

TABLE OF CONTENTS

SUMMARY.....	i
Foreword.....	i
Aggregate Supply to the Lower Mainland.....	ii
The Available Aggregate Resource.....	iii
Factors Impacting on Demand.....	iv
Industry Perspective and Constraints.....	v
1.0 INTRODUCTION	1
2.0 OBJECTIVES OF THE STUDY	3
3.0 ORGANIZATION OF THE STUDY	4
3.1 Format	4
3.1.1 Species of Aggregate.....	4
3.1.2 Conversion Factors	5
3.1.3 Groups Contacted.....	6
3.2 Methodology	6
3.2.1 Industry Survey	6
3.2.2 Data Analysis	7
3.2.3 Technological Change	8
4.0 SUPPLY	9
4.1 Background Information.....	9
4.2 Dredging	11
4.2.1 Fraser River	11
4.2.2 Marine - Local	15
4.2.3 Marine - Coastal.....	15
4.3 Deposits.....	16
4.3.1 Quarries	16
4.3.2 Coastal Sources.....	17
4.3.3 Fraser Valley.....	17
4.3.4 Squamish - Lillooett.....	19
4.3.5 Land Based Aggregate Production	19
4.4 Aggregate Sourcing Permit Requirements.....	21
4.4.1 MoE	22
4.4.2 MoELP and Other Ministries.....	22
4.4.2.1 Habitat Protection.....	22
4.4.2.2 Ministry of Forests	22
4.4.2.3 Crown Lands.....	22

**TABLE OF CONTENTS
(CONTINUED)**

4.4.3	DFO	23
4.4.4	FRHC	23
4.4.5	ALC	23
4.4.6	Regional Governments	23
4.4.7	Municipal Governments	24
4.4.8	Summary of Permit Requirements	25
4.5	Industry Comments	27
4.6	Summary of Supply Quantities	28
5.0	DEMAND	29
5.1	Impact of Development	29
5.1.1	Residential	29
5.1.2	Commercial/Industrial	29
5.1.3	Institutions	30
5.1.4	Infrastructure	31
5.1.4.1	Municipal Roads	31
5.1.4.2	Underground Services	36
5.1.4.3	Ministry of Transportation & Highways	37
5.2	Specialty Products	37
5.3	Impact of Large Construction Projects	38
5.3.1	General	38
5.3.2	Current Projects	40
5.3.2.1	Vancouver International Airport	41
5.3.2.2	Deltaport Container Terminal Project	43
5.3.2.3	Highway 1 High Occupancy Vehicle (HOV) Lanes - MoTH	43
5.4	City of Vancouver	44
	(Aggregate Handling and Asphalt and Concrete Recycling Plant)	
5.5	Market Areas - Lower Mainland Aggregate Study	46
5.6	Portland Cement Consumption	47
5.7	Information From Large Contractors	49
5.8	Impact of Technological Development on Aggregate Demand	49
5.8.1	Background	49
5.8.2	The Future for Recycling	50

5.9	Future Demands	51
6.0	AGGREGATE RESERVES	52

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

TABLE 1	Conversion Factors	a) Primary	5
		b) Supplementary	5
TABLE 2	Average Annual Dredging of Sand from the Lower Fraser River.11		
TABLE 3	Fraser River Dredging Volumes Below Patullo Bridge		
TABLE 4	Projected Average Annual Demand for Dredge Sand Fill in the GVRD.....		
TABLE 5	Lower Mainland Landbased Mineral Aggregate Production		
TABLE 6	Summary of Municipal Soil Removal and Deposit Fees and Issues Related to New Gravel Extraction Permits		
TABLE 7	1995 Aggregate Production (Tonnes x 1000)		
TABLE 8	Total Area of Schools Constructed and Total Aggregate Consumption		
TABLE 9	Average School Area and Concrete Aggregate Consumption....		
TABLE 10	Percentage of Roads by Type of Surface Roads		
TABLE 11	Road Gravel Consumption.....		
TABLE 12	Municipal Roads Total Length of Road - Kilometres		
TABLE 13	Aggregate Used in Municipal Roads and Services Tributary to Various Developments.....		
TABLE 14	Aggregate Consumption for Rehabilitation of Roads and Services (1994/1995)(Tonnes).....		
TABLE 15	Total Sewer and Watermain Distance (kms).....		
TABLE 16	Ministry of Transportation and Highways Aggregate Consumption (Tonnes) in the Lower Mainland		
TABLE 17	Quantities in Major Projects		
TABLE 18	Vancouver International Airport Expansion - Aggregate Demand.....		
TABLE 19	Vancouver International Airport - Aggregate Demand Reclassified to Species Here.....		
TABLE 20	Deltaport Aggregate Consumption.....		
TABLE 21	Projected Aggregate Consumption for Hwy 1 HOV Lanes		
TABLE 22	City of Vancouver - Purchase of Mineral Aggregates (Tonnes) ..		
TABLE 23	Concrete Aggregate Consumption in Lower Mainland Past and Projected		
TABLE 24	Estimated Sand and Gravel Aggregate Reserves.....		

TABLE OF CONTENTS (CONTINUED)

FIGURE 1	Plan of Study Area
FIGURE 2	Location of Active Aggregate Sources to Study Area
FIGURE 3	Locations of Principal Dredging Sites on the Lower Fraser River
FIGURE 4	Flow Chart of Typical Current Example of Approval Process for Application to Develop a Gravel Removal on Private Land
FIGURE 5	1995 Aggregate Production
FIGURE 6	Typical Road Section for Estimating Aggregate Usage
FIGURE 7	Lower Mainland Market Areas
APPENDIX A	Information Sources - Groups Contacted in the Survey
APPENDIX B	References for the Study
APPENDIX C	MoEI Position on Gravel Operation Approval
APPENDIX D	Maintenance Dredging Guidelines
APPENDIX E	Calculations for Table 13 - Aggregate Values for Various Developments
APPENDIX F	Portland Cement Consumption in British Columbia

ACRONYMS USED IN THIS REPORT

- ALC Agricultural Land Commission
- ALR Agricultural Land Reserve
- BIERC Burrard Inlet Environmental Review Committee
- DFO Department of Fisheries and Oceans
- FRHC Fraser River Harbour Commission
- FVRD Fraser River Regional District
- GVRD Greater Vancouver Regional District
- MoEI Ministry of Employment and Investment
- MoELP Ministry of Environment, Lands and Petroleum Resources
- MoMA Ministry of Municipal Affairs
- MoTH Ministry of Transportation and Highways
- PWC Public Works Canada