Appendix 1.

Methodology of this Study

Preliminary Phase

The first step in the process of identifying prospective quarry sites is the examination of background information (maps and data) to narrow the search area. The primary source was a resource evaluation study conducted by Prime (2001) to determine the bedrock aggregate potential of the Halifax-Dartmouth area. A comparison of the aggregate potential map with the land use constraints map generated from this research revealed several areas of resource interest. Subsequent examination of topographic maps, aerial photographs and the land ownership database were used to further narrow the possibilities. Site selection using these tools was based on the following criteria:

(a) Geotechnical suitability of the rock: A primary consideration when looking for a quarry site is the quality of the stone. Using the resource data of Prime (2001), the areas of focus were those granitic rock types capable of producing high quality aggregate. Within these rock units, the choice of sites was narrowed by looking at a variety of other geological factors which would have a significant influence on the quality of stone. Characteristics deemed negative to aggregate performance included proximity to geological contacts, alteration minerals, surface weathering, shearing and brecciation. Surficial features such as deep weathering zones and thick overburden were considered negative to stone quality and the economics of developing a quarry respectively. A more detailed look at geological features which can affect quarrying is provided in Appendix 4.

(b) Proximity to market: Another important consideration in determining the viability of a site for quarrying would be its location relative to the market. One can have the best aggregate possible, but if it cannot be delivered to the customer at a competitive price, the likelihood of success is not promising. The costs of blasting, extracting and beneficiation of crushed stone for most quarries is similar. However, the delivery charge of the materials to the customer depends on haulage distances which can strongly favour one quarry over another. It is imperative that a new quarry be located as close to the market as possible in order to be competitive. The locations for this study were selected on the basis of their proximity to the aggregate markets.

(c) Accessibility: The sites should be easily accessed from major highways; for the purpose of this study this meant proximity to limited access highways (100 series). Access barriers, such as subdivisions, rail lines or wetlands, may impede development. Haulage roads, for example, may not be allowed in some areas or could be very expensive to construct in others. Sites which could only be accessed through residential areas were eliminated as resource candidate areas.

(d) Land use concerns: A potential quarry site may meet the basic regulatory requirements of aggregate resource development and still be unsuccessful if conflicting land uses are present in the area. As previously discussed, a host of factors can significantly reduce the probability of acquiring a quarry permit. During the screening process for this study the authors tried to identify sites where potential land use conflicts appear to be at a minimum.

(e) Property ownership: From a land use perspective, a large property with one owner was deemed preferable to a number of small land holdings. A permanent quarry, with a long life span, could directly or indirectly have an impact on hundreds of hectares of land for 25-100 years. Although the footprint of the actual quarry may be a few tens of hectares in area, the buffers required around its perimeter to satisfy blasting setbacks, for example, would be substantially larger. Trying to negotiate an agreement with several land owners on issues such as permanent buffer zones around a quarry and right-of-ways to access the quarry could be a difficult to impossible task. In addition, land owners who were perceived by the authors to have long term commitment to their land holdings were viewed as having the best development potential. This decision was based on the premise that the continuing escalation of land values for residential and commercial development would most likely result in the constant concern of encroachment problems near the quarry site in an area of multiple land owners. By developing a quarry within a large land holding this worry is largely removed. Provincial Crown lands were also examined because of the government's integrated resource management approach to these lands.

Field Phase

The second phase of the project comprised a field study and sampling program. The initial fieldwork was of a reconnaissance nature, to locate target areas. Target location selection was based on, (1) where the best bedrock potential existed, and (2) the presence of outcrops which could be sampled using simple hand tools. The samples were almost always collected from bedrock exposed in road cuts or borrow pits. This was preferred because, until recently, the rock was covered by till and somewhat protected from surface weathering. Approximately 50 kg of stone were collected using a pinch bar, sledge hammer and wedges (Figs. 9a and 9b). Care was taken to retrieve samples which were representative of the outcrop. Some of the rock required trimming to remove surface weathered materials.

Analytical Phase

The analytical phase included the testing of the samples for aggregate quality and a compilation and synthesis of the results to determine if any of the sites are suitable for quarrying. The samples were processed by the Minerals Engineering Centre at Dalhousie University, Halifax. This included crushing, washing and screening in preparation for aggregate tests which were conducted at Jacques Whitford Materials Limited, Dartmouth. The tests conducted for this study are typical of the requirements for construction aggregate used in asphalt, Portland cement concrete and loose (no binder) aggregate for road applications. They comprised LA Abrasion Loss, Absorption, Bulk Relative Density, Petrographic Number and Micro-Deval Loss. A discussion of test methods and specifications for the tests are described in Appendixes 2 and 3 of Prime (2001). Upon the completion of the test work, the results were scrutinized to determine which bedrock locations had the most promise. By comparing these data to the topographical maps and the land use information, final site selection could be determined.

Figure 9a. The hand tools used in sample collection included a pinch bar, sledge hammers and chisels.

Figure 9b. Samples were typically taken from small outcrops.