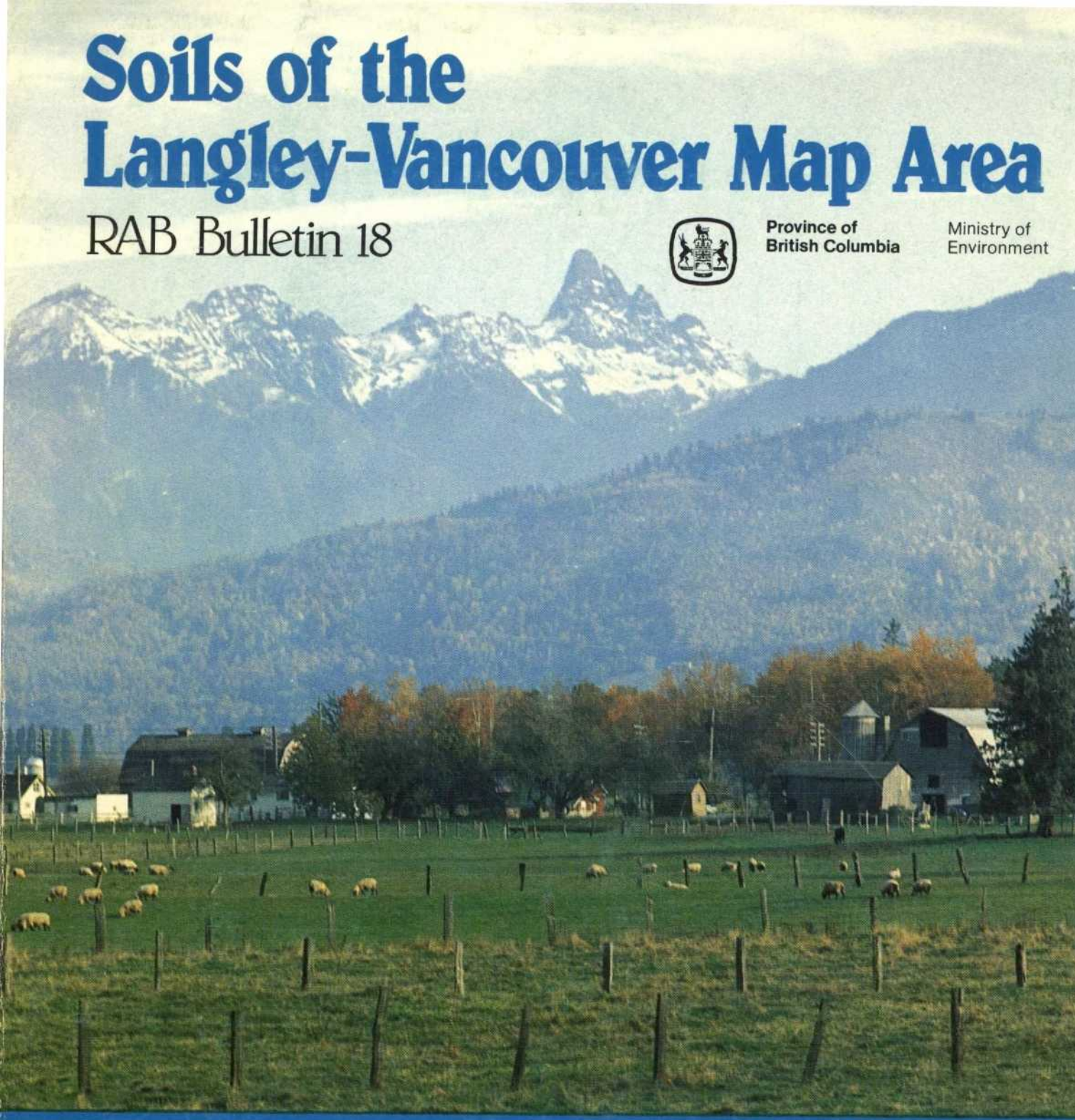
Soils of the Langley-Vancouver Map Area

RAB Bulletin 18

Province of British Columbia
Ministry of Environment



Volume 3

ISSN 0375-5886

Cover photo: Fraser Valley near Mission.
TOURISM B.C. PHOTO

Design & Layout
TERRESTRIAL STUDIES BRANCH

Province of British Columbia
Ministry of Environment
ASSESSMENT AND PLANNING DIVISION

RAB Bulletin 18

SOILS OF THE LANGLEY—VANCOUVER MAP AREA

Report No. 15
British Columbia Soil Survey

VOLUME 3

Description of the Soils

by

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Kelowna
1981

Canadian Cataloguing in Publication Data

Luttmerding, H. A., 1938-
Soils of the Langley-Vancouver map area

(RAB bulletin, ISSN 0228-5460 ; 18) (British Columbia soil survey, ISSN 0375-5886 ; report no. 15)

Contents: v. 3. Description of the soils --
ISBN 0-7719-8435-9

1. Soils - British Columbia - Lower Mainland region. 2. Soils - British Columbia - Lower Mainland region - Maps. I. British Columbia. Ministry of Environment. Assessment and Planning Division. II. Title. [III. Title: Description of the soils.] IV. Series. V. Series: British Columbia soil survey ; report no. 15.

S599.1.B7L87 631.4'771133 C81-092013-1

INTRODUCTION

The first soil survey of the Lower Fraser Valley was completed in the late 1930's (Kelley and Spilsbury, 1939). This valuable publication served its users for many years but as agricultural and other land use problems became increasingly complex, the realization grew that a more detailed, larger-scale soil survey was required. To meet this need, a resurvey of the Lower Fraser Valley was initiated in the late 1950's with field mapping completed in the early 1970's. Included as well in the survey area were the adjacent Coast Mountains and the southern part of the Sunshine Coast. The original impetus for the resurvey was supplied by the Assessment Commissioner, B.C. Department of Finance who requested assistance in developing uniform land assessments in the Lower Fraser Valley. His request (for more detailed soil information) was strongly supported by a variety of other soil and land users.

As the survey progressed, preliminary reports and soil maps (scale 1:24 000) were prepared, generally on a municipal base. A total of eleven separate maps and ten reports were published. This report, *Soils of the Langley-Vancouver Map Area,* collates, summarizes and updates the soil information contained in most of the preliminary series as well as presenting new information not published previously.

Field mapping procedures and soil classification techniques changed over the period of years required for the soil survey. Users of the preliminary maps and reports probably have noticed differences in terminology and soil classification among them. The present report, as much as possible, updates the information contained in the preliminary series to current standards (The Canadian System of Soil Classification, 1978) and presents it in a uniform, consistent manner. Both hard and soft conversions to metric measures occur (because of the time period during which this report has been compiled).

Soils of the Langley-Vancouver Map Area encompasses an area bounded on the west by the Strait of Georgia and on the east by 122°00′ west longitude (a north-south line passing between Chilliwack and Sumas Canal). The southern boundary is the Canada—United States of America border (49th parallel) while 49°30′ north latitude forms the northern boundary. Included are the central and western parts of the Lower Fraser Valley, the southern part of the Sunshine Coast and the southern edge of the Coast Mountains east to Chehalis Lake. Users will note that some areas, particularly in the vicinity of metropolitan Vancouver, are not mapped or classified. These consist mainly of areas which were already either partially or completely urbanized (or industrialized) at the time of the field survey.

Soils of the Langley-Vancouver Map Area is being produced, published and distributed in six volumes. **Volume 1** consists of soil map mosaics (1:25 000 scale) with legend, which cover the Lower Fraser Valley portion of the map area. **Volume 2** contains soil maps (1:50 000 scale) with legend, that encompass the remainder of the map area, mainly the southern Sunshine Coast and Coast Mountains. **Volume 3** ***(this publication)*** describes in detail the soils mapped and classified in volumes 1 and 2. It also generally discusses the environmental characteristics of the map area and contains a glossary and list of references. **Volume 4** consists mainly of interpretations for specified engineering uses of the soils described in volume 3 (and mapped in volumes 1 and 2). It contains information regarding soil suitability (or limitations) for septic tank effluent disposal, basement construction and other urban-related land uses. Also included are some interpretations for forest management concerns as well as interpretations for recreational endeavours. **Volume 5** is agriculturally oriented and contains information regarding agricultural cropping and management. Included also in this volume are revised soil capability for agriculture maps which replace those currently available. These maps are prepared at the scale of the soil maps in volumes 1 and 2. They are more detailed than the original, provisional series, incorporate more definitive climatic data into the ratings and show improved (drained and/or irrigated) capability ratings as well as ratings when these management inputs are not considered. **Volume 6** consists of the detailed, technical soil profile descriptions of the soils described in Volume 3. It also contains the results of

chemical and physical analyses of the sampled soils (or individual soil horizons). Only a limited number of copies of volume 6 are being produced, mainly for those persons who have day-to-day use for this detailed, specific data. Since this information is also stored in the British Columbia Soil Information System others can, as required, request the data (or portions of it) directly from the data file by contacting the Assessment and Planning Division Map Library, B.C. Ministry of Environment, Victoria, B.C.

This publication (Volume 3) consists mainly of three chapters. **Chapter 1** briefly describes the physical, social and environmental characteristics of the map area in terms of location, climate, vegetation, physiography, bedrock and surficial deposits. The surficial geologic deposits are discussed in somewhat more detail since they form a stratification in the soil mapping and classification methodology. **Chapter 2** describes the field mapping methodology and soil classification while **Chapter 3** describes, in detail, the characteristics of the individual soils as well as making general comment regarding their suitability (or limitations) for a variety of land uses.

HOW TO USE THE SOIL MAPS AND REPORT

Long-term soil resource managers such as farmers usually know the characteristics and variations of the soils in their immediate locality. However, unless a soil map and report is available, comparison with other soils in the area or region is impossible. Regional (and local) similarities and differences among soils are evident after a soil map has been made. Proven (or new) management techniques on a soil may then be transferred to the same or similar soils elsewhere with the least chance of failure.

To effeciently use this soil survey report (it consists of 6 volumes), the following procedure is suggested:

(1) Generally locate the area of concern on the "Index of Map Sheets" which immediately precede the soil map mosaics in Volume 1 and soil maps in Volume 2 of this report. Note the number(s) of the map sheet(s) which cover the area under consideration. Generally, lands in the Lower Fraser Valley are covered in **Volume 1** while areas on the Sunshine Coast or in the Coast Mountains are contained in **Volume 2**.

(2) Turn to the appropriate map sheet(s) and locate in detail the area of concern. Lakes, creeks, and rivers and other natural features as well as cultural detail including main roads, railways, communities, and section numbers are shown to assist in location.

(3) Note the soil map symbols in the map delineations (polygons) which encompass the area(s) under consideration.

(4) Consult the soil legend for a description of the soil map symbols. The topographic and stoniness class symbols are described here as is the soil parent material and drainage classification. Also given is the name(s) of the soil(s) identified by a symbol in the soil map polygon(s).

(5) Locate the named soil in **Volume 3** of the report. A detailed description of the soil is given here as well as its general suitability (or limitations) for a variety of uses.

(6) Refer to **Volumes 4** and **5** for specific land use interpretations of the named soils. Volume 4 deals with engineering characteristics related mainly to urban and associated land uses, as well as interpretations dealing with some forest management concerns and recreational endeavours. Volume 5 contains land capability for agriculture maps which are at the same scale as the soil maps in Volumes 1 and 2. These capability maps supercede the currently available provisional series (1:50 000 scale). They are at a larger scale, incorporate more definitive climate data and show improved (drained and/or irrigated) ratings as well as ratings when these management inputs are not considered. Also contained in Volume 5 are soil groupings and interpretations relating to agricultural land management.

(7) Users requiring the detailed, site specific, technical soil profile descriptions and associated physical and chemical analyses are referred to **Volume 6** or, if this information is required only on an irregular basis, to the British Columbia Soil Information System. (Contact the Assessment and Planning Division Map Library, B.C. Ministry of Environment, Victoria, B.C.).

Users of the soil maps and report should note that soils are differentiated on the basis of characteristics to a depth of a metre or more. Even though several soils have similar surfaces, subsurface and subsoil character can vary widely. Users should also understand that each soil exhibits a range of properties and that boundaries between different soils are not necessarily well defined. The boundaries shown on the soil maps are the best estimate of where soil characteristics change sufficiently to warrant identification of another soil.

ACKNOWLEDGEMENTS

The soil survey of the Langley-Vancouver map area was initially undertaken under the auspices of the British Columbia Ministry of Agriculture and field mapping and data gathering was completed while the author was with that Ministry. The Ministry's support and funding is acknowledged.

Gratefully acknowledged also are the numerous persons who assisted in the field mapping and those who freely supplied guidance and direction during the course of the survey. They are too numerous to list here but are individually identified in the several published preliminary reports. Specially acknowledged is Dr. T. Lewis who conducted most of the field mapping and data gathering in the Coast Mountains portion of this report.

The assistance and information provided by Dr. J.E. Armstrong, Geological Survey of Canada, regarding glacial history and surficial geology of the Lower Fraser Valley is also specially acknowledged.

Aerial photographs, used as field map sheets, were provided by Surveys and Mapping Branch, British Columbia Ministry of Environment. The excellent soil map mosaics and soil legend contained in Volume 1 were prepared by the Cartography Section, Land Resource Research Institute, Agriculture Canada, Ottawa.

Specially acknowledged is the contribution of Dr. B. Cann, retired, who collated much of the data from the individual preliminary reports and prepared draft descriptions of many of the soils contained herein. The positive editorial direction and encouragement provided by the Editorial Committee under the chairmanship of P.N. Sprout is acknowledged and greatly appreciated. The committee included Dr. T. Lewis (private consultant), M.G. Driehuyzen (British Columbia Ministry of Agriculture and Food) and Dr. L. Lavkulich (University of British Columbia). To all others who so cheerfully and freely contributed to the success of this project but are unable to be individually acknowledged, the author extends a collective, heartfelt thank you.

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CHAPTER ONE

GENERAL DESCRIPTION OF THE LANGLEY-VANCOUVER MAP AREA

LOCATION AND AREAL EXTENT

The Langley-Vancouver map area is located in the extreme southwest of mainland British Columbia (Figure 1). It lies immediately north of the Canada-United States of America border and extends northward into the Coast Mountains to 49°30′ north latitude. It stretches eastward from the Strait of Georgia to a north-south line passing between Sumas Canal and Chilliwack and northward through Chehalis Lake (122°00′ north longitude).

The soil surveyed areas encompass essentially all of the agricultural land as well as parts of urbanized or industrialized areas which fall within the project boundaries. Included also is the forested, mountainous land in the northern part of the map area and on Vedder and Sumas Mountains. The total area of mapped and classified land consists of about 402 000 ha of which about 189 000 ha are depicted on the soil map mosaics (Volume 1) and 213 000 ha on the line maps (Volume 2).

SOCIAL AND LAND USE CHARACTERISTICS

The Langley-Vancouver map area covers the most densely populated part of British Columbia and competition among agricultural, urban, industrial, recreational and forest land uses is very strong. The map area

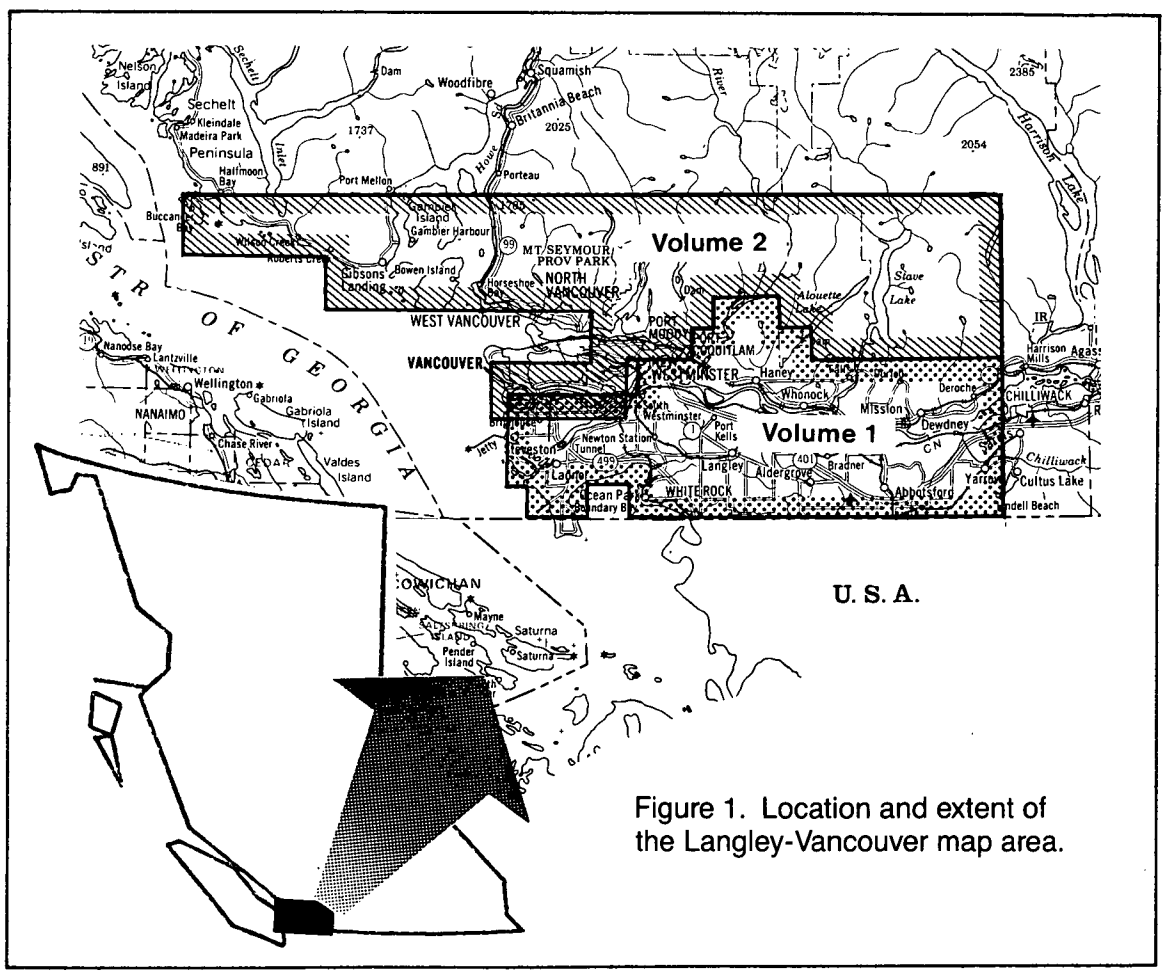


Figure 1. Location and extent of the Langley-Vancouver map area.

Plate 1 View northward over downtown Vancouver to the Coast Mountains. North Vancouver occupies the lower mountain slopes. Stanley Park is the forested area on the middle left. (Tourism B.C. photo).

includes all of the Regional District of Central Fraser Valley, almost all of Greater Vancouver Regional District, as well as parts of the regional districts of Fráser-Cheam, Dewdney-Alouette and Sunshine Coast. Collectively, incorporated municipalities within these regional districts had an estimated population of 1308807 people in 1977, of which over one million were in the Greater Vancouver Regional District (The Ministry of Municipal Affairs and Housing, 1978).

The settled parts of the map area are well provided with most of the accepted social amenities. A good network of hard-surface highways, roads, and streets as well as scheduled ferries provide access to all areas. International and regional air travel facilities are provided by Vancouver International Airport and several smaller airports supply facilities for private airplanes. The Vancouver-New Westminster area is the main westcoast seaport of Canada and contains the usual facilities associated with this type of enterprise. Electricity and telephone service is available throughout the area and daily mail delivery is provided almost everywhere. The larger population centres have community water and sewage systems while rural areas derive their water supplies from individual wells and dispose of sewage through septic systems.

Agriculture is the main land user in the Lower Fraser Valley. According to the British Columbia Ministry of Agriculture and Food, the total farm gate value of Provincial agricultural production is $750 million (1980). Of this, 51% is produced in the Valley. Dairying and associated forage crops, poultry, beef, small fruits, vegetables (including field peas, beans, corn and potatoes) and some cereal grains are the main commodities. Greenhouse crops are important in some areas. Urban and industrial pressures, although still strong, are controlled on

land designated as agriculture land reserves by the British Columbia Agricultural Land Commission. Many land parcels, particularly in the 'upland' areas, are small in size and are used basically as urban sites in a rural setting. Adjacent to the existing metropolitan area and around most of the larger towns much good agricultural land has in the past been converted to urban, commercial or industrial uses.

Forestry is a major land use in the mountainous northern part of the report area. Several managed and protected watersheds north of Vancouver provide the metropolitan area with abundant, excellent quality domestic water. Several provincial and regional parks, providing a wide variety of year-around, recreational facilities are also present. Cottaging and water oriented recreation uses are important on the Sunshine Coast and on Bowen and Gambier Islands.

Plate 2 Log booming area on the Fraser River. The Fraser River is an important transportation corridor for moving logs to processing mills in the Vancouver area.

CLIMATIC CHARACTERISTICS

The Pacific Climatic Region (Hare and Thomas, 1979), into which the Langley-Vancouver map area falls, can generally be characterized as having warm, rainy winters and relatively cool, dry summers. During winter a fairly steady succession of low pressure systems moving eastward from the Pacific Ocean produce among the cloudiest and rainiest conditions for any part of Canada. In contrast, the summers have frequent long periods of sunny weather as high pressure cells extend over the coast. Temperatures are warm and rainfall is low. Soil moisture deficiencies frequently develop and irrigation is required on many soils to maintain good agricultural production.

Appendices A, B and C are tables which present a variety of climatic data for some representative stations in or near the Langley-Vancouver map area. *Appendix A* indicates that mean annual temperatures are quite uniform for most lower elevation locations in the map area. Substantial reductions however, occur with increased elevation (see Hollyburn Ridge). The range in mean monthly temperatures tends to widen with increased distance from the ocean, a trend that is also evident in extreme low and high temperatures recorded. Not unexpectedly, mean annual, monthly mean and extreme high and low temperatures all decrease with increasing elevation.

Appendix B provides precipitation data for several representative stations. Mean annual precipitation is high, mostly much in excess of 1000 mm and increases inland from the ocean and especially with increased elevation. Snowfall follows a similar trend. Most precipitation occurs during the fall, winter and early spring while

during the growing season (May to September), average monthly precipitation is frequently less than 50 mm, especially in areas at low elevations and near to the ocean.

Table 1 shows the average May to September potential evapotranspiration (PE), average seasonal precipitation (P) and their difference (P–PE) for several stations in or near the Langley-Vancouver map area. It indicates that potential evapotranspiration exceeds precipitation for almost all low elevation locations and that, particularly in the coarser-textured soils, drought conditions are likely to develop. In the mountains (Coquitlam Lake), potential evapotranspiration tends to be lower and precipitation higher, making soil moisture deficiencies less likely.

TABLE 1

Average seasonal (May–Sept) potential evapotranspiration (PE), average seasonal precipitation (P) and difference (P–PE) for several stations in or near the Langley-Vancouver map area

Station	Avg. Seasonal PE (mm)	Avg. Seasonal P (mm)	P–PE (mm)	Elevation (M)
Abbotsford (airport)	381	306	–75	60
Agassiz (CDA)	340	369	29	15
Chilliwack	382	375	–7	7
Coquitlam Lake	327	639	312	161
Hope	368	303	–65	38
Vancouver (Int. Airport)	379	221	–158	5
White Rock	336	231	–105	61

Source—Air Studies Branch, B.C. Ministry of Environment

The longest frost-free periods in Canada occur on the Pacific Coast of which the Langley-Vancouver map area is part. *Appendix C* contains frost data for several stations in the region and shows that the average frost-free period varies from about 170 to 210 days, depending on location. In the mountains, increasing elevations produce corresponding decreases in frost-free period. Growing degree days (>5° C) range from about 1700 to 2100 days for most lower elevation locations.

Hours of bright sunshine occur mainly during the summer months. Out of about 1925 hours per year at Vancouver International Airport, 1420 hours occur during May to September, inclusive.

VEGETATION

The native vegetation in the Langley-Vancouver map area reflects the relatively warm temperatures and high rates of precipitation that occur. The lower elevations (below about 500 m) lie in the Coastal Douglas-fir Biogeoclimatic Zone (Krajina, 1965) or, by Rowe's classification, in the Strait of Georgia and Southern Pacific Coast sections of the Coast Forest Region (Rowe, 1972). The dominant natural tree species are coast Douglas-fir, western hemlock and western red cedar. In many areas this climax forest has either been removed or strongly altered by logging and land clearing. Red alder and bigleaf maple often vigorously invade logged areas, to the detriment of coniferous regeneration. Arbutus occurs along the coastal fringe and black cottonwood is usual in alluvial areas where Sitka spruce is also present.

Between about 500 and 1000 m elevation occurs Krajina's Coastal Western Hemlock Zone (this zone is still part of Rowe's Coastal Forest Region). In this cooler and moister climate, western hemlock dominates although western red cedar also occurs as does coast Douglas-fir at the lower elevations. Pacific silver fir is common at the upper elevations and yellow cedar is usually also present.

From about 1000 m elevation to tree-line occurs the Mountain Hemlock Zone (Krajina) or the Coastal

Subalpine Section of the Subalpine Forest Region (Rowe). Here mountain hemlock, Pacific silver fir and yellow cedar are the dominant trees. This zone grades into the Alpine Zone at elevations above 1500 to 1800 m. Exposed bedrock dominates parts of the upper Mountain Hemlock Zone and much of the Alpine Zone.

BEDROCK

Exposed bedrock is uncommon south of the Fraser River except on Sumas, Vedder and Chilliwack mountains. The rock is usually buried by 150 m or more of unconsolidated deposits (Armstrong, 1957) in most of the valley. Sumas Mountain consists mainly of granitic and volcanic bedrock, mostly andesite, quartz diorite and granodiorite although in the Kilgard area some sedimentary rocks also occur. Chilliwack Mountain is composed dominantly of volcanic rock while Mount Vedder is green graywacke, conglomerate, shale and arkose with a strip of variable, highly metamorphosed rock along the northwest slope.

The extreme southeast corner of the map area intrudes into the Cascade Mountains which here are mainly argillite and shale.

The Coast Mountains occupy the northern part of the map area and are composed dominantly of Coastal Plutonic rocks including granite, granodiorite and quartz diorite (Roddick, 1965). In a few, isolated areas, such as on Blue Mountain, conglomerate and sandstone also occur. Grant Hill and an area near Silverdale are basaltic while Nicomen Mountain and the area south and west of Chehalis Lake is mainly andesite and dacite porphyry. Remnants of the Tertiary erosion surface also cap scattered areas elsewhere including Seymour and Hollyburn mountains. Central and eastern Gambier Island and the lower slopes along the east side of Howe Sound consist of a variety of volcanic and metamorphic rock while most of Bowen Island and the Mt. Elphinstone area is greenstone, chert and graywacke. Apart from Mt. Elphinstone and South Thormanby Island which are mostly volcanic rock, the Sunshine Coast (in the map area) is mainly Coastal Plutonic rock similar to that east of Howe Sound (Roddick and Wordsworth, 1979).

PHYSIOGRAPHY AND DRAINAGE

The Langley-Vancouver map area contains parts of three physiographic subdivisions (Holland, 1976). The mountainous areas are mainly part of the Pacific Ranges of the Coast Mountains, although a small part of the Skagit Range of the Cascade Mountains intrudes into the extreme southeast corner of the map area. The Lower Fraser Valley falls in the Fraser Lowland subdivision which, together with the lower elevations along the Sunshine Coast, are part of the Georgia Lowland.

The Georgia Lowland essentially follows the contact between the granitic rocks of the Coast Intrusions and older rocks of the Vancouver Group and others that lie to the west. It is typically a dissected, late Tertiary erosion surface which is warped and rises gradually east and northward until it is sufficiently high in the Coast Mountains to be completely dissected and destroyed. In the map area it consists mostly of gently sloping upland surfaces.

The Fraser Lowland is part of the Georgia Lowland from which it differs in being of depositional rather than erosional origin. It extends in a triangular shape from Georgia Strait eastward to Laidlaw (about 110 km), thence southeast to the coast at Bellingham, Washington and includes the delta of the Fraser River. It is bounded on the north by the Pacific Ranges of the Coast Mountains and on the southeast by the Skagit Range of the Cascade Mountains, all of which rise abruptly from the plain.

The Fraser Lowland consists of extensive low hills (in this report called uplands) ranging in elevation from about 15 to 300 m separated by wide, flat-bottomed valleys (Armstrong, 1956, 1957, 1960). The uplands, as described by Armstrong, are of four main types:

(1) A core of glacial till and glaciomarine deposits with rolling, hummocky surfaces;
(2) a core of unconsolidated deposits with commonly flat, terraced surfaces of glacial outwash;
(3) a bedrock core overlain by a thin mantle of glacial till and glaciomarine deposits; and
(4) raised marine deltas with a possible core of bedrock.

The uplands are separated by flat-bottomed valleys up to 5 km wide and ranging in elevation to about 25 m. The main valleys are the present valley of the Fraser River; the valley occupied by the Pitt River from Pitt Lake to the Fraser River; the Alouette River valley from north of Haney to the Pitt River valley; the upper Nicomekl-Salmon River valley; the lower Nicomekl-Serpentine River valley and the lower part of Campbell Creek valley. All these

Plate 3 Dyke along the Fraser River in Matsqui valley. The lowlands of the Lower Fraser Valley are protected from periodic flooding by an extensive system of dykes.

valleys, except the present valley of the Fraser River, are considered to be former embayments of the sea and were not cut by the present streams.

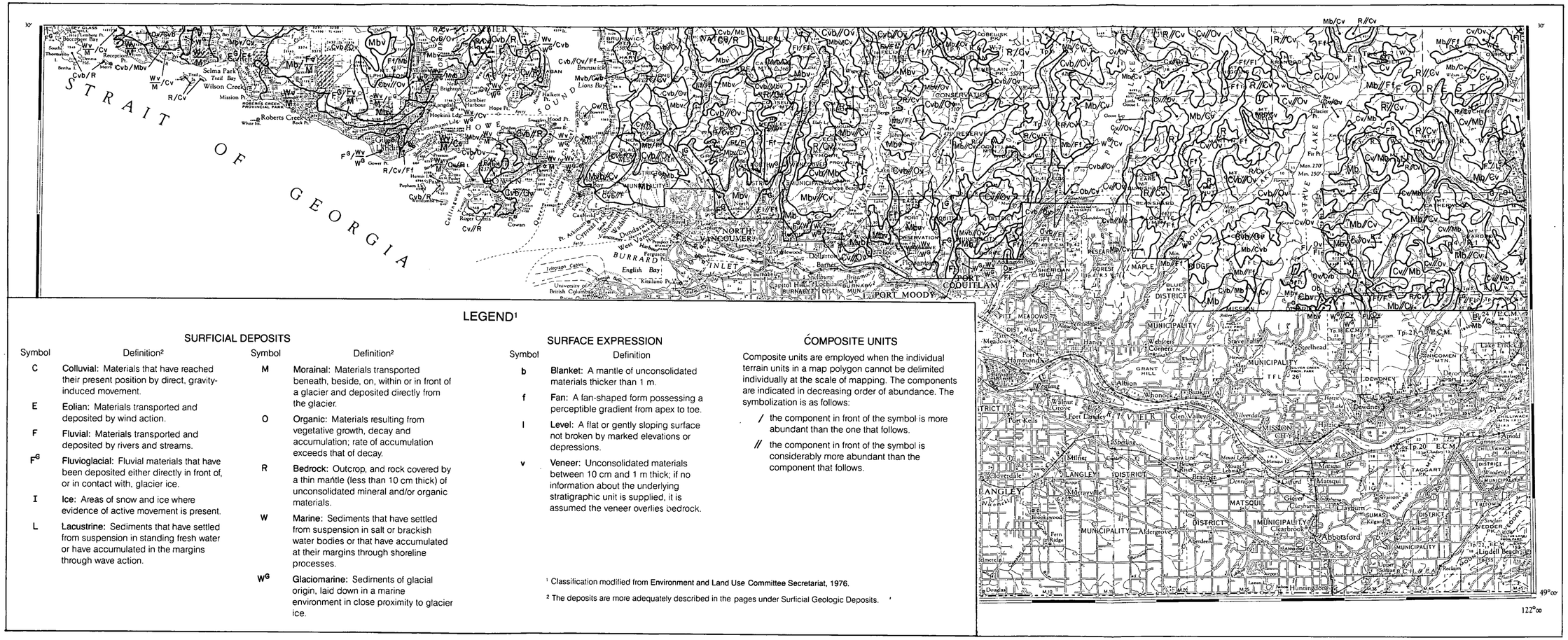
During the Pleistocene, several glacial advances occurred. Ice accumulated to depths of at least 2500 m and the land was depressed relative to the sea. Based on the occurence of marine fossils, the submergence amounted to at least 180 m and may have been as much as 300 m (Armstrong, 1957).

A variety of geologic deposits of Pleistocene origin have resulted from the complex geological history of the Georgia Lowland. These include
several kinds of marine and glaciomarine deposits, glacial till and glacial outwash terraces, plains and deltas. Eolian veneers cover many of these deposits, particularly in the eastern part of the map area. Colluvium, silty and sandy fluvial deposits and organic accumulations of Recent origin occur as well.

Immediately north of the Georgia Lowland are the Pacific Ranges of the Coast Mountains. These essentially granitic mountains, which rise on a long slope of about 15 degrees from the Lowland, are deeply incised by numerous streams and rivers. In the map area elevations range to 3000 m, culminating usually in steep, rocky peaks and ridges. A few permanent snowfields and glaciers occur such as that on Mt. Robie Reid. Surficial geologic deposits consist mostly of varying depths of colluvium on very steep slopes and glacial till (morainal deposits) in more gently sloping areas. Deposits in the lower elevation valleys are mostly glacial outwash, fluvial fan and alluvial deposits with glaciolacustrine deposits present in some larger valleys as well.

The Cascade Mountains occur only in the extreme southeast of the Langley-Vancouver map area and here consist mainly of strongly folded and metamorphosed sedimentary and volcanic rocks. In the map area they are mainly mantled by steeply sloping colluvium and glacial till similar to that in the Coast Mountains.

The Fraser River and its tributaries (Pitt, Alouette, Coquitlam, Chehalis, Stave, Salmon and Sumas Rivers, Vedder Canal and Norrish, Lagace and Whonnock Creeks being the larger ones) drain the east and northeast part of the map area westward into Georgia Strait. The southern fringe along the United States border is drained mainly by several small creeks flowing southward into the United States. The southwestern part (west of Surrey and Langley municipalities) drains directly into Boundary Bay through Serpentine, Nicomekl and Campbell Rivers. The area north of metropolitan Vancouver is drained into Burrard Inlet by Capilano and Seymour Rivers and Lynn and Cypress Creeks. Indian River drains into Indian Arm. Areas along Howe Sound and on the Sunshine Coast are drained by numerous creeks issuing directly into the ocean with Chapman, Roberts, Langdale and Dakota Creeks being among the larger ones.



LEGEND[1]

SURFICIAL DEPOSITS

Symbol	Definition[2]
C	**Colluvial:** Materials that have reached their present position by direct, gravity-induced movement.
E	**Eolian:** Materials transported and deposited by wind action.
F	**Fluvial:** Materials transported and deposited by rivers and streams.
F^G	**Fluvioglacial:** Fluvial materials that have been deposited either directly in front of, or in contact with, glacier ice.
I	**Ice:** Areas of snow and ice where evidence of active movement is present.
L	**Lacustrine:** Sediments that have settled from suspension in standing fresh water or have accumulated in the margins through wave action.
M	**Morainal:** Materials transported beneath, beside, on, within or in front of a glacier and deposited directly from the glacier.
O	**Organic:** Materials resulting from vegetative growth, decay and accumulation; rate of accumulation exceeds that of decay.
R	**Bedrock:** Outcrop, and rock covered by a thin mantle (less than 10 cm thick) of unconsolidated mineral and/or organic materials.
W	**Marine:** Sediments that have settled from suspension in salt or brackish water bodies or that have accumulated at their margins through shoreline processes.
W^G	**Glaciomarine:** Sediments of glacial origin, laid down in a marine environment in close proximity to glacier ice.

SURFACE EXPRESSION

Symbol	Definition
b	**Blanket:** A mantle of unconsolidated materials thicker than 1 m.
f	**Fan:** A fan-shaped form possessing a perceptible gradient from apex to toe.
l	**Level:** A flat or gently sloping surface not broken by marked elevations or depressions.
v	**Veneer:** Unconsolidated materials between 10 cm and 1 m thick; if no information about the underlying stratigraphic unit is supplied, it is assumed the veneer overlies bedrock.

COMPOSITE UNITS

Composite units are employed when the individual terrain units in a map polygon cannot be delimited individually at the scale of mapping. The components are indicated in decreasing order of abundance. The symbolization is as follows:

- / the component in front of the symbol is more abundant than the one that follows.
- // the component in front of the symbol is considerably more abundant than the component that follows.

[1] Classification modified from Environment and Land Use Committee Secretariat, 1976.

[2] The deposits are more adequately described in the pages under Surficial Geologic Deposits.

Figure 2. Generalized surficial deposits map of the Coast Mountains and Sunshine Coast portion of the Langley-Vancouver map area.

SURFICIAL GEOLOGIC DEPOSITS

Several glaciations, marine submergence and rebound, postglacial fluvial action and eolian deposition have produced a wide variety of surficial geologic deposits (soil parent materials) in the map area. They vary in texture, form and extent, and range from mostly colluvial and morainal materials in the mountains to complex fluvial and glaciofluvial, marine and glaciomarine, lacustrine and glaciolacustrine, organic and eolian deposits in the valleys. The general characteristics of the various materials, in the context of the map area, are briefly described in the following paragraphs. The individual soils developed on each deposit are shown in Table 2.

(1) **Morainal (glacial till) deposits** are materials laid down by glacier ice. They are common above about 150 m elevation and are mainly strongly or steeply sloping. They consist of compact, slowly permeable, heterogeneous mixtures of boulders, stones, gravel, sand, silt and clay derived mainly from the associated granitic bedrock. Textures are moderately coarse, sometimes varying to medium, with gravelly sandy loam or sandy loam being most common. The deposits are generally deeper than 1 m and usually conform topographically to the underlying bedrock. In the eastern part of the map area the morainal deposits are usually capped by a veneer of eolian material mostly less than 100 cm thick. Here, the surface textures are silt loam or loam.

(2) **Colluvial deposits** are common in the mountains and occupy relatively small areas elsewhere. They occur mostly on or at the base of steep slopes and on ridge tops and consist of materials originating from nearby sources which have been redeposited by the action of gravity. The deposits are usually loose, moderately to rapidly permeable and variable in depth to bedrock. Usual textures are gravelly sandy loam with a high proportion of stones and cobbles. They tend to be unstable and in some areas are still actively accumulating. In the eastern part of the map area, mainly on Sumas and Vedder mountains and near Mission, silty eolian material is mixed into the colluvium.

(3) **Glaciofluvial deposits** were laid down by flowing water during glacial advance and recession and are most common below 250 m elevation. They consist mainly of stratified gravels and sands, contain varying amounts of stones, and are usually rapidly permeable. The land surfaces are mostly level or gently undulating terraces and plains, although sometimes, they may be kettled or hummocky, particularly in ice-contact areas. Where glacial deltas predominate the deposits are usually gently or moderately sloping. Most deposits are relatively deep (well in excess of 2 m) and textures in or near the surface usually vary from gravelly sandy loam or loam to sand and gravel. In the eastern part of the map area, relatively large areas of glaciofluvial deposits are capped by a silty eolian veneer. Here the surface textures are loam or silt loam.

(4) **Fluvial deposits** consist of materials deposited by flowing water since glacial time. They have either been relatively recently deposited or are still in the process of deposition. Several groups of fluvial deposits have been identified in the Langley-Vancouver map area.

(i) **Deltaic deposits** occur where moving water carrying sediment discharges into a relatively still water body. In the case of the Langley-Vancouver map area, the main receiving waters are Georgia Strait and Mud Bay. Most of Richmond and Delta Municipalities and the Serpentine-Nicomekl River valley of Surrey Municipality are composed of these deposits with the sediment mainly being provided by the Fraser River in the first two instances. The surface deposits are stone-free and variable in texture, ranging from sand to silty clay, with the finer textures being most common. The deposits have high groundwater tables and the mostly sandy subsoils (below 1 to 2 m depth) are saline. High contents of sulphurous compounds are also common in the subsurface and subsoil layers (Clark, Gobin and Sprout, 1961). These mixed, marine and non-marine deltaic deposits all lie below 5 m elevation and, where not dyked, are subject to periodic flooding, either by high tides or river overflow. Surface topography varies from level to gently rolling.

(ii) **Floodplain deposits** of the Fraser and other rivers comprise much of the lowlands of the Langley-Vancouver map area. The deposits mostly lie below 10 m elevation, have level to gently rolling topography and include both lateral and vertical accretions. Textures range from sandy to clayey in the surface and usually grade to sand at depths of 0.5 to 2 m. Most areas are affected by high groundwater tables and many areas are poorly drained. Periodic flooding during freshet periods occurs in undyked areas.

(iii) **Alluvial deposits,** variable in nature, have been laid down by several local streams and smaller rivers flowing across the uplands and lowlands and in mountain valleys. These include levees, floodplains and terraces which range in texture from gravel and sand to silty clay depending on the

TABLE 2

The relationship between classified soils and surficial deposits (soils parent materials) in the Langley-Vancouver map area

Morainal (Glacial Till) Deposits	Colluvial Deposits (>1 m thick)	Glaciofluvial Deposits	Fluvial Deposits—Deltaic		Fluvial Deposits—Floodplain		Fluvial Deposits—Local Streams	
			Sandy	Silty or Clayey	Sandy	Silty or Clayey	Sandy	Silty or Clayey
Blaney Buntzen Burwell Cascade Devil Golden Ears Langdale Marion Porpoise Steelhead Strachan Surrey Whonnock	Cheam Hoover Kenworthy Lions Palisade Poignant	Capilano Columbia Defehr Errock Haney Lynden Roach Sechelt	Benson Neptune Seaview Tsawwassen	Blundell Crescent Deas Delta Embree Guichon Kitter Ladner Mathews McLellan Nicomekl Sandel Spetifore Vinod Westham	Dewdney Grevell Matsqui Seabird	Addington Alouette Annis Arnold Beharrel Blackburn Bonson Fairfield Grigg Hallert Hammond Hatzic Hazelwood Henderson Hjorth Katzie Monroe Neaves Niven Page Pelly Pitt Prest Sturgeon	Eastcap Hopedale Sardis Seymour	Bates Carvolth Lickman McElvee Ross Sim Westlang
	Shallow Colluvial (< m thick) Over Bedrock							
	Cannell Grouse Hollyburn Sayres							

source of the original sediment and the velocity of the streams. The topography is mostly gently undulating to gently rolling. High groundwater tables are usual for at least parts of the year and flooding during freshet periods or after heavy, prolonged rain is common in some areas.

(iv) **Fluvial fan deposits** occupy only scattered areas on the uplands and lowlands of the map area but are common in the mountain valleys. They usually occur where relatively swiftly flowing streams abruptly lose velocity and deposit part of their sediment load in a fan shaped pattern. Many are still in the process of formation. The deposits are usually moderately to excessively stony and are variable in texture. Most commonly however, they are coarse or moderately coarse. Topography varies from gently to steeply sloping in the direction of stream flow.

(5) **Glaciomarine deposits** are common in Langley, Matsqui, Surrey and Maple Ridge Municipalities below about 175 m elevation and occupy smaller areas elsewhere. Topographically, they vary from undulating to rolling. They consist of massive, compact, very slowly permeable silty to clayey sediments which have not been preloaded by glacial ice as is the case with morainal deposits. These deposits, which were laid down in near-shore locations during glacial recession and subsequently exposed through isostatic rebound, contain variable amounts (usually minor) of stones, cobbles and gravel incorporated from floating ice. Dark coloured (probably manganese and organic) coatings are common in the subsoil along cracks and fractures and sea shells can be found in some locations. In the eastern part of the map area, a thin, silty eolian veneer sometimes covers the surface.

TABLE 2

The relationship between classified soils and surficial deposits (soils parent materials) in the Langley-Vancouver map area—*Continued*

Fluvial Deposits—Fans	Glaciomarine Deposits	Marine Deposits		Lacustrine Deposits		Glaciolacustrine Deposits		Eolian Deposits	Organic Deposits (40–160 cm deep)
		Clayey	Lag and Littoral	Sandy	Silty or Clayey	Sandy	Silty		
Chehalis Dean Elk Harrison Isar Paton Rodgers Shalish	Albion Durieu Nicholson Scat Whatcom	Berry Cloverdale Langley Milner	Bose Boosey Heron Livingstone Murrayville Stave Summer Sunshine	Kennedy Sumas	Buckerfield Dixon Fadden Vedder Vye	Fellows	Coquitlam Tunbridge	Laxton	Banford Elphingstone Gibson Goudy Judson Lulu Richmond Widgeon
								Eolian Veneer over Morainal Deposits	
								Calkins Lonzo Creek Ryder	Orgainc Deposits (>160 cm deep)
								Eolian Veneer over Glacio-fluvial Deposits	Annacis Glen Valley Lumbum Triggs
								Abbostford Calkins Coghlan Keystone Lehman Marble Hill Peardonville	Organic Deposits (>10 cm deep/Rock)
									Dennett Eunice

(6) **Marine deposits** are common in the central part of the map area below elevations of 200 m. They are separated into two types.

(i) **Clayey sediments** which were deposited in marine off-shore locations and subsequently exposed through isostatic rebound after deglaciation comprise the first type. The upper elevations of these deposits is about 30 m. They are most prevalent in the Hazelmere, Cloverdale and Langley areas and consist of stone-free deposits which are compact, massive, very slowly permeable and which tend to be saline below depths of 1 to 2 m. They are mostly gently sloping or rolling and high groundwater is usual in the more level areas. Sea shells occur in some locations.

(ii) **Lag and littoral materials** which overlie glacial till and fine-textured marine and glaciomarine deposits form the second type. These sandy and/or gravelly deposits formed during isostatic uplift as wave action eroded and removed the finer textured sediments from the surface of existing deposits while redepositing the coarser textures as beaches, spits and veneers. The lag and littoral materials, usually less than 2 m thick, are rapidly permeable and sometimes very stony. They are common on the uplands of Surrey and Langley Municipalities and prevalent on the Sunshine Coast below elevations of 200 m.

(7) **Lacustrine deposits** consist of sediments deposited in lake environments in post-glacial time. In the map area they are restricted mainly to the Sumas Valley where they range in texture from clayey to sandy and occur at elevations below 10 m. The topography varies from level to gently rolling and most

areas have shallow groundwater tables. Sumas Lake, which was located just west of the present Vedder Canal, was artificially drained in the 1920's.

Partially stratified, silty and clayey deposits are most common. These are stone-free and moderately to slowly pervious. The surfaces in some areas have been modified by fluvial processes. West of the Vedder Canal, an extensive area of poorly drained lacustrine sand occurs, and scattered through the valley are small areas of stratified, sandy, raised spits, bars and beach ridges.

(8) **Glaciolacustrine deposits** occur north of Mission, near the south end of Coquitlam Lake and in the Statlu Creek valley. These deposits, laid down in temporary lakes during glacial time, range from sandy to silty in texture and are moderately stratified and compact. Topography is mostly srongly undulating to strongly rolling due to post-depositional erosion. A silty eolian capping occurs on the deposits north of Mission.

(9) **Eolian deposits** have been briefly discussed in relation to other surficial deposits. These silty, permeable deposits, usually less than 1 m thick, mantle most of the uplands and lower mountain slopes of the map area east of the Langley Valley and Haney. They appear to have originated from the extensive glacial outwash areas in the vicinity of, and south, from the Abbotsford Airport. Some volcanic ash may be incorporated in the eolian material since some soil properties are similar to those of soils derived from volcanic ash elsewhere.

Near Abbotsford, several areas of sand dunes occur. These sandy, moderately to strongly rolling deposits are also capped by silty deposits.

10) **Organic deposits** occupy significant portions of the Langley-Vancouver map area, particularly on the lowlands of the Lower Fraser Valley. Organic deposits form when the rate of organic matter accumulation exceeds the rate of decomposition. Two types of organic deposits occur.

(i) The first consists mainly of peat derived from accumulations of reeds, sedges and moss, in various stages of decomposition. The accumulations are at least 40 cm thick and may range to as much as 10 m deep but are usually less than 2 m thick. They contain at least 17 percent organic carbon. These deposits are usually found in depressional or level areas which are poorly drained and subject to excess water for long periods. Most areas are associated with deltaic or floodplain deposits but some also occur on the uplands and a few in the mountains. In some areas a proportion of mineral material is mixed with the organic, usually carried in and deposited during flooding by adjacent water courses.

(ii) The second type of organic deposit occurs in forested areas and consists of freely drained accumulations of needles, leaves, twigs, moss and other forest floor material at least 10 cm thick overlying bedrock. These organic deposits are relatively common in the mountainous areas, particularly at the higher elevations on rocky hummocks, ridges and knobs devoid of mineral soil.

The previous descriptions of the surficial geologic materials (soil parent materials) have been both brief and general. Readers wishing more detailed, specific information, particularly for the Lower Fraser Valley portion of the map area, are referred to several publications listed in "Selected Bibliography" at the end of this report. These publications include maps showing the distribution and extent of the different deposits and therefore they are not reproduced here. The distribution of soil forming deposits in the mountainous portion of the map area, however, have been generally less well defined in publications. Figure 2 has therefore been generalized from the soil maps in Volume 2 to show the general distribution and extent of the surficial deposits in the mountainous areas.

CHAPTER TWO

SOIL CLASSIFICATION AND FIELD MAPPING METHODS

This chapter discusses briefly the rationale of soil classification, the soil characteristics considered and the various levels of generalization in the hierarchy of the Canadian soil classification system. It also describes the field methods and procedures employed during the survey of the Langley-Vancouver map area.

SOIL CLASSIFICATION

Soil is the naturally occurring unconsolidated mineral or organic material at the earth's surface which is capable of supporting plant growth. It develops in response to the environment. The kind of soil produced is a function of climate, biota, topography and soil parent material (surficial geologic deposits) reacting interdependently over a period of time.

Each soil produced is a three-dimensional, naturally occuring body having length, width and depth. The objective of a soil survey is to identify the different kinds of soil produced, to separate or classify them by means of a classification system and to delineate their areal distribution on a map. Soils are classified on morphological characteristics observed in a vertical section (soil profile) and on the physical and chemical analysis of the soil pedon. Individual soil profiles are grouped (classified) according to categories of the soil classification employed. The resultant different groups are then delineated on the soil map by soil boundaries which encompass areas of soil in the same group. The kinds of morphologic characteristics considered are discussed in the following section dealing with field methods.

The basic soil mapping unit or category is the ***soil series***. A soil series consists of a group of related pedons derived from a similar kind of soil parent material which have soil profiles, textures, and soil moisture characteristics that fall within a narrow, defined range. Soil series names are usually place names occurring in the locality where the series was originally classified. The series, however, is not restricted to that locality only.

Soil phases are variations within a soil series or other hierarchial category due to stoniness, topography, depth of profile or other features which effect land use. Sometimes ***soil variants*** are employed when differing soils are identified but occupy such small areas that definition of a new soil is not warranted. These areas are usually classified as a variant of the established soil series (or other category) which has most characteristics in common with the variant.

The first level of generalization above the soil series is the ***soil family***. A soil family consists of a group of related soils which fall within a range of differentiating criteria that is broader than that for soil series. The differentiating criteria include particle size distribution, drainage, permeability, reaction and consistence as well as others that have implications for land use. A soil series should not be classified in more than one soil family.

The next level of generalization is the ***soil subgroup***. A soil subgroup consists of a group of soils which have defined common soil horizons which reflect the environmental conditions under which the soils developed. Soil subgroups may be grouped into ***soil great groups***. Soil great groups consist of soils which have major soil horizons in common which reflect the strength of the dominant soil forming process (or processes). The broadest level of generalization is the ***soil order***. A soil order is composed of groups of soils that have developed under broadly similar environmental conditions as expressed by the presence (or absence) of major, diagnostic soil horizons.

For a complete description of the soil classification used in this report, refer to the Canadian System of Soil Classification, 1978 and The System of Soil Classification for Canada, 1974, revised.

FIELD METHODS AND PROCEDURES

As earlier stated, the purpose of a soil survey is to delineate on a map the distribution of classified soils. In conjunction with the maps, a report is usually produced which describes the nature and properties of the classified soils. The report may also contain interpretations for various specified soil uses.

The level of soil classification employed in the Langley-Vancouver map area is basically the soil series, particularly for lands in the Lower Fraser Valley (Volume 1) of this report. In the mountainous areas (Volume 2), the classification approaches the soil family level due to lower survey intensity and somewhat less precise field data in the more inaccessible areas.

To determine the areal distribution of the classified soils, numerous test pits, roadside cuts, ditches, gravel pits and other exposures were examined and described. The soils were examined to determine soil parent material, texture, structure, consistence, permeability, drainage, colour, horizon sequence and depth, root abundance, rooting depth, and other observable and measurable features (CanSIS, 1978; Walmsley, et.al, 1980). Vegetation, stoniness, topography, cultural practices and other external features were also noted. The Munsell Colour system was used to identify soil colours. One or more representative soil profile of each classified soil was described in detail and sampled for chemical and physical laboratory analyses.

In the Lower Fraser Valley, air photographs—approximate scale 1:15 000—were used as field mapping sheets. Soil boundaries were established by bisecting them on roads, ditches, fence lines and by numerous transects across the land. The number of soil examinations varied with the complexity of the soil landscape, however, it is estimated that, on average, at least one examination was conducted for each 2 to 5 ha of land.

The mountainous areas and the Sunshine Coast were mapped on 1:30 000 air photographs. At the lower elevations on the Sunshine Coast all roads were traversed and foot transects were conducted across most map delineations. Field checking, however, was less intensive (less often) than in the Lower Fraser Valley. Again, the numbers of soil examinations varied with the complexity of the soil landscape but it is estimated an average of about one inspection occurred for every 5 to 15 ha. Large parts of the mountainous areas are relatively inaccessible. All available roads were utilized with the soils along them being examined in detail. The intervening land was then mainly mapped by air photo interpretation and extrapolation from known, described sites. Occasional foot transects were also employed and access to land along the shores of some of the larger lakes was afforded by boats. Field inspection of several high elevation alpine areas consisted of widely spaced spot checks by helicopter.

In many areas, two or more classified soils are so intermingled that it is impractical to separate them at the scale of mapping. Such areas are mapped as ***soil complexes***. The identified soils are indicated in the map symbol of each such map delineation in decreasing order of areal distribution.

CHAPTER THREE

DESCRIPTION OF THE SOILS

Chapter Three describes the characteristics of the 147 individual soils and 7 miscellaneous land types classified in the Langley-Vancouver map area. Detailed individual soil profile descriptions and chemical and physical analysis are not included. These are presented in Volume 6 of this report and are also available from the British Columbia Soil Information System.

The soils are arranged in alphabetical order and the soil map symbol is indicated in brackets after the soil name. For each soil, the approximate locale of the main areas in which it occurs is stated, together with the general range in elevation, the topography, soil parent material, soil texture and soil moisture characteristics. The usual vegetation is given where some natural cover exists. The species listed (after Taylor and MacBryde, 1977) only indicate the general nature of the vegetation and are not intended to be complete lists of the species present. Also presented is a general (representative) soil description to assist report and map users in identifying the soil in the field. Soil reaction (pH), except where specified otherwise, is based on measurements made in .01 M $CaCl_2$. Brief comments related to general land use are given as is the soil classification (Canadian System of Soil Classification, 1978). The most commonly associated soils are also given and brief comment is made on how they differ from the soil under discussion. Some technical terms may not be familiar to the reader; most are defined either in the Glossary or Appendices.

Several schematic, cross-sectional diagrams (Figures 3 to 10) are included to show the general landscape relationships between the more common soils of the map area.

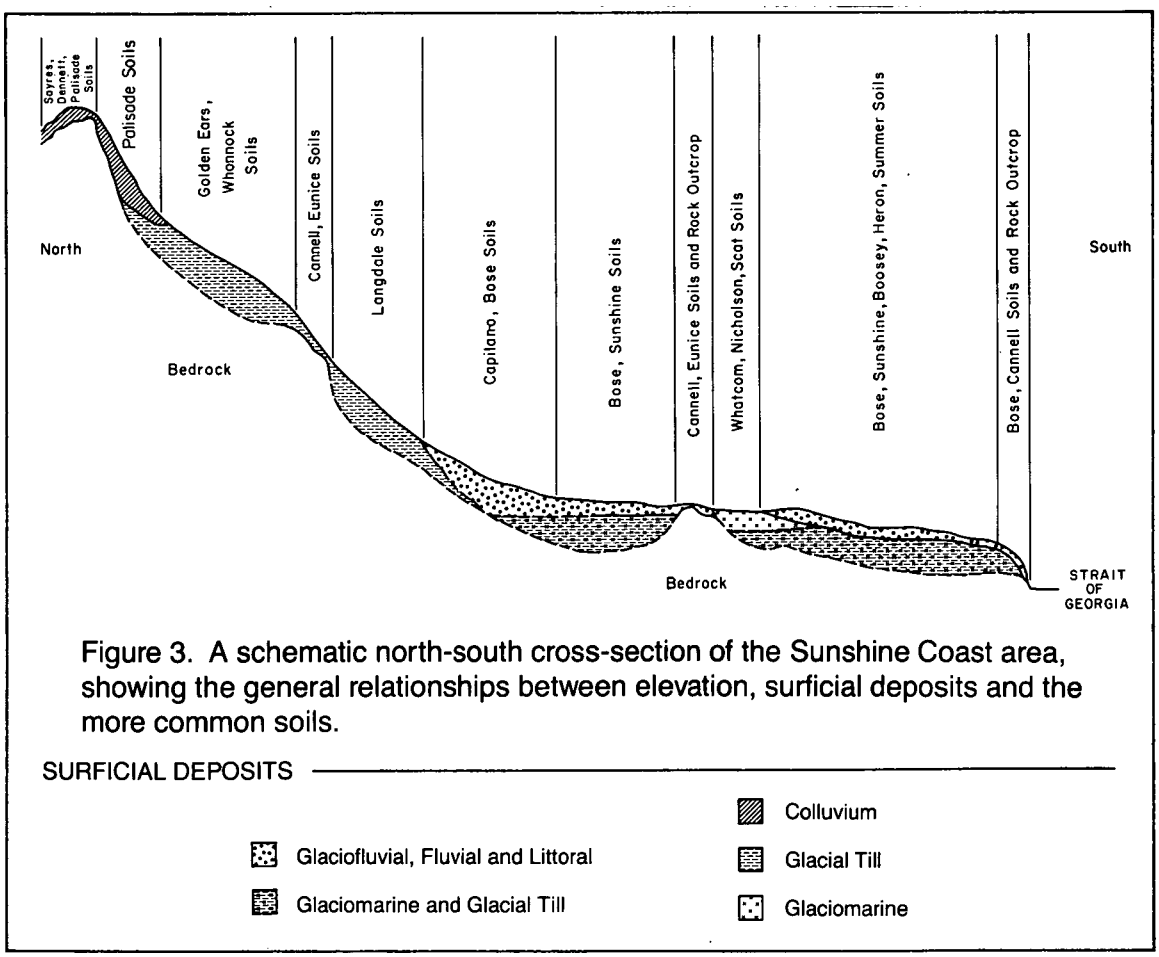


Figure 3. A schematic north-south cross-section of the Sunshine Coast area, showing the general relationships between elevation, surficial deposits and the more common soils.

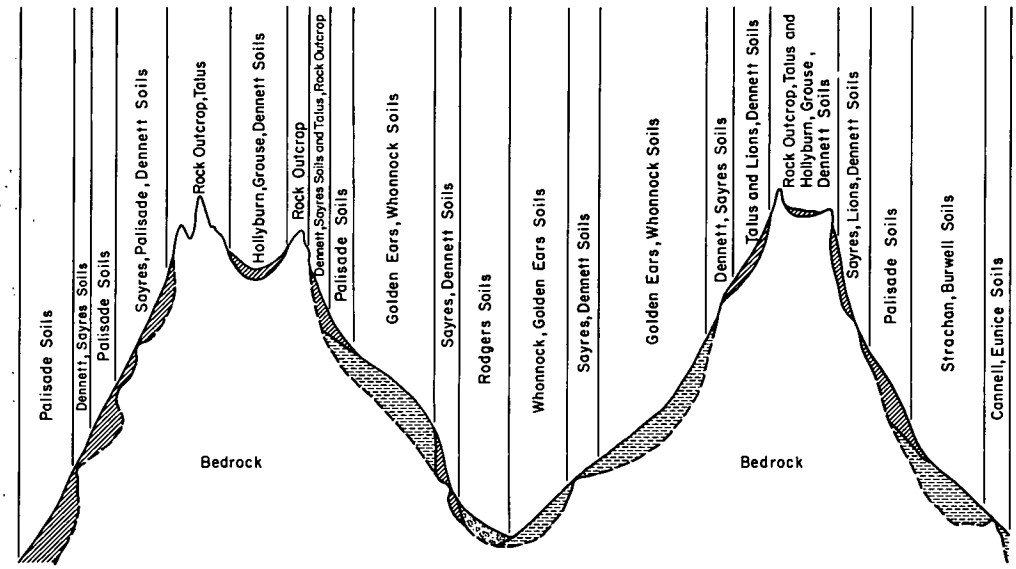


Figure 4. A schematic cross-section of the higher mountainous areas (above about 700 m elevation), showing the general relationship between elevation, surficial deposits and the more common soils.

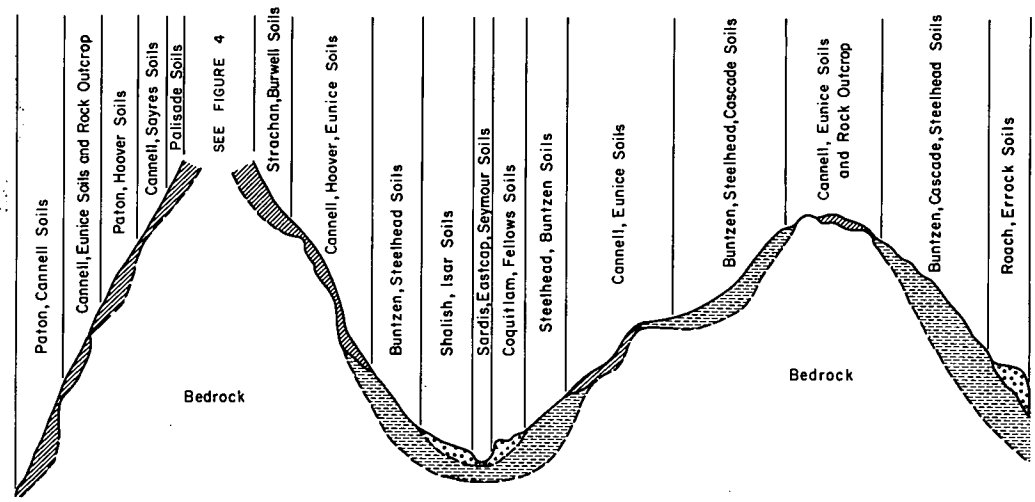


Figure 5. A schematic cross-section of the lower mountainous areas (between about 150 and 700 m elevation) showing the general relationship between elevation, surficial deposits and the more common soils.

SURFICIAL DEPOSITS

Colluvium
Glacial Till
Fluvial
Fluvial, Glaciofluvial
Lacustrine

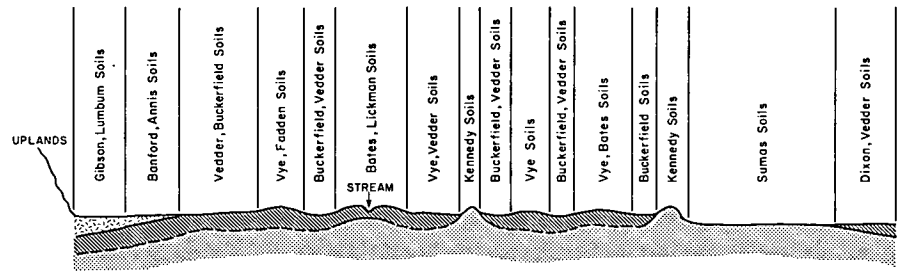


Figure 6. A schematic cross-section of the Sumas Valley showing the general relationship between elevation, surficial deposits and the more common soils.

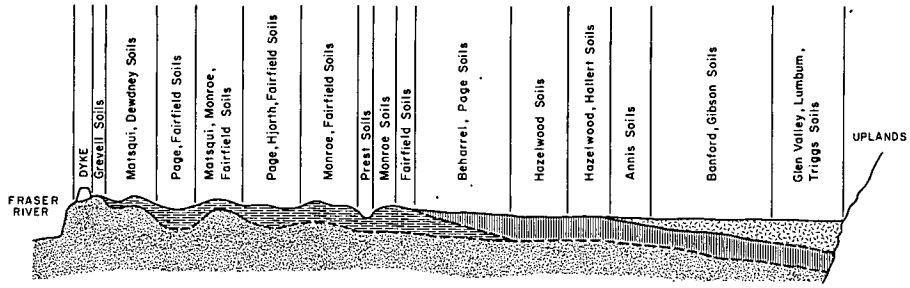


Figure 7. A schematic cross-section of the Fraser River floodplain showing the general relationship between elevation, surficial deposits and the more common soils.

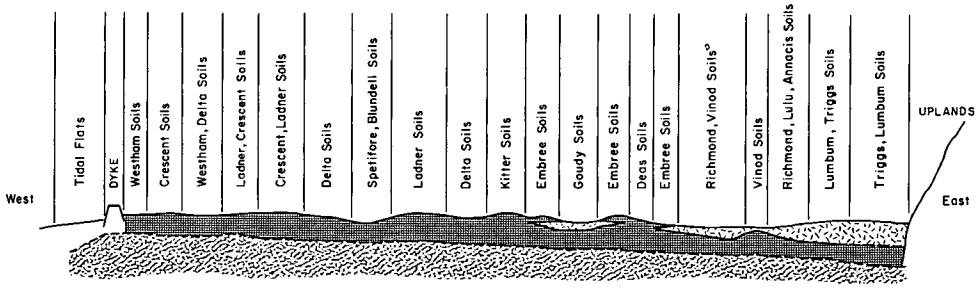


Figure 8. A schematic cross-section of the Fraser River delta showing the general relationship between elevation, surficial deposits and the more common soils.

SURFICIAL DEPOSITS

- Silty to Clayey Lacustrine (and some Fluvial)
- Sandy Lacustrine (and some Fluvial)
- Sandy Fluvial
- Silty Fluvial
- Clayey Fluvial
- Sandy Deltaic
- Silty to Clayey Deltaic
- Organic

3

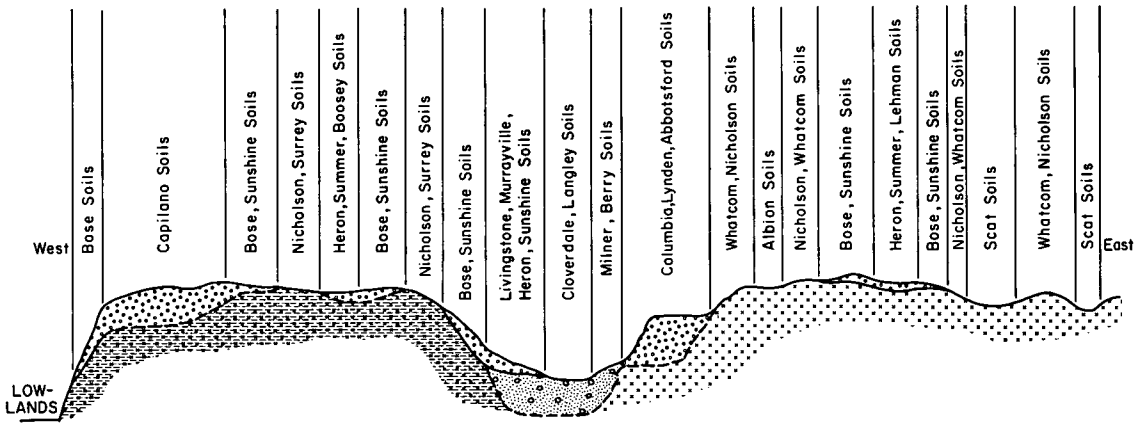


Figure 9. A schematic cross-section of the western uplands showing the general relationship between elevation, surficial deposits and the more common soils.

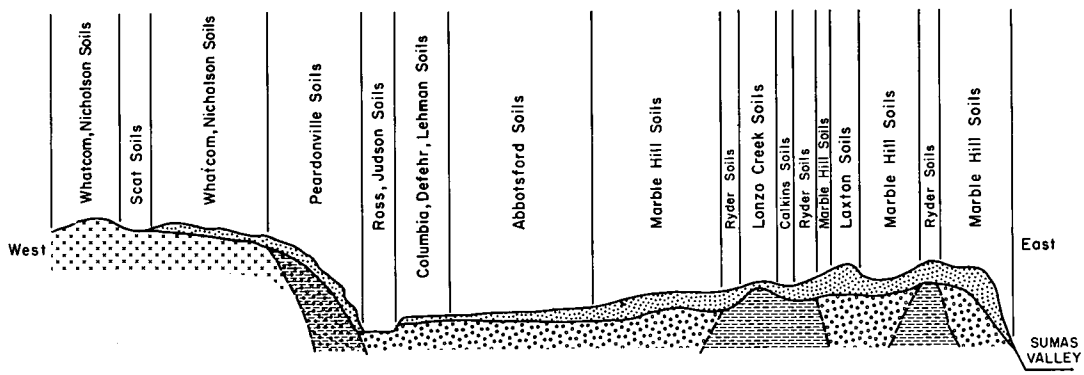


Figure 10. A schematic cross-section of the eastern uplands showing the general relationship between elevation, surficial deposits and the more common soils.

SURFICIAL DEPOSITS

- Marine
- Glaciomarine
- Glaciomarine and Glacial Till
- Glacial Till
- Eolian
- Glaciofluvial and Glacial Till
- Glaciofluvial and some Fluvial
- Glaciofluvial, Littoral and some Fluvial

Description of the Soils

ABBOTSFORD SOILS

Location and Extent: Abbotsford soils occur mostly in the vicinity of Abbotsford, Clearbrook, Mission, and Hopington and in the Columbia Valley south of Cultus Lake. There are about 2120 ha of pure map units and 2950 ha of soil complexes dominated by Abbotsford soils; the complexes are mainly with Marble Hill, Columbia and Laxton soils.

Topography and Elevation: The topography is mostly very gently sloping to undulating with slopes up to 5 percent; lesser areas vary to strongly rolling with slopes to 25 percent. Elevations are dominantly between 20 and 100 m above sea level, but rise to 200 m in the Columbia Valley.

Plate 4 Landscape near the Abbotsford Airport showing the typical topography of Abbotsford soils. Cole crops, raspberries and strawberries are common crops on these soils.

Parent Material and Texture: Abbotsford soils have generally developed from 20 to 50 cm of medium-textured eolian deposits underlain by stratified gravelly glacial outwash. The surface and subsurface texture is mostly silt loam, varying sometimes to loam or fine sandy loam where the surface capping is thin. The underlying gravel and gravelly sand is usually stony and contains lenses of coarse and medium sand. In some places, tree uprooting and land clearing has mixed some gravel and stones into the surface soil.

Soil Moisture Characteristics: Abbotsford soils are well to rapidly drained. They are rapidly to moderately pervious and have slow surface runoff. Water holding capacity is high in the upper, silty part, decreasing to low in the gravelly subsoil. There are slight drainage restrictions in a few, small areas due to weak cementation in the lower subsoil and a few, scattered areas are affected by seepage from higher, adjacent land. In some areas, such as in the vicinity of the Abbotsford Airport, a groundwater table is present at depths below at least 2 m.

General Soil Description: In uncleared areas Abbotsford soils have 5 cm or less of organic forest litter on the soil surface. The surface mineral soil is a thin, discontinuous, whitish layer less than 3 cm thick. This leached layer is underlain by a reddish-brown, silty, friable zone that becomes yellowish-brown or pale brown within 40 cm. Common to many, hard, spherical, reddish-brown concretions are usually present in the upper part. Below depths of 20 to 50 cm, a usually rapid change to loose, stratified gravel or gravelly sand occurs. Cultivated surfaces vary from 15 to 25 cm in depth and are dark reddish brown or dark brown in colour. Soil reaction varies from very strongly to strongly acid throughout. Soil classification is *Orthic Humo-Ferric Podzol*.

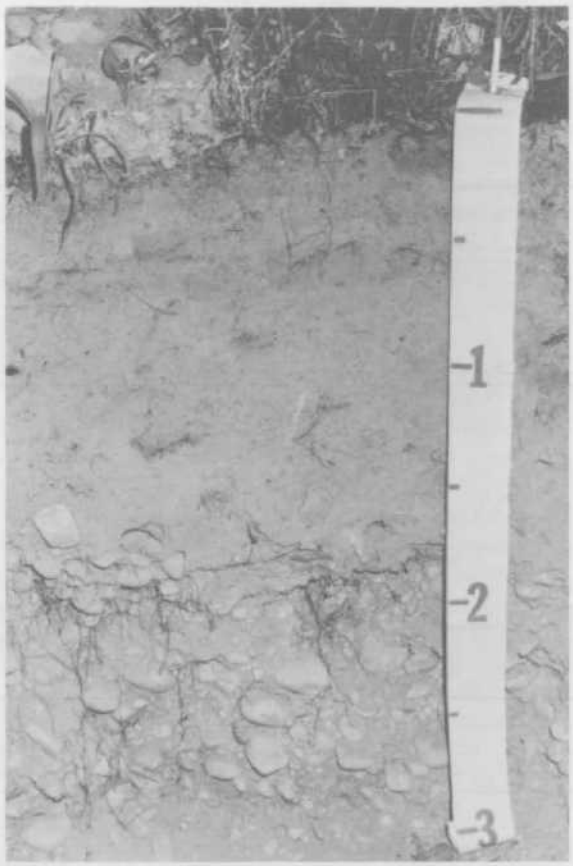


Plate 5 Abbotsford soil profile (Orthic Humo-Ferric Podzol). Abbotsford soils are well drained soils developed in 20 to 50 cm of silty eolian material overlying gravelly glaciofluvial deposits.

Commonly Associated Soils: Marble Hill, Columbia, Calkins and Laxton soils are often associated with Abbotsford soils, either in soil complexes or in adjacent map polygons. These soils are different from Abbotsford soils in that Marble Hill soils have silty, eolian cappings deeper than 50 cm over gravel while Columbia soils have less than 20 cm of silty capping and are usually gravelly and stony to the surface. Calkins soils are poorly drained while Laxton soils consist of shallow, silty, eolian cappings over medium to fine sand (mainly duned).

Vegetation: Most areas are cleared and used for agricultural or urban purposes. The remaining forested areas support mostly coast Douglas-fir, lodgepole pine and red alder. Rooting depth is generally unrestricted.

General Land Use Comments: (1) Abbotsford soils are well suited for most agricultural crops (root crops may be unsuited in areas where the silty capping is shallow). However, they tend to be droughty and irrigation is usually required for good production in most years. (2) Abbotsford soils are also well suited for urban or industrial use because of good drainage, high bearing strength and rather gentle topography. There is, however, potential for ground water contamination from septic tank effluent due to low filtration capacity of the subsoil gravel and coarse sand. The gravelly subsoil is usually a good source of aggregate. (3) Forest growth is moderate, limited mainly by soil moisture deficiencies during the latter parts of the growing season. Data from a limited number of plots indicates growth of coast Douglas-fir to be between 8 and 9 m^3/ha/yr.

ADDINGTON SOILS (AG)

Location and Extent: Addington soils occur only between Sturgeon Slough and the south end of Pitt Lake and on Siwash Island and Addington Point. These are about 510 ha of pure map units and 200 ha of soil complexes dominated by Addington soils. The complexes are mainly with Sturgeon soils.

Topography and Elevation: The topography is gently undulating to slightly depressional with slopes less than 2 percent. Addington soils lie below 3 m above sea level.

Parent Material and Texture: Addington soils have developed from shallow organic accumulations overlying mixed Fraser, Alouette and Pitt River alluvium. The surface consists of 15 to 40 cm of moderately to well-decomposed organic material. This overlies silt loam or loam which grades to medium or fine sand below about 100 cm of the soil surface.

Soil Moisture Characteristics: Addington soils are very poorly drained. They are moderately pervious but the groundwater table is either near or above the soil surface for much of the year. They also have high water holding capacity and slow surface runoff. Runoff accumulation from adjacent highlands and seepage (as well as some flooding) from Pitt River and Pitt Lake are usual.

General Soil Description: The surface layer consists of 15 to 40 cm of grayish-brown to black, mucky organic material containing many roots and with some silt and very fine sand admixed. Underlying this is a zone, usually 50 to 75 cm thick, of massive, olive-gray to grayish-brown, silty material containing a few, fine reddish mottles. Below about 100 cm depth, massive, dark gray sands occur. Soil reaction varies from extremely acid in the surface to very strongly acid in the subsoil. Soil classification is ***Rego Gleysol:peaty phase***.

Commonly Associated Soils: Widgeon and Sturgeon soils usually occur in close association with Addington soils. Widgeon soils differ from Addington soils in that they consist of 40 to 160 cm of partially-decomposed organic material. Sturgeon soils are slightly better drained than Addington soils, the surface organic layer is well decomposed and the subsoil textures are usually silt loam or silty clay loam.

Vegetation: All areas of Addington soils are essentially in a natural state and support reeds, sedges, reed canary grass, skunk cabbage, hardhack, sweet gale and other water tolerant species. A variable moss layer (thin) is usually present on the soil surface. The rooting depth is generally restricted to the upper 60 cm by high watertables.

General Land Use Comments: (1) All areas of Addington soils are undeveloped and extensive artificial drainage works are required before these soils can be used for arable agriculture. They however have some grazing potential in their present state. (2) Addington soils have low bearing strengths and very high watertables which makes road and building construction difficult. They are not suitable for excavations or septic tanks. (3) In their present state Addington soils are unsuited for wood production because of excessive wetness and common inundation. (4) Parts of the Addington soils areas are presently used for waterfowl production and refuge and this type of enterprise could, perhaps, be expanded.

Plate 6 Landscape typical of soils developed from glaciomarine deposits. Whatcom and Nicholson soils occur on the tops and slopes of the undulations while Scat and Albion soils occupy the depressions.

ALBION SOILS

Location and Extent: Albion soils occur mainly south and east of Murrayville and in the vicinities of Haney, Albion and Webster's Corner with small, scattered areas elsewhere. There are about 280 ha of pure map units while soil complexes dominated by Albion soils total 2190 ha. The complexes are mostly with Scat, Whatcom and Nicholson soils.

Topography and Elevation: The topography is slightly depressional to very gently sloping or undulating with slopes between 1 and 5 percent. In complexes with Whatcom or Nicholson soils, Albion soils usually occupy the lower topographic landscape positions. The elevational range of Albion soils is mainly between 50 and 100m above sea level.

Parent Material and Texture: Albion soils have developed from moderately fine to fine-textured glaciomarine deposits. In some locations up to 20 cm of silty, eolian material either overlies or is mixed into the surface of the glaciomarine sediments. Surface textures range from silt loam to silty clay loam while subsurface and subsoil textures vary from silty clay loam to clay.

Soil Moisture Characteristics: Albion soils are moderately poorly to poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. They are subject to runoff accumulation and seepage from adjacent, higher areas and perched watertables above the clayey subsoil are usual during the wet parts of the year.

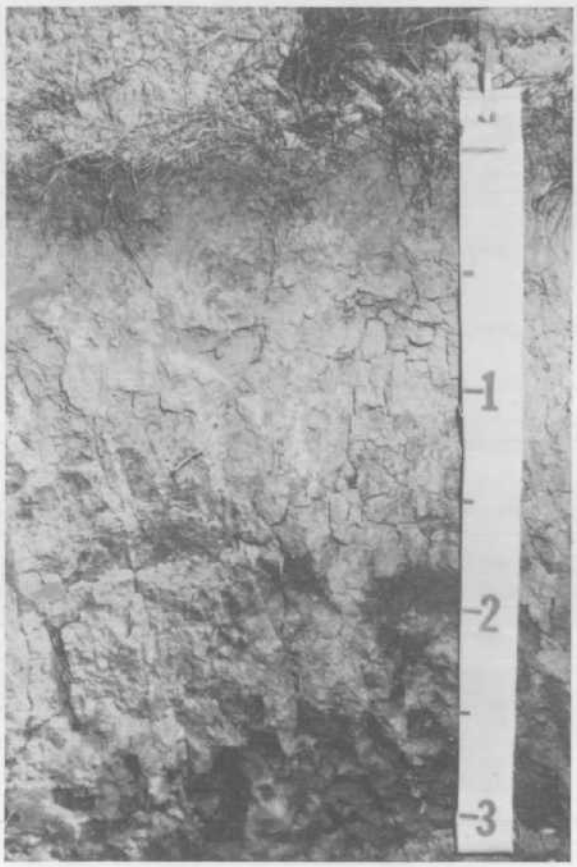


Plate 7 Albion soil profile (Humic Luvic Gleysol). These poorly drained soils have developed from clayey glaciomarine deposits. They have a prominent clay accumulation layer in the subsoil which, in the photo, begins at about 14 in. (35 cm) and extends to about 2.5 ft. (75 cm). A grayish, leached layer overlies it and starts at about 6 in. (15 cm). Scat soils are somewhat similar to Albion soils, however, the surface layer is usually deeper and darker coloured and the leached and clay accumulation layers are poorly defined.

General Soil Description: Albion soils have a dark gray to very dark gray, friable, silty, surface layer, 10 to 25 cm thick, which overlies about 15 cm of gray, friable to firm, leached, silty material containing many reddish, brownish and yellowish mottles. Underlying this is about 40 cm of dark gray, strongly structured, sticky, clayey material containing common, yellowish or brownish mottles and enriched with clay eluviated from above. This layer gradually grades to unweathered, gray, clayey, massive, unweathered glaciomarine soil parent material at about 110 cm. Soil reaction varies from strongly or very strongly acid in the upper part to neutral in the subsoil. Soil classification is *Humic Luvic Gleysol*.

Commonly Associated Soils: Whatcom, Nicholson and Scat soils usually occur in close association with Albion soils, either in soil complexes or adjacent map polygons. They differ from Albion soils in that Scat soils are more poorly drained and lack the clay accumulation layer in the subsurface. Whatcom and Nicholson soils are reddish-brown in colour, occupy topographically higher landscape positions and are well drained.

Vegetation: Most areas are cleared, cultivated and used mainly for forage and pasture. The remaining forested areas support western red cedar, western hemlock, red alder and some birch. Rooting is usually restricted below about 60 cm by dense, clayey subsoil layers.

General Land Use Comments: (1) Albion soils are moderately suited for agricultural crops, mainly for those that do not suffer excessively from prolonged wet conditions. Use could be improved through subsurface or surface drainage works to remove excess water. Power requirements for cultivation are relatively high due to the fine textures. (2) Albion soils are poorly suited for urban purposes because of poor drainage and the variable bearing capacity of the clayey material. Periodic high watertables and slow permeability severely limit operation of septic tank effluent disposal fields. (3) Limited plot data indicates that red alder produces relatively well on these soils, averaging about 9 to 11 m^3 of wood/ha/yr. Western red cedar appears to be the only conifer suited for growth on Albion soils.

ALOUETTE SOILS (AL)

Location and Extent: Alouette soils occur only on the lowlands of Pitt Meadows and Coquitlam Municipalities and in the southern part of Pitt Polder. There are about 1460 ha of pure map units and a further 810 ha of soil complexes which are dominantly Alouette soils. The complexes are mainly with Pitt, Sturgeon and Neaves soils.

Topography and Elevation: Slightly depressional to undulating with slopes less than 3 percent is the usual topography of Alouette soils. All occur at elevations below 5 m above sea level. In complexes with Pitt soils, Alouette soils occupy the slightly lower landscape positions.

Parent Material and Texture: Alouette soils have developed from shallow organic accumulations which are underlain by mixed Fraser, Alouette and Pitt river floodplain sediments. Textures consist of 15 to 40 cm of well-decomposed (humic) organic material (sometimes containing a proportion of silt) overlying silt loam for a metre or more. At greater depths, medium or fine sand usually occurs.

Soil Moisture Characteristics: Alouette soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity, and slow surface runoff. In undeveloped areas the watertable is at or near the surface during the winter and after other heavy rains. All developed areas are ditched and substantial areas are also tile drained.

General Soil Description: The surface of Alouette soils consists of 15 to 40 cm of black or very dark brown, friable, well-decomposed organic material. This is underlain by about 15 cm of dark grayish brown, silty material commonly containing vertical cracks filled with organic matter from above. Below this, the soil consists of massive, grayish-brown to olive-gray silty material to 1 m or more and contains common to few, reddish and yellowish mottles. Soil reaction varies from extremely acid in the upper soil to very strongly acid in the subsoil. Soil classification is *Orthic Gleysol: peaty phase*.

Commonly Associated Soils: Pitt, Sturgeon and Neaves soils are usually closely associated with Alouette soils. Pitt and Neaves soils differ from Alouette soils in that their surfaces are silty (Neaves) or clayey (Pitt) rather than organic. Sturgeon soils usually do not have the prevalent subsurface cracking of Alouette soils. All, however, are poorly drained.

Vegetation: Most areas of Alouette soils are used for agriculture, mostly for forage and pasture. Undeveloped areas generally support a growth of hardhack, sweet gale, reeds and sedges. Rooting depths are restricted to about 60 cm by high groundwater tables.

General Land Use Comments: (1) The main agricultural limitations of Alouette soils are poor drainage (high watertables) and susceptibility to surface ponding during the winter and other periods of heavy rain. They are presently used mostly for grass-clover pasture and forage production and some silage corn and oats as well as for blueberries and as nursery sites. Improved water control will widen the range of possible crops. Alouette soils are very acidic and liming to raise the pH is beneficial for most crops. (2) Low soil bearing capacity and high water tables make road and building construction difficult. High watertables discourage basements and other excavations while the efficiency of septic tank effluent disposal fields is severely impaired. (3) Alouette soils are estimated to be moderately capable of producing forest species tolerant of high water tables, such as western red cedar. Growth of this species is estimated to be about 6 to 8 m^3/ha/yr.

ANNACIS SOILS (AS)

Location and Extent: Annacis soils occur only along the southern margin of Burns Bog and in a small area south of the Pitt Meadows upland. There are about 130 ha of pure map units and a further 260 ha of soil complexes dominated by Annacis soils. The complexes are mainly with Richmond and Lumbum soils.

Topography and Elevation: Level to gently undulating with slopes less than 2 percent is the usual topography. All areas lie less than 5 m above sea level.

Parent Material and Texture: Annacis soils have developed from deep organic accumulations which overlie silty deltaic or floodplain sediments. Texturally, the surfaces consist of 40 cm or less of partially decomposed (mesic) organic material. This is underlain by at least 120 cm of well-decomposed (humic) organic material. The underlying mineral material is silty clay loam or silty clay and, in the Delta area, is usually saline and high in sulphur compounds.

Soil Moisture Characteristics: Annacis soils are very poorly drained. They are moderately to rapidly pervious and have very high water holding capacity and slow surface runoff. The watertable is at or near the surface for most of the wet winter months but retreats somewhat during the summer.

General Soil Description: The surface of Annacis soils generally consists of about 10 to 30 cm of reddish-brown to black, partially-decomposed, matted reed, sedge and woody plant remains. This overlies at least 130 cm of black to dark reddish brown, weakly stratified, well-decomposed organic material. The mineral underlay (which occurs at depths below 150 cm) is massive, gray to greenish-gray, silty clay loam or silty clay and is usually water saturated and sometimes saline. Soil reaction is extremely acid throughout. Soil classification is *Typic Humisol*.

Commonly Associated Soils: Lumbum, Richmond and Glen Valley soils usually occur in close association with Annacis soils. They differ from Annacis soils in that Lumbum soils are composed of deep, partially-decomposed organic material while Glen Valley soils consist of deep, undecomposed or only slightly decomposed organic deposits. Richmond soils are similar in decomposition to Annacis soils but the underlying mineral material occurs between 40 and 160 cm of the soil surface.

Vegetation: Small areas are cleared. Uncleared areas support mainly western red cedar, red alder and birch, understoried by a variety of ericaceous shrubs and sedges. Moss is usually present on the soil surface. Rooting is mostly restricted to the upper 50 cm by high watertables.

General Land Use Comments: (1) If groundwater levels are adequately controlled and maintained, Annacis soils have good potential for a variety of agricultural crops, including forages, annual root crops and blueberries. Excessive subsidence of the organic material can be controlled by lowering groundwater levels only sufficiently for the requirements of the crops grown. Acid soil characteristics can be controlled by liming. (2) Very low bearing capacities and high watertables make road and building construction and maintenance difficult and costly. Septic tanks effluent disposal is poor due to the high watertables.

ANNIS SOILS (AN)

Location and Extent: Annis soils occupy small, scattered areas throughout the lowlands, mainly in Mission, Langley, Matsqui, Sumas and Pitt Meadows Municipalities. There are about 650 ha of pure map units and a further 540 ha of complexes dominated by Annis soils. The complexes are mostly with Richmond, Hjorth, Hazelwood and Banford soils.

Topography and Elevation: Annis soils are slightly depressional to gently undulating with slopes up to 2 percent. They usually occupy slightly lower landscape positions in relation to adjacent soils. All Annis soil areas occur at elevations less than 10 m above sea level.

Parent Material and Texture: Annis soils have developed from shallow organic accumulations (between 15 and 40 cm thick) which overlie moderately fine to fine-textured Fraser River floodplain deposits and some lacustrine and deltaic deposits. Surfaces consist of 15 to 40 cm of usually well-decomposed organic material. Subsurface and subsoil textures are silty clay loam or silty clay. Below about 1 m depth these grade to medium or fine sand which, in the deltaic deposits, may be saline.

Soil Moisture Characteristics: Annis soils are poorly to very poorly drained. They are slowly pervious and have high waterholding capacity and slow surface runoff. The watertable is at or near the surface for most of the winter and after other heavy rains as well as during the freshet period of the Fraser River. It however, retreats to a depth of a metre or more during dry summers. The soils often act as catchments for the runoff from higher, adjacent land. Artificial drainage has been installed in some areas.

General Soil Description: The surface of Annis soils consists of 15 to 40 cm of dusky red to dark brown, variably decomposed organic material, sometimes stratified. This is underlain by 50 cm or more of massive, gray to dark gray, silty clay loam or silty clay which contains few to common, brown and reddish-brown mottles. This zone then either grades gradually or changes abruptly to medium or fine sand below about 1 m. For most of the year the sand is saturated with water. Soil reaction is extremely acid in the organic surface and grades to medium acid in the subsoil. Soil classification is ***Rego Gleysol:peaty phase***.

Commonly Associated Soils: Banford, Hallert, Gibson, Hjorth and Hazelwood soils are all commonly associated with Annis soils. Banford and Gibson soils differ from Annis soils by respectively consisting of 40 to 160 cm of well-decomposed (humic) organic material and 40 to 160 cm of partially decomposed (mesic) organic material. The surface of Hjorth and Hazelwood soils is mineral in texture (silty) while Hallert soils are composed of alternating layers of organic and silty material.

Vegetation: All areas are cleared and used mainly for pasture and forage. Rooting depth is usually restricted to about 60 cm by dense, clayey subsoil textures and high watertables.

General Land Use Comments: (1) Poor drainage and heavy subsoil textures limit the utilization of Annis soils for agriculture. Artificial drainage, where not already installed, will widen the range of suitable crops from the usual pasture and forage species to include most annual field crops. Improved drainage will also allow earlier cultivation in the spring. (2) High watertables and variable bearing capacities make road and building construction difficult. Septic tank effluent disposal fields function poorly while basements and other excavations are impractical due to high watertables.

ARNOLD SOILS (AR)

Location and Extent: Arnold soils only occur in a few areas near Arnold Station in western Chilliwhack Municipality. There are about 150 ha of pure map units and 20 ha of Arnold-Henderson soil complex.

Topography and Elevation: Very gently sloping to undulating with slopes less than 5 percent is the usual topography of Arnold soils. They lie between 5 and 10 m above sea level.

Parent Material and Texture: Arnold soils have developed from moderately fine textured, stone-free Fraser River floodplain deposits. These deposits, laid down by periodic flooding of the Fraser River, consist of thin, buried, dark-coloured, old surfaces alternating with thicker layers of lighter coloured materials. Surface, subsurface and subsoil textures vary from silt loam to silty clay loam to depths of at least 1 m.

Soil Moisture Characteristics: Arnold soils are moderately poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. A fluctuating groundwater table is present near the soil surface during prolonged, rainy periods and during the freshet stage of the Fraser River. It retreats to depths of 1 m or more during the latter parts of most growing seasons.

General Soil Description: Arnold soils have a dark grayish brown, cultivated, friable, silty surface about 20 cm thick, underlain by a grayish-brown, weakly structured, strongly mottled, silty layer between 15 mnd 30 cm thick. Layers below this consist of black, 5 to 20 cm thick, buried, silty, old soil surfaces alternating with gray, moderately mottled, silty, 20 to 50 cm thick strata to a depth of at least 1 m. The mottles range from reddish to yellowish in colour. Soil reaction is medium acid to at least 1 m depth (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Henderson, Blackburn and Grigg soils occur in soil complexes with Arnold soils or in adjacent map polygons. Henderson soils differ from Arnold soils by having a deep, black, surface layer (up to 80 cm thick) while Blackburn soils differ by being somewhat more poorly drained and clayey in texture. Grigg soils differ by having a well-defined clay accumulation layer in the subsoil.

Vegetation: Native vegetation has essentially all been cleared and the soils are used for a variety of agricultural crops. Rooting is partially restricted below about 70 cm depth by fluctuating groundwater tables.

General Land Use Comments: (1) Arnold soils are well suited for most agricultural crops. They are presently used mostly for production of forages, peas, corn and other field crops. The periodically high watertables restrict their use for perennial crops sensitive to saturated soils. Artificial drainage, where not already installed, is feasible and alleviates this problem. (2) Variable soil bearing capacities and periodic high watertables are limiting for road and building construction. Septic tank operation is inefficient and excavations such as basements are impractical due to periodic high watertables. (3) Productivity of black cottonwood on Arnold soils is estimated to be between 12 and 15 m^3/ha/yr.

BANFORD SOILS (BD)

Location and Extent: Banford soils occupy scattered locations throughout the lowlands, mostly in association with Fraser River floodplain deposits. There are about 190 ha of pure map units and a further 390 ha of soil complexes dominated by Banford soils. The complexes are mainly with Gibson, Annis and Niven soils.

Topography and Elevation: Depressional to gently undulating with slopes below 2 percent is the usual topography of Banford soils. They lie mostly between 5 and 10 m above sea level.

Parent Material and Texture: Banford soils have developed from shallow organic accumulations (40 to 160 cm thick) which overlie medium to moderately fine textured Fraser River floodplain or lacustrine deposits. Textures consist of 40 to 160 cm of well-decomposed (humic), organic material over 50 cm or more of silt loam or silty clay loam. Some silty material is often admixed with the organic material.

Soil Moisture Characteristics: Banford soils are poorly to very poorly drained. They are moderately pervious and have very high water holding capacity and slow surface runoff. The watertable is near and sometimes at the soil surface most of the winter and after heavy, prolonged summer rain. Runoff and seepage from adjacent higher areas also tends to accumulate on Banford soils. Some areas have been ditched and a few are tile drained.

General Soil Description: Banford soils consist of 40 and 160 cm of black to very dark gray, well-decomposed organic material often containing, in the lower part, thin, gray or light gray, silty bands. The underlying mineral deposits are massive, grayish-brown to gray, silt loam or silty clay loam, usually water saturated, and contain a few, brownish or yellowish mottles. Soil reaction varies from extremely to very strongly acid throughout (1:1 H_2O). Soil classification is *Terric Humisol*.

Commonly Associated Soils: Annis, Gibson, Niven and Hazelwood soils are usually closely associated with Banford soils. Annis soils differ from Banford soils by having only 15 to 40 cm of organic material over the underlying mineral soil. Gibson soils are similar to Banford soils except that the organic material is only partially-decomposed. Hazelwood soils have silty to clayey textures to the surface while Niven soils consist of 30 to 100 cm of silty mineral soil over organic materials.

Vegetation: Substantial areas of Banford soils are cleared and cultivated. The remaining uncleared areas support a variety of species, including willow, red alder, salmonberry, thimbleberry, blackberry, sedges, reeds and grasses as well as some western red cedar and western hemlock. Rooting depth is restricted to about 50 cm by high groundwater tables.

General Land Use Comments: (1) Cleared areas are used mainly for pasture, forages, blueberries and some vegetables. Poor drainage and high watertables are the main restrictions to agricultural use. With controlled watertables, Banford soils are suitable for a much wider range of crops, particularly annuals. Where tiles or similar material are used for drainage, they should be placed in the underlying mineral soil, otherwise differential settling in the organic material may lead to disruption of the system. (2) High watertables and low bearing capacities make building and road construction difficult and expensive. Septic tank effluent disposal fields and excavations (e.g. basements) are severely limited by the high watertables.

BATES SOILS (BT)

Location and Extent: Bates soils occur mainly in Matsqui, Hatzic and Sumas valleys and in the western part of Chilliwhack Municipality with smaller, scattered areas elsewhere on the lowlands. There are about 700 ha of pure map units and a further 2400 ha of soil complexes dominated by Bates soils. The complexes are usually with Lickman, Vye, Buckerfield, Fadden and McElvee soils.

Topography and Elevation: Topographically, Bates soils are gently undulating to gently rolling with slopes between 2 and 9 percent. When associated with better drained soils, Bates soils occupy the slight depressions and lower slopes of the undulating topography; when associated with more poorly drained soils, they occupy the tops and upper slopes of the undulations. Elevations range between 5 and 15 m above sea level.

Parent Material and Texture: Medium and some moderately fine textured, stone-free, local stream deposits are the parent material of Bates soils. These overbank deposits, usually at least 1 m thick, were eroded from surrounding higher areas and redeposited as levees and other forms along present and abandoned stream courses during flood periods. They usually overlie Fraser River floodplain or lacustrine deposits. Surface, subsurface and subsoil textures range from silt loam to silty clay loam. Sand is usually present at depths below at least 1 m and, occasionally, is encountered between depths of 50 and 100 cm.

Soil Moisture Characteristics: Bates soils are mostly imperfectly drained with a few areas being moderately poorly drained. They are moderately pervious and have high water holding capacity and moderate to slow surface runoff. A fluctuating groundwater table is usually present during the winter but drops below 1 m during the growing season and is, in part, related to water levels in adjacent streams.

General Soil Description: Bates soils have a friable, dark brown to dark grayish brown, silty surface layer about 20 cm thick which is underlain by a brown to grayish-brown, weakly leached layer about 15 cm thick containing faint, reddish and yellowish mottles. This leached layer is underlain, in turn, by about 40 cm of slightly clay enriched, brownish-gray, silty material that is moderately structured and contains many, reddish-brown to reddish-yellow mottles. It grades to a grayish-brown, massive, moderately mottled, silty subsoil, sometimes containing thin, grayish-black, old, buried surfaces. Sand or loamy sand usually occurs below 1 m or more and occasionally below 50 cm. Soil reaction ranges from strongly acid in the surface to slightly acid in the subsoil. Soil classification is *Gleyed Eluviated Melanic Brunisol*.

Commonly Associated Soils: Lickman, Sim, McElvee, Vye, Fadden and Buckerfield soils are usually closely associated with Bates soils. These soils differ from Bates soils by being, in the case of Buckerfield and Sim soils, more poorly drained and having black surfaces. McElvee soils are also more poorly drained than Bates soils but have a grayish surface. Vye and Fadden soils contain well-developed clay accumulation layers in the subsurface while Lickman soils are well-drained and contain smaller amounts of organic matter in the surface layer.

Vegetation: Natural vegetation has generally been cleared from Bates soils and most areas are cultivated. Small, remaining uncleared areas support a variety of mainly deciduous trees and shrubs with some western red cedar, coast Douglas-fir and occasional Sitka spruce. Rooting depth is relatively unrestricted, extending to at least 120 cm.

General Land Use Comments: (1) Bates soils are well suited for most agricultural crops although perennials sensitive to periodic high watertables may be adversely affected during the winter. Available water storage capacity is high and irrigation is usually required only during years that are drier than usual. The undulating topography sometimes produces uneven crop maturity which may lead to harvesting difficulties with some mechanically harvested crops. (2) Basements and other excavations may contain water when the watertable is high and the efficiency of septic tank disposal fields is impaired during these periods. (3) Bates soils appear well suited for growth of black cottonwood; potential yearly production of wood is estimated to be between 18 and 21 m^3/ha.

Plate 8 Bates soil profile (Gleyed Eluviated Melanic Brunisol). These imperfectly drained, silty soils have developed from local stream deposits and have a moderately leached subsurface layer. In the photo this layer is at 6 to 12 in. (15 to 30 cm). Underlying is a moderately structured, mottled, slightly clay enriched zone to about 2.5 ft. (75 cm). The dark-coloured bands near the bottom of the profile are buried, old surfaces.

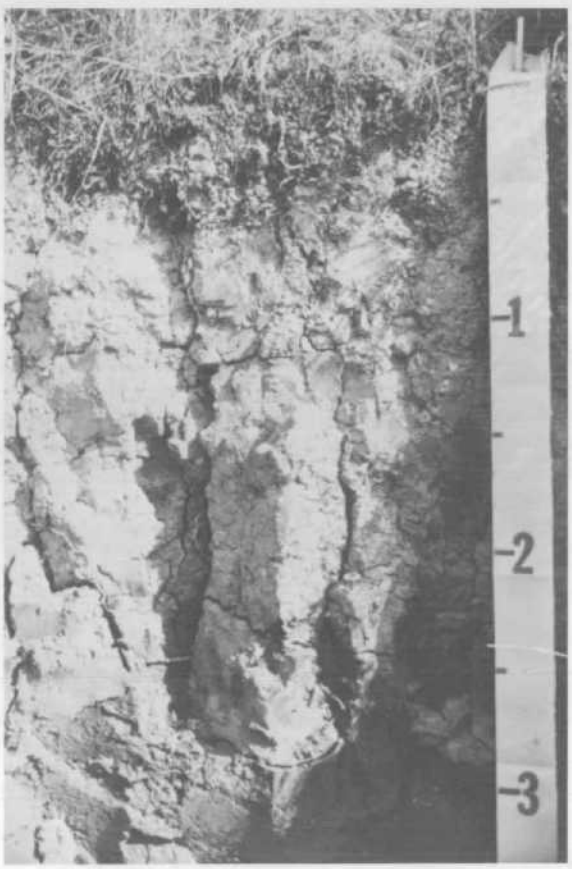


Plate 9 Beharrel soil profile (Humic Luvic Gleysol). These poorly to moderately poorly drained, clayey soils occur mainly in the Matsqui Valley. Note the well developed, prismatic subsurface layer.

BEHARREL SOILS (BL)

Location and Extent: Beharrel soils occur mostly in the central part of Matsqui Valley with lesser areas in Glen Valley. There are about 310 ha of pure map units and 200 ha of soil complexes dominated by Beharrel soils. The complexes are mainly with Bates and Hazelwood soils.

Topography and Elevation: Gently sloping to undulating with slopes between 2 and 6 percent is the usual topography of Beharrel soils. They lie between 5 and 10 m above sea level.

Parent Material and Texture: Beharrel soils have developed from moderately fine to fine-textured, vertically accreted, stone-free, Fraser River floodplain deposits with some inclusions of local stream deposits. Thin organic strata alternating with thicker mineral layers are often present below 50 cm. Surface and subsurface textures range from silty clay loam to silty clay. The subsoil is usually silty clay loam, grading gradually to silt loam below about 80 cm.

Soil Moisture Characteristics: Beharrel soils are moderately poorly to poorly drained. They are slowly to moderately pervious and have high water holding capacity and moderate to slow surface runoff. The water-table is near the surface during much of the winter but recedes to 1 m or more during the growing season. In slightly depressional areas surface water accumulates temporarily during heavy, prolonged rains.

General Soil Description: Beharrel soils have a very dark gray, firm, clayey, cultivated surface layer about 20 cm thick which is underlain by a gray, leached, 10 cm layer containing common, reddish mottles. This, in turn, is underlain by a very firm, strongly structured (prismatic), dark gray or brownish-gray, clay accumulation layer about 20 cm thick containing common, brownish mottles. Under this is 50 cm or more of gray or light gray, massive, silty material containing some yellowish-brown mottles and thin, black organic strata. Soil reaction grades from medium acid in the upper soil to slightly acid in the subsoil (1:1 H_2O). Soil classification is *Humic Luvic Gleysol*.

Commonly Associated Soils: Hazelwood, Bates, Hallert and Sim soils are often closely associated with Beharrel soils. Hazelwood and Sim soils differ from Beharrel soils by having a black surface layer high in organic matter. They also lack a well-defined clay accumulation zone in the subsurface. Sim soils are also silty rather than clayey in texture. Bates soils differ by also being silty as well as occupying slightly higher topographic positions and being imperfectly drained. Hallert soils differ by consisting of alternating strata of organic and silty material. They are also more poorly drained than Beharrel soils.

Vegetation: Most areas of Beharrel soils are cleared and cultivated. The few, small, remaining uncleared areas support cottonwood, willow and other deciduous trees and shrubs. Rooting is restricted mainly to the upper 50 cm of soil, due to the periodic high watertables and dense, clayey subsurface layers.

General Land Use Comments: (1) Beharrel soils are presently used mainly for forages and some grain although other annual crops are suited also. Artificial drainage improves productivity of these crops as well as the maintenance of overwintering perennials. Heavy, sticky soil textures have high power requirements for cultivation. (2) Relatively low bearing strengths and high watertables impede building and road construction. High watertables also make basements and other excavations impractical and poor septic tank effluent disposal occurs because of high watertables and slow permeability. (3) Productivity of cottonwood on Beharrel soils is estimated to be between 9 and 12 m^3/ha/yr.

BENSON SOILS (B)

Location and Extent: Benson soils are limited almost exclusively to lands along the north margin of Boundary Bay in south Delta Municipality. About 90 ha of pure map units and 130 ha of soil complexes dominated by Benson soils are mapped. The complexes are mostly with Mathews soils.

Topography and Elevation: Benson soils are slightly depressional to very gently undulating with slopes up to 2 percent. Elevations are all below 3 m above sea level.

Parent Material and Texture: Moderately coarse textured, stone-free Fraser River deltaic deposits are the parent material of Benson soils. Surface textures range from loam to sandy loam and generally become somewhat coarser with depth. Some thin, silty, subsoil strata may be encountered.

Soil Moisture Characteristics: Benson soils are poorly to very poorly drained. They are rapidly to moderately pervious and have moderate to low water holding capacity and slow surface runoff. The watertable is usually near the surface during the winter but gradually retreats during summer causing droughty conditions. Sea water readily seeps through the subsurface and subsoil sediments causing strongly saline conditions.

General Soil Description: Benson soils have a black or very dark gray, loamy, cultivated surface about 20 cm thick, often containing whitish salt crystals when dry. The surface layer is underlain by about 60 cm of gray, massive, weakly stratified sandy material which grades to greenish-gray, similarily textured material below about 80 cm. Many, prominent yellowish, brownish and reddish mottles are present throughout (except in the surface layer) and salt crystals are usually evident in the subsoil. High levels of sulphides and sulphates are usually present in the subsurface and subsoil. Soil reaction grades from medium or strongly acid in the surface to extremely acid in the subsoil (1:1 H_2O). Soil classification is ***Rego Humic Gleysol:saline phase***.

Commonly Associated Soils: Mathews, Spetifore and Guichon soils are commonly associated with Benson soils. Spetifore soils differ from Benson soils in that they are silty rather than sandy in texture. Guichon soils differ by consisting of about 50 cm of silty to clayey capping over sandy material. Both, however, are saline and poorly drained. Mathews soils, although similar to Benson soils in texture, are moderately poorly drained and non-saline.

Vegetation: Benson soils are all cleared. Where not recently cultivated, mainly salt tolerant grasses and herbs occur. Rooting depth restricted to 60 cm or less by strongly saline soil conditions and high watertables.

General Land Use Comments: (1) Crops are mainly limited to forages because of high salinity and poor drainage during the winter. Watertable control and irrigation to leach the salts and alleviate summer drought are required for satisfactory crop production. (2) Basements and other excavations are difficult to construct and maintain and septic tanks operate poorly because of high watertables. Corrosion of unprotected underground installations is likely because of strongly saline conditions and presence of compounds high in sulphur.

BERRY SOILS (BR)

Location and Extent: Berry soils occur mainly in the vicinities of Langley, Milner and Haney. There are about 180 ha of pure map units and a further 960 ha of soil complexes dominated by Berry soils. The complexes are mostly with Cloverdale and Milner soils.

Topography and Elevation: Berry soils are usually very gently sloping to undulating with slopes between 2 to 5 percent. A few, small areas along gullies have slopes to 30 percent. In soil complexes, Berry soils usually occupy intermediate landscape positions between the lower lying Cloverdale soils and the higher Milner soils. Elevation of Berry soils ranges from 15 to 50 m above sea level.

Parent Material and Texture: Berry soils have developed from moderately fine to fine-textured, stone-free, marine sediments. Silt loam or silty clay loam surface textures are usual. These grade to clay or silty clay in the subsurface and subsoil.

Soil Moisture Characteristics: Berry soils are imperfectly drained. They are moderately pervious in the upper 75 cm or so but become slowly pervious at depths below about 75 cm. Water holding capacity is high and surface runoff is slow to moderate. A temporary, perched watertable develops above the clayey subsoil layers during periods of heavy rain and lateral seepage occurs during these periods also.

General Soil Description: Berry soils have a brown to reddish-brown, friable, silty, cultivated surface about 20 cm thick which is underlain by friable, brown to yellowish-brown, silty material about 40 cm thick containing few to common, reddish-yellow to strong brown mottles. In turn, this is underlain by about 10 cm of light brownish gray, leached, silty material containing common, reddish-yellow mottles. The leached layer is abruptly underlain by an olive-gray, clay enriched layer about 40 cm thick which is very firm, strongly structured and contains some reddish, yellowish and brownish mottles. This grades gradually at about 1 m depth to dark grayish brown, dense, unweathered, clayey marine sediments which contain yellow-brown mottles in the upper part. Soil reaction varies from strongly to slightly acid in the upper 50 cm, then grades to mildly alkaline at depths below 1 m (1:1 H_2O). Soil classification is *Gleyed Podzolic Gray Luvisol*.

Commonly Associated Soils: Milner, Cloverdale, Carvolth, and Murrayville soils are often closely associated with Berry soils. Cloverdale soils differ from Berry soils by being poorly drained and having dark gray to black surfaces. Milner soils differ by being moderately well drained and more reddish in colour. They also lack mottling in the upper 50 to 75 cm. Murrayville soils consist of a sandy veneer over clayey marine sediments while Carvolth soils are poorly drained and occur on the floodplains of streams eroded into the marine sediments.

Vegetation: Most areas of Berry soils are cleared and used mainly for pasture and forage. Small, uncleared areas support coast Douglas-fir, western red cedar, western hemlock along with red alder, birch and bigleaf maple. Rooting is restricted mainly to the upper 80 cm of soil by the dense, clayey, subsoil textures.

General Land Use Comments: (1) Berry soils are utilized mainly for forages and pasture, however, they are suitable for a wide range of crops. Exceptions are those perennials that are susceptible to periodic high watertables over the winter months. (2) Variable soil bearing strengths and relatively high shrink-swell characteristics in the clayey subsoil may require special consideration when constructing building foundations. Operation of septic tank disposal fields is severely impaired by the slow permeability of the subsoils. (3) Berry soils appear to be well suited for the growth of forest crops. Productivity of coast Douglas-fir is estimated to be about 12 to 15 m^3/ha/yr.

BLACKBURN SOILS (BB)

Location and Extent: Blackburn soils occur only in the western part of Chilliwhack Municipality, mainly in the vicinity of Arnold Station. There are about 70 ha of pure map units and 140 ha of soil complexes dominated by Blackburn soils. The complexes are with Pelly, Grigg and Henderson soils.

Topography and Elevation: Blackburn soils are slightly depressional to gently undulating with slopes up to 5 percent. In soil complexes, Blackburn soils usually occupy slightly higher topographic landscape positions than Pelly soils and slightly lower positions than Grigg or Henderson soils. Blackburn soils lie between 5 and 10 m above sea level.

Parent Material and Texture: Blackburn soils have developed from moderately fine textured, stone-free, Fraser River floodplain deposits, mainly vertically accreted. The deposits usually contain thin, dark coloured lenses of buried, inter-flood organic matter accumulations. Surface, subsurface and subsoil textures are generally silty clay loam with inclusions of silty clay. Textures usually change to medium or fine sand at depths of 1 m or more.

Soil Moisture Characteristics: Blackburn soils are poorly to moderately poorly drained. They are moderately to slowly pervious, have high water holding capacity and slow to moderate runoff. The watertable is usually near the surface during the winter but gradually retreats to at least 1 m during most summers. Surface water temporarily accumulates in depressions during heavy rains.

General Soil Description: Blackburn soils have a very dark gray, friable, silty to clayey cultivated surface about 20 cm thick. This is underlain by about 50 cm of grayish-brown, strongly vertically cracked, very firm, clayey material that grades gradually to 30 cm or more of massive, olive-gray, silty deposits. These, in turn, are underlain by sandy materials at depths of 1 m or more. There are common to many yellowish-brown mottles and some dark grey, horizontal lenses throughout (except in the cultivated layer). Soil reaction grades from strongly acid in the surface to medium acid in the subsurface and subsoil layers (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Arnold, Grigg, Pelly and Henderson soils are usually closely associated with Blackburn soils. Arnold soils differ from Blackburn soils in that they are silty rather than clayey in texture. Grigg and Henderson soils differ by being imperfectly drained and contain well defined clay accumulation layers. In addition, Henderson soils have a very deep (up to 80 cm thick) black, surface layer. Pelly soils are more poorly drained than Blackburn soils and are often depressional in relation to them.

Vegetation: The natural vegetation on Blackburn soils has essentially all been cleared and the soils are cultivated. The few, small, remaining uncleared areas presently support mostly black cottonwood, vine maple, willow and a variety of shrubs. Rooting is restricted below about 60 cm depth by the dense, clayey subsoil and high groundwater tables.

General Land Use Comments: (1) Present utilization of Blackburn soils is mainly for forages and some field peas and corn. The range of possible crops can be substantially broadened through artificial drainage by controlling the watertable and removing surface water. (2) Variable soil bearing capacities and high watertables may require special road and building construction methods. Basements and other excavations are difficult to construct and maintain and are likely to contain water during parts of the year. High watertables and slow permeability make Blackburn soils generally poor for septic tank effluent disposal. (3) Forest crops such as black cottonwood appear to be well suited for Blackburn soils. Potential wood production by this species is estimated to be between 9 and 12 m^3/ha/yr.

BLANEY SOILS (BE)

Location and Extent: Blaney soils occur only on the University of British Columbia Research Forest, mainly near Blaney Lake. About 90 ha of soil complexes dominated by Blaney soils are mapped. The complexes are with Marion and Cannell soils.

Topography and Elevation: Hilly to strongly rolling with slopes between 15 and 50 percent is the usual topography of Blaney soils. They range in elevation from 350 to 450 m above sea level. Blaney soils usually occur in the mid- and upper slope positions of the landscape while Cannell soils are mostly on the ridges and Marion soils on the lower slopes and in the intervening swales.

Parent Material and Texture: Blaney soils have developed from moderately coarse to coarse-textured morainal (glacial till) deposits derived mainly from granitic rock. The deposits are usually more than 1 m but less than 3 m thick over rock. Surface, subsurface and subsoil textures vary from gravelly loamy sand to gravelly sandy loam and are very to excessively stony. The soils are strongly cemented below about 60 cm of the surface.

Soil Moisture Characteristics: Blaney soils are well to moderately well drained. They are rapidly pervious in the upper 60 cm or so but are slowly pervious in the cemented subsoil. They also have low water holding capacity and slow to moderate surface runoff. During and after heavy rain, a temporary, perched watertable develops quickly above the cemented zone and telluric seepage moves laterally along its surface.

General Soil Description: Blaney soils have up to 10 cm of raw to well-decomposed forest litter on the mineral soil surface. This is underlain by 2 to 5 cm of light gray, loose, leached sandy material, which, in turn, is underlain by a gravelly and sandy zone, about 40 cm thick, which varies in colour from brown and dark reddish brown to yellowish-brown and contains between 8 and 12 percent organic matter. It is friable to loose and contains scattered, moderately cemented patches, and usually, a well-developed root concentration layer near the bottom. The soil then changes abruptly to massive, strongly cemented, grayish-brown material similar in texture to the layer above. The cemented layer continues downward for about 50 cm and then grades gradually into softer, grayish-brown soil parent material or overlies bedrock. Soil reaction varies from extremely to very strongly acid throughout. Soil classification is *Duric Ferro-Humic Podzol*.

Commonly Associated Soils: Marion, Cannell and Eunice soils generally occur in close association with Blaney soils. Marion soils differ from Blaney soils in that they usually lie in topographically lower landscape positions and are imperfectly drained. Cannell soils consist of less than 100 cm of soil over bedrock while Eunice soils are composed of 10 cm or more of organic forest floor accumulations over bedrock.

Vegetation: The vegetation of Blaney soils consists mainly of second-growth coast Douglas-fir, western hemlock and western red cedar interspersed with various deciduous species. Rooting depth is restricted to about 75 cm by the cemented subsoil and a well defined zone of root concentration (root mat) is usually present immediately above the cemented zone.

General Land Use Comments: (1) Steep slopes, excessive stoniness and coarse textures make Blaney soils unsuitable for agricultural uses. (2) Road and building construction is difficult due to steep slopes and relatively shallow bedrock. Inefficient operation of septic tank disposal fields can be expected due to cemented, slowly permeable subsoils and steep slopes. (3) Blaney soils produce good forest growth although droughty conditions are limiting during periods of low rainfall. Estimated productivity of coast Douglas-fir is 9 to 12 m^3/ha/yr.

BLUNDELL SOILS (BU)

Location and Extent: Blundell soils occur only in Richmond and Delta Municipalities. There are about 190 ha of pure map units and 570 ha of soil complexes dominated by Blundell soils. The complexes are mainly with Delta, Westham and Annis soils.

Topography and Elevation: Level to very gently undulating with slopes less than 2 percent is the usual topography of Blundell soils. They are usually slightly depressional in relation to adjacent soils and lie at elevations less than 3 m above sea level.

Parent Material and Texture: Blundell soils have developed from shallow organic deposits (15 to 40 cm thick) overlying medium-textured, stone-free, Fraser River deltaic deposits. Surfaces consist of 15 to 40 cm of well-decomposed (humic) organic material containing admixed silt. The subsurface texture is silt loam. This grades in the subsoil to medium or fine sand below depths of about 1 m. On some of the small islands in the mouth of the Fraser River the sands may occur at depths between 50 and 100 cm. The deposits become saline below depths of 75 to 100 cm from the surface and at these depths also usually contain substantial amounts of compounds high in sulphur.

Soil Moisture Characteristics: Blundell soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is near the surface for most of the year, withdrawing to about 1 m during the latter part of the growing season. Water accumulates on the surface during and after heavy rains.

General Soil Description: Blundell soils have an organic, cultivated surface layer about 25 cm thick, which is black to very dark brown, friable and well-decomposed. It is underlain by about 50 cm of massive, grayish-brown, silty material containing occasional vertical cracks and a few reddish-brown to yellowish-red mottles. This grades to about 50 cm of massive, dark gray, silty material which contains hard, reddish and brownish tubules around old root channels, is saline and contains compounds high in sulphur in the lower part. Below about 120 cm depth, dark gray, massive, saline sand occurs. Soil reaction is extremely acid throughout. Soil classification is *Rego Gleysol:saline and peaty phase*.

Commonly Associated Soils: Delta, Westham and Annis soils usually occur in close association with Blundell soils. Delta and Westham soils differ from Blundell soils by having silty rather organic surface textures. Annis soils have surfaces similar to Blundell soils but the subsurface mineral soil is clayey rather than silty. The subsoil of Annis soils is also usually non-saline.

Vegetation: The Blundell soils are essentially all cleared and cultivated. The few, small, remaining uncleared areas support black cottonwood, willow and a variety of shrubs. Rooting is generally limited to about 50 cm depth by high groundwater tables.

General Land Use Comments: (1) Blundell soils are mostly used for forages, field peas and other field crops. With improved drainage, especially winter watertable control, a wider variety of crops, particularly perennials, is possible. Liming to improve the very acid conditions is also favourable. Salinity in the subsoil is usually sufficiently deep to have little adverse effect on most crops. (2) Poor bearing capacities and high watertables make road and building construction difficult. Excavations such as basements are usually not possible and septic tank effluent disposal is poor. The saline subsoils high in sulphur compounds are likely to cause deterioration and corrosion of unprotected buried installations.

BONSON SOILS (BN)

Location and Extent: Bonson soils occupy limited areas near the Alouette and North Alouette Rivers north of Haney, and on the lowlands of Coquitlam Municipality. There are about 140 ha of pure map units and a further 80 ha of Bonson-Alouette soil complex.

Topography and Elevation: The topography of Bonson soils is gently undulating to undulating with slopes up to 5 percent. The soils usually occupy the crests and upper slopes of the undulating landscape. Elevations range between 3 and 8 m above sea level.

Parent Material and Texture: Bonson soils have developed from medium-textured floodplain deposits, mainly of the Alouette, North Alouette and Coquitlam Rivers. Surface and subsurface textures are silt loam, changing in the subsoil to medium or coarse granitic sand at about 1 m depth.

Soil Moisture Characteristics: Bonson soils are imperfectly drained. They are moderately pervious and have high water holding capacity and moderate to slow surface runoff. The watertables fluctuate, at least in part, with changes in the water levels in adjacent watercourses. Drainage has probably improved since dyking was installed along the North Alouette and Alouette Rivers.

General Soil Description: Bonson soils have a very dark grayish brown, friable, cultivated, silty surface, about 15 cm thick and containing approximately 15 percent organic matter. The surface is underlain by 15 cm of grayish-brown, friable, vesicular, silty material containing a few, brownish mottles. This, in turn, is underlain by about 70 cm of friable, light grayish brown, silty material containing common to many, prominent, yellowish-red and strong brown mottles, especially in the lower part. At depths of 1 m or more, loose, olive sand is encountered. Soil reaction is very strongly acid in the upper part and strongly acid in the subsoil. Soil classification is *Gleyed Sombric Brunisol*.

Commonly Associated Soils: Alouette, Hammond and Sardis soils commonly occur in close association with Bonson soils. Sardis soils differ from Bonson soils by being gravelly sandy in texture while Alouette and Hammond soils differ by being poorly drained. Additionally, Alouette soils have an organic surface.

Vegetation: Most Bonson soil areas are cleared of natural vegetation. The few, remaining, uncleared areas support a mixed forest composed of, among others, western red cedar, black cottonwood, red alder and willow understoried by a variety of shrubs. Rooting is essentially unrestricted to at least 100 cm depth.

General Land Use Comments: (1) Drainage conditions are generally satisfactory for most shallow-rooted annual agricultural crops but improved drainage would benefit the deeper rooted annuals as well as most perennials. Liming to improve the strongly acid soil conditions is also beneficial for most crops. (2) Soil bearing capacities are variable and require consideration in building or road construction. Septic tank effluent disposal fields are impaired during periods of high watertables. (3) Bonson soils appear well suited for the growth of black cottonwood. Potential annual wood production for this species is estimated to be about 20 m^3/ha/yr.

BOOSEY SOILS (BY)

Location and Extent: Boosey soils occupy a few, small areas on the uplands in the western half of the map area, mainly in Surrey and Delta Municipalities. There are about 35 ha of pure map units and 15 ha of soil complexes dominated by Boosey soils. The complexes are mainly with Bose and Heron soils.

Topography and Elevation: Boosey soils are depressional to gently undulating with most slopes less than 5 percent. Elevations range from 20 to 100 m above sea level.

Parent Material and Texture: The parent material of Boosey soils consists of 30 to 160 cm of gravelly marine lag or glaciofluvial deposits overlying mostly glacial till and sometimes, glaciomarine sediments. Gravelly sandy loam or gravelly loamy sand are the usual surface textures. These grade to gravelly loamy sand or gravelly sand in the subsurface. The underlying compact, glacial till is gravelly sandy loam while the glaciomarine deposits are silty clay loam. The upper part of the soil is usually moderately stony.

Soil Moisture Characteristics: Boosey soils are poorly drained. They are rapidly pervious in upper sandy and gravelly layers but this changes to slowly pervious in the underlying glacial till and glaciomarine deposits. Water holding capacity is low and surface runoff is slow. Boosey soils are often accumulation areas for runoff and seepage from higher, adjacent land and watertables perch above the compact, subsoil materials. During periods of heavy, prolonged rain surface ponding is common.

General Soil Description: Boosey soils usually have 5 cm or less of mostly deciduous forest litter on the soil surface. This is underlain by about 20 cm of friable, very dark brown, gravelly material enriched with organic matter that grades to about 50 to 100 cm of grayish-brown, loose, gravelly soil containing common, yellowish-brown mottles. Below this a clear to abrupt change to compact, grayish-brown glacial till or glaciomarine deposits containing yellowish-brown mottles occurs. Soil classification is ***Rego Humic Gleysol***.

Commonly Associated Soils: Bose and Heron soils are usually closely associated with Boosey soils. Bose soils differ from Boosey soils by being well to moderately well drained. Heron soils have similar drainage as Boosey soils but are sandy rather than gravelly in the upper part.

Vegetation: Some areas are cleared and used mostly for pasture and forage. Uncleared areas support mainly red alder, black cottonwood and some maple and birch with a relatively dense shrubby understory and some moss on the soil surface. Rooting depths are limited to between 50 and 100 cm by perched watertables and compact subsoil layers.

General Land Use Comments: (1) Use for agriculture is limited by poor drainage, low water holding capacity and stoniness. Some areas with adequate outlets can be improved by artificial drainage. Irrigation is required to alleviate droughty conditions during most growing seasons. (2) Poor drainage and perched watertables make construction difficult during wet periods. Septic tank effluent disposal fields are severely restricted by high, perched watertables and slow subsoil permeability. (3) Boosey soils are moderately suited for western red cedar. Estimated potential wood production by this species is 6 to 8 m^3/ha/yr.

BOSE SOILS

Plate 10 Typical mixed coniferous and deciduous second-growth forest on Bose soils. Douglas-fir, western red cedar and red alder are most prevalent.

Location and Extent: Bose soils occupy extensive areas on the uplands in the western part of the map area, particularly on the Sunshine Coast and in Delta and Surrey Municipalities. About 5400 ha of pure map units and 8030 ha of soil complexes dominated by Bose soils are classified. The complexes are with a variety of soils but most commonly are with Capilano, Boosey, Sunshine, Summer and Whatcom soils.

Topography and Elevation: Bose soils are variable in topography and range from gently sloping and undulating to steeply sloping and strongly rolling. Slope gradients are mostly between 5 and 25 percent. Elevations mostly lie between 10 and 100 m above sea level.

Parent Material and Texture: The parent material of the Bose soils is similar to that of the Boosey soils. It consists of about 30 to 160 cm of moderately to very stony, gravelly marine lag or glaciofluvial deposits overlying moderately coarse-textured glacial till or sometimes moderately fine textured glaciomarine sediments. Gravelly sandy loam or gravelly loamy sand are the usual surface textures. These grade to gravelly sand, gravelly loamy sand, sand or gravel in the subsurface. Textures abruptly change in the subsoil to gravelly sandy loam where glacial till forms the underlay or to silty clay loam where glaciomarine deposits are present. Where glacial till forms the underlay, its upper 25 to 50 cm is usually strongly cemented.

Soil Moisture Characteristics: Bose soils are moderately well to well-drained. They are rapidly pervious in the upper, gravelly part but this changes to slowly pervious in the compact glacial till or glaciomarine underlay. They have low water holding capacity. Telluric seepage along the surface of the dense, compact subsoil is usual after prolonged, heavy rain.

General Soil Description: Bose soils have up to 10 cm of organic forest litter on the soil surface under which is a discontinuous, light gray, leached, sandy layer thinner than 4 cm. This, in turn, is underlain by a dark brown to reddish-brown, loose, gravelly zone about 60 cm thick which grades to a further 20 cm or so of yellowish-brown gravelly material. Abruptly underlying this, where glacial till is present, is a very hard, cemented, somewhat platy, sandy layer about 50 cm thick, containing common, reddish-brown to grayish-brown mottles. The cemented layer grades to compact, gray, unweathered glacial till below about 130 cm. In areas where the subsoil is of glaciomarine origin, the cemented layer is either only weakly developed or is absent and the subsoil consists of massive, silty to clayey materials. Soil reaction varies from strongly acid in the surface layers to

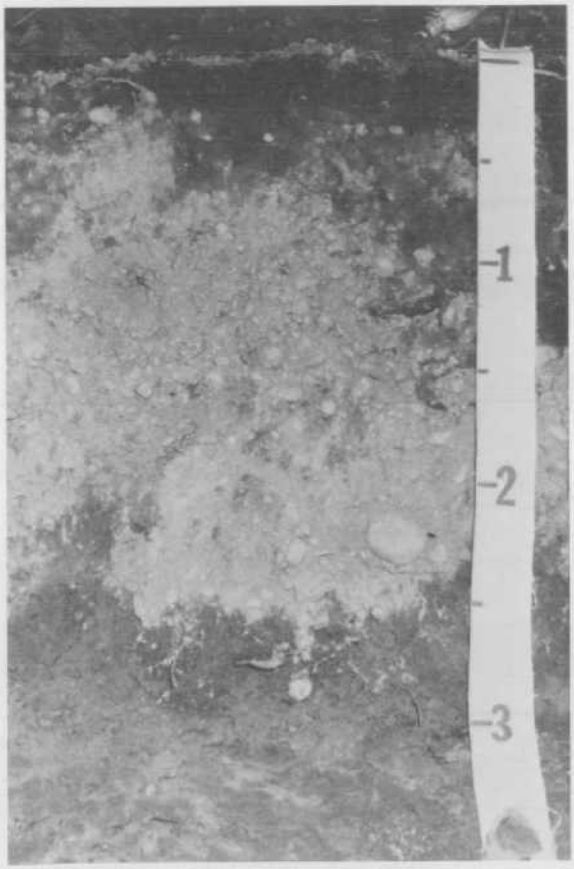


Plate 11 Bose soil profile (Duric Humo-Ferric Podzol). Bose soils have developed from gravelly littoral on glaciofluvial veneers overlying strongly cemented glacial till. In the photo, the contact between the two deposits is at 3 ft. (90 cm). The soil is moist near the contact due to lateral seepage above the cemented material.

moderately acid in the subsoil (1:1 H_2O). Soil classification is ***Duric Humo-Ferric Podzol*** in areas where the subsoil is glacial till; where the subsoil is glaciomarine deposits, the classification is ***Orthic Humo-Ferric Podzol***.

Commonly Associated Soils: Capilano, Boosey, Sunshine, Summer, Whatcom and Surrey soils often are closely associated with Bose soils, either in soil comlexes or adjacent map polygons. Capilano and Sunshine soils differ from Bose soils by respectively consisting of deep gravelly and sandy deposits. Boosey soils differ by being poorly drained while Summer soils are sandy, imperfectly drained and cemented in the subsurface rather than the subsoil. Surrey soils have developed from compact glacial till and Whatcom soils have developed from silty to clayey glaciomarine deposits. Neither have a gravelly capping.

Vegetation: Cleared areas are used mostly for forage or urban purposes. Most areas are uncleared and support second-growth coast Douglas-fir, western red cedar, western hemlock, red alder, vine and bigleaf maple and some birch and willow. The understory includes salal, Oregon grape, thimbleberry and bracken. Rooting depths range to about 100 cm, being restricted below that by dense, usually cemented soil layers.

General Land Use Comments: (1) Bose soils are limited for agricultural use by low water holding capacity, and, sometimes, adverse topography. Irrigation, adequate fertilization as well as stone-picking improves their suitability for agricultural uses. (2) Soil bearing capacities for houses and similar construction are good (varies to moderate where glaciomarine deposits occur in the subsoil), however low subsoil permeability and often strongly sloping topography limit sewage effluent disposal from septic tanks. (3) Forest production is moderately good although low soil moisture holding capacities limit growth through dry periods. Data from a limited number of plots indicates that growth of coast Douglas-fir is about 7 to 9 m^3 of wood/ha/yr.

BUCKERFIELD SOILS (BK)

Location and Extent: Buckerfield soils occur only in Sumas Valley, mainly in the western part. There are about 710 ha of pure map units and 310 ha of soil complexes dominated by Buckerfield soils. The complexes are mainly with Vye, Bates and Vedder soils.

Topography and Elevation: Topographically, Buckerfield soils vary from slightly depressional to gently undulating and occasionally, undulating. Slope gradients are less than 4 percent. Elevations range between 5 and 10 m above sea level.

Parent Material and Texture: Buckerfield soils have developed from moderately fine-textured lacustrine deposits, often underlain by sandy material below 1 to 2 m depth. The deposits are often stratified and sometimes contain one or more, thin, old, buried surfaces. Surface textures vary from silty clay loam to silt loam and subsurface textures are silty clay loam or silty clay. In the subsoil below about 75 cm gradation to silt loam occurs and further change to fine loamy sand or sand is common below 1 m.

Soil Moisture Characteristics: Buckerfield soils are poor to moderately poorly drained with the upper slopes of the undulations being slightly better drained than the depressions. They are moderately to slowly pervious with the subsurface clayey layer being most restricting. Water holding capacity is high and surface runoff is slow. Watertables rise to near the surface during the winter and surface ponding sometimes occurs.

General Soil Description: Buckerfield soils have a silty, cultivated surface that is about 20 cm thick, friable and dark grayish brown or very dark gray in colour. The surface is underlain by about 50 cm of very firm, clayey material containing moderate amounts of vertical cracks and many yellowish-red or yellowish-brown mottles. This zone then grades to a massive, dark gray, silty layer about 20 cm thick which, in turn, is underlain by loose, gray, medium or fine sand at depths greater than 100 cm. Reaction varies from moderately acid in the surface to slightly acid or neutral in the subsoil (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Vye, Bates and Vedder soils usually occur in close association with Buckerfield soils, either as part of soil complexes or in adjacent map polygons. Vye and Bates soils differ from Buckerfield soils by being imperfectly rather than poorly drained (they occupy slightly higher landscape positions). Additionally, Vye soils contain a well defined clay accumulation layer in the subsurface. Vedder soils, although having similar poor drainage as Buckerfield soils, have a lighter coloured surface which contains lesser amounts of organic matter.

Vegetation: Most Buckerfield soil areas are cleared and used for agriculture. A few, small, uncleared areas support mainly deciduous species including black cottonwood, maple and willow. Rooting depths are usually restricted to about 60 cm by high watertables and clayey subsoil layers.

General Land Use Comments: (1) Buckerfield soils are presently used mostly for forage production and a variety of field crops. These moderately to highly fertile soils are limited mainly by high watertables during the winter months and other rainy periods. Artificial drainage to control the high watertables makes these soils suitable for most crops. (2) Soil bearing capacities are variable (mainly low) requiring special consideration during building and other construction. Septic tank disposal fields usually function poorly because of high watertables and slow permeability. (3) Buckerfield soils appear to be moderately to well suited for the growth of black cottonwood. Yearly production of wood is estimated to be about 9 to 12 m^3/ha.

BUNTZEN SOILS

Plate 12 Glacial till covered landscape west of Stave Falls. Buntzen soils occur on the tops and slopes of the undulations while Steelhead soils are usual in the depressions and intervening swales. Note the excellent leader growth of the young Douglas-fir in the foreground.

Location and Extent: Buntzen soils are common on the lower mountain slopes north of the Fraser River, particularly west of the Hatzic Valley to Howe Sound. There are about 750 ha of pure map units and a further 13830 ha of soil complexes dominated by Buntzen soils. The complexes are mainly with Steelhead soils; lesser areas are with Cannell, Stave and Kenworthy soils.

Topography and Elevation: The topography of Buntzen soils is mostly strongly to very steeply sloping or moderately rolling to hilly. Slopes are mainly between 15 and 30 percent but can vary from 10 to 50 percent. Buntzen soils are located between 200 and 500 m above sea level and usually occupy the mid and upper slopes of the uneven landscape.

Parent Material and Texture: Moderately coarse to medium-textured glacial till is the parent material of Buntzen soils. There usually is some silty eolian material incorporated into the upper 20 to 30 cm. Surface and subsurface textures are loam or sandy loam containing moderate amounts of gravel and stones. The subsoil is strongly cemented, gravelly sandy loam. Few to common, hard, spherical concretions are usually present in the upper 60 m or so of soil.

Soil Moisture Characteristics: Buntzen soils are moderately well drained. They are rapidly pervious in the upper 100 cm but this decreases abruptly to slow below that. Water holding capacity is moderate. Lateral telluric seepage is common along the surface of the compact, cemented, subsoil layers during and after heavy rain and during snowmelt.

General Soil Description: The surface of Buntzen soils usually consists of 10 cm or less of raw to well-decomposed, coniferous forest litter which is underlain by a discontinuous, gray, leached, sandy layer up to 4 cm thick. This, in turn, is underlain by about 75 cm of friable, loamy soil which ranges from dark reddish brown in the upper part to dark brown and yellowish-brown in the lower part. It contains between 6 and 12 percent organic matter and common to few, hard reddish, spherical concretions. At about 75 to 100 cm depth, a dense, hard, cemented, sandy loam layer occurs which is dark grayish brown, massive or coarsely platy and contains many yellowish-red to dark red mottles. A zone of root accumulation and concentration is evident on top of this layer. Below about 120 to 150 cm, transition occurs to massive, slightly softer, grayish-brown, unweathered glacial till soil parent material. Soil reaction of the organic surface is extremely acid while the upper mineral soil is very acid. This grades to moderately acid below about 100 cm. Soil classification is *Duric Ferro-Humic Podzol.*

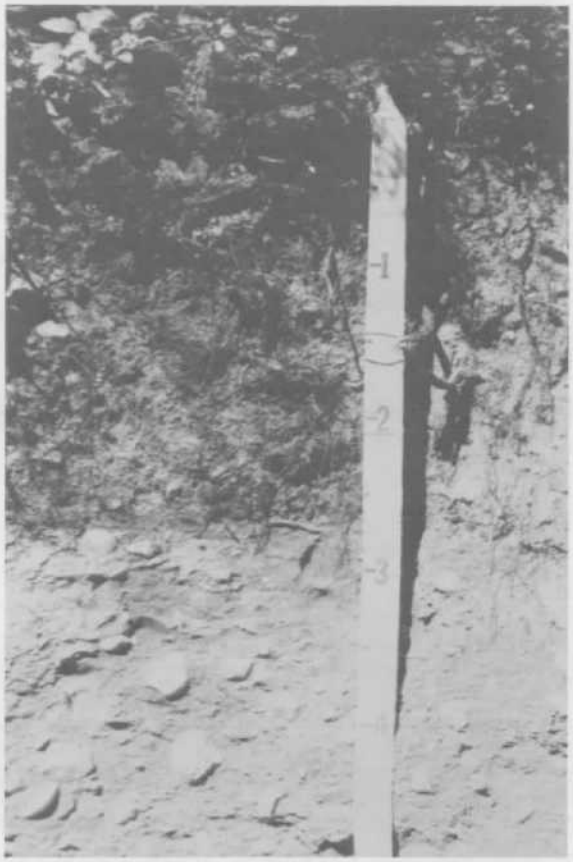


Plate 13 Buntzen soil profile (Duric Ferro-Humic Podzol). Note the abrupt upper surface of the strongly cemented duric layer at about 2.5 ft. (64 cm). Very few roots enter this dense zone and root mats are common on its surface.

Commonly Associated Soils: Steelhead and Cannell soils often occur in close association with Buntzen soils. Steelhead soils differ from Buntzen soils by occupying lower slopes and slight depressions where the drainage is imperfect. Cannell soils differ by being less than 1 m deep over bedrock. Stave and Kenworthy soils are sometimes closely associated with Buntzen soils also. Stave soils differ by having developed from 1 to 2 m of sandy material over glacial till while Kenworthy soils have developed from gravelly and stony colluvial deposits.

Vegetation: The usual vegetation is second-growth Douglas-fir, western hemlock and western red cedar; associated vegetation includes vine maple, red alder and various ferns and shrubs with moss on the soil surface. Rooting is usually unrestrictd to about 100 cm depth but is severely limited below that by the dense, cemented horizons. A root mat is usually present immediately above the cementation.

General Land Use Comments: (1) Buntzen soils have limited use for agriculture because of adverse topography and stoniness. Forage crops and pasture are possible in some areas. (2) Soil bearing capacities are high and, where not limited by steep slopes, Buntzen soils provide good construction sites for urban development. However, the dense, slowly permeable subsoils and steep slopes are poor for septic tank effluent disposal. (3) Forest production is good. Data from a limited number of plots indicates annual wood production by Douglas-fir to be about 9 to 12 m^3/ha.

BURWELL SOILS (BW)

Location and Extent: Burwell soils occur on the lower and middle mountain slopes, mostly in the Coast Range. There are about 460 ha of pure map units and an additional 3330 ha of soil complexes dominated by Burwell soils. The complexes are mostly with Strachan and Cannell soils.

Topography and Elevation: The topography of Burwell soils is very steeply to steeply sloping with slope gradients varying between 20 and 70 percent. The soils often occupy either slightly depressional or concave positions in the landscape. Elevations range between 150 and 700 m above sea level.

Parent Material and Texture: Burwell soils have developed from moderately coarse-textured glacial till deposits modified somewhat by colluvial action in the upper part. Surface and subsurface textures are usually sandy loam or gravelly sandy loam and contain numerous stones and some boulders. The subsoil (below about 100 cm) is dense, compact, stony, strongly cemented gravelly sandy loam or sometimes, gravelly loamy sand.

Soil Moisture Characteristics: Burwell soils are imperfectly drained. They are rapidly to moderately pervious in the upper part but this abruptly becomes slow in the cemented subsoil. Persistent, lateral, telluric seepage above the dense, cemented subsoil layers is usual and during periods of high rainfall, the seepage commonly comes to the surface in shallow, intermittent drainage-ways.

General Soil Description: The surface of Burwell soils consists of between 10 and 20 cm of organic forest litter, the lower half of which is black, well-decomposed and amorphous. Underlying this is a gray, leached, sandy layer usually varying from 2 to 5 cm in thickness but sometimes being absent. In turn, this is underlain by a sandy to gravelly, friable, moderately porous, dark reddish brown zone about 75 cm thick containing a few, hard, spherical concretions, some reddish or yellowish mottles and between 8 and 15 percent organic matter. Abruptly underlying for about 75 cm is a dense, hard, compact, strongly cemented, massive to coarsely platy layer which is olive-gray to grayish-brown in color. It is sandy to gravelly in texture and contains common, reddish or yellowish mottles. A well developed zone of organic matter accumulation (derived mainly from decayed roots) is usually present immediately above the cemented layer. Below depths of about 160 cm the cemented layer grades to gray and olive-gray, compact, massive, unweathered glacial till soil parent material. Soil reaction is extremely to very strongly acid in the upper 150 cm then gradually changes to medium acid at greater depths. Soil classification is *Duric Ferro-Humic Podzol*.

Commonly Associated Soils: Strachan, Cascade, Cannell and Eunice soils commonly occur in soil complexes with Burwell soils or occupy adjacent map polygons. Strachan and Cascade soils differ from Burwell soils by being well or moderately well drained, rather than imperfectly drained. Cascade soils also contain a proportion of silty, eolian material in the upper soil layers. Cannell soils differ by being underlain by bedrock within 1 m of the surface while Eunice soils consist of 10 cm or more of organic forest litter over bedrock.

Vegetation: The vegetation on Burwell soils is dominantly coniferous, mainly western hemlock, western red cedar and coast Douglas-fir; various ericaceous shrubs and ferns form the understory. Rooting is generally unrestricted to about 100 cm depth but is severely limited below that by the dense, cemented soil layers.

General Land Use Comments: (1) Burwell soils are not suitable for agricultural or urban purposes because of excessive slopes and stoniness. (2) Forest productivity is high. Limited plot data indicates growth of western hemlock and western red cedar is about 12 to 15 m^3/ha/yr. During harvest, special care is required to prevent surface erosion and to control seepage into road cuts and ditches. Slumping of steep cut slopes is probable.

CALKINS SOILS (CN)

Location and Extent: Calkins soils occupy small, scattered upland areas in the eastern part of the map area, particularly in the vicinities of Abbotsford, Mission and Peardonville. There are about 360 ha of pure map units and an additional 210 ha of soil complexes dominated by Calkins soils. The complexes are mainly with Lonzo Creek, Ryder and Judson soils.

Topography and Elevation: Calkins soils are level to gently undulating and usually depressional in relation to adjacent land. Slope gradients are less than 3 percent and elevations range between 30 and 125 m above sea level.

Parent Material and Texture: The parent material of Calkins soils consists of medium-textured eolian deposits, 20 to 75 cm thick, overlying mostly glacial till and some glaciofluvial deposits. Surface and subsurface textures are silt loam or sometimes silty clay loam. Subsoils are gravelly sandy loam in glacial till areas or sand to gravel where glacial outwash is present. Up to 15 cm of organic accumulation is present on the surface in some areas.

Soil Moisture Characteristics: Calkins soils are poorly to very poorly drained. They are moderately pervious in the surface and subsurface, however this changes to slowly pervious in the compact glacial till subsoil. A perched watertable is usually present above the restricting subsoil and substantial seepage and some runoff from adjacent, higher areas is usual. Water holding capacity of Calkins soils is moderate to high (depending on the depth of the silty capping) and surface runoff is slow. Surface ponding is usual after heavy, prolonged rain.

General Soil Description: Calkins soils have a surface consisting of about 20 cm of black or very dark brown, friable, silty material (sometimes capped by a thin layer of black organic material). This grades to 30 cm or more of olive to olive-gray, massive, silty material containing common, reddish and brownish mottles. Underlying the silty material is grayish-brown to olive-brown, compact, glacial till or cemented, sandy to gravelly glacial outwash. Soil reaction is very acid throughout (1:1 HåO). Soil classification is ***Rego Humic Gleysol***.

Commonly Associated Soils: Ryder, Lonzo Creek, Abbotsford, Marble Hill and Judson soils often occur in close association with Calkins soils. Ryder and Lonzo Creek soils differ from Calkins soils by being well or moderately well drained and reddish brown in colour. They consist, however, as do Calkins soils, of silty eolian cappings over glacial till. Abbotsford and Marble Hill soils are also well or moderately well drained but are composed of silty eolian cappings over glacial outwash. Judson soils are organic, between 40 and 160 cm deep.

Vegetation: Uncleared areas of Calkins soils support a variety of moisture tolerant species, mainly western red cedar with some red alder and willow understoried by various shrubs, skunk cabbage, sedges and grasses. Rooting depth is usually limited to about 50 cm by the high, perched watertables.

General Land Use Comments: (1) Undrained areas are mainly suited for forage or pasture production; artificial drainage will improve the range of crops possible. The depressional nature of Calkins soils, however, often makes drainage outlets difficult to locate and install. (2) High watertables, restricted subsoil permeability and potential for surface ponding make Calkins soils generally unsuitable for urban use. (3) Calkins soils seem to be well suited for trees such as black cottonwood. Productivity of this species is estimated to be about 12 to 15 m^3/ha/yr.

CANNELL SOILS (CE)

Location and Extent: Cannell soils are common in the mountainous parts of the report area. There are about 470 ha of pure map units and 24590 ha of soil complexes dominated by Cannell soils. The complexes are usually with Buntzen, Eunice, Lonzo Creek and Poignant soils and Rock Outcrop land type.

Topography and Elevation: Cannell soils are usually either strongly to very steeply sloping or moderately rolling to hilly with slope gradients between 20 and 60 percent. They mostly occupy the tops and upper slopes of ridges and knobs in the uneven landscape. Elevations range between 50 and 700 m above sea level.

Parent Material and Texture: The parent material of Cannell soils is a mixture of moderately coarse textured colluvium and glacial till. The deposits, up to 1 m deep but more commonly between 10 and 50 cm thick, overlie bedrock, usually granitic. In the eastern part of the report area, especially on Sumas and Vedder Mountains, variable amounts of silty eolian deposits either overlie or have been incorporated with the colluvium and glacial till. Surface and subsurface textures are mostly sandy loam or gravelly sandy loam, occasionally varying to gravelly loamy sand. Where the eolian deposits are present, loam textures are not uncommon. The soils are moderately to exceedingly stony.

Soil Moisture Characteristics: Cannell soils are well to rapidly drained. They are rapidly pervious and have low to moderate water holding capacity. Where the underlying bedrock is relatively massive (i.e. unfractured), lateral seepage along its surface is common during periods of heavy rain (or during snowmelt).

General Soil Description: Cannell soils have up to 15 cm of mixed raw to well-decomposed coniferous forest litter and moss on the mineral soil surface. This is underlain by a loose, gray, leached, sandy layer usually less than 6 cm thick which, in turn, is underlain by 10 to 50 cm of friable, reddish-brown or dark reddish brown, gravelly or sandy material containing some hard, spherical concretions. This is usually abruptly underlain by bedrock or where the bedrock is deeper, a massive, friable to firm gravelly zone, grayish-brown in colour which separates the rock from the more reddish layer above. A thin, concentrated layer of roots often immediately overlies the rock. Soil reaction varies from extremely to very strongly acid throughout. Soil classification generally is *Orthic Humo-Ferric Podzol:lithic phase* although in the drier parts of the map area such as on the Sunshine Coast, the classification sometimes changes to *Orthic* or *Degraded Dystric Brunisol:lithic phase*.

Commonly Associated Soils: Cannell soils are closely associated with a variety of soils but most commonly are associated with Buntzen, Eunice, Lonzo Creek, Strachan, Hoover and Poignant soils and Rock Outcrop land type. Buntzen, Lonzo Creek and Strachan soils differ from Cannell soils by being developed from glacial till deposits more than 1 m deep. Hoover and Poignant soils, although colluvial in origin, are also more than 1 m deep. Eunice soils, on the other hand, are very shallow, having developed from 10 to 20 cm of organic forest litter over bedrock. The Rock Outcrop land type consists either of bedrock exposed at the surface or covered by less than 10 cm of mineral or organic soil material.

Vegetation: Most Cannell soil areas support second-growth forest, mainly Douglas-fir and western hemlock. The usually scanty understory includes various ericaceous shrubs with moss on the soil surface. Rooting depth is limited to 100 cm or less, depending on the depth to the underlying bedrock.

General Land Use Comments: (1) Cannell soils are generally not suited for agricultural cropping because of shallowness to bedrock, steep slopes and stoniness. (2) They are also poorly suited for urban and similar construction because of shallowness to bedrock and steep slopes. Although foundation conditions are good because they can be placed directly on bedrock, basements, underground utilities and other excavations are difficult to install. Septic tanks are unsuitable because of lack of soil depth for effluent disposal, and steep slopes. Roads are difficult and expensive to construct. (3) Forest production is moderate to low, limited by shallow rooting depth and low soil moisture levels. Limited plot data indicates productivity of coast Douglas-fir is about 5 to 8 m^3/ha/yr. Special care should be exercised during harvesting to prevent erosion or other removal of the limited soil depth present.

CAPILANO SOILS (CP)

Location and Extent: Capilano soils occupy substantial areas on the uplands and along the lower mountain slopes in the western half of the map area. They are most prevalent between Gibsons and Sechelt on the Sunshine Coast. There are about 3180 ha of pure map units and a further 2710 ha of soil complexes dominated by Capilano soils. Complexes are mainly with Bose, Buntzen, Salish and Sechelt soils.

Topography and Elevation: Moderately to strongly sloping or gently to strongly rolling is the usual topography of Capilano soils. Slope gradients vary between 10 and 30 percent and elevations generally range between 30 and 200 m above sea level.

Parent Material and Texture: Parent materials of Capilano soils are deep (at least 2 m), coarse-textured, stony, glaciofluvial and deltaic deposits. Included also are deep, gravelly, marine lag deposits. Surface textures are mostly gravelly loamy sand, varying to gravelly sandy loam or lgravelly sand in a few areas. Stoniness is moderate to excessive. Subsurface and subsoil textures vary from stony gravel or gravelly sand to, sometimes, coarse sand. Strongly cemented layers are present between 40 and 100 cm depth.

Soil Moisture Characteristics: Capilano soils are well to rapidly drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. The cemented subsoil slightly restricts permeability in the subsoil.

General Soil Description: Capilano soils have up to 15 cm of coniferous forest litter on the mineral soil surface, the lower part of which is black and well-decomposed. This is underlain by 2 to 5 cm of loose, gray, leached, sandy material which, in turn, is underlain by about 40 cm of very friable or loose, dark reddish brown to yellowish-red, gravelly or coarse sandy material. This grades below about 50 cm to a strongly cemented, hard, gravelly zone which varies from brown or strong brown to olive in colour and is about 50 cm thick. Below this, at about 120 cm, gradation to loose, unweathered olive or olive-gray gravel and sand occurs. Soil reaction ranges from extremely acid in the upper 50 cm to very strongly acid below that. Soil classification is ***Ortstein Humo-Ferric Podzol***.

Commonly Associated Soils: Bose, Buntzen, Shalish and Sechelt soils are often closely associated with Capilano soils. Buntzen soils differ from Capilano soils by having developed from moderately coarse to medium-textured glacial till. Sechelt soils are sandy in texture while Shalish soils have developed from fluvial fan deposits. Bose soils differ from Capilano soils by having either compact, cemented glacial till or clayey glaciomarine material in the subsoil.

Vegetation: Second-growth forests consisting mainly of coast Douglas-fir, western hemlock, western red cedar, red alder and vine maple are the usual vegetative cover. Cleared areas are used mainly for urban purposes. Rooting is unrestricted to about 50 cm depth but is partially limited by cemented soil conditions below that.

General Land Use Comments: (1) Capilano soils are mainly limited for agricultural use by droughtiness and stoniness, although adverse topography and low fertility also are often limiting. Adequate fertilization and irrigation are required for good production of any crop. Stone picking is also usually required. (2) Urban development is a well suited use of Capilano soils although adverse topography may sometimes be restricting. Although septic tanks function efficiently for sewage effluent disposal, incomplete filtration of the effluent may occur due to the coarse subsoil textures, and ground water contamination is possible. Capilano soils also provide good sources of aggregate. (3) Forest production is moderately good, although low water holding capacity leads to droughty conditions during periods of low rainfall. Data from a few plots indicate productivity of coast Douglas-fir to be about 9 to 12 m^3/ha/yr.

4

CARVOLTH SOILS (CV)

Location and Extent: Carvolth soils occur along various streams on the uplands, mainly in Langley and Surrey Municipalities. There are a total of 450 ha of pure map units and an additional 30 ha of Carvolth-Westlang soil complex.

Topography and Elevation: Carvolth soils are level to undulating and usually depressional in relation to surrounding soils. Slope gradients are less than 5 percent and elevations mostly range between 10 and 30 m above sea level.

Parent Material and Texture: Carvolth soils have developed from moderately fine textured, stone-free, floodplain deposits of local streams. The deposits consist mainly of materials originally eroded from moderately fine and fine-textured marine and glaciomarine upstream sediments. Surface textures vary from silty clay loam to silt loam while subsurface and subsoil textures are usually silty clay loam or silty clay. A few thin, sandy lenses and strata may also occur. Fine-textured marine deposits usually occur at depth.

Soil Moisture Characteristics: Carvolth soils are mostly poorly or very poorly drained although a few, imperfectly drained areas along Campbell River are also included. The soils are slowly pervious and water holding capacity is high. Surface runoff is moderate to slow and seepage from higher adjacent soils tends to accumulate. Flooding during heavy rains is common in most areas.

General Soil Description: Carvolth soils have a friable to firm, cultivated, silty surface layer about 15 cm thick which is dark grayish brown in colour. It is underlain by grayish-brown or brownish-gray, clayey material, at least 70 cm thick, that contains common, reddish-brown or yellowish-red mottles and breaks in large, hard, angular clods. At depth, below 1 m or more, clayey, olive-gray to dark gray, massive, unweathered marine or glaciomarine deposits are encountered. Soil reaction varies from medium acid in the upper layers to slightly acid in the subsoil (1:1 H_2O). Soil classification is ***Rego Humic Gleysol***.

Commonly Associated Soils: Berry, Cloverdale, Milner and Westlang soils are often closely associated with Carvolth soils. They all differ from Carvolth soils by having developed from marine deposits. Additionally, Cloverdale and Berry soils have well-defined clay accumulation subsurface layers. Also, Berry and Milner soils respectively are imperfectly and moderately well drained.

Vegetation: Some areas have been cleared for agricultural use, mainly for pasture or forage. The remaining, uncleared areas support willow, vine maple, black cottonwood and other mainly deciduous species tolerant of high watertables. The undergrowth includes sedges, reeds and grasses. Rooting is restricted mainly to the upper 50 cm by high watertables and dense, clayey subsoils.

General Land Use Comments: (1) Agriculturally, Carvolth soils are presently mainly restricted to forage and pasture use by poor drainage and potential for flooding. Water control (both flooding and groundwater) improves the range of crops possible but, in most cases, is relatively costly. (2) Urban or similar construction is not suited because of high watertables, flooding potential and variable soil bearing strengths. Septic tank operation is poor because of high watertables and very slow subsoil permeability.

CASCADE SOILS (CC)

Location and Extent: Cascade soils occur only in the mountainous areas north of the Fraser River and east of the Hatzic Valley. There are about 5280 ha of soil complexes dominated by Cascade soils; the complexes are with Burwell and Cannell soils.

Topography and Elevation: The topography of Cascade soils is steeply to very steeply sloping with slope gradients between 15 and 50 percent. Along gullies, the slopes may rise to 80 percent. Elevationally, Cascade soils lie between 250 and 700 m above sea level.

Parent Material and Texture: Cascade soils have developed from moderately coarse textured glacial till into whose surface has been incorporated some medium-textured, eolian material. Surface and subsurface textures vary from mostly gravelly sandy loam to sandy loam or loam. The subsoils are gravelly sandy loam or, sometimes, gravelly loamy sand and are strongly cemented to indurated. The soils are moderately to very stony.

Soil Moisture Characteristics: Cascade soils are moderately well drained. They are rapidly to moderately pervious in the upper 100 cm or so but this changes to slowly pervious in the cemented subsoil. Variable amounts of telluric seepage flows laterally along the surface of the cemented layer during heavy rainfall or snowmelt. Water holding capacity and surface runoff are moderate.

General Soil Description: The surface of Cascade soils consists of 10 to 20 cm of organic forest litter, reddish brown in colour. This is underlain by about 2 to 5 cm of gray to pinkish-gray, leached, sandy material which, in turn, is underlain by about 80 cm of friable to firm, dusky red to strong brown and dark reddish brown, sandy and gravelly material containing between 10 and 20 percent organic matter. Abruptly below this is a dense, very hard, massive, strongly cemented, olive-gray, sandy to gravelly layer about 50 cm thick which contains many reddish-brown or yellowish-red mottles. Immediately above the cemented layer is a well-developed, dusky red zone of root concentration about 10 cm thick. Below about 150 cm depth, the cemented layer grades into compact, gray, unweathered glacial till. Soil reaction gradually grades from extremely acid in the organic surface to medium acid in the unweathered subsoil. Soil classification is *Duric Ferro-Humic Podzol*.

Commonly Associated Soils: Burwell and Cannell soils are generally closely associated with Cascade soils. Burwell soils differ from Cascade soils by being imperfectly drained while Cannell soils differ by consisting of soil less than 1 m deep over bedrock. Cascade soils are similar to the Buntzen soils in that they have developed from similar soil parent materials, occupy the same elevational range and have the same type of soil profile development. They, however, generally have a more strongly cemented layer and contain higher amounts of organic matter in the upper part than do Buntzen soils.

Vegetation: Cascade soils are all forested, mainly by coast Douglas-fir, western hemlock and western red cedar. The understory is variable but includes salmonberry and elderberry with moss on the soil surface. Rooting is unrestricted to about 100 cm depth but is severely restricted below that by the dense, strongly cemented layers. A well developed root mat, up to 10 cm thick, is usually present immediately above the cemented zone.

General Land Use Comments: (1) Very steep slopes and stoniness make Cascade soils unsuitable for agriculture; urban uses are severely restricted for the same reasons. (2) Forest growth is good. Data from a limited number of plots indicates that coast Douglas-fir produces between 9 and 12 m^3 of wood/ha/yr. Extra care should be exercized during harvesting to minimize erosion and also to control and contain seepage along cut slopes and road ditches.

CHEAM SOILS (CM)

Location and Extent: Cheam soils only occur in a few, scattered areas on the uplands. There are about 75 ha of Cheam-Isar soil complex.

Topography and Elevation: Cheam soils are strongly to very steeply sloping with slope gradients between 10 and 40 percent. They lie between 75 and 200 m above sea level.

Parent Material and Texture: Cheam soils have developed from coarse-textured colluvial (landslide and rockfall) deposits mixed with small amounts of alluvial fan deposits. The deposits are more than 1 m deep and overlie either bedrock or glacial till. Surface, subsurface and subsoil textures range from gravelly sandy loam to gravelly loamy sand and include lenses of gravel. High proportions (usually more than 50 percent by volume) of angular stones, cobbles and boulders are present.

Soil Moisture Characteristics: Cheam soils are well to rapidly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. Variable amounts of seepage is sometimes present in the lower subsoil, near the contact with the underlying bedrock or glacial till.

General Soil Description: The surface of Cheam soils consists of a thin layer (usually less than 5 cm thick) of forest litter. This is underlain by a loose to friable, sandy, gravelly and stony, dark brown or dark reddish brown layer about 20 cm thick. This layer, in turn is underlain by a 30 cm thick transitional zone consisting of dark yellowish brown, gravelly, stony and bouldery material that grades to olive-brown, unweathered soil parent material below about 60 cm. Soil reaction usually is strongly acid. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Isar soils are almost always closely associated with Cheam soils. Isar soils differ from Cheam soils by being of fluvial fan rather than colluvial origin. They are of recent deposition and either have no, or only slight soil profile development (are regosolic).

Vegetation: The vegetation on Cheam soils consists mainly of second-growth coast Douglas-fir, western hemlock, western red cedar, bigleaf maple, birch and red alder, understoried by a variety of shrubs and herbs. Rooting is usually unrestricted in the upper 75 cm but may be partially impaired below that by numerous stones and boulders.

General Land Use Comments: (1) Cheam soils are generally poorly suited for arable agriculture due to excessive stoniness and steep slopes; some areas may be developed for pasture. (2) Urban uses are also restricted by very stony and bouldery soils and steep slopes; some areas may also be susceptible to further mass movement hazard. (3) Moderate forest growth occurs and is limited by low soil moisture holding capacity.

CHEHALIS SOILS (CS)

Location and Extent: Chehalis soils are relatively uncommon in the map area. They occur mainly in the vicinity of Norrish Creek east of Dewdney. There are about 90 ha of pure map units and 75 ha of soil complexes dominated by Chehalis soils. The complexes are with Elk and Isar soils.

Topography and Elevation: The topography is gently to strongly sloping or, occasionally, undulating, with slope gradients between 2 and 10 percent. Elevations range between 15 and 40 m above sea level.

Parent Material and Texture: Chehalis soils have developed from coarse-textured alluvial fan deposits. Surface and subsurface textures range from gravelly loamy sand to sand and, sometimes, gravelly sandy loam. Subsoils are gravelly sand, coarse sand or sandy gravel. Stoniness varies, ranging from none on some parts of the fan aprons to excessively stony near the fan apexes.

Soil Moisture Characteristics: Chehalis soils are well to moderately well drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. Some of the lower lying areas have temporary, fluctuating watertables in the subsoil when the water levels in adjacent streams are high. Some potential for flooding exists during periods of prolonged, excessive rainfall and during rapid snowmelt.

General Soil Description: Chehalis soils usually have 5 cm or less of mixed deciduous and coniferous forest litter at the soil surface. This is underlain by 1 to 4 cm of grayish-brown, loose, partially leached, sandy material which, in turn, is underlain by about 20 cm of loose or very friable, brown or yellowish-brown, sandy or gravelly material. This grades to loose, unweathered sand or gravel below about 30 cm. Soil reaction varies from very strongly to extremely acid throughout. Soil classification is ***Eluviated Dystric Brunisol***.

Commonly Associated Soils: Isar and Elk soils usually occur in close association with Chehalis soils. Isar soils differ from Chehalis soils by having little or no soil profile development while Elk soils differ by being poorly drained and having a black surface layer.

Vegetation: Some areas of Chehalis soils have ben cleared for agricultural and urban uses. Uncleared areas support mixed stands of coast Douglas-fir, western red cedar, western hemlock, red alder, birch and others. The understory includes salal, bracken, huckleberry and blackberry. Moss usually covers the soil surface. Rooting is generally unrestricted to at least 100 cm depth.

General Land Use Comments: (1) Agricultural suitability is limited by low water holding capacity, low fertility and sometimes, stoniness. Adequate fertilization and irrigation is required for good crop production. (2) Chehalis soils are moderately suited for urban development although in some areas periodic high watertables may produce water in basements and other excavations; some potential for occasional surface flooding also exists on the lower fan aprons. The soils are well suited for disposal of septic tank effluent although incomplete filtration by the coarse-textured subsoils may lead to contamination of the groundwater and adjacent streams. (3) Forest growth appears to be moderately good, and productivity of coast Douglas-fir is estimated at about 8 to 10 m^3/ha/yr. Low soil water holding capacity is limiting during dry summer months.

CLOVERDALE SOILS

Location and Extent: Cloverdale soils are found mainly near Cloverdale, Hazelmere, Langley, Milner and Haney. There are about 2430 ha of pure map units and 740 ha of soil complexes dominated by Cloverdale soils. The complexes are usually with Milner, Sunshine and Berry soils.

Topography and Elevation: Cloverdale soils are generally level to gently undulating or gently sloping and are slightly depressional in relation to adjacent soils. Slope gradients are usually 2 percent or less, but in small areas sometimes rise to 5 percent. Elevations range from 5 to 30 m above sea level.

Parent Material and Texture: The parent material of Cloverdale soils is deep, fine-textured, stone-free marine sediments. Surface textures are silty clay loam or clay loam while subsurface and subsoil textures vary from silty clay to clay.

Soil Moisture Characteristics: The soils are poorly to moderately poorly drained. They are slowly to moderately pervious. Surface runoff is slow and water holding capacity is high. They are subject to runoff accumulation from higher surrounding soils and surface ponding is common during periods of high rainfall.

General Soil Description: Cloverdale soils have a clayey cultivated surface layer about 15 cm thick which is very dark gray or brownish-black, sticky, firm and contains between 8 and 15 percent organic matter. It is underlain by about 10 cm of light gray or light grayish brown, silty material which is partially leached of clay and contains many yellowish or reddish mottles. This, in turn, grades to a grayish-brown or olive-gray, clay enriched layer about 40 cm thick which is very firm, very sticky, breaks into coarse, hard prismatic clods and contains common to many, brownish-yellow or reddish-yellow mottles. Below about 80 cm depth transition occurs to massive, very firm, gray or dark gray, unweathered marine sediments which commonly contain yellowish mottles. Soil reaction gradually changes from strongly acid in the surface to moderately alkaline in the lower subsoil. Soil classification is *Humic Luvic Gleysol*.

Commonly Associated Soils: Langley, Livingstone, Milner, Berry, Heron and Sunshine soils often occur in close association with Cloverdale soils, either in soil complexes or adjacent map polygons. Milner and Berry soils, although also developed from marine sediments, differ from Cloverdale soils by respectively being moderately well and imperfectly drained. Their surfaces are reddish to brownish in colour and the soils occupy slightly higher landscape positions than do Cloverdale soils. Langley soils are similar to Cloverdale soils but have a deep (up to 40 cm thick), black surface layer containing between 20 and 30 percent organic matter. Livingstone, Heron and Sunshine soils have sandy surface and subsurface layers which overlie clayey material.

Vegetation: Most areas of Cloverdale soils are cleared and cultivated. Uncleared areas support western red cedar, western hemlock, some Sitka spruce, red alder, birch and black cottonwood as well as a variety of undergrowth, including salmonberry, devil's club, hardhack, elderberry, blackberry and other moisture tolerant species. Rooting is mainly limited to about 60 cm depth by dense, clayey soil layers and high watertable conditions.

General Land Use Comments: (1) Most areas of Cloverdale soils are used for agricultural production, mainly forage, pasture, cereal grain and silage corn. The soils are relatively fertile but artificial drainage widens the range of crops possible and improves productivity. The heavy textures have high power requirements for cultivation and moisture conditions during cultivation should be such that soil structure is not destroyed (i.e. puddling). (2) Cloverdale soils are generally not suited for urban development. Soil bearing capacities are variable and high shrink-swell conditions are present. High watertables, periodic surface ponding and the sticky nature of the soils make basements and other excavations impractical. Septic tank disposal fields operate poorly because of low subsoil permeability and high watertables. Corrosion of unprotected, buried installations is likely because of alkaline conditions at depth.

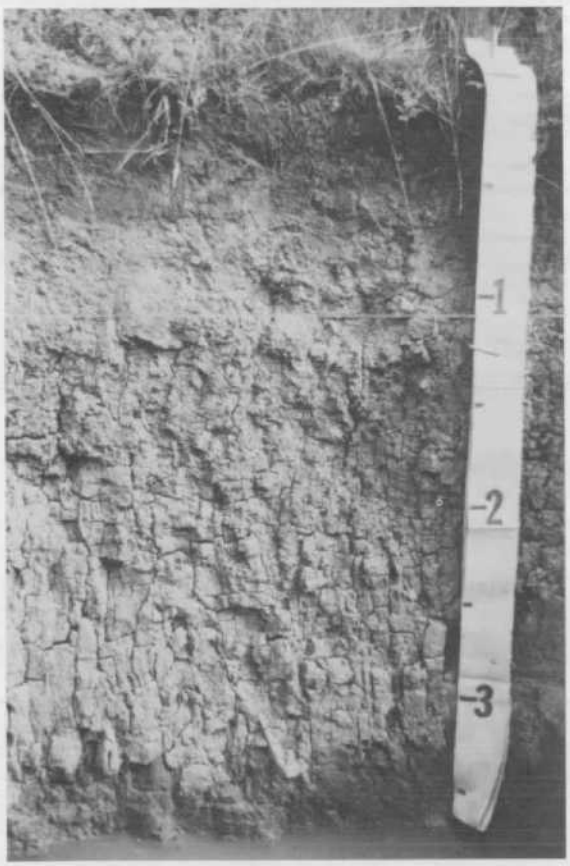


Plate 14 Cloverdale soil profile (Humic Luvic Gleysol). These poorly drained soils have developed from clayey marine sediments. Note the leached layer between 7 to 14 in. (18 to 36 cm) and the strongly structured clay accumulation layer from below that to about 2.5 ft. (75 cm).

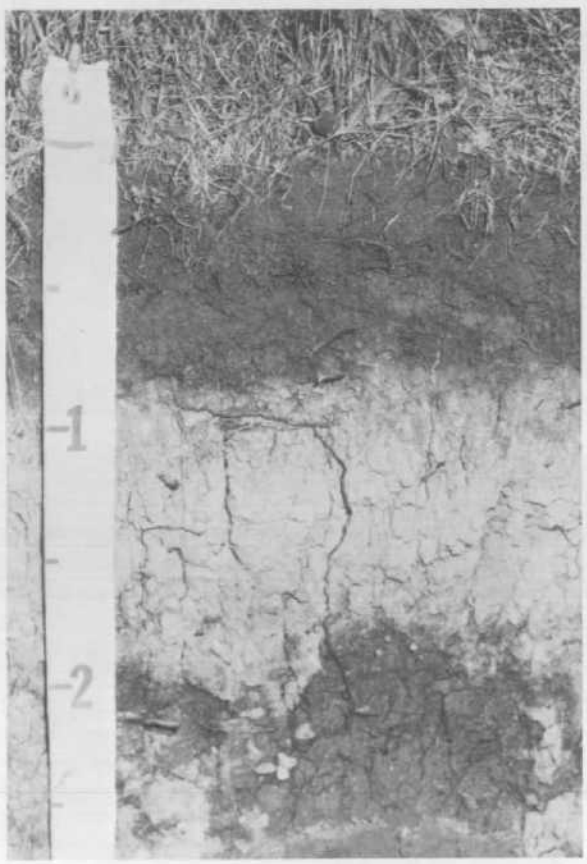


Plate 15 Langley soil profile (Humic Luvic Gleysol). Langley soils are similar to Cloverdale soils except that they have a deeper, black surface layer which contains between 20 and 30 percent organic matter.

COGHLAN SOILS (CG)

Location and Extent: Coghlan soils occupy a few areas south of Langley and in the vicinities of Hopington and the Abbotsford Airport. There are about 310 ha of pure map units and 30 ha of Coghlan-Defehr soil complex.

Topography and Elevation: The topography of Coghlan soils varies from level or slightly depressional to very gently sloping. Slope gradients are less than 3 percent and elevations range from 30 to 50 m above sea level.

Parent Material and Texture: Coghlan soils have developed from coarsetextured glaciofluvial deposits which have small amounts of silty eolian material on or mixed into the surface. Surface textures vary from gravelly sandy loam to loam and grade to gravelly sand or sandy gravel below about 20 cm. The surfaces are moderately stony and a cemented layer is present below about 30 cm.

Soil Moisture Characteristics: Coghlan soils are imperfectly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. The soils are subject to seepage accumulation from higher, adjacent areas and a fluctuating, perched watertable is present during periods of high precipitation.

General Soil Description: Coghlan soils have a dark gray to grayish-brown, friable, loamy, cultivated surface about 15 cm thick which is underlain by 5 to 15 cm of light gray, leached, sandy material containing a few reddish mottles. This, in turn, is underlain by about 50 cm of yellowish-brown or reddish-brown, hard, strongly cemented, gravelly material which grades to loose, gravelly sand or gravel below about 80 cm. Soil reaction ranges from very strongly acid in the surface to medium acid in the subsoil. Soil classification is *Gleyed Ortstein Humo-Ferric Podzol.*

Commonly Associated Soils: Defehr, Lehman, Columbia, Abbotsford and Lynden soils are usually closely associated with Coghlan soils. None, however, have cemented subsurface layers. Defehr and Lynden soils differ also by being sandy rather than gravelly in subsoil texture. Lehman soils are poorly drained while Abbotsford soils have silty surface and subsurface layers and are well drained.

Vegetation: Most areas of Coghlan soils are cleared and cultivated or used for urban purposes. Uncleared areas support a variable forest of western red cedar, western hemlock, red alder, willow, birch, black cottonwood and vine maple. Rooting depth is moderately restricted below about 40 cm by cemented soil layers.

General Land Use Comments: (1) Coghlan soils are limited for agriculture by low fertility and low water holding capacity; these can be improved by adequate fertilization and irrigation. The fluctuating watertables, particularly present during high rainfall periods, are harmful to perennial crops and some watertable control is beneficial. (2) Coghlan soils are moderately to poorly suited for urban and related development. High periodic watertables make basement and other excavations difficult to excavate during portions of the year and they are likely to contain water for varying periods. The operation of septic tanks is impaired during high watertable periods and incomplete filtration by the coarse-textured subsoils may potentially contaminate groundwater. (3) Coghlan soils seem moderately suited for forest production. Estimated yearly growth of western red cedar is 7 to 9 m^3 of wood/ha.

COLUMBIA SOILS

Location and Extent: Columbia soils occupy substantial areas on the uplands of the Lower Fraser Valley. The largest areas are in the Columbia Valley south of Cultus Lake, in the vicinities of Peardonville and Hopington, south of Langley and in Glen Valley. There are about 3330 ha of pure map units and 2370 ha of soil complexes dominated by Columbia soils. The complexes are mostly with Abbotsford, Lehman, Defehr and Peardonville soils.

Topography and Elevation: The topography of Columbia soils is usually level to gently undulating with slope gradients below 5 percent. Scattered areas are strongly sloping or strongly rolling with slopes to 20 percent and, along terrace scarps, slopes may rise to over 60 percent. The soils mainly lie between 30 and 100 m above sea level but range to 200 m above sea level in the Columbia Valley.

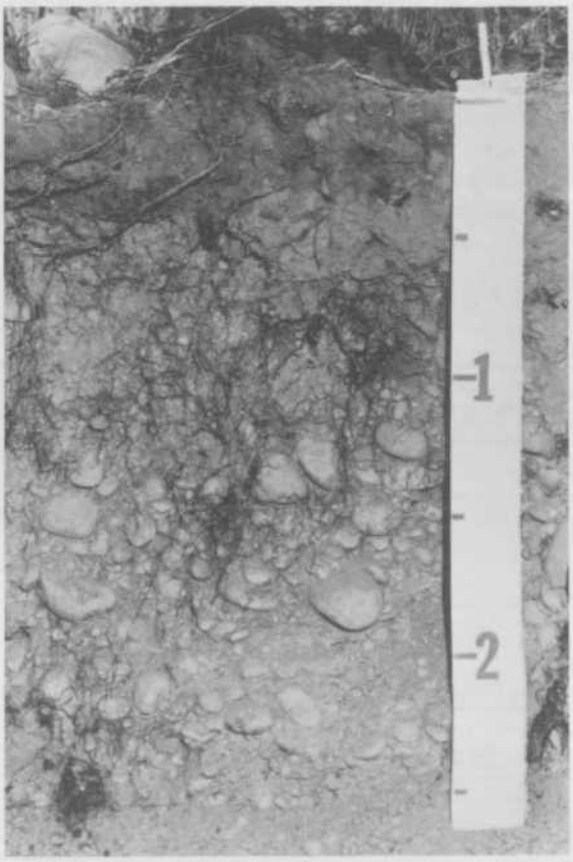


Plate 16 Columbia soil profile (Orthic Humo-Ferric Podzol). These soils have developed in gravelly glaciofluvial deposits. Sometimes a thin layer (less than 15 cm thick) of silty eolian material is mixed into the surface.

Parent Material and Texture: Columbia soils have developed from deep, coarse-textured, stratified glaciofluvial deposits, usually with a thin (less than 20 cm thick), silty, eolian veneer mixed into or on the surface. Surface textures range from loam to gravelly loamy sand but sandy loam or gravelly sandy loam are most common. Subsurface and subsoil textures are gravel or gravelly sand and contain some sand lenses. Stones and cobbles are common throughout.

Soil Moisture Characteristics: Columbia soils are well to rapidly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. They are droughty during most summers.

General Soil Description: Columbia soils usually have 5 cm or less of forest litter on the soil surface. This is underlain by a thin (less than 2 cm), discontinuous, grayish, sandy, leached layer, which, in turn, is underlain by about 15 cm of sandy or loamy, friable, reddish-brown, brown or yellowish-brown material. This material grades to about 40 cm of similarly coloured, loose gravel or gravelly sand. Below about 80 cm, unweathered, loose, stratified gravel and gravelly sand occur. Stones and cobbles are common throughout. Soil reactions range from strongly acid in the surface layers to medium or slightly acid in the lower subsoil. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Abbotsford, Lynden, Lehman and Defehr soils often occur in soil complexes with Columbia soils or occupy adjacent lands. Abbotsford soils differ from Columbia soils by having 20 to 50 cm of silty material over gravel or gravelly sand. Lynden soils are sandy rather than gravelly in texture while Lehman and Defehr soils respectively, are poorly and imperfectly drained.

Vegetation: Large areas have been cleared and are utilized for agricultural or urban uses. Uncleared areas support a mixed forest which includes coast Douglas-fir, western hemlock, grand fir, red alder, birch and maple. The understory includes salal, bracken, thimbleberry and various mosses. Other than impediments imposed by the gravelly subsoil, no restrictions to rooting occur to depths of 100 cm or more.

General Land Use Comments: (1) Agriculturally, Columbia soils are limited by low water holding capacity, relatively low fertility and stoniness. With adequate fertilization and irrigation (and stone picking as required), most crops can be produced satisfactorily. (2) Columbia soils are well suited for urban and similar uses. They are well drained and have good bearing strength and level topography. However, effluent from numerous septic tanks can potentially contaminate groundwater through incomplete filtration in the coarse-textured, gravelly subsoil. Columbia soils are usually good sources of aggregate. (3) Forest production on Columbia soils is moderate. Limited plot data indicates growth of coast Douglas-fir to be about 6 to 8 m^3/ha/yr. Droughtiness during the latter parts of the growing season seems to be the main growth limitation.

COQUITLAM SOILS (CQ)

Location and Extent: Coquitlam soils are only found near the south end of Coquitlam Lake and in the Statlu Creek and Chehalis River valleys. There are about 330 ha of pure map units.

Topography and Elevation: The topography of Coquitlam soils is mostly moderately rolling to hilly with slopes between 10 and 50 percent. Along gullies and escarpments, gradients may rise to over 60 percent. Elevations lie between 150 and 300 m above sea level.

Parent Material and Texture: Coquitlam soils have developed from medium-textured, stone-free, usually varved, glaciolacustrine deposits. There may be up to 25 cm of organic forest litter on the soil surface. The texture of the surface and subsurface of the mineral soil is usually silty clay loam, varying sometimes to silt loam. The subsoil is mostly silt loam and may contain thin, sandy lenses, especially near the boundary with Fellows soils.

Soil Moisture Characteristics: Coquitlam soils are moderately well drained. They have moderate to slow surface runoff (depending on steepness of slopes) and high water holding capacity. They are moderately pervious in the surface and subsurface mineral soil layers, but this decreases to slowly pervious in the compact subsoil. A temporary, perched watertable develops over the compact subsoil (about 1 m from the surface) during heavy, prolonged rains and telluric, lateral seepage occurs.

General Soil Description: Coquitlam soils have from 15 to 25 cm of dusky red to dark reddish brown organic forest litter on the soil surface which is mostly well-decomposed, matted and friable. This is abruptly underlain by 2 to 10 cm of leached, gray to brownish-gray, weakly structured, friable, silty material, which, in turn, is also abruptly underlain by a silty layer about 15 cm thick which is strong brown or dark reddish brown, moderately to strongly subangular blocky, friable to firm when moist, hard when dry, and contains from 10 to 15 percent organic matter. The variable colours are due to uneven organic matter distribution. This layer grades to about 20 cm of yellowish-brown or reddish-brown, moderately structured, friable to firm silty material. Under this is a silty zone about 30 cm thick that is massive, firm, yellowish-brown to olive and contains reddish mottles. Usually, a well-defined layer of concentrated roots is present in the lower part. This zone grades to very firm, varved, olive-gray, silty, unweathered parent material which contains a few yellowish to brownish mottles. Soil reaction is extremely acid in the upper 60 cm then gradually grades to strongly acid in the unweathered parent material. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Fellows and Roach soils usually are closely associated with Coquitlam soils. Fellows soils differ from Coquitlam soils by being sandy rather than silty in texture. Roach soils differ by being gravelly and containing strongly cemented subsurface layers.

Vegetation: All areas are forested, mainly by second-growth coast Douglas-fir, western hemlock and western red cedar with red alder, birch and vine maple. Rooting is unrestricted in the upper 100 cm of soil (from the surface) but is severely impeded below that by the dense, compact subsoil. A well-defined zone of root concentration (root mat) is usually present immediately above the compact layers.

General Land Use Comments: (1) Steep, eroded topography generally limits use of Coquitlam soils for agriculture although in the few, small areas where the topography is suitable, most crops not susceptible to occasional, perched watertables can be produced. (2) Adverse topography, susceptibility to erosion and slow subsoil permeability (which limits septic tank effluent disposal) generally make Coquitlam soils poorly suited for urban use. (3) Coquitlam soils are well suited for forest growth. Annual wood production by coast Douglas-fir and western hemlock is estimated to be between 12 and 15 m^3/ha. During harvest (and other operations) care is required to prevent initiation or enhancement of erosion of the silty material. Operations should be limited to the dry summmer months. Rapid brush invasion is likely to be a problem during post-harvest management.

CRESCENT SOILS

Location and Extent: Crescent soils are common on Westham and Crescent islands, in the southern part of Richmond Municipality and southwest of Ladner. There are about 990 ha of pure map units and 1040 ha of soil complexes dominated by Crescent soils. Most complexes are with Westham and Ladner soils.

Topography and Elevation: Crescent soils are usually nearly level or gently undulating with slopes less than 2 percent; minor areas are undulating with slopes to 4 percent. Land levelling has occurred in many areas. Elevations are all less than 5 m above sea level.

Parent Material and Texture: The parent material of Crescent soils are medium to moderately fine textured, stone-free, deltaic deposits of the Fraser River, usually deeper than 1 m and underlain by saline sand. Surface, subsurface and subsoil textures are mainly silt loam, sometimes varying to silty clay loam. At depths of 1 m or more, textures usually change to sand or loamy sand and at these depths a variety of sulphurous compounds are likely to be present.

Soil Moisture Characteristics: Crescent soils are moderately poorly to poorly drained. They are moderately pervious and have slow surface runoff and high soil water holding capacity. The watertables are often near the soil surface during winter months but artificial drainage by ditches, subsoil drains and pumping is sufficient to provide an adequate saturation-free rooting zone during most growing seasons. Some subsoil irrigation is also possible by watertable control during dry summer periods. Saline conditions exist below about 120 cm but have little effect on most of the rooting zone. Almost all areas are protected by dykes from flooding during high tides and flood stages of the Fraser River.

General Soil Description: Crescent soils have a friable to firm, dark grayish brown, silty, cultivated surface about 20 cm thick which is underlain by about 20 cm of dark gray, firm, silty material that breaks to prismatic or blocky clods and contains many, yellowish-red mottles as well as thin clay skins and clay flows. This layer grades to at least 50 cm of massive, silty material containing common, yellowish-red to dark reddish brown mottles and, in the lower part, hard, brownish tubules around old root channels. Underlying this is either gray to olive-gray, saline and sulphurous, fine sand or alternating lenses of sand and silt containing a few reddish-brown mottles and hard tubules. Soil reaction ranges from medium or strongly acid in the surface and

Plate 17 A landscape typical of parts of Richmond Municipality, Westham Island and western Delta Municipality. Crescent, Westham, Delta and Ladner soils are the usual soils developed in these nearly level to gently undulating poorly drained, silty to clayey deltaic deposits.

subsurface layers to extremely acid in the sandy subsoil. Soil classification is mostly *Orthic Gleysol*. A few small areas of Orthic Humic Gleysol are included where the surface layer is grayish-black in colour.

Commonly Associated Soils: Westham, Ladner and Delta soils usually occur in close association with Crescent soils. Westham soils differ from Crescent soils by having darker coloured surfaces, being somewhat more poorly drained and being saline between depths of 50 and 100 cm. Ladner and Delta soils differ by having substantially higher organic matter content in the surface; Ladner soils also have well developed clay accumulation layers in the subsurface.

Vegetation: All areas of Crescent soils are cleared and cultivated. Rooting is slightly restricted below about 25 cm by dense subsurface soil layers and is severely restricted below about 1 m by high watertable and saline conditions.

General Land Use Comments: (1) Crescent soils are considered to be among the best agricultural soils in the Lower Mainland area. Almost all climatically suited crops can be produced. The soils are relatively fertile although increased amounts of organic matter in the surface would help to improve structure and decrease susceptibility to puddling. Watertables, in most cases, can be artificially maintained at more or less optimum levels for good crop production. (2) Crescent soils are poorly suited for urban and related construction. Variable soil bearing capacities require special foundation considerations. Basements and other excavations are not practical because of high watertables and severe corrosion of unprotected underground installations is likely due to saline subsoils containing high amounts of sulphur compounds. Septic tank effluent disposal systems function poorly because of high watertables and relatively slow soil permeability.

Plate 18 Crescent soil profile (Orthic Gleysol). These moderately poorly drained, silty soils have moderately structured layers (zone between 1 and 2 ft. (30 to 60 cm) depth in photo) and are underlain by fine to medium, dark gray sand at depths greater than about 3 ft. (90 cm).

DEAN SOILS (DN)

Location and Extent: Dean soils occupy relatively minor areas, mainly in the mountains north of the Fraser River. There are about 50 ha of pure map units and 160 ha of soil complexes dominated by Dean soils. The complexes are with Isar and Shalish soils.

Topography and Elevation: The topography of Dean soils varies from gently to strongly sloping with slope gradients from 4 to 15 percent. Elevations lie between 300 and 500 m above sea level.

Parent Material and Texture: Dean soils have developed from coarse-textured, very stony and bouldery, alluvial fan deposits. Surface textures are gravelly loamy sand or gravelly sandy loam underlain by gravelly sand or gravel. Stones, cobbles and boulders occupy between 50 and 80 percent of the soil volume and subsurface horizons are strongly cemented.

Soil Moisture Characteristics: Dean soils are usually moderately well or sometimes, imperfectly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. During and after periods of heavy rainfall or during snowmelt, substantial downslope seepage occurs through the lower parts of the subsoil.

General Soil Description: Dean soils have about 10 cm of organic forest litter on the soil surface, the lower half of which is black and well-decomposed. The surface mineral soil consists of gray to dark gray, leached, sandy material about 2 to 20 cm thick and is underlain by about 40 cm of dark reddish brown, friable to loose, gravelly material containing between 8 and 15 percent organic matter. This, in turn, is underlain by about 60 cm of very firm, strongly cemented, yellowish-red to dark reddish brown, gravelly sand containing many, strong brown mottles. The cemented layer then gradually grades, at about 150 cm depth, to olive, olive-gray or variably coloured, loose, unweathered soil parent material. Stone, cobble and boulder content throughout the soil varies between 50 and 80 percent. Soil reaction ranges from extremely acid in the upper 40 cm to strongly acid below about 150 cm. Soil classification is *Ortstein Ferro-Humic Podzol*.

Commonly Associated Soils: Isar and Shalish soils commonly occur in close association with Dean soils. Isar soils differ from Dean soils by having little or no soil profile development (are regosolic). Shalish soils are similar to Dean except that they are well-drained and usually have lesser amounts of subsoil seepage.

Vegetation: All areas of Dean soils are forested with some portions having been logged. Forest cover consists mainly of western hemlock, western red cedar and some coast Douglas-fir. Rooting is restricted below about 50 cm by strongly cemented soil horizons. Additionally, rooting throughout the soil is limited by the very high content of coarse fragments.

General Land Use Comments: (1) Dean soils are unsuited for agricultural uses because of excessive stoniness, coarse textures and low soil moisture holding capacity. (2) The bouldery nature of the soils (and periodic subsoil seepage) makes excavations and similar construction difficult. The high content of stones and boulders also limits use of Dean soils as aggregate sources. (3) Forest growth is very good. Estimated production of western hemlock is about 14 to 18 m^3/ha/yr. Although water holding capacities are low, subsoil seepage seems to provide adequate moisture through most of the growing season.

DEAS SOILS (DS)

Location and Extent: Deas soils occur only on the lowlands of southeast Delta Municipality. There are about 100 ha of pure map units and 75 ha of Deas-Embree soil complex.

Topography and Elevation: The topography of Deas soils is gently undulating to undulating with slope gradients less than 3 percent. Land levelling has occurred in some areas. Elevations vary between 2 to 3 m above sea level.

Parent Material and Texture: Deas soils have developed from medium to moderately fine textured, stone-free Fraser River deltaic deposits composed of mixed marine and fresh-water sediments. Surface, subsurface and subsoil textures are mainly silt loam with some variation to silty clay loam. At depths below about 75 to 100 cm, the textures usually change to sand or interbedded sand and silt. Below about 75 cm depth the deposits are generally saline and contain high amounts of sulphurous compounds.

Soil Moisture Characteristics: Deas soils are poorly drained. They are moderately pervious and have slow surface runoff and high water holding capacity. The watertable is near the surface during most of the winter but gradually recedes during the growng season. Dykes provide protection from flooding during high tides. Salt water seepage through the underlying sandy strata causes saline conditions below about 75 to 100 cm.

General Soil Description: Deas soils have a black to very dark gray, friable, cultivated surface about 20 cm thick which contains between 10 and 20 percent organic matter. The surface is underlain by about 50 cm of grayish-brown to olive-gray, massive, silty material that is firm when moist, hard when dry and contains common, dark brown mottles. Below this is a massive, silty zone about 20 cm thick which contains common, pale yellow mottles and is high in sulphur compounds. The soil then gradually grades to dark gray, moderately to strongly saline, fine sand or alternating lenses of sand and silt below 80 to 100 cm. Soil reaction is extremely acid throughout. Soil classification is ***Rego Humic Gleysol:saline phase***.

Commonly Associated Soils: Embree, Sandel and Kitter soils are usually closely associated with Deas soils. Embree soils differ from Deas soils by containing an organic layer (10 to 30 cm thick) in the subsurface. Sandel and Kitter soils differ by having grayer surfaces (usually containing less organic matter). Kitter soils also differ by being moderately poorly rather than poorly drained and also are non-saline in the upper 100 cm.

Vegetation: All areas are cleared and cultivated. Rooting below about 50 cm is restricted by high watertable conditions.

General Land Use Comments: (1) Deas soils are presently used for producing forage, cereal and other field crops. With adequate artificial drainage and fertilization most climatically suited crops (except those very susceptible to "wet-feet") can be grown. The saline subsoil conditions are usually sufficiently deep to have little effect on most crops. (2) Deas soils are poorly suited for urban or similar uses. Soil bearing capacities are variable, probably requiring special foundation construction. Basements and other excavations are impractical due to high watertables while unprotected underground utility installations are susceptible to corrosion due to saline subsoil conditions and the presence of substantial amounts of compounds high in sulphur. High watertables limit efficient operation of septic tank disposal fields. (3) Deas soils appear to be moderately suited for forest species such as Sitka spruce. Productivity for this species is estimated to be about 5 to 6 m^3/ha/yr.

DEFEHR SOILS (DR)

Location and Extent: Defehr soils mainly occur in the vicinities of Haney, Port Hammond, Peardonville and Abbotsford Airport although small, scattered areas are also present elsewhere on the uplands. There are about 360 ha of pure map units and 380 ha of soil complexes dominated by Defehr soils. The complexes are mainly with Lehman, Heron and Sunshine soils.

Topography and Elevation: The topography of Defehr soils is very gently to gently sloping and undulating. Slope gradients range between 1 and 5 percent and elevations lie between 40 and 80 m above sea level.

Parent Material and Texture: Defehr soils have developed from coarse-textured (mainly sandy) glaciofluvial and marine lag deposits, at least 2 m deep and usually underlain by glacial till or glaciomarine sediments. A shallow veneer of medium-textured, eolian or slopewash material sometimes caps or is mixed into the surface. Surface textures are sandy loam or loam while subsurface and subsoil textures vary from sand to gravelly sand. Occasional stones are sometimes present.

Soil Moisture Characteristics: Defehr soils are imperfectly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. During periods of heavy rain, fluctuating, perched watertables develop above the less permeable geologic materials present at depth.

General Soil Description: Defehr soils have a friable, dark brown or dark yellowish brown, loamy, cultivated surface that is about 15 cm thick. The surface is underlain by about 40 cm of friable, weakly structured or loose, yellowish-brown or pale brown sand or loamy sand containing few to common, strong brown or reddish-brown mottles. This grades, below about 80 cm, to variably coloured, loose, gravelly sand or sand containing many reddish or brownish mottles. Surface soil reaction is strongly acid, changing to medium acid in the subsurface and subsoil. Soil classification is *Gleyed Humo-Ferric Podzol*.

Commonly Associated Soils: Lehman, Sunshine, Heron, Columbia and Abbotsford soils often occur in close association with Defehr soils, either in soil complexes or in adjacent map polygons. Sunshine soils are generally similar to Defehr soils, except that they are well-drained and contain no mottles in the subsurface and subsoil. Heron soils, although also sandy, are poorly drained. Lehman, Columbia and Abbotsford soils are gravelly rather than sandy in the subsoil. Additionally, Lehman soils are poorly drained while Columbia and Abbotsford soils are well to rapidly drained. Abbotsford soils also have a silty surface capping from 20 to 50 cm thick.

Vegetation: Substantial areas of Defehr soils are cleared for agricultural or urban uses. Uncleared areas support a variable forest of coast Douglas-fir, western hemlock, western red cedar, red alder, black cottonwood and willow. Rooting is generally unrestricted to at least 60 cm depth, then becomes variably restricted by the fluctuating watertables.

General Land Use Comments: (1) Most cultivated areas of Defehr soils are used for forage and pasture although most other crops are possible also. Low water holding capacity leads to droughty conditions in the summer and irrigation is required for good crop production. The fluctuating watertables which may damage some perennial crops during the winter can be controlled by artificial drainage. (2) Defehr soils are moderately suited for urban and related uses. The fluctuating watertables may cause problems with basements and other excavations. The operation of septic tank disposal fields is also impaired during the periods of high watertables. (3) Data from a few plots indicate that Defehr soils produce good forest growth. Douglas-fir produces about 12 to 15 m^3 of wood/ha/yr. The low soil water holding capacity appears to be effectively offset by the fluctuating watertables.

DELTA SOILS (DT)

Location and Extent: Delta soils are common in central and western Delta Municipality and central Richmond Municipality. There are a total of 1130 ha of pure map units and 1720 ha of soil complexes dominated by Delta soils. The complexes are mainly with Spetifore, Blundell and Ladner soils.

Topography and Elevation: Delta soils are very gently undulating with slope gradients less than 3 percent. Some areas have been partially levelled. Elevations lie between 1 and 3 m above sea level.

Parent Material and Texture: The parent material of Delta soils is medium to moderately fine textured Fraser River deltaic deposits, usually 100 cm or more deep and overlying medium or fine sand. Surface textures are mostly silt loam, varying sometimes to silty clay loam. The subsurface is usually silty clay loam while the upper subsoil is again silt loam. The lower subsoil textures change to sand, loamy sand or interbedded sand and silt. Below 75 cm depth, the soils are generally saline and contain substantial amounts of compounds high in sulphur.

Soil Moisture Characteristics: Delta soils are poorly drained. They are moderately pervious and have slow surface runoff and high water holding capacity. The watertable is near the soil surface during most of the winter but recedes somewhat during the summer. Temporary surface ponding during heavy rainfall is common in the slight depressions.

General Soil Description: Delta soils have a very dark gray or black, friable to firm, cultivated surface that is about 20 cm thick and usually contains between 10 and 20 percent organic matter. The surface is underlain by a grayish-brown, firm to very firm, silty to clayey zone, about 30 cm thick, which breaks to prismatic or blocky clods and contains some reddish-brown mottles. Underlying this is about 30 cm of dark gray or grayish-brown, massive, silty material containing common, reddish-brown mottles as well as light yellowish brown to yellow mottles in the lower part. The lower part is also often saline and high in sulphur compounds. This silty zone gradually grades to massive olive-gray, saline, sandy or silty material below about 100 cm. Soil reaction is extremely to very strongly acid throughout. Soil classification is *Orthic Humic Gleysol:saline phase*.

Commonly Associated Soils: Ladner, Spetifore, Blundell, Westham, Guichon and Crescent soils usually occur in close association with Delta soils. Ladner soils differ from Delta soils by having well developed clay accumulation layers in the subsurface as well as being finer textured. Spetifore soils are similar to Delta soils except that they are saline at or near the surface. Blundell soils vary by having an organic surface. Guichon soils are sandy below 50 cm as well as being saline at or near the surface. Westham and Crescent soils contain lower amounts of organic matter in the surface; Crescent soils are also somewhat better drained than Delta soils.

Vegetation: All areas of Delta soils are cleared and cultivated. Rooting is partially restricted in the upper 50 cm by dense soil strata and is severely restricted at lower depths by high watertables.

General Land Use Comments: (1) Delta soils are good agricultural soils and are utilized for a variety of crops, including forages, cereal grain, potatoes, vegetables and some small fruits. Watertable control through artificial drainage, however, is required for optimum utilization. The saline subsoil conditions are usually sufficiently deep to not hinder most crops except possibly, near the boundaries with the more strongly saline Spetifore or Guichon soils. (2) Delta soils are poorly suited for urban and related uses. Soil bearing capacities are variable (usually low), high watertables preclude basements and similar excavations while underground utility installations are highly susceptible to corrosion if not adequately protected. High watertables and relatively slow permeability limit efficient operation of septic tank effluent disposal fields. (3) Delta soils are moderately to poorly suited for most forest crops. Sitka spruce is estimated to produce from 5 to 6 m^3 of wood/ha/yr.

DENNETT SOILS

Location and Extent: Dennett soils are common at the higher elevations of the Coast Mountains. Although only about 15 ha of pure map units are classified, numerous soil complexes dominated by Dennett soils total 7060 ha. The complexes are mostly with Sayres, Lions, Palisade, Hollyburn and Whonnock soils and Rock Outcrop and Talus land types.

Topography and Elevation: Dennett soils are strongly rolling to very hilly with slope gradients ranging from 20 to over 70 percent. They occur mostly above 700 m elevation and usually occupy the tops and upper slopes of ridges and knobs in the mountainous landscape.

Parent Material and Texture: Dennett soils have developed from organic forest litter, at least 10 cm and usually between 15 and 30 cm thick, over bedrock. The deposits are mainly well-decomposed (humic) material. A thin layer of mineral soil, up to 10 cm thick, is sometimes present immediately above the bedrock.

Soil Moisture Characteristics: Dennett soils are well to moderately well drained. They are rapidly pervious and have a low surface runoff although substantial lateral seepage along the top of the subsurface bedrock is usual, especially where the bedrock is massive. Water holding capacity of the organic material is very high.

General Soil Description: Dennett soils generally consist of about 1 to 4 cm of raw to partially-decomposed needles, twigs and leaves underlain by about 20 cm of dark reddish brown, well-decomposed, humic material that is matted to amorphous and contains variable amounts of mycelia. Underlying this is bedrock, usually granitic. A thin (less than 10 cm) layer of grayish, leached sandy material sometimes occurs between the organic material and the top of the hard bedrock. Soil reaction of the organic material is extremely acid. Soil Classification is *Typic Folisol*.

Commonly Associated Soils: Sayres, Palisade and Hollyburn soils and Rock Outcrop and Talus land types usually occur in close association with Dennett soils, either in soil complexes or in adjacent map polygons. Sayres and Hollyburn soils differ from Dennett soils by consisting of 10 to 100 cm of mineral soil over bedrock while Palisade soils have developed from colluvium deeper than 1 m. The Rock Outcrop land type consists of exposed rock at the land surface while the Talus land type is composed of actively accumulating stones, boulders and gravel on and at the base of steep, rock faces.

Vegetation: The vegetation on Dennett soils is generally coniferous, consisting mainly of Pacific silver fir, western and/or mountain hemlock and yellow cedar, often in an open stand. There is usually also a relatively dense ericaceous shrub layer and soil surface moss cover. Rooting is limited to the depth of the underlying bedrock and a layer of concentrated roots is often present on top of the rock.

General Land Use Comments: (1) Dennett soils are unsuitable for agricultural or urban uses because of very steep slopes and shallow depths to bedrock. (2) Forest production is poor to moderate (usually between about 2.8 and 5.5 cubic metres of wood/ha/yr) and is limited by adverse, high elevation climatic conditions and shallowness to bedrock. During forest harvesting, extreme care must be taken to ensure the shallow organic capping is not removed or destroyed.

Plate 19 Old growth forest on Dennett soils.

Plate 20 Dennett soil profile (Typic Folisol). These soils consist of organic forest litter accumulations over bedrock. The tape is graduated in 6 in. (15 cm) increments.

DEVIL SOILS (DV)

Location and Extent: Devil soils occur only in the vicinity of Blue Mountain northeast of Haney, where about 280 ha of pure map units are classified.

Topography and Elevation: The topography of Devil soils is strongly to moderately rolling with slope gradients ranging between 10 and 30 percent. Elevations lie between 700 and 750 m above sea level.

Parent Material and Texture: Devil soils have developed from stony, moderately coarse to coarse-textured glacial till, about 80 to 200 cm thick, which overlies and is mainly derived from Tertiary sandstone and conglomerate. Sandy loam, gravelly sandy loam or sometimes loam are the usual surface textures while sandy loam, gravelly loamy sand or loamy sand are usual in the subsurface and subsoil. In some areas the underlying bedrock is partially weathered.

Soil Moisture Characteristics: Devil soils are moderately well drained. They are rapidly to moderately pervious and have moderate water holding capacity and moderate to slow surface runoff. Lateral, telluric seepage along the surface of the underlying bedrock is usual during and after heavy rain and during snowmelt.

General Soil Description: Devil soils have between 10 and 20 cm of coniferous forest litter on the mineral soil surface, the lower half of which is well-decomposed, friable and very dusky red to dark reddish brown in colour. Under this is 5 to 10 cm of leached, grayish, sandy material which abruptly overlies about 60 cm of dark reddish brown to yellowish-brown, friable, sandy or loamy material that contains between 8 and 15 percent organic matter. Below this is about 15 cm of firm, yellowish-brown, strongly weathered sandstone or conglomerate which grades to unweathered rock. Soil reaction is extremely acid throughout except in the partially weathered rock where it is strongly acid. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Whonnock, Dennett, Sayres and Golden Ears soils occupy map polygons adjacent to Devil soils. Whonnock and Golden Ears soils differ from Devil soils by having developed mainly from glacial till derived from and overlying, granitic rock. Both have strongly cemented subsoil layers and, additionally, Whonnock soils are imperfectly drained. Sayres soils differ by having bedrock within 1 m or less of the surface while Dennett soils consist of 10 cm or more of organic forest litter over bedrock.

Vegetation: Parts of the Devil soil areas have been logged. Unlogged areas support a coniferous forest consisting mainly of western hemlock, coast Douglas-fir and western red cedar mixed with Pacific silver fir, mountain hemlock and yellow cedar. Rooting is generally unrestricted to within 15 cm of the underlying rock.

General Land Use Comments: (1) The high elevations (adverse climate) and steep topography make Devil soils unsuitable for agricultural or urban uses. (2) Forest production is high. Mean annual increments of about 9 to 12 m^3/ha/yr by western hemlock are estimated. (3) The underlying sandstone and conglomerate provides a local aggregate source.

DEWDNEY SOILS (DW)

Location and Extent: Dewdney soils occur mainly near Hatzic, on Nicomen Island and in the Matsqui Valley with scattered areas elsewhere on the floodplain of the Fraser River. There are about 110 ha of pure map units and 810 ha of soil complexes dominated by Dewdney soils. The complexes are mainly with Page, Matsqui, Fairfield and Monroe soils.

Topography and Elevation: The topography of Dewdney soils is mostly gently to moderately undulating with slope gradients less than 5 percent. The soils are usually either slightly depressional or occupy lower landscape positions when related to adjacent, better drained Monroe and Matsqui soils and lie slightly higher than the more poorly drained Page soils. Elevations range between 5 and 15 m above sea level.

Parent Material and Texture: Dewdney soils have developed from 20 to 50 cm of medium-textured, stone-free Fraser River floodplain deposits (laterally accreted) overlying sand. Surface and subsurface textures are usually silt loam, occasionally varying to loam or very fine sandy loam. The subsoil is mostly medium or fine sand, sometimes containing finer textured lenses.

Soil Moisture Characteristics: Dewdney soils are imperfectly drained and moderately pervious. Surface runoff is slow to moderate. Water holding capacity is high in the upper, silty part, but low in the subsoil. The watertable fluctuates with the level of the Fraser River and also rises temporarily during periods of heavy rainfall.

General Soil Description: Dewdney soils have a silty, cultivated surface about 20 cm deep which is very dark brown and friable. It is underlain by about 10 cm of weakly leached, grayish-brown or yellowish-brown, friable, silty material containing a few, reddish or yellowish mottles. This, in turn, is underlain by about 15 cm of grayish-brown, silty material in which some illuvial clay has accumulated and is firm when moist and breaks to hard, blocky clods when dry. It also contains common, reddish or yellowish mottles. Below about 40 cm depth, variably coloured, loose, medium or fine sand or alternating silty and sandy lenses occurs. Reaction varies from medium acid in the surface to slightly acid in the subsoil. Casts and other evidence of earthworm activity are prevalent in the upper soil layers. Soil classification is *Gleyed Eluviated Melanic Brunisol.*

Commonly Associated Soils: Fairfield, Monroe, Matsqui and Page soils are frequently closely associated with Dewdney soils, either in soil complexes or in adjacent map polygons. Fairfield soils are similar to Dewdney soils except that the silty surface capping over sand is more than 50 cm thick. Monroe soils differ from Dewdney soils by also having a silty capping more than 50 cm thick, in addition to being moderately well drained. Matsqui soils are texturally similar to Dewdney soils but differ by being well drained. Page soils differ by being poorly drained.

Vegetation: Most areas of Dewdney soils are cleared and cultivated. Uncleared areas support mainly deciduous trees and shrubs including black cottonwood, red alder, vine and bigleaf maple, willow, cascara, salmonberry and blackberry as well as scattered western red cedar, coast Douglas-fir and Sitka spruce. Rooting, except for some minor limitations caused by the slight clay accumulation in the subsurface, is essentially unrestricted to at least 75 cm depth.

General Land Use Comments: (1) Dewdney soils are valuable agricultural soils. Most crops can be grown productively although droughty conditions may develop during the latter parts of most growing seasons, unless irrigation is used. Small individual areas and intermingling with other soils causes difficulties for management as individual soil units. (2) Rather low bearing strengths may cause subsidence problems if heavy structures are constructed on these soils. Basements and other excavations will probably contain water during periods when the watertable is high. Septic tank efficiency also suffers during these periods. (3) Growth of black cottonwood and similar species is very high. Limited plot data indicates wood production by black cottonwood to be between 18 and 21 m^3/ha/yr.

DIXON SOILS (DX)

Location and Extent: Dixon soils occur only in the eastern part of Sumas Municipality, mainly on the floor or along the margins of former Sumas Lake which was drained in the 1920's. About 1100 ha of Dixon soils are classified as well as 20 ha of Dixon-Vye soil complex.

Topography and Elevation: The topography is nearly level to gently undulating with slope gradients less than 2 percent. Elevations lie between 8 and 12 m above sea level.

Parent Material and Texture: The parent material of Dixon soils is 50 cm or more of moderately fine to fine-textured lacustrine sediments overlying coarse-textured (sandy) lacustrine deposits. Surface textures are mostly silty clay loam and some clay loam. Subsurfaces are silty clay loam or silty clay changing abruptly to medium or coarse sand in the subsoil.

Soil Moisture Characteristics: Dixon soils are poorly to very poorly drained and are slowly pervious. Surface runoff is slow and frequent surface ponding occurs during heavy rain. Water holding capacity is high. The watertable is at or near the surface for most of the winter and recedes somewhat during the summer because of artificial drainage and pumping during the growing season. Some growing-season subsoil irrigation is provided by controlling water levels in ditches.

General Soil Description: Dixon soils generally have a dark grayish brown to grayish-brown, cloddy, cultivated clayey surface layer about 20 cm thick which is low in organic matter (usually less than 4 percent). The surface layer is underlain by about 40 cm or more of gray, massive, clayey material containing widely spaced, vertical cracks and common to few, strong brown to reddish-brown mottles. This in turn, is underlain by loose, very dark gray or gray sand below about 80 cm. Soil reaction is medium acid throughout. Soil classification is *Rego Gleysol*.

Commonly Associated Soils: Sumas and Vedder soils commonly occur in close association with Dixon soils. Sumas soils differ from Dixon soils by being sandy in texture. Vedder soils are somewhat siltier and less poorly drained than Dixon soils as well as having a well-structured subsurface layer. Significant areas of Dixon soils:shallow variant have been classified. These soils are similar to Dixon soils except that the underlying sand occurs within 15 to 50 cm of the surface rather than below 50 cm as is the usual case. Dixon soils:shallow variant are gradational between the Dixon soils and the sandy Sumas soils.

Vegetation: Dixon soils are essentially all cleared and cultivated. Scattered trees along fence lines are mainly black cottonwood and willow. Rooting is partly restricted by the clayey subsurface layers and is severely restricted below 50 cm by high watertables.

General Land Use Comments: (1) High watertables and poor drainage presently limit Dixon soils to forage, pasture, cereal grains and some vegetables. Improved drainage will widen the range of possible crops and also assist in improving productivity of individual crops. Organic matter additions to the surface will improve soil structure and decrease susceptibility to puddling. (2) Dixon soils are unsuited for urban or similar construction. Generally low soil bearing strengths lead to subsidence problems if heavy structures are erected and high watertables preclude basements or other excavations. High watertables severely limit the operation of septic tank disposal fields.

DURIEU SOILS (DU)

Location and Extent: Durieu soils are almost exclusively restricted to the uplands in the northern part of Hatzic Valley. There are about 850 ha of pure map units and a further 290 ha of soil complexes dominated by Durieu soils. The complexes are mainly with Scat soils.

Topography and Elevation: Durieu soils occupy the slopes and ridge tops of the undulating to gently rolling topography. Slope gradients vary between 5 and 15 percent. Elevations range between 50 and 100 m above sea level.

Parent Material and Texture: The parent material of Durieu soils is moderately fine textured glaciomarine deposits (a few, small areas of glacial till are also included). A shallow capping (up to 20 cm thick) of medium-textured, eolian material usually occurs on, or is mixed into the surface. Surface and subsurface textures are mostly silt loam but sometimes vary to loam. These grade to compact, weakly stratified silty clay loam or clay loam in the subsoil. Occasional stones and gravel and a few boulders are usually present.

Soil Moisture Characteristics: Durieu soils are moderately well drained. They are moderately pervious in the surface and subsurface but become slowly pervious in the compact subsoil. Water holding capacity is high and surface runoff is moderate to slow. Variable amounts of lateral seepage develop along the surface of the dense subsoil during periods of heavy prolonged precipitation.

General Soil Description: Durieu soils generally have about 5 to 10 cm of organic forest litter on the soil surface, the lower half of which is black, well-decomposed (humic) and friable. This is underlain by a thin (less than 2 cm), grayish, discontinuous, leached, silty layer which, in turn, is underlain by about 15 cm of friable, weakly structured, dark reddish brown, silty material usually containing between 10 and 15 percent organic matter. Under this is about 50 cm of friable, weakly structured, silty material which grades in colour from reddish-brown in the upper part to yellow-brown near the bottom. Below about 70 cm, unweathered, olive or olive-gray, clayey glaciomarine sediments occur which are massive, hard, and contain common, dark brown or dark yellowish brown mottles. Soil reaction varies from extremely acid near the surface to strongly acid in the upper part of the soil parent material. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Scat and Judson soils usually occur in close assocation with Durieu soils. They generally occupy the depressional landscape positions in the areas of Durieu soils and are poorly drained. Additionally, the Judson soils are organic in the upper 50 to 150 cm.

Vegetation: Small areas of Durieu soils have been cleared for pasture or building sites. The majority, however is in second-growth forest, mostly coast Douglas-fir, western hemlock, western red cedar, red alder, and vine maple. Rooting depth is generally restricted by the dense, compact subsoil to the upper 80 cm or so of soil.

General Land Use Comments: (1) Durieu soils are moderately suited for a variety of agricultural crops although presently cleared areas are mainly used only for hay and pasture. The variable topography restricts the range of crops and crops sensitive to "wet-feet" may suffer during extended periods of heavy rainfall. (2) Variable bearing strengths may cause differential subsidence if heavy structures are erected. Septic tank effluent disposal is limited by the slowly permeable subsoil; lateral seepage is likely to occur along the surface of this zone and accumulate in depressional areas. (3) Durieu soils are well suited for growth of coniferous forest. Coast Douglas-fir is estimated to have the potential of producing between 9 and 12 m^3 of wood/ha/yr.

EASTCAP SOILS (EP)

Location and Extent: Eastcap soils occur only in the larger valleys in the mountainous, northern part of the map area. There are about 230 ha of pure map units and 130 ha of soil complexes dominated by Eastcap soils. The complexes are with Sardis and Seymour soils.

Topography and Elevation: Gently undulating to undulating with slopes less than 5 percent is the usual topography. Elevations range between 150 and 300 m above sea level.

Parent Material and Texture: The parent material of Eastcap soils is coarse and some moderately coarse textured, variably stony, alluvial deposits of rivers and larger streams in the mountains. These occur as floodplains, islands and low terraces in the valley bottoms. Surface textures vary from gravelly sand to loamy sand while subsurface and subsoil textures range from stony gravel to gravelly sand.

Soil Moisture Characteristics: Eastcap soils are mostly imperfectly drained with some slightly depressional areas varying to poorly drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Groundwater tables generally fluctuate with the water levels in the adjacent rivers and streams. Flooding is common during periods of high water.

General Soil Description: Eastcap soils generally have less than 15 cm of variably decomposed, mainly deciduous organic forest litter on the mineral soil surface. This overlies about 20 cm of grayish-brown, weakly structured, sandy or gravelly material that is often weakly stratified and contains variable amounts of reddish or brownish mottles, stones and cobbles. This zone then grades to loose, gravelly and sandy material, often very stony and containing reddish mottles. Soil reaction usually varies from very strongly acid in the upper part to medium or strongly acid in the subsoil. Soil classification is ***Gleyed Regosol***.

Commonly Associated Soils: Sardis and Seymour soils often occur in close association with Eastcap soils. Sardis soils differ from Eastcap soils by being somewhat better drained (moderately well) while Seymour soils differ by having well developed podzolic soil development and being less susceptible to flooding (due to somewhat higher landscape positions).

Vegetation: The vegetation of Eastcap soils is mainly deciduous and includes cottonwood, alder and willow with some western red cedar and western hemlock also present. Rooting is restricted mainly to the upper 60 cm by the coarse-textured, stony subsoil and periodic, high watertables.

General Land Use Comments: (1) Danger of periodic flooding and coarse, stony textures generally make Eastcap soils unsuitable for agriculture, except perhaps, for pasture. (2) Periodic flooding and high groundwater tables also generally preclude Eastcap soils for urban and similar uses. (3) Growth of forest species such as cottonwood is generally good (except in depressional locations where the drainage becomes poor). Estimated yearly wood production by cottonwood is in excess of 15 m^3/ha/yr.

ELK SOILS (EK)

Location and Extent: Elk soils mainly occur along the margins of Matsqui and Glen Valleys with small, scattered areas elsewhere in the map area. These are about 140 ha of pure map units and 220 ha of soil complexes dominated by Elk soils. The complexes are mainly with Isar and Harrison soils.

Topography and Elevation: Gently to moderately sloping with slope gradients below 8 percent is the usual topography of Elk soils. Elevationally, they range between 10 and 50 m above sea level.

Parent Material and Texture: The parent material of Elk soils is moderately coarse to medium-textured alluvial fan deposits. Surface and subsurface textures vary from gravelly sandy loam to silt loam with the latter being most common. Subsoils range from gravelly sand to gravel or gravelly loamy sand. The soils are usually moderately stony, especially in the subsurface and subsoil.

Soil Moisture Characteristics: Elk soils are poorly drained. They are rapidly to moderately pervious and have moderate to slow surface runoff and moderate water holding capacity. Runoff and seepage from higher adjacent lands as well as seepage from adjacent streams passes through Elk soil areas and moderate flooding sometimes occurs during heavy, prolonged rains.

General Soil Description: Elk soils generally have a cultivated, loamy surface layer about 15 to 20 cm thick which is friable, dark grayish brown to black in colour and contains between 15 and 25 percent organic matter. Underlying this is about 15 cm of grayish, friable, weakly structured, loamy material containing many to common, reddish or brownish mottles and variable amounts of gravel and stones. Below about 40 cm depth transition to variably coloured, loose, often stratified gravels and sands containing reddish and yellowish mottles occurs. Soil reactions vary from strongly to very strongly acid (1:1 H_2O). Soil classification is ***Rego Humic Gleysol***.

Commonly Associated Soils: Isar and Harrison soils often are closely associated with Elk soils. Isar soils differ from Elk soils by being well to moderately well drained and having little or no soil profile development (lack the dark coloured surface layer). Harrison soils differ by being well drained and reddish-brown in colour.

Vegetation: Substantial areas of Elk soils are cleared for agricultural uses. Uncleared areas support a variety of moisture tolerant species including black cottonwood, western red cedar, red alder, willow, blackberry, skunk cabbage and sedges. Rooting is mainly limited to the upper 50 cm of soil by coarse subsoil textures and saturated soil conditions.

General Land Use Comments: (1) Elk soils are mainly used for forage and pasture; other crops are also possible if runoff and seepage from higher areas and adjacent streams is controlled. During dry summers, supplemental irrigation is required for good production. (2) Elk soils are generally poorly suited for urban and related uses. High watertables prevent basements and other excavations and septic tank efficiency is impaired. Potential for groundwater contamination exists due to incomplete filtration of effluent by the coarse subsoil textures. Occasional flooding in some areas also discourages use as building sites.

ELPHINGSTONE SOILS (EF)

Location and Extent: Elphingstone soils occur only in small, scattered areas in the mountainous, northern part of the map area. Only 25 ha of pure map units and 40 ha of soil complexes dominated by Elphingstone soils are classified. The complexes are with Sayres and Whonnock soils.

Topography and Elevation: Elphingstone soils vary in topography from depressional to moderately sloping or gently rolling with slopes less than 8 percent. They are found in areas that are depressional in relation to adjacent soils or on lower, seepage and runoff receiving areas. Mostly they occur between 300 and 1200 m above sea level.

Parent Material and Texture: Elphingstone soils have developed from partially decomposed organic deposits which are composed mainly of sedge, reed and grass remains as well as some wood. The organic deposits, between 40 and 160 cm thick, overlie mainly glacial till or sometimes, alluvium. The surface is usually poorly decomposed (fibric) while the subsurface and subsoil organic material is partly decomposed (mesic). The underlying mineral soil is gravelly sandy loam or gravelly loam and in some areas, particularly near stream channels, thin lenses and strata of silty or sandy mineral material sometimes occur in the organic deposits.

Soil Moisture Characteristics: Elphingstone soils are very poorly drained. They are moderately pervious and have very high water holding capacities and slow to moderate surface runoff. The watertable is at or near the surface for most of the year due to accumulating seepage and runoff from higher, adjacent areas. At the higher elevations snow remains until late spring.

General Soil Description: Elphingstone soils have a surface organic layer, about 10 to 20 cm thick that is dark reddish brown to yellowish-brown and consists mainly of relatively undecomposed sedge, reed and grass remains. This is underlain by about 70 cm of dark reddish brown to yellowish-brown, matted to massive, firm, organic material containing variable amounts of woody fragments. This zone then grades to about 10 cm of black, well-decomposed organic material which is massive, firm and sometimes contains a proportion of silty or sandy mineral soil material. Underlying this is firm, massive, greenish-gray or brownish-gray, gravelly mineral soil containing occasional reddish mottles. Soil reaction grades from extremely acid in the surface to strongly or medium acid in the underlying mineral soil. Soil classification is *Terric Mesisol*.

Commonly Associated Soils: Sayres and Whonnock soils commonly are found in close association with Elphingstone soils. Both differ from Elphingstone soils by being mineral rather than organic in composition. Both are also well to imperfectly drained and additionally, Sayres soils have bedrock within 100 cm of the soil surface.

Vegetation: The vegetation on Elphingstone soils consists mainly of reeds, sedges and grasses with some willow, yellow cedar (western red cedar at the lower elevations), western and/or mountain hemlock, and Pacific silver fir as well as a variety of herbaceous shrubs and herbs. Rooting is restricted to the upper 70 cm or less by the high watertables.

General Land Use Comments: (1) Elphinstone soils are not used for agriculture at the present time. Poor drainage (and sometimes flooding) as well as adverse climate (high elevations) generally limit these soils to potential pasture or forage uses. Under natural conditions they provide native pasture which is utilized by wildlife. (2) Limitations similar to those for agriculture as well as low bearing strengths make these soils unsuited for urban or similar uses. (3) Forest productivity is very low.

EMBREE SOILS (EM)

Location and Extent: Embree soils occur only in the southeastern part of Delta Municipality and in the Serpentine-Nicomekl Valley of Surrey Municipality. There are about 170 ha of pure map units and 390 ha of soil complexes dominated by Embree soils. The complexes are mainly with Blundell, Sandel, Kitter and Goudy soils.

Topography and Elevation: Topographically, Embree soils vary from nearly level to undulating and are often slightly depressional in relation to adjacent soils. Slope gradients are less than 5 percent and elevations lie between 1 and 3 m above sea level.

Parent Material and Texture: Embree soils have developed from medium-textured, mixed marine and fresh water deltaic deposits. One or more organic layers, totalling between 10 and 50 cm in thickness, occur in the subsurface and subsoil. The organic layers, as well as the mineral material below them, are usually saline and contain compounds high in sulphur. Surface texture is mainly silt loam, occasionally varying to silty clay loam; subsurface and subsoil mineral soil layers have textures that are similar. The organic layers are well to moderately well decomposed (humic). Medium to fine sand may occur below depths of about 100 cm.

Soil Moisture Characteristics: Embree soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is at or near the soil surface during most of the winter and surface ponding is common during this rainy period. Growing season watertables gradually recede, due in part to ditching and other artificial drainage.

General Soil Description: Embree soils have a black or very dark brown, friable, silty, cultivated surface which is about 20 cm thick and generally contains between 10 and 20 percent organic matter. The surface layer is underlain by a grayish-brown, firm, moderately-cracked to massive, silty layer about 20 cm thick which, in turn, is underlain by about 20 cm of black to very dusky red, friable, well-decomposed organic material. Underlying the organic material is at least 40 cm of massive, saline, olive-gray or greenish-gray, silty material containing common, yellow to dark brown mottles and hard, brownish tubules around old root channels. The sulphur content of this zone is high as well. Below 1 m or more, dark gray, loose, medium or fine sand usually occurs. Soil reaction is extremely acid throughout. Soil classification is ***Rego Humic Gleysol:saline phase.***

Commonly Associated Soils: Goudy, Kitter, Sandell and Deas soils usually are closely associated with Embree soils. Goudy soils differ from Embree soils by being organic rather than mineral in texture at the surface. Kitter, Sandell and Deas soils differ by not having the organic layer(s) in the subsurface and subsoil. Also, Kitter soils are non-saline in the upper metre or more.

Vegetation: Essentially all areas of Embree soils are cleared and cultivated for agricultural uses. Rooting is unrestricted to about 50 cm, then is severely impeded by high watertables and saline subsoil conditions.

General Land Use Comments: (1) The main restrictions to agricultural use of Embree soils are high watertables. These can usually be artificially controlled. Deep rooted crops are sometimes adversely affected by the saline subsoil. Irrigation would help to wash out these salts as well as maintain good growth during dry summers. Embree soils are frequently closely intermingled with other soils making them difficult to manage as individual units. (2) Generally low bearing strengths are likely to cause subsidence problems when heavy urban or other structures are built. High watertables generally preclude basements or other excavations and severely impede operation of septic tank effluent disposal fields. Highly saline subsoils containing substantial amounts of sulphur are likely to cause severe corrosion of inadequately protected underground installations.

Plate 21 Landscape typical of the lowland areas near Mud Bay showing the undulating topography of the soils. Kitter soils are usual on the tops of the undulations while Embree and Deas soils occupy the slopes and shallower depressions. Goudy soils are usual in the deeper depressions.

ERROCK SOILS (ER)

Location and Extent: Errock soils are relatively uncommon and occur mainly in the vicinity of Steelhead. There are 30 ha of pure map units and 80 ha of Errock-Roach soil complex.

Topography and Elevation: The topography of Errock soils is level to gently undulating with slopes less than 5 percent. The soils are usually slightly depressional in relation to adjacent soils and lie at elevations about 730 m above sea level.

Parent Material and Texture: Errock soils have developed from coarse-textured, gravelly and stony glaciofluvial deposits. Surface textures are usually loamy sand or sandy loam, sometimes gravelly, while subsurfaces and subsoils are gravelly sand or sandy gravel. The soils are very to excessively stony and subsurface layers are strongly cemented to indurated.

Soil Moisture Characteristics: Errock soils are imperfectly drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. Downward water movement is slightly impeded by the subsurface cemented layers and temporary, perched watertables develop above this zone during periods of heavy, prolonged precipitation. The soils are subject to runoff and seepage from adjacent, higher areas.

General Soil Description: Errock soils generally have between 10 and 20 cm of coniferous forest litter on the mineral soil surface, the lower half of which is well-decomposed. The organic material is underlain by 5 to 10 cm of gray, strongly leached, sandy material which, in turn, is underlain by about 15 cm of friable, dark reddish brown, sandy and gravelly material containing about 10 to 20 percent organic matter. This layer is abruptly underlain by an extremely firm, very strongly cemented, gravelly and stony zone, about 40 cm thick, which varies in colour from yellowish-brown to strong brown and contains common, reddish mottles. Below about 60 cm gradual change to loose, stony gravel or gravelly sand begins. Soil reaction varies from extremely acid in the upper part to strongly acid in the subsoil. Soil classification is *Gleyed Ortstein Ferro-Humic Podzol.*

Commonly Associated Soils: Roach soils commonly occur in close association with Errock soils. They are similar to Errock soils except for being well, rather than imperfectly, drained. They tend to occupy slightly higher topographic landscape positions than do Errock soils.

Vegetation: Coast Douglas-fir, western red cedar and western hemlock are the dominant tree cover. Rooting is mainly restricted to the upper 30 cm by the cemented subsurface layer and coarse, stony textures.

General Land Use Comments: (1) Errock soils are generally poorly suited for agricultural use because of excessive stoniness, low fertility, shallow rooting depth and low water holding capacity. Any arable agricultural use will require substantial irrigation, stone-clearing and fertilization for satisfactory production. (2) Errock soils have high bearing strength for urban types of construction although stony, cemented soil conditions make excavations for basements and underground utilities difficult. Septic tank effluent disposal fields should operate efficiently (if installed below the cemented zone), however, potential groundwater contamination is possible because of poor filtration by the coarse subsoils. Errock soils have potential as aggregate sources. (3) Limited plot data indicates Errock soils produce good growth of western hemlock and Douglas-fir, about 9 to 12 m^3 of wood/ha/yr. The low soil water holding capacities seem to be offset by the restricted drainage.

EUNICE SOILS (EU)

Location and Extent: Eunice soils are common on the lower mountain slopes north of the Fraser River and on parts of the Sunshine Coast. About 170 ha of pure map units are classified as well as 7300 ha of soil complexes dominanted by Eunice soils. The complexes are mainly with Cannell, Hoover, Paton and Poignant soils and Rock Outcrop land type.

Topography and Elevation: Strongly to very steeply sloping or moderately rolling to hilly with slopes between 10 and 50 percent is the usual topography of Eunice soils. They usually occupy the tops and upper slopes of rocky ridges and knolls below 700 m above sea level.

Parent Material and Texture: Eunice soils have developed from 10 cm or more of coniferous organic material (litter) overlying bedrock. The upper 5 cm of organic material is partially decomposed to raw while the lower part is usually well-decomposed (humic). Less than 10 cm of sandy material sometimes lies between the organic material and the top of the bedrock.

Soil Moisture Characteristics: Eunice soils are well to rapidly drained. The organic material is rapidly pervious and has high water holding capacity. Substantial amounts of lateral seepage flows along the bedrock surface during prolonged heavy precipitation, especially where the bedrock is relatively massive.

General Soil Description: Eunice soils generally have a surface layer about 5 cm thick consisting of partially decomposed and undecomposed leaves, needles, twigs and moss. This is underlain by about 10 cm of black, matted, friable, well-decomposed (humic) organic material which, in turn, is abruptly underlain by massive to fractured, mainly granitic bedrock. Sometimes a thin (less than 10 cm), grayish, strongly leached, sandy layer lies between the organic material and bedrock. Soil reaction is extremely acid. Soil classification is *Typic Folisol*.

Commonly Associated Soils: Cannell, Hoover, Paton and Poignant soils and Rock Outcrop land type often are closely associated with Eunice soils either in soil complexes or in adjacent map units. Cannell soils differ from Eunice soils by consisting of 10 to 100 cm of mineral soil over bedrock, while Hoover, Paton and Poignant soils differ by being composed of more than 1 m of colluvial mineral soil over bedrock. Rock Outcrop land type differs from Eunice soils by having less than 10 cm of organic or mineral soil over bedrock, or has rock exposed at the land surface.

Vegetation: The natural vegetation is dominantly coniferous, mainly coast Douglas-fir, western hemlock, red alder and some western red cedar. Arbutus is also present in the coastal areas. Undergrowth is sparse and a moss layer usually covers the ground surface. Rooting is generally restricted to the depth of the organic material although some roots are established in fractures in the underlying bedrock.

General Land Use Comments: (1) Eunice soils are unsuited for agricultural use because of extreme shallowness to bedrock and steep topography. (2) Eunice soils are also very limited for urban and related uses. Although foundation conditions are good (bedrock), basements, underground utility installations and streets have to be constructed in rock. Insufficient soil exists for septic tank installation. (3) Forest growth is low to moderate being severely limited by shallow rooting depth and droughty conditions during the growing season. Limited plot data indicates potential productivity of Douglas-fir to range from about 3.5 to 7.5 m^3 of wood/ha/yr. During forest harvesting, extreme care is required to prevent removal or destruction of the organic layer. Should this happen, severe, long lasting site deterioration occurs.

FADDEN SOILS (FD)

Location and Extent: Fadden soils occur only in scattered areas in the western part of Sumas Valley, mainly south of Kilgard. There are about 280 ha of pure map units and 45 ha of soil complexes dominated by Fadden soils. The complexes are mostly with Bates and Vye soils.

Topography and Elevation: Fadden soils are gently undulating to undulating with slopes up to 4 percent. They commonly occupy the tops and upper slopes of the undulating landscape. Usual elevations are between 5 and 10 m above sea level.

Parent Material and Texture: Fadden soils have developed from moderately fine to medium-textured lacustrine deposits. At depths greater than 1 m sand is often encountered and thin, buried, old, surfaces are sometimes present at about 90 cm depth. Surface textures are silt loam or silty clay loam; subsurface and subsoil textures are generally silty clay loam or silty clay, changing to medium or coarse sand below 1 m or more.

Soil Moisture Characteristics: Fadden soils are imperfectly drained. They are moderately pervious and have high water holding capacity and slow to moderate surface runoff. The fluctuating groundwater table is usually high during the wet, winter months but recedes during the drier, summer period. In slightly depressional locations, occasional surface ponding occurs after heavy rains.

General Soil Description: Fadden soils have a black to very dark brown, friable, silty, cultivated surface that is between 15 and 20 cm thick. It is underlain by about 20 cm of gray to grayish-brown, friable, leached, silty material containing a few, strong brown mottles. Under this is a dark grayish brown to dark gray, clay enriched layer about 50 cm thick which has strong, coarse, prismatic structure and many, strong brown mottles, particularly in the lower part. The soil then grades, below 1 m or more, to loose sand containing reddish-brown mottles. Soil reaction grades from strongly acid in the surface to slightly acid in the subsoil. Abundant casts and other evidence of earthworm activity is present in the surface layers. Soil classification is *Gleyed Gray Brown Luvisol*.

Commonly Associated Soils: Bates, Vye, Vedder and Buckerfield soils often occur in close association with Fadden soils, either in soil complexes or adjacent map polygons. Bates soils are similar to Fadden soils except that the well defined clay accumulation layer in the subsoil is absent. Vye soils are also similar to Fadden but have lighter coloured surfaces containing less organic matter. Vedder and Buckerfield soils differ from Fadden soils by being poorly drained and usually lie in slightly lower topographic landscape positions when compared to the imperfectly drained Fadden soils.

Vegetation: All areas of Fadden soils are cleared and cultivated. Rooting is partially restricted below about 60 cm by the clayey subsoil layers and fluctuating winter watertables although roots commonly penetrate to depths of 100 cm.

General Land Use Comments: (1) Fadden soils are well suited for most agricultural crops although high, periodic watertables hinder the overwintering of some perennials and the growth of other crops particularly sensitive to "wet-feet". Artificial drainage and periodic subsoiling to loosen the dense, clayey subsurface layers lessens these problems. (2) Variable (usually low) soil bearing strengths can produce subsidence problems if heavy structures are erected and high, periodic watertables discourage basements and other excavations. The operation of septic tank disposal fields is restricted by periodic high groundwater and relatively low subsoil permeability. (3) Fadden soils appear well suited for forest crops such as cottonwood. Potential productivity for this species is estimated at about 9 to 12 m^3 of wood/ha/yr.

FAIRFIELD SOILS (F)

Location and Extent: Fairfield soils are common on the Fraser River floodplain; the largest areas are on Nicomen Island and in Matsqui Valley. Pure map units total about 820 ha while soil complexes dominated by Fairfield soils account for 2880 ha. The complexes are mostly with Monroe, Page and Dewdney soils.

Topography and Elevation: Fairfield soils are usually gently undulating to gently rolling with slopes between 2 and 6 percent. They usually occupy the lower slopes and shallow depressions when associated with Monroe soils and the upper slopes and lower ridges where associated with Page soils. From 5 to 10 m above sea level is the usual elevational range.

Parent Material and Texture: Fairfield soils have developed from medium and some moderately fine textured, laterally accreted, stone-free, Fraser River floodplain deposits, 50 cm or more deep, that overlie sand. Surface and subsurface textures are mostly silt loam, occasionally varying to very fine sandy loam or silty clay loam. The upper subsoil is also silt loam but with increased depth, grades to sand or loamy sand, sometimes containing thin, silty lenses.

Soil Moisture Characteristics: Fairfield soils are imperfectly drained. They are moderately pervious and have high water holding capacity and slow to moderate surface runoff. A fluctuating groundwater table is present, whose height is partially dependent on the water level in the Fraser River (seepage occurs through the sandy underlay). It also rises into the upper soil layers during periods of heavy rain. Areas lying outside the dykes are susceptible to flooding during the freshet period.

General Soil Description: Fairfield soils have a friable to firm, dark grayish brown to dark brown, silty, cultivated surface layer which is about 20 cm thick. It is underlain by about 20 cm of partially leached, grayish-brown or light brownish gray, firm to friable, silty material containing common, brownish or reddish mottles. This partially leached zone then grades to grayish-brown, firm, moderately prismatic structured, slightly clay enriched, silty material about 35 cm thick. Brownish and reddish mottles are present also. This layer, in turn, grades to a massive, grayish, silty zone up to 30 cm thick and again, containing reddish and brownish mottles. Below this is olive-gray to grayish-brown, medium to fine sand. Soil reaction varies from strongly to moderately acid in the upper soil layers and grades to moderately or slightly acid in the subsoil. Soil classification is ***Gleyed Eluviated Melanic Brunisol***.

Commonly Associated Soils: Monroe, Page, Dewdney, Matsqui and Hjorth soils are generally closely associated with Fairfield soils, either in soil complexes or adjacent map polygons. Dewdney soils are similar to Fairfield soils except that the underlying sand occurs between 20 and 50 cm of the surface. Monroe and Matsqui soils differ by being well or moderately well drained (occupy higher topographic landscape positions relative to Fairfield soils) while Page and Hjorth soils are poorly drained and lie at lower elevations in the undulating landscape.

Vegetation: Almost all areas of Fairfield soils are cleared, cultivated and used for a variety of agricultural crops. Small, uncleared areas (usually located outside the dykes) have dominantly deciduous vegetation, including black cottonwood, red alder, vine and bigleaf maple, willow, salmonberry, and blackberry. Rooting is essentially unrestricted to at least 75 cm for most vegetation although species very sensitive to fluctuating watertables will be limited to depths less than 75 cm.

General Land Use Comments: (1) Fairfield soils are among the best in the Lower Fraser Valley. They are suitable for most crops except those very sensitive to a fluctuating watertable and occasional "wet-feet". Fairfield soils frequently occur as small areas and are often closely intermingled with other soils thereby providing problems for management on an individual basis. (2) Rather low bearing strengths may cause problems for heavy structures through differential settling. Basements and other excavations are likely to contain water during periods when the watertable is high. Septic tank effluent disposal is also impaired during these periods. (3) Black cottonwood and hybrid European poplars do very well on Fairfield soils. Limited plot data indicates potential wood production by cottonwood is in excess of 15 m^3/ha/yr.

FELLOWS SOILS (FS)

Location and Extent: Fellows soils occur only near the southern end of Coquitlam Lake and in the Statlu Creek-Chehalis River valleys. There are about 330 ha of pure map units and 1920 ha of soil complexes dominated by Fellows soils. The complexes are with Coquitlam and Roach soils.

Topography and Elevation: The topography of Fellows soils is mostly moderately rolling to hilly with slope gradients between 10 and 50 percent, but along gullies or on escarpments, the gradients increase to over 60 percent. Elevations range between 150 and 300 m above sea level.

Parent Material and Texture: Fellows soils have developed from moderately coarse to coarse-textured glaciolacustrine deposits. There usually is 10 to 20 cm of dominantly well-decomposed organic forest litter on the soil surface. The texture of the surface mineral soil and upper part of the subsurface is sandy loam, or sometimes, fine sandy loam; the lower subsurface and subsoil are loamy sand or fine to medium sand. The subsoil is usually varved.

Soil Moisture Characteristics: Fellows soils are moderately well to well drained and moderately pervious. Downward water movement is impeded in some areas by weak to moderate, discontinuous cementation at depths below 70 cm. A temporary, perched watertable develops in the zone of cementation during heavy, prolonged rain and lateral, telluric seepage occurs. Water holding capacity is moderate and surface runoff is usually slow, except in areas of steeper slopes where it increases to moderate.

General Soil Description: Fellows soils generally have between 10 and 20 cm of organic forest litter on the mineral soil surface, most of which is black, matted and well-decomposed (humic). This is underlain by a strongly leached, sandy layer that is gray or reddish-gray, weakly structured and from 1 to 5 cm thick. Abruptly under this is a 10 to 20 cm thick, dark reddish brown zone of weakly structured, friable, sandy material containing between 10 and 25 percent organic matter and variable amounts of spherical, hard concretions. This organic matter enriched zone grades to about 40 cm of friable, weakly to moderately structured, sandy material which is dark yellowish brown to reddish-brown in colour (colour variation is due to uneven organic matter distribution). It, in turn, grades to about 50 cm of firm, olive-gray to dark gray, sandy material which is discontinuously weakly to moderately cemented, massive (breaks horizontally along varves when disturbed) and contains common, prominent, brown to dark yellowish brown mottles. Below about 100 cm depth, loose, massive, dark gray, unweathered sand occurs. Soil reaction grades from extremely acid in the organic surface and upper mineral soil to strongly or medium acid in the lower subsoil. Soil classification is usually *Orthic Ferro-Humic Podzol*. A few areas of Duric Ferro-Humic Podzol are also included where the subsoil cementation is relatively continuous.

Commonly Associated Soils: Coquitlam and Roach soils commonly occur in association with Fellows soils. Coquitlam soils are similar to Fellows soils except that they are silty rather than sandy in texture and do not have subsoil cementation. Roach soils differ by being gravelly and stony as well as having strongly cemented subsurface layers.

Vegetation: The vegetation on Fellows soils consists mainly of second-growth coast Douglas-fir, western hemlock and western red cedar, together with red alder, birch and some vine and bigleaf maple. Rooting is unrestricted to depths of 70 cm or so but is impeded below this in some areas by discontinuous cementation.

General Land Use Comments: (1) None of the Fellows soil areas are presently cleared or cultivated. Where topography is suitable, they have potential for most agricultural crops if supplemental irrigation is available. Adequate liming and fertilization is also required. (2) Relatively level areas are suitable for urban and similar uses. Care is required to prevent erosion of the sandy deposits. (3) Forest growth is good; estimated mean annual increments for Douglas-fir are 9 to 12 m^3/ha/yr. Soil moisture deficiencies during the latter parts of dry summers are somewhat limiting.

5

GIBSON SOILS (GN)

Location and Extent: Gibson soils occupy scattered areas on the Fraser River floodplain as well as small areas in Sumas Valley. The largest areas are in Glen and Matsqui Valleys. Pure map units total about 960 ha while soil complexes dominated by Gibson soils occupy a further 230 ha. The complexes are mainly with Banford and Lumbum soils.

Topography and Elevation: Slightly depressional, level, or gently undulating with slopes less than 2 percent is the usual topography of Gibson soils. They lie between 3 and 10 m above sea level.

Parent Material and Texture: Gibson soils have developed from partly decomposed organic deposits, between 40 and 120 cm thick, that overlie moderately-fine to medium-textured Fraser River floodplain and some lacustrine deposits. The organic material consists mainly of sedge, reed and other deciduous plant remains. Surfaces are usually partly (mesic) to well (humic) decomposed while the underlying organic material is mainly partly decomposed, sometimes containing a few, thin undecomposed layers. The subsoil mineral soil is silt loam or silty clay loam.

Soil Moisture Characteristics: Gibson soils are very poorly to poorly drained. They are moderately pervious and have very high water holding capacity and slow surface runoff. The watertable is near, and sometimes at the surface for most of the winter and early parts of the growing season, then retreats somewhat during the drier summer months.

General Soil Description: Gibson soils usually have a very dark brown to black, friable, granular, well-decomposed, organic, cultivated surface layer about 20 cm thick. This is underlain by between 20 and 100 cm of partly decomposed, dark reddish brown to yellowish-brown, weakly stratified to matted, organic material (individual plant remains are partially recognizable). The mineral subsoil, occurring at depths between 40 and 120 cm is massive, gray to olive-gray and silty. Soil reactions vary from strongly to extremely acid in and near the surface to strongly acid in the lower subsoil. Soil classification is *Terric Mesisol*.

Commonly Associated Soils: Banford , Hallert, Lumbum and Glen Valley soils are usually closely associated with Gibson soils. Banford soils are similar to Gibson soils except that the organic material is well decomposed rather than only partly decomposed. Lumbum soils are also similar except that the partly decomposed organic material is deeper than 120 cm. Glen Valley soils differ by consisting of deep (more than 120 cm), raw or only weakly decomposed organic deposits. Hallert soils differ by being composed of alternating organic and silty strata.

Vegetation: Some areas of Gibson soils are cleared and cultivated for agricultural uses. Uncleared areas mainly support a variety of water tolerant, deciduous plants including willow, bog birch, blackberry, skunk cabbage, hardhack, sedges and reeds as well as some western red cedar and western hemlock. Rooting in undrained areas is restricted to about 50 cm depth; it is usually deeper in areas with adequate watertable control.

General Land Use Comments: (1) Poor drainage is the main agricultural limitation of Gibson soils. With adequate water control and fertilization, hay, pasture, vegetables and other crops can be productively grown. Overdraining will likely cause accelerated decomposition and subsidence. Watertable control which permits progressive lowering of the watertable during the growing season is generally most satisfactory. (2) Very low bearing strength and high watertables generally preclude most urban-type construction unless the organic material is removed or pre-loaded. Excavations will generally contain water and septic tank operation is severely impaired by high watertables.

GLEN VALLEY SOILS

Location and Extent: Glen Valley soils occur on both the lowlands and uplands of the map area east from Delta Municipality. The main areas are located on the floodplains of the Fraser and Pitt Rivers. There are about 330 ha of pure map units and 720 ha of soil complexes dominated by Glen Valley soils. The complexes are mainly with Gibson, Lumbum, Judson, Triggs and Widgeon soils.

Topography and Elevation: The topography of Glen Valley soils varies from slightly depressional to level or gently sloping. Slope gradients are less than 2 percent. Most areas lie between 3 and 10 m above sea level with a few, scattered areas on the uplands ranging to 100 m above sea level.

Parent Material and Texture: Deep (more than 120 cm), undecomposed to weakly decomposed organic deposits composed mainly of reeds, sedges, grasses and other deciduous material form the parent material of Glen Valley soils. Scattered, old tree roots are found in the organic material as well. Surfaces vary from poorly decomposed (fibric) in uncleared areas to partly decomposed (mesic) in some cultivated fields. The subsurface and subsoil organic material is mostly fibric with, sometimes, a few, thin bands of mesic material. The underlying mineral material, usually encountered at depths greater than 2 m, is silty clay loam or silty clay.

Soil Moisture Characteristics: Glen Valley soils are very poorly drained. They are moderately pervious and have slow surface runoff and very high water holding capacity. The watertable is at or near the surface for most of the winter months and retreats slightly in the latter parts of the growing season. Glen Valley soils often act as accumulation areas for seepage and runoff from higher, adjacent lands.

General Soil Description: The surface of Glen Valley soils usually consists of partially-decomposed reeds, sedge and some moss remains. It is about 15 cm thick and is very dusky red to dark reddish brown in color. Underlying the surface layer for at least 100 cm is dark reddish brown, yellowish-brown or yellowish-red, undecomposed organic material that is weakly stratified and consists mainly of undecomposed sedge and reed remains. Occasional mossy lenses and old tree roots are also present. The underlying mineral material, usually occurring at depths greater than 2 m, is clayey, massive and gray to greenish-gray or olive-gray in color. Soil reaction of the organic material varies from extremely to very strongly acid while the mineral underlay is moderately to strongly acid. Soil classification is *Typic Fibrisol*.

Plate 22 Vegetation on an uncleared area of Glen Valley soils. The vegetation on these deep, organic soils is mainly deciduous.

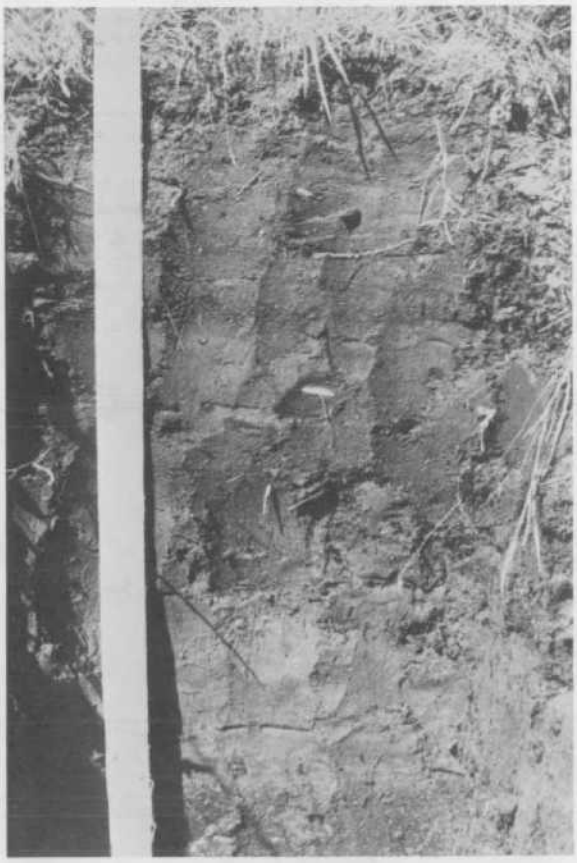


Plate 23 Glen Valley soil profile (Typic Fibrisol). These very poorly drained and slightly decomposed organic soils have developed from organic deposits deeper than 160 cm. The organic material is mainly composed of sedge, reed and grass remains.

Commonly Associated Soils: Banford, Gibson, Widgeon, Triggs and Lumbum soils are commonly closely associated with Glen Valley soils. Triggs soils differ from Glen Valley soils by being composed of deep, undecomposed, organic accumulations consisting mainly of moss. Lumbum soils are also composed of deep organic accumulations, but these are partially-decomposed (mesic). Banford, Gibson and Widgeon soils are organic also, however the underlying mineral material occurs with 40 to 120 cm of the surface. Additionally, Gibson and Widgeon soils are partially-decomposed while Banford soils are well-decomposed.

Vegetation: A few areas are cleared, cultivated and used mainly for pasture, forages or blueberries. Uncleared areas support mainly willow, red alder, birch, hardhack, skunk cabbage, sedges, reeds and other deciduous species with scattered western red cedar, western hemlock and lodgepole pine. Rooting depth is usually restricted to the upper 40 cm by the high watertables.

General Land Use Comments: (1) Poor drainage and for some crops, extreme acidity are the main agricultural limitations of Glen Valley soils. With adequate watertable control and fertilization a variety of vegetables, blueberries, hay and pasture and other crops can be produced. Overdraining will cause accelerated decomposition and subsidence of the organic material. Water control which permits progressive lowering of the watertable during the growing season is generally most satisfactory. Very low bearing strengths limit equipment to types that are relatively light or equipped with flotation-type tires or treads. (2) Very low bearing strengths and high watertables preclude most construction unless the organic material is removed or preloaded. Excavations will generally contain water and septic tank effluent disposal is unsatisfactory.

GOLDEN EARS SOILS (GE)

Location and Extent: Golden Ears soils are relatively common at the higher elevations in the mountainous, northern part of the map area. Soil complexes dominated by Golden Ears soils total about 12 210 ha. The complexes are mostly with Whonnock and Sayres soils.

Topography and Elevation: Steeply to very steeply sloping or strongly rolling to hilly with slope gradients between 15 and 40 percent is the usual topography of Golden Ears soils. In small areas the slopes may rise to 60 percent. Elevations are generally in excess of 700 m above sea level.

Parent Material and Texture: Golden Ears soils have developed from moderately coarse textured, stony and sometimes bouldery, glacial till derived mainly from granitic bedrock. Organic forest litter, between 15 and 25 cm thick and mainly well-decomposed (humic) occurs on the soil surface. The surface, subsurface and subsoil mineral soil textures are gravelly sandy loam or sandy loam, varying sometimes to gravelly loamy sand. The subsoil layers are strongly cemented.

Soil Moisture Characteristics: Golden Ears soils are moderately well drained. The upper 80 to 100 cm is moderately to rapidly pervious; this decreases to slowly pervious in the cemented subsoil. Surface runoff is moderate to slow and water holding capacity is very high in organic surface but decreases to low in the mineral soil. Lateral, telluric seepage develops along surface of the cemented layer during and after heavy rains, and during snowmelt.

General Soil Description: Golden Ears soils have about 20 cm of organic forest litter on the mineral soil surface. The organic material consists of about 2 to 5 cm of undecomposed needles, twigs and moss and about 15 cm of well-decomposed, black to very dusky red, matted to amorphous humic material. This is abruptly underlain by 5 to 10 cm of gray to dark gray, friable, strongly leached, sandy material which, in turn, is underlain by about 10 cm of very dark reddish brown to black, weakly structured, sandy material containing between 10 and 20 percent organic matter. This layer grades to about 50 cm of strong brown to reddish-brown, friable to firm, moderately structured, sandy and gravelly material in which the colours are intermixed due to uneven organic matter distribution. At about 80 to 100 cm depth, a strongly cemented layer which is very to extremely firm, and yellowish-brown to grayish-brown in colour occurs. This layer is about 50 cm thick and grades gradually into unweathered, massive, grayish glacial till. Usually a zone of root concentration up to 10 cm thick is present immediately above the cemented layer. Soil reactions are extremely acid in the upper 50 cm and grade to very strongly or strongly acid in the lower subsoil. Soil classification is *Duric Ferro-Humic Podzol*.

Commonly Associated Soils: Sayres, Whonnock, Dennett, and Palisade soils are usually closely associated with Golden Ears soils. Whonnock soils are similar to Golden Ears soils except they are imperfectly drained. Sayres soils differ from Golden Ears by being underlain by bedrock within 100 cm of the surface, while Dennett soils differ by consisting of 10 cm or more of organic forest litter overlying bedrock. Palisade soils differ by being derived from colluvium and do not contain cemented subsoil layers.

Vegetation: The vegetation on Golden Ears soils is mostly Pacific silver fir, western hemlock and some yellow cedar, with western red cedar also present in the lower parts of the soils' elevation range. Rooting depth is mainly limited to about 100 cm by the cemented subsoils. Strong concentrations of roots (root mats) are often present on the surface of the cemented layers.

General Land Use Comments: (1) Steep slopes, stoniness and adverse climate (high elevations) make Golden Ears soils unsuitable for agriculture; most urban and related construction is also limited for the same reasons. (2) Forest growth is good. Limited plot data indicates wood production by Pacific silver fir and western hemlock at elevations below 900 m to be between 9 and 12 m^3/ha/yr. With increasing elevations above 900 m growth correspondingly decreases due to increasingly harsh climatic conditions.

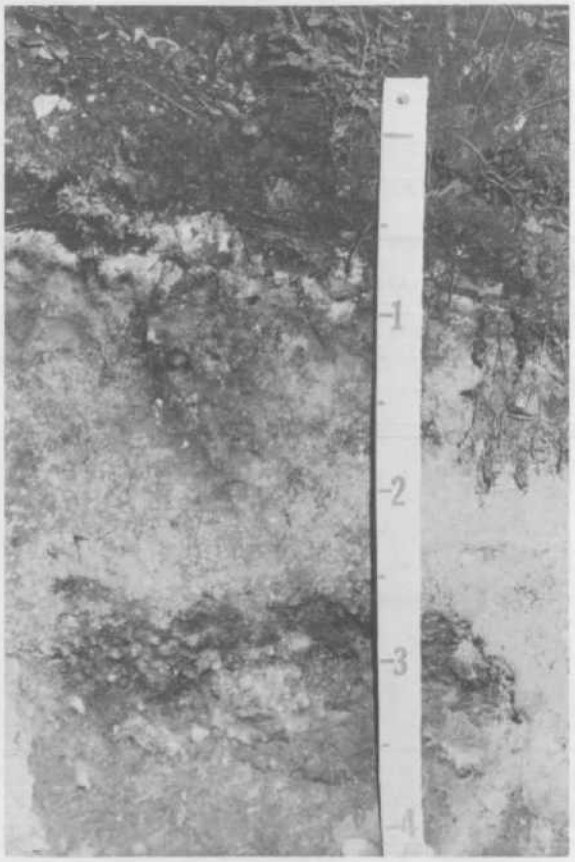


Plate 24 Golden Ears soil profile (Duric Ferro-Humic Podzol). These soils have developed from glacial till above elevations of 700m. Note the thick gray, leached horizon under about 8 in. (20 cm) of organic forest litter. The strongly cemented duric layer begins at about 2.5 ft. (75 cm).

Plate 25 Whonnock soil profile (Duric Ferro-Humic Podzol). These soils have developed from glacial till similar to that forming the parent material of Golden Ears soils. They, however, occur in imperfectly drained areas and this is reflected in the increased depth of organic forest litter. In the photo the organic material is about 2 ft. (60 cm) thick. The strongly cemented duric layer begins at about 3 ft. (90 cm).

GOUDY SOILS (GY)

Location and Extent: Goudy soils occur only in southeastern Delta Municipality and in the Serpentine-Nicomekl Valley of Surrey Municipality. There are about 210 ha of pure map units and 120 ha of soil complexes dominated by Goudy soils. The complexes are mainly with Embree and Vinod soils.

Topography and Elevation: Topographically, Goudy soils are depressional to gently undulating with slopes less than 2 percent. They all lie below 3 m above sea level.

Parent Material and Texture: Goudy soils have developed from well-decomposed organic deposits, 40 to 120 cm thick, which overlie medium to moderately-fine textured, mixed marine and freshwater deltaic deposits. The deposits are strongly saline within 50 cm of the surface and contain high amounts of sulphur compounds. The organic material is well-decomposed (humic) while the subsoil varies from silt loam to silty clay loam.

Soil Moisture Characteristics: Goudy soils are very poorly drained. They are moderately pervious and have slow surface runoff and high water holding capacity. The groundwater table is near or at the surface for a large part of the year, particularly during the winter. Runoff from adjacent, higher soils contributes to surface ponding during and after heavy rains.

General Soil Description: Goudy soils generally have a well-decomposed, cultivated, organic surface layer about 20 cm thick which is very dark gray to black in colour and is friable when moist but hard when dry. This is underlain by about 40 cm of black to reddish-brown, well to moderately decomposed organic material that is weakly stratified, firm when moist and hard when dry. Underlying this, in turn, is massive, olive-gray to gray, silty material often containing yellowish mottles. This layer also is strongly saline and high in sulphur compounds. The lower part of the overlying organic material is also commonly saline. Soil reactions are extremely acid throughout. Soil classification is *Terric Humisol:saline phase*.

Commonly Associated Soils: Vinod, Embree, Richmond, Sandel and Lulu soils often are closed associated with Goudy soils. Richmond and Lulu soils are organic and in that respect are similar to Goudy soils. However, they are usually non-saline. Lulu soils are also only partially decomposed. Vinod soils differ by having only 15 to 40 cm of organic material over a saline mineral underlay while Embree and Sandel soils are mineral to the surface.

Vegetation: Most areas of Goudy soils are cleared and cultivated. Small, remaining areas of "natural" vegetation consists mainly of species tolerant of high watertables and strong salinity. Rooting depth is mainly restricted to about 50 cm by the poorly drained and saline soil conditions.

General Land Use Comments: (1) Poor drainage and moderate to strong salinity limit Goudy soils to mainly forage and pasture use. Their suitability for other crops can be improved by artificial drainage which, together with irrigation, helps wash out the excess salts. (2) Low bearing strengths and high watertables as well as periodic flooding precludes use for most urban and related uses. Septic tank operation is poor and corrosion of buried, unprotected underground installations is likely. Management of Goudy soils as individual parcels is hindered by their small areas, scattered distribution and intimate association with other soils.

GREVELL SOILS (G)

Location and Extent: Grevell soils are found on the Fraser River floodplain east from its confluence with the Pitt River. They are mainly located near the river margins and on islands in the river. About 300 ha of pure units and 670 ha of soil complexes dominated by Grevell soils occur. The complexes are mainly with Seabird, Dewdney and Matsqui soils.

Topography and Elevation: The topography of Grevell soils is mainly gently undulating to gently rolling with slopes less than 8 percent. The soils generally occupy the tops and upper slopes of the ridges and undulations. Elevations range between 4 and 12 m above sea level.

Parent Material and Texture: Coarse-textured (sandy), stone-free Fraser River floodplain deposits form the parent material of Grevell soils. Surface textures are usually loamy sand, sometimes varying to sandy loam or sand while subsurface and subsoil textures are medium to coarse sand, sometimes changing to gravelly sand at depth. Thin, finer textured lenses occasionally occur in the subsoil as do thin, buried, old surface layers.

Soil Moisture Characteristics: Grevell soils are well to moderately well drained. They are rapidly pervious and have slow surface runoff and low water holding capacity. A very temporary watertable may develop in the subsoil during the freshet stage of the Fraser River and during this time, temporary flooding may also occur in areas that are not protected by dykes.

General Soil Description: In uncultivated areas, Grevell soils generally have a very thin organic surface layer (less than 2 cm thick) consisting mostly of deciduous leaves and twigs. This is underlain by a thin (less than 5 cm), discontinuous, grayish-brown, sandy layer slightly enriched with organic matter which grades to 1 m or more of loose, grayish sand sometimes containing a few, weak, reddish or brownish mottles in the lower part. Soil reactions are usually slightly acid or neutral in the upper part and neutral or mildly alkaline at depth (1:1 H_2O). Soil classification is *Orthic Regosol*.

Commonly Associated Soils: Matsqui, Seabird, Monroe, Dewdney and Fairfield soils commonly occur in close association with Grevell soils. Seabird soils have textures similar to Grevell soils, however they are imperfectly drained. Matsqui and Dewdney soils differ from Grevell soils by having between 20 and 50 cm of silty material overlying sand while Monroe and Fairfield soils have more than 50 cm of silty material over sand. Additionally, Dewdney and Fairfield soils are imperfectly drained.

Vegetation: In uncleared areas the vegetation on Grevell soils is mainly deciduous and includes black cottonwood, red alder, willow, vine maple as well as a variable shrub cover. Some coast Douglas-fir, western red cedar and occasional Sitka spruce may also be present. Rooting depth is essentially unrestricted.

General Land Use Comments: (1) Because of low water storage capacity, irrigation is required for satisfactory production of most crops. However with irrigation and adequate fertilization most crops can be grown productively. Flooding by the Fraser River during freshet periods in undyked areas will limit production in some years. (2) Where dyked, Grevell soils probably provide the best sites for farmsteads and similar construction on the Fraser River floodplain. They generally occur on the highest parts of the floodplain, are well drained and have moderate soil bearing strength. (3) Forest growth of cottonwood is good. Limited plot data indicates potential wood production by this species of 12 to 15 m^3/ha/yr.

GRIGG SOILS (GG)

Location and Extent: Grigg soils occur only on the lowlands of the eastern part of the map area, south of Chilliwack Mountain. There are 55 ha of pure map units and 110 ha of soil complexes dominated by Grigg soils. The complexes are mainly with Blackburn and Monroe soils.

Topography and Elevation: The topography of Grigg soils is undulating to gently rolling with slopes between 3 and 8 percent. They lie between 7 and 10 m above sea level.

Parent Material and Texture: Laterally and vertically accreted, moderately-fine textured, stone-free, Fraser River floodplain deposits form the parent material of Grigg soils. Surface and subsurface textures are usually silty clay loam, varying sometimes to silt loam. The clay accumulation layer in the lower subsurface and upper subsoil is mainly silty clay or clay. The lower subsoil is silty clay loam or silty clay, grading to medium or fine sand below depths of at least 1 m.

Soil Moisture Characteristics: Grigg soils are imperfectly to moderately poorly drained. They are moderately to slowly pervious and have high water holding capacity and moderate to slow surface runoff. Winter watertables are high but retreat to below 1 m during most growing seasons. Where Grigg soils occupy slightly depressional positions (in relation to adjacent soils), surface ponding commonly occurs during heavy rains.

General Soil Description: Grigg soils generally have a surface consisting of 15 to 20 cm of dark gray, firm when moist and hard when dry, silty, cultivated material. The surface is underlain by about 20 cm of gray to grayish-brown, leached, silty material which is blocky, hard when dry and contains some reddish and yellowish mottles. This grades to a clay accumulation zone about 40 cm thick composed of grayish, clayey material which has strong blocky structure and is hard when dry and sticky and plastic when wet. It contains many reddish and yellowish mottles and clay flows and skins are well expressed. The clay enriched layer then grades to massive, gray, silty material below about 80 cm and loose, medium or fine sand below 1 m or more. Soil reactions vary from strongly or very strongly acid in the upper layers to medium or slightly acid in the lower subsoil. Soil classification is ***Gleyed Gray Luvisol.*** In some moderately poorly drained, slightly depressional areas, the soil classification is Orthic Luvic Gleysol.

Commonly Associated Soils: Pelly, Blackburn, Arnold and Monroe soils commonly are closely associated with Grigg soils, either in soil complexes or adjacent map polygons. Pelly, Blackburn and Arnold soils all differ from Grigg soils by being somewhat more poorly drained. They also do not have a well defined, subsoil clay accumulation layer. Monroe soils occupy slightly higher landscape positions than do Grigg soils and are well drained.

Vegetation: All areas of Grigg soils have been cleared and are cultivated. Black cottonwood, willow and other deciduous trees are common along fences and field boundaries. Rooting depth is mainly restricted to the upper 60 cm by the well-developed clay accumulation layer and periodically high watertables.

General Land Use Comments: (1) Most areas of Grigg soils are used for forage production and pasture as well as corn and field peas. Underdrainage to control winter and spring watertables assists in maintaining consistently high yields, especially of perennial crops. Subsoiling to open the clayey subsoil improves water permeability and rooting depth. (2) Relatively low bearing strengths can potentially cause subsidence of heavy structures while basements and other excavations will probably contain water through part of the year. Efficient septic tank effluent disposal is impaired by slow subsoil permeability and periodically high watertables. (3) Grigg soils seem moderately suited for forest crops such as cottonwood. This species is estimated to potentially produce about 9 to 12 m^3/ha/yr of wood on Grigg soils.

GROUSE SOILS (GR)

Location and Extent: Grouse soils occupy small, scattered areas at the upper elevations in the mountainous, northern part of the map area. There are about 250 ha of soil complexes dominated by Grouse soils. Most complexes are with Hollyburn and Dennett soils and Rock Outcrop land type.

Topography and Elevation: The topography of Grouse soils is generally moderately rolling to hilly with slopes between 10 and 30 percent. The soils usually occupy slightly depressional locations or lower slope positions where seepage accumulates. Elevations are 1000 m or more above sea level.

Parent Material and Texture: Grouse soils have developed from moderately coarse and coarse-textured, stony colluvium, glacial till or mixed colluvium and till that is less than 1 m thick over bedrock. Between 15 and 30 cm of mostly well-decomposed organic material usually covers the mineral soil surface. The mineral soil is mainly gravelly sandy loam or sandy loam in texture sometimes varying to gravelly loamy sand.

Soil Moisture Characteristics: Grouse soils are imperfectly drained. They are rapidly pervious and have moderate water holding capacity and slow surface runoff. The soils often occur in areas where snow accumulates and remains into late spring or early summer. A fluctuating, perched watertable is usually present above the bedrock during heavy rains or snowmelt, or during runoff and seepage from adjacent, higher areas. It is also a zone of lateral, telluric seepage where the bedrock is relatively massive.

General Soil Description: Grouse soils generally have a dark reddish brown to black, matted, well-decomposed, organic surface, about 25 cm thick, and often containing some sandy windblown material derived from local sources. This grades to between 10 and 20 cm of black, friable, weakly structured, sandy soil usually containing 10 to 30 percent organic matter. Under this is a layer, about 5 cm thick, of gray to grayish-black, leached, friable, sandy material which, in turn, is underlain by about 20 cm of dark brown to dark reddish brown, weakly structured, friable, sandy to gravelly material containing variable amounts of yellowish or reddish mottles. Abruptly under this layer is bedrock, usually granitic. Soil reaction varies from extremely acid in the organic surface to strongly acid in the mineral soil above the bedrock. Soil classification is ***Gleyed Sombric Ferro-Humic Podzol:lithic phase***.

Commonly Associated Soils: Hollyburn, Dennett and Sayres soils and Rock Outcrop and Talus land types generally are closely associated with Grouse soils. Dennett soils differ from Grouse soils by consisting of 10 cm or more of coniferous organic material overlying bedrock. Both Hollyburn and Sayres soils are composed of materials similar in depth and texture to Grouse soils. They are, however, well rather than imperfectly drained and neither contains the dark coloured, organic matter enriched sandy layer below the organic surface.

Vegetation: Grouse soils occur in the lower alpine and subalpine parkland areas and the vegetation is typical of these zones. It includes, among others, scattered yellow cedar and mountain hemlock, various heathers, blueberries, sedges and grasses. Rooting is restricted to the depth of soil above bedrock (less than 1 m).

General Land Use Comments: (1) Harsh, high elevation climate, stoniness and adverse topography preclude use of Grouse soils for any sort of arable agriculture, although limited amounts of natural grazing are sometimes available. (2) Limitations similar to those for agriculture preclude most urban and related uses as well. (3) Forest growth is also poor, due mainly to the inclement climate. (4) Spectacular scenery makes Grouse and associated soils attractive for hiking and similar recreational uses. Trails and other construction should be carefully located to prevent damage to the relatively fragile, slow to recover, plant communities.

GUICHON SOILS (GU)

Location and Extent: Guichon soils occur only in south Delta Municipality, west of the Boundary Bay Airport. There are 370 ha of pure map units and 95 ha of soil complexes dominated by Guichon soils. The complexes mainly are with Spetifore and Ladner soils.

Topography and Elevation: Guichon soils are nearly level to very gently undulating with slopes less than 2 percent. They all lie less than 3 m above sea level.

Parent Material and Texture: Guichon soils have developed from medium to moderately fine textured deltaic deposits, 30 to 80 cm thick, which overlie moderately-coarse textured sediments. Surface and subsurface textures are silty clay loam or silt loam. The subsoil is loamy sand or sandy loam, frequently containing thin, silty lenses. The subsurface and subsoil are strongly saline and usually high in sulphur compounds.

Soil Moisture Characteristics: Guichon soils are poorly drained. They are moderately pervious and have slow surface runoff and moderate water holding capacity. The watertable is at or near the surface during the winter and surface ponding commonly occurs during heavy rain. The sandy subsoil is subject to salt-water seepage from nearby Boundary Bay.

General Soil Description: Guichon soils have a black or very dark gray, friable, silty, cultivated surface, about 20 cm thick, which becomes hard when dry. It is underlain by about 30 cm of strongly blocky or prismatic, gray or olive-gray, very firm, silty to clayey material which contains common to many, yellowish-red to yellowish-brown mottles and some clay films on ped surfaces. This is underlain or grades to olive-gray, massive, sandy material which contains a few, strong brown mottles. Ditch faces and other exposures frquently have precipitated salts below about 20 cm depth. Soil reactions are very strongly or strongly acid in the surface and subsurface and grade to slightly acid in subsoil. Soil classification is *Orthic Humic Gleysol:saline phase*.

Commonly Associated Soils: Ladner, Benson, Mathews and Spetifore soils are usually closely associated with Guichon soils. Ladner soils differ from Guichon by consisting of 1 m or more of silty to clayey soil before encountering the subsoil sands. They also have a well defined clay accumulation layer in the subsurface. Benson and Mathews soils differ by being dominantly sandy in texture; as well, Mathews soils are non-saline. Spetifore soils differ by consisting of deep, silty materials.

Vegetation: All Guichon soil areas are cleared and cultivated. Salt tolerant species tend to invade pastures and other perennial crops. Rooting is mostly restricted to the upper 50 cm by saline subsoil conditions and high watertables.

General Land Use Comments: (1) Guichon soils are mainly used for forage production although field crops such as oats and canning peas are also grown. Rooting depth and water penetration can be improved by subsoiling, especially coupled with underdrainage or other watertable control. Irrigation is required for good crop production during dry summers and also assists in leaching the soil of excess salts. (2) Generally low soil bearing strengths may cause subsidence problems if heavy structures are erected and excavations will usually contain water, especially during the winter. Unprotected buried utilities and similar installations are likely to suffer from severe corrosion. Septic tank effluent disposal is severely impaired by the high watertables.

HALLERT SOILS (HT)

Location and Extent: Hallert soils occur on the Fraser River floodplain, mainly in Matsqui and Glen Valleys and usually near the margins of organic soil areas. There are about 790 ha of pure map units and 140 ha of soil complexes dominated by Hallert soils. Most complexes are with Banford and Niven soils.

Topography and Elevation: The topography of Hallert soils varies from level to very gently sloping or gently undulating. Slope gradients are less than 2 percent and most areas lie between 3 and 7 m above sea level.

Parent Material and Texture: Hallert soils have developed from medium-textured, Fraser River floodplain deposits that contain organic lenses and strata. The surface texture is mainly silt loam and contains high amounts of organic matter. In some areas the organic matter content is sufficient for the surface to be organic (humic). The subsurface and subsoil consists of alternating layers of silt loam or silty clay loam and variably decomposed organic material.

Soil Moisture Characteristics: Hallert soils are poorly to very poorly drained. They are moderately pervious and have slow surface runoff and high water holding capacity. The watertables are near and sometimes at the soil surface for most of the winter and surface ponding is common during heavy rains.

General Soil Description: Hallert soils generally have a silty, cultivated surface layer about 20 cm thick which is grayish-brown to black, friable and contains between 15 and 25 percent organic matter. This is underlain by a zone 50 cm or more thick consisting of alternating bands of gray or brownish-gray, massive, silty material and dark brown to dusky red, variably decomposed organic material (mostly sedge, reed and grass remains). Sometimes the organic material is disseminated throughout rather than being in bands. At depth, gradation to massive, grayish silt or silt loam occurs. Soil reaction in the surface is extremely or very strongly acid and grades to moderately to strongly acid in the subsoil (1:1 HåO). Soil classification is Rego Humic Gleysol. In the scattered areas where the surface is organic, the classification is ***Rego Gleysol:peaty phase***.

Commonly Associated Soils: Banford, Niven and Gibson soils are frequently closely associated with Hallert soils. Banford and Gibson soils differ from Hallert soils by being organic in the upper 40 to 120 cm of soil while Niven soils consist of 20 to 50 cm of silty material overlying organic material 40 cm or more thick.

Vegetation: Most areas are cleared and cultivated. The vegetation on uncleared areas is mainly deciduous and includes willow, red alder, birch, blackberry, salmonberry, hardhack, sedges and grasses. Some western red cedar and western hemlock are also present. Rooting is mainly restricted to the upper 50 cm by high watertables.

General Land Use Comments: (1) Poor drainage is the main limitation for agriculture of Hallert soils. The main crops at present are forage and pasture and blueberries. With adequate watertable control a variety of vegetables and field crops are possible. (2) Hallert soils are generally unsuited as urban sites because of subsidence problems due to low soil bearing strengths. High watertables make basements and other excavations impractical and septic tank operation is severely impaired.

HAMMOND SOILS (HA)

Location and Extent: Hammond soils occur only on the Alouette River floodplain north of Haney, and in the vicinity of Coquitlam. About 180 ha of pure map units and 300 ha of soil complexes dominated by Hammond soils are classified. The complexes are with Alouette, Bonson and Sturgeon soils.

Topography and Elevation: Hammond soils are slightly depressional to gently undulating with slopes less than 2 percent. They lie between 2 and 6 m above sea level.

Parent Material and Texture: Hammond soils have developed from medium-textured, stone-free deposits of the Alouette and Coquitlam Rivers. These deposits, usually 1 m or more thick, overly sand. Surface, subsurface and subsoil textures are silt loam or loam, changing to sand or loamy sand below about 1 m.

Soil Moisture Characteristics: Hammond soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is near and sometimes at the surface for most of the winter and surface ponding is common after heavy rains. Periodic flooding from the Alouette River also occurs in some areas.

General Soil Description: Hammond soils generally have a cultivated surface layer about 20 cm thick, consisting of dark brown, dark yellowish-brown or black, friable, silty material containing 20 to 30 percent organic matter. This is underlain by about 80 cm of olive-gray, gray or olive, massive, silty material containing common, prominent, yellowish-red to strong brown mottles located mainly around old root channels. Below about 1 m, loose, gray or olive-gray sand occurs. Soil reaction varies from extremely acid in the upper part to very strongly acid in the subsoil. Soil classification is ***Rego Humic Gleysol***.

Commonly Associated Soils: Bonson, Alouette and Sturgeon soils are usually closely associated with Hammond soils. Bonson soils diffr from Hammond soils by occupying slightly higher landscape positions and being imperfectly drained. Alouette and Sturgeon soils both have organic surfaces in contrast to the silty surface of Hammond soils.

Vegetation: Most Hammond soil areas are cleared and cultivated. Uncleared areas support mainly deciduous vegetation including willow, black cottonwood, red alder, blackberry and other shrubs; scattered western red cedar, western hemlock and Sitka spruce also occur. Rooting is restricted mainly to the upper 50 cm of soil by the high watertables.

General Land Use Comments: (1) Most areas are presently used for forage and pasture production and for blueberries. Poor drainage is the main agricultural limitation. Its improvement will allow production of a much wider range of crops, including vegetables and field crops. Adequate fertilization is also required, including liming to improve the extremely acid surface conditions. (2) Urban or similar use is limited due to potential subsidence problems because of low soil bearing strengths; basements and other excavations will commonly contain water and septic tank operation is severely impaired by high watertables. (3) Hammond soils are moderately well suited for forest species such as cottonwood. Potential wood growth of this species is estimated to be from 9 to 12 m^3/ha/yr.

HANEY SOILS (HY)

Location and Extent: Haney soils are mainly located north of Haney in the vicinity of the Haney Correctional Institute and along the lower slopes of the Alouette Valley south of Alouette Lake. There are about 490 ha of pure map units and 1140 ha of soil complexes dominated by Haney soils. The complexes are with Judson and Nicholson soils.

Topography and Elevation: The topography of Haney soils varies from moderately or strongly rolling to very steeply sloping. Most slope gradients are between 10 and 30 percent, but some rise to 50 percent. Elevations range from 150 to 200 m above sea level.

Parent Material and Texture: Haney soils have developed from coarse-textured, stony to very stony, weakly stratified, kames, eskers and other glaciofluvial (mainly ice-contact) deposits that are kettled in some areas. Surface textures are loamy sand or gravelly loamy sand. The subsurface and subsoil are gravelly sand or sandy gravel. Coarse fragments (stones, cobbles, boulders and gravel) occupy between 50 and 80 percent of the soil volume. Moderate cementation is sometimes present below about 2 m.

Soil Moisture Characteristics: Haney soils are mostly well to rapidly drained; some moderately well drained areas on lower slopes and in slight depressions are also included. They are rapidly pervious and have low water holding capacity and slow surface runoff. On lower slopes and in shallow depressions intermittent lateral seepage occurs in the lower subsoil.

General Soil Description: Haney soils usually have from 8 to 15 cm of organic forest litter on the mineral soil surface. The upper part consists mainly of undecomposed needles, twigs, leaves and moss while the lower half is moderately to well-decomposed, dark reddish brown to black and matted. This is underlain by 1 to 5 cm of gray, leached, soft, sandy material. In turn, this is underlain by about 120 cm of loose, very stony gravelly sand or sandy gravel grading in colour from dark reddish brown in the upper part through strong brown to grayish-brown near the bottom. Below 120 cm is loose, very stony, unweathered gravelly sand or sandy gravel, sometimes containing moderately cemented patches and lenses. Soil reaction grades from extremely acid in the organic surface layers to medium acid below 75 cm. Soil classification is *Orthic Humo-Ferric Podzol.*

Commonly Associated Soils: Judson soils are organic and poorly drained and occupy some of the deeper depressions in the Haney soil areas while the silty Nicholson soils occur on the hummocks and ridges of glaciomarine materials that in some areas protrude through the glaciofluvial deposits.

Vegetation: The vegetation on Haney soils consists mostly of second-growth coast Douglas-fir, western hemlock and some western red cedar with red alder and vine maple; shrubs include salal, huckleberry and thimbleberry. Rooting depth is usually at least 100 cm although the coarse, stony textures limit root distribution.

General Land Use Comments: (1) Haney soils are limited in use for agriculture by stoniness, adverse topography and low water holding capacity. In less topographically severe areas, irrigation, stone-picking and adequate fertilization will probably lead to moderate forage and pasture production. (2) High bearing capacities and good drainage make Haney soils attractive for urban and similar sites. Adverse topography may be limiting in some areas and excavation of basements and underground utilities may be difficult due to high stone content. Septic tank effluent disposal is efficient although potential for groundwater contamination exists due to incomplete filtration by the coarse textures. Haney soils are also aggregate sources; several gravel pits are present. (3) Forest growth is moderate. Limited plot data indicates wood production by coast Douglas-fir is between 7 and 10 m^3/ha/yr.

HARRISON SOILS (HR)

Location and Extent: Harrison soils occupy scattered, lower elevation areas, mainly in the eastern part of the map area north of the Fraser River. There are about 610 ha of pure map units and 270 ha of soil complexes dominated by Harrison soils. The complexes are mainly with Isar and Shalish soils.

Topography and Elevation: The topography of Harrison soils is mostly moderately to steeply sloping although gently or very steeply sloping areas also occur. Slope gradients range from 5 to 30 percent and elevations vary between 20 and 175 m above sea level.

Parent Material and Texture: Harrison soils have developed from coarse to moderately coarse textured, usually stony, alluvial fan deposits, commonly with a shallow capping of silty, eolian material mixed into the surface. Surface textures are mainly gravelly sandy loam, gravelly loam or loam grading to gravelly sand or sandy gravel in the subsurface and subsoil.

Soil Moisture Characteristics: Harrison soils are generally well to rapidly drained, with small areas along some fan aprons being moderately well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff.

General Soil Description: Harrison soils generally have a thin (usually less than 5 cm), surface organic layer consisting of raw to well-decomposed forest litter. This is underlain by a discontinuous, grayish, leached, sandy layer less than 3 cm thick. In turn, this is abruptly underlain by about 20 cm of friable, loamy or sandy material which is dark brown to reddish-brown in colour and contains variable amounts of gravels and stones, and a few, fine, spherical concretions. This zone grades to unweathered, loose gravelly sand or gravel at about 40 cm. Soil reactions vary from very strongly acid in the upper part of the soil to moderately acid in the subsoil. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Isar, Elk and Shalish soils are often closely associated with Harrison soils. Isar soils differ from Harrison soils by having little soil development (are regosolic) while Elk soils differ by being poorly drained and having black surfaces. Shalish soils differ by having strongly cemented subsoil layers.

Vegetation: Small areas are cleared and cultivated. Uncleared areas support second-growth coast Douglas-fir, western red cedar, some western hemlock, red alder, bigleaf and vine maple and birch as well as huckleberry, thimbleberry, salal and bracken. Rooting is generally unrestricted except for moderate limitations imposed by coarse, stony subsoil textures.

General Land Use Comments: (1) Harrison soils have limited agricultural use because of droughtiness, stoniness and adverse topography. Irrigation and stone-picking improves their value for forage, pasture and other crops. (2) Urban and similar uses are moderately suited to these soils. The soils have high bearing strength and good drainage. Excessive stoniness in the subsoil may cause problems in excavating basements and underground utilities while adverse topography may be limiting in some areas. Efficient septic tank effluent disposal occurs although incomplete filtration by the coarse subsurface textures may lead to ground water contamination. Harrison soils are also potential sources of aggregate. (3) Forest growth is moderately good—about 9 to 12 m^3/ha/yr of wood production by coast Douglas-fir is indicated from limited plot data.

HATZIC SOILS (HZ)

Location and Extent: Hatzic soils are found only in the Hatzic Valley north of Hatzic Lake where 170 ha of pure map units and 20 ha of Hatzic-Sim soil complex are classified.

Topography and Elevation: Hatzic soils are level to very gently sloping or undulating with slopes less than 2 percent. They are usually slightly depressional in relation to adjacent soils and lie between 4 and 6 m above sea level.

Parent Material and Texture: The parent material of Hatzic soils are fine-textured, vertically accreted, stone-free Fraser River floodplain deposits. Surface textures are silty clay loam or silty clay; subsurfaces and subsoils are silty clay or clay.

Soil Moisture Characteristics: Hatzic soils are poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. The watertable is near, and sometimes at, the soil surface for most of the winter and during the freshet period of the Fraser River. Surface ponding commonly occurs during heavy rains.

General Soil Description: Hatzic soils have a very dark gray to gray, clayey, cultivated surface layer about 15 cm thick that is subangular blocky in structure and sticky and plastic when wet. It is underlain by about 10 cm of grayish-brown, partially leached, silty to clayey material that is blocky in structure, plastic when wet; hard when dry and contains common, strong brown mottles. This, in turn, is underlain by a clayey zone about 30 cm thick which is grayish-brown to dark gray, has well defined prismatic structure, is very plastic when wet and contains common, strong brown to yellowish-red mottles. Clay flows and skins are common on the ped surfaces. This zone grades to gray, massive, plastic, unweathered parent material containing some yellowish or reddish mottles. Soil reaction is mainly very strongly acid in the upper soil and grades to medium or strongly acid in the subsoil. Soil classification is *Orthic Luvic Gleysol*.

Commonly Associated Soils: Sim soils sometimes occur in soil complexes with Hatzic soils. They differ from Hatzic soils by having black surfaces and silty rather than clayey textures.

Vegetation: Essentially all areas of Hatzic soils have been cleared and are cultivated. The few, small, remaining, uncleared areas support willow, black cottonwood and some western red cedar as well as hardhack, sedges, reeds and grass. Rooting is mainly limited to the upper 40 to 50 cm by the dense, clayey subsoil and high watertables.

General Land Use Comments: (1) Hatzic soils, at present, are mainly used for forage production or pasture. They are severely limited by excess moisture but can be improved by artificial drainage which widens the range of suited crops. The slow permeability, however, requires that tile lines be closely spaced. The heavy textures necessitate high power requirements for cultivation and also provide conditions that easily lead to puddling and compaction. (2) Housing or similar construction is generally unsuitable on Hatzic soils. Soil bearing strengths are relatively low and shrink-swell potentials are high. Basements and other excavations will usually contain water and septic tank effluent disposal is severely impaired by the low soil permeability and high watertables.

HAZELWOOD SOILS (HD)

Location and Extent: Hazelwood soils occupy scattered areas on the Fraser River floodplain, mostly in Matsqui Valley. There are about 490 ha of pure map units and 230 ha of soil complexes dominated by Hazelwood soils. The complexes are mainly with Beharrel, Sim and Annis soils.

Topography and Elevation: Hazelwood soils vary in topography from level to undulating. Slope gradients are less than 3 percent and elevations lie between 3 and 7 m above sea level.

Parent Material and Texture: Moderately fine to fine-textured, vertically accreted, stone-free, Fraser River floodplain deposits, 1 m or more thick overlying sand, are the parent material of Hazelwood soils. Surface and subsurface textures are mainly silty clay, sometimes varying to silty clay loam or clay while the subsoil textures are usually silty clay loam or silt loam. Loamy sand or sand occurs below depths of 100 cm or more.

Soil Moisture Characteristics: Hazelwood soils are poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. The watertable is near and sometimes at the surface for most of the winter but retreats to about 1 m depth during the latter part of most summers. Surface ponding commonly occurs during periods of heavy rain.

General Soil Description: Hazelwood soils have a black or very dark gray, friable, cultivated, clayey surface layer that is about 20 cm thick and contains between 20 and 30 percent organic matter. It is underlain by a gray to dark gray, clayey layer, about 40 cm thick, which has moderate prismatic structure, is very firm when moist and contains many to common, reddish mottles. This layer then grades through massive, gray, silty material containing a few yellowish mottles to loose sand below 100 cm depth. Soil reaction generally grades from very strongly or strongly acid in the upper soil to medium acid below about 50 cm depth (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Beharrel, Annis and Hallert soils often occur closely associated with Hazelwood soils, either in soil complexes or adjacent map polygons. Beharrel soils differ from Hazelwood soils by being somewhat less poorly drained and contain less organic matter in the surface layer. They also have a well-defined clay accumulation layer in the subsurface which Hazelwood soils do not have. Annis soil differ by having an organic surface layer and Hallert soils differ by consisting of alternating organic and silty lenses to depths of 1 m or more.

Vegetation: Essentially all areas of Hazelwood soils are cleared and cultivated. A few, scattered remnants of native vegetation include black cottonwood, willow, vine maple, red alder, scattered western red cedar, salmonberry and blackberry. Rooting is mainly restricted to the upper 50 cm by the high watertables and the dense, clayey soil conditions.

General Land Use Comments: (1) Hazelwood soils are presently used mainly for forage and pasture, although some silage corn and other field crops are also grown. The main agricultural limitation is poor drainage. Artificial water control will increase productivity (and range of crops possible) by promoting improved aeration and rooting depth. Tile lines will require relatively close spacing because of low soil permeability. (2) Urban and similar uses are not suited to Hazelwood soils. Relatively low bearing strengths and high shrink-swell characteristics may lead to potential foundation instability; basements and other excavations will often contain water and septic tank effluent disposal is severely impaired by high watertables and slow soil permeability. (3) Hazelwood soils appear moderately suited for the growth of forest crops such as cottonwood. Estimated potential annual wood production by this species is 9 to 12 m^3/ha/yr.

HENDERSON SOILS (H)

Location and Extent: Henderson soils occur only in the eastern part of the map area in the vicinity of Greendale. There are about 190 ha of pure map units and 40 ha of Henderson-Arnold soil complex.

Topography and Elevation: The topography of Henderson soils varies from gently undulating to undulating with slopes between 1 and 5 percent. The soils range from 5 to 8 m above sea level.

Parent Material and Texture: Moderately fine textured, stone-free, Fraser River floodplain deposits form the parent material of Henderson soils. Surface and subsurface textures are usually silty clay loam, varying sometimes to silt loam while subsoil textures are mostly silty clay in the upper part and grade to silt loam and sometimes sand below 1 m.

Soil Moisture Characteristics: Henderson soils are mostly imperfectly drained with variation to moderately poorly drained in some shallow depressions. They are moderately to slowly pervious and have high water holding capacity and moderate to slow surface runoff. A fluctuating watertable is present which is usually high during the winter, during the freshet period of the Fraser River and after heavy, prolonged rains.

General Soil Description: Henderson soils have a deep (50 to 80 cm thick), organic matter enriched, very dark brown to dark grayish brown layer at the soil surface, the upper 20 cm of which is cultivated and friable to firm when moist. Underlying the cultivated layer is a zone about 30 cm thick which is firm when moist, hard when dry and grades into a very firm to hard, clay enriched layer about 20 cm thick that has strong prismatic structure. Underlying this is another clay enriched layer that is grayish-brown to gray, strongly prismatic, very firm and contains many strong brown to reddish-brown mottles. These latter two layers contain clay flows and skins on ped faces and in pores. Occuring below about 100 cm is massive, olive-gray, silt loam that grades, in some areas, to loose sand at depth. Soil reaction grades from strongly or medium acid in the upper part to slightly acid below 100 cm (1:1 H_2O). Soil classification is Gleyed Gray Brown Luvisol. In a few areas where the clay enriched layers are less well developed, the classification is ***Gleyed Eluviated Melanic Brunisol***.

Commonly Associated Soils: Blackburn, Arnold, Bates and Fadden soils often occur in close association with Henderson soils. All differ from Henderson soils by either not having the deep, organic matter enriched, dark coloured surface layer or have a layer which is much thinner. Blackburn and Arnold soils also lie at slightly lower landscape positions and are more poorly drained.

Vegetation: Henderson soils are essentially all cleared and cultivated. The few, small, remaining areas of native vegetation include black cottonwood, western red cedar, willow, various deciduous shrubs, sedges and grass. Rooting extends to at least 100 cm although it is somewhat restricted below 60 cm by the clay enriched layers.

General Land Use Comments: (1) Henderson soils are good agricultural soils presently used mainly for hay and pasture. They are also well suited to most other crops (except those very sensitive to occasional high watertables). (2) Urban and similar construction may be potentially affected by the relatively low soil bearing strengths and water may occur in basements and other excavations during periods when watertables are high. Septic tank effluent disposal is also restricted during these periods.

HERON SOILS (HN)

Location and Extent: Heron soils occupy scattered areas on the uplands, mainly in the western part of the map area. There are about 410 ha of pure map units and 1540 ha of soil complexes dominated by Heron soils. The soil complexes are mostly with Scat, Sunshine, Summer, Boosey and Cloverdale soils.

Topography and Elevation: The topography of Heron soils varies from depressional to gently undulating or undulating with slopes less than 5 percent. When in complexes with better drained soils, Heron soils usually occupy slightly depressional locations. Elevations range between 20 and 100 m above sea level.

Parent Material and Texture: Heron soils have developed from coarse-textured (sandy) littoral or glaciofluvial deposits which overlie fine textured marine or moderately fine-textured glaciomarine deposits. Occasionally the underlay is glacial till. The depth of the sandy overlay varies from about 50 cm to 2 m but usually is 80 to 150 cm. Surface textures are sandy loam or fine sandy loam with some variation to loamy sand or loam while subsurfaces are usually loamy sand or sand. The underlays range from silty clay loam to clay in texture.

Soil Moisture Characteristics: Heron soils are poorly drained. They are rapidly pervious in the sandy material but this changes to slowly pervious in the clayey underlay. They have moderate to low water holding capacity and slow surface runoff. A perched watertable exists above the compact, dense underlay which is fed by rainfall and runoff and seepage from adjacent, higher ground. Surface ponding sometimes occurs during periods of high rainfall.

General Soil Description: Heron soils usually have 5 to 10 cm of raw to well-decomposed forest litter on the soil surface. This is underlain by 10 to 15 cm of very dark brown to black, friable, sandy mineral soil. Under this is about 80 cm of grayish, loose sand which contains common to many, yellowish-brown to yellowish-red mottles and scattered, weakly-cemented patches. Under the sand, at about 100 cm depth, is gray, massive, dense, clayey material containing some reddish or yellowish mottles. Soil reaction ranges from extremely or very strongly acid near the surface to medium or strongly acid in the subsoil (1:1 H_2O). Soil classification is *Rego Humic Gleysol*.

Commonly Associated Soils: Sunshine, Summer, Boosey, Scat and Cloverdale soils usually occur in close association with Heron soils. Sunshine and Summer soils differ from Heron soils by being, respectively, well and imperfectly drained. Boosey, Scat and Cloverdale soils, although poorly drained, differ texturally from Heron soils. Boosey soils are gravelly in the upper part while Scat and Cloverdale soils are clayey.

Vegetation: Scattered areas of Heron soils are cleared and cultivated. On uncleared areas a second-growth forest usually occurs, including western red cedar, western hemlock, red alder, willow and black cottonwood. Rooting depth is mainly restricted to 50 to 75 cm by the high watertables and dense subsoil.

General Land Use Comments: (1) Agriculturally, Heron soils are presently used mainly for pasture and hay. They are limited by poor drainage and relatively low fertility as well as by droughty conditions during the latter parts of dry growing seasons. However, with adequate watertable control, and fertilization and irrigation as required, a variety of crops can be satisfactorily produced. (2) Heron soils are limited for urban and similar uses by high watertables. Basements and other excavations will usually contain water during parts of the year. Septic tank effluent disposal is impaired by the high watertables and slow permeability in the lower subsoil. Effluent will tend to flow laterally above the dense subsoil and perhaps collect and surface in depressions. (3) Heron soils are moderately suited for western red cedar and estimated potential wood production by this species is 6 to 8 m^3/ha/yr.

HJORTH SOILS (HJ)

Location and Extent: Hjorth soils occupy scattered locations on the Fraser River floodplain, mainly in the vicinity of Dewdney. There are about 220 ha of pure map units and 280 ha of soil complexes dominated by Hjorth soils. The complexes are mostly with Fairfield, Page and Annis soils.

Topography and Elevation: Topographically, Hjorth soils vary from nearly level to gently undulating or undulating with slope gradients less than 5 percent. They are usually slightly depressional in relation to associated, better drained soils and lie at elevations between 3 and 10 m above sea level.

Parent Material and Texture: Hjorth soils have developed from medium-textured, stone-free, laterally accreted Fraser River floodplain deposits that usually are at least 50 cm deep and overlie sand at depth. In a few areas the silty overlay is between 20 and 50 cm thick. Surface, subsurface and subsoil textures are usually silt loam with some variation to silty clay loam. The coarse-textured underlay is usually sand or loamy sand.

Soil Moisture Characteristics: Hjorth soils are poorly to moderately poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. Watertables are near and sometimes at the surface during most of the winter and during the freshet stage of the Fraser River. Surface ponding is common during heavy rain and areas outside the dykes commonly flood during the freshet season.

General Soil Description: Hjorth soils have a dark grayish brown to dark brown, silty, cultivated surface layer about 20 cm thick which is friable to firm when moist. It is underlain by about 20 cm of grayish-brown to gray, firm, blocky, silty material containing yellowish-red mottles. This, in turn, is underlain by about 50 cm of gray or olive-gray, massive, silty material containing common, yellowish-brown or yellowish-red mottles. This zone then grades to olive-gray, loose, prominantly mottled sand below about 100 cm. Soil reaction varies from strongly to medium acid throughout. Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Fairfield, Page, and Annis soils are often closely associated with Hjorth soils, either in soil complexes or adjacent map polygons. Page soils differ from Hjorth soils by lacking the well defined, organic matter enriched, dark coloured surface. Annis soils are more clayey in texture than Hjorth soils and have an organic surface layer. Fairfield soils differ from Hjorth soils by being imperfectly drained; they also lie at slightly higher landscape positions. Hjorth: shallow variant soils are mapped in a few areas. These are similar to the described Hjorth soils except that the underlying sand occurs between 20 and 50 cm depth rather than below 50 cm as is the usual case.

Vegetation: Most Hjorth soil areas are cleared and cultivated. The few, remaining, uncleared areas support, among others, black cottonwood, red alder, willow and western red cedar. Rooting depth is generally restricted to between 50 and 75 cm by the high watertables.

General Land Use Comments: (1) High watertables during the winter and parts of the growing season are the main agricultural limitation of Hjorth soils. These relatively fertile soils, presently mainly used for pasture, hay and some cereal grain, can be quite productive for a variety of crops if watertables are controlled. (2) Hjorth soils are generally unsuited for urban or similar uses. Low soil bearing strengths can cause subsidence problems if heavy structures are erected. Basements and other excavations will be below the watertable for parts of the year and septic tank effluent disposal is severely impaired by high watertables. (3) Hjorth soils appear well suited for black cottonwood and potential annual wood production by this species is estimated to be about 12 to 15 m^3/ha.

HOLLYBURN SOILS (HB)

Location and Extent: Hollyburn soils are relatively common at the higher elevations of the mountainous, northern part of the map area. About 620 ha of pure map units and 8760 ha of soil complexes dominated by Hollyburn soils are mapped. The complexes are mainly with Dennett, Sayres and Grouse soils and Rock Outcrop land type.

Topography and Elevation: The topography of Hollyburn soils is mostly moderately rolling to hilly with slope gradients between 10 and 50 percent. Elevations are generally 1000 m or more above sea level.

Parent Material and Texture: Hollyburn soils have developed from moderately coarse to coarse-textured, stony deposits of colluvium, glacial till or mixed colluvium and till which are less than 1 m deep and overlie bedrock. There is usually 5 to 10 cm of variably decomposed organic material on the mineral soil surface. The textures of the mineral soil are mainly gravelly sandy loam or sandy loam, with some variation to gravelly loamy sand.

Soil Moisture Characteristics: Hollyburn soils are well to moderately well drained. They are rapidly pervious and have low water holding capacity and moderate to slow surface runoff. Lateral seepage along the underlying bedrock surface is usual during heavy rains and snowmelt, especially where the bedrock is relatively massive.

General Soil Description: Hollyburn soils generally have 5 to 10 cm of variably decomposed organic material on the mineral soil surface. This is underlain by up to 5 cm of discontinuous, leached, gray, friable, sandy material which, in turn, is underlain by about 30 cm of sandy material which is weakly structured, friable and ranges in colour from reddish-brown or yellowish-brown near the top to brown or dark brown near the bottom. This zone either directly overlies bedrock or is separated from the bedrock by a sandy zone that is olive-gray to gray, massive and friable. Soil reaction grades from extremely acid in the surface to strongly acid above the underlying bedrock. Soil classification is mainly ***Orthic Humo-Ferric Podzol:lithic phase*** with some inclusions of Orthic Ferro-Humic Podzol:lithic phase and Sombric Humo-Ferric Podzol:lithic phase where organic matter enrichment of the surface and subsurface mineral soil layers is higher than usual.

Commonly Associated Soils: Grouse, Dennett and Sayres soils and Rock Outcrop land type generally are closely associated with Hollyburn soils. Grouse soils differ from Hollyburn soils by being imperfectly drained and having a well defined, organic matter enriched, dark coloured, surface mineral soil layer. Dennett soils differ by consisting of 10 cm or more of organic material over bedrock while Sayres soils differ by having well-developed organic matter accumulation layers in the subsurface. The Rock Outcrop land type differs by consisting either of less than 10 cm of soil material (organic or mineral) over bedrock or has rock exposed at the land surface.

Vegetation: Hollyburn soils occur in the subalpine parkland and in lower alpine areas. The vegetation is typical of this zone and includes, among others, scattered, usually stunted, yellow cedar, mountain hemlock and Pacific silver fir as well as various heathers, blueberries, sedges and mosses. Rooting is restricted to the depth of soil above bedrock (less than 1 m).

General Land Use Comments: (1) High elevations, harsh climate, adverse topography, and shallowness to bedrock preclude agricultural uses of Hollyburn soils. Similar limitations also prevent urban and related uses. (2) Forest growth is poor, mainly due to the inclement climate. (3) Spectacular scenery makes hiking and similar recreational uses attractive. Trails and other construction should be carefully located to prevent damage to the relatively fragile, slow to recover plant communities.

HOOVER SOILS (HV)

Location and Extent: Hoover soils occur on the lower mountain slopes, mainly north of Mission. About 75 ha of pure map units and 1220 ha of several soil complexes dominated by Hoover soils are mapped. The complexes are mainly with Cannell, Kenworthy and Buntzen soils and Rock Outcrop land type.

Topography and Elevation: The topography of Hoover soils is mostly steeply to very steeply sloping or strongly rolling to hilly with slope gradients between 15 and 60 percent. Some extremely sloping areas also occur with slopes in access of 60 percent. Hoover soils generally lie between 200 and 600 m above sea level.

Parent Material and Texture: Hoover soils have developed from moderately coarse to coarse-textured, stony colluvial deposits, usually 1 m or more thick. These usually overlie bedrock, or sometimes, glacial till. At the lower elevations, small amounts of silty, eolian material is mixed into the surface. Surface, subsurface and subsoil textures are usually sandy loam or gravelly sandy loam. Lenses of gravelly loamy sand or loam sometimes also occur.

Soil Moisture Characteristics: Hoover soils are moderately well to well drained. They are rapidly pervious in the colluvial material but this changes to slow in the underlying glacial till. They have moderate to low waterholding capacity and generally slow surface runoff. Lateral, telluric seepage above the glacial till or bedrock during and after periods of heavy rain or snowmelt is usual.

General Soil Description: Hoover soils usually have 5 to 10 cm of raw to well-decomposed coniferous forest litter and moss on the mineral soil surface. This is underlain by about 4 to 8 cm of grayish, leached, very friable, sandy material, which, in turn, is abruptly underlain by about 30 cm of dark brown or dark reddish brown, friable, sandy material containing substantial amounts of angular gravel and stones. Below this is about 10 to 20 cm of similarly textured material which is friable, yellowish-brown in colour and commonly contains a few reddish or brownish mottles in the lower part. The soil then grades to about 40 cm of dark gray or olive-gray, friable, unweathered colluvium containing a thin, well defined root mat immediately above the underlying glacial till or bedrock. The underlying till (if present) is hard, dense, olive-gray in colour and usually less than 50 cm thick over bedrock. The upper soil reaction is extremely or very strongly acid and grades to strongly or medium acid in the lower subsoil. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Cannell, Eunice and Buntzen soils and Rock Outcrop land type usually occur in close association with Hoover soils. Cannell soils differ from Hoover soils by consisting of between 10 and 100 cm of soil over bedrock while Eunice soils differ by having 10 cm or more of organic material over bedrock. Buntzen soils have developed from glacial till and have strongly cemented layers in the subsurface and subsoil.

Vegetation: The vegetation of Hoover soils consists mostly of second-growth forest, dominantly coast Douglas-fir, western hemlock and western red cedar. Rooting is generally unrestricted in the colluvial material but is severely restricted below about 1 m depth by the underlying compact glacial till or bedrock.

General Land Use Comments: (1) Hoover soils are unsuited for agriculture due to very steep slopes and stoniness. (2) Hoover soils are also unsuited for urban development due to steep to very steep slopes and shallowness to bedrock. (3) A limited number of plot measurements indicate Hoover soils are moderately suited for forest growth. Measured growth of coast Douglas-fir ranges from about 6.5 to 8 m^3/ha/yr.

HOPEDALE SOILS (HP)

Location and Extent: Hopedale soils occupy scattered locations on the lowlands of the map area, mainly in the eastern half. The largest areas are in Glen and Hatzic Valleys and east of Vedder Canal. There are about 250 ha of pure map units and 530 ha of soil complexes dominated by Hopedale soils. Most complexes are with McElvee, Isar and Sardis soils.

Topography and Elevation: Gently undulating to undulating or gently sloping with slope gradients between 2 and 5 percent is the usual topography of Hopedale soils. They occupy slightly depressional locations when associated with better drained soils and lie between 4 and 10 m above sea level.

Parent Material and Texture: Hopedale soils have developed from medium-textured, stone-free, local stream deposits and some fan deposits. The deposits are between 20 and 50 cm thick and lie over coarse-textured sediments. Surface and subsurface textures are mostly silt loam, sometimes varying to loam, while subsoils are sand or loamy sand, occasionally gravelly and containing loamy lenses.

Soil Moisture Characteristics: Hopedale soils are poorly drained. They are moderately to rapidly pervious and have moderate water holding capacity and slow surface runoff. High watertables are usual for most of the winter and after heavy rains; seepage from adjacent streams is common also.

General Soil Description: Hopedale soils have a grayish-brown, friable, silty, cultivated surface layer between 15 and 20 cm thick. This is underlain by about 25 cm of olive-gray or grayish-brown, friable to firm, massive to medium blocky, silty material containing common to many, yellowish-red to strong brown mottles. This is either abruptly underlain or grades to gray or dark gray sandy deposits that are variably mottled and sometimes contain thin, silty lenses. Soil reaction is usually medium acid throughout (1:1 H_2O). Soil classification is mainly ***Rego Gleysol;*** some Orthic Gleysol also occurs where the subsurface layer is moderately structured.

Commonly Associated Soils: McElvee, Sardis, Isar and Bates soils are usually closely associated with Hopedale soils. Sardis and Isar soils differ from Hopedale soils by being better drained and having sandy and gravelly textures throughout. McElvee soils are similar to Hopedale except that the silty capping over sand is more than 50 cm thick. Bates soils differ by being imperfectly drained and also have 50 cm or more of silty material over sand.

Vegetation: Most areas of Hopedale soils are cleared and cultivated. Uncleared areas support, among others, black cottonwood, western red cedar, red alder, willow, vine and bigleaf maple, salmonberry, thimbleberry, sedges, grass. Rooting is mainly limited to the upper 75 cm by high watertables.

General Land Use Comments: (1) Hopedale soils are used mainly for hay, pasture and some corn, peas and other field crops. Poor drainage during the winter and early part of the growing season and somewhat droughty conditions during the latter part of the summer are the main agricultural limitations. Watertable control and irrigation make these soils capable of producing a wide range of crops. (2) High watertables and moderate bearing capacities limit Hopedale soils for urban and related uses. Excavations such as basements will probably contain water during parts of the year and efficient functioning of septic tanks is impaired by the high watertables. Potential groundwater contamination may occur if numerous septic tanks are installed, due to incomplete filtration by the coarse textured subsoils. (3) Hopedale soils are well suited for black cottonwood and potential annual wood production by this species is estimated to be between 12 and 15 m^3/ha.

ISAR SOILS (IS)

Location and Extent: Isar soils are scattered throughout the map area and usually occur near where rapidly flowing mountain streams issue into larger valleys. About 1140 ha of pure map units and 1240 ha of soil complexes dominated by Isar soils are mapped. The complexes are mainly with Chehalis, Elk, Harrison and Shalish soils.

Topography and Elevation: Isar soils vary from gently to steeply sloping with slope gradients between 5 and 30 percent. The steeper slopes usually occur near the fan apexes. Elevations range between 10 and 100 m above sea level.

Parent Material and Texture: Coarse-textured, moderately to very stony alluvial fan deposits form the parent material of Isar soils. Surface textures vary from loamy sand to gravelly loamy sand while subsurface and subsoil textures range from gravelly sand to gravel. Stoniness varies from moderately stony on the fan aprons to excessively stony near the fan apexes—usually 50 percent or more of the soil volume consists of stones, cobbles and boulders.

Soil Moisture Characteristics: Isar soils are rapidly to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. They have variable amounts of telluric seepage at depth and some areas are susceptible to flooding during heavy rains by overflow from adjacent streams.

General Soil Description: Isar soils have 5 to 10 cm of mixed, deciduous and coniferous forest litter on the soil surface, the lower half of which is usually black and well-decomposed. Underlying this may be less than 10 cm of grayish-brown, very friable, sandy material slightly enriched with organic matter. The usual underlay, however, is 1 m or more of loose, variably coloured, gravel or gravelly sand containing numerous stones, cobbles and boulders. Soil reactions are very strongly to extremely acid throughout. Soil classification is *Orthic Regosol*.

Commonly Associated Soils: Harrison, Shalish, Elk and Chehalis soils usually occur closely associated with Isar soils. Harrison and Shalish soils differ from Isar soils by having podzolic soil development and the upper soil layers are reddish to brownish in colour. Additionally, Shalish soils are strongly cemented in the subsurface and subsoil. Elk soils differ by being poorly drained and having dark coloured surfaces enriched with organic matter. Chehalis soils differ by having weak soil development intermediate between Isar and Harrison soils.

Vegetation: Some areas are roughly cleared and used for pasture. Uncleared areas support a variable forest, including coast Douglas-fir, red alder, willow, vine and bigleaf maple, dogwood, western hemlock, western red cedar, salmonberry, salal and huckleberry. Other than restrictions imposed by the coarse, stony textures, rooting depth is unimpaired.

General Land Use Comments: (1) Isar soils are mostly poorly suited for agricultural use due to low moisture holding capacities and high stone contents. Some areas can be improved by stone-picking and irrigation for pasture and hay production. Speciality crops such as Christmas trees may also be suited. (2) Urban and similar uses are moderately to poorly suited for Isar soils. Basements and other excavations may be difficult to construct due to high stone content. Septic tank effluent disposal is efficient although incomplete filtration by the coarse textures may lead to ground water contamination. Potential flooding may also severely limit some areas. Isar soils are potential aggregate sources although screening to remove the numerous stones will probably be required. (3) Forest growth is moderately good. Limited plot data indicates that potential wood production by coast Douglas-fir and western hemlock is usually between 9 and 12 m^3/ha/yr.

JUDSON SOILS (JN)

Location and Extent: Judson soils occupy scattered locations throughout the uplands of the map area. There are about 910 ha of pure map units and 560 ha of soil complexes dominated by Judson soils. The complexes are mainly with Heron, Scat, Calkins and Ross soils.

Topography and Elevation: Topographically, Judson soils range from slightly depressional to level or gently undulating with slopes less than 2 percent. They mostly lie at elevations between 15 and 100 m above sea level.

Parent Material and Texture: Judson soils have developed from 40 to 160 cm of mostly well-decomposed organic material overlying either glaciomarine or glacial till deposits. The organic material is usually well-decomposed (humic), containing, sometimes, partly-decomposed strata. The mineral subsoil textures vary from silty clay loam or silty clay in glaciomarine areas to sandy loam or loam where the underlay is glacial till.

Soil Moisture Characteristics: Judson soils are very poorly to poorly drained. They are moderately pervious in the organic material but this decreases to slowly pervious in the compact mineral underlay. Water holding capacity is very high and surface runoff is slow. Judson soils are accumulation areas for seepage and runoff from adjacent, higher soils and they have a more or less permanent, perched watertable. They are also susceptible to flooding during periods of heavy rainfall.

General Soil Description: Judson soils generally have about 5 cm of undecomposed forest litter on the soil surface. This is underlain by between 50 and 120 cm of mainly black to reddish-brown, friable, weakly stratified, well-decomposed organic material, sometimes containing partially-decomposed strata and old tree roots. Underlying this is massive, compact, gray to olive-gray, glaciomarine or glacial till material. Soil reaction is generally extremely to very strongly acid throughout. Soil classification is usually ***Terric Humisol*** with a few inclusions of Terric Mesisol where the organic material is only partly-decomposed (mesic) rather than well-decomposed.

Commonly Associated Soils: Scat, Glen Valley, Heron, Calkins and Ross soils often are closely associated with Judson soils. Scat, Heron, Calkins and Ross soils all differ from Judson soils by being mineral in texture, rather than organic. All are poorly drained, however. Glen Valley soils differ by consisting of deep, mostly undecomposed organic material mainly of sedge, reed and grass origin.

Vegetation: Some Judson soil areas are cleared and used mostly for pasture and forage. Uncleared areas support, among others, western red cedar, western hemlock, willow, red alder, bog birch, lodgepole pine, hardhack, Labrador tea, sedges and various mosses. Rooting depth is restricted to the upper 50 to 75 cm by the high watertables.

General Land Use Comments: (1) Agriculturally, Judson soils are mainly limited by poor drainage, particularily during the winter and early parts of the growing season. Adequate watertable control will allow a relatively wide range of crops to be grown. Adequate outlets for artificial drainage are sometimes difficult to locate due to the often depressional nature of Judson soils. Overdraining can cause rapid subsidence of the organic material; the best watertable control is one which allows progressive lowering of the watertable as required by the crop. (2) Urban and similar uses are unsuited for Judson soils. Low soil bearing strengths and high watertables preclude most construction. Excavations generally contain water and septic tank operation is severely impeded.

KATZIE SOILS (KZ)

Location and Extent: Katzie soils occur only in the vicinity of Fort Langley and in the southern part of Pitt Meadows Municipality. About 170 ha of pure map units and 250 ha of complexes dominated by Katzie soils are mapped. The complexes are mainly with Fairfield and Pitt soils.

Topography and Elevation: Katzie soils are gently to moderately undulating with slopes between 2 and 8 percent. They usually occupy the lower slopes and shallow depressions when associated with better drained soils and the upper slopes and ridge tops when intermingled with poorer drained soils. All areas lie less than 6 m above sea level.

Parent Material and Texture: The parent material of Katzie soils are fine to moderately fine textured Fraser River floodplain deposits. Surface textures are mostly silty clay loam while subsurface and subsoils are dominantly silty clay. Sandy materials sometimes occur at depths below 1 m or more.

Soil Moisture Characteristics: Katzie soils are moderately poorly drained. They are moderately to slowly pervious and have high water holding capacity and moderate to slow surface runoff. Groundwater tables are usually high during the winter and freshet period of the Fraser River but retreat to depths of 1 m or more over the drier, summer period.

General Soil Description: The surface layer of Katzie soils usually consists of 20 to 40 cm of very dark gray to black, silty to clayey, organic enriched material which is blocky to granular in structure and friable to firm when moist. The upper 20 cm are usually cultivated. Underlying the organic matter enriched surface layer is about 30 cm of grayish-brown, clayey material which is coarsely vertically cracked and contains common to many, strong brown to reddish mottles. This, in turn, is underlain by at least 50 cm of massive, gray to olive-gray, clayey material which contains common, strong brown to yellow red mottles. Soil reactions vary from moderately or strongly acid in the upper part to slightly acid at about 1 m depth (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Pitt and Fairfield soils are closely associated in the landscape with Katzie soils. Pitt soils differ from Katzie by being poorly drained and usually lie in slightly lower landscape positions. Fairfield soils, on the other hand, are imperfectly drained and lie somewhat higher than Katzie soils. They also have a thinner surface layer containing less organic matter and are silty rather than clayey in texture.

Vegetation: Most areas of Katzie soils are cleared and cultivated. Scattered remnants of natural vegetation includes western red cedar, Sitka spruce, black cottonwood, willow and various shrubs. Rooting extends to about 80 cm and is restricted below that by the fine subsoil textures and high winter watertables.

General Land Use Comments: (1) Although Katzie soils currently are mainly used for forage and pasture, other crops are also suited, especially those which can tolerate temporary high watertables. Artificial drainage will further widen the range of crops possible. The usually intimate intermingling with other soils makes individual management of Katzie soils difficult. (2) Even though Katzie soils tend to occupy the higher landscape positions in the areas where they occur, they are severely limited for urban and similar uses. Soil bearing strengths are relatively low, excavations such as basements will probably contain water during winter and other high watertable periods. Slow permeability severely limits the operation of septic tanks.

KENNEDY SOILS

Plate 26 A typical landscape in the Sumas Valley. Dairying and associated forage (grass—clover) production is one of the main land uses. The farmstead in the background is located on a sandy beach ridge where well drained Kennedy soils occur.

Location and Extent: Kennedy soils occupy small, scattered areas in the Sumas Valley where 250 ha of pure map units are mapped.

Topography and Elevation: Kennedy soils are undulating to strongly rolling with slopes mainly between 5 and 25 percent. They occupy the highest landscape positions and usually lie between 6 and 12 m above sea level.

Parent Material and Texture: Coarse-textured (sandy) spits, bars, beaches and similar stratified lacustrine deposits form the parent material of Kennedy soils. Surface textures vary from loamy sand to fine sandy loam while subsurface and subsoil textures are usually medium or fine sand, sometimes containing thin, sandy loam lenses.

Soil Moisture Characteristics: Kennedy soils are well to rapidly drained. They are rapidly pervious and have low water holding capacity and slow surface runoff.

General Soil Description: Kennedy soils generally have a dark brown to reddish-brown, weakly structured, very friable, sandy surface layer about 30 cm thick which is underlain by a loose, partially leached, yellowish-brown to pale brown sandy zone which is about 25 cm thick. This, in turn, is underlain by a zone up to 300 cm thick consisting of numerous, dark yellowish brown, friable to firm, clay enriched, sandy lamellae or bands up to 5 cm thick alternating with loose, grayish-brown to gray, partially leached layers. This zone then grades to loose, grayish sand. Soil reactions range from strongly or very strongly acid in the surface and subsurface to moderately acid in the lower subsoil. Soil classification is mostly ***Brunisolic Gray Luvisol*** with a few Podzolic Gray Luvisol inclusions.

Commonly Associated Soils: Bates, Buckerfield, Lickman, Vedder and Vye soils are all often closely associated with Kennedy soils. They all differ from Kennedy soils by being silty rather than sandy in texture and lie in lower landscape positions. Additionally, Buckerfield and Vedder soils are poorly drained while Bates and Vye soils are imperfectly drained.

Vegetation: Most Kennedy soil areas are cleared and used either for crop production or farmsteads. The remaining native vegetation includes coast Douglas-fir, western red cedar, Sitka spruce, vine and bigleaf maple, red alder and various shrubs. Roots penetrate at least to 100 cm depth.

General Land Use Comments: (1) Agriculturally, Kennedy soils are limited by droughtiness and adverse topography. With irrigation and adequate fertilization, however, most crops can be satisfactorily produced. Small, scattered, variable shaped locations make management as individual soil units difficult. (2) Kennedy soils occupy the topographically highest parts of the landscape and are the location of many of the present farmsteads. Bearing strengths are moderate, watertables are usually below 2 m and septic tank effluent disposal is efficient. These moderately urban suited soils are also potential locations for sand extraction.

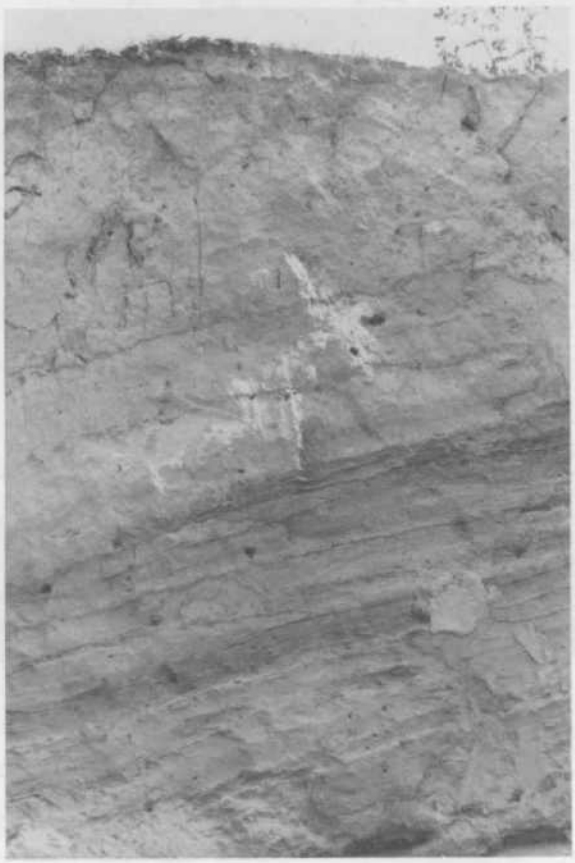


Plate 27 Kennedy soil profile (Brunisolic Gray Luvisol). These soils have developed on sandy lacustrine beach ridges and spits in the Sumas Valley. Note the numerous, thin clay enriched lenses in the subsurface and subsoil.

KENWORTHY SOILS (KW)

Location and Extent: Kenworthy soils are located on the lower mountain slopes north of the Fraser River, mainly in Mission and Maple Ridge Municipalities. There are about 230 ha of pure map units and 920 ha of soil complexes dominated by Kenworthy soils. The complexes are mostly with Hoover, Cannell and Steelhead soils.

Topography and Elevation: Kenworthy soils are generally steeply to extremely sloping or sometimes, strongly rolling to very hilly. Most slope gradients are between 30 and 60 percent although some may be as low as 20 percent or as high as 80 percent. Elevations range between 150 and 600 m above sea level.

Parent Material and Texture: The parent material of Kenworthy soils are mostly moderately coarse and some coarse-textured, somewhat unstable colluvial deposits, at least 1 m thick that contain some silty eolian material on or mixed into the surface. The deposits contain a very high proportion of angular gravel and stone-sized rock fragments throughout. Surface, subsurface and subsoil textures vary from gravelly loamy sand to gravelly loam although gravelly sandy loam is the most common.

Soil Moisture Characteristics: Kenworthy soils are mostly well drained with some moderately well drained areas on lower slopes. They are rapidly pervious and have moderate to low water holding capacity and slow surface runoff. Intermittent telluric seepage is usually present in the lower subsoil of areas located near the base of long slopes.

General Soil Description: Kenworthy soils generally have 5 to 10 cm of well to undecomposed, organic forest litter on the mineral soil surface. Under this is 2 cm or less of discontinuous, grayish, leached, mineral material which, in turn, is underlain by about 60 cm of friable, loamy to sandy material which varies from dark reddish brown in the upper part to reddish-brown or yellowish-brown in the lower part. It contains at least 40 percent (by volume) angular gravels and stones as well as common, fine, hard, reddish concretions. In turn, this is underlain by a layer about 60 cm thick which is loose, dark yellowish brown or yellowish-brown, contains up to 80 percent coarse fragments and is transitional to the colluvial soil parent material. The parent material is loose and contains up to 80 percent coarse fragments and common to few, yellowish or reddish mottles. Soil reactions vary from very strongly or extremely acid in the upper soils to medium acid in the subsoil. Soil classification is generally *Orthic Humo-Ferric Podzol* although a few, small inclusions of Orthic Dystric Brunisol or Orthic Regosol also occur where the soils are unstable.

Commonly Associated Soils: Cannell, Eunice, Hoover, Buntzen and Steelhead soils often occur in close association with Kenworthy soils. Cannell and Eunice soils differ from Kenworthy soils by respectively, consisting of less than 100 cm of mineral soil over bedrock and 10 cm or more of organic soil over rock. Hoover soils differ by containing substantially lower volumes of coarse fragments in the soil as well as overlying glacial till. Buntzen and Steelhead soils have developed from glacial till and contain strongly cemented layers in the subsoil. Additionally, Steelhead soils are imperfectly drained.

Vegetation: The vegetation on Kenworthy soils consists generally of second-growth coast Douglas-fir, western hemlock and western red cedar with some red alder, vine maple and other deciduous species. Other than moderate limitations imposed by high gravel and stone contents, rooting depths are essentially unrestricted to at least 100 cm.

General Land Use Comments: (1) Very steep slopes and stoniness make Kenworthy soils unsuitable for agricultural uses. (2) They are also unsuited for urban uses because of the steep slopes and unstable nature of the soils. Downslope soil creep is evident by soil accumulations on up-slope sides of trees, curved (pistol-butt), lower parts of tree trunks, and stone stripes. (3) Forest growth is usually good although moisture deficiencies occur during long, dry periods. Potential annual wood production by Douglas-fir is estimated to be between 9 and 12 m^3/ha. When forest harvesting is undertaken, extreme care should be taken to prevent surface erosion and perhaps slumping in some areas. In the steeper areas, surface soil creep may cause problems with forest regeneration, either natural or planted.

KEYSTONE SOILS (KE)

Location and Extent: Keystone soils occur north of the Fraser River, mainly in the western parts of Mission and eastern parts of Maple Ridge Municipalities. There are 430 ha of pure map units and 1040 ha of soil complexes dominated by Keystone soils. Most complexes are with Stave soils; a few areas are complexes with Roach, Errock or Whatcom soils.

Topography and Elevation: The topography of Keystone soils is mostly gently to moderately sloping or undulating to gently rolling with slopes between 3 and 10 percent. A few, very steeply sloping areas along gullies and escarpments also occur; here the slopes may rise to over 50 percent. Keystone soils generally lie between 30 and 150 m above sea level.

Parent Material and Texture: Keystone soils have developed from coarse-textured glaciofluvial deposits with variable amounts of silty eolian material mixed into the upper 25 cm. Surface textures vary from sandy loam to silt loam, although loam is most common. Subsurface and subsoil textures are gravelly sand or gravel. The surfaces are moderately stony and the lower subsoil is strongly cemented to indurated. Usually there are moderate to many, fine, hard concretions in the surface.

Soil Moisture Characteristics: Keystone soils are dominantly well drained, varying to moderately well drained in a few areas where the subsoil cementation is shallow. They are rapidly pervious and have low water holding capacity and slow surface runoff. Slight restrictions to downward water movement is caused by the cementation in the subsoil.

General Soil Description: Keystone soils usually have 5 to 10 cm of variably decomposed, organic forest litter on the soil surface. This overlies 2 to 5 cm of friable, grayish, leached loamy material which is underlain by about 20 cm of dark reddish brown or reddish-brown, friable, loamy soil. Under this is about 50 cm of loose gravel or gravelly sand containing few to common, distinct mottles in the lower part. Abruptly underlying this at about 80 cm depth is 20 to 40 cm of hard, massive, strongly cemented, variably colored gravel or gravelly sand containing many, prominent, yellowish or reddish mottles. A distinct root accumulation zone (root mat) up to 5 cm thick is frequently present above the cementation. Soil reaction grades from extremely acid in the organic surface horizons to strongly acid in the subsoil. Soil classification is *Duric Humo-Ferric Podzol.*

Commonly Associated Soils: Stave, Roach and Errock soils are often closely associated with Keystone soils. Roach and Errock soils lack the loamy surface layer (are gravelly to the surface) and the cemented layers begin in the subsurface. Additionally, Errock soils are imperfectly drained. Stave soils differ by being mainly sandy rather than gravelly in the subsurface and subsoils. Also, compact glacial till or glaciomarine deposits occur within 1 to 2 m of the soil surface.

Vegetation: Some areas of Keystone soils are cleared and cultivated, mainly for forage or pasture. Uncleared areas mostly support a variable, second-growth forest consisting of, among others, coast Douglas-fir, western hemlock, western red cedar and red alder. Rooting to about 80 cm is unrestricted but is severely limited below that by strong soil cementation. Appreciable root concentrations (root mats) often occur immediately above the cementation.

General Land Use Comments: (1) Keystone soils are moderately suited for agricultural cropping. Moderately stony surfaces, sometimes adverse topography and low water holding capacity are the main limitations. If stones are cleared and irrigation is available, most crops can be successfully grown. (2) Keystone soils are well suited for urban uses. They are well-drained, have high bearing capacity and the topography is usually suitable. Septic tank effluent fields should function well if installed below the cemented subsoil layer. A potential for groundwater contamination exists however, due to incomplete filtration by the coarse-textured subsoil material. Potential aggregate sources are available in Keystone soil areas. (3) Keystone soils are moderately to well suited for forest growth although some growth limitations are imposed by droughty conditions during dry summers. Data from a limited number of plots indicates potential annual wood growth by Douglas-fir to be between 9 and 12 m^3/ha.

KITTER SOILS (K)

Location and Extent: Kitter soils are mainly found in the southern part of Delta Municipality and in the western part of the Nicomekl-Serpentine Valley in Surrey Municipality. About 180 ha of pure map units and 1240 ha of a variety of soil complexes dominated by Kitter soils are mapped. The complexes are mostly with Delta, Embree, Ladner, Sandel and Goudy soils.

Topography and Elevation: The topography of Kitter soils is mostly undulating with a few areas very gently rolling. Slopes are between 2 and 6 percent. The soils occupy the topographically highest positions in the related landscape and in some areas have been partially levelled. Elevations range from 1 to 3 m above sea level.

Parent Material and Texture: The parent material of Kitter soils are medium-textured, stone-free, deltaic deposits. Surface and subsurface textures are usually silt loam, occasionally varying to silty clay loam or loam. Subsoil textures are similar in the upper part but become sandy at depths below about 100 to 150 cm. Saline soil conditions are usual below about 125 cm depth and at these depths, substantial amounts of compounds high in sulphur also usually occur.

Soil Moisture Characteristics: Kitter soils are moderately poorly drained. They are moderately pervious and have high water holding capacity and moderate to slow surface runoff. High groundwater tables and excessive rainfall cause saturated conditions during the winter months. During the growing season watertables usually recede sufficiently to provide a saturation-free zone adequate for most crops.

General Soil Description: Kitter soils generally have a dark grayish brown or dark brown, silty cultivated surface layer about 20 cm thick which is fine-blocky in structure and friable to firm when moist. The surface layer is underlain by a dark grayish brown, silty zone approximately 30 cm thick, which contains many, prominent, reddish-brown to yellowish-brown mottles and, in the upper part, common clay films on ped surfaces and some old root channels. It is firm when moist and hard when dry and contains common vertical cracks. This zone, in turn, is underlain by about 40 cm of dark grayish brown, silty material which is massive or weakly stratified (few, fine sandy lenses) and contains common, reddish-brown or yellowish-red mottles. It grades below about 100 cm depth to olive-gray, silty, saline, soil parent material that contains some reddish-brown mottles and hard, brownish tubules around old root channels. Surface soil reaction varies according to management practises but usually is strongly acid. This grades to extremely acid below about 75 cm. Soil classification is *Orthic Gleysol*.

Commonly Associated Soils: Embree, Delta and Goudy soils are often closely associated with Kitter soils. All are more poorly drained than Kitter soils and usually lie in slightly lower topographic positions. Embree and Delta soils have dark gray or black, silty surfaces and are saline within 100 cm of the surface. As well, Embree soils have an organic layer in the subsurface. Goudy soils have organic surface and subsurface layers and are saline also.

Vegetation: Essentially all areas of Kitter soils are cleared and cultivated. Rooting is restricted mainly to the upper 60 to 75 cm by the massive subsoil and the periodically high watertables.

General Land Use Comments: (1) Kitter soils are good agricultural soils but their small areal extent in any one location and very irregular boundaries make them difficult to manage separately from adjacent, usually more poorly drained soils. They are sufficiently drained for good production of most annual crops but perennials usually suffer during the winter when watertables are high. (2) Urban and similar uses are restricted by variable bearing strengths and periodically high watertables. Basements and other excavations will probably contain water during parts of the year and septic tank effluent distribution fields operate poorly due to high water tables and relatively slow permeability. Underground installations require special protection from corrosion by the saline subsoils.

LADNER SOILS

Location and Extent: Ladner soils occur mainly in Delta Municipality. Lesser areas are found in Richmond Municipality and in the Serpentine-Nicomekl Valley. There are about 1220 ha of pure map units and 450 ha of soil complexes dominated by Ladner soils. The complexes are mostly with Delta and Guichon soils.

Topography and Elevation: The topography of Ladner soils varies from level to gently undulating with slopes less than 2 percent. Land levelling has occurred in some areas. Elevations vary from 1 to 3 m above sea level.

Parent Material and Texture: Ladner soils have developed from moderately fine and some fine-textured, stone-free, mixed marine and freshwater deltaic deposits which are underlain by sandy materials at depths below 100 cm or more. Surface textures are mostly silty clay loam with variations to silt loam, subsurfaces are usually silty clay and subsoil textures range from silty clay loam to silt loam. Below about 120 cm, textures become sandier and saline conditions are usually encountered. The deposits below about 75 cm usually also contain substantial amounts of compounds high in sulphur.

Plate 28 A view across an area of Ladner soils on the lowlands of Delta Municipality. Potatoes, in the foreground, and corn, oats and pasture in the middle distance, are being produced on these nearly level soils.

Soil Moisture Characteristics: Ladner soils are moderately poorly to poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. High watertables are usual during the winter and surface ponding is common during and after heavy rains. The watertable usually recedes to 100 cm or more during the summer.

General Soil Description: Ladner soils generally have a very dark gray, firm, silty to clayey, cultivated surface layer between 15 and 20 cm thick. It is underlain by 5 to 10 cm of grayish, partially leached, very firm, silty to clayey material containing common, reddish-brown mottles. This, in turn, is underlain by a clayey layer about 30 cm thick which is grayish-brown, very firm and plastic, has strong, prismatic structure and contains many reddish or brownish mottles. Well-developed clay flows in pores and root channels and on ped surfaces are also present. This clay enriched layer grades to about 40 cm of gray or dark gray, massive, silty material containing a few, reddish or yellowish mottles. Gradual change then occurs to dark gray or olive-gray, saline, massive, silty material (with a few, thin, sandy lenses) containing common, yellow mottles and hard, reddish or brownish tubules around old root channels. Surface and subsurface soil reaction is variable depending on management practises but is usually very strongly or strongly acid. Below about 50 cm it changes to extremely acid. Soil classification is ***Humic Luvic Gleysol***.

Commonly Associated Soils: Delta and Guichon soils often occur in close association with Ladner soils. Delta soils differ from Ladner soils by being somewhat more silty in texture and lack the well-developed clay accumulation zone in the subsurface. Guichon soils differ by having saline, sandy material within 50 cm of the surface and also lack a well-defined clay accumulation zone.

Vegetation: The native vegetation on Ladner soils has essentially all been removed by land clearing and cultivation. Rooting is mainly restricted to the upper 60 cm by dense subsurface soils and high watertables.

General Land Use Comments: (1) Ladner soils are used for a variety of agricultural crops. Annual crops generally do well since high watertables tend to recede during the growing season. Perennials, however, suffer during winter months and artificial drainage is beneficial. Subsoiling improves water movement and rooting depth. Puddling is a problem and the soils should not be cultivated when wet. (2) Low or variable bearing strengths and high watertables limit Ladner soils for urban or related uses. Foundations require special considerations and basements or other excavations will probably contain water for at least part of the year. Septic tank effluent disposal is restricted by high watertables and low soil permeability. Underground installations, such as utilities, require special protection from corrosion by the saline subsoils. (3) Ladner soils appear moderately suited for western red cedar. Annual potential wood production by this species is estimated to be between 6.5 and 8 m^3/ha.

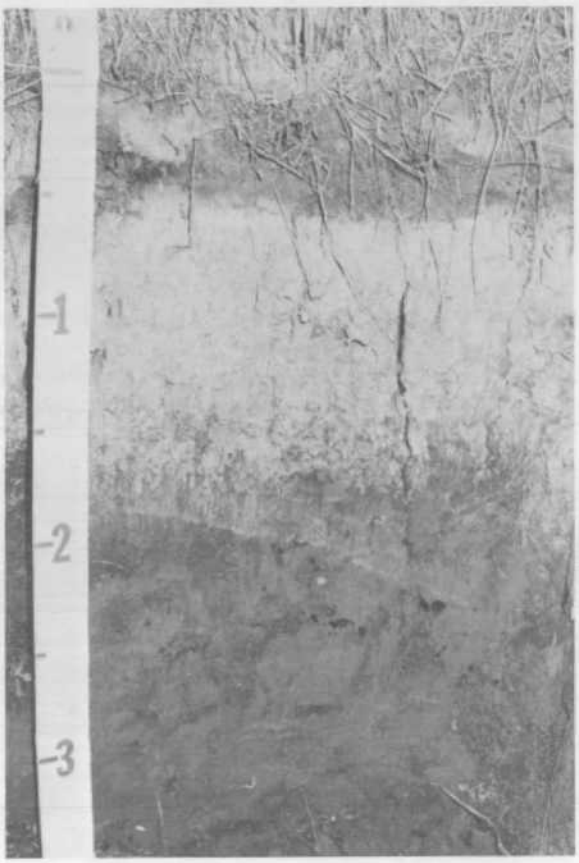


Plate 29 Ladner soil profile (Humic Luvic Gleysol). These moderately poorly drained, clayey soils have developed from deltaic deposits. They have a strongly leached grayish layer (6 to 11 in. (15 to 27 cm) in the photo) under the cultivated surface. This is underlain by a clay enriched layer about 12 in. (30 cm) thick. Dark gray sand, usually saline, is present below depths of 3 ft. (90 cm) or more.

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LANGDALE SOILS (LE)

Location and Extent: Langdale soils occur only on the lower mountain slopes of the Sunshine Coast, mainly between Gibsons and Sechelt. There are about 2420 ha of pure map units and 1910 ha of Langdale-Cannell soil complex.

Topography and Elevation: The topography of Langdale soils is mainly moderately to steeply sloping with slope gradients between 5 and 30 percent. Some small, gently sloping or hilly areas also occur. Elevations range between 250 and 700 m above sea level.

Parent Material and Texture: Langdale soils have developed from moderately coarse textured glacial till overlain by variable depths of similarily textured, moderately stony slopewash. The surface, subsurface and subsoil textures are mostly sandy loam with some variation to gravelly sandy loam or loamy sand.

Soil Moisture Relationships: Langdale soils are well to moderately well drained. They are rapidly pervious in the surface and subsurface layers. This changes to moderately or slowly pervious in the lower subsoil due to the presence of discontinuous, weak to moderate cementation and dense, compact unweathered glacial till. Water holding capacity is low to moderate and surface runoff is slow. Temporary downslope telluric seepage is usually present in the zone above the cementation or above the dense till during periods of heavy rain or snowmelt.

General Soil Description: Langdale soils usually have 5 to 10 cm of variably decomposed, organic forest litter on the mineral soil surface. Under this is a gray, discontinuous, leached, friable, sandy layer up to 5 cm thick. This is abruptly underlain by about 30 cm of yellowish-brown to reddish-brown, friable, sandy material containing a few weakly cemented pockets. Underneath this is yellowish to brownish, friable, sandy material which varies to firm in weakly to moderately cemented, discontinuous lenses and pockets. A few reddish mottles are also present. Below about 100 cm, grayish, compact, unweathered glacial till occurs which contains a few reddish mottles in the upper soil. Soil reaction usually varies from extremely acid in the upper part to moderately acid in the lower subsoil. Soil classification is mostly *Orthic Humo-Ferric Podzol*. Some small areas of Orthic Ferro-Humic Podzol are also included at the upper parts of the elevational range. Scattered areas of Duric Humo-Ferric Podzol are also present where the cementation in the subsoil is well developed.

Commonly Associated Soils: Cannell, Capilano and Golden Ears soils often are closely associated with Langdale soils. Cannell soils differ from Langdale soils by being underlain by bedrock within 1 m of the surface. Capilano soils usually lie at somewhat lower elevations than Langdale soils and are coarse-textured (gravelly) while Golden Ears soils occur at higher elevations and have well-developed, organic matter enriched subsurface layers and are strongly cemented in the subsoil.

Vegetation: The vegetation of Langdale soils consists mainly of second-growth Douglas-fir, western hemlock and western red cedar with occasional western white pine as well as red alder and vine maple. Rooting depth is generally unrestricted to at least 1 m.

General Land Use Comments: (1) Agriculturally, Langdale soils are limited by adverse topography, stoniness and low water holding capacity. With adequate irrigation (and fertilization) the more topographically subdued areas can produce adequate forage and similar crops. (2) Langdale soils, except in steeply sloping areas, are generally suited for urban development, especially if sewage gathering systems are installed. Septic tanks may lead to subsoil seepage if they are installed in large numbers. (3) Forest growth is good. Estimated mean annual increments of coast Douglas-fir are 9 to 12 m^3/ha/yr. Droughtiness during the latter part of the growing season is sometimes limiting.

LANGLEY SOILS (LA)

Location and Extent: Langley soils occur mainly in the vicinity of Milner where about 320 ha of pure map units are mapped.

Topography and Elevation: The topography of Langley soils varies from level to very gently sloping or gently undulating with slopes less than 2 percent. Elevations range from 15 to 20 m above sea level.

Parent Material and Texture: Langley soils have developed from deep, fine-textured, stone-free, marine sediments. The surface texture is usually silty clay loam, sometimes varying to silt loam or clay loam, and contains between 20 and 30 percent organic matter. The sub-surfaces are silty clay or clay while the subsoil is heavy clay or clay.

Soil Moisture Characteristics: Langley soils are moderately poorly to poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. During the winter and other periods of heavy rain, perched watertables develop above the very slowly permeable subsoil and surface ponding sometimes occurs.

General Soil Description: Langley soils have a surface layer about 35 cm thick which is black to very dark brown, friable, granular and silty to clayey in texture. The upper 20 cm is cultivated and contains between 20 and 30 percent organic matter. Underlying the surface layer is about 10 cm of grayish, silty, leached material containing a few reddish mottles. This, in turn, is underlain by about 40 cm of gray or dark gray, dense, vertically cracked, very firm and plastic, clayey material containing common yellowish-brown mottles and well-defined clay flows on ped surfaces. This then grades to gray, dense, extremely firm, clayey soil parent material containing common, brownish mottles and dark brown coatings and stains on clod surfaces. Soil reaction varies from strongly or medium acid in the upper 50 cm to neutral in the subsoil (1:1 H_2O). Soil classification is *Humic Luvic Gleysol*. (See Plate 15, page 55.)

Commonly Associated Soils: Cloverdale and Livingstone soils often occupy map polygons adjacent to Langley soils. Cloverdale soils differ from Langley soils by having a surface layer which is only 10 to 20 cm thick while Livingstone soils differ by having sandy surface and subsurface textures.

Vegetation: Essentially all areas of Langley soils are cleared and cultivated. A few, small, relatively undisturbed areas, such as along fences, support a few Sitka spruce and western red cedar as well as a variety of shrubs, grass and sedges. Rooting is mainly restricted to the upper 60 cm by the dense subsoil and perched watertable.

General Land Use Comments: (1) Langley soils are limited for agricultural use mainly by the high perched, winter watertables that affect perennial crops. Annual crops generally do well although cultivation and planting in the spring is delayed by wet soil conditions. Artificial drainage is beneficial—tile lines require close spacing due to slow soil permeability. (2) Urban uses are limited by high periodic watertables which affect basements and other excavations. Septic tank effluent disposal is severely impaired by very slow soil permeability and high watertables. (3) Langley soils are only moderately suited for tree growth. Potential annual wood production by western red cedar is estimated to be between 5 and 6.5 m^3/ha. Growth is limited by the dense subsoils and wet conditions.

LAXTON SOILS (LX)

Location and Extent: Laxton soils occur in scattered areas on the uplands, mainly in the vicinity of Abbotsford, near Mission and along the margins of Matsqui Valley. There are about 150 ha of pure map units and 570 ha of soil complexes dominated by Laxton soils. The complexes are usually with Abbotsford, Marble Hill and Ryder soils.

Topography and Elevation: The topography of Laxton soils varies from gently sloping and undulating to steeply sloping and strongly rolling. Most slopes are between 5 and 25 percent but along gullies and escarpments they rise to over 60 percent. Elevations range between 25 and 100 m above sea level.

Parent Material and Texture: Laxton soils have developed from deep, eolian deposits that are medium-textured near the surface and coarse-textured in the subsoil. They usually are duned although relatively level areas also occur and, in these areas, some glaciofluvial sands may be included. Surface textures vary from fine sandy loam to silt loam while subsurface and subsoil textures consist of sand, fine sand or loamy sand.

Soil Moisture Characteristics: Laxton soils are well to rapidly drained. They are rapidly pervious and have low to medium water holding capacity.

General Soil Description: In uncleared areas Laxton soils have up to 5 cm of raw to well-decomposed leaves, needles and other organic forest litter on the mineral soil surface. This is underlain by about 20 cm of reddish-brown to yellowish-brown, very friable, silty or very fine sandy material. Occasionally, a thin, discontinuous, gray, leached layer is present at the top of this zone. The brownish soil, in turn, is underlain by a transition zone of loose, yellowish-brown fine sand that is very friable and about 50 cm thick. Below about 80 cm, light brownish yellow or light olive brown, loose, fine to medium sand occurs, sometimes containing below 100 cm, thin (less than 2 cm) dark brown lamellae slightly enriched with clay. Soil reactions vary from medium to strongly acid throughout. Soil classification is mostly *Orthic Humo-Ferric Podzol* although a few small areas of Orthic or Eluviated Dystric Brunisol also occur.

Commonly Associated Soils: Abbotsford, Marble Hill, Ryder and Lonzo Creek soils usually occur closely associated with Laxton soils. All have silty eolian surfaces similar to Laxton soils but vary in subsoil texture and deposits. In Abbotsford soils, gravel or sandy gravel occurs at depths between 20 and 50 cm of the surface. In Marble Hill soils, the gravels occur at depths greater than 50 cm. Ryder and Lonzo Creek soils have compact, loamy glacial till at depths of, respectively, greater than 50 cm and between 20 and 50 cm of the soil surface.

Vegetation: Most areas of Laxton soils are cleared and are either cultivated or used for urban sites. Scattered, uncleared areas support a mixed second-growth forest of coast Douglas-fir, red alder, vine and bigleaf maple and birch, understoried by a variety of shrubs and herbs, including Oregon grape, huckleberry and bracken. Rooting depth is unrestricted to at least 100 cm.

General Land Use Comments: (1) Low water holding capacity and, in some locations, adverse topography restrict Laxton soils for agricultural uses. However, with adequate irrigation and fertilization as required, most crops can be satisfactorily produced. (2) Except for steeply sloping areas, Laxton soils are well suited for most urban and related uses. They are well drained, easy to excavate, and are well suited for septic tank effluent disposal. They also provide sources for sand. (3) Forest growth is moderate due to droughty conditions during the latter part of the growing season. Potential annual wood production by coast Douglas-fir is estimated at about 6 to 7.5 m^3/ha.

LEHMAN SOILS (LH)

Location and Extent: Lehman soils occupy small, scattered locations throughout the uplands of the map area but are most common in the eastern half. About 130 ha of pure map units and 610 ha of soil complexes dominated by Lehman soils are mapped. The complexes are mostly with Coghlan, Judson, Defehr and Columbia soils.

Topography and Elevation: Lehman soils vary from level to very gently sloping or undulating and are often slightly depressional in relation to adjacent soils. The slopes are usually less than 4 percent and elevations range between 30 and 100 m above sea level.

Parent Material and Texture: Lehman soils have developed from coarse-textured glaciofluvial deposits (and some fluvial deposits) which have up to 30 cm of medium-textured eolian material on, or mixed into, the surface. Surface textures are loam or silt loam while subsurface and subsoil textures are gravelly sand, sand or gravel, often stratified. Moderate amounts of stones are present in the surface where the eolian capping is shallow.

Soil Moisture Characteristics: Lehman soils are poorly drained. They are rapidly pervious and have low to moderate water holding capacity and slow surface runoff. They are subject to runoff and seepage from higher, adjacent land and perched watertables develop above impermeable glacial till or glaciomarine sediment that usually occurs at depth.

General Soil Description: Lehman soils (in uncleared areas) have up to 5 cm of raw to well-decomposed, mainly deciduous, organic forest litter on the mineral soil surface. Under this is about 15 cm of black or very dark gray, weakly structured, friable, silty soil which, in turn, is underlain by an olive-gray or grayish-brown, friable, moderately structured, loamy to sandy layer about 10 cm thick containing common, strong brown to reddish-brown mottles. This is abruptly underlain by at least 100 cm of stratified loose gravel or gravelly sand which contains many, prominent, strong brown or reddish-brown mottles. Surface soil reaction is usually very strongly acid while subsurface and subsoil reactions vary from strongly to medium acid (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Coghlan, Defehr, Columbia and Judson soils often occur in close association with Lehman soils. Coghlan and Defehr soils differ from Lehman soils by being imperfectly rather than poorly drained. They also have reddish or brownish surfaces rather than the black surface of Lehman soils. Also, Coghlan soils have strongly cemented subsurface layers. Columbia soils differ by being well-drained, while Judson soils consist of organic materials between 40 and 160 cm deep.

Vegetation: Many areas of Lehman soils are cleared and cultivated. The remaining natural vegetation includes western red cedar, western hemlock, willow, red alder, black cottonwood and vine maple, understoried by cascara, salmonberry, skunk cabbage, ferns and others. Rooting depth is mainly restricted to the upper 50 cm by the periodic high watertables and gravelly subsoil textures.

General Land Use Comments: (1) Lehman soils are limited agriculturally by high watertables during the winter months and, in the summer after the perched watertables recede, by droughty conditions. Artificial drainage and irrigation are both required for good crop production. (2) High watertables during parts of the year limit use of Lehman soils for urban or similar uses. Basements and other excavations can be expected to contain water during these periods and septic tank effluent disposal is severely restricted. Lehman soil areas provide potential aggregate sources. Extraction should only occur during the drier parts of the year. (3) Lehman soils appear moderately suited for forest crops such as cottonwood. Potential annual wood production is estimated at between 9 and 12 m^3/ha.

LICKMAN SOILS (LK)

Location and Extent: Lickman soils occur in small, scattered lowland locations in the eastern half of the map area. About 250 ha of Lickman soils and 170 ha of soil complexes dominated by Lickman soils are mapped. The complexes are mainly with Sardis and Bates soils.

Topography and Elevation: Lickman soils vary from gently undulating to undulating with slopes between 1 and 5 percent and usually occupy the topographically highest parts of the related landscapes. Elevations range from 5 to 15 m above sea level.

Parent Material and Texture: The parent material of Lickman soils is medium-textured, stone-free, deposits of local streams which flow across various parts of the lowlands. The deposits, which overlie sand, are usually at least 50 cm thick although small areas where the deposits are between 20 and 50 cm thick also occur. Surface and subsurface textures are usually silt loam or loam, varying sometimes to fine sandy loam or sandy loam. The subsoil is mostly fine sandy loam in the upper part, changing to sand below depths of 50 cm or more.

Soil Moisture Characteristics: Lickman soils are moderately well to well drained. They are moderately pervious and have moderate water holding capacity and slow surface runoff. A temporary groundwater table usually develops in the lower part of the subsoil during and after heavy rains and during periods when the water levels in adjacent streams are high.

General Soil Description: Lickman soils have a dark grayish brown or grayish-brown, friable, cultivated, silty surface layer about 20 cm thick. The surface is underlain by about 10 cm of grayish-brown, friable, partially leached, weakly structured, silty material. In turn, this is underlain by a moderately blocky, slightly clay enriched, firm to friable, dark grayish brown, silty or fine sandy zone about 30 cm thick. The clay enrichment usually occurs as thin bands or lenses. A gradual change to loose, medium or fine sand occurs below about 60 cm. Soil reaction grades from medium or strongly acid in the surface to slightly acid in the subsoil (1:1 HåO). Soil classification is *Eluviated Eutric Brunisol*. Lickman soil:shallow variant occurs in scattered areas. It is similar to the described Lickman soil except that the sandy subsoil occurs between 20 and 50 cm of the surface rather than below 50 cm as is the usual case.

Commonly Associated Soils: Bates, Hopedale, McElvee and Sim soils are often closely associated with Lickman soils. Bates soils differ from Lickman soils by being imperfectly drained and usually have a darker coloured surface. Hopedale, McElvee and Sim soils all differ by being poorly drained; Sim soils also have a black surface. All usually lie in somewhat lower landscape positions compared to Lickman soils.

Vegetation: Most Lickman soil areas are cleared and cultivated. Scattered remnants of forest include coast Douglas-fir, western hemlock, black cottonwood, vine and bigleaf maple and red alder, understoried by a variety of shrubs and forbs. Rooting is unrestricted to at least 100 cm depth.

General Land Use Comments: (1) Lickman soils are suited for most agricultural crops. Droughtiness, however, is a problem during most growing seasons, particularly in areas mapped as shallow variant, and irrigation is required for good production. Management of Lickman soils as individual parcels is often difficult because of very irregular soil boundaries and small individual areas. (2) Lickman soils provide some of the better building sites on the lowlands because they usually occur in the topographically highest landscape positions. Septic tank effluent disposal is usually efficient although some restrictions may occur during occasional high watertables.

LIONS SOILS (LS)

Location and Extent: Lions soils occupy scattered, small areas at the upper elevations in the mountainous, northern part of the map area. About 160 ha of soil complexes dominated by Lions soils are mapped. The complexes are mostly with Dennett, Hollyburn, and Sayres soils and with Talus and Rock Outcrop land types.

Topography and Elevation: The topography of Lions soils is very steeply to extremely sloping with slope gradients greater than 40 percent. The soils generally lie at elevations greater than 800 m above sea level.

Parent Material and Texture: Lions soils have developed from deep, moderately coarse to coarse-textured, very stony and bouldery, colluvial deposits consisting mainly of stabilized talus and avalanche track debris. Surface, subsurface and subsoil textures range from gravelly sandy loam to loam which is interspersed between the numerous boulders and stones. Coarse fragments generally occupy at least 80 percent of the soil volume.

Soil Moisture Characteristics: Lions soils are moderately well to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Telluric downslope seepage in the lower subsoil is usual, either flowing over bedrock, or less commonly, over glacial till.

General Soil Description: Lions soils usually have a 10 to 20 cm thick, mainly well-decomposed, matted, organic surface layer derived mostly from deciduous plant remains. The organic layer is underlain by about 10 to 30 cm of very dark gray to dark brown, friable, weakly structured, loamy material containing between 10 and 30 percent organic matter. At least 50 percent of the soil volume is occupied by stones and boulders. This then grades to a loamy zone about 40 cm thick which is reddish-brown or yellowish-brown, friable, and extremely stony and bouldery which, in turn, gradually grades to loamy or sandy, gray to grayish-brown, very stony and bouldery material below about 80 cm. Soil reaction is extremely acid throughout. Soil classification is mostly *Sombric Humo-Ferric Podzol* although some areas of Orthic Sombric Brunisol also occur in areas which are either only partially stabilized or have been stabilized for only a short time.

Commonly Associated Soils: Dennett, Hollyburn and Sayres soils and Rock Outcrop and Talus land types usually are closely associated with Lions soils. Hollyburn and Sayres soils differ from Lions soils by being underlain by bedrock within 100 cm of the surface. They also lack the dark coloured, organic matter enriched, surface mineral soil layer. Dennett soils differ by being composed of 10 cm or more of organic material over bedrock. Rock Outcrop land type differs by consisting of less than 10 cm of mineral or organic soil over bedrock or having exposed rock at the surface while Talus land type is composed of actively accumulating, colluvial materials.

Vegetation: The vegetation of Lions soils consists mainly of deciduous shrubs and herbs. It includes Sitka alder, willow, mountain ash, copper bush, hellebore, salmonberry, and ferns as well as some scattered mountain hemlock and yellow cedar, either as individuals or in groups. The growth is usually lush due to telluric subsoil seepage. Rooting depth is unrestricted to at least 100 cm although root distribution is severely limited by the high number of stones and boulders in the soil.

General Land Use Comments: (1) Extreme slopes and stoniness as well as potential instability preclude use of Lions soils for agriculture and urban uses. (2) Forest growth of coniferous species is generally poor. If logging or road construction is considered, extreme caution is required to prevent reactivating downslope movement. Additionally, snow avalanche hazard is very high.

LIVINGSTONE SOILS (LV)

Location and Extent: Livingstone soils occur only in the Langley Valley in the vicinities of Langley and Milner. There are about 170 ha of pure map units and 440 ha of soil complexes dominated by Livingstone soils. The complexes are mainly with Murrayville, Cloverdale and Summer soils.

Topography and Elevation: Topographically, Livingstone soils vary from very gently to gently sloping or gently undulating with slopes between 1 and 5 percent. Elevations range between 15 to 25 m above sea level.

Parent Material and Texture: The parent material of Livingstone soils is moderately coarse-textured, stonfree, littoral deposits, usually between 30 and 100 cm thick, which overlie fine-textured marine deposits. Surface textures are loam or sandy loam, subsurface textures are loamy sand or sand and the subsoil varies from clay to heavy clay.

Soil Moisture Characteristics: Livingstone soils are imperfectly to moderately poorly drained. They are rapidly to moderately pervious in the surface and subsurface, changing to slowly pervious in the clayey subsoil. They have moderate to low water holding capacity and slow surface runoff. Perched watertables develop above the very slowly permeable subsoil during rainy periods and lateral seepage occurs at these times.

General Soil Description: Livingstone soils have a black to very dark gray, friable, cultivated, loamy surface about 20 cm deep which contains about 15 percent organic matter. This is abruptly underlain by about 10 cm of reddish-gray or gray, leached, friable, sandy material which, in turn, is underlain by about 20 cm of reddish-brown, friable to firm, moderately structured, sandy material containing weakly cemented clods. This zone also contains many, prominent, strong brown mottles. Underlying this is a clayey layer about 10 cm thick which is gray to light gray, very firm, vertically cracked, partially leached, and contains many, prominent reddish-brown to yellowish-red mottles. Under this is a gray, clayey layer about 40 cm thick which is very firm when moist and hard when dry, has strong, prismatic structure and contains many well-defined clay flows and prominent, yellowish-red mottles. Below about 100 cm, this clay enriched layer grades to greenish-gray, massive, clayey soil parent material containing a few, brown mottles. Soil reaction ranges from very strongly acid in the surface to slightly acid in the upper part of the clayey subsoil. Soil classification is *Gleyed Sombric Humo-Ferric Podzol.*

Commonly Associated Soils: Summer, Cloverdale and Murrayville soils are usually closely associated with Livingstone soils. Summer soils differ from Livingstone soils by being imperfectly drained; also also contain strongly cemented subsurface layers. Cloverdale soils differ by lacking the sandy overlay and are clayey to the surface. Murrayville soils are texturally similar to Livingstone soils but are imperfectly drained and lack the well-defined, black surface layer.

Vegetation: Almost all areas of Livingstone soils are cleared and cultivated. The small, scattered, remaining uncleared areas support western red cedar, western hemlock, cottonwood and red alder, understoried by hardhack, sedges, skunk cabbage and other moisture tolerant species. Rooting is mainly restricted to the upper 60 cm by the dense subsoil and perched watertables.

General Land Use Comments: (1) Livingstone soils are moderately well suited for agricultural use. Artificial drainage should be installed to control the perched watertables during the winter. Irrigation is beneficial during dry summers after the watertables disappear. (2) Urban uses of Livingstone soils are limited by high water tables, and variable bearing strengths of the underlying clay. Water is likely in basements and other excavations during the winter months and septic tank effluent disposal is severely impeded by the dense, slowly permeable subsoil and high watertables. (3) Livingstone soils appear moderately suited for tree species such as western red cedar. Estimated potential mean annual increment of this species is about 6.5 to 8 m^3/ha.

LONZO CREEK SOILS (LZ)

Location and Extent: Lonzo Creek soils occupy substantial upland areas in the eastern part of the map area. About 510 ha of pure map units and 9420 ha of soil complexes dominated by Lonzo Creek soils are mapped. The complexes are mostly with Ryder, Cannell, Poignant and Abbotsford soils.

Topography and Elevation: Lonzo Creek soils are mostly gently to strongly rolling although undulating or hilly areas also occur. Slopes vary from 3 to 50 percent but most commonly are between 8 and 25 percent. Elevations range from 20 to 300 m above sea level.

Parent Material and Texture: Lonzo Creek soils have developed from shallow (20 to 50 cm thick), medium-textured, stone-free eolian deposits that overlie moderately coarse textured, compact glacial till. The texture of the eolian material is mostly silt loam, occasionally varying to loam or fine sandy loam while the glacial till is gravelly sandy loam or loam.

Soil Moisture Characteristics: Lonzo Creek soils are well to moderately well drained. They are moderately pervious in the silty eolian capping; this changes to moderately or slowly pervious in the underlying glacial till. They have moderate water holding capacity and slow to moderate surface runoff. Very temporary perched watertables develop above the glacial till during periods of heavy rain and lateral seepage occurs during these times also.

General Soil Description: Lonzo Creek soils, in uncleared areas, generally have up to 5 cm of variably decomposed, organic forest litter on the soil surface. The organic material is underlain by between 20 and 50 cm of reddish-brown to yellowish-brown, friable, weakly structured, silty material containing variable amounts of fine, rounded concretions. Underlying the silty material, often abruptly, is pale brown or grayish-brown, massive to weakly stratified, compact, moderately stony, loamy glacial till. Soil reaction varies from medium to strongly acid throughout (1:1 H_2O). Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Ryder, Abbotsford, Marble Hill, Poignant and Cannell soils often occur closely associated with Lonzo Creek soils, either in soil complexes or occupying adjacent map polygons. Ryder soils are similar to Lonzo Creek soils except that the depth of the silty eolian capping is greater than 50 cm. Abbotsford and Marble Hill soils differ from Lonzo Creek soils by being underlain by gravelly glacio-fluvial materials rather than glacial till. Poignant soils differ by being composed of mixed silty eolian material and stony colluvium while Cannell soils differ by being underlain by bedrock within 100 cm of the surface.

Vegetation: Substantial areas of Lonzo Creek soils are currently cleared and cultivated. The uncleared areas support second-growth forest, mainly consisting of coast Douglas-fir, western hemlock, red alder, bigleaf and vine maple and some western red cedar. Rooting is mostly restricted to the upper 50 cm by the compact, subsoil glacial till. Root concentrations (root mat) often occur immediately above the glacial till.

General Land Use Comments: (1) Lonzo Creek soils are suited for most agricultural crops although adverse topography is limiting in some areas. The soils tend to be droughty and irrigation is required in most years to ensure good production. (2) Lonzo Creek soils are moderately suited for urban and related uses. The underlying glacial till provides firm foundations although its relatively low permeability limits septic tank effluent disposal. Adverse topography is limiting in some areas and surface erosion is likely to occur in areas of bare soils. (3) Forest production is moderately high, limited mainly by droughty conditions during the latter part of the growing season. Data from a limited number of plots indicates that the potential annual wood production by coast Douglas-fir is between 7.5 and 9 m^3/ha.

LULU SOILS

Location and Extent: Lulu soils occupy scattered areas in Richmond Municipality, the Serpentine-Nicomekl Valley and the eastern lowlands of Delta Municipality. There are about 280 ha of pure map units and 1180 ha of soil complexes dominated by Lulu soils. Most complexes are with Richmond, Lumbum and Triggs soils.

Topography and Elevation: Lulu soils are generally level to very gently sloping or gently undulating with slopes less than 2 percent. They are often slightly depressional in relation to adjacent mineral soils and lie between 1 and 4 m above sea level.

Parent Material and Texture: Lulu soils have developed from partially decomposed organic deposits, between 40 and 160 cm thick, which overlie moderately fine or fine-textured deltaic sediments. Surfaces vary from undecomposed to well-decomposed, depending on whether and how long they have been cultivated. The subsurface deposits are partially decomposed (mesic) and consist of mixed moss, sedge and shrub remains in the upper part and mainly sedges and reeds in the lower part. The underlying subsoil mineral material is silty clay loam or silty clay. It is usually moderately to strongly saline and high in sulphur compounds. A few areas of Lulu soils are mapped where once deeper organic deposits have been partially excavated for commerical peat.

Soil Moisture Characteristics: Lulu soils are very poorly drained. They are moderately pervious and have very high waterholding capacity and slow surface runoff. The watertable is near, or sometimes at, the soil surface for most of the winter and during rainy periods of the summer; some areas are subject to surface ponding.

General Soil Description: Lulu soils usually have about 15 cm of black to reddish-brown, friable, partially decomposed (mesic), cultivated organic material at the surface. This is underlain by between 30 and 140 cm of dark brown or dark reddish brown, weakly stratified, partially decomposed organic material in which individual moss, sedge and woody plant remains are identifiable. Under the organic material is gray or greenish-gray, massive, clayey material which is usually saline and contains common to few, yellowish mottles. Soil reactions are extremely acid throughout. Soil classification is *Terric Mesisol*.

Commonly Associated Soils: Lumbum, Richmond, Triggs and Vinod soils often occur in close association with Lulu soils. Lumbum soils are similar to Lulu soils except that the partially decomposed, organic material is more than 160 cm deep. Richmond soils differ by consisting dominantly of well-decomposed (humic) organic material and Triggs soils differ by being composed of deep, essentially raw organic material derived mainly from moss. Vinod soils differ by consisting of 15 to 40 cm of organic material over saline, clayey, mineral soil.

Vegetation: Uncleared areas of Lulu soils support variable vegetation including birch, shore pine, hardhack, Labrador tea, western red cedar, western hemlock, bracken and several mosses. Rooting is mainly restricted to the upper 50 cm by high groundwater tables. Saline subsoil conditions are usually sufficiently deep to have little effect on growth of most plants.

General Land Use Comments: (1) Lulu soils are limited for agricultural use by high watertables and extreme acidity. Adequate water table control and liming will allow production of most annual crops which are not very sensitive to "wet-feet". Perennial crops are mainly limited to those able to withstand high watertables during the winter months. Artificial drainage should provide watertable control sufficient for the crops grown. Overdraining will accelerate subsidence and decomposition of the organic material which, in some areas, may cause the saline subsoil to depress crop growth. (2) Urban and similar uses are poorly suited for Lulu soils. Bearing strengths are very low and high watertables preclude basements or similar excavations. High watertables also make septic tanks unsuitable. Severe corrosion of unprotected in-ground installations, such as utilities, is likely due to the saline subsoil conditions.

Plate 30 Lodgepole pine is a common component of the vegetation on many of the slightly to moderately decomposed organic soils.

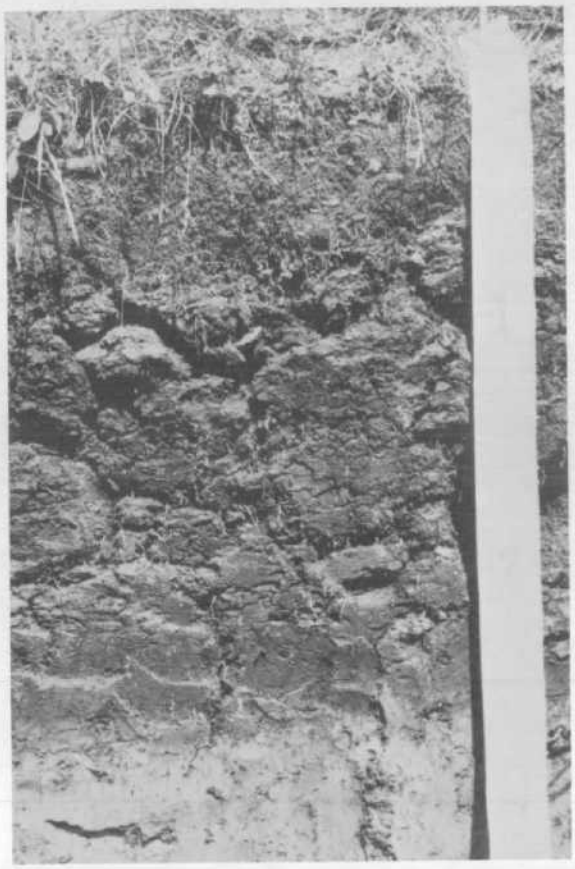

Plate 31 Lulu soil profile (Terric Mesisol). These soils consist of 40 to 160 cm of moderately decomposed organic material over saline, silty deltaic deposits. In the photo the organic deposits are 2.5 ft. (75 cm) deep. Note the strong cracking (shrinkage) as these soils dry.

LUMBUM SOILS (LM)

Location and Extent: Lumbum soils occur throughout the uplands and lowlands of the report area. The largest areas, however, are found on the lowlands of Richmond, Delta and Surrey Municipalities. About 2830 ha of pure map units and 1950 ha of soil complexes dominated by Lumbum soils are mapped. The complexes are mostly with Triggs, Glen Valley, Lulu, Gibson and Judson soils.

Topography and Elevation: The usual topography of Lumbum soils varies from level to very gently sloping or gently undulating with slopes less than 2 percent. Elevations range from 1 to 100 m above sea level.

Parent Material and Texture: Lumbum soils have developed from deep, partially-decomposed, organic deposits at least 160 cm thick. Surfaces vary in decomposition, ranging from essentially undecomposed (fibric) in some uncleared areas to well-decomposed (humic) in areas that have been cultivated for a number of years. Subsurface and subsoil organic material is partially-decomposed (mesic) and is derived from mixtures of sedges, reeds and moss. The underlying mineral sediments are usually either clayey deltaic, silty floodplain or clayey glaciomarine deposits. The deltaic deposits are usually saline. In a few areas, varying amounts of surface organic material have been removed by peat harvesting.

Soil Moisture Characteristics: Lumbum soils are very poorly drained. They are moderately pervious and have very high water holding capacity and slow surface runoff. The watertable is near, and sometimes at, the soil surface for most of the winter and during heavy, prolonged, summer rains. Surface ponding is likely during these times.

General Soil Description: The surface of Lumbum soils in cultivated areas consists of partially-decomposed, black to dark reddish brown, friable organic material about 20 cm thick. In uncleared area, it consists of about 20 cm of yellowish-red to dark reddish brown, spongy, weakly to partially decomposed material. The surface layer is underlain by at least 140 cm of dark reddish brown to dark brown or yellowish-brown, weakly stratified, partially-decomposed (mesic) organic material varying in composition from sedge and reed remains to mostly moss. The degree of decomposition generally increases with increasing depth and occasional pieces of wood are usually scattered throughout. Soil reaction is extremely acid throughout. Soil classification is *Typic Mesisol*.

Commonly Associated Soils: Lulu, Triggs, Gibson and Judson soils often occur in close association with Lumbum soils. Lulu and Gibson soils differ from Lumbum soils by consisting of between 40 and 160 cm of partially-decomposed organic material over mineral sediments. The mineral subsoils of Lulu soils are usually saline while those in Gibson soils are non-saline. Judson soils differ from Lumbum by consisting of 40 to 160 cm of well-decomposed organic material over mostly glaciomarine deposits. Triggs soils differ by consisting of deep, undecomposed, organic deposits composed mainly of moss.

Vegetation: Uncleared areas support a variety of plants, including birch, shore pine, western red cedar, western hemlock, red alder, Labrador tea, bracken, blackberry, salal, sedges and several mosses. Rooting is mostly restricted to the upper 50 cm by the high, groundwater tables.

General Land Use Comments: (1) Agriculturally, Lumbum soils are limited by high watertables and extreme acidity. Acidity can be improved by liming, the amount required dependent on the crops grown. Artificial drainage is required to control the high watertables. Watertable control should be sufficient for the crops grown; overdraining is likely to cause undue subsidence and decomposition. Low bearing strengths may require "flotation-type" of equipment for cultivation. (2) Urban and related uses are not suited for Lumbum soils. Low bearing strengths are likely to cause severe foundation problems, periodic flooding is possible and basements and similar excavations are not possible due to high watertables. High groundwater also makes septic tanks unsuitable for sewage disposal.

LYNDEN SOILS (LY)

Location and Extent: Lynden soils occur mainly on the uplands south of Langley and near Pitt Meadows. About 1200 ha of pure map units and 450 ha of soil complexes dominated by Lynden soils are mapped. The complexes are mostly with Sunshine and occasionally, Heron soils.

Topography and Elevation: Very gently to gently sloping and undulating with slopes less than 5 percent is the usual topography of Lynden soils. Elevations range from 15 to 30 m above sea level.

Parent Material and Texture: Lynden soils have developed from deep, coarse-textured (sandy), mainly glaciofluvial and some littoral deposits. Surface textures are generally loamy sand, occasionally varying to sandy loam. Subsurface and subsoil textures are medium to coarse sand. Occasional gravel and stones are sometimes present in the surface and subsurface.

Soil Moisture Characteristics: Lynden soils are well to rapidly drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. The permeability is slightly restricted in some areas by weak, discontinous, subsoil cementation.

General Soil Description: Uncleared areas of Lynden soils generally have up to 5 cm of raw to well-decomposed needles, leaves and other organic forest litter on the soil surface. This is underlain by a discontinous, gray, loose, strongly leached layer less than 5 cm thick which, in turn, is underlain by a friable to loose, sandy zone about 50 cm thick that ranges from dark reddish brown in the upper part to reddish-brown or yellowish-brown in the lower part. Below about 60 cm depth this grades to loose, single-grained sand. Soil reaction ranges from extremely acid in the upper soil to medium acid below about 75 cm. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Columbia, Lehman, Coghlan, Sunshine and Heron soils commonly are closely associated with Lynden soils. The upper portion of Sunshine soils is texturally similar to Lynden soils but is underlain at 1 to 2 m by compact glaciomarine or glacial till deposits. Columbia soils differ from Lynden soils by being gravelly and stony while Coghlan soils differ by being imperfectly drained and having strongly cemented subsurface layers. Lehman and Heron soils are poorly drained.

Vegetation: Cleared areas are either cultivated or used for residential development. Uncleared areas support second-growth forest, including mainly coast Douglas-fir and scattered red alder and western red cedar. The understory includes, among others, bracken, salal, Oregon grape, huckleberry, trailing blackberry and moss. Rooting depth is unrestricted.

General Land Use Comments: (1) Droughtiness is the main agricultural limitation of Lynden soils and irrigation is required for good crop production. Coarse textures limit the soils' nutrient holding ability and fertilizer applications should usually be as several smaller applications during the growing season rather than as one or two large applications. (2) Lynden soils are well suited for urban uses. Topography is moderate; they are well drained and easy to excavate. A potential limitation if many septic tanks are installed is incomplete septic tank sewage effluent filtration by the coarse textures which may lead to groundwater contamination. Lynden soils are sources of sand and sometimes, at depth, gravel. (3) Forest growth is moderate, limited mainly by droughty conditions due to the soils' low water holding capacity. Annual potential wood growth by coast Douglas-fir is estimated at between 6.5 and 8 m^3/ha.

MARBLE HILL SOILS

Location and Extent: Marble Hill soils occupy substantial upland areas throughout the eastern part of the map area. The largest areas are in the vicinities of Abbotsford and Mission. About 1610 ha of pure map units and 1830 ha of soil complexes dominated by Marble Hill soils are mapped. The complexes are usually with Abbotsford, Ryder, Calkins and Laxton soils.

Topography and Elevation: Topographically, Marble Hill soils vary from very gently sloping or gently undulating to hilly with slopes between 2 and 40 percent. Usually, however, they are undulating to gently rolling with slopes from 4 to 15 percent. Elevations mostly lie between 30 and 100 m above sea level but some areas rise to 200 m.

Parent Material and Texture: Marble Hill soils have developed from medium-textured, stone-free, eolian deposits, greater than 50 cm thick, which overlie gravelly glaciofluvial deposits. The eolian material is mostly silt loam, sometimes varying to loam or fine sandy loam, while the underlying glaciofluvial deposits are either sandy gravel or gravelly sand.

Soil Moisture Characteristics: Marble Hill soils are well drained. They are moderately pervious and have moderate to high water holding capacity and slow surface runoff.

General Soil Description: In uncleared areas Marble Hill soils have up to 5 cm of raw to well-decomposed, organic forest litter on the mineral soil surface. This is underlain by 50 cm or more of friable, weakly structured, silty material which ranges from dark reddish brown in the upper part to dark yellowish brown at depth and contains variable amounts of rounded, hard, reddish concretions. The subsoil below the silty eolian material is loose, single-grained gravel or gravelly sand, sometimes containing weakly cemented patches. Soil reaction is strongly acid throughout. Soil classification is *Orthic Humo-Ferric Podzol.*

Commonly Associated Soils: Abbotsford, Ryder, Lonzo Creek, Calkins and Laxton soils often occur in close association with Marble Hill soils. The surfaces of Abbotsford and Laxton soils are similar to that of Marble Hill soils. In Abbotsford soils however, the gravelly underlay occurs between 20 and 50 cm of the surface while, in Laxton soils, the underlay is sandy. Ryder and Lonzo Creek soils also have surfaces similar to Marble Hill soils, however their subsoil is compact glacial till rather than gravelly glaciofluvial deposits. The glacial till in Ryder soils occurs at depths greater than 50 cm while, in Lonzo Creek soils it is encountered between 20 and 50 cm of the surface. Calkins soils differ from Marble Hill soils by being poorly drained and having a black surface.

Vegetation: Substantial areas of Marble Hill soils are cleared and cultivated. Uncleared areas support a variable forest which includes coast Douglas-fir, western hemlock, red alder, vine and bigleaf maple and western red cedar. The undergrowth includes salal, bracken, Pacific dogwood, trailing blackberry and moss. Rooting depth is unrestricted.

General Land Use Comments: (1) Marble Hill soils are suited for most agricultural crops although adverse topography is limiting in some areas. They tend to become droughty during dry growing seasons and irrigation is required to maintain good productivity. (2) Marble Hill soils are generally well suited for urban and related uses. They are well-drained and the subsoil gravels provide good foundation conditions. Potentially, groundwater contamination can occur if septic tanks are intensively installed, due to incomplete filtration by the coarse-textured subsoil. Areas of Marble Hill soils are potential aggregate sources. (3) Forest productivity is moderate to high; the main limitation seems to be soil moisture deficiencies during the latter parts of most growing seasons. Data from a limited number of plots indicates potential annual wood production by coast Douglas-fir is about 7.5 to 9 m^3/ha.

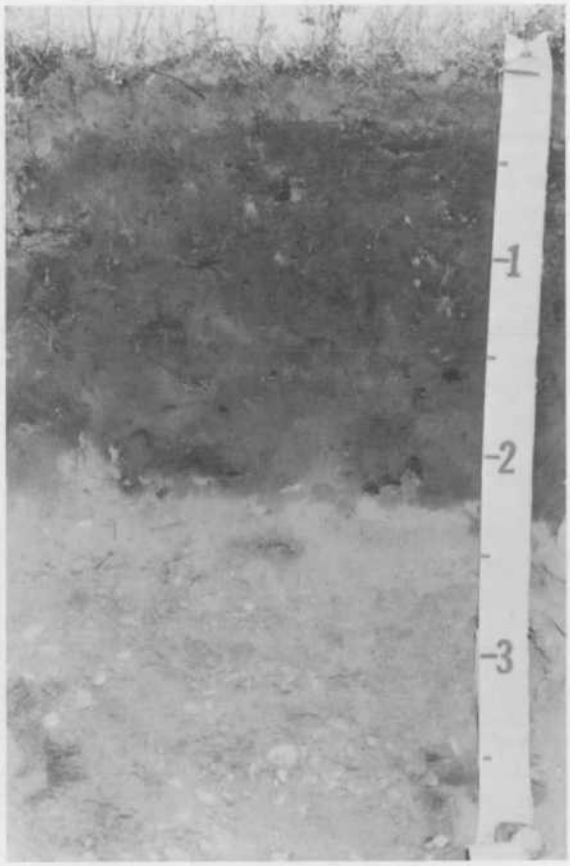

Plate 32 Marble Hill soil profile (Orthic Humo-Ferric Podzol). These soils have developed in 50 cm or more of silty eolian material overlying gravelly glaciofluvial deposits. In the photo the contact between the two deposits is at about 2.5 ft. (75 cm). The darker colour of the upper soil is due to its being moister than the underlying gravelly material.

MARION SOILS (MN)

Location and Extent: Marion soils occur only in a few, small areas, mostly on the University of British Columbia Research Forest. It is mapped only as a secondary soil in soil complexes, usually with Blaney soils.

Topography and Elevation: Marion soils are strongly to steeply sloping or moderately to strongly rolling, with slopes between 10 and 30 percent. They usually occupy lower slope positions or shallow depressions in the uneven landscape. Elevations lie in the vicinity of 400 m above sea level.

Parent Material and Texture: Marion soils have developed from moderately coarse to coarse-textured, stony glacial till derived mainly from granitic rock. The deposits are usually more than 1 m but less than 3 m deep over bedrock. Surface, subsurface and subsoil textures vary from gravelly loamy sand to gravelly sandy loam. Discontinuous, moderate cementation is often present in the subsurface while the subsoil is continuously, strongly cemented below about 70 cm.

Soil Moisture Characteristics: Marion soils are imperfectly drained. They are rapidly pervious in the surface and subsurface but this decreases abruptly to slowly pervious in the cemented subsoil. They have low to moderate water holding capacity and slow to moderate surface runoff. During the rainy winter and after other heavy rains a periodic, perched watertable develops above the cemented subsoil and variable amounts of telluric seepage develops along the surface of the cemented layer.

General Soil Description: Marion soils generally have from 10 to 25 cm of organic forest litter on the mineral soil surface, the lower half of which is black, friable and well-decomposed. This is abruptly underlain by 5 to 10 cm of grayish, strongly leached, friable, sandy material, which, in turn, is underlain by about 25 cm of dark brown or dark reddish brown, blocky, firm, discontinuously cemented, sandy or gravelly material containing between 10 and 15 percent organic matter. This grades to about 50 cm of olive-brown or olive, discontinuously cemented, firm; sandy or gravelly material containing many, prominent dark reddish brown or reddish-brown mottles. The lower 5 cm usually contains a well-defined zone of root concentration (root mat). Abruptly underlying this is a massive, gravelly or sandy zone at least 25 cm thick that is gray or olive-gray, very strongly cemented to indurated and contains common, strong brown mottles. This cemented zone then gradually grades below 1 m to grayish, unweathered glacial till or overlies bedrock. Soil reaction ranges from extremely acid in the upper soil to strongly acid below about 70 cm. Soil classification is usually *Duric Ferro-Humic Podzol.* Ortstein Ferro-Humic Podzols also occur in a few areas where the subsurface layers are more strongly cemented than usual.

Commonly Associated Soils: Blaney, Cannell and Eunice soils are usually closely associated with Marion soils. Blaney soils are similar to Marion soils except that they are well to moderately well drained, rather than imperfectly drained and lack the well-defined mottling on the subsoil. Cannell soils differ from Marion soils by having bedrock within 1 m of the surface while Eunice soils differ by consisting of 10 cm or more of organic forest litter over bedrock.

Vegetation: Most areas of Marion soils have been logged in the past. Currently they support a second-growth forest consisting mainly of western hemlock, western red cedar and coast Douglas-fir interspersed with red alder and vine maple. Rooting depth restricted to about 75 cm by the cemented subsoil.

General Land Use Comments: (1) Marion soils are poorly suited for agriculture because of adverse topography and stoniness. (2) Urban and related uses are also poorly suited for Marion soils. Steep slopes, periodic perched watertables and seepage as well as relatively shallow bedrock are all limitations. Inefficient septic tank operation can be expected due to cemented, slowly permeable subsoils and steep slopes. (3) Forest growth is good. Data from a limited number of plots indicates annual potential wood production by western hemlock and western red cedar to be between 12 and 15 m^3/ha.

MATHEWS SOILS (MW)

Location and Extent: Mathews soils are found only along Boundary Bay in Delta Municipality where about 110 ha of pure map units are classified.

Topography and Elevation: Mathews soils are gently undulating to undulating with slopes between 1 and 3 percent. They occupy the highest locations in the associated landscape and elevations are about 2 m above sea level.

Parent Material and Texture: Mathews soils have developed from medium-textured, stone-free, usually stratified, mixed marine and freshwater deltaic deposits which grade to sand below depths of 1 m or more. The surface texture is usually loam, with some variations to sandy loam or silt loam while the subsurface is either fine sandy loam, fine loamy sand or sandy loam. The subsoil varies from silt loam to silty clay loam in the upper part to increasingly sandy conditions at greater depths. Saline conditions are encountered at depths of 1 m or more.

Soil Moisture Characteristics: Drainage of Mathews soils varies from moderately poor to poor. They are moderately pervious and have moderate water holding capacity and slow surface runoff. A groundwater table is near the soil surface during most of the rainy winter months but recedes sufficiently during the summer to produce droughty conditions in the latter part of the growing season.

General Soils Description: Mathews soils have a black to very dark brown, friable, granular, cultivated, loamy surface about 20 cm thick. It is underlain by about 30 cm of grayish-brown to gray, sandy material which is weakly platy, friable, partially leached and contains common, prominent, yellowish-red to dark brown mottles. This material grades to thin, alternating sandy and silty bands which are gray or olive-gray and contain some brownish mottles. Soil reaction varies from extremely acid in the surface and subsurface to medium acid in the upper subsoil, then becoming increasingly more acid with increasing depth. Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Guichon, Benson and Delta soils are usually associated with Mathews soils. Guichon soils differ from Mathews soils by being saline within 50 to 75 cm of the soil surface while Benson soils differ by being both sandy and saline throughout. Delta soils are somewhat more poorly drained than Mathews soils and are silty in texture.

Vegetation: All areas of Mathews soils are cleared and cultivated. Rooting depth is generally restricted to about 75 cm by the high winter watertables.

General Land Use Comments: (1) Mathews soils are suited for most annual crops although perennials suffer from high watertables during the winter. Artificial drainage is required for winter watertable control. Irrigation is beneficial for good productivity during the summer. (2) High watertables and variable soil bearing strengths limit Mathews soils for urban and related uses. Basements and other excavations are likely to contain water during parts of the year while septic tank operation is severely limited by high watertables. Corrosion of unprotected, in-ground installations is likely because of saline soil conditions at depth.

MATSQUI SOILS

Location and Extent: Matsqui soils occupy scattered locations on the Fraser River floodplain, mostly in Matsqui Valley and on Nicomen Island. About 250 ha of pure map units and 1330 ha of soil complexes dominated by Matsqui soils are classified. The complexes are generally with Monroe, Fairfield, Grevell, Dewdney and Page soils.

Topography and Elevation: The topography of Matsqui soils is mostly undulating to gently rolling with some variation to gently undulating or moderately rolling. Slopes range from 1 to 10 percent. The soils usually occur on the higher parts of the associated landscape and elevations range between 4 and 15 m above sea level.

Plate 33 Southward view over Nicomen Island towards Sumas Mountain. The undulating lowland is typical of the silty Fraser River floodplain. Well drained Monroe or Matsqui soils are usual on the upper part of the undulations, imperfectly drained Fairfield or Dewdney soils are general on the slopes while poorly drained Page soils occupy the deeper swales.

Parent Material and Texture: The parent material of Matsqui soils is shallow (15 to 50 cm thick), stone-free, medium-textured, laterally accreted Fraser River floodplain deposits that overlie sand. Surface and subsurface textures are mostly silt loam with some variation to fine sandy loam or loam while the subsoils are medium or fine sand, sometimes containing thin, finer textured lenses.

Soil Moisture Characteristics: Matsqui soils are well to moderately well drained. They are moderately to rapidly pervious and have moderate water holding capacity and slow to moderate surface runoff. Areas outside the dykes may flood during the freshet season, depending on the height to which the Fraser River rises. Temporary groundwater tables often develop in the lower subsoil during periods when the river is high or after heavy, prolonged rain.

General Soil Description: Matsqui soils have a grayish-brown to dark grayish brown, friable, silty, cultivated surface about 20 cm thick. This is underlain by about 10 cm of brown or pale brown, weakly platy, friable, partially leached, silty material. Under this, in turn, is about 10 cm of brown to dark brown, friable, moderately blocky, silty material which is slightly enriched with eluviated clay and contains moderate amounts of clay flows and clay skins. This is underlain, usually abruptly, by grayish-brown to yellowish-brown, loose, single-grained sand containing thin, finer textured bands. Few to common, dark reddish brown to yellowish-red mottles sometimes occur below about 75 cm depth. Casts and other evidence of earthworm activity are often present in the upper soil. Soil reaction varies from strongly or medium acid in the upper part to medium or slightly acid in the subsoil. Soil classification is ***Eluviated Eutric Brunisol***.

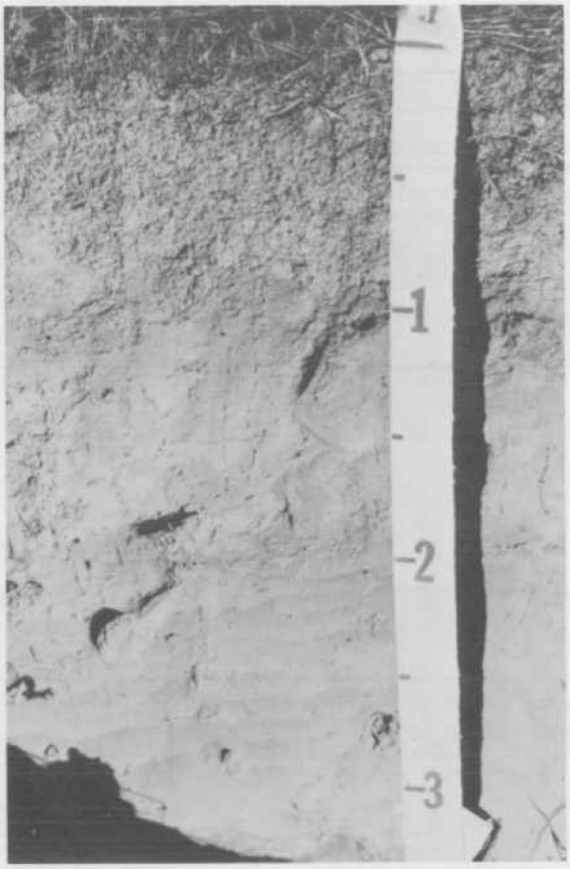

Plate 34 Matsqui soil profile (Eluviated Eutric Brunisol). The soil typically consists of about 8 in. (20 cm) of cultivated, silty material underlain by about 4 in. (10 cm) of weakly leached, silty material underlain by sand containing thin clay enriched lenses at 2 ft. (60 cm) depth.

Commonly Associated Soils: Monroe, Grevell, Dewdney, Fairfield, Seabird and Page soils usually occur in close association with Matsqui soils. Monroe soils are similar to Matsqui soils except that the depth to the underlying sand is more than 50 cm. Grevell and Seabird soils differ from Matsqui soils by being sandy to the surface. Seabird soils are also imperfectly drained. Fairfield and Dewdney soils have silty textures in the upper part similar to Matsqui soils, however, they also are imperfectly drained. Page soils are usually depressional in relation to Matsqui soils and are poorly drained.

Vegetation: Most areas of Matsqui soils are cleared and cultivated. The natural vegetation in the remaining, uncleared areas is variable and includes black cottonwood, birch, coast Douglas-fir, western red cedar, vine and bigleaf maple, occasional Sitka spruce, red alder, thimbleberry, salmonberry and blackberry. Rooting is unrestricted to depths of at least 100 cm.

General Land Use Comments: (1) Matsqui soils are suited for most agricultural crops although adverse topography may be somewhat limiting in a few areas. Droughtiness is common during the latter parts of most growing seasons because of relatively low waterholding capacity and irrigation is needed to maintain good productivity. Irrigation water is usually readily available from the nearby river, from sloughs or the relatively shallow groundwater table. Matsqui soils rarely occur as large areas; usually they are intimately intermixed with other soils which makes their individual management difficult. If land levelling is undertaken care should be exercised to avoid exposing the subsoil sand at the surface. The best method is to strip and stockpile the silty surface material, level the underlying sand, then respread the silty material back on the surface. (2) Matsqui soils provide some of the better locations for building sites on the floodplain landscape since they occur in the higher topographic positions. Variable bearing strengths however, may cause uneven subsidence if heavy structures are erected. Septic tank efficiency may be impeded during the freshet season when groundwater levels can rise to about 1 m from the soil surface. Excavations may also contain water during this period. (3) Growth of black cottonwood is moderately good on Matsqui soils. Data from a limited number of plots indicates that black cottonwood potentially can produce between 12 and 15 m^3/ha of wood per year. Islands in the Fraser River and other areas susceptible to periodic flooding or with poor access may be best used for crops such as cottonwood or hybrid European poplars.

McELVEE SOILS (ME)

Location and Extent: McElvee soils occur in scattered locations throughout the map area; the largest areas, however, occur on the lowlands in the eastern half. There are about 260 ha of pure map units and 340 ha of soil complexes dominated by McElvee soils. Most complexes are with Hopedale and Bates soils.

Topography and Elevation: Topographically, McElvee soils are gently undulating, undulating or gently sloping with slopes from 1 to 4 percent. In complexes with better drained soils, they usually occupy lower or depressional landscape positions. Elevations generally lie between 5 and 20 m above sea level.

Parent Material and Texture: McElvee soils have developed from medium-textured, stone-free, local stream deposits at least 50 cm deep, which overlie coarse-textured (sandy) sediments. Surface textures are usually silt loam, varying in a few areas to loam. Subsurface and upper subsoil textures are also mostly silt loam with some loam or silty clay loam and sometimes, thin, sandy bands. The lower subsoil grades to medium or coarse sand.

Soil Moisture Characteristics: McElvee soils are poorly drained. They are moderately pervious and have high to moderate water holding capacity and slow surface runoff. Watertables are near the surface during most the winter and after heavy, prolonged rains. Seepage from adjacent streams and higher land is common and temporary surface ponding occurs in some areas.

General Soil Description: McElvee soils have dark grayish brown to grayish-brown, friable, silty, cultivated surfaces about 20 cm thick. Underlying this is 30 cm or more of massive, grayish-brown, firm, silty material containing common to many, yellowish or reddish mottles and, sometimes, thin, sandy lenses. This then either changes abruptly or gradually grades to loose, coarse sand. Soil reaction is usually medium acid throughout (1:1 H_2O). Soil classification is mostly ***Rego Gleysol*** with some inclusions of Orthic Gleysol where small amounts of eluviated clay have accumulated in the subsurface.

Commonly Associated Soils: Hopedale, Bates and Sim soils often are closely associated with McElvee soils. Hopedale soils are similar to McElvee soils except that the underlying sand is encountered between 20 and 50 cm of the surface. Bates soils have textures similar to McElvee soils but usually occupy slightly higher landscape positions and are imperfectly drained. Sim soils differ by having black surfaces in contrast to the grayish colours of McElvee soils.

Vegetation: Most areas of McElvee soils are cleared and cultivated. Uncleared areas support, among others, black cottonwood, western red cedar, red alder, willow, vine and bigleaf maple, salmonberry, thimbleberry, blackberry, sedges and grass. Rooting depth is usually restricted to about 75 cm by high watertables.

General Land Use Comments: (1) Poor drainage, the main agricultural limitation of McElvee soils, limits the overwintering of most perennial crops. Annual crops are usually less affected but wet soil conditions can retard planting times. Artificial drainage is beneficial for good production of all crops. (2) McElvee soils are poorly suited for most urban or related uses. Variable soil bearing strengths may cause uneven subsidence if heavy structures are erected and basements or other excavations are likely to contain water for at least part of the year. Septic tank effluent disposal is severely impeded by the high watertables. (3) McElvee soils appear well suited for forest crops such as black cottonwood. Potential annual wood production by this species is estimated at 12 to 15 m^3/ha.

McLELLAN SOILS (ML)

Location and Extent: McLellan soils are found only in the Serpentine Valley of Surrey Municpality where about 15 ha of pure map units and 210 ha of soil complexes dominated by McLellan soils are classified. The complexes are mainly with Vinod and Richmond soils.

Topography and Elevation: McLellan soils are gently undulating to undulating with slopes between 1 and 5 percent. They occur mainly as low, sinuous ridges with depressed centers and occupy slightly higher topographic positions than the adjacent soils. They all lie less than 2 m above sea level.

Parent Material and Texture: McLellan soils have developed from moderately fine to fine-textured, mixed marine and freshwater deltaic deposits which have been exposed by the subsidence and decomposition of organic deposits which formerly covered them. Surface and subsurface textures vary from silty clay loam to silty clay; the upper subsoil textures are similar but gradually change to silt loam below about 60 cm. Saline conditions usually occur below 1 m and at this depth substantial amounts of compounds high in sulphur occur also.

Soil Moisture Characteristics: McLellan soils are poorly drained. They are slowly pervious and have high water holding capacity and moderate surface runoff. Watertables are near the surface for most of the rainy winter period but retreat somewhat over the growing season.

General Soil Description: McLellan soils have a clayey, cultivated surface about 20 cm thick which is dark grayish brown or grayish-brown, blocky, firm when moist and very hard when dry. It consists of mixed organic (peaty) material and clayey mineral sediments and contains variable amounts of reddish mottles. The surface is underlain by about 30 cm of dark grayish brown to grayish-brown, massive to coarsely prismatic, clayey material which is firm when moist, sticky when wet and contains variable amounts of reddish mottles. Vertical cracks up to 2 cm wide and at intervals of 10 to 30 cm develop when the soil dries. This zone grades to dark gray, massive, silty material containing common, reddish mottles mostly confined to old root channels and becomes saline at about 100 cm. Soil reactions range from strongly acid in the surface to extremely acid in the subsoil (1:1 H_2O). Soil classification is usually ***Orthic Gleysol*** with some included Orthic Humic Gleysol where the surface is darker than usual.

Commonly Associated Soils: Vinod and Richmond soils are generally closely associated with McLellan soils. Both usually lie in slightly lower landscape positions than do McLellan soils. Vinod soils differ from McLellan soils by having between 15 and 40 cm of organic material on the soil surface while Richmond soils differ by consisting of 40 to 160 cm of well-decomposed organic material.

Vegetation: Most areas are cleared and cultivated. Scattered, uncleared areas support a variety of vegetation including bog birch, western red cedar, shore pine, red alder, willow, Labrador tea, hardhack, bracken, and various mosses. Rooting is limited mainly to the upper 50 cm by the dense subsoil and high watertables. In the subsurface and subsoil the roots are mostly concentrated along vertical cracks.

General Land Use Comments: (1) Poor drainage and dense subsoils are the main agricultural limitations of McLellan soils. Perennial crops suffer during the winter and annuals are depressed by restricted rooting depths. Artificial drains and subsoiling helps to improve both moisture movement and rooting depth. The soils tend to puddle easily and should not be cultivated when wet. McLellan soils occupy small, irregularly shaped areas making them difficult to manage separately from adjacent soils. (2) McLellan soils are unsuited for urban and related uses. Variable bearing strengths cause foundation problems; excavations are likely to contain water due to high watertables and occasional flooding is likely. Septic tanks function poorly because of high watertables and low soil permeability. Corrosion of unprotected underground installations is likely due to saline subsoil conditions.

MILNER SOILS (ML)

Location and Extent: Milner soils occupy substantial areas in the Langley Valley and near Cloverdale and Hazelmere. Although only about 95 ha of pure map units are classified, a further 1500 ha of soil complexes dominated by Milner soils also occur. The complexes are mainly with Cloverdale, Berry, Carvolth and Sunshine soils.

Topography and Elevation: Most areas of Milner soils are gently undulating to gently rolling with slopes to 9 percent. A few areas along gullies and stream banks are steeply sloping or strongly rolling with slopes to 30 percent. In soil complexes with more poorly drained soils, Milner soils occur in the topographically highest landscape positions. Elevations range from 5 to 30 m above sea level.

Parent Material and Texture: Milner soils have developed from deep, fine to moderately fine textured, stone-free marine deposits. Surface textures are usually silt loam, varying occasionally to loam or silty clay loam. Subsurface textures vary from silty clay loam to clay loam while the compact subsoil ranges from clay to silty clay.

Soil Moisture Characteristics: Milner soils are moderately well drained. They are moderately pervious in the surface and subsurface but this decreases to slowly pervious in the subsoil. They have high water holding capacity and slow to moderate surface runoff. During heavy rains a temporary, perched watertable develops above the slowly permeable subsoil.

General Soil Description: Milner soils, in uncleared areas, have up to 5 cm of raw to well-decomposed, organic forest litter on the soil surface. The surface mineral soil consists of about 20 cm of dark reddish brown to yellowish-red, friable, weakly structured, silty material usually containing numerous, hard, spherical concretions. This is underlain by a dark yellowish brown to yellowish-brown, silty zone about 30 cm thick which is friable to firm, moderately subangular blocky in structure and contains occasional concretions. In turn, this is underlain by about 15 cm of olive to olive-gray, firm, moderately structured, partially leached, silty material which grades to about 50 cm of grayish-brown to olive-gray, very firm, prismatic structured clayey material enriched with eluviated clay. The clay enriched layer then grades below 1 m to massive, grayish-brown, clayey, marine sediments that are very firm. These sediments fracture conchoidally and have dark brown or black coatings along fracture faces and contain common, yellowish-brown mottles. Soil reaction in the upper 70 cm varies from very strongly to extremely acid, then gradually increases to slightly acid below about 200 cm. Soil classification is *Luvisolic Humo-Ferric Podzol*.

Commonly Associated Soils: Berry, Cloverdale and Sunshine soils are commonly associated with Milner soils. Berry soils have textures similar to Milner soils but are imperfectly drained and usually lie at slightly lower landscape positions. Cloverdale soils differ by being poorly drained and having dark gray or black surfaces. Sunshine soils differ by being sandy in the upper 50 to 150 cm.

Vegetation: Substantial areas of Milner soils are cleared and cultivated. Uncleared areas support a variable forest which includes coast Douglas-fir, western red cedar, some western hemlock, grand fir and Sitka spruce, red alder and vine maple. The understory includes blackberry, thimbleberry, elderberry, salmonberry, bracken, salal, and various ferns and grasses. Rooting depth is mainly limited to about 70 cm by dense, clayey subsoil layers.

General Land Use Comments: (1) Milner soils are generally well suited for most agricultural crops although temporary perched watertables may inhibit growth of those crops strongly susceptible to these conditions. Adverse topography may also be limiting in some locations. (2) Urban or related uses are only moderately suited for Milner soils. Variable soil bearing strengths and high shrink-swell conditions in the subsoil may require special foundation considerations while excavations, due to slow permeability, will probably contain water during periods of heavy rainfall. Septic tank disposal fields generally function poorly because of slow subsoil permeability. (3) Forest growth on Milner soils appears to be moderately good. Estimated potential annual wood production of coast Douglas-fir is about 9 to 12 m^3/ha.

MONROE SOILS

Location and Extent: Monroe soils are common on the floodplain of the Fraser River east from the confluence with the Pitt River. The largest areas are in Matsqui Valley and on Nicomen Island. About 110 ha of pure map units and 1290 ha of soil complexes dominated by Monroe soils are classified. The complexes are mostly with Fairfield, Matsqui and Page soils.

Topography and Elevation: Monroe soils are mostly gently undulating or undulating, sometimes varying to gently or moderately rolling. Slope gradients are less than 10 percent. The soils occupy the topographically higher landscape positions when in complexes with poorer drained soils. Elevations range from about 4 to 15 m above sea level.

Parent Material and Texture: Monroe soils have developed from medium-textured, stone-free Fraser River floodplain deposits that are more than 50 cm deep and overlie coarse-textured deposits, mainly sand. Surface and subsurface textures are usually silt loam, occasionally varying to fine sandy loam, loam or silty clay loam. The upper subsoil textures are similar but change at depth to sand or loamy sand, sometimes interstratified with thin, finer textured bands.

Soil Moisture Characteristics: Monroe soils are moderately well to well drained. They are moderately pervious and have high water holding capacity and slow to moderate surface runoff. Temporary groundwater tables may develop in the subsoil during the freshet period on the Fraser River or during heavy, prolonged rain.

General Soil Description: Monroe soils generally have a grayish-brown, friable, cultivated silty surface about 20 cm thick which is underlain by about 15 cm of brown or brownish-gray, friable, weakly subangular blocky to fine platy, partially leached, silty material. In turn, this is underlain by a dark brown to dark yellowish brown, friable, moderately subangular blocky zone about 50 cm thick that is slightly enriched with eluviated clay in the upper part and contains scattered clay flows and skins. It grades with increasing depth to loose sand or, sometimes, sand interspersed with thin, finer textured bands and contains few to common, brownish or reddish mottles below about 100 cm. Casts and other evidence of earthworm activity are usually present in the upper 50 cm. Soil reactions vary from very strongly or strongly acid in the surface and grade to medium or slightly acid at depth. Soil classification is *Eluviated Eutric Brunisol*.

Commonly Associated Soils: Fairfield, Matsqui, Dewdney and Page soils are usually associated in the undulating landscape with Monroe soils. Fairfield soils differ from Monroe soils by being imperfectly drained and usually lie in slightly lower landscape positions. Matsqui soils have textures similar to Monroe soils but the underlying sand occurs within 20 to 50 cm of the surface; Dewdney soils are similar to Matsqui soils and additionally, are imperfectly drained. Page soils, generally depressional in relation to Monroe soils, are poorly drained.

Vegetation: Most Monroe soil areas are cleared and cultivated. The remaining, small, uncleared areas support, among others, black cottonwood, red alder, vine and bigleaf maple, birch, coast Douglas-fir, western red cedar, occasional Sitka spruce, blackberry, thimbleberry, salmonberry, and grass. Rooting is unrestricted to at least 100 cm depth.

General Land Use Comments: (1) Monroe soils are well suited for most agricultural crops although adverse topography may be somewhat limiting in a few areas. Irrigation is beneficial during dry summers to maintain good production. If land levelling is undertaken, care should be taken to avoid exposing the sandy subsoil material since this will lower the soil's water holding capacity. A suggested method is to stockpile the silty upper material, level the underlying sand, then spread the stockpiled soil. Monroe soils usually occupy relatively small, individual areas with convoluted boundaries making them difficult to manage as discrete units. (2) Monroe soils are among the better building sites on the Fraser River floodplain. The soils are relatively well drained although variable bearing strengths may require special foundation construction. Septic tanks usually function well. Where not dyked, Monroe soil areas are susceptible to flooding during the Fraser River freshet period. (3) Monroe soils are well suited for the production of forest crops such as black cottonwood and data from a limited number of plots indicates this species potentially produces between 12 and 15 m^3/ha of wood per year. Production of black cottonwood and hybrid European poplars should be considered for relatively inaccessible areas such as the islands in the Fraser River, or undyked areas susceptible to flooding.

MURRAYVILLE SOILS

Location and Extent: Murrayville soils occupy scattered, upland areas, mainly in the Langley Valley and on Bowen Island. There are about 35 ha of pure map units and 740 ha of soil complexes dominated by Murrayville soils. The complexes are with Livingstone, Berry, Bose, Sunshine and Milner soils.

Topography and Elevation: The topography of Murrayville soils varies from gently undulating to moderately rolling with slopes up to 15 percent. Elevations are between 15 and 40 m above sea level in the Langley Valley but rise to over 100 m on Bowen Island.

Parent Material and Texture: Murrayville soils have developed from about 50 to 100 cm of moderately coarse to medium-textured, stone-free littoral or fluvial deposits that overlie fine-textured marine sediments. Surface textures are loam or fine sandy loam while subsurface textures vary from loamy fine sand to sandy loam. The texture of the underlying marine sediments varies from clay to silty clay.

Soil Moisture Characteristics: Murrayville soils are mostly imperfectly drained with some moderately well drained inclusions. They are moderately pervious in the surface and subsurface layers but this decreases to slowly pervious in the clayey subsoil. These soils have moderate water holding capacity and slow surface runoff. Perched watertables above the dense subsoil are usual during the winter and other times of prolonged rain.

General Soil Description: Murrayville soils have up to about 5 cm of organic forest litter on the soil surface. This is underlain by a dark reddish brown, friable, loamy layer about 20 cm thick that contains scattered, fine, spherical concretions. This layer grades to about 50 cm of dark brown to dark yellowish brown, very friable, fine sandy material containing few to common, reddish mottles in the lower part. This, in turn, is underlain, often abruptly, by about 10 cm of olive-brown, firm, blocky, partially leached, clayey material containing common, brownish or yellowish mottles. Under this is about 50 cm of olive-gray, very firm, prismatic structured, dense, clayey material slightly enriched with eluviated clay, and containing few to common clay skins and flows as well as common to many, prominent, yellowish-red mottles. Below about 130 cm, massive, clayey, olive-gray, unweathered marine sediments occur containing common, reddish mottles. Soil reaction varies from strongly to moderately acid in the upper 70 cm, then gradually increases to neutral below about 100 cm (1:1 H_2O). Soil classification is mostly ***Gleyed Humo-Ferric Podzol***, with some Luvisolic Humo-Ferric Podzol present where subsoil eluvial clay enrichment is greater than usual.

Commonly Associated Soils: Berry, Milner, Livingstone, Sunshine and Bose soils often occur in close association with Murrayville soils. Berry and Milner soils differ from Murrayville soils by lacking the loamy to sandy surface and subsurface textures; they are silty instead. Livingstone soils have textures similar to Murrayville soils but are moderately poorly to poorly drained and have black surfaces. Sunshine soils differ by having sandy surface, subsurface and subsoil textures and are well to moderately well drained. Bose soils have gravelly surface and subsurface textures.

Vegetation: Most Murrayville soil areas are cleared and cultivated. Uncleared areas support, among others, black cottonwood, coast Douglas-fir, western red cedar, red alder, vine maple, blackberry, thimbleberry, salmonberry, bracken and grass. Rooting is mainly restricted to the zone above the dense subsoil, usually about 90 cm, but some roots penetrate to in excess of 100 cm.

General Land Use Comments: (1) Murrayville soils are well suited for most agricultural crops. They are friable, relatively level and have good rooting depth. Irrigation is beneficial during most summers for ensuring good growth. Periodic high watertables may adversely affect crops sensitive to periodic wet conditions. This applies mainly to overwintering perennial crops since the perched watertables are most prevalent during this period. Murrayville soils are usually intimately intermingled with other soils, and for this reason are usually difficult to manage on an individual basis. (2) Urban or similar uses for Murrayville soils are somewhat limited by variable bearing strengths and high shrink-swell potential of the subsoil clay and these may require special foundation considerations. Excavations will probably contain water during parts of the year and septic tank effluent disposal is limited by low subsoil permeability. (3) Murrayville soils are well suited for forest crops such as Douglas-fir. This species is estimated to produce from 12 to 15 m^3/ha of wood per year.

NEAVES SOILS (NV)

Location and Extent: Neaves soils occur only in northern Pitt Meadows Municipality and in the Pitt Polder area. There are 240 ha of pure map units and 85 ha of soil complexes dominated by Neaves soils. The complexes are mostly with Alouette and Sturgeon soils.

Topography and Elevation: Neaves soils are mainly level to gently undulating; a few areas are undulating. Slopes are all less than 3 percent. Neaves are usually slightly depressional in relation to adjacent soils and lie less than 4 m above sea level.

Parent Material and Texture: Neaves soils have developed from medium-textured, stone-free, mixed floodplain deposits of the Alouette, Pitt and Fraser Rivers which are more than 50 cm thick and overlie sand. The surface texture is silt loam and contains about 10 percent organic matter; the subsurface and upper subsoil are also usually silt loam but vary occasionally to loam. The lower subsoil gradually changes to sand or loamy sand below about 80 cm.

Soil Moisture Characteristics: Neaves soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is near, and sometimes at, the soil surface during most of the winter but recedes slightly during the growing season. Surface ponding is common after heavy rains.

General Soil Description: Neaves soils have a very dark grayish brown to dark grayish brown, friable to firm, silty, cultivated surface layer about 20 cm thick. It contains about 10 percent organic matter in various stages of decomposition. The surface layer is underlain by about 30 cm of dark grayish brown, firm, massive, silty material containing few to common, yellowish-brown mottles. This then grades to about 40 cm of grayish-brown, gray, or dark gray, massive, silty or loamy material containing common, prominent, yellowish-red to strong brown mottles and old, vertical, dead roots. Under this is dark gray to greenish-gray, massive, sandy material, usually saturated. Soil reaction gradually increases from extremely acid in the surface to medium acid below about 100 cm depth. Soil classification is ***Rego Gleysol***.

Commonly Associated Soils: Alouette, Pitt and Sturgeon soils often occur in close association with Neaves soils. Alouette and Sturgeon soils differ from Neaves soils by having organic surfaces between 15 and 40 cm thick. Pitt soils lie in slightly higher landscape positions and are clayey in texture.

Vegetation: Most areas of Neaves soils are cleared and cultivated. Uncleared areas support willow, hardhack, sedges, reeds, and other moisture tolerant species. Rooting depth is mainly restricted to the upper 50 cm by high groundwater tables.

General Land Use Comments: (1) Poor drainage limits Neaves soils for most agricultural crops and artificial drainage is required for good production. The high watertables are particularly damaging for perennials during the winter months. Liming is beneficial to ameliorate the extremely acid surface conditions. (2) Urban and related uses are not suited for Neaves soils. Variable soil bearing strengths require special foundation considerations; watertables are at or near the surface for most of the year thereby making basements and other excavations impractical and periodic surface flooding is likely. Septic tank effluent disposal is severely impaired by the poor drainage conditions.

NEPTUNE SOILS (NP)

Location and Extent: Neptune soils only occur in a few, small areas in south Delta Municipality where they are mapped as a secondary component of soil complexes dominated by Tsawassen soils.

Topography and Elevation: The topography of Neptune soils varies from gently undulating to undulating with slopes less than 3 percent. All areas lie less than 5 m above sea level.

Parent Material and Texture: Neptune soils have developed in man-made (midden) deposits of shells and other sea-life overlying or mixed with coarse-textured beach deposits. Surface and subsurface textures consist of mixed shell remnants and sand while subsoil textures gradually become dominantly sand with increasing depth.

Soil Moisture Characteristics: Neptune soils are moderately well to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Groundwater tables rise periodically into the lower subsoil during the winter months.

General Soil Description: Neptune soils, where not cultivated, have a thin layer (less than 5 cm thick) of organic forest litter on the soil surface. This is underlain by a black to grayish-black, loose mixture of sand and shell fragments. This usually extends to a depth of at least 50 cm, then gradually grades to grayish, loose sand containing a few, reddish or yellowish mottles below about 100 cm. Soil classification varies form ***Orthic Regosol*** to ***Humic Regosol*** depending on the thickness of the dark coloured surface layer.

Commonly Associated Soils: Tsawwassen soils occur in association with Neptune soils. They differ from Neptune soils by lacking shell fragments in the surface and subsurface. The colour of the surface layer of Tsawwassen soils is also much lighter than that of Neptune soils.

Vegetation: The few, remaining remnants of native vegetation are variable in composition but include coast Douglas-fir, western red cedar, Sitka spruce, red alder and willow. Rooting depth is unrestricted to at least 100 cm.

General Land Use Comments: Neptune soils occupy only a few, small sites and are not important in an areal context. They are however, archeological sites related to the native peoples of the Lower Mainland. They are limited agriculturally by low waterholding capacities and irrigation is required for good agricultural production. (2) For urban uses they are limited by periodic groundwater tables which limit construction of basements and other excavations. Septic tank effluent disposal is usually adequate although incomplete filtration may occur due to the coarse texture of the subsoil.

NICHOLSON SOILS

Location and Extent: Nicholson soils occur throughout the uplands of the map area but are most common in Langley, Surrey and Matsqui Municipalities. About 640 ha of pure map units and 4820 ha of soil complexes dominated by Nicholson soils are mapped. The complexes are usually with Whatcom, Scat, Albion, Bose and Sunshine soils.

Topography and Elevation: The topography of Nicholson soils is mostly undulating to moderately rolling with slopes between 2 and 15 percent. Some steeply or very steeply sloping gullies and escarpments with slopes over 50 percent also occur. Nicholson soils are usually located on the tops and upper slopes of the ridges and knolls in the uneven landscape. Elevations range from 15 to 115 m above sea level.

Parent Material and Texture: Nicholson soils have developed from moderately fine and sometimes fine-textured, compact, glaciomarine deposits which contain a few pebbles and stones. In the eastern half of the map area, variable amounts of silty, eolian material, up to 25 cm thick, either overlies or is mixed into the surface of the glaciomarine deposits. Surface textures are usually silt loam, with some variation to loam or silty clay loam. Subsurface textures are silt loam or silty clay loam while the subsoil ranges from silty clay loam to silty clay or, occasionally, clay.

Soil Moisture Characteristics: Nicholson soils are generally moderately well drained although some imperfectly drained areas are also included. They are moderately pervious in the surface and subsurface layers but this decreases to slowly pervious in the compact subsoil. They have high soil moisture holding capacity and moderate to slow surface runoff, depending on steepness of the slopes. A temporary, perched watertable usually develops above the compact subsoil during periods of heavy rain and lateral seepage along the surface of the compact material occurs at this time.

General Soil Description: Nicholson soils, when cultivated, have a dark reddish brown, weakly structured, friable, silty surface about 15 cm thick. This is underlain by a yellowish-red to reddish-brown, friable, weakly structured zone about 20 cm thick that contains variable amounts of small, sherical, hard, reddish-brown concretions (these somtimes occur in the surface also). Under this, in turn, is a firm, subangular blocky, yellowish-brown to pale brown, silty, partially leached zone about 10 cm thick which contains few to common, reddish mottles. The leached zone grades to gray or dark grayish brown, clayey material about 50 cm thick that is very firm when moist, extremely hard when dry, cracks into coarse, prismatic peds, and contains numerous clay flows on ped surfaces. This clay enriched zone grades to dark grayish brown or brown, compact, clayey, unweathered glaciomarine sediments below about 100 cm. The unweathered material fractures conchoidally and has black castings on fracture faces. Soil reaction gradually increases from very strongly acid in the surface to slightly acid or neutral below about 100 cm. The unweathered material fractures conchoidally and has black coatings on fracture faces. Soil reaction gradually increases from very strongly acid in the surface to slightly acid or neutral below about 100 cm. Soil classification is mainly *Podzolic Gray Luvisol* although some Orthic Humo-Ferric Podzol areas are also included where the clay enrichment in the subsoil is not sufficient to meet the criteria of Luvisolic soils.

Commonly Associated Soils: Whatcom, Scat, Albion, Sunshine and Bose soils are usually closely associated with Nicholson soils, either as components of soil complexes or occupying adjacent map polygons. Whatcom soils are similar to Nicholson soils except that the clay enriched subsoil layer occurs at greater depth. Scat and Albion soils both differ from Nicholson soils by being poorly drained; they also have black surfaces. Sunshine and Bose soils differ by respectively having sandy and gravelly surface and subsurface layers over clayey deposits similar to those of Nicholson soils.

Vegetation: Substantial areas of Nicholson soils are cleared and cultivated. The remaining, uncleared areas support a variable second-growth forest including coast Douglas-fir, western red cedar, red alder, vine maple, cascara and some western hemlock. The understory contains a variety of species including thimbleberry, salmonberry, bracken, blackberry, and moss. Rooting is mainly restricted to the upper 50 to 60 cm by the dense, compact, clayey subsoil.

General Land Use Comments: (1) Except where severely limited by adverse topography, Nicholson soils are generally moderately to well suited for most agricultural crops. Annual crops usually do well although rooting restrictions due to the dense subsoil may sometimes be somewhat limiting. Perennial crops very susceptible to temporary, perched watertables will suffer during the winter months and artificial drainage may be beneficial for these crops. Land levelling which exposes the dense, clayey subsoil is discouraged. Not only will several years of intensive soil management such as substantial manuring and deep plowing be required to return the soil to its previous productivity, trafficability will also be reduced because of the clayey nature of the new surface soil. Nicholson soils are usually intimately intermingled with other soils which often makes them difficult to manage as discrete areas. (2) Nicholson soils are moderately to poorly suited for urban or similar uses. Soil bearing strengths are variable and excavation is difficult due to high clay contents. Sediment yield from runoff is high. Excavations are likely to contain water through parts of the year and septic tank disposal fields will function inefficiently due to the low soil permeability. (3) Trees grow well although rooting depth is somewhat restricted by the dense subsoil. Data from a limited number of plots indicates potential annual wood production by Douglas-fir to be between 9 and 12 m^3/ha. Wood-lots or similar uses should be considered in areas where adverse topography limits agricultural uses.

NICOMEKL SOILS (NK)

Location and Extent: Nicomekl soils occur only on the lowlands of Surrey Municipality near Mud Bay and in the Serpentine—Nicomekl valley. About 30 ha of pure map units and 150 ha of soil complexes dominated by Nicomekl soils are mapped. The complexes are mostly with Sandel and Goudy soils.

Topography and Elevation: Nicomekl soils are gently undulating to undulating with slopes less than 5 percent. They usually occupy slightly higher topographic positions when compared to adjacent soils but all lie less than 3 m above sea level.

Parent Material and Texture: The parent material of Nicomekl soils are medium to moderately fine textured local stream deposits, mainly from the Nicomekl and Serpentine rivers, that are mixed with some deltaic deposits. Surface and subsurface textures are mostly silt loam with some loam or silty clay loam inclusions. Subsoil textures are similar in the upper part but grade to loam or fine sandy loam and sometimes sand at depth. Saline conditions and compounds high in sulphur are usually present below 100 cm depth.

Soil Moisture Characteristics: Nicomekl soils are poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The groundwater table is near the soil surface for most of the winter, after prolonged heavy rain and during other periods when the water levels in the adjacent rivers are high.

General Soil Description: Nicomekl soils generally have a black, friable, granular, cultivated silty surface layer about 20 cm deep which contains between 15 and 25 percent organic matter. The surface layer is underlain by grayish-brown to gray, silty material about 30 cm thick which is firm when moist, very hard when dry and contains vertical cracks between 10 and 20 cm apart. Common, reddish mottles are also present. This layer then grades to massive, dark gray to gray, silty material 50 cm or more thick. Common, reddish mottles are usual in the upper part; these change to yellowish below about 1 m and at this depth, compounds high in sulphur are also present. Soil reaction grades from strongly acid in the surface to extremely acid in the subsoil (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Sandel, Embree, Kitter and Goudy soils are usually closely associated with Nicomekl soils. Sandel soils differ from Nicomekl soils by lacking the dark coloured surface layer and being saline within 100 cm of the surface. Embree soils also differ by being saline within 1 m of the surface in addition to containing an organic band, usually 10 to 40 cm thick, in the subsurface. Kitter soils are somewhat better drained than Nicomekl soils and lack a black surface layer. Goudy soils have organic surface and subsurface layers as well as being saline below about 50 cm.

Vegetation: Nicomekl soils are essentially all cleared and cultivated. A few, relatively natural, uncleared areas such as those along fence lines support mostly deciduous species including willow, blackberry, sedges, reeds as well as some western red cedar. Rooting depth is usually restricted to the upper 60 cm by high groundwater tables and relatively dense subsoil layers.

General Land Use Comments: (1) Nicomekl soils are used mainly for agricultural crops. High watertables and poor drainage limit production and perennials suffer during the winter months. Artificial drainage is required for good watertable control and improved productivity. (2) Urban and similar uses are generally not suited for Nicomekl soils. Variable, usually low, soil bearing strengths often require that special foundations be considered while excavations such as basements will contain water for large portions of the year. Septic tank effluent disposal fields are inefficient due to high watertables and saline subsoil conditions will likely cause severe corrosion of unprotected, underground installations.

NIVEN SOILS (NN)

Location and Extent: Niven soils occupy small, scattered areas on the Fraser River floodplain, usually near the boundary between organic and mineral soils. About 160 ha of pure map units and 85 ha of soil complexes dominated by Niven soils are mapped. The complexes are usually with Hallert, Hjorth or Annis soils.

Topography and Elevation: Niven soils are nearly level to gently undulating with slopes less than 2 percent and often are slightly depressional in relation to adjacent soils. Elevations lie less than 10 m above sea level.

Parent Material and Texture: Niven soils have developed from moderately fine to medium-textured Fraser River floodplain deposits, usually 30 to 80cm thick, which overlie variably decomposed, organic materials. Surface and subsurface textures are silty clay loam or silt loam. The textures of the upper subsoil, where the mineral deposits are sufficiently thick, are similar. Generally, however, the subsoil is variably decomposed organic material, often containing thin, silty bands.

Soil Moisture Characteristics: The drainage of Niven soils is poor to very poor. They are moderately pervious and have high water holding capacity and slow surface runoff. The groundwater table is near, and sometimes at, the soil surface for most of the winter although it recedes somewhat during the growing season. Surface ponding is common after heavy, prolonged rains.

General Soil Description: Niven soils generally have a dark gray to gray, silty, cultivated surface layer, about 15 cm thick, which is friable to firm and moderately subangular blocky structured. It is underlain by about 30 cm of massive, gray, very firm, silty to clayey material containing common, dark brown to reddish-brown mottles. This then grades to about 15 cm of alternating thin bands of gray, massive, silty material and very dark brown, partially to well-decomposed organic material. Under this is 50 cm or more of mainly dark brown, massive, peat or muck which usually contains some silt, either disseminated through the organic material or occurring as occasional, thin, gray bands. Soil reaction varies from strongly to very strongly acid in the surface to medium or strongly acid in the subsoil (1:1 H_2O). Soil classification is ***Rego Gleysol***.

Commonly Associated Soils: Hallert, Hjorth, Annis and Hazelwood soils are often closely associated with Niven soils. Hallert soils differ from Niven soils by consisting of alternating organic and silty mineral bands to 1 m or more. Hjorth, Annis and Hazelwood soils all lack the subsoil organic material that is present in Niven soils. Additionally, Hjorth soils differ by being silty throughout, while Annis soils have an organic surface layer and Hazelwood soils are clayey.

Vegetation: Most areas of Niven soils are cleared and cultivated. Uncleared areas support a variety of moisture tolerant species including western red cedar, willow, vine maple, red alder, skunk cabbage, sedges and reeds. Rooting depth is mainly restricted to the upper 50 cm by the high, prolonged groundwater tables.

General Land Use Comments: (1) The main agricultural limitation of Niven soils is poor drainage. Most perennial crops suffer substantially during the winter months while cultivation and planting is retarded during the spring. Artificial drainage is required for adequate watertable control. The watertable, however, should not be lowered more than necessary for good crop growth in order to avoid undue subsidence of the underlying organic material. (2) Urban and similar uses are not suited to Niven soils. Soil bearing strengths are low, high watertables preclude basements and other excavations, periodic surface flooding is probable and septic tank effluent disposal fields are severely inhibited by high groundwater levels.

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PAGE SOILS (PE)

Location and Extent: Page soils occupy substantial areas of the Fraser River floodplain, particularly on Nicomen Island and in Matsqui Valley. About 580 ha of pure map units and 1600 ha of soil complexes dominated by Page soils are mapped. The complexes are mostly with Fairfield, Hjorth, Prest, and Dewdney soils.

Topography and Elevation: The topography of Page soils varies from nearly level to very gently sloping and undulating. Slope gradients are less than 4 percent. The soils usually occupy landscape positions which are slightly lower or depressional in relation to adjacent soils and elevations generally are less than 10 m above sea level.

Parent Material and Texture: Page soils have developed from medium to moderately fine textured Fraser River floodplain deposits, at least 50 cm thick, which overlie medium to fine sand. Surface and subsurface textures are silt loam or silty clay loam; the upper subsoil has similar textures but changes to sand or loamy sand below depths of 50 cm or more. A few areas where the underlying sand is encountered between 20 and 50 cm below the surface are also included.

Soil Moisture Characteristics: Page soils are poorly to moderately poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. Watertables are near the soil surface for most of the winter and during the freshet period of the Fraser River but gradually recede after that. Surface ponding is common during heavy rains due to relatively slow infiltration and percolation rates and runoff accumulation from adjacent, higher areas.

General Soil Description: Page soils have a dark gray, firm, subangular blocky, silty, cultivated surface about 15 cm thick. The surface is underlain by a silty to clayey zone about 40 cm thick which is firm, blocky structured and contains many, prominent, strong brown to reddish mottles. This zone then grades to a massive, gray, silty layer about 30 cm thick containing common, reddish or brownish mottles. Underlying this are alternating sandy and silty lenses or loose sand. Soil reactions usually range from strongly acid in the surface to medium acid in the subsoil. Soil classification is *Orthic Gleysol*. A few, small areas of Page:shallow variant soils are also mapped. These soils are similar to the usual Page soils except that the underlying sand occurs within 20 to 50 cm of the surface rather than below 50 cm as is the usual case.

Commonly Associated Soils: Fairfield, Monroe, Hjorth and Dewdney soils are closely associated with Page soils. Hjorth soils differ from Page soils by having a black surface but are poorly drained similar to Page soils. Fairfield and Dewdney soils usually lie topographically higher than Page soils and are imperfectly drained. Monroe soils are also topographically higher and are well drained.

Vegetation: Most areas are cleared and cultivated. Remaining natural vegetation is mostly deciduous and includes, among others, willow, birch, black cottonwood, red alder, sedges and reeds. Rooting depth is restricted mainly to the upper 60 cm by the high groundwater tables.

General Land Use Comments: (1) Agriculturally, Page soils are limited by high watertables and poor drainage. Most perennial crops suffer substantially during the winter months while high watertables interfere with cultivation and crop growth during the spring freshet period. Artificial drainage should be installed to achieve the soils' production potential. Because of Page soils' usual depressional landscape position, adequate drainage outlets are sometimes difficult to locate. Page soils are usually intimately intermixed with other soils and therefore are often difficult to manage on an individual basis. (2) Page soils are poorly suited for urban or similar uses. They have variable, usually low, bearing strengths; basements and similar excavations are likely to contain water for at least part of the year and surface flooding is likely in some areas. Effluent disposal from septic tanks is severely impaired by high groundwater tables. (3) Trees such as cottonwood appear well suited for growth on Page soils. Data from a limited number of plots indicates annual potential wood production by this species to be between 12 and 15 m^3/ha.

PALISADE SOILS (PA)

Location and Extent: Palisade soils are relatively common at the upper elevations in the mountainous, northern part of the map area. About 190 ha of pure map units and 3630 ha of soil complexes dominated by Palisade soils are mapped. The complexes are mostly with Sayres, Dennett and Whonnock soils and Talus and Rock Outcrop land types.

Topography and Elevation: Palisade soils are usually very steeply sloping with some variation to extremely sloping. Slope gradients are in excess of 30 percent and elevations range upwards from 800 m above sea level.

Parent Material and Texture: Palisade soils have developed from moderately coarse textured, stony colluvial deposits at least 1 m deep and overlying mostly bedrock or sometimes, compact glacial till. The soil surface consists of mostly well-decomposed organic forest litter up to 25 cm thick. The upper mineral soil material varies from gravelly loam to gravelly sandy loam and grades to gravelly sandy loam or gravelly loamy sand with increasing depth. Coarse fragment content varies from about 30 to 50 percent in the upper part of the mineral soil to between 50 and 80 percent below 100 cm.

Soil Moisture Characteristics: Palisade soils are moderately well drained. They are moderately to rapidly pervious and have moderate to low water holding capacity and moderate surface runoff. Telluric downslope seepage is usual below about 100 cm depth during snowmelt and heavy rains.

General Soil Description: Palisade soils generally have from 15 to 25 cm of organic forest litter on the soil surface which consists mainly of black to very dusky red, friable, well-decomposed material. This is underlain by a 5 to 10 cm thick, grayish-brown or gray, friable, strongly leached, sandy layer which, in turn, is abruptly underlain by a dark brown to very dusky red, friable, weakly structured, loamy or sandy zone about 50 cm thick. This zone grades to about 50 cm of brown to dark brown, friable, sandy material containing common, reddish or yellowish mottles in the lower part. Under this is massive, firm, olive-brown or grayish-brown, gravelly, unweathered colluvial parent material that contains variable amounts of reddish mottles. Angular gravel, stones, cobbles and boulders occupy about 30 to 50 percent (by volume) of the upper mineral soil and increase to between 50 and 80 percent in the lower depths. Soil reaction is extremely acid in the upper 100 cm, then decreases to very strongly or strongly acid. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Sayres, Dennett, Whonnock and Golden Ears soils and Rock Outcrop and Talus land types are usually closely associated with Palisade soils. Whonnock and Golden Ears soils differ from Palisade soils by having developed from glacial till and contain strongly cemented subsoil layers. Also, Whonnock soils are imperfectly drained. Sayres soils differ from Palisade soils by being underlain by bedrock within 100 cm of the surface while Dennett soils consist of 10 cm or more of organic material over bedrock. The Talus land type differs by consisting of actively accumulating colluvial debris while the Rock Outcrop land type consists either of exposed bedrock or bedrock covered by less than 10 cm of mineral or organic soil.

Vegetation: Unlogged areas of Palisade soils support old-growth coniferous forests consisting mostly of Pacific silver fir, mountain hemlock and yellow cedar with a relatively dense ericaceous shrub layer and soil surface moss cover. In the lower part of the soils' elevational range some western hemlock and western red cedar are intermixed. Rooting depth is essentially unrestricted. Most roots, however, are concentrated in the upper 100 cm.

General Land Use Comments: (1) Very steep slopes preclude any use of Palisade soils for agriculture. (2) Steep slopes and potentially unstable conditions also preclude urban and related development. (3) Forest growth is moderate, limited mainly by the adverse climatic conditions present at the high elevations in which Palisade soils are found. Potential annual wood production by western hemlock and Pacific silver fir is estimated to be between 6 and 8 m^3/ha. Palisade soils appear relatively stable under presently forested conditions but logging road construction will likely make the steeper areas relatively unstable, particularly if high cut slopes are produced and adequate culverting is not installed to control seepage and runoff.

PATON SOILS

Location and Extent: Paton soils occupy scattered locations throughout the mountainous, northern part of the map area, usually intermingled with or near the base of steep, rocky areas. About 90 ha of pure map units and 2840 ha of soil complexes dominated by Paton soils are mapped. The complexes are mostly with Cannell and Eunice soils and Rock Outcrop and Talus land types.

Topography and Elevation: The topography of Paton soils ranges from steeply to extremely sloping with slope gradients from 20 to over 60 percent. Most areas, however, are very steeply sloping with gradients between 30 and 60 percent. Elevations range upward from sea level to about 675 m.

Parent Material and Texture: Paton soils have developed from very stony, bouldery and gravelly, coarse-textured colluvial and alluvial-colluvial fan deposits that usually occur on or near the base of steep, rocky areas. Included also are some stabilized talus accumulations. The deposits are usually more than 2 m thick and usually are underlain by bedrock. Surface and subsurface textures range from gravel to gravelly loamy sand and from 50 and 80 percent angular coarse fragments are usually present. The subsoil generally consists of stony and bouldery, angular gravel containing 80 percent or more coarse fragments.

Soil Moisture Characteristics: Paton soils are well to rapidly drained. They are rapidly pervious and have low moisture holding capacity and slow surface runoff. Telluric downslope seepage often occurs in the lower subsoil (above the underlying bedrock) after heavy rain.

General Soil Description: Paton soils usually have up to 10 cm of brownish to black organic forest litter on the soil surface. This is underlain by a thin, discontinuous, grayish, sandy layer up to 3 cm thick which, in turn, is underlain by about 80 cm of very friable to loose, very gravelly material which varies in colour from dark reddish brown to dark brown and contains 50 to 80 percent angular stones, cobbles and boulders. The soil then changes to about 80 cm of loose, yellowish-brown, very gravelly material containing about 80 percent angular stones, cobbles and boulders. Unweathered, gravelly, stony and bouldery soil parent material occurs below about 160 cm. Soil reaction is extremely acid in the organic surface layer and very strongly acid in the mineral soil. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Cannell, Eunice, Strachan and Burwell soils and Rock Outcrop and Talus land types are usually closely associated with Paton soils. Strachan and Burwell soils differ from Paton soils by being developed in glacial till and having strongly cemented subsoil layers. Burwell soils are also imperfectly drained. Cannell soils differ by consisting of less than 100 cm of soil over bedrock while Eunice soils differ by being composed of more than 10 cm of organic material over bedrock. The Rock Outcrop land type differs by consisting of rock either exposed at, or occurring within 10 cm of the land surface. Talus land type consists of actively accumulating, colluvial rock debris. In some locations, stabilized talus deposits form the parent material of Paton soils.

Vegetation: The vegetation on Paton consists mostly of coast Douglas-fir with some western hemlock and western red cedar. Red alder and vine maple also occur, especially in somewhat unstable locations or in logged areas. Arbutus is a common component of the vegetation at the lower elevations along the sea coast. Rooting is unrestricted although limitations to root distribution are imposed by the severely stony, bouldery and gravelly soil conditions.

General Land Use Comments: (1) Paton soils are unsuited for agricultural uses due to excessive slopes and very stony, coarse textured soils. (2) Paton soils are also unsuited for urban and similar uses due to steep slopes and, in some areas, instability. Many areas are at or near the angle of repose and undercutting will lead to cut-slope ravelling and increased downslope movement. Some areas are also susceptible to periodic colluvial additions by rock and other debris from upslope locations. Some areas of Paton soils are moderately suited as sources of aggregate and fill. (3) Forest growth is moderate, limited mainly by the stony nature of the soil and its low water holding capacity. Potential annual wood production by coast Douglas-fir is estimated at between 6.5 and 9 m^3/ha. During logging and road construction special care to avoid soil disturbance and exposure is

required to ensure soil instability is not increased. Paton soils usually occur as small, discontinuous areas intermingled among Rock Outcrops and soils shallow to bedrock which make them difficult to manage individually.

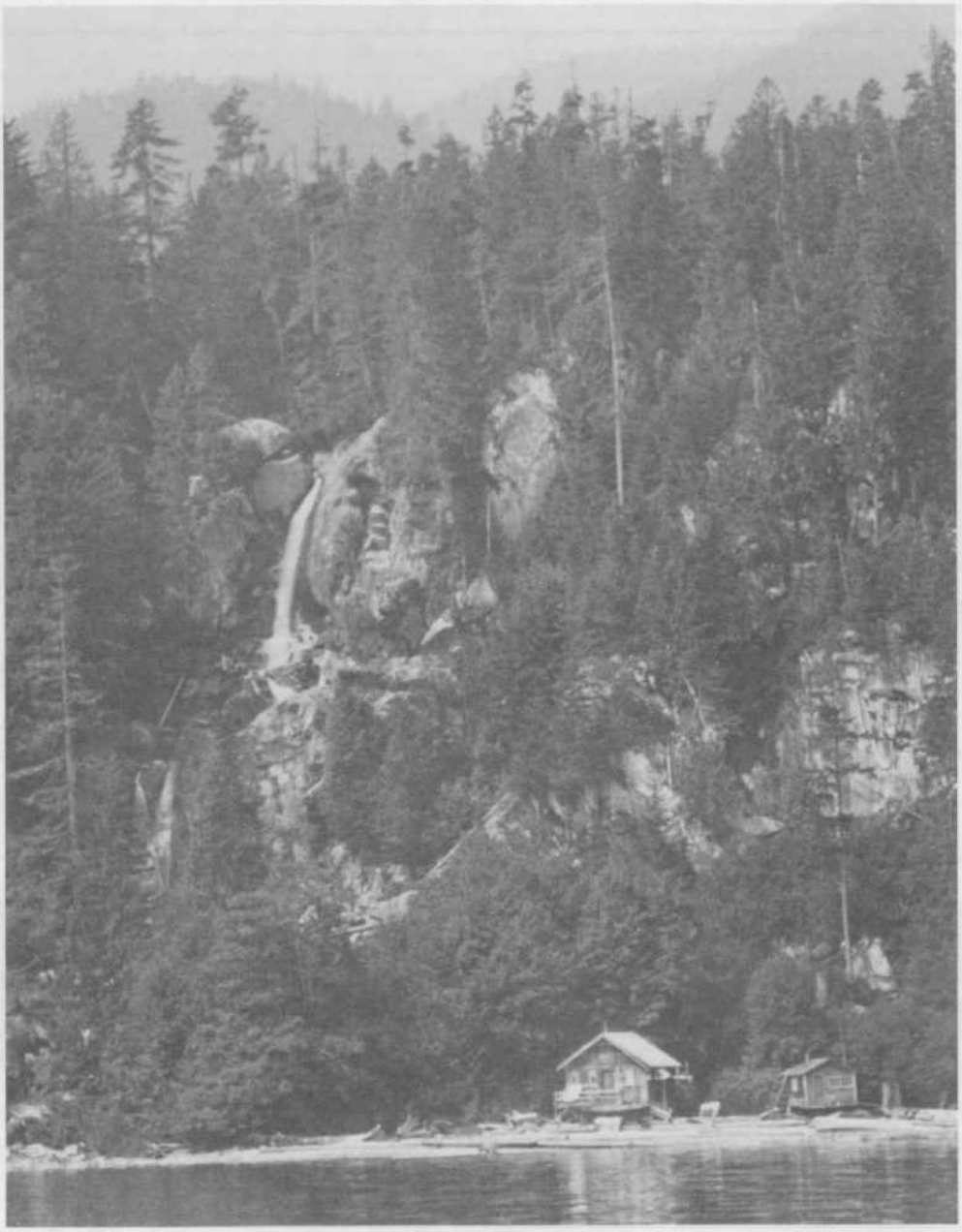

Plate 35 Typical lower slopes along Pitt Lake consisting of shallow colluvial and alluvial deposits (Cannell and Paton soils), shallow organic accumulations over bedrock (Eunice soils) and exposed bedrock. Cottaging is an important recreational use of the shores of Pitt Lake. (Tourism B.C. photo).

PEARDONVILLE SOILS (PD)

Location and Extent: Peardonville soils occur mainly in the vicinity of Peardonville and on the uplands west of Matsqui Valley where 600 ha of pure map units and 160 ha of soil complexes dominated by Peardonville soils are mapped. The complexes are usually with Columbia and Calkins soils.

Topography and Elevation: The topography of Peardonville soils is mostly gently to moderately rolling with slopes between 6 and 15 percent. A few areas range to very steeply sloping or hilly with gradients to 60 percent. Elevations range between 50 and 100 m above sea level.

Parent Material and Texture: Peardonville soils have developed in 50 to 100 cm of medium-textured eolian deposits that overlie moderately coarse to coarse-textured, heterogeneous ice-contact deposits. Surface and subsurface textures are silt loam or loam and become moderately stony where the silty capping is shallow. The subsoils vary from loamy sand to gravel where glaciofluvial materials are dominant, to gravelly sandy loam or loam where lenses and pockets of glacial till occur.

Soil Moisture Characteristics: Peardonville soils are well drained. They are moderately pervious and have moderate to high waterholding capacity. Surface runoff is slow to moderate, depending on the steepness of the slopes.

General Soil Description: Peardonville soils, when under forest, have up to 10 cm of brownish to black, variably decomposed, organic litter on the mineral soil surface. This is underlain by about 60 cm of dark reddish brown to dark yellowish brown, weakly structured, friable, silty material which contains scattered, hard, reddish, spherical concretions. Under this is about 15 cm of friable, yellowish-brown, sandy material which contains some stones. Under this is loose, gravelly and sandy material containing pieces and lenses of compact loamy till. Soil reaction grades from very strongly acid in the surface organic layer through strongly or medium acid in the upper 50 cm of the mineral soil to slightly acid in the subsoil (1:1 H_2O). Soil classification is ***Orthic Humo-Ferric Podzol***. A shallow variant of Peardonville soils is mapped in a few areas. It is similar to the usual Peardonville soils except that the silty surface capping is 20 to 50 cm thick rather than the usual 50 cm or more thick.

Commonly Associated Soils: Columbia, Abbotsford, Marble Hill, Calkins, Ryder and Lonzo Creek soils are closely associated with Peardonville soils. All except Columbia soils are similar to Peardonville soils in that they have silty, eolian surfaces. They vary, however, in subsoil materials or drainage. Ryder and Lonzo Creek soils differ by being respectively underlain with glacial till at depths greater than 50 cm and between 20 and 50 cm. Marble Hill and Abbotsford soils differ by being respectively underlain by gravelly glaciofluvial materials at depths of greater than 50 cm and between 20 and 50 cm of the surface. Columbia soils are gravelly to the surface while Calkins soils are poorly drained.

Vegetation: Most of the topographically suited areas of Peardonville soils are cleared and cultivated for agricultural crops. Uncleared areas support a mixed, second-growth forest, dominantly coast Douglas-fir, red alder and vine maple with undergrowth that includes salmonberry, thimbleberry, bracken, and cascara. Rooting depth is usually unrestricted although in locations where glacial till is dominant in the subsoil, some impediment occurs due to its compact nature.

General Land Use Comments: (1) Where not topographically limited, Peardonville soils are suited for most crops if irrigation is available. Otherwise, and especially where the silty surface capping is thin, droughty conditions develop during the latter part of most growing seasons. (2) Peardonville soils are variably suited for urban and similar development. Steeply sloping areas are unsuited while the more level areas are well suited. The soils are well drained and high watertables are not a problem. Septic tank effluent disposal fields generally work well although groundwater contamination is a possibility due to inefficient filtration by the coarse-textured subsoil if numerous systems are installed. Surface erosion is probable during heavy, prolonged rain in steeply sloping, vegetation-free areas. (3) Peardonville soils are moderately well suited for forest production. Potential annual wood production by coast Douglas-fir is estimated to be between 7.5 and 9 m^3/ha.

PELLY SOILS (PY)

Location and Extent: Pelly soils occur only as small areas in Chilliwhack Municipality, south and west of Chilliwack Mountain. About 30 ha of pure map units and 25 ha of soil complexes dominated by Pelly soils are mapped. The complexes are with Blackburn and Annis soils.

Topography and Elevation: Pelly soils are nearly level to gently undulating. They have slopes up to 2 percent and usually are slightly depressional in relation to adjacent soils. Elevations vary between 5 and 10 m above sea level.

Parent Material and Texture: The parent material of Pelly soils are moderately fine to medium-textured, stone-free, Fraser River floodplain deposits at least 50 cm thick which overlie sand. Surface textures are usually silty clay loam with some variation to silt loam or silty clay. Subsurface textures are similar while the subsoil gradually changes to silt loam with depth and sometimes contains lenses of sand or loamy sand.

Soil Moisture Characteristics: Pelly soils are poorly drained. They are slowly to moderately pervious and have high water holding capacity and slow surface runoff. Groundwater tables are near the surface during most of the winter and during the freshet period on the Fraser River but recede gradually over the growing season. Surface ponding is common during heavy, prolonged rains due to slow permeability and runoff accumulation from adjacent, higher areas.

General Soil Description: Pelly soils generally have a silty, cultivated surface layer about 20 cm thick which is friable and very dark grayish brown in colour. It is underlain by a gray to dark gray, firm, sticky, coarsely structured, silty to clayey zone about 20 cm thick that contains few to common, yellowish-brown mottles. This zone is underlain by 40 cm or more of gray to olive-gray, firm, sticky, massive, silty material containing common to few, yellowish-red mottles. At depth, the silty material often contains lenses of sand. Soil reaction ranges from strongly acid in the surface and subsurface to medium or slightly acid in the subsoil (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Blackburn, Annis and Grigg soils are commonly closely associated with Pelly soils. Annis soils differ from Pelly by having between 15 and 40 cm of organic material at the soil surface. Blackburn soils differ by containing buried (dark coloured), old surface layers in the subsurface and subsoil. They usually also lie slightly higher than Pelly soils and are somewhat less poorly drained. Grigg soils differ by being imperfectly drained and contain a well-defined clay accumulation layer in the subsurface.

Vegetation: All areas of Pelly soils are cleared and cultivated. Natural vegetation along fences and in similar locations includes black cottonwood, thimbleberry, salmonberry, blackberry, willow, sedges and grass. Rooting is mainly restricted to the upper 60 cm by the high groundwater levels and massive subsoil.

General Land Use Comments: (1) Poor drainage and high groundwater levels are the main agricultural limitation of Pelly soils. Artificial drainage is required for good crop production, particularly for overwintering of perennial crops and will also allow earlier cultivation in the spring. Pelly soils are usually closely intermingled with other, usually somewhat better drained soils which makes them difficult to manage individually. (2) Urban and similar developments are poorly suited for Pelly soils. High watertables preclude basements or other excavations and variable bearing strengths may require special foundations. High watertables and relatively slow permeability severely impede septic tank effluent disposal. Periodic flooding during heavy rains is a severe urban limitation.

PITT SOIL (P)

Location and Extent: Pitt soils occur only in Pitt Meadows and Coquitlam Municipalities and in the south parts of Pitt Polder. About 910 ha of pure map units and 700 ha of soil complexes dominantly Pitt soils are mapped. Most complexes are with Alouette and Katzie soils.

Topography and Elevation: Topographically, Pitt soils are gently undulating to undulating with slopes less than 4 percent. They usually occupy slightly higher landscape positions than adjacent soils and often occur as slightly raised, sinuous, discontinuous ridges. Elevations are less than 4 m above sea level.

Parent Material and Texture: Pitt soils have developed from moderately fine textured, stone-free, mixed floodplain deposits of the Fraser, Alouette and Pitt Rivers. Surface textures are either silt loam or silty clay loam while the subsurface is mainly silty clay loam with some variation to silty clay. The subsoil is silt loam to at least 75 cm depth, then sometimes gradually grades to more sandy material.

Soil Moisture Relationships: Pitt soils are poorly to moderately poorly drained. They are slowly to moderately pervious and have high water holding capacity, and slow to moderate surface runoff. Groundwater tables are near the surface for most of the rainy winter period but usually gradually recede during the growing season.

General Soil Description: Pitt soils generally have a black, moderately structured, friable, cultivated, silty surface layer about 20 cm thick that contains about 20 percent organic matter. This is underlain by about 30 cm of gray, very firm, coarsely prismatic, silty to clayey soil containing many to common, strong brown to yellowish-red mottles and, in the upper part, common clay flows on crack surfaces and in old root channels. This zone is then underlain by at least 30 cm of massive, friable to firm, dark gray to olive-gray, silty material containing common to few, dark brown to yellowish-red mottles, mainly along old root channels. At greater depths sand is sometimes encountered. Soil reaction grades from extremely acid in the surface to strongly or medium acid in the lower subsoil. Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Alouette and Katzie soils are often in close association with Pitt soils. Alouette soils usually lie in slightly lower landscape positions than do Pitt soils and have organic surfaces from 15 to 40 cm thick. Katzie soils differ from Pitt soils by being somewhat less poorly drained; they also have strongly mottled subsurface layers and usually lie in slightly higher landscape positions.

Vegetation: Almost all areas of Pitt soils are cleared and cultivated. Vegetation along fence lines and in other uncleared locations includes black cottonwood, western red cedar, blackberry, salmonberry, hardhack, sedges and grass. Rooting is restricted mainly to the upper 60 cm by the high groundwater tables and dense soil material.

General Land Use Comments: (1) Poor drainage and high watertables are the main agricultural limitation of Pitt soils and artificial drainage is beneficial for crop production, especially for maintenance of perennial crops. Severe acidity is also a problem for some crops and this can be ameliorated by adequate liming. Pitt soils are usually closely intermingled with other soils (often Alouette) which makes them difficult to manage individually. (2) Pitt soils are poorly suited for urban or similar uses. Variable bearing strengths make special foundations a consideration while high watertables generally preclude basements and other excavations. High watertables and relatively low permeability severely impede efficient disposal of septic tank effluent. (3) Pitt soils appear moderately suited for the growth of trees such as black cottonwood. Potential annual wood production by this species is estimated at 12 to 15 m^3/ha.

POIGNANT SOILS (PT)

Location and Extent: Poignant soils occur in the eastern part of the map area, mainly along the lower mountain slopes adjacent to the Fraser Valley. About 2630 ha of soil complexes dominated by Poignant soils are mapped; the complexes are usually with Lonzo Creek and Cannell soils.

Topography and Elevation: Poignant soils are steeply to extremely sloping; most slope gradients are between 30 and 70 percent. Elevations range from about 20 to 600 m above sea level.

Parent Material and Texture: The parent material of Poignant soils is a medium to moderately coarse textured, stony, mixture of silty eolian deposits and colluvium. The deposits are deeper than 1 m and overlie bedrock. Surface textures vary from gravelly silt loam to gravelly sandy loam, the subsurface is mostly gravelly sandy loam or gravelly loam while the subsoil varies from gravelly sandy loam to gravelly loamy sand. Stones, cobbles, and sometimes boulders are common throughout the soil.

Soil Moisture Relationships: Poignant soils are well drained. They are rapidly pervious and have moderate to low water holding capacity and moderate to slow surface runoff. Temporary telluric seepage occurs in some areas along the surface of the underlying bedrock after heavy rain.

General Soil Description: Poignant soils generally have up to 10 cm of variably decomposed organic forest litter on the soil surface. This is underlain by about 20 cm of reddish-brown to dark brown, friable, weakly structured, silty to loamy material containing variable amounts of fine, spherical concretions and usually 30 to 60 percent coarse fragments (gravel, stones and cobbles). This zone then grades into about 30 cm of friable to loose, yellowish-brown to brown, sandy or loamy material containing between 40 and 70 percent coarse fragments. Under this, in turn, is 50 cm or more of loose, gravelly and stony colluvium which overlies bedrock or, occasionally, glacial till. Soil reactions vary from very strongly or strongly acid in the upper soil to medium or slightly acid in the lower subsoil. Soil classification is usually *Orthic Humo-Ferric Podzol* although small inclusions of Orthic Dystric Brunisol also occur in areas that are somewhat unstable.

Commonly Associated Soils: Lonzo Creek, Cannell and Eunice soils and Rock Outcrop land type usually are closely associated with Poignant soils. Lonzo Creek soils differ from Poignant soils by consisting of 20 to 50 cm of silty aeolian material over glacial till. Cannell soils differ by being underlain by bedrock within 100 cm of the surface while Eunice soils differ by being composed of 10 cm or more of organic material over bedrock. The Rock Outcrop land type consists either of exposed rock or rock covered by less than 10 cm of mineral or organic material.

Vegetation: The usual vegetation on Poignant soils is second-growth forest that includes coast Douglas-fir, some western red cedar and western hemlock, red alder, vine and bigleaf maple and a variable shrub cover. Rooting, except for limitations imposed by stoniness, is essentially unrestricted down to the underlying bedrock.

General Land Use Comments: (1) Excessive slopes and stoniness make Poignant soils unsuitable for agricultural use. (2) Excessive slopes, relative shallowness to bedrock and potential instability also make Poignant soils unsuited for urban uses. (3) Forest growth is moderate, limited somewhat by low water holding capacity and resultant droughty conditions during most growing seasons. Poignant soils are frequently closely intermingled with soils of differing character making them difficult to manage individually. Estimated annual wood production by coast Douglas-fir is about 6.5 to 9 m^3/ha.

PORPOISE SOILS (PP)

Location and Extent: Porpoise soils occur only on the Sunshine Coast where they occupy small areas in the western part. About 280 ha of soil complexes dominated by Porpoise soils are classified; the complexes are mostly with Cannell, Eunice and Langdale soils.

Topography and Elevation: Topographically, Porpoise soils are moderately rolling to hilly or very steeply sloping with slopes varying from 10 to 50 percent. Usually they are either depressional or occupy lower slope positions, particularly when associated with Cannell or Eunice soils. Elevations range between 100 and 200 m above sea level.

Parent Material and Texture: The parent material of Porpoise soils is stony, moderately coarse to medium-textured glacial till. Surface textures are either sandy loam or gravelly sandy loam,; subsurface and subsoil textures are similar with some variation to gravelly loamy sand or loam. The subsoil, below about 1 m depth, is compact and usually contains discontinuous, moderately cemented patches and lenses.

Soil Moisture Characteristics: Porpoise soils are well to moderately well drained. They are moderately pervious and have moderate to low water holding capacity and slow surface runoff. Temporary perched watertables develop above the compact subsoil during periods of heavy rain and telluric, lateral subsoil seepage is present during these times.

General Soil Description: Porpoise soils generally have up to 12 cm of variably decomposed organic forest litter on the soil surface. Under this is up to 5 cm of grayish, friable, strongly leached, sandy material. In turn, this is underlain by about 50 cm of friable, reddish-brown to dark reddish brown, sandy material which is very stony and sometimes contains scattered, moderately cemented patches, particularly in the lower part. This zone then grades to about 50 cm of yellowish-brown to grayish-brown, friable to firm, sandy and stony material which sometimes contains reddish mottles in the lower part. Below about 1 m depth, compact, relatively unweathered soil parent material occurs which is brownish-gray, and contains scattered, moderately cemented patches and few to common, reddish and yellowish mottles in the upper part. Soil reaction varies from extremely or very strongly acid in the surface and subsurface to very strongly or strongly acid in the subsoil. Soil classification is *Orthic Humo-Ferric Podzol* in most areas although a few Eluviated Dystric Brunisols also occur, particularly at the lower elevations.

Commonly Associated Soils: Cannell, Eunice and Langdale soils are generally closely associated with Porpoise soils. Langdale soils are similar to Porpoise soils except they are sandier in texture and contain fewer stones. Cannell soils differ from Porpoise soils by being underlain by bedrock within 100 cm of the surface while Eunice soils differ by consisting of 10 cm or more of organic material over bedrock.

Vegetation: Most areas of Porpoise soils have been logged and now support second-growth stands of mostly coast Douglas-fir with lesser amounts of western hemlock, western red cedar, red alder and vine maple. Rooting is generally unrestricted to about 100 cm, then is somewhat impeded by the compact subsoil.

General Land Use Comments: (1) Steep slopes and stony conditions severely limit Porpoise soils for agricultural uses. Pasture and forages can be produced in all except the most steep locations. (2) Urban uses of Porpoise soils is also limited by adverse slopes. Numerous installations of septic tank effluent disposal fields may cause lateral effluent seepage along the surface of the compact subsoil. (3) Forest growth of species such as Douglas-fir appears to be good. Potential annual wood production by this species is estimated at between 9 and 12 m^3/ha.

PREST SOILS (PR)

Location and Extent: Prest soils occur in numerous, small, depressional locations on the floodplain of the Fraser River. There are about 600 ha of pure map units and 340 ha of soil complexes dominated by Prest soils. Most complexes are with Page soils and occasionally, with Fairfield, Dewdney and Seabird soils.

Topography and Elevation: Prest soils are nearly level to gently undulating with slopes less than 5 percent. They are generally depressional in relation to adjacent soils and often occur in meander channels and other similar landscape positions on the floodplain. Elevations are generally less than 10 m above sea level.

Parent Material and Texture: Prest soils have developed from medium and moderately fine textured Fraser River floodplain deposits that are usually at least 50 cm thick, and overlie medium or fine sand. Surface textures range from silt loam to silty clay loam while the subsurface usually is silty clay loam or silty clay. The subsoil is mostly silt loam in the upper part, sometimes containing sandy lenses, and changes to sand or loamy sand at depth. In uncultivated areas, a shallow organic layer, less than 15 cm thick, is sometimes present on the mineral soil surface.

Soil Moisture Characteristics: Prest soils are very poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. The watertable is either near or above the soil surface for most of the winter and during the freshet period of the Fraser River, then recedes slightly during the latter part of the summer. Surface ponding is usual during heavy rains.

General Soil Description: Under natural conditions Prest soils have a thin (usually less than 10 cm thick) layer of organic material derived mainly from reeds, sedge and grass on the soil surface. This is underlain by about 20 cm of grayish-brown or brownish-gray, firm, weakly structured silty to clayey material containing common to many, dark red to reddish-brown mottles. This grades to about 30 cm of gray, massive, very firm, silty or clayey material containing common, yellowish-brown mottles. Under this is gray or olive-gray, massive, silty material containing a few, variably coloured mottles and, sometimes, bands of dark gray sand or loamy sand. Soil reaction varies from very strongly or strongly acid in the upper soil to slightly acid in the subsoil (1:1 H_2O). Soil classification is mostly ***Rego Gleysol*** with occasional variation to Rego Gleysol: peaty phase where the organic surface layer is more than 15 cm thick. In a few areas, a shallow variant of Prest soils has been mapped. The shallow variant is similar to the usual Prest soils except that the underlying sand occurs within 20 to 50 cm of the soil surface rather than below at least 50 cm as is usually the case.

Commonly Associated Soils: Page, Hjorth and Fairfield soils are often closely associated with Prest soils, either as components of soil complexes or occupying adjacent map polygons. Page soils are similar to Prest soils except that they are poorly rather than very poorly drained and occur in slightly higher landscape locations. Hjorth soils are similar to Page soils except that they have black surfaces. Fairfield soils differ from Prest soils by being imperfectly drained and lie substantially higher in the landscape.

Vegetation: The natural vegetation of Prest soils is mostly reeds, sedges, grasses and others adapted to very poorly drained conditions, with willow and black cottonwood also sometimes present. Rooting depth is mainly restricted to 30 cm by the high watertables.

General Land Use Comments: (1) Poor drainage, high watertables and periodic flooding severely limit Prest soils for agriculture. Artificial drainage is required for essentially all crops (except reed canary grass which is very tolerant of excess moisture). However, due to the depressional nature of Prest soils, drainage outlets are usually difficult to locate and install. (2) Urban uses are unsuited for Prest soils. High watertables preclude basements and other excavations and periodic flooding is usual. Septic tank effluent disposal is severely impaired by the very high watertables. In some locations Prest soils can be excavated and used as water storage areas, perhaps for irrigation of adjacent soils.

RICHMOND SOILS (RC)

Location and Extent: Richmond soils are common in the Serpentine-Nicomekl Valley and also occur on the lowlands of Richmond and Delta Municipalities. About 300 ha of pure map units and 1390 ha of soil complexes dominated by Richmond soils are mapped; the complexes are mainly with Vinod, Lulu, and Annacis soils.

Topography and Elevation: The topography of Richmond soils is level to gently undulating. Slope gradients are less than 2 percent and elevations lie below 3 m above sea level.

Parent Material and Texture: Richmond soils have developed from 40 to 160 cm of mainly well-decomposed organic material that overlies moderately fine and medium-textured deltaic deposits. Included are some areas from which once deeper peat deposits have been mined. Surfaces vary from moderately to well-decomposed, depending on the length of time they have been cultivated. The subsurface organic material is well-decomposed (humic) while the underlying mineral soil is silt loam or silty clay loam and usually saline (except for some locations close to the Fraser River). The mineral soil generally contains substantial amounts of compounds high in sulphur.

Soil Moisture Relationships: Richmond soils are very poorly drained. They are moderately pervious and have very high water holding capacity and slow surface runoff. The groundwater tables are near, or sometimes at the soil surface during most of the winter and early spring but usually recede somewhat during the growing season. Surface ponding during heavy, prolonged rains is common, due in part to accumulation of runoff from adjacent soils at higher elevations.

General Soil Description: Richmond soils generally have a cultivated surface layer about 20 cm thick which is black to dark reddish brown, friable, somewhat granular and well to moderately well decomposed. It is underlain by between 30 and 100 cm of black, brownish-black or dark reddish brown, massive (when wet), well-decomposed organic material which is friable when moist and hard when dry; vertical cracks develop on drying. The organic material is underlain by gray to olive-gray, massive, silty material, often containing the vertical remains of old plant stems and roots. Yellowish mottles are common, particularly where the material is saline. Soil reaction is extremely acid throughout and soil classification is *Terric Humisol*.

Commonly Associated Soils: Vinod, Lumbum, Lulu, Annis, Blundell, Goudy and Sandel soils are all often closely associated with Richmond soils. Vinod and Annis soils differ from Richmond soils by having only between 15 and 40 cm of organic material over clayey mineral soil; Vinod soils are also strongly saline in the mineral underlay. Lulu and Goudy soils have depths of organic material similar to Richmond soils but in Lulu soils, the organic material is partially (mesic) rather than well-decomposed while Goudy soils are strongly saline within 50 cm of the surface. Lumbum soils differ by consisting of more than 160 cm of partially-decomposed organic material. Sandel soils differ by being silty to the surface while Blundell soils consist of 15 to 40 cm of well-decomposed organic soil over silty mineral material.

Vegetation: Most areas of Richmond soils are cleared and cultivated. The few, remaining uncleared areas support moisture tolerant vegetation that includes sedges, reeds, western red cedar, birch, red alder, blackberry, hardhack, moss and grass. Rooting is mostly restricted to the upper 50 cm by the high groundwater tables and where the organic material is shallow, by the saline subsoils.

General Land Use Comments: (1) Agriculturally, Richmond soils are limited mainly by high watertables (especially during the winter) and very acid soil conditions. The acid conditions can be improved by liming or similar soil amendments while artificial drainage is required to control the high watertables. Watertable control sufficient only to meet the crop requirements is usually best. Overdraining accelerates the subsidence and decomposition of the organic material and eventually will bring the saline subsoil into the range of crop roots. (2) Urban or similar uss are not suited for Richmond soils. Low bearing strengths require special foundation considerations while high watertables preclude basements and other excavations as well as severely limiting septic tank effluent disposal. Underground utility and other installations are likely to corrode rapidly if not adequately protected.

ROACH SOILS (RH)

Location and Extent: Roach soils occur on the uplands and at the lower elevations in the mountains north of the Fraser River, mainly in the vicinity of Steelhead and in the Norrish and Statlu Creek valleys. About 1810 ha of pure map units and 2390 ha of soil complexes dominated by Roach soils are mapped. The complexes are mostly with Errock, Keystone, Buntzen, Fellows and Stave soils.

Topography and Elevation: Roach soils have variable topography, ranging from undulating or moderately sloping to very steeply sloping or hilly. Slope gradients range from 5 to 50 percent. Elevations usually lie between 150 m and 500 m above sea level.

Parent Material and Texture: The parent material of Roach soils is coarse-textured, gravelly and stony, often stratified glaciofluvial deposits. In some areas, small areas of alluvial fan deposits are included. Surface textures vary from gravelly loamy sand to gravelly sandy loam. In a few locations a thin (less than 15 cm thick), loam surface layer is present. The subsurface and subsoil range from stony gravel to gravelly sand and are strongly cemented.

Soil Moisture Characteristics: Roach soils are moderately well to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Temporary, perched watertables sometimes develop above the cemented layer during and after heavy, prolonged rains and telluric subsoil seepage occurs in this zone during these times, particularly in areas with long, uniform slopes.

General Soil Description: Roach soils generally have between 8 and 15 cm of organic forest litter on the soil surface, the lower half of which is black to dark reddish brown and well to moderately decomposed. Under this is 5 to 10 cm of gray to pinkish-gray, friable, strongly leached, sandy material which, in turn, is abruptly underlain by about 15 cm of dark reddish brown, friable, stony, gravelly and sandy material containing scattered, moderately cemented pockets. Below this occurs a zone about 50 to 150 cm thick which is dark reddish brown in the upper part and yellowish-red, reddish-brown or yellowish-brown in lower part, is very strongly cemented, extremely hard, and consists mainly of stony gravel and sandy gravel. This cemented zone then gradually grades into loose, stony and gravelly unweathered soil parent material. Soil reaction varies from extremely acid near the surface to strongly acid in the subsoil. Soil classification is dominantly *Ortstein Ferro-Humic Podzol* although small areas of Duric Ferro-Humic Podzol are also included.

Commonly Associated Soils: Errock, Keystone, Fellows and Stave soils often occur in close association with Roach soils. Errock soils are similar to Roach soils except they are imperfectly drained and usually lie at slightly lower landscape positions. Keystone soils differ from Roach soils by having loamy surfaces; also, cementation only occurs in the lower subsoil. Both Fellows and Stave soils differ from Roach soils by being sandy in texture.

Vegetation: Most areas of Roach soils have been logged and now support second-growth coast Douglas-fir, western hemlock and western red cedar, red alder and a variety of shrubs and ground cover. Rooting is restricted mainly to the upper 50 cm by the strongly cemented subsurface and subsoil layers.

General Land Use Comments: (1) Roach soils have limited use for agricultural crops because of restrictions imposed by adverse topography, low moisture and nutrient holding capacity and excessive stoniness. (2) In areas which have relatively subdued topography, Roach soils are moderately suited for urban and related purposes. Soil bearing strengths are high and groundwater tables are not a problem. Basements, underground utilities and other excavations are hindered by the stony nature of the soils. Septic tank effluent disposal is satisfactory since tile fields are usually below the cemented zone, however incomplete effluent filtration is likely due to the coarse soil texture. Areas of Roach soils are potential sources of aggregate and fill, although the stony character of the soil material may limit their use for some purposes. (3) Forest growth is only moderate, apparently limited by droughty conditions and restricted rooting due to subsurface cementation. Data from limited measurements indicates potential annual wood production by Douglas-fir is 5 to 6.5 m^3/ha.

RODGERS SOILS (RG)

Location and Extent: Rodgers soils occupy small, scattered, high elevation areas in the mountainous, northern part of the map area. About 390 ha of pure map units and 470 ha of soil complexes dominated by Rodgers soils are classified.

Topography and Elevation: The topography varies from moderately to steeply sloping with slope gradients between 5 and 30 percent. Elevations are in excess of 700 m above sea level.

Parent Material and Texture: Rodgers soils have developed from coarse to moderately coarse textured, stony and bouldery alluvial fan deposits. Surface textures vary from stony gravelly loamy sand to stony gravelly sandy loam while subsurface and subsoil textures range from sandy gravel to gravelly loamy sand, both very stony and bouldery.

Soil Moisture Characteristics: Rodgers soils are well to moderately well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Substantial amounts of telluric seepage flows through the lower subsoil during and after heavy rain or during snowmelt.

General Soil Description: Rodgers soils generally have 15 cm or more of organic forest litter on the soil surface, the lower half of which is black to dark reddish brown and well to moderately decomposed. The organic litter is underlain by 5 to 10 cm of gray to brownish-gray, friable, strongly leached, sandy material which, in turn, is underlain by about 40 cm of dark reddish brown to dark brown soil material that is friable, sandy to gravelly and contains 50 to 80 percent stones, cobbles and boulders. This zone then grades to about 50 cm of reddish-brown to yellowish-brown, sandy and gravelly material which varies from friable to firm due to discontinuous cementation and contains at least 70 percent stones, cobbles and boulders. Below this is grayish-brown or brownish-gray, loose, gravelly parent material containing many stones and boulders. Few to common, reddish mottles are also present. Soil reaction ranges from extremely acid in the surface and subsurface to very strongly acid in the lower subsoil. Soil classification is *Orthic Ferro-Humic Podzol*.

Commonly Associated Soils: Sayres, Palisade, Golden Ears and Whonnock soils and Talus land type often occur in close association with Rodgers soils. Sayres and Palisade soils differ from Rodgers soils by being developed in very steeply sloping colluvial deposits; additionally, Sayres soils are underlain by bedrock within 100 cm of the surface. Golden Ears and Whonnock soils differ by having developed from glacial till and are strongly cemented in the subsoil; Whonnock soils also differ by being imperfectly rather than well to moderately well drained. The Talus land type differs from Rodgers soils by consisting of actively accumulating rock debris.

Vegetation: The forest cover on Rodgers soils is mainly Pacific silver fir, mountain hemlock and some yellow cedar; at the lower elevations western hemlock and western red cedar are also present. Rooting depth is essentially unrestricted although some impediments to root distribution are present due to the stony and bouldery soil characteristics.

General Land Use Comments: (1) Rodgers soils are unsuited for agricultural use due to excessive stoniness and adverse climatic conditions, mainly heavy snow packs which persist into the early part of the growing season. (2) Similarily, Rodgers soils are also unsuited for year-round urban or similar uses. Excessive snowfall during the winter makes access difficult. Soil bearing strengths are adequate but basements and other excavations are difficult to construct due to the stony and bouldery character of the soils. In some areas Rodgers soils may serve as sources of aggregate. (3) Forest growth is good at the lower elevational range but decreases due to adverse climatic conditions (deep snowpack, short growing season) as elevations increase. Potential annual wood production by western hemlock and Pacific silver fir is estimated at almost 9 to 12 m^3/ha at the lower elevations.

ROSS SOILS (RS)

Location and Extent: Ross soils occur in small, scattered areas throughout the uplands of the report area. About 370 ha of pure map units and 180 ha of soil complexes dominated by Ross soils are mapped; the complexes are mostly with Lehman and Judson soils.

Topography and Elevation: Topographically, Ross soils vary from nearly level to gently sloping or undulating with slopes of less than 3 percent. They are usually depressional in relation to adjacent soils. Elevations lie between 10 and 100 m above sea level.

Parent Material and Texture: The parent material of Ross soils is medium and moderately fine textured, stone-free floodplain deposits of streams flowing over the uplands, these streams carry mainly sediments eroded from upstream glaciomarine, glacial till and eolian materials. Surface textures vary from silt loam to silty clay loam; the subsurface and upper subsoil is mainly silty clay loam or, sometimes, silty clay. At depths of 50 cm or more, gradation to sandy or gravelly textures often occurs.

Soil Moisture Characteristics: Ross soils are very poorly to poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. The groundwater table is due to lateral seepage from the adjacent streams, seepage from higher, adjoining soils and prolonged, heavy rainfall. Flooding is common during periods of heavy rain.

General Soil Description: Ross soils generally have a dark gray to dark grayish brown, friable, cultivated, silty surface about 20 cm thick that sometimes contains a few reddish mottles. The surface is underlain by a gray to dark grayish brown, weakly structured to massive, firm, silty to clayey zone about 30 cm thick that contains common (or sometimes many), dark brown to reddish-brown mottles. This zone usually grades to 20 cm or more of dark gray to olive-gray, massive, clayey to silty material containing a few, brownish to reddish mottles. This zone is underlain (often abruptly) by loose, usually water saturated, sandy to gravelly material. Soil reactions grade from very strongly acid in the surface to slightly acid in the subsoil (1:1 H_2O). Soil classification is dominantly ***Rego Gleysol***, changing to Rego Humic Gleysol in the few areas where the surface is darker coloured than usual.

Commonly Associated Soils: Sardis, Lehman and Judson soils are frequently closely associated with Ross soils. Sardis soils differ from Ross soils by being gravelly and sandy in texture; they are also well to imperfectly drained. Lehman soils have coarse-textured (gravelly) subsurfaces and subsoils and dark colored surfaces. Judson soils differ by consisting of 40 to 160 cm of organic material.

Vegetation: Most larger areas of Ross soils are cleared and cultivated. The remaining uncleared areas support mostly deciduous species including willow, red alder, black cottonwood and some western red cedar and western hemlock. Rooting is mainly restricted to the upper 40 to 50 cm by the high watertables and clayey subsoil textures.

General Land Use Comments: (1) Ross soils usually occupy small, variably shaped areas which makes them difficult to manage individually. They are limited for agricultural uses by high watertables and danger of flooding. Water control is required to improve them for a wier range of crops than is grown at present (mainly forages). Access to Ross soils is sometimes difficult since they occur on the floors of steep-sided gullies and channels. (2) Poor drainage and flooding hazard limit Ross soils for urban and related uses. Flooding is common during and after heavy, prolonged rains while high watertables preclude basements and other permanent excavations. Septic tank effluent disposal fields are severely impaired by high watertables and the usually dense, compact subsoil. (3) Black cottonwood is estimated to have the potential capability of producing 12 to 15 m^3/ha of wood/yr on Ross soils.

RYDER SOILS

Location and Extent: Ryder soils are common on the uplands and lower mountain slopes in the eastern part of the map area. About 1280 ha of pure map units and 3260 ha of soil complexes dominated by Ryder soils are mapped. The complexes are mainly with Lonzo Creek, Calkins, Marble Hill and Cannell soils.

Topography and Elevation: Ryder soils have variable topography, ranging from undulating or gently sloping to very steeply sloping or hilly. Slope gradients range between 5 and 50 percent. Most areas, however, are gently rolling or moderately sloping to strongly rolling with gradients from 10 to 30 percent. Elevations range from about 30 to 200 m above sea level.

Parent Material and Texture: Ryder soils have developed from medium-textured, stone-free eolian deposits, 50 cm or more thick, which overly moderately coarse textured glacial till. Surface and subsurface textures are mostly silt loam, varying sometimes to loam or fine sandy loam. The moderately stony underlying compact glacial till is sandy loam or gravelly sandy loam, sometimes containing lenses of gravel or sand.

Soil Moisture Characteristics: Ryder soils are well to moderately well drained. They are moderately pervious and have high water holding capacity and slow to moderate surface runoff. Telluric seepage along the surface of the subsoil glacial till often occurs during and after heavy, prolonged rains.

General Soil Description: Ryder soils have a dark reddish brown to reddish-brown, friable, weakly structured, silty, cultivated surface about 20 cm thick that contains moderate amounts of soft to hard, spherical concretions. The surface is underlain by at least 30 cm of friable, silty material which varies from reddish-brown in the upper part to yellowish-brown in the lower part and contains variable amounts of usually soft, spherical concretions. Under this, often abruptly, is grayish-brown, firm to very firm, sandy to loamy glacial till which contains, usually in lower slope positions, common to few, yellowish-brown to yellowish-red mottles. A thin (less than 5 cm thick), discontinuous zone of root concentration is often present on top of the glacial till. Soil reaction varies from very strongly acid in the surface and subsurface to strongly acid in the upper part of the glacial till. Soil classification is *Orthic Humo-Ferric Podzol*.

Plate 36 Typical landscape on the uplands north of Mission. On the undulating landscape in the foreground are mainly Ryder and Lonzo Creek soils developed in a variable depth of silty, eolian material overlying glacial till. The soils on the hilly background are similar except Cannell soils also occur there. Cannell soils are underlain by bedrock within 1 m of the surface.

Plate 37 Ryder soil profile (Orthic Humo-Ferric Podzol). These soils have developed in 50 cm or more of silty, eolian material overlying glacial till. In the photo, the contact between the two deposits is at about 3.5 ft. (105 cm). Note the good root distribution in the silty material.

Commonly Associated Soils: Lonzo Creek, Calkins, Marble Hill, Cannell and Poignant soils are frequently closely associated in the landscape with Ryder soils. Lonzo Creek soils are similar to Ryder soils differing only in the depth of the silty eolian capping. The depth in Lonzo Creek soils is 20 to 50 cm. Marble Hill soils also have a silty capping similar to Ryder soils; the underlay, however, is gravelly glaciofluvial materials rather than glacial till. Calkins soils differ by being poorly drained while Cannell soils are underlain by bedrock within 100 cm of the surface. Poignant soils differ by having developed from a mixture of stony colluvium and silty eolian material.

Vegetation: Areas with more subdued topography are mostly cleared and cultivated. The steeper, uncleared areas support a variable, mainly second-growth, forest which includes coast Douglas-fir, western hemlock, red alder, vine and bigleaf maple and western red cedar. The undergrowth includes salal, bracken, Pacific dogwood, thimbleberry and moss. Rooting is unrestricted in the silty overlay but decreases abruptly in the compact underlying glacial till. A variable, discontinuous root mat is often present immediately above the till.

General Land Use Comments: (1) Ryder soils are suited for most agricultural crops although adverse topography limits their use in many areas. Droughtiness during the latter part of most growing seasons effects late maturing crops and irrigation is beneficial. (2) In areas where topography is not excessive, Ryder soils are moderately suited for urban and related uses. Surface erosion of exposed, sloping areas is likely during heavy rains and septic tank effluent disposal may be impeded by the compact, slowly permeable underlying glacial till. (3) Forest growth is moderately good, the main growth limitation being droughty conditions during the latter parts of most growing seasons. Data from a limited number of plots indicates potential annual wood production by Douglas-fir to be between 9 and 12 m^3/ha.

SANDEL SOILS (SA)

Location and Extent: Sandel soils occur mainly on the lowlands of south Delta Municipality with lesser areas also found in the Serpentine-Nicomekl valley. About 280 ha of pure map units and 550 ha of soil complexes dominated by Sandel soils are mapped. The complexes are mainly with Spetifore, Embree, Vinod and Kitter soils.

Topography and Elevation: Sandel soils vary from nearly level to gently undulating; slope gradients are under 3 percent. All areas lie at elevations less than 3 m above sea level.

Parent Material and Texture: The parent material of Sandel soils are medium-textured, stone-free, mixed marine and freshwater deltaic deposits, underlain usually by sand below 1 m or more. Surface and subsurface textures are mostly silt loam, occasionally varying to loam or silty clay loam. The upper subsoil textures are similar except that thin, sandy lenses are also sometimes present. In the lower subsoil the textures usually grade to sand, loamy sand or alternating bands of sand and silt. Below about 80 cm depth saline conditions are encountered and substantial amounts of compounds high in sulphur are present.

Soil Moisture Characteristics: Sandel soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is near, and sometimes at, the soil surface during most of the winter but gradually recedes to about 75 cm or more during the summer. Surface ponding is common during heavy, prolonged rains.

General Soil Description: Sandel soils generally have a gray to dark gray, friable, silty, cultivated surface about 20 cm thick, sometimes containing a few, faint, reddish or brownish mottles. It is abruptly underlain by about 20 cm of dark grayish brown to grayish-brown, massive, friable, silty material which cracks vertically on drying and contains common, prominent, dark reddish brown or strong brown mottles. This zone grades to about 40 cm of grayish-brown or dark grayish brown, massive, silty material that contains occasional vertical cracks, common, distinct, yellow to dark brown mottles and hard, reddish-brown tubules around old root channels. Under this is grayish-brown or dark gray, massive, usually water saturated, silty to sandy material containing common, yellow to yellowish-red mottles and reddish-brown, hard tubules around old root channels. This zone is usually saline. The latter two zones are also high in sulphur compounds. Soil reaction is extremely acid throughout and soil classification is ***Rego Gleysol:saline phase***.

Commonly Associated Soils: Embree, Goudy, Spetifore and Kitter soils are all closely associated in the landscape with Sandel soils. Embree and Spetifore soils differ from Sandel soils by having black, organic matter enriched surfaces. Embree soils also contain organic strata in the subsurface. Kitter soils differ by occupying slightly higher topographic positions and having slightly clay enriched, strongly mottled subsurface layers. The subsoils of Kitter soils are also usually non-saline. Goudy soils differ by consisting of 40 to 160 cm of organic material.

Vegetation: Essentially all areas of Sandel soils are cleared and cultivated. The remaining "natural" vegetation along fences and other similar locations includes blackberry, hardhack, sedges, willow and others tolerant of poor drainage. Rooting is mainly confined to the upper 60 cm by the high watertables. Saline subsoil conditions are usually sufficiently deep to have little effect on most shallow rooted crops.

General Land Use Comments: (1) Poor drainage and high watertables are the main agricultural limitation of Sandel soils. These particularly effect perennial crops during the winter months but also limit crops during other parts of the year. Artificial watertable control is required for good production of most crops. Extreme soil acidity is also a limitation—this can be improved by liming or similar practices. Sandel soils often occupy relatively small areas intimately mixed with other soils which makes them difficult to manage individually. (2) Urban or similar uses are poorly suited for Sandel soils. Variable (usually low) soil bearing strengths may necessitate special foundations. Basements and other excavations will probably contain water during substantial parts of the year. Efficient septic tank effluent disposal is severely impaired by high watertables while underground utility and other installations are likely to corrode severely if not adequately protected.

SARDIS SOILS (SD)

Location and Extent: Sardis soils occupy scattered areas throughout the uplands and lowlands of the map area. The largest areas are in the vicinity of Vedder Canal and along the Alouette River north and east of Haney. About 1200 ha of pure map units and 1570 ha of soil complexes dominated by Sardis soils are mapped. Most complexes are with Hopedale, Ross, Seymour and Judson soils and with shallow variants of Lickman and Bates soils.

Topography and Elevation: The topography of Sardis soils varies from nearly level to gently undulating. Slope gradients are less than 5 percent and elevations lie between 10 and 100 m above sea level.

Parent Material and Texture: Sardis soils have developed from coarse-textured, variably stony, usually stratified deposits of steams flowing over both the uplands and lowlands. The deposits usually occur either as floodplains or as low terraces along the stream margins. Surface textures range from gravelly sand to sandy loam although gravelly sandy loam and gravelly loamy sand are most common. Subsurface and subsoil textures range from stony gravel to gravelly sand.

Soil Moisture Relationships: Sardis soils are mostly moderately well drained, although some slightly depressional areas are imperfectly drained or, occasionally, poorly drained. They are rapidly pervious and have low water holding capacity and slow to moderate surface runoff. A groundwater table is sometimes present in the lower soil, depending on the water level in the adjacent streams. Flooding occurs in some areas (where not dyked) during periods of heavy, prolonged rain or rapid snowmelt.

General Soil Description: Sardis soils usually have up to 10 cm of variably decomposed forest litter mainly of deciduous origin, on the soil surface. Under this is about 20 cm of grayish-brown, weakly structured to loose, sandy material containing variable amounts of stones. This then grades to loose gravel or gravelly sand, often very stony. Reddish or brownish mottles are sometimes present below 50 cm. In cultivated areas the organic surface accumulation is missing and the upper 20 cm of mineral soil is usually brown or grayish-brown. Soil reaction is variable; the upper soil usually varies from strongly acid to very strongly acid while the subsoil ranges from medium to strongly acid. Soil classification is mainly *Orthic Regosol*. Scattered areas of Gleyed Regosols also occur in imperfectly drained locations.

Commonly Associated Soils: Ross, Hopedale, Eastcap and Seymour soils as well as shallow variants of Lickman and Bates soils commonly occur in close association with Sardis soils. Ross and Hopedale soils differ from Sardis soils by being poorly drained. Also, Ross soils are silty to clayey in texture while Hopedale soils have silty surfaces, over sand. Eastcap and Seymour soils are texturally similar to Sardis soils but both are imperfectly drained. Additionally, Seymour soils have podzolic soil development. The shallow variants of Lickman and Bates soils differ texturally from Sardis soils and consist of silty surfaces over sand; Bates soils are also imperfectly drained.

Vegetation: Uncleared areas of Sardis soils support a variable, mainly deciduous forest including black cottonwood, bigleaf and vine maple, willow, red alder, western red cedar and western hemlock. Rooting is mainly restricted to the upper 70 cm by the coarse-textured, stony subsoil and periodic high watertables.

General Land Use Comments: (1) Sardis soils are limited for agricultural use by coarse, stony textures, droughtiness and, in some areas, by their susceptibility to flooding. Substantial amounts of irrigation and fertilization are required for the satisfactory production of most crops. (2) Sardis soils also are limited for urban and similar uses. Periodic high groundwater tables make basements and other similar excavations impractical and, in most areas, their susceptibility to occasional flooding is also a hazard. Septic tank effluent disposal is usually good (except when watertables are high) but filtration and purification of the effluent is likely to be incomplete due to coarse soil textures. (3) Growth of species such as black cottonwood is good on Sardis soils. Data from a limited number of plots indicates annual wood production by this species to be about 12 to 15 m^3/ha.

SAYRES SOILS (S)

Location and Extent: Sayres soils are common at the higher elevations of the mountainous parts of the map area. Although only 140 ha of pure map units are mapped, 27 800 ha of soil complexes dominated by Sayres soils also occur. The complexes are mostly with Dennett, Whonnock, Palisade, Golden Ears, Hollyburn, Strachan and Grouse soils.

Topography and Elevation: Sayres soils vary from steeply sloping or strongly rolling to extremely sloping or very hilly with slope gradients from 15 to over 60 percent. Most commonly, however, gradients are between 40 and 60 percent. Elevations mostly lie between 650 and 1300 m above sea level.

Parent Material and Texture: Sayres soils have developed from moderately coarse textured, stony colluvium or glacial till that is between 10 cm and 100 cm thick and overlies bedrock. The organic forest litter on the soil surface is dominantly well-decomposed while the underlying mineral soil varies from mainly sandy loam or gravelly sandy loam to gravelly loamy sand. Numerous stones, cobbles and boulders are present.

Soil Moisture Characteristics: Sayres soils are moderately well to well drained. They are moderately pervious and have high to moderate water holding capacity and moderate to slow surface runoff. Moderate to abundant telluric seepage occurs along the surface of the underlying bedrock during heavy rain or snowmelt, especially in areas where the bedrock is massive.

General Soil Description: Sayres soils generally have 15 cm or more of organic forest litter on the soil surface, most of which is well-decomposed, friable, matted and very dusky red to black in colour. The organic material is underlain by about 4 to 10 cm of gray, very friable, strongly leached, sandy material which, in turn, is underlain by a 20 to 50 cm thick zone of dark reddish brown to reddish-brown, friable to firm, weakly structured, sandy soil. Numerous gravel, stone, and cobble size particles are present and the organic matter content of the zone ranges from 10 to 20 percent. The zone is then abruptly underlain by bedrock, mostly granitic. A well defined very dusky red root mat, from 2 to 10 cm thick is usually present immediately above the bedrock. Soil reaction ranges from extremely acid in the upper soil to very strongly acid above the underlying rock. Soil classification is *Orthic Ferro-Humic Podzol:lithic phase*.

Commonly Associated Soils: Dennett, Whonnock, Golden Ears, Palisade, Strachan, Hollyburn and Grouse soils all commonly occur in close association with Sayres soils, either occupying adjacent map polygons or as part of soil complexes. Dennett soils differ from Sayres soils by consisting of 10 cm or more of organic forest litter over bedrock. Whonnock, Golden Ears, Palisade and Strachan soils are all more than 100 cm deep, over bedrock and vary from Sayres soils in that respect. Additionally, Whonnock, Golden Ears and Strachan soils all have strongly cemented subsoils; Whonnock soils are also imperfectly drained. Hollyburn and Grouse soils have soil depths over bedrock similar to Sayres soils. Hollyburn soils, however, do not contain the high levels of organic matter in the subsurface layers while Grouse soils are imperfectly drained and have a dark coloured surface mineral soil layer.

Vegetation: The natural forest on Sayres soils is mostly Pacific silver fir, mountain hemlock and yellow cedar; at the lower elevations, western hemlock and western red cedar also occur. Rooting is unimpeded down to the underlying bedrock. A well defined zone of root concentration (root mat) is usually present immediately above the bedrock.

General Land Use Comments: (1) Sayres soils are unsuited for agriculture due to very steep slopes, stoniness, shallowness to bedrock and poor climatic conditions (very deep snow packs and short growing seasons). (2) Urban or similar uses are also unsuited for reasons similar to those for agriculture. (3) Forest growth is somewhat variable, ranging from moderate at the lower elevations where it is limited by shallow rooting depth and sometimes droughtiness, to poor at the higher elevations where adverse climatic conditions and shallow rooting depress growth. During forest harvesting care should be taken to prevent soil disturbance which will either remove or further thin the already relatively shallow soil capping over bedrock. Data from a limited number of measured plots indicate Sayres soils have an annual productivity of wood of about 5 to 6.5 m^3/ha. The species considered are mountain hemlock, yellow cedar and Pacific silver fir.

SCAT SOILS

Location and Extent: Scat soils are scattered throughout the uplands of the map area. The largest areas occur on the Matsqui-Langley-Surrey uplands and east of Haney. About 460 ha of pure map units and 1470 ha of soil complexes dominated by Scat soils are mapped. The complexes are mainly with Whatcom, Heron, Nicholson, Albion and Boosey soils.

Topography and Elevation: Scat soils are level to gently sloping with slope gradients less than 5 percent. Usually they are depressional in relation to adjacent soils. Elevations vary from 10 to 150 m above sea level.

Parent Material and Texture: Scat soils have developed from moderately fine and fine-textured, compact glaciomarine deposits. In the eastern part of the map area a shallow capping of medium-textured eolian deposits commonly occurs on or is mixed into the surface. Surface textures are dominantly silt loam or silty clay loam with occasional variation to loam; subsurface and subsoil textures are silty clay loam or silty clay. Widely scattered stones may be present in some areas.

Soil Moisture Relationships: Scat soils are poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. Seepage and runoff from adjacent areas accumulates in Scat soils resulting in perched watertables above the slowly permeable subsoil. Surface ponding is common during and after heavy, prolonged rains. During prolonged, dry periods, the perched watertables dissipate.

General Soil Description: In uncleared areas the soil surface usually consists of up to 10 cm of mostly well-decomposed, black to reddish-brown organic forest litter of dominantly deciduous origin. This organic material is underlain by 10 to 15 cm of black to brownish-black, friable, silty material. In cultivated areas, the soil surface consists of a layer about 20 cm thick that is black to grayish-black, friable, weakly granular and silty. Underlying the surface mineral soil layer is about 15 cm of grayish-brown, blocky, firm, silty to clayey material containing many, prominent, strong brown to reddish-brown mottles. This then grades to about 40 cm of grayish-brown, massive, firm to very firm, clayey material containing few to common, reddish-brown or yellowish-brown mottles. Below this are extremely firm, grayish-brown, compact, weakly stratified to massive, unweathered glaciomarine deposits which contain common, very dark brown coatings along cleavage planes and a few yellowish mottles. Soil reaction is very strongly or strongly acid in the upper soil and grades to neutral or slightly acid in the subsoil (1:1 H_2O). Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Whatcom, Nicholson, Albion, Durieu, Heron and Boosey soils all frequently occur in close association with Scat soils. Whatcom, Nicholson and Durieu soils differ from Scat soils by occupying higher landscape positions and are well or moderately well drained. The upper soil layers are also reddish to brownish in colour. Albion, Heron and Boosey soils are poorly drained and are similar to Scat soils in that respect. Albion soils, however, differ by having a well defined clay accumulation layer in the subsurface. Heron and Boosey soils respectively differ by having sandy and gravelly surface and subsurface textures.

Vegetation: Many areas of Scat soils are cleared and cultivated and used for mostly pasture and forage production. Uncleared areas are variably forested and support mostly deciduous species; red alder, birch, vine maple, black cottonwood as well as western red cedar and western hemlock are the most common. The undergrowth includes salmonberry, blackberry, sword fern, hardhack, skunk cabbage, sedges, grass and moss, among others. Rooting is mainly restricted to the upper 50 cm of soil by high watertables and the dense, compact subsoil.

General Land Use Comments: (1) Agriculturally, Scat soils are limited by high watertables (poor drainage), particularly during the winter months and after heavy, prolonged rains. Artificial drainage is required to control these situations, however, the often depressional positions of Scat soils frequently make drainage outlets difficult to locate and install. Scat soils often occur as small areas intermixed with other soils which makes them difficult to manage separately. (2) Urban and related uses are poorly suited for Scat soils. High watertables make basements impractical and, together with the sticky nature of the soils, make underground utility and other installations difficult to install. Septic tank disposal fields function poorly due to the dense, slowly permeable subsoils and high, perched watertables. Periodic surface flooding is also a hazard. (3) Scat soils appear to be moderately well suited for growing trees such as black cottonwood. Estimated annual wood production by this species is about 9 to 12 m^3/ha.

SEABIRD SOILS (SB)

Location and Extent: Seabird soils occur as small, scattered areas on the Fraser River floodplain, mainly in locations near the river. About 130 ha of pure map units and 140 ha of soil complexes dominated by Seabird soils are mapped. The complexes are mostly with Grevell and Page soils.

Topography and Elevation: Seabird soils are mostly gently undulating or undulating with some areas varying to gently rolling. Slope gradients range between 1 and 8 percent. Elevations lie between 5 and 10 m above sea level.

Parent Material and Texture: The parent material of Seabird soils consists of coarse and moderately coarse textured, stone-free, laterally accreted Fraser River floodplain deposits which sometimes contain thin, silty lenses. Surface textures are mostly loamy sand or sand but sometimes range to sandy loam; subsurface and subsoil textures are similar but thin, silty bands or lenses are also sometimes present.

Soil Moisture Relationships: Seabird soils are imperfectly drained. They are mostly rapidly pervious although moderately pervious conditions occur where the silty subsoil lenses somewhat restrict permeability. Water holding capacity is low and surface runoff is slow. Periodic watertables occur in the upper soil during the freshet season and are related to the water level in the Fraser River. Undyked areas may suffer temporary flooding during these periods. Transitory perched watertables develop above the silty subsoil lenses during periods of heavy, prolonged rain.

General Soil Description: Seabird soils generally have a very dark grayish brown or dark grayish brown, very friable or loose, sandy, cultivated surface layer about 20 cm thick. In uncultivated areas, up to 5 cm of variably decomposed, mainly deciduous organic material is present on the soil surface. The surface layer is underlain by dark grayish brown or brownish-gray, loose, sandy material at least 100 cm thick that contains few to common, faint to distinct, usually reddish-brown to dark brown mottles in the lower part. Silty, olive-gray to dark grayish brown lenses, less than 15 cm thick, are sometimes present in the sandy material and contain common to many, prominent, dark reddish brown to dark brown mottles. Soil reaction ranges from slightly acid or neutral in the upper soil to neutral in the subsoil (1:1 H_2O). Soil classification is ***Gleyed Regosol***.

Commonly Associated Soils: Grevell, Page, Dewdney and Matsqui soils are usually found in close association with Seabird soils. Grevell soils are texturally similar to Seabird soils but usually occupy slightly higher landscape positions and are well drained. Dewdney and Matsqui soils differ from Seabird soils by having silty surface and subsurface textures. Page soils usually lie topographically lower than Seabird soils, and are poorly drained and silty in texture.

Vegetation: Cleared and cultivated areas of Seabird soils are used mainly for forage and pasture. Uncleared areas support a variable, mainly deciduous forest which includes black cottonwood, bigleaf maple and willow as well as western red cedar, Douglas-fir and Sitka spruce. Rooting depth is generally unrestricted for most vegetation.

General Land Use Comments: (1) The main agricultural limitation of Seabird soils is low soil moisture holding capacity which produces droughty conditions during the latter parts of the growing season. Irrigation is generally required to maintain good growth. The coarse textures also restrict nutrient holding ability. Fertilizer additions (in smaller amounts) several times during the growing season as well as increasing the organic matter content of the plow layer will help improve this problem. (2) High water tables during the spring when the Fraser River is high is the main restriction for urban and related development. During this season, basements and other excavations are likely to contain water and septic tank effluent disposal systems are impaired. The probability of flooding (in undyked areas) is also a hazard. (3) Forest growth of deciduous species such as cottonwood is high and this use may be best for those areas outside the dykes and on some of the islands in the river. Data from a limited number of plots indicates the annual wood production by cottonwood to be between 12 and 15 m^3/ha.

SEAVIEW SOILS (SV)

Location and Extent: Seaview soils occur only along the western margin of Boundary Bay where 100 ha of pure map units are mapped.

Topography and Elevation: Topographically, Seaview soils vary from nearly level to gently undulating with slopes of less than 2 percent. All areas lie less than 2 m above sea level.

Parent Material and Texture: Seaview soils have developed from medium-textured deltaic deposits underlain by sand or gravelly sand at depths of 50 cm or more. Surface and subsurface textures are silt loam; the subsoil is sand or gravelly sand, sometimes containing thin, silty lenses and fragments of sea shells. Strongly saline conditions are usual below depths of about 20 cm and substantial amounts of compounds high in sulphur are present also.

Soil Moisture Relationships: Drainage of Seaview soils is poor to very poor. They are moderately to rapidly pervious and have high water holding capacity and slow surface runoff. The watertable is at or near the surface for most of the winter but recedes slightly over the summer. Seepage and runoff from adjacent soils accumulates on Seaview soils and the coarse-textured subsoil permits seepage of salt water from the ocean.

General Soil Description: Seaview soils have a a dark grayish brown, moderately structured, friable, silty surface layer about 15 cm thick which contains 15 to 25 percent organic matter and, sometimes, common, fine to distinct, reddish mottles. This surface layer grades to about 50 cm of dark gray to olive-gray, vertically cracked (when dry), firm, silty material containing common, prominent, reddish-brown to yellowish-red mottles and dark reddish brown organic coatings on the walls of cracks. This zone is moderately to strongly saline. Underlying is strongly saline, dark brown to dark gray sand or loamy sand, usually loose but sometimes containing cemented pockets or thin lenses of silty material and fragments of sea shells. Soil reaction varies from extremely acid in the upper 70 cm to slightly acid in the underlying sand. Soil classification is ***Rego Gleysol:saline phase***.

Commonly Associated Soils: Tsawwassen soils commonly occur in close association with Seaview soils. They usually lie topographically higher than Seasview soils and consist of well drained, sandy, raised beach deposits.

Vegetation: The natural vegetation on Seaview soils is mainly salt tolerant grasses, shrubs and forbs.

General Land Use Comments: (1) Seaview soils are mostly used for permanent pasture which consists of salt tolerant grasses. Artificial drainage (and dyking) is required to control the watertable and irrigation is needed to wash the excess salts from the soil. (2) Seaview soils are poorly suited for urban or similar development. High watertables preclude basements and severely restrict septic tank effluent disposal. Strongly saline soil conditions are likely to cause severe corrosion of unprotected underground utility and other installations.

SECHELT SOILS (SL)

Location and Extent: Sechelt soils occur only in the vicinity of Sechelt on the Sunshine Coast where about 1670 ha of pure map units and 85 ha of Sechelt-Dean soil complex are mapped.

Topography and Elevation: The topography of Sechelt soils varies from gently to steeply sloping with slope gradients between 5 and 30 percent. Elevations range from sea level to about 400 m above sea level.

Parent Material and Texture: Sechelt soils have developed from deep, coarse-textured (sandy), mainly stone-free alluvial fan and delta deposits which change sometimes to gravel below 2 m or more. Surface textures vary from sand to loamy sand. Subsurface and subsoil textures are mainly medium or coarse sand containing, sometimes, thin strata of gravelly material.

Soil Moisture Relationships: Sechelt soils are rapidly to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff.

General Soil Description: Sechelt soils have a variably decomposed layer of organic forest litter less than 10 cm thick on the soil surface. The organic material is underlain by a discontinuous, gray, loose, strongly leached, sandy layer less than 5 cm thick. It in turn, is abruptly underlain by about 20 cm of reddish-brown, loose, sandy material. This grades to about 50 cm of mainly loose, yellowish-brown, sandy material that sometimes contains thin, reddish, weakly cemented, gravelly lenses. Below this is deep, loose, variably coloured sand. Soil reactions range from very strongly acid in the upper soil to medium or strongly acid in the lower subsoil. Soil classification is mostly *Orthic Humo-Ferric Podzol* although some Eluviated Dystric Brunisol areas are also included, particularly at the lower elevations.

Commonly Associated Soils: Dean, Capilano and Bose soils are commonly associated with Sechelt soils. Dean and Capilano soils differ from Sechelt soils by being gravelly in texture. Additionally, Capilano soils have strongly cemented subsurface layers. Bose soils also have gravelly and stony surface and subsurface layers but compact, loamy glacial till or clayey glaciomarine deposits occur in the subsoil.

Vegetation: Small areas of Sechelt soils are cleared, mainly for forage or pasture production or are used as urban sites. Uncleared areas support a variable forest consisting mainly of coast Douglas-fir, red alder and some western red cedar and lodgepole pine; some Sitka spruce also occurs at the lower elevations near the sea shore. Rooting is unrestricted to at least 100 cm depth.

General Land Use Comments: (1) Low soil water holding capacity resulting in droughtiness is the main agricultural limitation of Sechelt soils. In some locations adverse topography is also limiting. Adequate irrigation and fertilization will make Sechelt soils productive for a variety of agricultural crops. (2) Where topography is not excessive, Sechelt soils are suited for urban uses. Basements and other excavations are easy to construct, and septic tank effluent disposal fields should function efficiently due to the rapid soil permeability. High concentrations of septic tank fields in small areas may, however, lead to potential groundwater contamination because of incomplete filtration by the coarse textured soil materials. Sechelt soil areas are also sources of aggregate, mainly sand. (3) Forest growth is moderate, limited mainly by soil moisture deficiencies during the growing season. Estimated annual wood production by Douglas-fir is about 6.5 to 8 m^3/ha.

SEYMOUR SOILS (SY)

Location and Extent: Seymour soils occur mainly along the Coquitlam, Seymour and Alouette Rivers in the northern part of the map area. About 450 ha of pure map units and 1060 ha of soil complexes dominated by Seymour soils are mapped. The complexes are usually with Sardis, Judson, Shalish and Eastcap soils.

Topography and Elevation: The topography of Seymour soils varies from nearly level to gently sloping or undulating with slope gradients of less than 5 percent. Elevations range from about 20 to 150 m above sea level.

Parent Material and Texture: The parent material of Seymour soils consists of coarse-textured, stony, alluvial deposits, usually occurring as low terraces along the river margins. Surface textures are gravelly loamy sand, gravelly sand or sandy gravel, usually stony. Subsurface and subsoil textures are mainly sandy gravel and are very stony and bouldery.

Soil Moisture Characteristics: Seymour soils are imperfectly drained. They are usually rapidly pervious although discontinuous cemented strata in some locations somewhat retard downward moisture movement. Water holding capacity is low and surface runoff is slow. Seymour soil areas receive seepage from adjacent, higher lands and a fluctuating watertable is usually present which is related to the heighth of water in the adjacent streams. The soils are subject to periodic flooding during high runoff periods.

General Soil Description: Seymour soils generally have up to 15 cm of mostly well-decomposed, matted, dark reddish brown, organic forest litter on the soil surface. This is underlain by 2 to 5 cm of reddish-gray to gray, friable, weakly structured, strongly leached, gravelly and sandy material which, in turn, is underlain by about 20 cm of friable to firm, weakly structured, dark reddish brown or dark brown, gravelly material. This layer is underlain by about 60 cm of variably coloured (dark brown, brown or reddish-brown), loose to firm, variably cemented, gravelly material containing from 50 to 80 percent stones and boulders as well as common,reddish to yellowish mottles. This zone gradually grades to loose, stony and bouldery gravel below about 120 cm which contains variable amounts of reddish and yellowish mottles and stains. Soil reaction grades from extremely acid in the upper soil to very strongly or strongly acid in the subsoil. Soil classification is mostly ***Gleyed Ferro-Humic Podzol*** although some Gleyed Ortstein Ferro-Humic Podzols and Duric Ferro-Humic Podzols are also present in areas where the subsurface and subsoil cementation is stronger than usual.

Commonly Associated Soils: Sardis, Eastcap, and Shalish soils are usually closely associated with Seymour soils. Sardis and Eastcap soils differ from Seymour soils by having very little soil development (are regosolic) while Shalish soils have developed from alluvial fan deposits and are well to moderately well drained.

Vegetation: The vegetation on Seymour soil consists mainly of second-growth forest, including coast Douglas-fir, western red cedar, western hemlock, red alder, black cottonwood and vine and bigleaf maple. Rooting depth is variable, depending on height of the periodic watertable, strength of the discontinuous subsurface cementation and on the amount of stones and boulders in the subsoil.

General Land Use Comments: (1) Seymour soils are generally unsuited for agricultural use due to the stony and bouldery, coarse-textured nature of the soil. Periodic flooding hazard and low moisture holding capacity also limit agricultural use. (2) Urban and similar uses are mainly unsuited. Periodic flooding is a hazard and basements and other excavations are likely to contain water during parts of the year. Stones and boulders make excavation difficult and potential ground water contamination may occur from septic tank disposal fields due to poor filtration by the coarse-textured soil. (3) Forest growth is moderately good although periodic soil moisture deficiencies and restricted root distribution due to stones and boulders are somewhat limiting. Annual wood production by Douglas-fir and western red cedar is estimated to be about 7.5 to 10 m^3/ha.

SHALISH SOILS

Location and Extent: Shalish soils are common on the floors and lower walls of most mountain valleys in the map area. About 2040 ha of pure map units and 5200 ha of soil complexes dominated by Shalish soils are mapped. Most complexes are with Isar soils although lesser areas in complexes with Strachan, Seymour and Sardis soils also occur.

Topography and Elevation: The topography of Shalish soils generally varies from strongly to steeply sloping with slope gradients between 10 and 30 percent. Elevations range from sea level to about 300 m above sea level.

Parent Material and Texture: Shalish soils have developed from stony and bouldery, coarse-textured alluvial fan deposits. Surface textures vary from gravelly sandy loam to gravelly loamy sand, both stony. Subsurface textures are mainly gravelly loamy sand or gravelly sand and grade to gravelly sand or sandy gravel in the subsoil. Coarse fragments usually range, by volume, from about 50 percent in the surface to between 60 and 90 percent in the subsurface and subsoil.

Soil Moisture Characteristics: Shalish soils are moderately well to well drained. They are rapidly pervious for the most part although a few moderately pervious areas also occur where discontinuous cementation exists in the lower subsoil. Water holding capacity is low and surface runoff is slow. Telluric seepage through the lower subsoil is common during and after heavy rains or during snowmelt.

General Soil Description: Shalish soils generally have an organic surface litter layer between 5 and 15 cm thick which is mainly well-decomposed, matted and dark reddish brown to black in colour. It is underlain by a weakly structured, gray to reddish-gray, strongly leached, sandy and gravelly layer about 4 to 8 cm thick. In turn, this is abruptly underlain by a dark reddish brown, organic matter enriched (10 to 15 percent organic matter content), friable, weakly structured, sandy and gravelly layer about 15 cm thick that contains about 50 percent coarse fragments. This layer grades to about 75 cm of friable, weakly structured, stony and bouldery, gravelly sand or sandy gravel that is usually dark reddish brown in the upper part and reddish-brown near the bottom and contains variably coloured mottles in the lower part as well. Under this, usually, is loose, stony and bouldery, gravelly and sandy material or sometimes, a layer of massive, moderately cemented, similarly textured, brownish-gray or reddish-brown material. Where cementation exists a zone of root concentration is usually present on its' surface and variable amounts of telluric seepage is present in this zone also. Soil reaction grades from extremely acid in the upper soil to very strongly or strongly acid in the lower subsoil. Soil classification is mainly *Orthic Ferro-Humic Podzol* although some areas of Duric Ferro-Humic Podzols are also included where the subsoil cementation is stronger than usual and is relatively continuous.

Commonly Associated Soils: Isar soils are usually associated with Shalish soils; sometimes Seymour and Sardis soils are closely associated as well. Isar soils are texturally similar to Shalish soils but have little soil profile development (are regosolic). They are usually found on the actively depositing or recently deposited portions of the alluvial fans while the Shalish soils occupy the older, more stable fan areas. Seymour and Sardis soils differ from Shalish soils by being imperfectly drained and usually lie at lower topographic positions than do Shalish soils. The alluvial fans deposits which form the parent material of Shalish soils frequently overlie the fluvial terraces on which Seymour and Sardis soils occur.

Vegetation: The natural vegetation on Shalish soils usually consists of coast Douglas-fir, western hemlock and western red cedar; red alder, maple and some black cottonwood are prevalent in second-growth areas. Rooting, except for limitations imposed by the high coarse fragment content, is unrestricted to at least 100 cm. Below this depth, restriction sometimes occurs because of discontinuous cementation.

General Land Use Comments: (1) Excessive stoniness and low water holding capacity generally make Shalish soils unsuited for arable agriculture. (2) Urban and related uses are moderately to poorly suited for Shalish soils. The stony and bouldery nature of the soil make basements, septic tank disposal fields and other excavations difficult to construct. Effluent filtration may be incomplete because of coarse textures and may either contaminate groundwater or other areas downslope. Stream channel shifting or diversion is a significant hazard in some areas. Shalish soils provide potential sources of fill and aggregate; screening is likely to be required, however. (3) Forest growth is good in spite of the coarse soil textures and low water holding capacity. Telluric subsoil seepage seems to provide enough moisture during most of the growing season. Data from a limited number of plots indicates western hemlock and Douglas-fir produce about 9 to 15 m^3/ha of wood/yr. The higher rates of growth are associated with areas receiving the greatest amounts of seepage.

SIM SOILS (SI)

Location and Extent: Sim soils occupy relatively small areas in the lowlands of the map area; most areas occur on the floodplain of the Fraser River. About 250 ha of pure map units and 380 ha of soil complexes dominated by Sim soils are mapped. The complexes are mostly with Hazelwood, Bates and Beharrel soils.

Topography and Elevation: The topography of Sim soils varies from undulating to gently rolling with slopes between 2 and 6 percent. Elevations range from 5 to 15 m above sea level. Sim soils are usually slightly depressional or lie at somewhat lower topographic positions, when compared to adjacent better drained soils.

Parent Material and Texture: Sim soils have formed in medium and moderately fine textured alluvial deposits of local streams. These deposits, usually 1 m or more thick, were eroded from the surrounding uplands and redeposited as natural levees along the courses of streams flowing across the lowlands. They usually overlie, at depth, Fraser River, or sometimes, lacustrine deposits. Surface, subsurface and subsoil textures vary from silt loam to silty clay loam. In a few areas sand occurs at 20 to 50 cm from the surface but usually is below 1 m from the surface.

Soil Moisture Characteristics: Sim soils are generally poorly drained although a few moderately poorly drained areas are included also. They are moderately pervious and have high water holding capacity and slow surface runoff. The groundwater table is near the surface during most of the winter but recedes gradually during the summer. The restricted permeability and, in some areas, slightly depressional landscape locations cause surface ponding during periods of heavy rain.

General Soil Description: Sim soils generally have a friable, black, silty, cultivated surface layer which contains between 10 and 20 percent organic matter and is about 20 to 25 cm thick. The surface layer is abruptly underlain by about 20 cm of gray to dark gray, firm, silty to clayey material which cracks vertically on drying and usually contains many, prominent, yellowish-red to strong brown mottles. This zone then grades to about 20 cm of gray to grayish-brown, massive, firm, silty to clayey material which contains common to few, reddish-yellow to dark brown mottles, mainly along old root channels. Under this, in turn, is gray to olive-gray, massive, silty material with usually a few brownish or yellowish mottles. Sand usually occurs at depth, mostly below 100 cm. Soil reaction grades from very strongly or strongly acid in the upper soil to medium acid in the subsoil. Soil classification is *Orthic Humic Gleysol*.

Commonly Associated Soils: Hazelwood, Beharrel and Bates soils commonly are closely associated with Sim soils. Hazelwood and Beharrel soils are both poorly drained, as are Sim soils, but differ by being clayey in texture. Additionally, Beharrel soils contain a well-defined clay accumulation layer in the subsurface. Bates soils usually occupy slightly higher landscape positions than do Sim soils and differ by being imperfectly drained.

Vegetation: Most areas of Sim soils are cleared and used for producing a variety of agricultural crops. The small, remaining, uncleared areas support mainly deciduous vegetation which includes black cottonwood, red alder, willow, blackberry, salmonberry, sedges and grasses. Rooting is restricted mainly to the upper 60 cm by the high winter watertables and massive subsoil materials.

General Land Use Comments: (1) The main agricultural limitation of Sim soils is poor drainage and high watertables during the winter months which severely restrict overwintering of legume and most other perennial crops. Artificial drainage can overcome this problem and will also allow earlier cultivation in the spring. Sim soils usually occur as relatively small areas intimately intermingled with other soils of varying texture or drainage, and this makes them difficult to manage on an individual basis. (2) High winter watertables, some hazard due to flooding and relatively slow permeability limit Sim soils for urban and similar uses. Soil bearing strengths appear to be mostly low, probably requiring special foundation consideration. High watertables severely restrict efficient operation of septic tank effluent disposal fields.

SPETIFORE SOILS (SF)

Location and Extent: Spetifore soils occur only on the Fraser River delta, almost exclusively in the central and southern parts of Delta Municipality. About 330 ha of pure map units and 480 ha of soil complexes dominated by Spetifore soils are mapped. The complexes are usually with Delta, Vinod and Goudy soils.

Topography and Elevation: Spetifore soils are nearly level to gently undulating with slopes less than 2 percent. They are usually slightly depressional in relation to adjacent soils and lie at elevations less than 3 m above sea level.

Parent Material and Texture: Spetifore soils have developed from medium-textured deltaic deposits which are deeper than 1 m and usually overlie medium or fine sand. The surface texture is silt loam. Subsurface and subsoil textures are usually similar, changing to silty clay loam in a few areas. The subsurface and subsoil, and often the surface, are moderately to strongly saline and contain substantial amounts of compounds high in sulphur.

Soil Moisture Characteristics: Spetifore soils are poorly to very poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertables are usually near or at the soil surface during the winter but gradually recede to 50 cm or more during the summer. The underlying sands are generally permanently saturated with saline water. Temporary surface ponding during heavy, prolonged rain is common.

General Soil Description: Spetifore soils generally have a cultivated, silty surface that is about 20 cm thick, very dark brown to very dark grayish brown in colour, friable and moderately structured. It contains between 15 to 25 percent organic matter and is often weakly or moderately saline. Abruptly underlying the surface is about 20 cm of dark gray or dark grayish brown, massive, firm, silty material containing some vertical cracks with reddish to brownish organic coatings on their walls. A few to common, reddish-brown to light yellowish brown mottles are also present and the layer is usually moderately to weakly saline. Under this is 50 cm or more of firm, massive, dark gray to olive-gray, silty material containing widely spaced vertical cracks. Common to few, yellowish mottles are present in the upper part which change to reddish-brown in the lower part and hard, very dark gray to dark reddish brown tubules around old root channels are also present. This zone is generally moderately to strongly saline and grades below 100 cm to either saturated, strongly saline sand or alternating bands of silt and sand. Substantial amounts of compounds high in sulphur are generally present in the soil downwards from the surface layer. Soil reaction is extremely acid to at least 100 cm depth. Soil classification is *Rego Humic Gleysol:saline phase*.

Commonly Associated Soils: Delta, Vinod, Goudy and Guichon soils often occur in close association with Spetifore soils. In common with Spetifore soils, all are saline. In Delta soils, however, the saline conditions do not generally occur until depths of 80 cm of more. Vinod soils differ from Spetifore soils by being clayey in the subsoil and also by having an organic surface from 15 to 40 cm thick. Goudy soils differ by consisting of organic matter from 40 to 160 cm thick while in Guichon soils, sand is encountered between 20 and 50 cm of the surface.

Vegetation: Essentially all areas of Spetifore soils are cleared and cultivated. Rooting is mainly restricted to the upper 50 to 60 cm by high groundwater levels, saline conditions and massive subsoil.

General Land Use Comments: (1) Spetifore soils are agriculturally limited by high watertables which particularly inhibit overwintering of perennial crops, and by saline soil conditions. Artificial drainage is required to control watertables and also to help wash out the salts from the soil. (2) Urban and similar uses are poorly suited for Spetifore soils. Variable (usually low) bearing strengths probably require special foundations, basements and other excavations will contain water at least during parts of the year, and septic tank disposal fields are severely impeded by the high watertables. Unless adequately protected, buried utility and other installations are likely to suffer severe corrosion. Periodic surface ponding is also a hazard.

STAVE SOILS

Location and Extent: Stave soils occur mostly on the uplands north of the Fraser River and east from Alouette Lake. About 660 ha of pure map units and 480 ha of soil complexes dominated by Stave soils are mapped. The complexes are mostly with Keystone, Roach and Buntzen soils.

Topography and Elevation: The topography of Stave soils is variable, ranging from gently sloping or undulating to strongly sloping or moderately rolling. Slopes are usually between 2 and 15 percent but along incised streams, the gradients rise to 60 percent. Elevations mainly lie between 100 and 200 m above sea level.

Parent Material and Texture: Stave soils have developed from moderately coarse to coarse-textured (sandy) littoral, glaciofluvial or sometimes, lacustrine deposits at least 1 m thick which are underlain usually by glacial till or occasionally, glaciomarine deposits. Shallow (less than 50 cm thick) deposits of silty aeolian material usually are mixed into the upper part of the coarser material. Surface textures range from sandy loam to loam. The subsurface varies from loamy sand to coarse sand while the subsoils are mostly coarse sand or gravelly sand, often containing numerous stones, cobbles and boulders. Moderate numbers of stones are sometimes present in the surface. The glacial till which occurs at depth is compact, dense, gravelly sandy loam.

Soil Moisture Characteristics: Stave soils are well to moderately well drained. They are rapidly pervious although some hinderance to moisture movement occurs in the lower subsoil due to moderate, discontinuous cementation in some locations. Permeability of the underlying till or glaciomarine material is low, leading to seepage along the surface of this zone. Areas of Stave soils along the margin of Stave Lake may have watertables in the subsoil depending on the height of the water level in the lake. The soils have slow surface runoff and low to moderate water holding capacity.

General Soil Description: Stave soils usually have 10 cm or less of variably decomposed, organic forest litter on the soil surface. This is underlain by 2 to 5 cm of gray to reddish-gray, friable, strongly leached, sandy to loamy material. The leached layer is abruptly underlain by about 20 cm of dark reddish brown or reddish-brown, friable, weakly structured, loamy soil often containing moderate amounts of stones and common, hard, reddish concretions. This zone then grades to about 40 cm of sandy material which is friable, weakly structured and varies from reddish-brown in the upper part to yellowish-brown in the lower part and may contain moderate amounts of stones. Under this is about 40 cm of yellowish-brown to olive, sandy material containing variable amounts of stones and boulders as well as discontinuous, moderately cemented patches and a few mottles. A loose to very firm (due to cemented patches) zone is then encountered which consists of gravelly sand that contains common, reddish or yellowish mottles and often excessive amounts of stones and boulders. Seepage is present during parts of the year. At depths of at least 1 m, dense, compact glacial till or glaciomarine deposits occur. Soil reactions grade from extremely acid in the surface to strongly acid in the subsoil. Soil classification is *Orthic Humo-Ferric Podzol.*

Commonly Associated Soils: Keystone, Roach and Buntzen soils are often closely associated with Stave soils. Buntzen soils differ from Stave soils by being developed from glacial till and contain strongly cemented subsoil layers. Keystone and Roach soils are both gravelly in texture and have strong cementation in the subsurface and/or subsoil. Stave soils are somewhat similar to Sunshine soils. Sunshine soils however have coarser textured surfaces and are stone-free.

Vegetation: Most areas of Stave soils have been logged and now support second-growth western hemlock, western red cedar and coast Douglas-fir as well as red alder and maple. Rooting depth is essentially unrestricted to at least 100 cm, then becomes variably restricted by the discontinuous cementation and underlying dense geologic materials.

General Land Use Comments: (1) Stave soils are moderately suited for agricultural use, particularly if irrigated. Their main limitations are low waterholding capacities and, in some areas, adverse topography and moderate stoniness. Most areas are presently uncleared. (2) Urban related uses are well to moderately suited for Stave soils (except in areas adjacent to Stave Lake where groundwater conditions may exist during parts of the year). In some areas stoniness and boulders may interfere with excavation. Numerous septic tank installations may cause seepage to occur in downslope locations. Road building properties are good owing to the relatively coarse subsoil and subdued topography. (3) Forest growth is good. Limited plot data indicates that Douglas-fir and western hemlock produce between 12 and 15 m^3 of wood/ha/yr. Some growth limitations are imposed by the low waterholding capacity during dry summers.

STEELHEAD SOILS

Location and Extent: Steelhead soils occupy scattered areas on the uplands and lower mountain slopes north of the Fraser River and east from Howe Sound. About 330 ha of pure map units and 1430 ha of soil complexes dominated by Steelhead soils are mapped. The complexes are mostly with Buntzen soils and, in some areas, with Cannell or Nicholson soils.

Topography and Elevation: The topography of Steelhead soils varies from moderately sloping and gently undulating to steeply sloping or strongly rolling. Slope gradients range from 5 to 20 percent. The soils usually occur in lower slope positions or in slightly depressional locations. Elevations range between 150 and 700 m above sea level.

Parent Material and Texture: Steelhead soils have developed from moderately coarse textured (and occasionally medium-textured) glacial till. Medium-textured aeolian material, usually less than 20 cm thick, is mixed into the surface, particularly in the eastern part of the map area. Surface textures vary from loam to sandy loam while subsurface and subsoil textures are mostly gravelly sandy loam, occasionally varying to loam or gravelly loamy sand. Moderate stone contents are usual and the subsoil is strongly cemented below about 80 cm.

Soil Moisture Characteristics: Steelhead soils are imperfectly drained. They are moderately pervious in the surface and subsurface; this decreases to slow in the cemented subsoil. They also have moderate water holding capacity and slow surface runoff. The slightly depressional and lower slope landscape positions allow temporary perched watertables to develop above the cemented layer due to seepage from upslope.

General Soil Description: Steelhead soils usually have 10 to 15 cm of organic forest litter on the soil surface, the lower two-thirds of which is partially to well-decomposed and dark reddish brown to black in colour. The organic surface layer is underlain by 2 to 5 cm of friable, gray to grayish-brown, strongly leached, loamy material which, in turn, is abruptly underlain by about 15 cm of friable to firm, moderately structured, dark reddish brown to black, loamy soil containing a few, scattered, moderately cemented patches. This zone is underlain by about 50 cm of friable, weakly structured, strong brown, yellowish-red or yellowish-brown, sandy or loamy material containing a few, distinct, reddish mottles in the upper part and common to many mottles in the lower part. Abruptly under this is extremely firm, massive, strongly cemented, sandy material, grayish-brown to olive-gray in colour, which contains common, yellowish-red mottles. A zone of root concentration, 5 to 10 cm thick and dark brown to reddish-brown in colour, usually immediately overlies the cemented zone. The cemented zone grades to unweathered, olive-gray to grayish-brown glacial till below about 150 cm. Soil reaction grades from extremely acid in the upper soil to medium acid in the lower subsoil. Soil classification is *Duric Ferro-Humic Podzol.*

Commonly Associated Soils: Buntzen and Cannell soils commonly occur in close association with Steelhead soils. Buntzen soils are generally similar to Steelhead soils except that they usually occupy somewhat higher landscape positions and are well to moderately well drained. Cannell soils differ by being underlain by bedrock within 100 cm of the surface and are wll to rapidly drained.

Vegetation: Most areas of Steelhead soils have been logged and currently support a second-growth forest that includes coast Douglas-fir, western hemlock and western red cedar with red alder and maple. Rooting is unrestricted in the upper 80 to 100 cm but is severely impeded below that by the cemented subsoil. Well defined root concentrations (root mat) are usually present immediately above the cemented material.

General Land Use Comments: (1) Steelhead soils are severely to moderately limited for agriculture by adverse topography, stoniness and periodic high watertables, particularly during the winter months. (2) Although soil bearing strengths are high, periodic high watertables and slow subsoil permeability severely limit Steelhead soils for urban development that requires septic tank sewage effluent disposal. The cemented subsoil makes excavations difficult and these are likely to contain water during parts of the year. (3) Forest growth on Steelhead soils is good. Seepage and temporary perched watertables ensure adequate moisture for most growing seasons. Limited plot data indicates western red cedar and western hemlock produce 12 to 15 m^3 of wood/ha/yr on Steelhead soils. Prompt replanting (after logging) is suggested since non-commercial species tend to invade quickly.

STRACHAN SOILS (SN)

Location and Extent: Strachan soils are common on the lower mountain slopes, mainly in the Coast Range. Although only 260 ha of pure map units are mapped, soil complexes dominated by Strachan soils occupy 23 720 ha. The complexes are mainly with Burwell and Cannell soils and less commonly, with Eunice, Paton, Sayres and Palisade soils.

Topography and Elevation: Strachan soils are very steeply to steeply sloping. Slope gradients vary from 20 to 70 percent but mostly are between 40 and 60 percent. Elevations range from about 150 to 700 m above sea level.

Parent Material and Texture: Strachan soils have developed from moderately coarse textured glacial till modified in the upper part by colluvial action, or capped by colluvium. Surface and subsurface textures are sandy loam or gravelly sandy loam containing numerous stones and some boulders. The subsoil is dense, compact, cemented, stony gravelly sandy loam or gravelly loamy sand. Bedrock occurs at depths deeper than 1 m.

Soil Moisture Characteristics: Strachan soils are mostly moderately well drained with some well drained inclusions. They are moderately to rapidly pervious in the surface and subsurface but this decreases to slowly pervious in the cemented subsoil. Variable amounts of telluric seepage flows along the surface of the cemented layer, mainly during and after heavy rain or during snowmelt. There is moderate surface runoff and the water holding capacity is moderate.

General Soil Description: Strachan soils usually have 10 to 20 cm of organic forest litter on the soil surface, most of which is black to dark reddish brown, matted to amorphous and well to partially decomposed. The organic surface layer is underlain by a gray to dark reddish gray, strongly leached, sandy layer from 2 to 5 cm thick. The leached layer is abruptly underlain by about 40 cm of friable, weakly to moderately structured, dark reddish brown to dark brown, sandy material containing 10 to 15 percent, variably distributed organic matter and usually, a few, hard, spherical concretions. Under this is about 50 cm of weakly structured, friable, reddish-brown to yellowish-red, sandy material which contains concentrations of roots in the lower part as well as variable amounts of seepage. Abruptly underlying this is grayish-brown to olive-gray, very firm, massive, strongly cemented, sandy material containing common, brownish to yellowish or reddish mottles. Gradation to unweathered, brownish-gray or olive-gray glacial till occurs below about 150 cm. Soil reactions are extremely acid in the upper 50 cm then gradually grade to medium or very strongly acid in the lower subsoil. Soil classification is *Duric Ferro-Humic Podzol*.

Commonly Associated Soils: Burwell and Cannell soils are usually closely associated with Strachan soils. Burwell soils are generally similar to Strachan soils but usually occur on lower slope or depressional landscape positions and are imperfectly drained. Cannell soils differ from Strachan soils by being underlain by bedrock within 100 cm of the surface.

Vegetation: The natural vegetation on Strachan soils is dominantly coniferous and includes western hemlock, western red cedar and coast Douglas-fir with mountain hemlock and yellow cedar also sometimes present at the soils' upper elevational range. Various deciduous species, including red alder, tend to invade logged and other severely disturbed areas. Rooting is generally unimpeded to about 100 cm depth but is severely restricted below that by the dense, cemented subsoil.

General Land Use Comments: (1) Strachan soils are unsuited for agricultural or urban uses due to excessive slopes and stoniness. (2) Forest growth is good although moisture deficiencies during the latter parts of the growing season develop during dry summers. Limited plot data indicates wood production by Douglas-fir and western hemlock to be about 9 to 12 m^3/ha/yr. During forest harvesting, special care is required to prevent surface erosion and to control seepage into road cuts and ditches.

STURGEON SOILS (SG)

Location and Extent: Sturgeon soils occur mainly in the Pitt Polder area and in the northern part of Pitt Meadows Municipality. Lesser areas are found along the western edge of the lower Pitt River and near the mouth of Widgeon Creek. About 320 ha of pure map units and 1550 ha of soil complexes dominated by Sturgeon soils are mapped. Most complexes are with Addington, Alouette and Widgeon soils.

Topography and Elevation: The topography of Sturgeon soils varies from slightly depressional or nearly level to gently undulating with slopes of less than 2 percent. All areas lie less than 5 m above sea level.

Parent Material and Texture: Sturgeon soils have developed from medium-textured, mixed floodplain deposits of the Alouette, Pitt and Fraser Rivers, capped by 20 to 40 cm of mostly well-decomposed organic material. Surface texture is humic, usually containing from 20 to 50 percent silt. The subsurface is silt loam, occasionally varying to silty clay loam or silt. The upper subsoil is similar but below depths of 100 cm or more, the texture gradually changes to fine loamy sand or fine sandy loam.

Soil Moisture Characteristics: Sturgeon soils are very poorly to poorly drained. They are moderately pervious and have high water holding capacity and slow surface runoff. The watertable is at or near the surface for most of the winter and recedes only slightly during the summer. Undyked areas are susceptible to flooding.

General Soil Description: Sturgeon soils usually have about 10 cm of black, well-decomposed, friable, granular, organic material at the soil surface. This grades to a further 30 cm of very dark brown to dark yellowish brown, friable, organic material that contains variable amounts of silt (usually 20 to 50 percent) and cracks vertically on drying. This is underlain by about 50 cm of silty material that is massive, dark grayish brown in colour, friable and contains few to common, dark brown to reddish-brown mottles. Occasional vertical cracks are present which contain organic material from above. Under this is massive, very dark gray to olive-gray, silty or fine sandy material that contains common, prominent, brownish mottles along old root channels. Soil reaction grades from extremely acid in the upper soil to medium or very strongly acid below 100 cm depth. Soil classification is ***Rego Gleysol:peaty phase***.

Commonly Associated Soils: Alouette, Widgeon and Addington soils often are closely associated with Sturgeon soils. Alouette soils are generally similar to Sturgeon soils except that the upper part of the mineral subsurface layer is well structured. Alouette soils are also usually slightly better drained than are Sturgeon soils. Addington soils are usually more poorly drained and have water on the soil surface for large parts of the year. The mineral subsurface and subsoil of Addington soils is also more sandy than are those in Sturgeon soils. Widgeon soils differ by being organic in the upper 40 to 160 cm.

Vegetation: Cultivated (and drained) areas are used mostly for forage production and some blueberries. The majority of Sturgeon soils are undeveloped and support a variety of moisture tolerant species including sedges and reeds, willow, some black cottonwood, hardhack, sweet gale and others. Rooting is confined mainly to the upper 60 cm by the high groundwater tables.

General Land Use Comments: (1) Where unreclaimed, Sturgeon soils are agriculturally limited to mainly permanent pasture uses. With adequate watertable control (both subsurface and flooding), these soils are potentially suited for most crops, except perhaps, those that are especially susceptible to periodic wet conditions. (2) Urban and related uses are generally unsuited for Sturgeon soils. Bearing strengths are variable (usually low), a flooding hazard is present in most locations and high watertables preclude basements and severely inhibit operation of septic tank effluent disposal fields. (3) High watertables and periodic flooding preclude most commercial tree species.

SUMAS SOILS

Location and Extent: Sumas soils occur only in the eastern part of the map area, west of the Vedder Canal, and occupy mainly the basin of former Sumas Lake (the lake was drained in the 1920's). About 2400 ha of pure map units and 270 ha of Sumas-Dixon:shallow variant soil complex are mapped.

Topography and Elevation: The topography of Sumas soils is nearly level with some variation to gently undulating. Slope gradients are less than 2 percent and elevations are below 5 m above sea level.

Parent Material and Texture: The parent material of Sumas soils is coarse-textured lacustrine deposits. Surface textures are usually loamy sand with some variation to sandy loam. Subsurface and subsoil textures are medium or coarse sand, occasionally containing bands of loamy sand.

Soil Moisture Characteristics: Sumas soils are poorly to very poorly drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. Most of the Sumas soil areas have controlled water levels achieved through a system of ditches, floodgates and pumping. Sub-irrigation of most of the area is accomplished by manipulation of water levels in drainage ditches. During the winter especially, temporary flooding may occur during heavy rains which rapidly raise the already high groundwater table.

General Soil Description: Sumas soils have a sandy, cultivated surface about 15 to 20 cm thick, which is of dark grayish brown, friable and contains sometimes, faint reddish or brownish mottles. The surface is underlain by about 30 cm of very friable to loose, grayish-brown to olive-gray, medium sand containing few to common, usually faint mottles along old root channels. This zone, in turn, grades to loose, olive-gray, medium or coarse sand, usually water saturated and containing occasional, variably coloured mottles. Soil reaction generally grades from strongly or very strongly acid in the surface to slightly acid or neutral in the subsoil (1:1 H_2O). Soil classification is ***Rego Gleysol***.

Commonly Associated Soils: Dixon soils are often found near the margin of Sumas soils. They are poorly drained as are Sumas soils but have silty to clayey surface and subsurface textures which contrast with the sandy textures of Sumas soils.

Vegetation: Essentially all areas of Sumas soils are cleared and cultivated. A few, isolated uncleared areas support grasses, sedges, reeds, willow and black cottonwood. Rooting is generally restricted to the upper 50 cm by the high groundwater levels.

Plate 38 Landscape across the nearly level, poorly drained sandy Sumas soils. These soils are used for a variety of annual cash crops. Note the level of the water in the ditch. Subirrigation during the growing season is provided by controlling the water levels in the ditches.

General Land Use Comments: (1) High winter watertables and low natural fertility are probably the main agricultural limitations of Sumas soils. With adequate watertable control (removal of excess winter water as well as maintenance of water levels to provide sub-irrigation during the growing season) and substantial fertilization, Sumas soils are capable of producing good yields of a variety of annual crops. Organic matter levels are low and increases would improve the nutrient holding ability of the soil. (2) Sumas soils are poorly suited for urban and related uses. High watertables preclude basements and other excavations and effluent disposal from septic tank tile lines is severely impeded. The filtration ability of the coarse-textured subsoil is low and effluent from numerous septic tanks (or other large amounts of waste) may lead to groundwater contamination. (3) Growth of tree species such as black cottonwood and hybrid poplars is excellent and this may be an option for use of Sumas soils. Estimated annual wood production by black cottonwood is in excess of 20 m^3/ha.

SUMMER SOILS (SR)

Location and Extent: Summer soils are relatively uncommon and occupy small areas on the uplands, mainly in the central part of the map area. About 55 ha of pure map units and 630 ha of soil complexes dominated by Summer soils are mapped. Most complexes are with Heron, Sunshine and Livingstone soils.

Topography and Elevation: Summer soils are nearly level to gently undulating and often are slightly depressional in relation to adjacent, better drained soils. Slope gradients are less than 5 percent and elevations range between 20 and 150 m above sea level.

Parent Material and Texture: Summer soils have developed from coarse to moderately coarse textured (sandy) littoral or glaciofluvial deposits, usually from 50 to 100 cm thick, which overlie moderately fine to fine-textured marine or glaciomarine sediments. Surface textures are sandy loam or fine sandy loam while the subsurface and upper subsoil vary from loamy sand to sand. The subsurface layer is strongly cemented. The lower subsoil, consisting of the underlying marine and glaciomarine materials, varies from silty clay loam to clay.

Soil Moisture Characteristics: Summer soils are imperfectly to moderately poorly drained. They are slowly pervious and have low water holding capacity and slow surface runoff. Periodic, temporary surface ponding occurs during heavy, prolonged rains due to raising of the perched watertable above the clayey subsoil. The perched watertable usually disappears during the latter part of the summer and moisture deficiencies are common towards the end of this period.

General Soil Description: Where cultivated, the surface layer of Summer soils consists of about 15 cm of black to very dark gray, very friable, loamy material. This is underlain by about 10 cm of gray to brownish-gray, very friable, strongly leached, sandy material. Under natural conditions about 5 cm of organic forest litter and, sometimes, 10 to 15 cm of dark gray or very dark gray, friable, partially leached, sandy material overlies the strongly leached zone. The leached zone is abruptly underlain by 10 to 20 cm of very dusky red to dark reddish brown, strongly cemented, sandy material which is extremely firm when moist and extremely hard when dry. The cemented zone is underlain by about 15 cm of brown to yellowish-brown, partially cemented, sandy material containing a few reddish mottles. Under this is about 50 cm of olive-gray or gray sand with common, reddish or brownish mottles. Gray, massive, clayey deposits occur at about 100 cm depths. Soil reactions gradually grade from extremely or very strongly acid in the surface to slightly acid in the clayey subsoil (1:1 H_2O). Soil classification is *Gleyed Ortstein Humo-Ferric Podzol*.

Commonly Associated Soils: Heron, Sunshine, Bose and Boosey soils often occur in close association with Summer soils. Heron and Boosey soils differ from Summer soils by being poorly drained. They also lack a cemented subsurface layer and, as well, Boosey soils are gravelly in texture. Bose and Sunshine soils differ by being well or moderately well drained. They also lack a cemented subsurface layer and additionally, Bose soils are gravelly.

Vegetation: Cleared areas are used mainly for pasture and forage production. Uncleared areas support a variety of species tolerant of periodic wet conditions and include western red cedar, western hemlock, red alder and blackberry. Most rooting is restricted to the upper 30 cm by the dense, cemented subsurface layer.

General Land Use Comments: (1) Agricultural use of Summer soils is mainly restricted by high winter watertables which adversely affect perennial crops and by limited rooting depth and droughty conditions which develop during the latter part of the growing season. Adequate watertable control, subsoiling to disrupt the cemented layer and supplemental irrigation as required (as well as adequate fertilization), make Summer soils suitable for most crops. (2) Urban use of Summer soils is restricted by periodic high watertables which adversely affect basements and other excavations and, together with slow subsoil permeability, retards efficient operation of septic tank disposal fields. (3) Forest growth, which is mostly western red cedar, is moderate and is limited mainly by restricted rooting depth. Estimated annual wood production by western red cedar and Sitka spruce is about 7.5 to 9 m^3/ha.

SUNSHINE SOILS (SS)

Location and Extent: Sunshine soils occupy scattered locations throughout the uplands of the map area but are most common in Delta, Surrey, Langley and Maple Ridge Municipalities. About 1650 ha of pure map units and 2700 ha of soil complexes dominated by Sunshine soils are mapped. Most complexes are with Heron and Summer soils although complexes with Whatcom, Defehr and Nicholson soils also occur.

Topography and Elevation: Sunshine soils are very gently undulating, undulating or gently sloping with slope gradients less than 5 percent. Elevations lie mostly between 20 and 150 m above sea level.

Parent Material and Texture: Sunshine soils have developed from coarse to moderately coarse textured (sandy), stone-free, littoral, glaciofluvial and fluvial deposits, usually 1 to 2 m thick, which overlie mainly moderately fine textured glaciomarine and marine deposits or sometimes, moderately coarse textured glacial till. Surface textures are usually sandy loam, varying occasionally to loamy sand or loam; subsurface and subsoil textures are sand containing, sometimes, loamy sand lenses. The underlying glaciomarine and marine materials range from silty clay loam to clay while the glacial till is either sandy loam or gravelly sandy loam.

Soil Moisture Characteristics: Sunshine soils are well to moderately well drained. They are rapidly to moderately pervious and have slow surface runoff and low to moderate water holding capacity. During heavy, prolonged rains a temporary perched watertable sometimes develops above the slowly permeable underlay and variable amounts of lateral seepage occur along this contact.

General Soil Description: The surface layer of Sunshine soils, when cultivated, consists of about 20 cm of very friable, dark brown to dark reddish brown, loamy material. Under natural conditions, the surface usually consists of about 5 cm of variably decomposed, organic forest litter underlain by a discontinuous, gray, strongly leached layer from 2 to 5 cm thick. The surface layer is underlain by about 20 cm of very friable, reddish-brown, sandy material which then grades to about 50 cm of sand that varies from strong brown in the upper part to yellowish-brown in the lower part. A few, reddish, prominent mottles may also be present in the lower part. Under this, variably coloured, loose sand occurs which sometimes contains thin, finer textured bands and few to common, reddish mottles. Below 1 to 2 m, dense, compact, gray or grayish-brown glaciomarine, marine or glacial till deposits are found. Soil reactions grade from strongly or very strongly acid in the upper part to medium or slightly acid near the bottom of the sandy material. Soil classification is *Orthic Humo-Ferric Podzol*.

Commonly Associated Soils: Summer, Heron, Bose, Whatcom, Nicholson and Defehr soils are often found in close association with Sunshine soils. Summer and Heron soils have textures similar to Sunshine soils but are, respectively, imperfectly and poorly drained. As well, Summer soils have strongly cemented subsurface layers. Bose soils differ by being gravelly rather than sandy in texture. Defehr soils are usually gravelly also, as well as being imperfectly drained. Whatcom and Nicholson soils are silty to clayey in texture and have developed from glaciomarine deposits similar to those that occur in the lower subsoil of Sunshine soils.

Vegetation: Most areas of Sunshine soils are cleared and used mainly for pasture or forage. Uncleared areas support a mixed, second-growth forest which includes coast Douglas-fir, western hemlock, western red cedar, red alder and others. Rooting depth is unrestricted to depths of 1 m or more.

General Land Use Comments: (1) Low moisture holding capacity is the main agricultural limitation of Sunshine soils. If irrigated (and adequately fertilized) most crops can be produced satisfactorily. (2) Sunshine soils are moderately suited for urban and related uses. Numerous septic tank disposal fields may cause perching of a groundwater table above the slowly permeable subsoil resulting in lateral seepage. (3) Forest growth is good although inadequate soil moisture limits growth during dry seasons. Limited plot data indicates annual wood production by Douglas-fir to be between 12 and 15 m^3/ha.

SURREY SOILS (SU)

Location and Extent: Surrey soils are relatively uncommon and occur mainly on the uplands of Surrey and Delta Municipalities. About 120 ha of pure map units and 310 ha of Surrey-Boosey soil complex are mapped.

Topography and Elevation: Surrey soils are generally undulating to gently rolling with slopes ranging from 4 to 10 percent. Elevations range from about 20 to 100 m above sea level.

Parent Material and Texture: The parent material of Surrey soils is moderately coarse textured, compact, stony glacial till. Surface, subsurface and subsoil textures are usually sandy loam or gravelly sandy loam with occasional variation to gravelly loamy sand or loam. The subsoil is strongly cemented.

Soil Moisture Characteristics: Surrey soils are moderately well to well drained and have low water holding capacity and slow surface runoff. They are rapidly pervious in the upper part but this decreases to slowly pervious in the cemented subsoil. During heavy, prolonged rain, a temporary, perched watertable develops above the cemented subsoil and lateral telluric seepage occurs.

General Soil Description: Surrey soils generally have up to 10 cm of raw to well-decomposed, organic forest litter on the soil surface. Under this is up to 4 cm of gray to grayish-brown, weakly structured, friable, strongly leached, sandy material. In cultivated areas the surface is usually about 15 to 20 cm of friable, dark brown to dark reddish brown sandy material. The leached zone is underlain by about 40 cm of weakly structured, friable, sandy material which is dark reddish brown in the upper part and dark brown or yellowish-brown in the lower part and contains variable amounts of hard, spherical concretions, stones and gravel. This zone grades to about 15 cm of brown or yellowish-brown, moderately structured, friable to firm, sandy material which contains common, reddish mottles. Under this, usually abruptly, is grayish-brown, massive, very firm, strongly cemented, sandy material from 20 to 50 cm thick and containing common to few, reddish mottles. The upper part of this zone sometimes tends to break horizontally into coarse, plate-like pieces. Below about 120 cm depth, gradation to unweathered, gray, massive, compact glacial till occurs. Soil reactions grade from very strongly or extremely acid at the surface to medium or slightly acid in the upper part of the unweathered glacial till (1:1 H_2O). Soil classification is *Duric Humo-Ferric Podzol*.

Commonly Associated Soils: Bose, Boosey, Heron and Sunshine soils usually occur in close association with Surrey soils. Bose and Boosey soils differ from Surrey soils by having developed from up to 150 cm of gravelly material (of littoral or glaciofluvial origin) over glacial till; additionally, Boosey soils are poorly drained. Heron and Sunshine soils differ by consisting of up to 150 cm of sandy material overlying the glacial till. In addition, Heron soils are poorly drained.

Vegetation: Cleared areas of Surrey soils are mainly developed for urban uses or are used for pasture and forage crops. Uncleared areas support a second-growth forest consisting of, among others, coast Douglas-fir, western hemlock, western red cedar, red alder and birch understoried by blackberry, salal, elderberry, vine maple, dogwood and willow. Rooting is unrestricted in the surface and subsurface but is severely limited in the cemented subsoil (usually 60 to 100 cm from the surface). A thin layer of concentrated roots usually occurs immediately above the cemented zone.

General Land Use Comments: (1) Agriculturally, Surrey soils are limited by low moisture holding capacity which causes droughty conditions during most summers. Deep rooting is restricted by the cemented subsoil and susceptible perennial crops may be adversely affected by perched watertables during the winter. (2) Most areas of Surrey soils are presently developed for urban uses for which they are moderately suited. Soil bearing strengths are high but septic tank effluent disposal is impeded by the slowly permeable subsoil. Excavations may be difficult to construct due to the compact, cemented, stony nature of the subsoil.

TRIGGS SOILS (TR)

Location and Extent: Triggs soils occupy substantial areas on the lowlands of the map area, mainly in Burns Bog, Glen Valley and in Richmond and Pitt Meadows Municipalities. Small, scattered areas also occur in upland locations. About 3290 ha of pure map units and 480 ha of soil complexes are mapped. The complexes are generally with Lumbum or Glen Valley soils.

Topography and Elevation: The topography of Triggs soils varies from nearly level or slightly depressional to very gently sloping (domed). Slope gradients are less than 2 percent and most areas lie at elevations less than 10 m above sea level.

Parent Material and Texture: Triggs soils have developed from deep (at least 2 m), undecomposed organic deposits composed mainly of sphagnum and other mosses. Variable amounts of woody material (trunks, branches, and roots) are also commonly present. The surface, subsurface and subsoil all consist of relatively undecomposed (fibric) organic material. At depths below 150 cm or more, the organic material sometimes becomes moderately decomposed. The underlying mineral deposits are usually medium or moderately fine textured Fraser River deltaic or floodplain sediments. In upland areas the mineral underlay is usually clayey glaciomarine sediments.

Soil Moisture Relationships: Triggs soils are very poorly drained. The watertable is at or near the surface for most of the year except near the centre of some of the larger deposits where, because of their domed nature, the watertable may be somewhat lower. The soils are moderately pervious and have very high water holding capacity and slow surface runoff. Some areas are partially drained by ditches at the present time.

General Soil Description: Triggs soils generally have a layer of living sphagnum moss on the soil surface. This is underlain by about 20 cm of undecomposed (fibric), spongy and soft, yellowish-brown to yellowish-red organic material. Under this is 100 cm or more of very slightly decomposed (fibric), massive to weakly layered, slightly compacted, dark several thin, black bands of charcoal. The organic material consists mainly of moss remains. Gradual change then occurs to partially decomposed, dusky red to dark reddish brown organic material (fibric or mesic) usually composed of mixed moss, sedge, reed and grass remains. Soil reactions are extremely acid throughout. Soil classification is *Typic Fibrisol*.

Commonly Associated Soils: Glen Valley, Lumbum, Gibson and Annacis soils often occur in close association with Triggs soils. Glen Valley soils differ from Triggs soils by consisting of deep, undecomposed, organic deposits composed mainly of sedge and reed remains, rather than moss. Lumbum, Gibson and Annacis soils are also all organic but differ from Triggs soils in the following ways: Lumbum soils consist of deep, partially decomposed (mesic) organic materials; Annacis soils are composed of deep, well-decomposed (humic) organic deposits while Gibson soils are composed of 40 to 160 cm of partially decomposed organic material overlying silty or clayey Fraser River floodplain sediments.

Vegetation: The natural vegetation on Triggs soils is variable but is typical of poorly drained, extremely acid soil conditions. It includes birch, stunted lodgepole pine, hardhack, Labrador tea, blueberry, cranberry, bracken and sweetgale with sphagnum and other mosses on the ground surface. Rooting is restricted mainly to the upper 30 cm.

General Land Use Comments: (1) Triggs soils are generally not suited for most agricultural crops unless extensive reclamation is undertaken. Blueberries and cranberries require relatively lesser amounts of reclamation. Extensive drainage works are required as well as large amounts of lime and fertilizer to improve the acidic soil reactions and low fertility. Cultivation of the surface to accelerate surface decomposition is required to produce suitable seed beds. In several locations, Triggs soils are being mined for commercial peat. The remaining, underlying partially decomposed organic material is also suitable for reclamation after the commercial peat has been removed. (2) Triggs soils are unsuited for urban or related purposes. Very low soil bearing strengths and high permanent watertables are the main limitations. The extremely acidic conditions may cause corrosion of unprotected concrete and other in-ground installations. (3) Triggs soils have very low forest productivity. Lodgepole pine is essentially the only coniferous species which grows on these soils.

TSAWWASSEN SOILS (TS)

Location and Extent: Tsawwassen soils are limited mainly to areas along Boundary Bay and near the mouth of the Fraser River. About 340 ha of pure map units and 100 ha of soil complexes dominated by Tsawwassen soils are mapped. The complexes are with Neptune and Seaview soils. Small areas of an anthropogenic variant of Tsawwassen soils also occur which consist mainly of sand dredgings from the Fraser River.

Topography and Elevation: The topography of Tsawwassen soils is gently undulating to undulating with slopes less than 5 percent. Elevations range up to 3 m above sea level.

Parent Material and Texture: Tsawwassen soils have developed from coarse-textured, stone-free, recent marine beach deposits. Surface textures are loamy sand or sandy loam while subsurface and subsoil textures are mainly medium or coarse sand, sometimes containing lenses of gravelly sand. In some slightly depressional locations the lower subsoil is saline.

Soil Moisture Characteristics: Tsawwassen soils are moderately well to well drained. They are rapidly pervious and have low water holding capacity and slow surface runoff. In some lower topographic positions, temporary watertables sometimes develop in the subsoil due to heavy, prolonged rainfall or from tidal seepage through the coarse-textured material.

General Soil Description: The surface of Tsawwassen soils consists of up to about 10 cm of grayish-brown to black, very friable, sandy material. It is underlain by at least 50 cm of loose, variably coloured, medium to coarse sand, sometimes containing lenses and pockets of gravelly sand. It then grades to loose sand containing common to occasional, reddish or brownish mottles. Soil reaction grades from very strongly or extremely acid in the surface to strongly or medium acid in the subsoil. Soil classification is ***Orthic Regosol***.

Commonly Associated Soils: Neptune, Seaview, Benson and Mathews soils are often closely associated with Tsawwassen soils. Neptune soils differ from Tsawwassen soils by containing substantial amounts of shells and other remnants of sea life; they also have deep, black surfaces. Seaview and Benson soils usually occupy lower landscape positions than do Tsawwassen soils and are poorly drained and strongly saline. Mathews soils occupy intermediate landscape positions, are moderately poorly drained and have loamy textures.

Vegetation: Cleared areas are used mainly for pasture and forage or for urban development. Uncleared areas support coast Douglas-fir, western red cedar, Sitka spruce and a variety of deciduous shrubs and herbs. Rooting depth is essentially unrestricted.

General Land Use Comments: (1) Agriculturally, Tsawwassen soils are severely limited by low water holding capacity and nutrient content. With adequate irrigation and fertilization moderate amounts of most crops can be produced. (2) Temporary watertables in the lower subsoil and potential incomplete septic tank effluent filtration by the coarse-textured material somewhat limits Tsawwassen soils for urban uses.

TUNBRIDGE SOILS (TU)

Location and Extent: Tunbridge soils occur only on the uplands of Mission Municipality where about 100 ha of pure map units and 50 ha of soil complexes dominated by Tunbridge soils are mapped. The complexes are usually with Calkins soils.

Topography and Elevation: The topography of Tunbridge soils is mostly very gently sloping to undulating with slopes less than 5 percent. Along gullies and in other similar small locations the slope gradients increase to as much as 50 percent. Elevations lie between 100 to 150 m above sea level.

Parent Material and Texture: The parent material of Tunbridge soils consists of medium-textured, stone-free, aeolian deposits, usually 20 to 50 cm thick, which overlie medium-textured glaciolacustrine deposits. Thin, sandy lenses are sometimes present in the upper part of the glaciolacustrine material. Surface textures are silt loam and subsurface textures are usually similar except for some sandy loam lenses. The subsoil varies from heavy silt loam to silty clay loam.

Soil Moisture Characteristics: Tunbridge soils are imperfectly drained. They are moderately pervious in the surface and subsurface but this changes to slowly pervious in the subsoil. They have high water holding capacity and slow surface runoff. Temporary, perched watertables develop above the compact subsoil during heavy, prolonged rain, particularly during the winter and lateral seepage occurs at these times also.

General Soil Description: Uncleared areas of Tunbridge soils usually have up to 10 cm of organic forest litter on the soil surface, the lower part of which is well-decomposed, friable and dark reddish brown to black in colour. Cultivated areas usually have a dark brown to dark reddish brown, friable, silty surface about 20 cm thick. The surface organic layer is underlain by about 25 cm of dark reddish brown to reddish-brown, friable, weakly structured, silty material containing variable amounts of hard, spherical concretions. Gradation to about 15 cm of yellowish-red to brown, silty material containing few to common, distinct mottles then occurs. This zone is underlain by about 15 cm of yellowish-brown, moderately structured, partially leached, sandy material containing common, yellowish-red to strong brown mottles and scattered, weakly cemented patches. Under this is about 30 cm of very firm, clay enriched material that is grayish-brown, contains many prominent, strong brown mottles and cracks into prismatic structure on drying. The clay enriched layer then grades to brownish-gray, silty to clayey, massive, compact glaciolacustrine deposits with many, brownish or reddish mottles. Soil reaction grades from very strongly or extremely acid in the surface to strongly or medium acid in the subsoil. Soil classification is *Luvisolic Humo-Ferric Podzol*.

Commonly Associated Soils: Calkins, Ryder, Lonzo Creek and Abbotsford soils are usually closely associated with Tunbridge soils. Calkins soils occupy depressional locations in the Tunbridge soil areas and are poorly drained. Ryder and Lonzo Creek soils have silty eolian surfaces similar to Tunbridge soils but differ by having subsoils consisting of glacial till. Abbotsford soils also have eolian surfaces but, in this case, the subsoil consists of gravelly glaciofluvial deposits.

Vegetation: Cleared areas are used mainly for hay and pasture. Uncleared areas support second-growth forests of coast Douglas-fir, western red cedar, western hemlock, red alder, maple and birch, understoried by salmonberry, various ferns, elderberry and others. Rooting is unrestricted in the upper 50 cm or so but is impeded below that by the dense, compact subsoil and periodic, perched watertables.

General Land Use Comments: (1) Tunbridge soils are suited for most agricultural crops although perennials susceptible to "wet feet" may suffer some damage during the winter due to the perched watertables. Artificial drainage is beneficial if these types of crops are produced. (2) Urban suitability of Tunbridge soils is moderate. Perched watertables interfere with excavations (basements, underground utilities) and the dense subsoil impedes disposal of septic tank effluent. Variable bearing strengths may require special foundation considerations. (3) Forest growth on Tunbridge soils is good. The restricted drainage conditions appears to provide adequate moisture during all but the driest growing seasons. Wood production by Douglas-fir is estimated to be about 12 to 15 m^3/ha/yr.

VEDDER SOILS (VD)

Location and Extent: Vedder soils only occur in the Sumas Valley where about 770 ha of pure map units of Vedder soils, 120 ha of a shallow variant of Vedder soils and 190 ha of soil complexes dominated by Vedder soils are mapped. The complexes are generally with Vye, Buckerfield and Bates soils.

Topography and Elevation: Vedder soils are nearly level to gently undulating and have slopes less than 2 percent. The soils usually occupy depressional landscape positions in relation to adjacent soils. Elevations lie between 3 and 8 m above sea level.

Parent Material and Texture: Vedder soils have developed from moderately fine to medium-textured lacustrine and mixed lacustrine and alluvial deposits, usually 75 cm or more thick, over sand. Surface textures are silt loam or silty clay loam. Subsurface textures are mainly silty clay loam, sometimes varying to silty clay, while the subsoil is similar until the underlying medium to fine sand is encountered.

Soil Moisture Characteristics: Vedder soils are poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. Groundwater tables are near the surface for most of the rainy winter months, then gradually subside over the growing season. Surface ponding sometimes occurs due to slow permeability and runoff accumulation from adjacent, higher areas.

General Soil Description: Vedder soils have a silty, cultivated surface about 20 cm thick which is friable to firm, moderately structured and grayish-brown to dark grayish brown in colour. The surface is underlain by about 20 cm of firm, silty to clayey material that cracks vertically on drying, contains common to many, reddish to yellowish mottles and has a few clay flows on ped surfaces. This grades to massive, gray to olive-gray, silty to clayey material at least 40 cm thick, then is either abruptly underlain or grades to sand at depth. Soil reaction ranges from medium or strongly acid in the surface to slightly acid in the subsoil (1:1 H_2O). Soil classification is *Orthic Gleysol*.

Commonly Associated Soils: Vye, Buckerfield, Annis and Bates soils usually occur in close association with Vedder soils. Buckerfield soils differ from Vedder soils by having black rather than grayish surfaces. Annis soils differ by having organic surfaces between 15 and 40 cm thick. Vye and Bates soils usually occupy slightly higher landscape positions than Vedder soils and are imperfectly drained; Vye soils also differ by having a well-defined clay accumulation layer in the subsurface. Areas mapped as a shallow variant of Vedder soils are similar to Vedder soils except that the underlying sand occurs at 20 to 50 cm from the soil surface rather than at depths greater than 50 cm.

Vegetation: All areas of Vedder soils are cleared and cultivated for agricultural purposes. Most perennial crops are grass-clover mixes for pasture and forage; annual crops include those that are not readily susceptible to periodic high watertables. Rooting is restricted mainly to the upper 50 cm by the high groundwater tables and dense subsoil.

General Land Use Comments: (1) Vedder soils are limited for agricultural uses by high groundwater tables during the winter and spring months which damage perennial crops and retard early spring crop growth and cultivation. With artificial drainage most crops suited to the Fraser Valley can be produced. (2) Urban and similar uses are poorly suited for Vedder soils. High watertables make basements and other excavations impractical, septic tank effluent disposal is severely restricted and because of variable (usually low) bearing strengths, special foundation considerations may be required. Periodic surface flooding is also a hazard. (3) Vedder soils appear to be moderately suited for tree species such as black cottonwood. Estimated potential annual wood production by this species is 9 to 12 m^3/ha/yr.

VINOD SOILS

Location and Extent: Vinod soils occupy scattered areas on the lowlands of Delta Municipality and in the Serpentine-Nicomekl Valley. About 150 ha of pure map units and 740 ha of soil complexes dominated by Vinod soils are mapped. The complexes are mainly with Richmond soils and lesser areas are complexed with McLellan, Goudy, Lulu and Spetifore soils.

Topography and Elevation: Vinod soils are nearly level to very gently undulating with slopes less than 2 percent. They occur either as slight depressions in areas of better drained, mineral soils or as slight ridges in areas of organic soils. Elevations lie below 3 m above sea level.

Parent Material and Texture: Vinod soils have developed from shallow (15 to 40 cm thick), well-decomposed organic material that overlies moderately fine textured deltaic deposits. The surface is usually humic in decomposition while subsurface and subsoil textures are silty clay loam or silty clay. Medium or fine sand sometimes occurs below 1 m. The subsurface and subsoil are saline and, where the organic surface is relatively shallow, some of the underlying mineral soil has been mixed by cultivation with the organic material. The mineral material also generally contains substantial amounts of compounds high in sulphur.

Soil Moisture Characteristics: Vinod soils are poorly to very poorly drained. They are moderately to slowly pervious and have high water holding capacity and slow surface runoff. The watertable is usually near, and sometimes at the surface, during the winter and early spring, then recedes slightly during the summer. In the slightly depressional areas, temporary surface ponding is common during and after heavy rain, particularly in winter.

General Soil Description: Vinod soils generally have a black, cultivated, mucky (humic) surface layer about 20 cm thick which is friable and soft. It is underlain (where the organic deposits are deep enough) by about 15 cm of firm, compact, dark reddish brown organic material (plow pan) containing some silty mineral material. The organic material is then underlain by about 30 cm of grayish-brown to gray, massive, silty to clayey material containing common, yellow mottles, vertical remains of old roots and occasional vertical cracks containing organic matter from above. This zone then grades to dark gray or gray, massive, silty material containing common, yellow mottles and vertical old root remains in the upper part as well as hard, brownish tubules around old root channels. Below about 1 m, bluish to greenish-gray sand sometimes occurs. Soil reaction is extremely acid throughout. Soil classification is ***Rego Gleysol:saline and peaty phase***.

Commonly Associated Soils: Richmond, Goudy and McLellan soils usually occur in close association with Vinod soils. Richmond and Goudy soils differ from Vinod soils by consisting of 40 to 160 cm of well-decomposed organic material; Goudy soils are also strongly saline in the subsurface and subsoil layers. McLellan soils differ from Vinod by lacking a shallow organic surface layer. McLellan soils likely were similar at one time to Vinod soils but decomposition and subsidence of the organic surface layer has occurred to such an extent that the organic layer is no longer distinct.

Vegetation: Most areas of Vinod soils are cleared and cultivated; perennial crops are mostly hay and pasture; annual crops are mainly vegetables although oats and other field crops are also grown. Rooting is confined mainly to the upper 50 cm by the high watertables and the dense, saline subsoil.

General Land Use Comments: (1) The main agricultural limitation of Vinod soils is high watertables during the winter and spring which severely damage perennial crops and retard spring cultivation. Artificial drainage installation will improve this problem. Salinity in the subsurface is also potentially limiting for some crops, especially where the organic surface is thin. Subsoiling helps to break up the plow pan that is present in some areas as well as improving rooting depth, water movement and aeration. Irrigation is beneficial for shallow rooted crops during most summers and also assists in leaching some of the salts from the subsurface. (2) Vinod soils are poorly suited for urban uses. High groundwater tables preclude basements and other excavations; variable (usually low) soil bearing strengths probably require special foundation considerations and septic tank effluent disposal is severely restricted. Surface flooding in some areas is a hazard and underground utility and other installations are likely to suffer severe corrosion if not adequately protected.

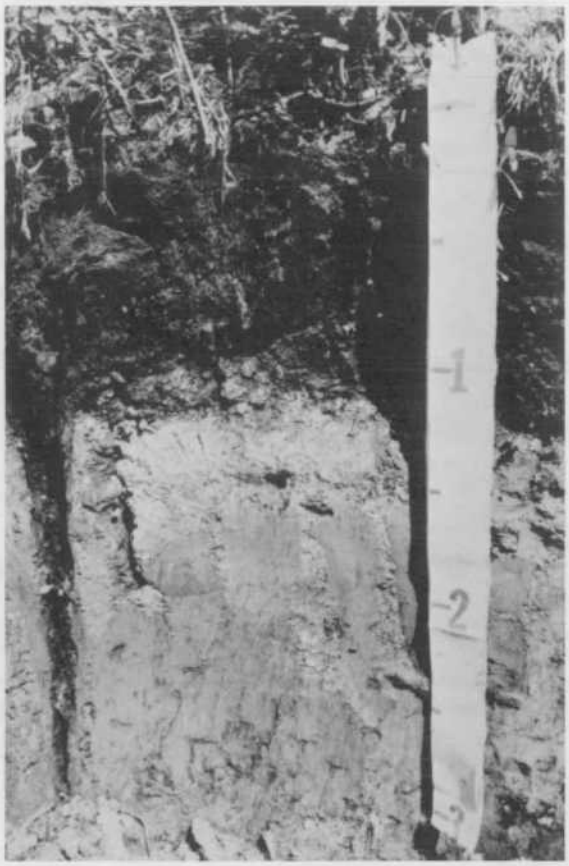

Plate 39 Vinod soil profile (Rego Gleysol:saline and peaty phase). These poorly drained soils have developed from 6 to 16 in. (15 to 40 cm) of well to moderately decomposed organic material overlying silty, saline deltaic deposits. The dark coloured flecks and streaks in the subsoil are mainly dark brown to reddish-brown, hard tubules around old root channels. Note the wide crack on the left of the photo—these are common in Vinod soils.

VYE SOILS

Location and Extent: Vye soils occur only in the Sumas Valley, mainly in the western part. About 540 ha of pure map units and 870 ha of soil complexes dominated by Vye soils are mapped. Most complexes are with Bates, Vedder and Buckerfield soils.

Topography and Elevation: Vye soils are gently undulating to undulating with slopes up to 5 percent. Elevations generally range between 5 and 10 m above sea level.

Parent Material and Texture: Vye soils have developed from moderately fine to medium-textured lacustrine and mixed lacustrine and alluvial deposits usually at least 1 m thick and underlain by sand. Surface textures are silt loam or silty clay loam while subsurface textures are mainly silty clay loam with minor variations to silty clay or silt loam. The upper subsoil has textures similar to the subsurface; these gradually grade to medium or fine sand below 1 m or more.

Plate 40 Landscape of the silty, undulating lacustrine deposits of the Sumas Valley. Imperfectly drained Vye and Fadden soils are usual on the tops and slopes of the undulations while Vedder and Buckerfield soils occupy the poorly drained intervening depressions.

Soil Moisture Characteristics: Vye soils are imperfectly drained. They are moderately pervious and have high water holding capacity and slow to moderate surface runoff. Temporary groundwater tables occur in the upper soil during the winter and after heavy, prolonged rains.

General Soil Description: Vye soils generally have a cultivated, silty, dark grayish brown surface that is about 20 cm thick and is moderately structured, firm to friable when moist and moderately hard when dry. It is underlain by a partially leached, grayish-brown to brownish-gray, silty layer about 10 cm thick that is moderately blocky, firm when moist, hard when dry and contains common to many, fine to medium, yellowish-brown mottles. This leached zone grades to a clay-enriched layer about 40 cm thick which is grayish-brown, moderately prismatic, firm to very firm when moist, hard when dry and contains many, yellowish-red to dark reddish brown mottles. Clay flows are present on and in peds. This zone then grades to gray or dark gray, massive, silty material below about 70 cm that contains variable amounts of yellowish to reddish mottles. Soil reaction gradually grades from strongly acid in the surface to medium or slightly acid below about 100 cm. Soil classification is mostly ***Gleyed Gray Luvisol*** although some Orthic Gleysols are also included in some slightly depressional, moderately poorly drained locations.

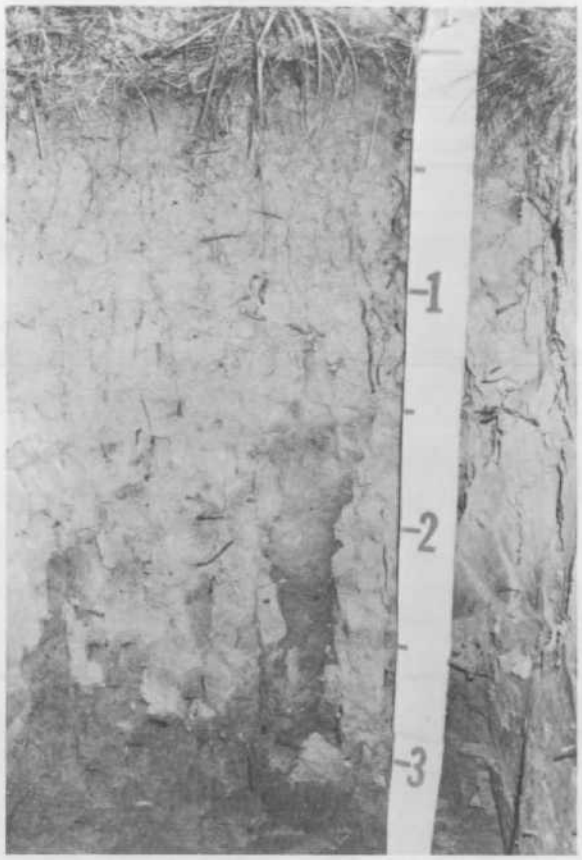

Plate 41 Vye soil profile (Gleyed Gray Luvisol). These imperfectly drained silty soils have a moderately leached subsurface layer. In the photo it is between 10 and 18 in. (25 and 45 cm). Underlying is a moderately clay enriched layer about 12 in. (30 cm) thick.

Commonly Associated Soils: Vedder, Bates and Buckerfield soils usually occur in close association with Vye soils. Vedder and Buckerfield soils both differ from Vye soils by being poorly drained; also, neither has a well-defined clay accumulation layer in the subsurface. Bates soils also differ from Vye soils by lacking a subsurface clay accumulation layer. They are also somewhat more silty than Vye soils.

Vegetation: Vye soils are essentially all cleared and used for a variety of agricultural crops. Roots penetrate to at least 100 cm but are mainly in the upper 60 cm.

General Land Use Comments: (1) Vye soils are well suited for most agricultural crops although susceptible perennials may suffer some damage during the winter from periodic high watertables. Undulating topography in some areas makes these soils somewhat unattractive for field crops requiring even maturity. (2) Urban uses are limited by periodic high watertables which adversely affect basements and other excavations as well as restricting operation of septic tank effluent disposal fields. Variable (usually low) bearing strengths may require that special foundation construction be employed.

WESTHAM SOILS

Location and Extent: Westham soils occur only on the lowlands of Delta Municpality, mainly on Westham and Crescent Islands, and in the southern part of Richmond Municipality. There are about 1520 ha of pure map units and 570 ha of soil complexes dominated by Westham soils. Most complexes are with Crescent and Blundell soils.

Topography and Elevation: Westham soils vary in topography from nearly level or slightly depressional to gently undulating with slopes up to 2 percent. They all lie less than 5 m above sea level amd usually occur at slightly lower elevations than the adjacent, better drained Crescent soils and are slightly higher than the associated, more poorly drained Blundell soils.

Parent Material and Texture: Westham soils have developed from medium to moderately fine textured deltaic deposits of the Fraser River, usually 1 m or more thick, over sand. Surface, subsurface and subsoil textures are mostly silt loam with some variation to silty clay loam. The lower subsoil is sometimes loam or fine sandy loam and usually grades to sand with increasing depth. Moderately to strongly saline conditions are usual below 50 to 100 cm depth and substantial amounts of compounds high in sulphur are also usually present.

Soil Moisture Characteristics: Westham soils are poorly drained. They are moderately pervious and have slow surface runoff and high water holding capacity. Watertables are near the surface during the winter months but, in most areas, ditches, subsoil drains and pumping provide a moderate saturation-free zone during the growing season. Some sub-irrigation is possible through watertable control during dry summer periods. In depressional areas surface ponding occurs during periods of heavy rains.

General Soil Description: Westham soils have a dark grayish brown, silty, cultivated surface layer about 20 cm thick which is moderately structured and friable to firm when moist. It is underlain by a silty zone about 20 cm thick which is mainly massive, firm to friable, and contains variable amounts of reddish to yellowish mottles. This zone grades to 50 cm or more of dark gray to gray, silty material that is firm, massive, and contains common to many, mainly yellow mottles as well as hard, reddish to brownish tubules around old root channels. The lower part is usually saline. Massive, dark gray, saline, fine or medium sand occur below 1 m or more. Soil reaction usually ranges from strongly to slightly acid in the surface (depending on the amount of liming) and is extremely acid in the subsurface and subsoil. Soil classification generally is ***Rego Humic Gleysol:saline phase*** although areas of Orthic Humic Gleysol:saline phase are included where the subsurface structure is moderately well developed. On some of the small islands near the mouth of the Fraser River, the underlying sands usually occur between 50 and 100 cm from the surface rather than below 1 m as is the usual case. These areas are mapped as a shallow variant of Westham soils.

Commonly Associated Soils: Crescent and Blundell soils often occur in close association with Westham soils. Crescent soils usually lie at slightly higher landscape positions than do Westham soils, are slightly better drained and are non-saline in the upper 1 m. Blundell soils, on the other hand, usually lie slightly lower than do Westham soils, are more poorly drained and are usually saline at depths below 50 cm from the surface. They also have organic surfaces that are 15 to 40 cm thick.

Vegetation: Essentially all areas of Westham soils are cleared and cultivated; most climatically suited crops are produced (except those perennials very susceptible to "wet feet" over the winter months). Rooting is confined mainly to the upper 70 cm and is limited below that by saturated and saline soil conditions.

General Land Use Comments: (1) Westham soils are among the better soils in the Lower Fraser Valley if adequate watertable control is present. Most climatically suited crops (except those susceptible to damage by high winter groundwater levels) can be satisfactorily produced. Saline subsoil conditions are usually deep enough to have little affect on most annual crops. The soils are relatively fertile although increased amounts of organic matter in the surface would help improve structure and decrease susceptibility to puddling. (2) Urban and related uses are poorly suited for Westham soils. Variable (usually low) soil bearing strengths probably require special foundation requirements. Basements and other excavations are impractical due to high watertables and septic tank effluent disposal systems function poorly. Severe corrosion of unprotected underground utility and other installations is likely due to the saline character of the subsoil.

WESTLANG SOILS (WS)

Location and Extent: Westlang soils occur only on the lowlands near Fort Langley and in northwestern Langley Municipality where about 320 ha of pure map units and 50 ha of soil complexes dominated by Westlang soils are mapped. The complexes are with Annis and Katzie soils.

Topography and Elevation: Topographically, Westlang soils are gently undulating to undulating with slope gradients less than 5 percent. They are either slightly depressional or lie topographically lower than associated, better drained soils. Elevations are between 3 and 5 m above sea level.

Parent Material and Texture: Westlang soils have developed from moderately fine to fine-textured deposits of sediments eroded from the adjacent marine uplands mixed with Fraser River floodplain deposits. Surface textures range from silty clay loam to silty clay while subsurface and subsoil textures vary from silty clay to clay. Below depths of about 80 cm, a gradual transition to silty or fine sandy textures often occurs.

Soil Moisture Characteristics: Westlang soils are poorly to very poorly drained. They are slowly pervious and have high water holding capacity and slow surface runoff. Watertables are at or near the surface for most of the winter and early part of the summer and temporary flooding is usual during heavy, prolonged rain.

General Soil Description: Westlang soils have a very dark gray, cultivated, clayey surface about 15 cm thick which is strongly blocky to subangular blocky in structure, very firm when moist and hard when dry. It is underlain by 50 cm or more of massive, very to extremely firm, dark gray to gray, clayey material which contains common, yellowish-red mottles and vertical cracks 15 to 30 cm apart when dry. This zone, in turn, grades to firm, dark gray, silty material containing few to common, yellowish-brown to dark brown mottles. Soil reaction varies from medium or strongly acid in the surface to medium or slightly acid in the subsoil (1:1 H_2O). Soil classification is *Rego Humic Gleysol*.

Commonly Associated Soils: Katzie and Annis soils often occur in close association with Westlang soils. Annis soils differ by having organic surfaces from 15 to 40 cm deep while Katzie soils occur at slightly higher landscape positions than Westlang soils and are somewhat better drained and have well structured subsurface layers.

Vegetation: Cleared and cultivated areas are used mainly for pasture and hay. Natural vegetation includes black cottonwood, willow, sedges, reeds and grass. Rooting is restricted mainly to the upper 50 cm by the dense subsoil and high watertables.

General Land Use Comments: (1) High watertables and susceptibility to surface ponding are the main agricultural limitations of Westlang soils, particularly for perennial crops. Tile drainage will help improve the structure of the subsoil as well as providing better aeration and water movement. Tile spacings should be relatively close because of the slowly permeable subsurface and subsoil. Power requirements for cultivation are high and surface puddling is likely if cultivated when wet. (2) High watertables, slow subsoil permeability, flooding hazard and variable soil bearing strengths combine to make Westlang soils poorly suited for urban uses.

WHATCOM SOILS

Plate 42 A typical undulating to rolling landscape in which Whatcom soils dominate. Sometimes the ridges are Nicholson soils and generally, the depressions are either Scat or Albion soils.

Location and Extent: Whatcom soils are one of the dominant soils of the uplands of the map area. The largest areas are in Matsqui, Langley and Maple Ridge Municipalities with lesser areas in Surrey and Mission Municipalities. Small areas also occur near Gibsons and northwest of Sechelt. About 3090 ha of pure map units and 17940 ha of complexes dominated by Whatcom soils are mapped. The complexes are mostly with Nicholson, Scat, Albion, Bose and Sunshine soils.

Topography and Elevation: The topography of Whatcom soils generally varies from undulating to moderately rolling with slope gradients from 2 to 15 percent; along gullies and in other small areas the gradients may exceed 60 percent. Whatcom soils usually occupy the slopes and commonly the ridges of the uneven landscape. Elevations range from 20 to 150 m above sea level.

Parent Material and Texture: Whatcom soils have developed from moderately fine to fine glaciomarine deposits, capped in some areas by up to 50 cm of medium-textured aeolian material. The wind-blown capping is most prevalent in the eastern part of the map area. Surface and subsurface textures are silt loam while the subsoil grades to compact, dense, silty clay loam or silty clay. Occasional stones and gravel are usually present in the glaciomarine material.

Soil Moisture Characteristics: Whatcom soils are moderately well to well drained. They are moderately pervious in the surface and subsurface; this decreases to slowly pervious in the compact subsoil. They also have high water holding capacity and slow to moderate surface runoff, depending on the steepness of the slopes. Temporary, perched watertables develop above the compact, dense subsoil during periods of heavy precipitation and lateral seepage occurs in this zone during these periods.

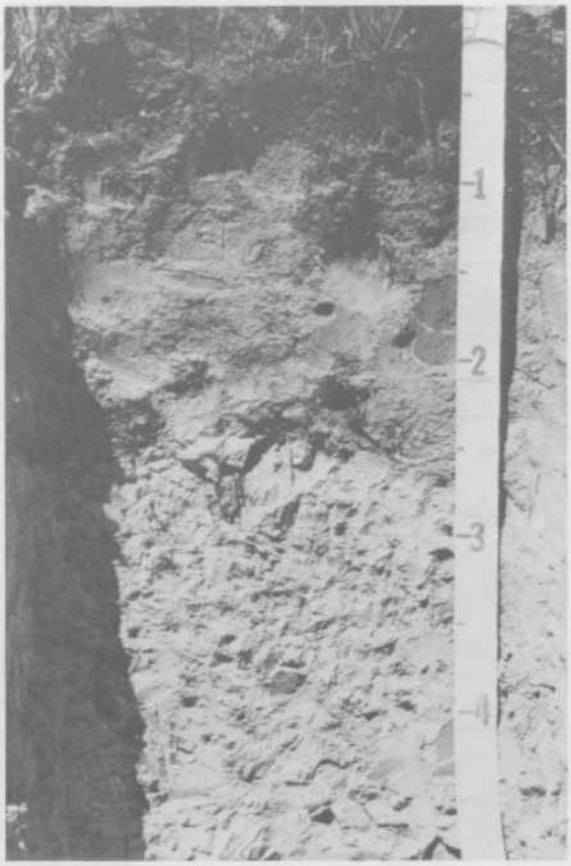

Plate 43 Whatcom soil profile (Luvisolic Humo-Ferric Podzol). These soils have developed in clayey glaciomarine sediments which have a variable, usually thin, silty eolian capping on the surface. They have a clay enriched layer 50 cm or more below the surface. In the photo, this layer begins at about 3 ft. (90 cm).

General Soil Description: In uncleared aras, Whatcom soils usually have up to 5 cm of organic (mainly deciduous) forest litter on the soil surface. This is underlain by about 15 cm of dark reddish brown, very friable, soft, weakly structured, silty material containing variable amounts of hard, spherical concretions. (In cultivated areas the surface consists of about 20 cm of friable, dark brown to dark reddish brown, silty material). This is underlain by about 40 cm of reddish-brown to yellowish-brown, friable, weakly structured, silty material containing occasional concretions. Under this is a leached layer about 15 cm thick that is brown or grayish-brown, moderately blocky, firm when moist and contains common to many, strong brown to reddish mottles. Under this, in turn, is a zone, about 40 cm thick, of grayish-brown or dark grayish brown, clay enriched, strongly blocky, very firm, silty to clayey material which contains, few to common, brownish or reddish mottles in the upper part and common clay flows on and in peds. This zone gradually grades to dense, massive, dark gray, unweathered glaciomarine sediments at about 150 cm depth which fracture conchoidally and have dark coloured coatings on the fracture faces. Soil reaction varies from strongly or very strongly acid in the upper 70 cm to slightly acid or neutral at about 120 cm. Soil classification is usually ***Luvisolic Humo-Ferric Podzol***; a few areas of Orthic Humo-Ferric Podzol are included where the clay-enriched subsoil layer is only weakly developed.

Commonly Associated Soils: Scat, Nicholson, Albion, Bose and Sunshine soils are commonly associated with Whatcom soils. Nicholson soils are similar to Whatcom soils except that the clay-enriched subsoil layer occurs between 20 and 50 cm of the surface rather than at depths below 50 cm. Scat and Albion soils differ from Whatcom soils by being poorly drained and are either depressional or lie in slightly lower landscape positions. Bose and Sunshine soils differ from Whatcom soils by being, respectively, gravelly and sandy in the surface and subsurface layers.

Vegetation: Substantial areas of Whatcom soils are cleared and utilized for a variety of agricultural uses, including pasture and hay, small fruits and vegetables, corn and bulb crops. Uncleared areas support second-growth forest which includes red alder, coast Douglas-fir, western hemlock, western red cedar, vine and bigleaf maple, and birch. The understory includes, among many others, thimbleberry, salmonberry, cascara, elderberry, trailing blackberry and bracken. Rooting is unrestricted to at least 50 cm and more commonly, 75 cm depth. Below that, root penetration is severely impeded by the dense, compact subsoil.

General Land Use Comments: (1) Where adverse topography is not restricting, Whatcom soils are suited for most agricultural crops. Some susceptible perennials may be adversely affected during the winter by temporary, perched watertables and telluric seepage. As with most soils in the map area, supplemental irrigation is beneficial during most summers. Other soils, especially Scat and Albion soils, are often closely intermingled with Whatcom soils causing some difficulties in individually managing these soils. (2) Whatcom soils are moderately to poorly suited for urban uses. The dense, compact subsoil severely impedes septic tank effluent disposal while variable soil bearing strengths may require special foundation requirements. Temporary perched watertables and seepage may cause problems for basements and other excavations. (3) Whatcom soils potentially produce good forest growth. Limited data indicates wood production by Douglas-fir to be between 9 and 12 m^2/ha/yr, constrained mainly by soil moisture deficiencies during some mid-to-late summers.

WHONNOCK SOILS (WH)

Location and Extent: Whonnock soils are relatively common at the higher elevations in the mountains of the map area. There are about 1560 ha of pure map units and 8270 ha of soil complexes dominated by Whonnock soils. Most complexes are with Sayres and Golden Ears soils.

Topography and Elevation: The topography of Whonnock soils is mostly strongly to very steeply sloping although moderately sloping or moderately rolling to hilly areas also occur. Most slope gradients are between 10 and 40 percent. The soils usually occur in lower slope positions and other areas where seepage concentrates. Elevations range mainly between 700 and 950 m above sea level.

Parent Material and Texture: Whonnock soils have developed from moderately coarse textured glacial till deposits which are more than 1 m deep, over bedrock. There is usually between 25 to 50 cm of mainly well-decomposed (humic) organic forest litter on the mineral soil surface. The mineral soil is sandy loam or gravelly sandy loam with some variation to gravelly loamy sand or loam; the subsoil is strongly cemented and stones and boulders are common.

Soil Moisture Characteristics: Whonnock soils are imperfectly drained. They are moderately pervious in the upper part but this decreases to slowly pervious in the cemented subsoil. They also have moderate to high water holding capacity and slow to moderate surface runoff. Perched watertables develop above the cemented subsoil and telluric seepage flows along the surface of this zone during all but the dryest parts of the year.

General Soil Description: Whonnock soils usually have about 35 cm of organic forst litter on the soil surface, the upper 5 cm of which is relatively undecomposed. The remainder is well-decomposed, very dusky red to black, friable, and matted to amorphous. This is underlain by about 10 cm of reddish-gray to grayish-black, friable, strongly leached, sandy material which, in turn, is underlain by a sandy zone about 30 cm thick that is dark reddish brown to dark brown, weakly to moderately subangular blocky, friable and contains between 10 and 25 percent organic matter. This zone then grades to about 40 cm of dark brown to reddish-brown sandy material which is moderately structured, friable and contains common, reddish to grayish mottles. Seepage is usually present in this zone. Abruptly underlying this is 30 to 50 cm of extremely firm, dense, massive to coarsely platy, very strongly cemented, olive-gray to brownish-gray, sandy or gravelly material containing common to many, dark brown to yellowish-brown mottles. This cemented zone grades gradually to very firm, massive, olive-gray to gray, unweathered glacial till below about 160 cm. Soil reaction is extremely acid throughout except in the lower subsoil where it increases to strongly acid. Soil classification is ***Duric Ferro-Humic Podzol***.

Commonly Associated Soils: Golden Ears and Sayres soils generally are closely associated with Whonnock soils. Golden Ears soils usually occupy slightly higher landscape positions and do not have the large amounts of seepage that Whonnock soils have. Consequently, they are moderately well to well drained rather than imperfectly drained. Sayres soils occupy landscape positions similar to Golden Ears soils but differ from both Whonnock and Golden Ears soils by having bedrock within 100 cm of the soil surface.

Vegetation: The natural tree species on Whonnock soils are mostly Pacific silver fir, mountain hemlock and yellow cedar although western hemlock and western red cedar are also present in the lower parts of the soils' elevational range. Rooting is restricted to the upper 100 cm of soil by the dense, cemented subsoil. A concentration of roots (root mat) is usually present immediately above the cemented zone.

General Land Use Comments: (1) Whonnock soils are generally unsuitable for agricultural uses due to steep topography, stoniness, and adverse climate. (2) Urban and related uses are also poorly suited because of excessive topography, and high snowfall conditions. Septic tank effluent disposal is severely impeded by the strongly cemented subsoil. (3) Forest growth is good. Limited plot data indicates growth of western hemlock and Pacific silver fir ranges from 9 to 12 m^3/ha/yr at the soil's lower elevational limit to between 7 and 9 m^3/ha/yr near its' upper limits. Whonnock soils tend to "brush-in" rapidly and should be reforested with desirable, suited species as soon after logging as possible. Subsoil seepage requires that adequate water control structures (culverts and ditches) are present on access roads.

WIDGEON SOILS (WG)

Location and Extent: Widgeon soils occur only in the northern part of Pitt Meadows Municipality, in the Pitt Polder area and near the mouth of Widgeon Creek. About 350 ha of pure map units and 480 ha of soil complexes dominated by Widgeon soils are classified. Most complexes are with Sturgeon, Glen Valley, Addington and Alouette soils.

Topography and Elevation: Widgeon soils, with slopes less than 2 percent, are nearly level or slightly depressional to gently undulating. Elevations all lie below 3 m above sea level.

Parent Material and Texture: Widgeon soils have developed from shallow organic deposits, between 40 and 160 cm thick and derived mainly from reeds and sedges, which overlie mixed, medium-textured, floodplain deposits of the Pitt, Fraser and Alouette Rivers. Some sedimentary organic material is also present. The surface 10 cm or so is mainly undecomposed (fibric) moss remains; the underlying organic material is well-decomposed (humic) and contains varying amounts of silt. The mineral subsoil is generally silt loam.

Soil Moisture Characteristics: Widgeon soils are very poorly drained. They are moderately pervious and have very high water holding capacity and slow surface runoff. Groundwater tables are near the surface for most of the year and surface flooding is common during heavy, prolonged rains or during the freshet (high water) season on the adjacent rivers.

General Soil Description: Widgeon soils have a surface layer about 10 cm thick which is dark reddish brown to yellowish-brown and consists mainly of undecomposed moss. Under this is about 60 cm of well-decomposed organic material which is massive, slippery when wet, contains varying amounts of silt, ranges in colour from dark reddish brown in the upper part through dark yellowish brown to very dark grayish brown near the bottom and is usually saturated with water. The underlying silty soil is massive and changes from dark grayish brown in the upper part to dark gray with increasing depth. Soil reaction is extremely acid in the organic material and very strongly acid in the silty subsoil. Soil classification is *Terric Humisol*.

Commonly Associated Soils: Sturgeon, Glen Valley and Addington soils usually occur in close association with Widgeon soils. Sturgeon and Addington soils differ from Widgeon soils by having organic surface deposits between 15 and 40 cm deep, rather than between 40 and 160 cm thick. Also, the underlying mineral soil in Addington soils is loamy to sandy, rather than silty. Glen Valley soils differ by consisting of mainly undecomposed peat 160 cm or more deep.

Vegetation: Only a few, small areas are cleared; these are mostly used to produce reed canary grass. Uncleared areas have vegetation that includes hardhack, sweetgale, sedges, reeds, grass, bog birch, occasional western red cedar and lodgepole pine with a mixed moss ground cover. Rooting is restricted mainly to the upper 30 cm by the high watertables.

General Land Use Comments: (1) Most areas of Widgeon soils are presently suited only for permanent pasture uses. With adequate water control through ditching, subsurface drains and dyking, they could be reclained for a variety of agricultural crops. (2) Urban and related uses are not suited for Widgeon soils due to permanently high watertables, surface flooding and very low soil bearing strengths.

Plate 44 Widgeon Lake. Exposed bedrock and talus are common at the higher elevations of the map area. Palisade, Sayres and Dennett soils occupy the middle distance. (Tourism B.C. photo).

Plate 45 A view typical of the Tidal Flats miscellaneous land type. These areas, which lie outside the dykes, are periodically flooded by tidal action and are silty to sandy in texture and saline.

MISCELLANEOUS LAND TYPES

Miscellaneous land types consist of naturally occuring or man-made components of the landscape but are considered not to be "soil" as defined in this report. They, however, are mappable and seven different land types are classified in the map area.

Anthropogenic (A): The Anthropogenic land type consists of areas which are man-made or so severely man-modified that the original characteristics of the soil have been destroyed. About 310 ha are classified as Anthropogenic land type, located mainly in the vicinity of Vancouver. In the map area, this land type consists mainly of land fill materials including hog fuel, gravel, and sand dredgings. An anthropogenic soil variant employed in some map units is similar to this Anthropogenic land type except that land disturbance is usually less severe and some characteristics of the original soil are still identifiable.

Gravel Pit (GP): The Gravel Pit land type consists of both active and inactive areas of gravel or sand extraction sufficiently large to be mapped at the time of the survey. About 550 ha are classified as Gravel Pit land type.

Ice (I): The Ice land type consists of glaciers and permanent snow fields that occupy a small part of the map area. About 85 ha are classified as Ice land type in the vicinity of Mt. Robie Reid.

Recent Alluvium (RA): The Recent Alluvium land type is composed of gravel and sand bars, spits and other similar deposits in or adjacent to rivers and streams. They are usually inundated except during low water and are generally unvegetated. Their shape, size and location may be altered from year to year by erosion and subsequent redeposition. About 1050 ha are classified as Recent Alluvium land type, mainly in or adjacent to the Fraser River.

Rock Outcrop (RO): The Rock Outcrop land type is common in the map area, particularly at the higher elevations in the mountains. It consists of areas of exposed bedrock or bedrock areas with less than 10 cm of mineral or organic soil on the rock surface. Topographically, Rock Outcrops areas are usually very to extremely sloping or hilly to very hilly; slope gradients are mostly greater than 30 percent. About 440 ha of Rock Outcrop land type are classified as well as 23 040 ha of complexes dominated by Rock Outcrop. The complexes are with a variety of soils and Talus land type.

Talus (TA): The Talus land type consists of actively accumulating, colluvial depositions of mostly gravel, stones and boulders at the base of rock cliffs and other steep rock faces. They are usually unvegetated and occur mainly at the higher elevations in association with Rock Outcrops. About 3290 ha are classified as Talus land type with an additional 430 ha mapped as complexes dominated by Talus land type. The complexes are mostly with Rock Outcrop land type and Paton and Lions soils.

Tidal Flat (TF): The Tidal Flat land type consists of areas lying outside the dykes that are periodically covered by tidal waters. The main areas are along Boundary and Mud Bays, along Roberts Bank and near the mouth of the Fraser River. The deposits are mainly fine sandy to silty in texture, are strongly saline and very poorly drained. About 3940 ha are classified as Tidal Flat land type.

Plate 46 Urban encroachment onto agricultural land. This change in land use is now controlled through the establishment of Agricultural Land Reserves by the B.C. Agricultural Land Commission.

Plate 47 Transportation and utility corridors occupy substantial lands in the Langley-Vancouver map area. This view in Delta Municipality is an example.

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GLOSSARY

absorbed water: Water held mechanically in a soil mass and having physical properties similar to ordinary water at the same temperature and pressure.

acid soil: A soil material having a pH of less than 7.0.

adsorbed water: Water held in a soil mass by physicochemical forces and having physical properties substantially different from absorbed water or chemically combined water at the same temperature and pressure.

aeration, soil: The process by which air in the soil is replaced by air from the atmosphere. In a well-aerated soil, the soil air is similar in composition to the atmosphere above the soil. Poorly aerated soils usually contain a much higher percentage of carbon dioxide and a correspondingly lower percentage of oxygen than the atmosphere. The rate of aeration depends largely on the volume and continuity of pores in the soil.

aggregate: Sand, gravel and other similar mineral material suitable for use in construction (i.e. for road surfaces, concrete, pavement).

aggregate, soil: A group of soil particles cohering in such a way that they behave mechanically as a unit.

alkaline soil: Any soil that has a pH greater than 7.0.

alkalinity, soil: The degree or intensity of alkalinity of a soil expressed by a value greater than 7.0 on the pH scale.

alluvial fan: A fan-shaped deposit of alluvium laid down by a stream where it emerges from an upland into less steeply sloping terrain.

alluvium: Material such as clay, silt, sand, and gravel deposited by modern rivers and streams.

amorphous mineral: (i) A mineral that has no definite crystalline structure. (ii) A mineral that has a definite crystalline structure, but appears amorphous because of the small crystal size.

anthropogenic: Man-made, or strongly man-modified, soil materials.

apron: A relatively gentle slope at the bottom of a steeper slope, and formed of materials similar to those on the upper slope (i.e. alluvial fan apron).

arable soil: Soil suitable for plowing and cultivation.

aspect: A measure of the orientation of a slope by means of compass points.

Atterberg Limits (Plastic Limits): The range of water content over which a soil exhibits plastic behaviour. The Lower Atterberg Limit is the water content at which the soil is not plastic when worked and crumbles on application of pressure. The Upper Atterberg Limit is the water content at which the soil changes from plastic to flow behaviour.

available nutrient: The portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants. ("Available should not be confused with "exchangeable".)

available water: The portion of water in a soil that can be readily absorbed by plant roots; usually considered to be the water held in the soil against a pressure of up to approximately 15 bars.

bar: A unit of pressure equal to one million dynes per square centimeter.

base saturation percentage: The extent to which the adsorption complex of a soil is saturated with exchangeable cations other than hydrogen and aluminum. It is expressed as a percentage of the total cation exchange capacity.

beach deposits: Sediments that are modified in their degree of sorting, or surface relief, or both, by the action of waves in forming beaches.

bearing capacity (bearing strength): The average load per unit area that is required to rupture a supporting soil mass.

bedrock: The solid rock that underlies soil and the regolith or that is exposed at the surface.

blanket: A mantle of unconsolidated material thick enough to mask minor irregularities in the underlying rock or other deposits, but which still conforms to the general underlying topography.

bog: An area covered, or filled with, peat material which generally consists of undecomposed to moderately decomposed mosses.

boulders: Rock fragments over 60 cm (2 ft) in diameter. In engineering practice boulders are greater than 20 cm (8 inches) in diameter.

Brunisolic: An order of soils whose horizons are developed sufficiently to exclude the soils from the Regosolic order, but that lack the degrees or kinds of horizon development specified for soils of the other orders. These soils, which occur under a wide variety of climatic and vegetative conditions, all have Bm or Btj horizons. The great groups Melanic Brunisol, Eutric Brunisol, Sombric Brunisol, and Dystric Brunisol belong to this order.

bulk density, soil: The mass of dry soil per unit bulk volume. The bulk volume is determined before the soil is dried to constant weight at 105° C.

calcareous soil: Soil containing sufficient calcium carbonate, often with magnesium carbonate, to effervesce visibly when treated with cold 0.1 N hydrochloric acid.

capability class: A rating that indicates the capability of land for some use such as agriculture, forestry, recreation, or wildlife.

capability subclass: A grouping of lands that have similar kinds of limitations and hazards. It provides information on the kind of conservation problem or limitation. The class and subclass together provide information about the degree and kind of limitation.

carbon-nitrogen ratio: The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

category: A grouping of related soils defined at approximately the same level of abstraction. In the Canadian soil classification the categories are order, great group, subgroup, family, and series.

cation exchange: The interchange of a cation in solution and another cation on the surface of any surface-active material such as clay colloid or organic colloid.

cation exchange capacity: The total amount of exchangeable cations that a soil can adsorb. It is expressed in milliequivalents per 100 g of soil or other adsorbing materials such as clay.

cemented-indurated: Having a hard, brittle consistence because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminum. The hardness and brittleness persist even when the soil is wet.

Chernozemic: An order of soils that have developed under xerophytic or mesophytic grasses and forbs, or under grassland-forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-colored surface (Ah, Ahe, or Ap) horizon and a B or C horizon, or both, of high base saturation. The order consists of the Brown, Dark Brown, Black, and Dark Gray great groups.

chroma: The relative purity, strength, or saturation of a colour. It is directly related to the dominance of the determining wavelength of light. It is one of the three variables of colour. See also **Munsell colour system; hue;** and **value, colour.**

class, soil: A group of soils having a definite range in a particular property such as acidity, degree of slope, texture, structure, land-use capability, degree of erosion, or drainage.

classification, soil: The systematic arrangement of soils into categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics, and subdivisions on the basis of more detailed differences in specific properties.

clay: (i) As a particle-size term: a size fraction less than 0.002 mm in equivalent diameter, or some other limit (geologists and engineers). (ii) As a rock term: a natural, earthy, fine grained material that develops plasticity with a small amount of water. (iii) As a soil term: a textural class in which the soil materials contain 40 percent or more of clay. (iv) As a soil separate: a material usually consisting largely of clay minerals but commonly also of amorphous free oxides and primary minerals.

clay films (skins): Coatings of oriented clays on the surfaces of soil peds and mineral grains, and in soil pores.

clay loam: Soil material that contains 27% to 40% clay and 20% to 45% sand.

clay mineral: Finely crystalline hydrous aluminum silicates and hydrous magnesium silicates with a phyllosilicate structure.

clayey: Containing large amounts of clay, or having properties similar to those of clay.

climatic moisture deficit: The negative difference between precipitation and the potential evapotranspiration from May 1st to September 30th.

climatic moisture surplus: The positive difference between precipitation and the potential evapotranspiration from May 1st to September 30th.

climax: A plant community of the most advanced type capable of development under, and in dynamic equilibrium with, the prevailing environment.

clod: A compact, coherent mass of soil produced by digging or plowing. Clods usually slake easily with repeated wetting and drying.

coarse fragments: Rock or mineral particles greater than 2.0 mm in diameter.

coarse texture: The texture exhibited by sands, loamy sands, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

cobble: Rounded or partially rounded rock or mineral fragment 7.5 to 25 cm (3 to 10 inches) in diameter. In engineering practice, cobbles are greater than 7.5 cm (3 inches) but less than 20 cm (8 inches) in diameter.

colluvium: Product of mass wasting; materials that have reached their present position by direct, gravity induced movement.

complex, soil: A mapping unit used in detailed and reconnaissance soil surveys where two or more defined soil units are so intimately intermixed geographically that it is impractical, because of the scale used, to separate them.

concretion: A mass or concentration of a chemical compound, such as calcium carbonate or iron oxide, in the form of a grain or nodule of varying size, shape, hardness, and color, found in soil and in rock. The term is sometimes restricted to concentrations having concentric fabric. The composition of some concretions is unlike that of the surrounding material.

consistence: (i) The resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass. Terms used for describing consistence at various soil moisture contents are:

wet soil—nonsticky, slightly sticky, sticky, and very sticky; nonplastic, slightly plastic, plastic, and very plastic.

moist soil—loose, very friable, friable, firm, and very firm; compact, very compact, and extremely compact.

dry soil—loose, soft, slightly hard, hard, very hard, and extremely hard.

cementation—weakly cemented, strongly cemented, and indurated.

creep, soil: An imperceptibly slow, more or less downward and outward movement of soil or rock on slopes due mainly to gravity. The movement is essentially viscous, under shear stresses sufficient to produce permanent deformation but too small to produce shear failure, as in a landslide.

Cryosolic: An order of soils in the Canadian taxonomic system. Cryosolic soils are mineral or organic soils that have perennially frozen material within 1 m (3 ft) of the surface in some part of the soil body, or pedon. The mean annual soil temperature is less than 0° C (32° F). They are the dominant soils of the zone of continuous permafrost and become less widespread to the south in the zone of discontinuous permafrost; their maximum development occurs in organic and poorly drained, fine textured materials.

degradation: The changing of a soil to a more highly leached and weathered state, usually accompanied by morphological changes such as the development of an eluviated, light-coloured A (Ae) horizon.

delta: An area at the mouth of a river formed by deposition of successive layers of sediments brought down from the land and spread out on the bottom of a basin. Where the stream current reaches quiet water, the bulk of the coarser load is dropped and the finer material is carried farther out.

deposit: Material left in a new position by a natural transporting agent such as water, wind, ice, or gravity, or by the activity of man.

drain: (i) To provide channels, such as open ditches or drain tile, so that excess water can be removed by surface or by internal flow. (ii) To lose water from the soil by percolation.

dunes: Wind-built ridges and hills of sand.

duric: A soil horizon tht is strongly cemented and usually has an abrupt upper boundary and a diffuse lower boundary. Cementation is usually strongest near the upper boundary. Air-dried clods do not slake when immersed in water.

ecology: The study of the relationship between organisms and their environment.

eluvial horizon: A soil horizon that has been formed by the process of eluviation.

eluviation: The transportation of soil material in suspension or in solution within the soil by the downward or lateral movement of water.

eolian deposit: Sand, or silt, or both, deposited by the wind. See also loess and dunes.

erosion: The group of processes whereby surficial or rock materials are loosened, or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion and transportation.

evapotranspiration: The loss of water from a given area during a specified time by evaporation from the soil surface and by transpiration from the plants.

exchange capacity: The total ionic charge of the adsorption complex that is active in the adsorption of ions.

family, soil: A category in the Canadian sytem of soil classification. Differentiae are primarily texture, drainage, thickness of horizons, permeability, mineralogy, consistence, and reaction.

fan, alluvial: A fan-shaped landform that can be likened to the segment of a cone, and possessing a perceptible gradient from apex to toe.

fen: An area covered by, or filled with, peat material which generally consists of well to moderately decomposed sedge and reed vegetation.

fibric layer: A layer of organic soil material containing large amounts of weakly decomposed fiber whose botanical origin is readily identifiable.

field capacity: The percentage of water remaining in the soil 2 or 3 days after the soil has been saturated and free drainage has practically ceased. The percentage may be expressed in terms of weight or volume.

fine texture: Consisting of or containing large quantities of the fine fractions, particularly of silt and clay. It includes all the textural classes of clay loams and clays: clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay. Sometimes it is subdivided into clayey texture and moderately fine texture.

firm: A term describing the consistence of a moist soil that offers distinctly noticeable resistance to crushing, but can be crushed with moderate pressure between the thumb and forefinger.

floodplain: The land bordering a stream or river, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluvial deposits: All sediments, past and present, deposited by flowing water, including glaciofluvial deposits. Wave-worked deposits and deposits resulting from sheet erosion and mass wasting are not included.

forest floor: All dead vegetable and organic matter, including litter and unincorporated humus, on the mineral soil surface under forest vegetation.

friable: A consistence term pertaining to the ease of crumbling of soils.

genesis, soil: The mode of origin of the soil, especially the processes or soil-forming factors responsible for the development of the solum from unconsolidated parent material.

glaciofluvial deposits: Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers, and kame terraces.

gleyed soil: Soil affected by gleysation.

gleysation: A soil-forming process, operating under poor drainage conditions, which results in the reduction of iron and other elements and in gray colours, and mottles.

Gleysolic: An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons.

gravel: Rock fragments 2 mm to 7.5 cm (3 inches) in diameter.

gravelly: Containing appreciable or significant amounts of gravel. The term is used to describe soils or lands.

great group: A category in the Canadian system of soil classification. It is a taxonomic group of soils having certain morphological features in common and a similar pedogenic environment.

groundwater: Water that is passing through or standing in the soil and the underlying strata. It is free to move by gravity. See also **water table.**

horizon, soil: A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as colour, structure, texture, consistence, and chemical, biological, and mineralogical composition. A list of the designations and properties of soil horizons may be found in The Canadian System of Soil Classification, 1978.

hue: The aspect of colour that is determined by the wavelengths of light, and changes with the wavelength. Munsell hue notations indicate the visual relationship of a colour to red, yellow, green, blue, or purple, or an intermediate of these hues. See also **Munsell colour system, chroma**; and **value, colour**.

humic layer: A layer of highly decomposed organic soil material containing little fiber.

humus: (i) The fraction of the soil organic matter that remains after most of the added plant and animal residues have decomposed. It is usually dark coloured. (ii) Humus is also used in a broader sense to designate the humus forms referred to as forest humus. They include principally mor, moder, and mull. (iii) All the dead organic material on and in the soil that undergoes continuous breakdown, change, and synthesis.

igneous rock: Rock formed by the cooling and solidification of magma. It has not been changed appreciably since its formation.

illuvial horizon: A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension as a layer of accumulation.

illuviation: The process of depositing soil material removed from one horizon in the soil to another, usually from an upper to a lower horizon in the soil profile. Illuviated substances include silicate clay, hydrous oxides of iron and aluminum, and organic matter.

impeded drainage: A condition that hinders the movement of water by gravity through soils.

impervious: Resistant to penetration by fluids or roots.

indurated layer: A soil layer that has become hardened, generally by cementation of soil particles.

infiltration: The downward entry of water into the soil.

infiltration rate: A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions, including the presence of excess water.

inorganic soil: A soil made up mainly of mineral particles; a soil containing less than 17% organic carbon.

irrigation: The artificial application of water to the soil for the benefit of growing crops.

kame: An irregular ridge or hill of stratified glacial drift deposited by glacial meltwater.

kettle: Depression left after the melting of a detached mass of glacier ice buried in drift.

lacustrine: Sediments that have settled from suspension in bodies of standing fresh water, or that have accumulated at their margins through wave action. These sediments range in composition from sands to clays.

land: The solid part of the earth's surface or any part thereof. A tract of land is defined geographically as a specific area of the earth's surface. Its characteristics embrace all reasonably stable, or predictably cyclic, attributes of the biosphere vertically above and below this area, including those of the atmosphere, the soil, and the underlying geology, the hydrology, the plant and animal populations, and the results of past and present human activity, to the extent that these attributes exert a significant influence on the present and future uses of land by man.

land classification: The arrangement of land units into various categories based on the properties of the land or its suitability for some particular purpose.

landforms: The various shapes of the land surface resulting from a variety of actions such as deposition or sedimentation (eskers, lacustrine basins), erosion (gullies, canyons), and earth crust movements (mountains).

landscape: All features such as fields, hills, forests, and water that distinguish one part of the earth's surface from another part. Usually it is the portion of land or territory that the eye can see in a single view, including all its natural characteristics.

leaching: The removal from the soil of materials in solution. See also **eluviation**.

levee: A natural or artificial embankment along a river or stream.

liquid limit (upper plastic limit, Atterberg limit): (i) The water content corresponding to an arbitrary limit between the liquid and plastic states of consistence of a soil. (ii) The water content at which a pat of soil, cut by a standard-sized groove, will flow together for a distance of 12 mm under the impact of 25 blows in a standard liquid-limit apparatus.

lithic layer: Bedrock under the control section of a soil. In Organic soils, bedrock occurring within a depth of between 10 cm and 160 cm from the surface, while in mineral soils it occurs between 10 and 100 cm of the surface.

loamy: Intermediate in texture and properties between fine-textured and coarse-textured soils. It includes all textural classes having "loam" or "loamy" as a part of the class name, such as clay loam or loamy sand.

loess: Material transported and deposited by wind and consisting of predominantly silt-sized particles.

Luvisolic: An order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.

map, soil: A map showing the distribution of soil mapping units related to the prominent physical and cultural features of the earth's surface.

medium texture: Intermediate between fine-textured and coarse-textured soils. It includes the following textural clases: very fine sandy loam, loam, silt loam, and silt.

mesic layer: A layer of organic material at a stage of decomposition between that of the fibric and humic layers.

metamorphic rock: Rock derived from pre-existing rocks, but differing from them in physical, chemical, and mineralogical properties as a result of natural geological processes, principally heat and pressure, originating within the earth. The pre-existing rocks may have been igneous, sedimentary, or another form of metamorphic rock.

mineral soil: A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter. It contains less than 17% organic carbon except for an organic surface layer that may be up to 40 cm thick.

miscellaneous land type: A mapping unit for areas of land that have little or no natural soil.

moder: A zoogenous forest humus form made up of plant remains partly disintegrated by the soil fauna (F layer), but not matted as in raw humus. It is transitional to a zone of spherical or cylindrical microejections of arthropods that is permeated by loose mineral particles in its lower part and often throughout. Incorporation of organic matter is shallow and the mixing of organic and mineral particles is purely mechanical.

moderately coarse texture: Consisting predominantly of coarse particles. In soil textural classification, it includes all the sandy loams except very fine sandy loam.

moderately fine texture: Consisting predominantly of intermediate-sized soil particles with or without small amounts of fine or coarse particles. In soil textural classification, it includes clay loam, sandy clay loam, and silty clay loam.

moraine (glacial till): The materials transported beneath, beside, on, within and in front of a glacier; deposited directly from the glacier and not modified by any intermediate agent.

morphology, soil: (i) The physical constitution, particularly the structural properties, of a soil profile as exhibited by the kinds, thickness, and arrangement of the horizons in the profile, and by the texture, structure, consistence, and porosity of each horizon. (ii) The structural characteristics of the soil or any of its parts.

mottles: Spots or blotches of different colour or shades of colour interspersed with the dominant colour. They are described in terms of abundance (few, common, many), size, (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottling in soils indicates poor aeration and lack of good drainage.

mottling: Formation or presence of mottles in the soil.

mull: A zoogenous forest humus form consisting of an intimate mixture of well-humified organic matter and mineral soil that makes a gradual transition to the horizon underneath. It is distinguished by its crumb or granular structure, and because of the activity of the burrowing microfauna, partly decomposed organic debris does not accumulate as a distinct layer (F layer) as in mor and moder.

Munsell colour system: A colour designation system specifying the relative degrees of the three simple variables of colour: hue, value, and chroma.

order, soil: The highest category in the Canadian system of soil classification. All the soils of Canada have been divided into nine orders: Chernozemic, Solonetzic, Luvisolic, Podzolic, Brunisolic, Regosolic, Gleysolic, Organic, and Cryosolic. All the soils within an order have one or more characteristics in common.

Organic: An order of soils that have developed dominantly from organic deposits. The majority of Organic soils are saturated for most of the year, unless artificially drained, but some of them are not usually saturated for more than a few days. They contain 17% or more organic carbon.

organic matter, soil: The organic fraction of the soil; includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

ortstein: (i) An indurated layer in the B horizon of Podzols in which the cementing material consists of illuviated sesquioxides and organic matter. (ii) As a subgroup of Podzolic soils, Ortstein indicates a Bhfc or Bfc horizon that is strongly cemented, occurs over at least one-third of the exposure, and is at least 2.5 cm (1 inch) thick.

outwash, glacial: Sediments carried by, and deposited from flowing water beyond a glacier front and laid down as stratified drift in thin foreset beds. The particle size may vary from boulders to silt.

pans: Horizons or layers in soils that are strongly compacted, indurated, or very high in clay content.

parent material: The unconsolidated and more or less unweathered mineral or organic matter from which the solum of a soil has developed by pedogenic processes.

peat: Unconsolidated soil material consisting largely of undecomposed, or only slightly decomposed, organic matter.

ped: A unit of soil structure such as a prism, block, or granule, which is formed by natural processes, in contrast with a clod, which is formed artificially.

podgenic: Of or referring to the genesis (formation and development) of soil; used mainly when discussing the kind, strength and distribution of soil horizons in a soil profile.

pedology: The aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping, and taxonomy of soils, and classification in terms of their use.

perched water table: A water table due to the "perching" of water on a relatively impermeable layer at some depth within the soil. The soil within or below the impermeable layer is not saturated with water.

percolation (of soil water): The downward movement of water through soil.

permeability, soil: The ease with which gases and liquids penetrate or pass through a bulk mass of soil or a layer of soil. Because different soil horizons vary in permeability, the specific horizon should be designated.

perviousness: The potential of a soil to transmit water internally, as inferred from soil characteristics.

pH, soil: The negative logarithm of the hydrogen ion activity of a soil; the degree of acidity or alkalinity of a soil.

phase, soil: A subdivision of a soil type or other unit of classification having characteristics that affect the use and management of the soil, but that do not vary sufficiently to differentiate it as a separate type.

plastic limit (Atterberg limit): (i) The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistence of a soil. (ii) The water content at which a soil will just begin to crumble when rolled into a thread approximately 3 mm in diameter.

platy: Consisting of soil aggregates that have developed predominantly along the horizontal axes; laminated; flaky.

Podzolic: An order of soils having podzolic B horizons (Bh, Bhf,or Bf) in which amorphous combinations of organic matter (dominantly fulvic acid), Al, and usually Fe are accumulated. The sola are acid and the B horizons have a high pH-dependent charge. The great groups in the order are Humic Podzol, Ferro-Humic Podzol, and Humo-Ferric Podzol.

pore space: The total space not occupied by soil particles in a bulk volume of soil.

prismatic: A soil structure type having prismlike aggregates that have vertical axes much longer than the horizontal axes.

profile, soil: A vertical section of the soil through all its horizons and extending into the parent material.

reaction, soil: The degree of acidity or alkalinity of a soil, usually expressed as a pH value.

regolith: The unconsolidated mantle of weathered rock and soil material overlying solic rock.

Regosolic: An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other soil orders.

runoff: The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

saline: A nonalkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 mmhos/cm, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5

sand: (i) A soil particle between 0.05 and 2.0 mm in diameter. (ii) Any one of five soil separates: very coarse sand, coarse sand, medium sand, fine sand, or very fine sand. (iii) A soil textural class.

sandy: Containing a large amount of sand. It may be applied to any one of the soil classes that contains a large percentage of sand.

science, soil: The science dealing with soil as a natural resource. It includes: soil formation, classification, and mapping; the physical, chemical, and biological properties of soils; and the management of soils for various purposes such as the production of agricultural and forest crops, the construction of roads, and others.

sedimentary rock: A rock formed from materials deposited from suspension or precipitated from solution and usually more or less consolidated. The principal sedimentary rocks are sandstones, shales, limestones, and conglomerates.

seepage: (i) The escape of water downward through the soil. (ii) The emergence of water from the soil along an extensive line of surface in contrast to a spring where the water emerges from a local spot.

series, soil: A category in the Canadian system of soil classification. This is the basic unit of soil classification, and consists of soils that are essentially alike in all major profile characteristics except the texture of the surface.

silt: (i) A soil separate consisting of particles between 0.05 and 0.002 mm in equivalent diameter. (ii) A soil textural class.

single-grain structure: A soil structure in which the soil particles occur almost completely as individual or primary particles; secondary particles or aggregates are seldom present. It is usually found only in very coarse-textured soils.

soil: (i) The unconsolidated material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The naturally occurring unconsolidated material on the surface of the earth that has been influenced by parent material, climate (including the effects of moisture and temperature), macro- and micro-organisms, and relief, all acting over a period of time to produce soil that may differ from the material from which it was derived in many physical, chemical, mineralogical, biological, and morphological properties. (iii) For the purpose of the Canadian taxonomic system, the earth's surface (the material that is to be classified) is divided into soil and nonsoil. Soil is the naturally occurring, unconsolidated, mineral or organic material at the earth's surface that is capable of supporting plant growth. It extends from the surface to 15 cm below the depth at which properties produced by soil-forming processes can be detected. These properties differ from those found in any underlying unconsolidated material.

soil forming factors: The variable, usually interrelated natural agencies that are responsible for the formation of soil. The factors are: parent material, climate, organisms, relief, and time.

solum: (see Genesis, soil).

stones: Rock fragments greater than 25 cm in diameter if rounded and greater than 38 cm along the greater axis if flat. In engineering practice these fragments are included with boulders, which are considered to be greater than 20 cm in diameter.

stoniness: The relative proportion of stones in or on the soil.

stony: Containing sufficient stones to interfere with or prevent tillage. To be classified as stony, more than 0.1% of the surface of the soil must be occupied by stones.

structure, soil: The combination or arrangement of primary soil particles into secondary particles, units, or peds. The peds are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades.

subgroup, soil: A category in the Canadian classification system. These are subdivisions of the soil great groups.

subsoil: A general term for the layer of soil (or surficial geologic deposit) which, in the context of this report, underlies the surface and subsurface soil layers. It begins about 50 cm below the surface and continues downward for about 75 to 100 cm.

subsurface soil: A general term used in this report for the approximately 20 to 30 cm thick layer of soil underlying the surface soil.

surface soil: The uppermost part of the soil that is ordinarily moved in tillage, or its equivalent in uncultivated soils. In this report it refers to the upper 15 to 20 cm of the soil.

telluric seepage: Seepage moving through the soil on a plane more or less parallel to the land surface and often above a restricting area; the waters are usually oxygenated.

terric layer: An unconsolidated mineral substratum underlying organic soil material.

texture, soil: The relative proportions of the various soil separates (sand, silt and clay) in a soil as described by the classes of soil texture. The names of textural soil classes may be modified by adding suitable adjectives when coarse fragments are present in substantial amounts.

tidal flats: Areas of nearly flat, often barren mud periodically covered by tidal waters. Normally these materials have an excess of soluble salt. A miscellaneous land type.

till (moraine): Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

type, soil: A unit in the natural system of soil clasification; a subdivision of a soil series consisting of or describing soils that are alike in all characteristics including the texture of the A horizon.

value, colour: The relative lightness of colour, which is approximately a function of the square root of the total amount of light.

variant, soil: A soil whose properties are believed to be sufficiently different from other known soils to justify a new name, but comprising such a limited geographic area that creation of a new named soil is not justified.

water table (groundwater): Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

weathering: The physical and chemical disintegration, alteration, and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Appendices

APPENDIX A

Average Monthly, Annual Mean and Extreme Temperatures for Several Stations in or Near the Langley-Vancouver Report Area

Station	Degrees Centigrade															Type of Normal	Elev. (m)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	High	Low		
Abbotsford (airport)	1.3	4.2	5.6	8.6	12.2	14.9	16.9	16.7	14.4	10.1	5.7	3.1	9.5	37.8	−21.2	2	60
Agassiz (CDA)	1.2	4.5	6.3	9.6	13.2	15.8	18.0	17.7	15.4	10.9	6.1	3.1	10.2	39.4	−25.0	1	15
Chilliwack	1.5	4.8	6.0	9.3	13.0	15.9	18.1	17.8	15.6	10.9	6.2	3.4	10.2	37.8	−21.7	3	7
Gibsons	2.1	3.8	5.2	8.0	12.1	14.9	17.1	16.9	14.1	9.9	5.6	3.4	9.4	35.6	−17.8	8	143
Haney (UBCRF Marc)	1.2	3.4	4.6	7.8	11.6	14.4	16.8	16.4	14.0	9.3	4.9	2.7	8.9	37.2	−20.6	8	171
Hollyburn Ridge	−2.2	−0.2	0.3	2.7	6.6	10.1	13.5	12.8	10.9	5.6	1.1	−0.9	5.0	33.3	−26.7	8	952
Ladner	2.1	4.1	5.2	8.1	11.7	14.4	16.3	16.1	13.4	9.6	5.7	3.4	9.2	35.0	−17.8	4	1
Merry Island	4.1	5.3	6.4	9.1	12.9	15.6	17.9	17.7	14.8	10.8	7.3	5.2	10.6	32.3	−11.7	8	58
Pitt Polder	1.9	4.2	5.4	8.4	12.3	15.4	17.2	16.8	14.2	9.9	5.5	3.3	9.5	36.1	−23.3	4	2
Stave Falls	1.6	3.9	5.4	8.8	12.3	15.1	17.4	17.3	14.7	10.2	5.8	3.1	9.6	40.0	−23.3	2	55
Steveston	2.2	4.1	5.6	8.6	11.9	14.7	16.7	16.3	13.7	9.6	5.7	3.5	9.4	34.4	−21.1	2	2
Vancouver (Int. Airport)	2.4	4.4	5.8	8.9	12.4	15.3	17.4	17.1	14.2	10.1	6.1	3.8	9.8	33.3	−17.8	1	5
White Rock	2.6	4.7	5.9	8.7	11.9	14.3	16.2	16.1	13.9	10.2	6.2	4.2	9.6	33.3	−20.0	2	61

Source — Environment Canada, Atmospheric Environment Service. 1975. Canadian Normals, Temperature, 1941–1970. Volume 1-SI. Downsview, Ont.

APPENDIX B

Mean Monthly and Total Annual Precipitation and Mean Annual Snowfall for Several Stations in or Near the Langley-Vancouver Report Area

Station	mm													cm	Type of Normal	Elev. (m)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Snowfall		
Abbotsford (airport)	207.3	163.8	145.0	104.1	72.9	59.9	37.8	49.0	86.0	170.4	190.5	215.1	1502.4	78.8	2	60
Agassiz (CDA)	214.6	170.9	145.3	115.6	80.0	76.2	47.8	59.9	105.4	193.0	203.7	235.2	1647.6	84.5	1	15
Chilliwack	237.5	175.3	152.9	121.9	89.2	71.6	43.9	61.0	109.5	198.9	223.8	255.5	1741.0	102.9	2	7
Gibsons	178.3	161.8	127.0	81.0	64.8	49.8	51.1	64.5	89.2	174.5	197.4	207.5	1446.9	58.3	8	143
Haney (UBCRF Marc)	289.1	219.5	230.6	154.4	110.7	92.2	67.8	80.3	128.0	248.9	274.6	315.5	2211.6	110.8	8	171
Hollyburn Ridge	365.8	272.5	243.6	204.7	117.6	112.8	88.6	123.4	201.9	387.1	393.2	427.7	2938.9	810.8	4	952
Ladner	129.8	104.1	82.6	56.1	44.2	39.9	26.2	34.0	59.7	109.7	130.8	141.2	958.3	36.8	8	1
Merry Island	118.1	82.8	62.0	59.4	40.6	41.4	29.7	39.9	57.2	103.6	118.6	129.3	882.6	28.5	8	58
Pitt Polder	304.5	244.1	184.2	155.7	99.6	92.7	51.6	77.7	125.0	273.3	305.1	347.2	2260.7	77.2	8	2
Stave Falls	265.4	211.8	196.9	154.2	113.8	106.4	66.3	88.4	132.6	243.1	261.1	294.9	2134.9	63.1	2	55
Steveston	138.2	105.7	81.5	55.6	45.0	41.9	26.4	37.1	57.2	116.8	136.9	151.6	993.9	40.7	2	2
Vancouver (Int. Airport)	147.3	116.6	93.7	61.0	47.5	45.2	29.7	37.1	61.2	122.2	141.2	165.4	1068.1	45.5	1	5
White Rock	138.4	110.7	91.4	65.5	51.6	49.5	27.4	42.7	59.7	116.6	139.4	153.9	1046.8	37.4	2	61

Source — Environment Canada, Atmospheric Environment Service. 1975. Canadian Normals, Precipitation, 1941–1970. Volume 2-SI. Downsview, Ont.

APPENDIX C

Average Minimum and Maximum Frost Free (>0°C) Period and Average, Minimum and Maximum Growing Degree (>5°C) Days for Several Stations in or Near the Langley-Vancouver Report Area

Station	Frost Free (>0°C) Period (Days)				Growing Degree (>5°C) Days				Elev. (m)
	Annual Average	Minimum	Maximum	Period of Record (years)	Annual Average	Minimum	Maximum	Period of Record (years)	
Abbotsford (airport)	169	129	200	30	1947	1567	2449	30	60
Agassiz (CDA)	210	168	267	34	2052	1752	2600	34	15
Chilliwack	213	164	261	23	2064	1752	2635	24	7
Gibsons	190	170	222	7	1709	1471	2205	8	143
Haney (UBC Forest)	190	153	231	21	1663	1477	2004	22	171
Hollyburn Ridge	128	108	159	14	974	701	1303	14	952
Ladner	160	123	192	14	1822	1552	2262	14	1
Merry Island	307	232	356	15	2134	1859	2412	15	58
Pitt Polder	179	137	244	20	1942	1578	2356	20	2
Stave Falls	199	149	236	31	1986	1651	2413	31	55
Steveston	172	143	226	26	1885	1493	2321	24	2
Vancouver (Int. Airport)	211	58	246	34	2003	1670	2476	34	2
White Rock	207	166	269	28	1892	1402	2459	26	61

Source — Air Studies Branch, B.C. Ministry of Environment, Victoria, B.C.

APPENDIX D

Summary of Area Occupied by Individual Soils in the Langley-Vancouver Report Area

Soil Name (Map Symbol)	Simple Map Units* (ha)	Compound Map Units** (ha)	Total (ha)
Abbotsford (AD)	2 120	2 950	5 070
Addington (AG)	510	200	710
Albion (AB)	280	2 190	2 470
Alouette (AL)	1 460	810	2 270
Annacis (AS)	130	260	390
Annis (AN)	650	540	1 190
Arnold (AR)	150	20	170
Banford (BD)	190	390	580
Bates (BT)	700	2 400	3 100
Beharrel (BL)	310	200	510
Benson (B)	90	130	220
Berry (BR)	180	960	1 140
Blackburn (BB)	70	140	210
Blaney (BE)	—	90	90
Blundell (Bu)	190	570	760
Bonson (BN)	140	80	220
Boosey (BY)	35	15	50
Bose (BO)	5 400	8 030	13 430
Buckerfield (BK)	710	310	1 020
Buntzen (BZ)	750	13 830	14 580
Burwell (BW)	460	3 330	3 790
Calkins (CN)	360	210	570
Canell (CE)	470	24 590	25 060
Capilano (CP)	3 180	2 710	5 890
Carvolth (CV)	450	30	480
Cascade (CC)	—	5 280	5 280
Cheam (CM)	—	75	75
Chehalis (CS)	90	75	165
Cloverdale (CD)	2 430	740	3 170
Coghlan (CG)	310	30	340
Columbia (CL)	3 330	2 370	5 700
Coquitlam (CQ)	330	—	330
Crescent (CT)	990	1 040	2 030
Dean (DN)	50	160	210
Deas (DS)	100	75	175
Defehr (DR)	360	380	740
Delta (DT)	1 130	1 720	2 850
Dennett (DE)	15	7 060	7 075
Devil (DV)	280	—	280
Dewdney (DW)	110	810	920
Dixon (DX)	1 100	20	1 120
Durieu (DU)	850	290	1 140
Eastcap (EP)	230	130	360
Elk (EK)	140	220	360
Elphingstone (EF)	25	40	65
Embree (EM)	170	390	560
Errock (ER)	30	80	110
Eunice (EU)	170	7 300	7 470

Soil Name (Map Symbol)	Simple Map Units* (ha)	Compound Map Units** (ha)	Total (ha)
Fadden (FD)	280	45	325
Fairfield (F)	820	2 880	3 700
Fellows (FS)	330	1 920	2 250
Gibson (GN)	960	230	1 190
Glen Valley (GV)	330	720	1 050
Golden Ears (GE)	—	12 21	12 210
Goudy (GY)	210	120	330
Grevell (G)	300	670	970
Grigg (GG)	55	110	165
Grouse (GR)	—	250	250
Guichon (GU)	270	95	365
Hallert (HT)	790	140	930
Hammond (HA)	180	300	480
Haney (HY)	490	1 140	1 630
Harrison (HR)	610	270	880
Hatzic (HZ)	170	20	190
Hazelwood (HD)	490	230	720
Henderson (H)	190	40	230
Heron (HN)	410	1 540	1 950
Hjorth (HJ)	220	280	500
Hollyburn (HB)	620	8 670	9 290
Hoover (HV)	75	1 220	1 295
Hopedale (HP)	250	530	780
Isar (IS)	1 140	1 240	2 380
Judson (JN)	910	560	1 470
Katzie (KZ)	170	250	420
Kennedy (KD)	250	—	250
Kenworthy (KW)	230	920	1 150
Keystone (KE)	430	1 040	1 470
Kitter (K)	180	1 240	1 420
Ladner (L)	1 220	460	1 680
Langdale (LE)	2 420	1 910	4 330
Langley (LA)	320	—	320
Laxton (LX)	150	570	720
Lehman (LH)	130	610	740
Lickman (LK)	250	170	420
Lions (LS)	—	160	160
Livingstone (LV)	170	440	610
Lonzo Creek (LZ)	510	9 420	9 930
Lulu (LU)	280	1 180	1 460
Lumbum (LM)	2 830	1 950	4 780
Lynden (LY)	1 200	450	1 650
Marble Hill (MH)	1 610	1 830	3 440
Mathews (MW)	110	—	110
Matsqui (MQ)	250	1 330	1 580

Soil Name (Map Symbol)	Simple Map Units* (ha)	Compound Map Units** (ha)	Total (ha)
McElvee (ME)	260	340	600
McLellan (ML)	15	210	225
Milner (MR)	95	1 500	1 595
Monroe (M)	110	1 290	1 400
Murrayville (MY)	35	740	775
Neaves (NV)	240	85	325
Nicholson (N)	640	4 820	5 460
Nicomekl (NK)	30	150	180
Niven (NN)	160	85	245
Page (PE)	580	1 600	2 180
Palisade (PA)	190	3 630	3 820
Paton (PN)	90	2 840	2 930
Peardonville (PD)	600	160	760
Pelly (PY)	30	25	55
Pitt (P)	910	700	1 610
Poignant (PT)	—	2 630	2 630
Porpoise (PP)	—	280	280
Prest (PR)	600	340	940
Richmond (RC)	300	1 390	1 690
Roach (RH)	1 810	2 390	4 200
Rodgers (RG)	390	470	860
Ross (RS)	370	180	550
Ryder (RD)	1 280	3 260	4 540
Sandel (SA)	280	55	80
Sardis (SD)	1 200	1 570	2 770
Sayres (S)	140	27 800	27 940
Scat (SC)	460	1 470	1 930
Seabird (SB)	130	140	270
Seaview (SV)	100	—	100
Sechelt (SL)	1 670	85	1 755
Seymour (SY)	450	1 060	1 510
Shalish (SH)	2 040	5 200	7 240
Sim (SI)	250	380	630
Spetifore (SF)	330	480	810
Stave (SE)	660	480	1 140
Steelhead (ST)	330	1 430	1 760
Strachen (SN)	260	23 720	23 980
Sturgeon (SG)	320	1 550	1 870
Sumas (SM)	2 400	270	2 670
Summer (SR)	55	630	685
Sunshine (SS)	1 650	2 700	4 350
Surrey (SU)	120	310	430
Triggs (TR)	3 290	480	3 770
Tsawwassen (TS)	340	100	440
Tungridge (TU)	100	50	150
Vedder (VD)	890	190	1 080
Vinod (V)	150	740	890
Vye (VY)	540	870	1 410
Westham (WS)	1 520	570	2 090
Westlang (WL)	320	50	370
Whonnock (WH)	1 560	8 270	9 830
Widgeon (WG)	350	480	830
Total Soils	87 765 ha	281 310 ha	369 075 ha

Miscellaneous Land Types

Anthropogenic (A)	310	—	310
Gravel Pit (GP)	550	—	550
Ice (I)	85	—	85
Recent Alluvium (RA)	1 050	—	1 050
Rock Outcrop (RO)	440	23 040	23 480
Talus (TA)	3 290	430	3 720
Tidal Flat (TF)	3 940	—	3 940
Total Land Types	6 665 ha	23 470 ha	30 135 ha
Total Map Area	97 430 ha	304 780 ha	402 210 ha

* Map polygons contain only one identified soil (or land type).

** Map polygons contain two or three identified soils and/or land types. The hectares are summarized by the dominant soil (or land type) in each polygon.

APPENDIX E
SOIL PERVIOUSNESS CLASSES*

Soil perviousness classes refer to the potential of a soil to transmit water internally, and are inferred from soil characteristics such as structure, texture, porosity, cracks, organic matter content, and shrink-swell properties. They are closely related to measures of permeability, percolation rate, and infiltration rate, but these are reserved for actual measurements using standard techniques. Perviousness applies to the whole soil profile. Because of this, the perviousness class is determined by the least permeable layer in the soil. It is important to distinguish between soil drainage and perviousness. For example, a rapidly pervious soil could be receiving excessive seepage and thus be poorly drained.

Rapidly pervious—the capacity to transmit water vertically is so great that the soil will remain wet for no more than a few hours after thorough wetting. The horizons and soils have large and continuous or connecting pores and cracks that do not close with wetting.

Moderately pervious—the capacity to transmit water vertically is great enough that the soil will remain saturated for no more than a few days after thorough saturation. Most moderately pervious soils hold relatively large amounts of water against the force of gravity, and are considered good, physically, for rooting and supplying water to plants. Soil horizons may be granular, blocky, weakly platy or massive (but porous) if continuous conducting pores or cracks are present which do not close with wetting.

Slowly pervious—the potential to transmit water vertically is so slow that the horizon or the soil will remain saturated for periods of a week or more after thorough wetting. The soil may be massive, blocky or platy, but connecting pores that conduct water when the soil is wet are few, and cracks or spaces among peds that may be present when the soil is dry, close with wetting. Even in positions accessible to plant roots, roots are usually few or absent. When present, roots are localized along cracks.

* Walmsley, M., G. Utzig, T. Vold, D. Moon and J. van Barneveld, editors. 11980. Describing Ecosystems in the Field. RAB Technical Paper 2; Resource Analysis Branch, B.C. Ministry of Environment, and Research Branch, B.C. Ministry of Forests, Victoria, B.C.
Dumanski, J., editor. 1978, revised. The Canada Soil Information System (CANSIS). Manual for Describing Soils in the Field. Land Resource Research Institute, Agriculture Canada, Ottawa, Ont.

APPENDIX F

SOIL DRAINAGE CLASSES*

The soil drainage classes are defined in terms of (i) actual moisture content in excess of field moisture capacity; and (ii) the extent of the period during which such excess water is present in the plant-root zone.

Rapidly drained—The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions. Soils are free from any evidence of gleying or mottling throughout the profile. Rapidly drained soils often occur on steep slopes.

Well drained—The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 1 m, but may be motted below this depth.

Moderately well drained—The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are often faintly mottled in the lower B and C horizons or below a depth of 70 cm. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the A and B horizons.

Imperfectly drained—The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year. Soils are often distinctly mottled in the B and C horizons; the Ae horizon, if present, may be mottled. The matrix generally has a lower chroma than in the well drained soil on similar parent material. Soils are generally "gleyed" subgroups of mineral soil orders.

Poorly drained—The soil moisture in excess of field capacity remains in all horizons for a large part of the year. The soils are usually strongly gleyed. Except in high chroma parent materials, the B, if present, and upper C horizons usually have matrix chromas of 3 or less; prominent mottling may occur throughout. Soils are generally in the Gleysolic or Organic order.

Very poorly drained—Free water remains at or within 30 cm of the surface most of the year. The soils are usually strongly gleyed. Subsurface horizons usually are of low chroma and yellowish to bluish hues. Mottling may be present within 30 cm or at depth in the profile. Soils are generally in the Gleysolic or Organic order; mineral soils are usually a peaty phase.

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* Walmsley, M., G. Utzig, T. Vold, D. Moon and J. van Barneveld, editors. 11980. Describing Ecosystems in the Field. RAB Technical Paper 2; Resource Analysis Branch, B.C. Ministry of Environment, and Research Branch, B.C. Ministry of Forests, Victoria, B.C.

Dumanski, J., editor. 1978, revised. The Canada Soil Information System (CANSIS). Manual for Describing Soils in the Field. Land Resource Research Institute, Agriculture Canada, Ottawa, Ont.

APPENDIX G

SURFACE RUNOFF CLASSES*

Very rapid runoff—A very large part of the water moves rapidly over the surface of the soil and a very small part passes through the profile. Surface water runs off as fast as it is added. Soils with very rapid rates of runoff are usually steep or very steep and have low infiltration capacities. The erosion hazard is commonly high or very high.

Rapid runoff—A large proportion of the precipitation moves rapidly over the surface of the soil and a small part moves through the soil profile. Surface water runs off nearly as fast as it is added. Soils with rapid runoff are usually moderately steep to steep and have low infiltration capacities. The erosion hazard is commonly moderate to high.

Medium (moderate) runoff—Surface water flows away at such a rate that a moderate proportion of the water enters the soil profile and free water lies on the surface for only short periods. A large part of the precipitation is absorbed by the soil and used for plant growth, is lost by evaporation, or moves downward into underground channels. With medium runoff, the loss of water over the surface does not seriously reduce the supply available for plant growth. The erosion hazard may be slight to moderate if soils of this class are cultivated.

Slow runoff—Surface water flows away so slowly that free water covers the soil for significant periods or enters the soil rapidly and a large part of the water passes through the profile or evaporates into the air. Soils with a slow rate of surface runoff are either nearly level or very gently sloping, or they absorb precipitation very rapidly. Normally there is little or no erosion hazard.

Very slow runoff—Surface water flows away so very slowly that free water lies on the surface for long periods or enters immediately into the soil. Much of the water either passes through the soil or evaporates into the air. Soils with very slow surface runoff are commonly level.

Ponded—None of the water added to the soil as precipitation or by flow from surrounding higher land escapes as runoff. The total amount of water that must be removed from ponded areas by movement through the soil or by evaporation is usually greater than the total rainfall. Ponding normally occurs in depressed areas and may fluctuate seasonally.

APPENDIX H

TOPOGRAPHIC CLASSES

Simple Topography Single Slopes (Regular Surface)	Complex Topography Multiple Slopes (Irregular Surface)	Slope %
A depressional to level	a nearly level	0 to 0.5
B very gently sloping	b gently undulating	0.5+ to 2
C gently sloping	c undulating	2+ to 5
D moderately sloping	d gently rolling	5+ to 9
E strongly sloping	e moderately rolling	9+ to 15
F steeply sloping	f strongly rolling	15+ to 30
G very steeply sloping	g hilly	30+ to 60
H extremely sloping	h very hilly	over 60

* Dumanski, J., editor. 1978, revised. The Canada Soil Information 1System (CANSIS). Manual for Describing Soils in the Field. Land Resource Research Institute, Agriculture Canada, Ottawa, Ont.

APPENDIX I

SOIL REACTION CLASSES*

Soil reaction (pH) can be measured in several ways. In this report, where no method of determination is indicated, the method is "pH meter (0.01M $CaCl_2$)".

Reaction Class	pH Values
Extremely acid	<4.5
Very strongly acid	4.6—5.0
Strongly acid	5.1—5.5
Medium acid	5.6—6.0
Slightly acid	6.1—6.5
Neutral	6.6—7.3
Mildly alkaline	7.4—7.8
Moderately alkaline	7.9—8.4
Strongly alkaline	>8.5

APPENDIX J

WATER HOLDING CAPACTIY

Water holding (storage) capacity, in the context of this report, refers to the soils' ability to retain water against the pull of gravity and is inferred mainly from the particle size composition of the soil (texture), the soil particle arrangement (structure), and the soil depth. The depth generally used in this report is 1 m. The general values used in this report are:

Low Water Holding Capacity—<1 in. (2.5 cm)/1 ft. (0.3 m) of soil
Moderate Water Holding Capacity—1 to 2 in. (2.5 to 5 cm)/1 ft. (0.3 m) of soil
High Water Holding Capacity—2 to 4 in. (5.0 to 10 cm)/1 ft. (0.3 m) of soil
Very High Water Holding Capacity—>4 in. (10 cm)/1 ft. (0.3 m) of soil

* Walmsley, M., G. Utzig, T. Vold, D. Moon and J. van Barneveld, editors. 1980. Describing Ecosystems in the Field. RAB Technical Paper 2; Resource Analysis Branch, B.C. Ministry of Environment, and Research Branch, B.C. Ministry of Forests, Victoria, B.C.

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