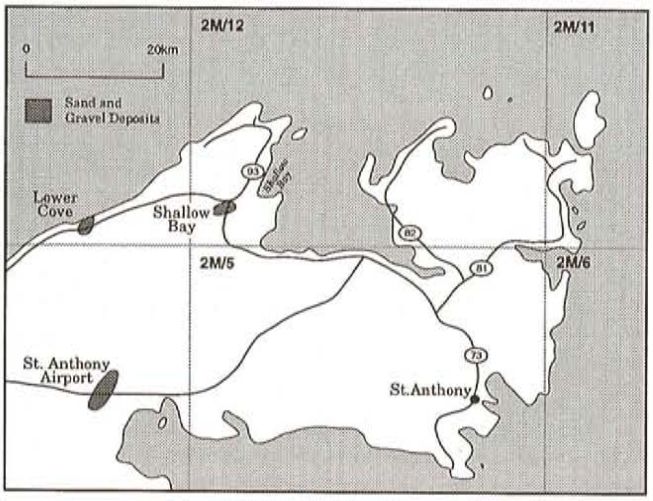

Figure 2. *Proposed aggregate reserve areas, tip of the Great Northern Peninsula.*

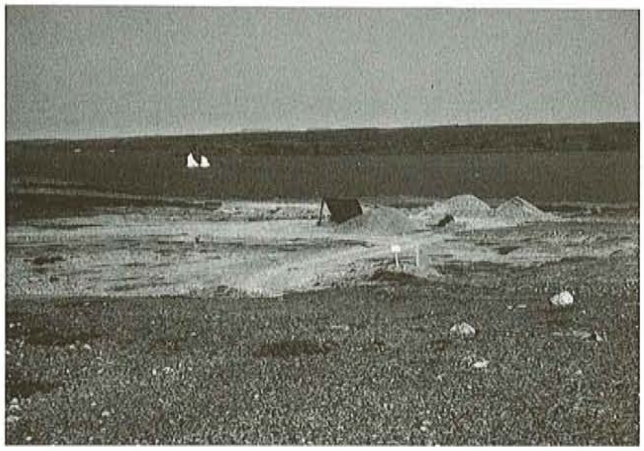

Plate 2. *Quarry in raised beach deposit, Burnt Island.*

raised marine gravels situated on Burnt Island as the only source of high-quality aggregate within the planning area. In 1992, Ricketts and House (1993) conducted an aggregate survey on the entire tip of the Great Northern Peninsula. This survey identified two sites that have the potential to supply concrete aggregate, but past exploitation of these resources has resulted in small reserves remaining.

This present study was conducted within a 50 km radius of St. Anthony involving extensive vehicular and foot traversing. A total of 44 excavation test pits were dug and 15 samples were taken. In most test pits, granular deposits were generally less than 2 m thick and underlain by bedrock. As a result of the initial part of the study, three areas were slated for detailed analyses. These areas are at Shallow Bay, Lower Cove and St. Anthony Airport (Figure 2). Two of these deposits were previously described by Ricketts and House (1993).

The surficial geology of the study area is characterized by numerous bedrock outcrop and thin veneers of till or rock rubble over bedrock. In low-lying areas and some upland areas, there are remnants of marine terraces that were developed when sea level was 150 m above its present level (Grant, 1992).

Shallow Bay. The Shallow Bay deposit (Ricketts and House, 1993) is composed of a sandy pebble raised marine gravel, containing shells. Past exploitation for concrete aggregate, and sand for ice control, has largely depleted this deposit. Large waste stockpiles of stone, which were screened out in the production of winter sand, constitute much of the remaining reserves. This stone is of high quality and suitable for use in concrete but there is a lack of sand, which constitutes up to half of the concrete mix.

In 1995, 21 test pits were dug in and around the existing quarry in an attempt to identify new reserves. Two test pits were attempted in the floor of the existing pit but they immediately struck bedrock. Eight of nineteen test pits were dug around the parameter of the existing quarry revealing 0.3- to 1-m-thick sand and gravel over bedrock (Plate 3). Samples taken form three of these test pits revealed an average grain-size distribution of 57 percent gravel, 42 percent sand and less than 1 percent silt/clay. Petrographic analysis of three samples shows petrographic numbers ranging from 100 to 128. Eight other test pits encountered diamicton, ranging from 0.5 to 1.9 m in thickness. Samples taken from three pits in the diamicton revealed a grain-size distribution of 42 percent gravel, 47 percent sand and 11 percent silt/clay. Petrographic numbers for three samples analyzed range from 100 to 266. The remaining three test pits encountered limestone bedrock immediately below the organic vegetation mat. These test-pit results indicate that the quarry is nearing exhaustion.

Plate 3. *One and a half metres of sand and gravel over limestone bedrock.*

Lower Cove. The Lower Cove deposit (Figure 2) is a raised beach deposit composed almost exclusively of rounded cobble-size aggregate (Plate 4). The deposit has been quarried in the past, but there is still a substantial reserve remaining (in excess of 20 000 m^3). Two test pits were dug in this deposit and revealed a raised marine deposit having an average grain-size distribution of 67 percent gravel, 31 percent sand and 2 percent silt/clay. Petrographic numbers for three samples analyzed range from 116 to 154. The pebble types consisted of over 95 percent slightly weathered dolomite and the remainder moderately weathered sandstone. The sand content of this deposit is low and is heavily stained. Further testing would have to be done to determine if it is suitable for use in concrete.

Plate 4. *Raised marine deposit composed of cobble-size material.*

St. Anthony Airport. The St. Anthony airport deposit is located approximately 50 km southwest of St. Anthony near the airport on Route 430. The deposit is composed of a shallow sandy-pebble marine gravel having an estimated 10 to 15 percent shell content (Plate 5). The deposit has been quarried in the past and is mainly confined to hollows between limestone ridges. A total of sixteen test pits were dug

Plate 5. *Sandy – pebble gravel having a high shell content.*

in the deposit. Eight samples were collected from the test pits and three were taken from exposures along forest access roads.

Average grain-size analysis of 15 samples collected in the St. Anthony airport deposit shows 62 percent gravel, 37 percent sand and less than 1 percent silt/clay. Petrographic numbers of eleven samples range between 100 and 126. The low petrographic number and the low silt/clay content appear to indicate that this deposit is a excellent source of concrete aggregate. However, due to the high shell content (10 to 15 percent), extensive testing would have to be done to determine the effect of the high shell content on its use as an aggregate source for the production of concrete.

WESLEYVILLE AREA

The Wesleyville study area is situated on NTS map areas 2F/4, 5 and 6 and the extreme eastern portion of 2E/8 (Figures 1 and 3). The aim of this project was to identify areas of high-quality surficial deposits that could supply the region with a source of high-quality aggregate.

In the past, most of the aggregate used in the Wesleyville area was obtained from local beaches. In 1975, a program of beach inspections was begun in the province that led to restrictions being placed on beach removal. As a result, alternate sources of aggregate were needed. A major aggregate source was located at Wareham approximately 30 km south of Wesleyville (Figure 3). In recent years, residential development has encroached upon the pit, which is located in the centre of town (Plate 6). This has caused a movement by residents to have the quarry closed permanently. As a result of the potential closure of this deposit, the decision was made to conduct this survey.

The area south of Wesleyville is characterized by extensive rock outcrop with veneers of till in the lee of the

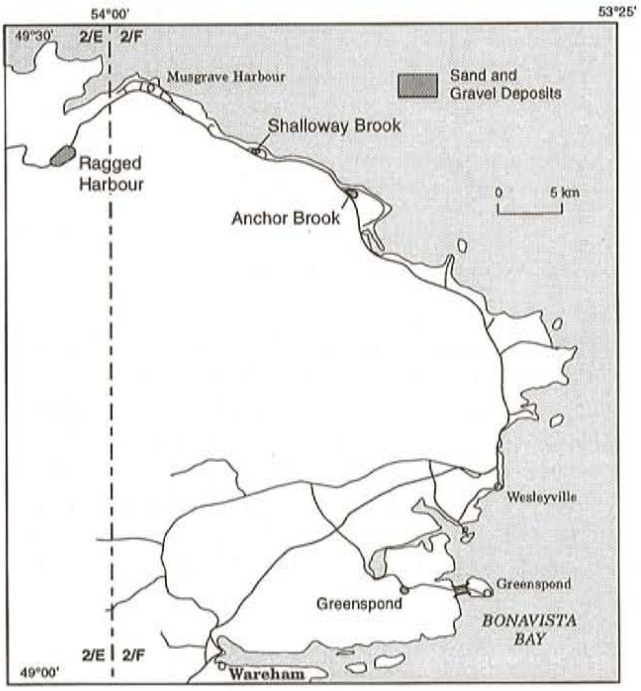

Figure 3. *Proposed aggregate reserve areas in the Wesleyville study area.*

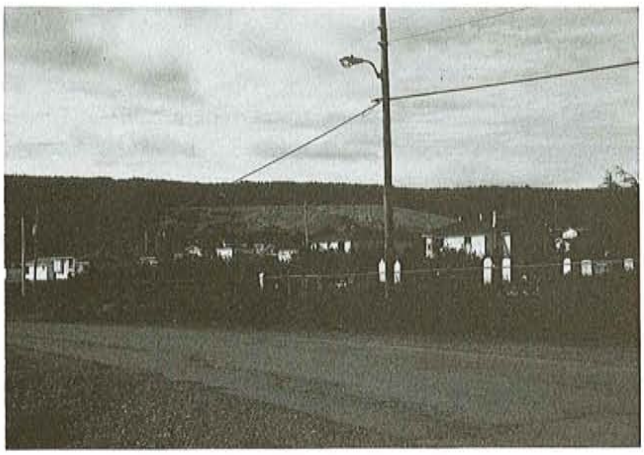

Plate 6. *Location of gravel pit, Wareham, Bonavista Bay.*

hills. To the west, the surficial geology in characterized by extensive bog cover, rock outcrops and thin deposits of marine sediment. This gives way to extensive deposits of glacioflucial sands and gravel in the area west of Musgrave Harbour.

Field work in the area identified four areas that have the potential to supply high-quality aggregate to meet local area needs. These areas are located at Greenspond, Anchor Brook, Shalloway Brook and Ragged Harbour River (Figure 3). The Greenspond deposit is locate midway along the Greenspond access road and has been exploited in the past with much of the high-quality gravel having been extracted. However, there is a large reserve of high-quality sand remaining (Plate 7). This sand is of excellent quality for use as mortar sand or blending sand in asphaltic pavement production. Grain-size analysis from two samples gives an average grain-size distribution of 4 percent gravel, 89 percent sand and 7 percent silt/clay.

Plate 7. *Five to seven metre exposure of fine sand near Greenspond.*

Anchor Brook. This deposit is located approximately 1 km south east of Anchor Brook (Figure 3). The deposit is composed of a 1.5- to 2.5-m-thick sandy, pebble gravel with large angular granite blocks incorporated into the deposit (Plate 8). Analysis of three samples collected from this site give a grain-size distribution of 43 percent gravel, 56 percent sand and less than 1 percent silt/clay. Petrographic analysis conducted on two samples shows a petrographic number of 380. The high petrographic number is mainly the result of a high percentage (28 percent) of moderately weathered coarse-grained granites in the deposit. Further testing would be required before this aggregate source could be used as a source for concrete aggregate.

Shalloway Brook. This deposit is located approximately 1 km northeast of Shalloway Brook. This deposit is composed of 2 to 3 m of sandy pebble gravel. Analysis of samples collected from the site gives an average grain-size distribution of 62 percent gravel, 37 percent sand and less than 1 percent silt/clay. An average petrographic number of 362 was determined from the analysis of three samples. Again the reason for the relatively high petrographic number is the presence of a high percentage of moderately weathered coarse-grained granites.

Ragged Harbour River. This deposit is located 4 km southwest of Musgrave Harbour. Samples taken from this

Plate 8. *Sandy – pebble marine gravel with high boulder content.*

stratified sand and gravel deposit show an average grain-size distribution of 36 percent gravel, 63 percent sand and less than 1 percent silt/clay (Plate 9). An average petrographic number of 344 was determined from analysis of six samples. The presence of highly weathered medium- to fine-grained sandstone and moderately weathered coarse-grained granite has resulted in a poor petrographic quality in this area. Further testing would have to be done to determine if this aggregate could be used in concrete an asphaltic pavement production.

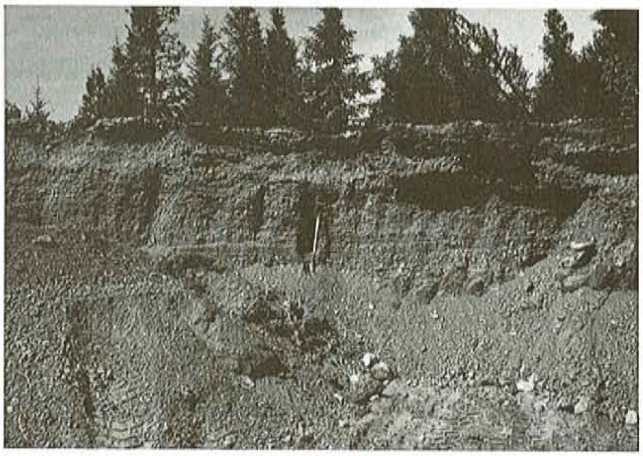

Plate 9. *Stratified sand and gravel in a 5-m quarry exposure, Ragged Harbour.*

MUNICIPAL PLAN REVIEWS

Municipal plan reviews were conducted in the Point Lemington, Botwood, Bishop's Falls, Traytown, Glovertown, Long Harbour, Ferryland and Cape Broyle municipal planning areas (Figure 1). Field work in these areas usually involved a one- to two-day field inspection and involved the remapping of the area with respect to new quarry developments, change in status of pre-existing quarry areas (mined out) and the addition of new aggregate-reserve areas. All new information gathered will be forwarded to the Planning Office of the Department of Municipal and Provincial Affairs for inclusion into the revised plans for these areas.

SUMMARY

Work conducted on the tip of the Great Northern Peninsula resulted in a testpitting program being conducted on three deposits. The Shallow Bay and Lower Cove deposits contain suitable supplies of coarse aggregate but each lacked sufficient quantities of sand for the production of concrete. The raised marine deposits near the St. Anthony Airport although thin, could support a small-scale quarry operation. However, a high shell content (10 to 15 percent) may restrict its use as a source for concrete production.

In the Wesleyville area, the Greenspond deposit has been identified as a source for mortar and blending sand. The Anchor Brook, Shalloway Brook and Ragged Harbour deposits have been identified as having the potential to supply concrete aggregate. However, the petrographic numbers are high (260 to 360), therefore, further testing would be required before it could be determined if they are suitable for use in concrete.

Municipal plan reviews were conducted in Point Leamington, Botwood, Bishops Falls, Glovertown, Traytown, Long Harbour, Ferryland and Cape Broyle. The results of these surveys will be forwarded to the Planning Office of the Department of Municipal and Provincial Affairs for inclusion in the municipal plan updates for these areas. By identifying these resources, they can be protected from conflicting land uses that could prevent aggregate extraction.

ACKNOWLEDGMENTS

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