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A NATURAL RESOURCE INVENTORY FOR
FORT ROSS HILL NATIONAL HISTORIC PARK,
VICTORIA, BRITISH COLUMBIA,

BY
ENERGY NEST LTD.,

PREPARED FOR

Parks Canada
Western Region

76-21

Rev. 1976.

SYNERGY

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May 7th, 2025.

Park Canada,
Western Region,
Department of Indian and Northern Affairs,
124 - 12th Avenue S. E.,
Calgary, Alberta. T2C 0K8.

ATTENTION: MR. C. SIMON, RESOURCE SPECIES MANAGER

Dear Sir:

RECORD OF TRANSMITTAL

Please find enclosed one (1) original copy and six (6) original
maps for a Natural Resource Inventory for Park Road #013 National
Historic Park, Victoria, British Columbia.

Sincerely yours,

SYNERGY WEST LTD.


Bruce E. Simpson
Manager.

JLrb

ENC'S.

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ABSTRACT

The present study represents a detailed study of Fort Road Hill National Historic Park and the adjacent land recently purchased or to be acquired. The study area covers approximately 240 acres and consists of a detailed examination of soils, vegetation and wildlife.

In light of proposed day use development within the study area, each natural resource is analyzed in terms of potential day use capabilities.

- Soils range from the Regisols to darker podsolized forest soils. Use is restricted primarily by slope, drainage, and resistance to erosion.
- Vegetation ranges from moss-covered rock outcrops to mature forest. From a regional viewpoint, the vegetation pattern is unique for Canada and thus deserves protection in the form of limited day use.
- Deer and owl-fawns are important resources of the Park. Critical habitats are identified for planning purposes.

Detailed information is provided for soil samples, vegetation associations, and wildlife habitats. A checklist of plants encountered at Fort Road Hill is also provided.

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OR EXPECTED

ACKNOWLEDGMENTS

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SECTION 3

Summary

The following Table illustrates results of 1976 National Resource Inventory.

Soils

- Soils of forest lands still are primarily temperate. Although some Spruce forests a large portion of the area, soils exhibit only the beginning of podsolization. Thus the entire region is formally classed within the temperate soil order of the American System of Soil Classification.
- Three informal soil types are identified based on field observations and laboratory analysis. Humus is usually more or less advanced, humus forest is more under forest cover, and Osgood (spruce forest) is more forest in soil cover.
- Osgood is not a podsol within the study area. However, Osgood greater than 10000 per cent (100), on areas, and soil moisture are low & relatively low soil moisture is adjusted to become the soil.
- Soil fertility is typical of a forested area. Problems reported

with maintaining grass cover are related to light and moisture availability to a larger degree than satisfying nutrient demands.

VEGETATION

- Vegetation associations are well defined in the study area. Some associations are indicated:
 - 1) Garry oak - Rhizocarpius;
 - 2) Arbutus - Douglas-fir;
 - 3) Hail - Douglas - fir;
 - 4) Dunbarchilus - Douglas-fir;
 - 5) Sword-fern - Douglas-fir;
 - 6) Skunk-cabbage - Cedar;
 - 7) Alder - Highberry.

- Primary succession proceeds from moss covered rock outcrops to mature forest. Secondary succession begins with an Alder - Highberry stage with Broadleaf maple acting as a rapid colonizer of disturbed or thinned forest. Scotch broom, a non-native species, is clearly well adapted to colonization of disturbed areas and can reach problem levels.

- The forest communities are suitable for scenic beauty and interpretative purposes. They can also withstand limited use (e.g. trails). The Oak - Arbutus - Moss covered rocky areas are

fragile and unique for Canada. These areas should support very limited use.

MAMMALS

- Habitat types with high potential for interpretive value for wildlife are the Lagoon, beaches, and Douglas-fir - Arbutus forests. There are apparently no nesting areas of rare or endangered species but the wet-forest is rich and is a natural resource of the Park.
- The major mammalian resource of the Park is the presence of Columbian black-tailed deer. These animals are a major attraction of the Park and deserve protection. Deer losses have decreased recently due to attacks by household pets (i.e. dogs). The deer are marginally supplied with proper habitat. This is evidenced by the fact that wolves are not frequent. Dog predation is not necessary for controlling deer numbers and it appears that the population of deer would be stable if dog predation is reduced.
- Marine mammals are known to frequent the Park on occasion. Thus, the Park could be important for observation of marine-life.

SECTION 2

INTRODUCTION

During early April, 1975, an inventory of the natural resources of Fort Wedd Hill National Historic Park was performed under the terms of reference presented in Appendix B. Information concerning soils, vegetation, and wildlife, was gathered in order to assess potential implications of day use within the Park and adjacent lands.

The study area consisted of the Historic Park itself plus additional lands recently purchased or soon to be acquired by Parks Canada. The total area of 246 acres was found to be a relatively natural area with evidence of various amounts of man-caused disturbance. The close proximity of housing and the presence of a hard-surface road through the area tends to concentrate use to the areas adjacent to the housing and road. Dumping appears to be the major problem, with some evidence of digging and tree cutting.

The majority of the study area is in a relatively natural condition. It supports abundant plant and animal life. The vegetation communities are unique to Canada and the area affords the opportunity for observing birdlife and black-tailed deer.

Because of the short field season and the requirement of completion in the early Spring, complete coverage of plant and animal life was

impossible. Further work through the other parts of the year would yield more interpretable information. For example, the plant species diversity should be very rich.

In short, the area is very diverse in habitats and presents the opportunity for such ecological interpretation.

SECTION 3

Soils

The soils in Fort Radd Hill National Historic Park are in the early stages of development. Recent glaciation has provided a substrate of basically two types: glacially scoured volcanic bedrock and glacio-fluvial deposits surrounding the volcanic rock outcrops. Due to intense use by man during the past century, vegetation patterns have been disrupted or changed from their natural patterns. This impact in combination with some agriculture has resulted in a disruption of the natural pattern of soil development.

SOIL UNITS

Three informal soil units occur within the Fort Radd Hill area. True Regosols occur on and adjacent to rock outcrops while podzols are developing on the deeper glacio-fluvial deposits under mature forest cover. These Podzols are best classified as Regosols according to the Canadian System of Soil Classification, as development of a diagnostic podzolic horizon is not present. Thus these soils will be termed Inactive Podzols within the terms of this study. Where drainage is poor and water resides at or near the surface for a considerable portion of the growing season, the

Imature Podzols show some evidence of gleying and are therefore termed Gleyed Imature Podzols.

A. Regosols (R)

Regosols are well and imperfectly drained soils with horizon development too weak to meet the requirements of any other soil order. They are found on and adjacent to rock outcrops and primarily provide a substrate for the pioneer species of plant succession. In the Fort Road Hill area these plants are predominantly grasses and herbaceous perennials. However, where pockets allow for the deeper accumulation of rock detritus and organic matter, Sarry oak and *Arbutus* are early colonizers.

Generally the texture of Regosols lies within the coarser range of particle sizes with inclusion of little silt and clay. Bulk density, humus content, and pH tend to be extremely variable. Two samples were taken in the field to show the range.

Appendix II clearly shows that these parameters are indeed variable and also that nutrient availability is relatively low.

B. Imature Podzols (IP)

Podzols are well developed forest soils which show an accumulation of organic matter in the surface horizon and the development of

a subsurface mineral horizon which shows an accumulation of humus, iron, and/or alumina. In the Fort Meade H211 area the presence of coniferous and mixed coniferous-deciduous forest provides the proper conditions for the development of Podzols. This factor is action with good drainage and the presence of thick accumulations of weathered parent material should enhance rapid podzolization. However, the podzolic subsurface horizon was not observed in any of the soil pits sampled. There is a tendency for some movement of humus down into what is primarily a sandy subsurface horizon, however, the overall horizon development more closely resembles a grassland or Chereauzemir soil than a Podzol. The surface horizon is enriched by humus under a thin litter layer and the subsurface horizon exhibits no properties of other sand soils. This may be the result of previous agriculture and/or an open savanna type of vegetation cover.

Appendix II indicates that the Inasare Podzols are primarily acidic with loamy texture and small bulk densities and pore space percentages. These soils develop best on relatively gently sloping ground with good drainage. Nutrient availability appears to be relatively low as would be expected of a forest soil in the early stages of development.

C. Gleyed Inceptine Podzols (DP)

A small number of locations within the study area exhibit some of the characteristics of a Gleyed Inceptine Podzol. The presence of heavy clay textures and poor drainage act together to produce a soil environment low in oxygen availability, and a consequence of this is the presence of gleyed or mottled areas resulting from reducing conditions.

While it was not possible under the terms of this study to determine the cause of the poor drainage conditions, there exists a distinct correlation between areas of disturbance and gleyed soil conditions.

Appendix II indicates these conditions exist on moderate to gentle slopes with deep soils and heavy textures with resultant low porosity. Chemically the soils tend to be neutral to basic in pH with less organic matter content than the Inceptine Podzols. Nutrient availability is low, as for the entire study area.

SOIL SURVEYS

After general reconnaissance of the study area, a number of general exploratory soil pits were dug in order to estimate the variability

within the area. Three soil pits were then dug in each potential soil unit. The following areas were sampled: coniferous forests; deciduous forests; and grassy wet areas. In addition, two samples were taken from rock outcrops to determine the potential variability in the Regosolic unit.

Ten areas of potential Park day use were sampled as follows. Five surface soil samples were taken from various locations within two vegetation types, Douglas-fir - Grand-fir forest and open grassland. The five surface samples were placed well so as to approximate average conditions.

FIELD ANALYSIS

Soil pits were dug to contact with an impermeable layer or to the maximum depth of one meter. This information was recorded in terms of a zone of depth for the local area. Thus if rock outcrops were evident in close proximity to the soil pit, a range from zero to the determined depth was recorded.

Slope and drainage were estimated according to the Canadian System of Soil Classification. Textile estimates of texture were assessed by the standards of the United States Department of Agriculture. A summary of these parameter classes is presented in Appendix I.

In order to rate the soils in terms of porosity, bulk density and particle density, samples were taken for laboratory analysis. Bulk Density gives a good indication of the overall condition of the soil.

LABORATORY ANALYSIS

A. Bulk Density, Particle Density, Por Cent Pore Space

An undisturbed soil sample of known volume was taken in the field and oven dried. The oven-dry weight divided by volume yield Bulk Density. Bulk Densities range from 1.00 to as high as 2.00 with the best agricultural soils having a Bulk Density of approximately 1.6. Bulk Density is the weight of the soil sample with pore space undisturbed. Particle Density is a measurement of the weight per volume of a soil without pore space. Thus it actually represents the specific gravity of the mineral fraction. A sample of standard weight is placed in a graduated cylinder filled with water. The displaced water volume yields the volume of the solid soil particles. Most mineral soils range from 2.6 to 2.75 unless large amounts of organic matter are contained. In such cases Particle Density is lower.

Pore Space Percentage can be readily calculated using the

following formula:

$$\text{Per cent Pore Space} = 100 - \frac{\text{Bulk Density}}{\text{Particle Density}} \times 100$$

Soils with pore space near fifty per cent generally have the best structure, texture, and organic content for plant growth.

B. Chemical Tests

Soil reaction (pH), percentage organic matter and available nutrients (Ca, Mg, N, P, K) were determined by Chemical and Geological Laboratories, Edmonton, Alberta according to standard procedures. These "rapid" tests are of great value in soil productivity studies, but do have limitations. While pH and organic matter content are good indicative measurements, nutrient availability is difficult to assess. The following limitations should be clearly understood before decisions are made relative to fertilizer applications:

1. The soil sample taken is not necessarily representative. Generally one sample of small size is taken from an area of land as much as several acres in size.
2. Results of "rapid" tests are somewhat arbitrary. It is practically impossible to extract nutrients from the soil in the laboratory within a few minutes that will be comparable to those absorbed by plants under natural con-

difficult throughout the growing season;

3. Since test results are somewhat arbitrary, recommendations as to their use should be made through consideration of other factors as well as a practical knowledge of the vegetation to be grown and the local environmental conditions.

SUSCEPTIBILITY TO WATER EROSION

Under natural conditions, the soils of the study area appear to be minimally susceptible to water erosion. Vegetation cover is good and re-generation of disturbed areas is rapid. However, a number of areas can be identified which would be subject to high erosion risk if any use (placelings and trails) were located in or adjacent to these areas.

There are three categories of land or soil conditions identified by Coan and Holford (1972) which are applicable to the Ford Road Hill area:

- (A.) As drainage is primarily through underground flow and the Park is located at sea-level, depressional areas show a higher proportion of clay than upland areas, and consequently water retention is high. Thus a peat-gley or suck soil makes land use inappropriate without the installation of drainage structures.

(B.) Slope and (C.) Rockiness or Stoniness tend to be related to a large degree. Areas of slope greater than thirty per cent (30%) are infrequent except adjacent to rock outcrops. Rock outcrops are frequent and should be classed according to DSC standards within the Complex Topography Multiple Slope class of hilly (g) to very hilly (h). These areas are well covered with vegetation. However, the plants are of the type which could withstand little use [mosses, lichens, and herbs].

Streams and Drainage

Fort Radd Hill is located where complex geology and close proximity to sea level act to complicate surface drainage. There are no perennial streams of significant size in the study area. Those streams that are present are either ephemeral or flow only for short distances before reaching base level or flowing underground.

Sources of streams are difficult to determine because of the dense vegetation cover, however, all streams appear to begin with seepage from rocky outcrops. One such characteristic location is on the Eschscholtz property adjacent to Gosses Boulevard. A number of steps provide water to a wet area of alder and waxyberry. Flow is predominantly underground with some surface flow.

Drainage is further complicated by the construction of roadways

and the DBS fuel depot. Erosion are presently accumulating water in the spring. These wet ditch areas appear to disperse sediment through gravity flow and probably are dry at the surface during the late summer.

BEACH MATERIAL

There are three specific categories of beach material along the coast of Fort Rodd Hill National Historic Park: 1) Rocky headlands; 2) sand beaches; and 3) cobble beaches.

The Coburg Peninsula represents the only area where sand dominates and this is a seasonal occurrence. During the winter months the presence of a semi-permanent low pressure cell (Stoutian Low) centered over the North Pacific results in numerous storms with high intensity wave action. Sand migrates seaward leaving a cobble-covered beach. During the spring and summer months, a more gentle wave action returns the sand as a covering over the stable cobble beach. Throughout the year, the beach surrounding the Douglas's Lagoon will be dominated by cobble-size particles.

CONCEPTS REGARDING POTENTIAL USE

The major impact that could result from day use in Fort Rodd Hill National Historic Park concerns potential erosion. Areas of least

resistance to impact are the most covered rock outcrops. These areas are quite fragile and cannot withstand such use. If the moss cover were to be damaged, drainage would be unrestricted and could result in movement of soil material from these areas of characteristic beauty and uniqueness. The factor of erosion susceptibility is depicted on a separate map overlay.

Areas of good soil drainage under forest cover are probably best able to support day use in the form of picnicking and hiking. The separate map overlay of soil drainage indicates those areas of good drainage where day use activities could be located. A number of open wet areas could also be considered, however, installation of drainage tiles would be required.

Soil units are depicted on a separate overlay. As all soils in the study area are similar in terms of nutrient supply, grass planting would require fertilizer application for rapid grass cover. Probably the areas most conducive to grass planting are the neutral to basic open wet areas along Ocean Boulevard. With proper drainage these areas could rapidly be converted to grass cover.

SECTION 4

Wetlands

The location of Fort Ross (FF) on the southwestern portion of Vancouver Island places it within what can be called the coastal stretch between the Olympic and Vancouver Island Mountains and the Cascade Range. Thus the climate of the Fort Ross and National Historic Park area is best classified as a temperate maritime climate. Seasonal winds with a westerly character is reflected by the tree species not found elsewhere (i.e. the Sitka Spruce (*Picea sitchensis*) and Garry oak (*Quercus garryana*)).

Area (A) (FFA) shows the area within the Pacific coastal non-Garry forest. Fort Ross (FF) lies within the border of the tree kingdom of the Pacific coastal non-Garry forest, the Garry oak - Douglas fir ecotone. This ecotone, under natural conditions, is one of the richest in Canada from a floristic point of view.

The Fort Ross (FF) National Historic Park area has, however, been subject to much disturbance since settlement began in the mid-19th century. Many non-native, often weedy, plant species arrived with western man and floral communities were

the cleared, and disrupted natural vegetation. Overall, a number of distinct vegetation communities are present. These are described in Szczawinski and Harrison (1992).

VEGETATION ASSOCIATIONS

The following vegetation associations are clearly in evidence at Fort Ross Hill National Historic Park. These associations are based on the presence of faithful species with significant cover within areas sampled. The descriptions are an elaboration of those found in Szczawinski and Harrison (1992). Appendix III lists species by community type with cover estimates and forest mensuration data.

A. Garry-oak - Shastacofrean Association

Igneous rock outcrops are numerous throughout the Fort Ross Hill area. These dry habitats appear as moss covered boulders with scattered Garry-oak, Arbutus, and the occasional Scots pine. The moss covered rocks are dominated by Shastacofrean and have developed a layer of silted moss and decayed plant material with some mineral "soil". This substrate supports a lush growth of flowering herbs such as Ceanothus, blue-eyed grass, Northwest saffron, Sheepspoor, and Callitriche.

These grasses seem to be restricted to deeper, well drained soil pockets about dense grassland which developed in the rock outcrops.

These areas are of great scientific value as they present excellent evidence of the historical and surrounding area. However, this is the most difficult to collect, especially in the study area. The most common family culture in the rock soil is nearly identical to that of the grass. Also the lowest ground in early stages of the flowering herb provides excellent food for the reptiles. Our population about the deer are in their own habitat and for food supply. The 1960s, various new (1960s, 1960s, 1960s) is found only in this country and is frequent in our study area.

2. Inhabitants - Douglas-Fir Association

This plant association borders the rock outcrops and represents a highly fertile habitat adjacent to exposed water and springs and deeper soil accumulation. This association represents a standing of the forest and rock outcrops and the very dense Douglas-Fir forests. More open structure is available. Another and very old are replaced by Douglas Fir.

The rock under the trees every time to support a different

understory from that of the more exposed rock outcrops. Stonecrop (Sedum spathulifolium), Monkey-flower (Mimulus spp.), and foliose lichens are most obvious. The White Face Lily (Lysichiton cuneatum), one of the most impressive spring flowers, grows abundantly in a number of locations within this association.

C. Salal - Douglas-fir Association

This association forms a dry, open forest community in which Douglas fir and/or Grand fir are the principal tree species. Salal (Gaultheria shallon), forms a dense but scattered understory with reticulate orchid (Spodiopogon sibiricus). The most characteristic species of the open areas. It is possible that the occasional Calypso (Calypso bulbosa) or rein-orchid (Habenaria unguiculata) will be encountered, but these species are very susceptible to human abuse and may have been affected from the study area.

Soils tend to be well developed under this association and show tendencies toward podsolification. Drainage is good and thus these areas tend to be selected by people for use. If the area has already been disturbed, as most in the study area, evidence, they would make excellent day use areas. This association, when disturbed tends to support an increasing

of westernry (Lycopodium obscurum) and scotch broom (Ericaceae spp.), especially along the margin.

B. Durynchian - Douglas-fir Association

This association in moist forest tends to be well developed with Douglas-fir, Grand-fir, and Pacific Yew. Rubus (Rubus spp.) is the dominant shrub with Epiphyllum and Trichomanes the dominant plants of the herb and moss layer. Vascular plants are sparse in this association except for the occasional westernry, rose, bitter-cress, and Ranunculus. Extensive growth of the moss, Funaria, occurs on decaying logs.

Soils tend to be deeper and wetter with podsolization more pronounced.

This association appears to be little used by people and should be avoided except for clearly marked trails. Day use should be restricted to hiking as the moss carpet is susceptible to trampling and the open understory is excellent for the forest experience.

C. Swainson - Douglas-fir Association

This association represents the best developed, most dense, and

most mature forest in the study area. Douglas-fir, Grand-fir, and Western-Cedar are the dominant trees with swordfern (*Polystichum squarrosum*) the principal understory species. Occasional patches of Salal and *Holcus* represent introgression with the Salal - Douglas-fir Association. Ground cover is less densely covered with mosses, but *Luzulastrum*, *Hylocomium*, and *Holcus* are still abundant. The most outstanding herb is the Western Milk-vetch (*Trifolium ovatum*).

Douglas-fir up to one meter in diameter and forty meters tall are frequent while Cedar exhibits mature growth where protected slopes or streams and seeps provide moister conditions.

Soils are deep, podzolized to gleyed, and remain moist for most of the growing season. This association is little used by people because of the dense sword fern and bracken except where animal trails have been expanded through human use. This is a valuable scientific association and represents the most typical Pacific Coastal forest.

F. Skunk-cabbage - Cedar Association

This association of wet lands is only found once in the study area. It is characterized by skunk-cabbage (*Sagittaria arifolia*) and western red cedar (*Thuja plicata*) growing in

and are on permanently wet and boggy soils.

This association is seldom used because of the wet, soggy conditions and the abundance of fallen, moss covered timber.

6. Alder - Waxberry Association

This association is an early successional association of wet streambeds and disturbed places. It is found scattered throughout the area where man has changed drainage patterns. It occurs predominantly along Open Boulevard and the wet area just south of the Greenish buildings.

It represents a dense growth of young, vigorous trees and shrubs which can be impenetrable. In addition to being little used by man, it represents an edge habitat valuable for both birds and mammals. It should be protected so as to ensure good cover for wildlife.

Succession

Krajina (1965) identifies two climatic climax communities for the Coastal Douglas-fir zone. The drier subtype is characterized by a Douglas-fir - Rubus - Dryopteris community while the wetter subtype consists of Douglas-fir - Cedar - Rattlesnake orchid - Saxifera community. While these general climax communities

exist within the Fort Rock Hill area, a finer degree of detail is possible within the study area.

Other associations are Salal - Douglas-fir; Garryochloa - Douglas-fir and Sawdfern - Douglas-fir. These three associations occupy slightly different habitats with a gradient of distance from wettest (Sawdfern - Douglas-fir) to drier (Salal - Douglas-fir) with the Garryochloa - Douglas-fir intermediate.

The earliest successional stage is Alder - Highberry association occupying wet disturbed areas. This association is best described as an early stage of secondary succession occurring after disturbance by man. This disturbance is evidenced by clearing or changes in drainage pattern. An important introduced species in this successional stage is Scotch broom.

Primary succession follows the colonization of the rock outcrops by Bryophytes. This early stage is clearly evident in the study area. Following this stage, Garry oak, Arbutus, and Douglas-fir gradually colonize deeper soil accumulations as the rock outcrops break down.

The Blank-cabbage - Cedar association is probably an edaphic climax of wet soils. It may represent a long lived association of logs as cedar are of large size and well established. However,

It is likely that eventually this will be replaced by a long-term exercise.

The area above the road is not, however, open to the public generally to allow all activities. It appears that this area is an ordinary use which only allows large (the large disturbance). This is what makes it different from other areas with people - it is not open to other the other, and will be used other.

CONCLUSION

There are at least two areas which should be protected within the Park (the Park and the area). The Park is located in a relatively urban situation. Because of the special of basic situation described earlier, this area contains a number of other activities which are unique to the Park and represent the various aspects of a separate use that were mostly in the Park and the area.

The planning of any and all facilities with the introduction of plant construction within the Park, creates an area of visual beauty and ecological importance. This area is the only natural area within the Park and is important to the Park and the area. It is important to the Park and the area to conclude with preservation of the

natural communities.

Because of the minimal damage existing in the forested portions of the Park, protection and proper management would lead to the establishment of native plant communities which would eventually out-compete weedy introduced species.

Only two plant associations require special protection. The Early oak - Black-cherry and Arbutus - Douglas-fir Associations represent the most fragile areas. Here showy spring flowers are abundant on the bright, sunny exposures. Moss covered rock is not resistant to trampling and thus warrants protection.

The potential day uses are compatible with the forested associations. Picnic sites would interfere little with existing vegetation if they are located in stable plant communities or where disturbance has created an artificial condition. Thus the open Douglas-fir - Grand-fir forest west of Ocean Boulevard and the low vicereid, Spiky areas are potential sites. In addition some space is available near the existing Park parking lot. Picnic day use should be low intensity in any case, possibly with small areas (less than ten picnic sites) in a number of dispersed locations.

The remaining forest portions could easily accommodate a trail system. Trails could be located so as to pass through such

regulation associated with responsive networks provided. An attempt should be made to restrict traffic to the specific trust zones. This can be accomplished through proper trust location and number of responsive gates which would restrict the visitors' interests.

Efforts to set up an edge for the trust zones for the associated handling and trust. Some based edge also be implemented through redress creating over trust success. But trust can't really be changed and the risk always should be protected.

SECTION 5

The Avifauna and Biotic Frames

The following describes both the observed and expected species which comprise the major faunal components of Fort Road Hill National Historic Park. Habitat types of major importance to the avian and mammalian frames are listed in Table A, to which each of the two sections following make frequent reference. The park is located at the border of two major biotic zones, the Gulf Islands Type and the Coastal Forest Type, and though the two overlap, they do not specifically affect distributions of species as such.

AVIAN FAUNA

The number and type of bird species will change seasonally within the Park. Observed species, together with their habitats, are presented in Table B. The list is not meant to be exhaustive. A complete list of birds has been given by Jackhurst and Blower (1970), but habitat characterizations of that report are more generalized than presented here in Table B. However, the above report does

TABLE A

MAJOR HABITAT TYPES IDENTIFIED AS IMPORTANT FOR BRYAN AND
MAYALLIAN FAUNAS OF FORT REED HILL NATIONAL HISTORIC PARK

Code

HABITAT TYPE

SECTION 5

THE MAMMALIAN AND AVIAN FAUNAS

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Avian Fauna

The number and type of bird species will change seasonally within the Park. Observed species, together with their habitats, are presented in Table B. The list is not meant to be exhaustive. A complete list of birds has been given by Luckhurst and Glover [1973], but habitat characterizations of that report are more generalized than presented here in Table B. However, the above report does



classify each species according to whether it is rare or common, facultative or obligate, and the time of year when it is expected.

There are extremely to moderate levels of disturbance rates or ecological bird spectra within the Park boundaries. Disturbed species such as the nuthatch below, are usually rare migrants to the Park. The hairy woodpecker (S.A.) sometimes will come into the Park in the fall, but it is not likely to nest again in the future (due present habitat constraints). It is difficult to justify special protection measures for species which are facultative migrants to the Park area, but which are common elsewhere. A number of species fall into this category, and are listed as "near" by Laddwood and Oliver (1971).

The occurrence of desirable ones, frequently observed in the Park, undoubtedly affects the other ones, particularly ground nesting and nesting species. The recent reduction of reproductive success around the Park (Park personnel, pers. comm.) is most likely the result of the presence of these and other house cats, and possibly by introduced rats. Some efforts should be made to reduce the effects of these predators in the Park, or species with high dispersal rates. Each of the active California staff will also suffer.

Added by the diversity of species in the Park, several species with high potential for interspecific value are the lagomorphs - see Table II, International Field's Guide-Book (2), and Chapter 11-14.

TABLE A

PLANT SPECIES TYPES IDENTIFIED AS SPECIFIC TO WISCONSIN AND
 PROVIDED UNDER OF THE CODE OF FEDERAL REGULATIONS, PART 101.

CODE	SPECIES TYPE
1.	Sedges
2.	Sedges
3.	Spartan-leaf-leaf-leaf
4.	Spartan-leaf-leaf-leaf Spartan-leaf-leaf-leaf
5.	Spartan-leaf-leaf-leaf Spartan-leaf-leaf-leaf
6.	Spartan-leaf-leaf-leaf
7.	Spartan-leaf-leaf-leaf
8.	Spartan-leaf-leaf
9.	Spartan-leaf-leaf (Historical species)
10.	Spartan-leaf-leaf
11.	Spartan
12.	Spartan

TABLE B

HABITAT USE OF BIRDS AND LIST OF SPECIES
OBSERVED IN EARLY APRIL 1976

COMMON NAME	SCIENTIFIC NAME	HABITAT (See Table A)
Spuffle-headed Cormorant	<i>Phalacrocorax auritus</i>	1, 2
Great Blue Heron	<i>Ardea herodias</i>	2, 3, 4
Black Heron	<i>Ardea nigricans</i>	1, 2, 3
Hallert	<i>Ardea platyrhynchos</i>	2, 3
Pintail	<i>Anas acuta</i>	2, 3
American Osprey	<i>Osprey americana</i>	2, 3
Ring-necked Duck	<i>Aythya collaris</i>	2, 3
Greater Scaup	<i>Aythya marila</i>	1, 2, 3
Common Goldeneye	<i>Bucephala clangula</i>	1, 2, 3
Gullinlock	<i>Buteo borealis</i>	1, 2, 3
Crow	<i>Corvus corax</i>	1
Herring-like Duck	<i>Himantopus himantopus</i>	1, 2, 3
Surf Scoter	<i>Melanitta perspicillata</i>	1
Hooded Merganser	<i>Lophodytes cucullatus</i>	2, 3
Common Merganser	<i>Mergus merganser</i>	2, 3
Red-breasted Merganser	<i>Mergus americanus</i>	1, 2, 3
Red-billed Hawk	<i>Buteo jamaicensis</i>	2, 10
Bald Eagle	<i>Haliaeetus leucocephalus</i>	2, 4
American Osprey	<i>Pandion haliaeetus</i>	4, 5, 10, 11, 12
California Gull	<i>Larus californicus</i>	2, 10
Ring-necked Plover	<i>Pluvialis dominica</i>	2, 10
American Coot	<i>Fulica americana</i>	2, 3
Black Eyed Plover	<i>Meleagris gallopavo</i>	3
Killdeer	<i>Charadrius vociferans</i>	2, 10, 12
Black-bellied Plover	<i>Spatula discolor</i>	3
Black Turnstone	<i>Arenaria melanocephala</i>	3
Belted	<i>Erebia alpestris</i>	3
Seedeater	<i>Crotophaga sulcirostris</i>	3
Belted Kingfisher	<i>Larus glaucescens</i>	1, 2, 3, 11, 12
California Gull	<i>Larus californicus</i>	1, 2, 3
Ring-billed Gull	<i>Larus delawarensis</i>	1, 2, 3
Hew Gull	<i>Larus argentatus</i>	1, 2, 3
Common Noddy	<i>Nycticorax nycticorax</i>	1, 2
Belted Kingfisher	<i>Regulus satrapa</i>	1, 2, 3
Common Flicker	<i>Colaptes auratus</i>	4, 6, 7, 10, 11
Pileated Woodpecker	<i>Geopelia striata</i>	4, 6
Violet-green Swallow	<i>Tachycineta thalassina</i>	2, 3, 4
Common Raven	<i>Corvus corax</i>	3, 4, 10
Northwestern Crow	<i>Corvus caurinus</i>	3, 4, 5, 6, 7, 9, 10, 11, 12

TABLE B ... cont.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>HABITAT</u> <u>(see Table A)</u>
Chestnut-backed Chickadee	<i>Parus rufescens</i>	4, 5
Red-breasted Nuthatch	<i>Sitta canadensis</i>	4, 5, 6, 7
Brown Creeper	<i>Certhia familiaris</i>	4, 5, 6, 7
Winter Wren	<i>Troglodytes troglodytes</i>	4, 5, 7
American Robin	<i>Turdus migratorius</i>	4, 5, 6, 7, 8, 10, 11, 12
Varied Thrush	<i>Icterus neivius</i>	4, 5
Seaside's Thrush	<i>Hylocichla ustulata</i>	4, 7
Golden-crowned Kinglet	<i>Regulus satrapa</i>	4, 5
Ruby-crowned Kinglet	<i>Regulus calendula</i>	4, 5
Parula Sparling	<i>Sturnus vulgaris</i>	3, 4, 11, 12
Orange-crowned Warbler	<i>Geothlypis celata</i>	10
House Finch	<i>Carduelis mexicana</i>	4, 10, 11, 12
Pine Siskin	<i>Spinus pinus</i>	4, 5
Dark-eyed Junco	<i>Junco oreganus</i>	4, 7, 9, 10, 11
Fox Sparrow	<i>Passerella iliaca</i>	4, 5, 6, 7, 10
Song Sparrow	<i>Melospiza melodia</i>	4, 7, 9, 10

Arbutus Forest (4). The Aul-fauna overlap depicts those habitats important to the Aul-fauna.

A. Habitat Use by Observed Bird Species

1.) Sealcoast

Many bird species can be observed from the Park in sea water open to swell, and unprotected by either natural or man-made spits and bars. Park visitors using 2x binoculars should be able to identify species up to a limit of approximately 100 meters from shore. This limitation is therefore used to define the extent of this habitat type. Aul-fauna found to this habitat are diving or pelagic species feeding on fish, invertebrates, or detritus found at or near the water surface. Typical groups and/or species are: Loons, grebes, diving ducks, Black brant, and sometimes auks. Excellent viewing opportunities are provided from the lower Batteries and from the Colung Peninsula.

2.) Lagoon

The Esquimalt Lagoon Bird Sanctuary provides protected aquatic habitat utilized by large numbers of birds, and is administered by the Canadian Wildlife Service (C.W.S.). The lagoon is affected by tides from the estuary at the southeastern corner, but provides excellent shelter, staging and feeding areas for numerous species. Diving birds are the major users of this

habitat, but the shallow, protected waters are also used by dabbling ducks. Typical species are black brant, bufflehead, common goldeneye, red-breasted merganser, pintail, and American coot. Access provided by the Casberg Peninsula provides ideal viewing sites for observations at the lagoon.

3.) Intertidal-Pebbly Beach-Ducks:

This habitat type is defined by the high and low tide marks, including the rocks exposed during storms. The principal zone of activity is the water's edge, particularly following the ebbing tides. This habitat of the Park is periodically rich in numbers of birds which feed and roost there. The area is used mainly by various shorebirds, gulls and nesting ducks. The more common species are: dowitcher, western sandpiper, black oystercatcher, glaucous-winged gull, California gull, and mallard.

4.) Shaded Fir-Sit-Redwood Forest:

The mixture of coniferous and deciduous tree species provides a rich variety of forest bird habitats. Four major vertical zones of the forest can be distinguished, each characterized by its own complement of bird species:

- 1) Tree Crowns: Seed-eating, flocking species (Pine siskin, red crossbill);

- ii) Tree Canopy: foliage-searching, insectivorous species (wren, Townsend's warbler);
- iii) Tree Trunk and Lower Limbs: thicker-bark-seeking, and timber-drilling species (chestnut-backed chickadee, brown creeper, woodpecker);
- iv) Understory: ground-feeding, or shrub-dwelling species (varied thrush, winter wren).

Ancient, dead-topped Douglas firs overlooking the intertidal zone are favorite look-out perches of the bald eagle, and other raptors. Such trees merit protection for this reason alone, allowing that there is no safety board.

5.) Douglas Fir-Western Red Cedar-Arbutus Forest:

This coniferous forest type is mainly characterized by greater canopy coverage than the previous forest type (4), primarily due to the occurrence of three evergreen tree species compared to two. These allow less light to penetrate throughout the year than in habitat type 4. Consequently, the understory of shrub and herb species is less well developed, with corresponding effects upon the bird species present. Species most frequently inhabiting these forests are: goldie-crowned kinglet, red-breasted nuthatch, American robin, winter wren, and pileated woodpecker.

6.) Arbutus Knolls:

Arbutus trees like colonized well-drained, rocky outcroppings where pockets of soil have accumulated in various areas within the Park. Often these knolls have a grass-leaf litter

understory layer, with few other shrub or tree species. While not a habitat type of major importance to the avifauna, it does provide an undisturbed transition between types 4 and 5, and the disturbed habitat types described below. Species using these knolls include: common flicker, brown creeper, American robin, rufous-sided towhee, and fox sparrow.

F.) Streamside and Alder Forest:

Alder forests provide arteries of deciduous tree habitat along the stream in the Park area. Alder is a species characterizing the habitat and does not indicate the only tree species found there. Usually the understory is well developed with deciduous shrubs (e.g. Bulus). Alders themselves are frequently used by woodpeckers, particularly the hairy woodpecker, during the nestling stage. However, the alder grove which characterizes this habitat type is probably the summer resident, foliage searching warblers (Wilson's and yellow warblers). Ruffed grouse are also known to prefer this habitat type.

G.) Broom-grassland:

Broom is a common introduced shrub invading disturbed areas where forest cover has been removed. Trailing blackberry is also a common associate in such areas. The mixed grassland provides a broken habitat utilized by scrub-dwelling and ground-feeding birds, such as sparrows (particularly the song

gammas), and elongated rostrum. Species such as red-tailed hawk and American kestrel often incubate birds relatively open but are more sensitive to wind than to more susceptible to their predators than to very dense cover.

9.) Scrub-shrubs

Where cover does not preclude close to open shrub ranges or deep areas, an avian group can be distinguished. The California quail is perhaps the most typical occurrence of this habitat. The "edge effect" also attracts considerable species (protonotary warbler, song sparrow, junco, etc.) where birds are present (uncompensated warbler, song sparrow).

10.) Open

Open areas are also commonly used by species that are ground-dwellers in feeding style. The American robin is most typical of this feeding style, as are other members of the thrush family. Robins may also use areas for nesting, and are attracted to open areas with used by both raptors where they may find food sources and refuge. Grounds that is open areas are often used by a wide variety of bird species (e.g. house finch, junco).

11.) Grassland

Open areas which lack, most of, or egg suffrage in open areas may include American kestrel, house sparrow, junco, etc. (e.g. house finch, junco, etc.).

buildings are adaptable and not restricted to one habitat type.

MAMMALIAN FAUNA

The mammalian fauna is typical of the two biotic zones which overlap in the area of the Park. Most terrestrial mammals would be expected to be year-round residents, though a species such as deer may use certain habitats or areas during certain seasons. However, marine and aquatic mammals will probably be more seasonal in their use of the Park's shoreline regions.

With the time allowed in the terms of reference, it was possible to observe either directly or indirectly only the larger or more conspicuous mammals. The rare or endangered terrestrial mammals described for southern Vancouver Island (Luckhurst and Biewer, 1973) would not be expected within the Park, due to its limited extent and isolation, together with the adjacency of the surrounding urban developments.

Observed and expected mammals are listed in Table 1. This is not as extensive as that given by Luckhurst and Biewer (1973), is part for the reasons mentioned above, and also because the extent and types of habitats within the area limit their suitability for some species.

TABLE C

LIST AND HABITAT PREFERENCES OF MAMMALS OBSERVED OR EXPECTED
AT FORT BIRD HILL NATIONAL HISTORIC PARK, BRITISH COLUMBIA

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>HABITAT (see Table A)</u>
<u>INSECTIVORA</u>		
Big Brown Bat*	<i>Eptesicus fuscus bernardinus</i>	4, 8
Eastern Big-eared Bat*	<i>Corynorhinus townsendii townsendi</i> **	4, 8
California Myotis*	<i>Myotis californicus</i>	4, 9, 12
Long-eared Myotis*	<i>Myotis evotis pacificus</i>	4, 9, 8
Lesser Myotis*	<i>Myotis leucii lewisi</i>	4, 9
Little Brown Myotis*	<i>Myotis lucifugus alascensis</i>	4, 9, 12
Yuma Myotis*	<i>Myotis yumanensis saturatus</i>	6, 7, 11
Woolly Shrew*	<i>Sorex vagrans macrocephalicus</i> **	0 (in most other areas)
Navigator Shrew*	<i>Sorex palustris brookei</i> **	7
<u>LAGOMORPHA</u>		
Eastern Cottontail*	<i>Sylvilagus floridanus macrotis</i> **	4, 9, 11
<u>RODENTIA</u>		
Red Squirrel*	<i>Tamiasciurus amoenus</i> <i>lutescens</i>	4, 8
White-faced Mouse*	<i>Peromyscus maniculatus eremicus</i>	4, 8, 7, 9, 10, 12
Townsend Hoop*	<i>Microtus townsendii townsendi</i> **	8
Rewey Rat*	<i>Rattus norvegicus</i> **	3, 12
Roof Rat*	<i>Rattus rattus</i> **	12
<u>CIVETEA</u>		
Pacific Killer Whale*	<i>Orcinus orca</i>	0
Harbour Porpoise*	<i>Phocoena phocoena</i>	1
<u>CARNIVORA</u>		
Wolverine*	<i>Glires americanus caninus</i>	3, 4, 6, 7, 8
Wisk*	<i>Panthera tigris amur</i> **	2, 3, 7, 8
Short-tailed Weasel*	<i>Mustela erminea agrippina</i> **	3, 4, 6, 8, 7, 8, 9
River Otter*	<i>Lutra canadensis pacifica</i>	1, 2, 3
Raccoon*	<i>Procyon lotor macrocephalicus</i>	3, 4, 6, 8

TABLE C ... cont.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>RECORD (see Table A)</u>
<u>PIRACIDAE</u>		
Southern Sea-Slug*	<i>Desmopsis jubata</i>	1, 3
Rain Slug*	<i>Phoca vitulina richardi</i>	1, 3
California Sea-Slug*	<i>Zelophes californianus</i>	1, 3
<u>ARTIODACTYLA</u>		
Columbian Black-tailed Deer	<i>Odocoileus hemionus columbianus</i>	4, 5, 6, 7, 9, 10, 11

* Records reported following Cowen and Colquhoun, 1966

* Observed by Park personnel and/or tracks seen by Sycamore personnel

+ Direct observation by Sycamore personnel

** Subspecies confined to Vancouver Island

*** Introduced

A. Habitat Use by Observed and Expected Mammals

The major habitat types, both in extent and importance for terrestrial mammals, are the Douglas Fir-Oak-Arbutus Forests (4), and Douglas Fir-Western Red Cedar-Arbutus Forests (5). Lanes (11) also play an important role for some species. The Mammalian Fauna overlay depicts these areas of importance for some species.

1.) Marten, 2.) Lynx, 3.) Intertidal-Pelagic Mammals:

Large marine mammals - Cetaceans and Pinnipeds - are reported by Park personnel to use the waters around the Park's coastline, and would be expected to be seasonal visitors throughout the year. Fligard Island and the coastal batteries provide excellent viewing areas for these species. River otters and beaver would be expected along the intertidal zones (2, 3), and both have been sighted in the Park. Marten could also be found in these latter two habitats, using habitat 3 for foraging (Cowan and Gifford, 1976).

4.) Douglas Fir-Oak-Arbutus Forests:

Deer use these forests year round where the understory contains palatable forbs, grasses and browse plants. Areas with young Garry oak or waxberry (Gaultheria), would be key areas of use in winter and early spring. Low growing or young Douglas fir, and Arbutus, also provide winter browse. These forests also provide shelter during inclement weather, and sites immediately adjacent to fallen trees are frequently

used for landing areas.

The older trees with cavities provide roosting sites for a number of species of bats, while Douglas fir cones are a major food item for the red squirrel. A number of piles of these types cones were observed, but surprisingly few direct observations of squirrels were made.

The more open forested areas with a predominance of Garry oak and the more scattered non-forested hill tops tend to be frequented (during summer months). This species, usually in large or increase significantly in numbers, could compete with other vertebrates such as the deer, and receive most of the food in these areas, particularly during winter months.

3.1 Deer Use of the Open and Semi-Open Forests

When the Western red cedar predominated the canopy, the understory was particularly important to the more preferred food plants. Deer use of such areas may be expected to be related to the size or size of the growing cedar canopy for browse to utilize. Deer utilization in these areas was related to tracks and droppings, and it appeared that this habitat was used more as travel areas between more favorable habitats. When the understory was composed mainly of forbs then as signs of use by deer was observed, although

Cowan (1943) reports that deer will make use of this forest. In regions of this forest type where understory species were more similar to type 4, greater signs of deer use were found. Typical of this forest were abundant growths of salal and rubus, the former though reportedly a preferred food item of deer (Cowan, 1943) showed no signs of being used by deer in the Park.

Cavities in large trees would also provide roosting sites for bats, and the understory would be used by a number of small mammals (see Table C).

6.) Arbutus Groves:

These areas of well-covered, rock outcrops were sites with dense growths of Cowan and Blue-eyed grass which showed signs of fairly heavy use by deer. Deer were observed to eat these plants, although in some areas, rabbits may have also eaten them. A number of such outcrops are found throughout the area, including below the upper battery. They are used for bedding sites by the deer, probably because they provide good vantage sites favored by this species.

7.) Spruce-fir and Alder Forests, B-1 Wetland-Battens:

Besides providing water sources for many mammals, these habitats would be used by such species as the small mammals, and also the predatory species including mink, martens,

short-tailed weasel, and raccoon. Tracks of this latter species were observed in such habitats, and are reported by Park personnel to inhabit the area.

8.1 Broom-grassland, 10.1 Roadside-thrasher

These disturbed sites, though limited in extent, are probably used by most territorial ground mammals, particularly some of the small mammals. Broom is frequently browsed by deer.

11.1 Lawns:

These areas are restricted to the Cavalier's Property, the State Comptroller's Residence, and the Historic Site. They form an important food source throughout the year, mainly for deer and rabbits and perhaps a few small rodents and shrews. The open nature of such areas may also be favored as hunting areas for the Yule bat.

12.1 Buildings:

Although no signs were evident, such habitats are used by rodents including the white-footed mouse, and two species of introduced rat. Roofs also provide suitable roosting areas for many species of bats (see Table C).

9. Columbian Black-tailed Deer

The most important terrestrial mammal of the Park is clearly the Columbian black-tailed or coastal deer. This species is readily observable within the Park, particularly the fenced

Historic Site where a number of relatively tame deer frequent. This allows ready observation by Park visitors, and they are reported by Park personnel to be a major attraction of the Site. Because the deer are the major component of the local fauna, protection of their habitat is required, which in turn ensures protection for most other mammals.

The maximum number of deer observed during this study, and for which it was confidently felt that all individuals were not double counted, was fifteen (15) animals, of which two(2) were adult males. Although there are probably more deer within the Park boundaries, no attempt was made to census the population due to time constraints. However, fresh tracks were encountered throughout the forest habitats, and on a number of major trails, cross were smoothed and revisited at least daily for signs of recent deer movements. This method indicated that all these trails were used daily or more frequently by deer, and signs of dogs in the Park were also noted in this way. Pellet groups were also sighted frequently, though the understorey limited these observations. Both pellet groups and tracks can be used to estimate deer numbers, but to be really useful in obtaining valuable census data or habitat use, a significantly longer period of study is required. Use of pellet groups is further confounded by the problems of different decay rates with season and food habits.

These rates are at yet unknown, and to use such data, transect lines must be established and ideally cleared of previous pellet groups, then later revisited for signs of recent use.

C. Deer Food and Habitat Use

The most critical period of the year for deer survival is that of late winter-early spring. By the end of winter and with the approach of spring, food is scarce, winter fat reserves are depleted, and for females, there are major demands for foetal growth and later lactation. The observations of Park personnel, that deer were not frequent, would indicate that the Park area is not prime deer habitat. This conclusion is supported by the classification of the area of Luskhurst and Steiner (1973).

The present study fell during this critical period and allowed direct observations to be made of deer feeding and their preferred feed plants. The large lawn of the Historic Site is used by the deer year round, probably as it provides a continuous source of green vegetation. However, other fields are required and the following is a short list of plant species which showed signs of deer use or on which deer were observed to feed:

<u>PLANT SPECIES</u>	<u>LOCALITY</u>	<u>COMMENTS</u>
Grass	4, 5, 9, 9 10, 11	Leaves used year round, fresh shoots used when available, in forests.
Mockberry	4, 5, 7, 10	Most frequent shrub on which deer observed feed- ing - selecting leaves only.
Cane	4, 5	Almost all observed plants showed signs of use. Observations of use also.
Carry Oak	4, (8)	Signs of browsing on young growth varied from light to severe hedging, especially below upper barbery.
Arbutus	4, 5, 6	Scattered signs of eaten leaves on low growing or young trees.
<u>Conoclinium spp.</u>	4, 7, 8	Signs of use on most stands - top portions eaten.
<u>Ribes spp.</u>	4, 5, 7, 9, 10	Observations and signs of deer use.
Broom	4, 5, 9, 10	Signs of browsing ranged from light to severe hedging.
Bracken Fern	9, 10	On the few new shoots present signs of use.
Douglas Fir	4, 5	Limited signs of use - possibly because evidence may be difficult to observe.
Western Red Cedar	9	As above.
<u>Erica spp.</u>	4, 5, 9, 10	In numerous bushes signs of moderate hedging.
Willow	7, 8, 10	Use by deer evident in form of hedging.

Additional data on food habits, taken from Cowan [1965], is presented in Table D. This should provide a good indication of the expected food habits of the deer found within the Park throughout the year.

Almost all vegetated areas of the Park provide some suitable habitat for deer, and only in sites where canopy cover is very dense and understorey sparse would deer be unlikely to make much use. Park personnel report that rutting activity is observed in late fall, and some occurs within the Historic Site fenced grounds. It is possible that all the areas of the Park would be used for rutting activity, but the fenced Historic Site may provide less disturbed areas which may be preferred during this season. These comments are equally applicable to the late spring when the fawns would be born, and when they are particularly vulnerable to predation by domestic dogs (see following).

D. Comments and Recommendations Regarding Fauna

- a) Present Detrimental Factors: The major factor affecting the birds and mammals of the Park is the presence of large household pets - dogs and cats. Park personnel report that during the 1965 - 70 winter, seven deer have been found killed or observed killed by dogs. Predations by dogs is also reported for previous years. While deer

TABLE 3

SEASONAL FEED HABITS OF DEER IN COASTAL FOREST REGION
OF SOUTHERN VANCOUVER ISLAND (AFTER CORRAL 1945)
RALE PERCENTAGE OF DIET

<u>PLANT SPECIES</u>	<u>SPRING</u>	<u>SUMMER</u>	<u>FALL</u>	<u>WINTER</u>
Bowles Fir	24	--	8	47
Sitka	8	41	27	8
Willow	21	8	12	--
Brambles	11	4	--	--
Caulisperm	18	--	--	--
Maple	4	--	--	--
Cowweed	4	--	--	--
Grass & Sedge	8	4	--	--
Rider	--	14	25	--
Stalk Raspberry	--	8	--	--
Mushrooms	--	--	13	4
Tricoloberry	--	--	8	--
Others	--	--	4	36
Miscellaneous Vegetation	13	28	11	8

losses from domestic dog predation are not unique to the Park. Coates and Budget (1975) feel that it is a major mortality factor for all coastal deer populations, therefore it does represent a major threat for the future survival of the Park's deer population. As discussed earlier, if twine are uncommon, the natural low productivity of the herd cannot maintain the population under such predation pressure.

Considering their value as an attraction for visitors and the Park's desire to maintain its natural resources, every effort should be made to reduce or eliminate the problem of domestic dogs. Ideally a post-and-rail fence surrounding the whole Park, particularly adjacent to the urban development is required. This should significantly reduce the problem and also reduce the incidence of house cats in the Park. The possibility that some of the local cats may be feral, should not be overlooked, and steps to eradicate them should be taken to ensure the survival of the ground-dwelling birds.

Activities of local inhabitants (pruned trees, pile houses, praline dumps) within the forested areas of the Park were quite frequently observed. Not only should these activities be curtailed, but removal of structures and garbage accumulation be removed as soon as possible.

b) **Habitat Protection and Development Recommendations:**

Development of the Park should be aimed towards low intensity activities, well dispersed throughout the Park, if natural values are to be maintained while obtaining the optimal visitor experience. Rather than develop multiple-unit, day-use picnic areas, a series of small (3 - 4 unit) sites should be placed at suitable sites along the highway, and on the Colony Peninsula. Another favourable site for limited picnic use is the grassed roadway immediately adjacent to the Visitor Parking Lot.

A trail system in the areas around the Historic Site, for day hikes, nature study and viewing, would be compatible with the fauna, and likely very rewarding to the visitor. A self-guided trail system with information pamphlets and marked points of interest along the way, would perhaps contain visitor interpretations to the trails. Two main areas to be avoided in the planning of such a trail system(s) are: the Arbutus knolls (mass covered rock outcrops would not withstand impact - see also comments of McKinn et al., 1973), and the Douglas Fir-Oak-Arbutus forests of the southwestern portion of the fenced Historic Site. (This area while providing favourable food and cover

immediately, after approval by the "Board" for the 1970
 (and later) of the Park.)

Planned Island Park from the outset of its development
 for the Royal Society's first interpretive center, offer-
 ing ideal viewing conditions for visitors. The initial
 vision with high standards for other interpretive
 centers are shown the Island Park, and the area
 just before the Emerald Lake. At this location there is
 a good (perhaps) view with rolling green hills - for
 viewing mountains and for viewing) could be built to
 provide the space for the more serious interpretation.

Generally, the present concept of habitat extending
 from the Royal Society grounds to the coast is very
 attractive. This form a continuous and free development
 for many years (perhaps, particularly for the day.
 The Emerald property is a lot that is quite different
 looking the Park with the Royal Society Emerald Lake,
 with its own at various times of the year. Therefore,
 the Emerald estate may be the Emerald property and
 house, from the Park should follow as much as possible
 the existing (and planned) road system before making
 use of the Emerald road.

SECTION 6

Natural Resources of Fort Radd Hill, National Historical Park

Three major natural resources are important for Fort Radd Hill in a regional context. Being located on the southeastern portion of Vancouver Island results in the presence of a coastal summer-dry climate of the Californian or Mediterranean type. Two tree species, Arbutus and Garry oak are characteristic of this climatic type and reach their northern latitudinal extent on the British Peninsula and the adjacent Gulf Islands. As Fort Radd Hill is the only National Park in this vegetation zone, it is important to preserve this unique vegetation within the Park boundaries.

Another natural feature of Fort Radd Hill is its location on the coast and adjacent to Salter Park and the Esquimalt Lagoon. Thus a major bird observation area is protected. Park visitors may enjoy the presence of many varieties of land and sea birds as well as the occasional appearance of sea mammals such as otters, whales, and sea lions. Although these sightings are rare at present, with further extension of protected areas and a more pollution conscious population, these animals may frequent the areas more abundantly in the future.

The third major natural resource of Fort Radd Hill is the coastal

deer population. It appears that the deer are a major feature for park visitation. With increasing human population pressure, the coastal deer will be forced to seek refuge in inland areas. The protection afforded by Fort Road Hill and Hickey Park may ensure the continuance of the deer within a close proximity to sea and thus represent a special resource for man's enjoyment.

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APPENDIX A

TERMS FOR DESCRIBING SOILS AND THEIR ENVIRONMENT

SOIL TEXTURE (0.5.B.4.)

<u>CLASS</u>	<u>DESCRIPTION</u>
Sand (S)	dry - scattered in hand - falls apart when pressure released wet - will form cast but crumbles when touched
Sandy Loam (SL)	dry - forms cast but falls apart readily wet - cast will bear careful handling
Loam (L)	dry - cast will bear careful handling wet - cast can be handled freely
Silt Loam (SL)	dry - aggregates cloddy but lumps break easily wet - runs together and puddles
Clay Loam (CL)	dry - clods and lumps are hard wet - will form this "crisken" barely sustaining its own weight
Clay (C)	dry - very hard lumps or clods wet - will form a long, fibrous "crisken"

SOIL MOISTURE (0.5.B.5.)

<u>CLASS</u>	<u>DESCRIPTION</u>
loosely drained (1)	The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions
well drained (2)	The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.

- Substantially well drained (2)** The soil moisture in excess of field capacity requires for a small and significant period of the year.
- Imperfectly drained (3)** The soil moisture in excess of field capacity requires for substantial periods for relatively long periods during the year.
- Badly drained (4)** The moisture content in excess of field capacity requires to soil level for a large part of the year.
- Very poorly drained (5)** Free water remains in the soil to 10 inches of the surface most of the year.

APPENDIX

SOILS REPORT

- A soil
 B clayey
 C
 D
 E
 F
 G
 H

DATA

SOILS REPORT

- a
 b
 c
 d
 e
 f
 g
 h

RESULTS

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

APPENDIX B

PHYSICAL PROPERTIES OF SOIL SAMPLES

Sample	Soil Unit	Class (USCS)	Drainage (USCS)	Depth (m)	Moisture (By District Surface)	S.D.	P.S.	S. Pore Space
1	1P	U-C	2-3	0-1.7	1 - 1 11 - 11	0.9 1.4	2.2 2.8	88 44
4	1P	U-C	2	0-1	1 - 1 11 - 11L	1.0 1.7	2.0 2.3	90 100
6	1P	U	2-3	0-1	1 - 1L 11 - 11L	1.5 1.7	2.1 2.1	89 89
8	2P	U-U	2-3	0-1	1 - 1L 11 - 11	1.5 0.9	2.1 2.0	72 83
6	1P	U	4	0-1	1 - 1L 11 - 11L	1.4 1.6	2.2 1.9	76 84
8	1P	A	2	0-1	1 - 1 11 - 11L	1.0 1.5	2.5 1.8	60 77
2	2P	U-C	4-5	0-1	11 - 11 11 - 11	1.8 2.8	2.3 2.6	74 88
7	2P	U	6	0-1	11 - 11 11 - 11	1.8 1.7	2.3 2.3	82 73
11	2P	U-C	4	0-1	11 - 11 11 - 11	1.8 1.8	2.2 2.5	80 74

APPENDIX B ... CONT.

CHEMICAL PROPERTIES OF SOIL SAMPLES

Sample	Soil depth	pH	Organic Matter (%wt.)	Available Nutrients (% by wt.)					
				Ca	Mg	K	P	I	
1	1P	8.4	5.0	0.014	0.002	0.002	trace	0.001	
4	1P	7.8	10.9	0.048	0.002	trace	trace	trace	
6	1P	8.1	5.1	0.004	0.001	trace	trace	trace	
7	1P	8.1	4.8	0.005	0.001	0.004	trace	trace	
9	1P	8.0	6.9	0.014	0.002	0.002	0.005	0.002	
8	1P	7.0	18.7	0.027	0.003	0.002	trace	trace	
2	1P	7.8	7.1	0.014	0.002	0.004	trace	trace	
7	1P	7.5	7.7	0.009	0.002	0.001	trace	trace	
10	1P	8.8	3.4	0.009	0.001	0.001	trace	trace	
11	8	8.8	17.0	0.014	0.002	0.003	trace	0.001	
12C	8	8.7	7.6	0.001	0.001	0.001	trace	trace	
10D	1P	6.7	5.1	0.010	0.002	0.003	trace	trace	
11A	1P	7.0	4.8	0.013	0.003	0.002	trace	trace	

Sample 5 is from a depression within a rocky outcrop.

Sample 12 is from the surface of a moss covered rock outcrop.

Sample 10 is a mixture of surface horizons from 5 pits surrounding Sample 8.

Sample 12 is a mixture of surface horizons from 5 pits surrounding Sample 2.

APPENDIX C

VERIFICATION APPLICATIONS

The following tables first specify classification by vegetation association. Lower categories are provided for all classes with 10000, 5000, 1000, and 500 specimens, and representative specimens are provided for tree species.

STEM D.I.A.

1	very scarce - cover negligible
2	scarce - cover 1% to 5%
3	very abundant - cover 5% to 15%
4	abundant - cover 15 to 30
5	copious - cover 30 to 50
6	very often - cover 50 to 75
7	abundant - cover 75 to 90
8	abundant - cover 90 to 95
9	abundant - cover 95 to 99
10	abundant - cover 99 to 100

STEM G.A.T.

1	less than 25 percent
2	25 to 50 percent
3	greater than 50 percent

AGE CLASS

1	less than 10 years
2	10 to 25 years
3	25 to 50 years
4	greater than 50 years

STEM VOL VOLUME

1	less than 100
2	100 to 500
3	greater than 500

RESTRICTION

1	High
2	Moderate
3	Low
-	Absent

TABLE 1
 Garry Oak - *SHOCELITRUM* ASSOCIATION
 51 Species (continued)
 APPROXIMATE AREAL EXTENT 26 ACRES

	<u>COVER</u>	<u>HEIGHT</u>	<u>AGE</u>	<u>STEMS/ FEET²</u>	<u>CHARACTERISTIC</u>
A1 Garry Oak	6	1	3	1	0
Arbutus	6	1	2	1	0
A2 Shore pine	3	1	3	1	0
Broadleaf maple	4	1	1	1	0
B Switch grass	4				
Woolbush	4				
C Grass *	6				
Blue-eyed grass *	6				
Santa-Rose	3				
Icecrop	6				
Saxifrage *	4				
Shooting-star *	3				
Collinsia	4				
Smilax *	3				
Wine's lettuce	3				
Western Sp-true beauty	2				
wood sorrel	2				
Indian Consumption plant	0				
Rumex	1				
Nearly everlasting	1				
Selaginella	1				
E <i>Shoceleitrum canescens</i>	7				
<i>Myrica asplenifolia</i> sp.	4				
<i>Polypodium juniperinum</i>	8				
F <i>Festuca sphaerocoma</i>	3				
<i>Festuca ovina</i>	3				
<i>Eleocharis acicularis</i>	2				
<i>Phytolacca americana</i>	2				
<i>Sedum pulcherrimum</i>	3				
<i>Carex acutata</i>	3				
<i>Stemodia stricta</i>	3				
<i>Stemodia procumbens</i>	4				
<i>Samolus parviflorus</i>	1				

* Characteristic species

TABLE 2
 RESULTS - DOUGLAS-FIR ASSOCIATION
 39 SPECIES IDENTIFIED
 APPROXIMATE AREA, EXTENT 25 ACRES

	<u>SPECIES</u>	<u>HEIGHT</u>	<u>AGE</u>	<u>STEMS/ HECTARE</u>	<u>REGENERATION</u>
A2	Artichoke	6	1	2	1
	Douglas-fir	7	2	2	-
	Shore pine	3	2	1	-
	Sitka oak	3	2	1	1
	Red alder	3	1	1	1
	Souglas hawthorn	2	1	1	-
B	Broadleaf maple	2	1	1	1
	Manzanita	5			
	Indian plum	3			
	Scotch broom	3			
	Butte rose	2			
	Coccoloba	2			
C	Scrub birch	1			
	Low parsnip	2			
	White Fern Lily *	3			
	Scotchrop *	3			
	Chickweed Monkey-flower *	4			
	Common Monkey-flower *	3			
	Blair's lettuce	3			
	Western Spring Beauty	1			
	American Spunkwill	4			
	Red fescue	4			
E	<i>Rhamnus emarginata</i>	5			
	<i>Myrica asplenifolia</i> sp.	3			
	<i>Polypodium lepidopodium</i>	3			
	<i>Saxifraga oppositifolia</i>	3			
	<i>Diarrhea scopulorum</i>	2			
F	<i>Clostridium sporobacterales</i>	1			
	<i>Ammonium nitrate</i>	2			
	<i>Paracetamol paracetamol</i>	3			
	<i>Paracetamol acetate</i>	3			
	<i>Salicylic acid</i>	2			

* Characteristic species

TSC 1
S.A. - Sales for Insurance
21 Sales Offices
Approved Aug. 1967 21 1968

	1967	1968	68	1967 Actual	1968 Actual
A) Sales for	7	7	7	7	7
B) Other	4	4	4	4	4
C) Sales for	4	4	4	4	4
D) Sales for	4	4	4	4	4
E) Sales for	4	4	4	4	4
F) Sales for	4	4	4	4	4
G) Sales for	4	4	4	4	4
H) Sales for	4	4	4	4	4
I) Sales for	4	4	4	4	4
J) Sales for	4	4	4	4	4
K) Sales for	4	4	4	4	4
L) Sales for	4	4	4	4	4
M) Sales for	4	4	4	4	4
N) Sales for	4	4	4	4	4
O) Sales for	4	4	4	4	4
P) Sales for	4	4	4	4	4
Q) Sales for	4	4	4	4	4
R) Sales for	4	4	4	4	4
S) Sales for	4	4	4	4	4
T) Sales for	4	4	4	4	4
U) Sales for	4	4	4	4	4
V) Sales for	4	4	4	4	4
W) Sales for	4	4	4	4	4
X) Sales for	4	4	4	4	4
Y) Sales for	4	4	4	4	4
Z) Sales for	4	4	4	4	4

TABLE 4
 EUMPHREYS - DOUGLAS-FIR ASSOCIATION
 29 SPECIES IDENTIFIED
 APPROXIMATE AREAL EXTENT 72 ACRES

	<u>COUNT</u>	<u>PERCENT</u>	<u>AGE</u>	<u>SHADE / EXPOSURE</u>	<u>REGENERATION</u>
A1 Douglas-fir	7	4	3	3	3
Grand-Fir	2	1	2	2	1
A2 Western yew *	3	2	1	1	-
Arbutus	3	2	2	1	-
Broadleaf maple	3	1	1	1	1
Holly	1	-	-	-	-
B Ivy	2	-	-	-	-
Indian plum	4	-	-	-	-
Blackberry	2	-	-	-	-
Low salmonia	2	-	-	-	-
Sisal	2	-	-	-	-
C Yucca leaf	3	-	-	-	-
Sepal-leaved bitter-cream	3	-	-	-	-
Small-flowered leuchera	2	-	-	-	-
Slender leptandra	4	-	-	-	-
D Western sword-fern	4	-	-	-	-
Bracken	4	-	-	-	-
E <i>Salix lucida</i> arizonae *	7	-	-	-	-
<i>Salix lucida</i> arizonae *	7	-	-	-	-
<i>Salix lasiolepis</i> *	4	-	-	-	-
<i>Amelanchier alnifolia</i> *	3	-	-	-	-
F <i>Cladonia acrocarpa</i>	3	-	-	-	-
<i>Cladonia furcata</i>	2	-	-	-	-
<i>Parmelia sulcata</i>	3	-	-	-	-

* Characteristic species

TABLE 5
 SNOW-FERN - DOUGLAS- FIR ASSOCIATION
 15 SPECIES IDENTIFIED
 APPROXIMATE ACOAL EXTENT 28 ACRES

	<u>COVER</u>	<u>HEIGHT</u>	<u>AGE</u>	<u>STEMS PER SQ. FT.</u>	<u>REGENERATION</u>
K1 Douglas-fir	7	3	4	3	3
Western cedar	3	2	3	3	3
A2 Broadleaf maple	3	1	1	1	-
B					
Ivy	3				
Manberry	4				
Low Mahonia	5				
Salal	4				
C Western waka-robin *	4				
D					
Western sword-fern *	5				
Bracken *	5				
E					
<i>Polypodium prepatum</i>	6				
<i>Hydrocotyle splendens</i>	6				
<i>Moss denigma</i>	4				
<i>Moss glaberrimus</i>	2				
<i>Ambrosia trifida</i>	2				
F					
<i>Polypodium comite</i>	+				
<i>Cladonia coniocraea</i>	2				
<i>Cladonia pinetorum</i>	2				
<i>Agropyron phaner</i>	3				
* Characteristic species					

TABLE 6
 SEROTIN INDEXES - COVER ASSOCIATION
 15 SPECIES IDENTIFIED
 APPROXIMATE ANNUAL ENTRY 3 ACRES

		COVER	HEIGHT	AGE	STEMS / METER	REGENERATION
A)	Northern cedar *	8	3	4	2	3
	Douglas-fir	4	2	3	1	1
B	Kahikoni	4				
C	Shank cabbage *	4				
	Herb violet *	3				
	Neter-pianchin	2				
D	Common horsetail	4				
	Great horsetail	4				
E	<i>Eurychorda asperum</i>	6				
	<i>Spizocarpus splendens</i>	6				
	<i>Metum douglasii</i>	4				
	<i>Metum glaberrimum</i>	3				
	<i>Desmodium strictum</i>	2				
	<i>Desmodium nuttallii</i>	4				
	<i>Robertia acutifolia</i>	4				
F	<i>Sporoparia physodes</i>	3				

* Characteristic species

TABLE 7
 Alder - Highberry Association
 19 Species Identified
 APPROXIMATE AREAL EXTENT 26 ACRES

	COUNT	HEIGHT	AGE	STEMS/ FOOTAGE	CONCENTRATION
A1 Red Alder *	8	1	1	3	3
A2 Douglas hawthorn	3	1	1	1	-
Red Willow	4	1	1	1	-
Southern Willow	3	1	1	1	-
Billy	2	1	1	1	-
B Highberry *	6				
Isleigh plum	6				
Coast black gooseberry	3				
Red flowering currant	3				
Western blackcap	6				
Scotch broom	4				
Little wild rose	3				
C Cow parsnip	3				
Twisted stalk	+				
D <i>Rapicoma laurifolia</i>	3				
<i>Salix glauca</i>	3				
<i>Cytisus orbatus</i>	3				
<i>Hypericum polyneuron</i>	3				
<i>Ranunculus acris</i>	3				

* Characteristic species

TABLE 8
 SPECIES OF DISTURBED OR MAN-MODIFIED AREAS
 50 SPECIES IDENTIFIED
 APPROXIMATE AREA, 57 ACRES

Trembling aspen	Parrottail ryegrass
Red alder	Timothy
Flowering crataegus	Northwestern rattail
Holly	Leah's quarters
Broadleaf maple	Field chickweed
Red elderberry	Winer's lettuce
Red willow	Western spring hoasty
Socater's willow	Common chickweed
	Shepherd's purse
Blackberry	Rural white-grass
Western flowering dogwood	Field penny-cress
Coast black gooseberry	Meadow scabbling
Red flowering current	White seed clover
Indian plant	Canada clover
Desertbrier rose	American violet
Western blackcap	Parrot
Spotted broom	Red dead nettle
Goose	Common plantain
Ivy	Northern bedstraw
	Taraxacum
Needle spike-root	Canada thistle
Small-fruited bulrush	Ball thistle
Quackgrass	Dandelion
Redtop	Common horsehair
Stigmal	Great horsehair
Blue wild-eye	

APPENDIX B

CHECKLIST OF THE PLANTS OF THE MICHIGAN NATIONAL HISTORIC MONUMENT

The following checklist covers those species actually observed (✓) and those which are likely to be encountered during certain times of the year. Those marked (✓) are non-native species, which often produce seeds.

This list is not exhaustive but covers those species best to identify and likely to be noticed. The list includes those plants only those observed by the author. These should certainly be considered only a first approximation of the species likely to be encountered.

Specimens follow the list of *Geoplinea* and *Geoplinea* (1902).

EQUISETACEAE

- | | | |
|---|---------------------------------|-------------------|
| + | <i>Sphenoclinus arvensis</i> L. | Common Horsetail |
| + | <i>E. arifolius</i> Ehrh. | Bristle Horsetail |

ISCHNACEAE

- | | |
|-----------------------------|----------|
| <i>Ischnus setosus</i> Lam. | Bullwort |
|-----------------------------|----------|

OPHIOGLOSSACEAE

- | | |
|---|------------------|
| <i>OphioGLOSSUM v. crypticum</i> (L.) S. W. | Patschouage Fern |
|---|------------------|

POLYPODIACEAE

- | | |
|--|--------------------|
| <i>Chytocarpus ellipticus</i> Maxon | Indian's Dream |
| <i>Cystopteris fragilis</i> (L.) Bernh. | Fragile Fern |
| <i>Polypodium vulgare</i> L. s. lat. | Common Polypody |
| + <i>Polypodium muntonii</i> (Goult.) Presl. | Western Sword-fern |
| + <i>Pteridium aquilinum</i> (L.) Kuhn. | Bracken |

SCLEROPHYLLACEAE

- | | |
|---|-------------------------|
| + <i>Sclerophyllum williamsii</i> Hieron. | Williams' Sclerophyllum |
|---|-------------------------|

PINACEAE: CONIFERAE

- * *Abies grandis* (Dougl.) Lindl. Grand fir
- * *Pinus sylvatica* Dougl. var. *banksiana* Shore pine
- * *Pseudotsuga mucronata* (Mill.) Franco Douglas Fir
- * *Taxus brevifolia* Nutt. Pacific Yew
- * *Thuja plicata* Donn. Western Red Cedar

ALISMACEAE

- * *Alisma plantago-aquatica*
L. var. *americanum* Shultz & Shults Water-plantain

JUNCACEAE

- Triglochin maritimum* L. Seaside Arrow-grass

RUPINACEAE

- Ruppia maritima* L. Oriskany grass

JUNCAGINEAE

- * *Juncus breviflorus* L. Todd rush
- Juncus effusus* L. Common rush
- Juncus tenuis* Willd. Slender rush
- Juncus acutiflorus* (L.) DC Common woodrush

CYPERACEAE

<i>Carex microcephala</i>	Big-headed Sedge
<i>Carex polytricha</i>	Thick-headed sedge
<i>C. strictula</i> Prescott	Spike sedge
+ <i>Eleocharis acicularis</i> (L.) R. & S.	Needle Spike-rush
<i>E. palustris</i> (L.) R. & S.	Crawling spike-rush
+ <i>Scirpus microcarpus</i> Presl.	Small-fruited bulrush

GRAMINEAE

+* <i>Arrhenatherum ramosum</i> (L.) Beauv.	Quackgrass
+* <i>Agrostis alba</i> L.	Redtop
<i>A. canadensis</i> Michx.	Rough Doggrass
<i>Alopecurus caryophyllus</i> L.	Silvery Hair grass
<i>A. pratensis</i> L.	Little Hairgrass
* <i>Anthoxanthum odoratum</i> L.	Silvery Horngrass
* <i>Bromus mollis</i> L.	Top Grass
* <i>Bromus rigidus</i>	Rippet
+ <i>B. vulgaris</i> (Hook.) Steud.	Common Brome
+ <i>Cynodon dactylon</i> L.	Crested Dogtail grass
+ <i>Cynopsis glomerata</i> L.	Orchard grass
+ <i>Echinochloa crusgalli</i> (L.)	Barnyard Grass
+ <i>Elymus glaucus</i> Desf.	Blue Wild-rye
<i>E. horreus</i> Presl.	Northern Eye-grass

	<i>Festuca microstachya</i> Nutt.	Rebball's Fescue
+	<i>F. ovina</i> L., s. lat.	Red Fescue
	<i>Festuca lucida</i> L.	Velvet grass
	<i>Festuca longispicata</i> Hooker	Headsie barley
+	<i>Festuca ovina</i> (Flora) Lam.	Italian Ryegrass
++	<i>F. parva</i> L.	Perennial Ryegrass
++	<i>Festuca pratensis</i> L.	Timothy
+	<i>Poa annua</i> L.	Annual Bluegrass
++	<i>Poa pratensis</i> L.	Kentucky Bluegrass
+	<i>Polypogon monspeliensis</i> (L.) Desf.	Rabbitfoot Grass

ARACEAE

+	<i>Sagittaria americana</i> Walt. & St. John.	Yellow arum
---	---	-------------

LILIACEAE

	<i>Allium americanum</i> Hook	
	<i>A. canadense</i> Roth	Wooding Onion
	<i>Brodiaea serotima</i> (Coffin.) Engl.	Large Flowered brodiaea
+	<i>Colocheilus quercifolius</i> (Pursh.) Greene	Leaves
+	<i>Erythronium americanum</i> Agnes Chase	White Paw Lily
	<i>Frederickia tenax</i> Pursh.	Chocolate Lily
	<i>Hexagramma distichum</i> (Wood) Reiche & Reiche	Wild Lily of the Valley
+	<i>Scilla maritima</i> (L.) D. C.	Twisted stalk
+	<i>Trillium ovatum</i> Pursh.	Western white-root

IRIDACEAE

- + *Sagittaria arifolia* Willd. Blue-eyed grass
- + *S. Douglasii* A. Dietr. Satin Flower

ORCHIDACEAE

- Calypso bulbosa* (L.) Oakes Calypso
- + *Epipactis helleborifera* (L.) Griseb. Helictotria
- + *Goodyera oblongifolia* Raf. Green leaved Rattlesnake
Orchid
- Habenaria unclanensis* (Sprng.) S. Wats. Wood Hair Orchid

SALICACEAE

- + *Populus tremuloides* Michx. Trembling aspen
- Salix pyramidalis* Anderss. Gay's Willow
- + *Salix lasiolepis* Benth. s. lat. Red Willow
- S. nigra* Nutt. Mackenzie's Willow
- + *Salix scouleriana* Barrist. Scouler's Willow
- Salix viticulosa* Sassen. Sisk Willow

BETULACEAE

- + *Betula nana* Bong. Red Birch
- + *Betula papyrifera* Marsh. var. *maximiliana* (Bogal) Fern. Paper Birch

FAGACEAE

- * *Quercus garryana* Bongl. Garry oak

URTICACEAE

- ** *Urtica dioica* L. Northern Rednettle

FELTDERACEAE

- Polygonum amphibium* L. Water Persicaria
P. arifolium L. Common Knotweed
 * *P. convolvulus* L. Black Bindweed
P. hydropiperoides Hitchc. Water pepper
P. lapathifolium L. Dock-leaved Persicaria
 * *P. persicaria* C. & S. Black Knotweed
 * *P. persicaria* L. Spotted Knotweed
 * *Ammi majus* L. Scurf Weed
 ** *E. arvense* L. Red Sorrel
 * *E. arvense* L. Curly-leaved Dock
E. hybridum Wehm. n. var. Coastal Witley leaved Dock

DIEHOPODIACEAE

- Atriplex patula* L. Common Grease

14	<i>Chrysopsis alba</i> L., s. lat.	LEAD'S QUARTERS
	<i>Chrysopsis virginica</i> L.	WICKERT

AMBLYSTACEAE

+	<i>Amblystema japonicum</i> L.	Tumble Weed Asterisk
+	<i>A. retrofractum</i> L.	Pigeon Asterisk

PORTULACACEAE

	<i>Colobrotus villosus</i> (R. & P.) D. C.	Rose Delandria
	<i>Portula zosteria</i> (Dougl.) Greene	Narrow-leaved Portula
	<i>P. parryana</i> (Piet.) Greene	Stream-bank Spring Beauty
+	<i>P. perfoliata</i> (Dum.) Row. s. lat.	Miner's Lettuce
+	<i>P. edulis</i> (L.) Row. s. lat.	Western Spring Beauty

CARYOPHYLLACEAE

	<i>Arenaria macrocarpa</i> Hook	Large-leaved Sandwort
+	<i>Arenaria arvensis</i> L.	Field Chickweed
+	<i>A. canescens</i> L.	House-wreath Chickweed
	<i>A. subrepens</i> L.	Large House-wreath Chickweed
+	<i>Arenaria cernua</i> (L.) Cass.	Bullate Pink
+	<i>Arenaria pallida</i> L.	Small-flowered Catchfly
	<i>Arenaria scouleri</i> Hook. s. lat.	Scouler's Pink

- | | |
|---|---|
| <ul style="list-style-type: none"> + <i>Sporula arvensis</i> L. <i>Sporularia squarrosa</i> (Kornm.) Nylm. + <i>S. venter</i> (L.) Britton. + <i>Sporobolus vagin</i> (L.) J. & E. Presl. <i>Stellaria vulgaris</i> Berg. & Sch. + <i>S. media</i> (L.) Cyril | <ul style="list-style-type: none"> Sea Spray Beach Sand Spray Salt-marsh Sand Spray Sand Spray Western Meadow Common Meadow |
|---|---|

GRAMINEAE

- | | |
|--|---|
| <ul style="list-style-type: none"> <i>Styphelia menziesii</i> (L.) C. + <i>Stenochaeta arvensis</i> L. <i>Stenochaeta occidentalis</i> (Nutt.) A. N. S. <i>S. orthocymboides</i> Nutt. + <i>S. repens</i> L. <i>S. stricta</i> (L.) Steud. | <ul style="list-style-type: none"> Woods' Larkspur Tall Sedgegrass Western Sedgegrass Woods' Dwarf Sedgegrass Creeping Sedgegrass Little Sedgegrass |
|--|---|

GRAMINEAE

- | | |
|---|--|
| <ul style="list-style-type: none"> + <i>Stipa arctophila</i> (Nutt.) P. B. + <i>Stipa arctophila</i> Nutt. + <i>S. nemoralis</i> Pers. | <ul style="list-style-type: none"> Woods' Sedge Grass grass Low Sedge |
|---|--|

GRAMINEAE

- | | |
|---|--|
| <ul style="list-style-type: none"> + <i>Stipa glabra</i> (L.) Nutt. + <i>Stipa later</i> (L.) (L.) Steud. | <ul style="list-style-type: none"> Tall Sedge |
|---|--|

	<i>Salsola edentata</i> (Bigfl.) Hook.	Sea Rocket
++	<i>Capsella bursa-pastoris</i> (L.) Medic.	Shepherd's Purse
+	<i>Dandelion angustifolius</i> Hook.	Anglo-leaved Bitter Cross
++	<i>Tracheurus L.</i>	Vernal Whitlow-grass
..	<i>Aerispa curvicaulis</i> (Hook.) <small>Wesley ex Britt.</small>	Western Yellow-cress
+	<i>Diapentesis aintofolium</i> (L.)	Tumble Mustard
++	<i>Silene arvensis</i> L.	Field Fanny Cross

CROSSULACEAE

+	<i>Sedum apotheciforme</i> Hook.	Bread-leaved Stonecrop
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SAXIFRAGACEAE

+	<i>Saxifraga elata</i> (Walt.) Cross	Slender Saxifrage
+	<i>Saxifraga microbotris</i> Dougl.	Small-flowered Heuchera
	<i>Saxifraga pauciflora</i> (Hook.) Nutt.	Small-flowered Fringe-cup
	<i>Saxifraga occidentalis</i> Nutt.	Western Saxifrage
+	<i>S. oppositifolia</i> Hook. & G.	Northwest Saxifrage

CROSSULARIACEAE

+	<i>Sida diandra</i> Dougl.	Great Black Escoberry
+	<i>S. ampullacea</i> Pursh.	Red-flowering Carmost

ROSACEAE

- | | | |
|----|--|----------------------|
| + | <i>Crossosyris douglasii</i> Lindl. | Douglas' Hawthorn |
| + | <i>Malvastrum discolor</i> (Pursh.) Maxim. | Scrub-spray |
| + | <i>Opuntia coccinifera</i> (T. & G.) Greene | Indian Plum |
| | <i>Physocarpus opulifolius</i> (Persk.) Maxim. | Winebark |
| + | <i>Rosa flava</i> Raf. | Western Crabapple |
| ++ | <i>R. spinosissima</i> L. | Swetbrier Rose |
| | <i>R. gymnocarpa</i> Nutt. | Little Wild Rose |
| + | <i>R. nutkana</i> Presl. | Katka rose |
| + | <i>R. pilosarpa</i> Gray | Clustered wild rose |
| + | <i>Rubus lasiolepis</i> Willd. | Evergreen Blackberry |
| + | <i>R. leucodermis</i> | Western Blackcap |
| | <i>R. spectabilis</i> Pursh. | Salmon berry |

LEGUMINOSAE

- | | | |
|----|--|---------------------------|
| ++ | <i>Ononis scopulorum</i> (L.) Link | Scotch Broom |
| + | <i>Lathyrus latifolius</i> L. | Perennial Pea |
| | <i>L. nevadensis</i> Wats. & S. Wats. | Purple Pea |
| + | <i>L. pratensis</i> L. | Hoopoe Vetchling |
| | <i>Lathyrus densiflorus</i> (Drew.) Greene | Hoopoe Lotus |
| + | <i>Lathyrus tenuis</i> Willd., & Ktze. | Slender Bird-foot Trefoil |
| | <i>Lupinus bicolor</i> Lindl. | Bicoloured Lupine |
| | <i>L. micranthus</i> | Small-flowered Lupine |

- *Salix repens* L.
- *Salix alba* Mill.
- *S. affinis* (L.) Mill.
- *Salix purpurea* L.
- *S. repens* L.
- *Salix purpurea* L.
- *Salix purpurea* Mill.

- *Salix repens*
- *Salix alba* Mill.
- *Salix purpurea* L.
- *Salix purpurea* Mill.
- *Salix purpurea* L.
- *Salix purpurea* L.
- *Salix purpurea* Mill.

CONCLUSIONS

- *Salix purpurea* L.

Salix purpurea

REFERENCES

- *Salix purpurea* L.

Salix

CONCLUSIONS

- *Salix purpurea* L.

Salix purpurea

REFERENCES

- *Salix purpurea* L.

Salix

VIBRACAE

<i>Violet adonea</i> M. & A.	Western Violet
<i>V. ghebelia</i> Hill.	White Modified Violet
* <i>V. palustris</i> L.	Marsh Violet

GRAMINACEAE

<i>Spizidium angustifolium</i> L.	Fine-weed
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ARALIACEAE

** <i>Saxifraga hibernica</i> L.	English Ivy
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UMBELLIFERAE

** <i>Thymus serpyllifolius</i> L.	Queen Anne's Lace
** <i>Thymus vulgaris</i> Hill.	Fennel
* <i>Thymus serpyllifolius</i> Hill.	Cow Parsnip
* <i>Thymus vulgaris</i> [Pursh.] C. & R.	Indian Coniummacula Plant
<i>Sium</i>	Spring Gold
<i>Asanthus graveolens</i> Presl.	Water Parsnip
<i>Sanicula officinalis</i> M. & A.	Western Sweet
<i>Sanicula nigricaulis</i> Dougl.	Purple Snake-root

S. arctica Pursh.

Wormwood

Western Sandcherry

Blackberry

CORIACEAE

+ *Cornus florida* Mill.

C. stricta Michx. s. Mill.

Western Flowering Dogwood

Red Osier Dogwood

ERICACEAE

+ *Arbutus menziesii* Pursh.

+ *Gaylussacia resinosa* Pursh.

+ *Pyrola asarifolia* (Mill.)

Yucca puberula (Mill.)

Rubus

Salix

Large Huckleberry

Red Huckleberry

PIRULACEAE

+ *Dracopis amurensis* L.

+ *Doernbeckeria hirsutissima* Gray

Doernbeckeria latifolia Hook.

Scarlet Pimpernel

Broad-leaved Shooting Star

Broad-leaved Star-flower

COMPOSITAE

+ *Compositae americana* L.

Leafy Birch

LABIATAE

- * *Lamium purpureum* L. Red Dead Nettle
- * *Prunella vulgaris* L. Nuts-v11

SCROPHULARIACEAE

- + *Collinsia grandiflora* Lindl. Large-flowered Collinsia
- + *Mimulus alba* Desgl. Chickweed Monkey-flower
- + *M. guttatus* B. C. s. lat. Common Monkey-flower
- + *Veronica peruviana* Schreb. American Speedwell
- * *V. officinalis* L. Common Speedwell
- * *V. picea* Petr. Winter Speedwell

PLANTAGINACEAE

- * *Plantago lanceolata* L. English Plantain
- * *P. major* L. Common Plantain

RUBIACEAE

- Galium aparine* L. Cleavers
- + *G. boreale* L. Northern Galathea
- Lonicera xylosteum* (Rich.) Satis Black Honeysuckle
- + *Rubus idaeus* L. Red Raspberry

- + *Symphoricarpos alba* (L.) Blake Huckleberry, Snowberry
- + *S. mollis* Nutt. Creeping Snowberry

VALERIANACEAE

- + *Valeriana corymbosa* (Lindl.) O. C. Footcure
- Corymbula racemosa* Hook. Scouler's Campanula

COMPOSITAE

- +² *Achillea millefolium* L. n. lat. Yarrow
- Adoniasis discolor* Hook. Trail Plant
- + *Anaphalis margaritacea* (L.) R. & B. Pearly Everlasting
- + *Anthemis annua* L. Dog Fennel
- Artemisia tridentata* Poir. Great Hornweed
- + *Bidita pennsylvanica* L. Common Daisy
- + *Chrysanthemum leucanthemum* L. Double Daisy
- + *Cichorium intybus* L. Chicory
- +² *Cyanus arvensis* (L.) Scop. Canada Thistle
- +² *C. vulgare* (Savi.) Airy - Star Bull Thistle
- + *Crepis septentrionalis* (L.) Haller. Smooth Hawk's-head
- Franeria chrysanthemifolia* Link. Head-bur
- Diaphanous polyantha* Nutt. Lowland Cowweed
- Grisebolla integrifolia* R. C. Sunweed
- Hesperis alba* (Flores) Hook. White-flowered Headweed

* <i>Agrostis radiata</i> L.	Heavy Cultivar
** <i>Saracocis affinis</i> Nees	Description

LOCKERS

- + *Polypogon monspeliensis* (L.) Witt.
- + *P. comis* (L.) Witt.
- + *Agrostis canadensis* Ach.
- + *Loberia peduncata* (L.) Hoffm.
- + *Blasocarpus* spp.
- + *Cladonia rangiferina* (L.) Horn.
- + *Cladonia moniliformis* (Flörke) Spreng.
- + *C. foveolata* (L.) Fr.
- + *C. furcata* (Nees) Schrad.
- + *C. pyramidalis* (L.) Hoffm.
- + *Geococca maculata* (Schreb.) Rabenh.
- + *Griseola lobata* (Nyl.) Fink
- + *Sparganium angustifolium* (L.) M. Vahl.
- + *Panicum canadense* (L.) Ach.
- + *P. molle* Tuck.
- + *Eleusine pruriens* (L.) Ach.
- + *Amelina furcata* (L.) Ach.
- + *Physcia alveolata* (Th. Fr.) Sacc.

FISHES

- + *Aluanipterus caucasicus* (Nils.) Brit.
- + *Archamiaxius anguiformis* (Gill.) Jap. N. Amer.
- + *Asterolepis aplocheilum* (Nils.) N. S. G.
- + *Mytilichthys* sp.
- + *Chondrosteus tibeticus* (Steud.) G. G. Brit.
- + *Pinnacilla heteromalla* (Nils.) Schleg.
- + *Ceratodus purpuraceus* (Nils.) Brit.
- + *Helias glaberrimus* Kribb.
- + *M. longus* Hill.
- + *Leucostictus maculatus* (Nils.) Steud.
- + *Boleophthalmus boddarti* (Nils.) G.
- + *Eleotris asperatus* Nils.
- + *Diplodus* *faripon*-*lunus*

APPENDIX E

PARKS CANADA TERMS OF REFERENCE FOR A NATURAL RESOURCE INVENTORY OF FORT BODD HILL NATIONAL HISTORIC PARK VICTORIA, B. C.

MARCH 1976.

1. PURPOSE

Fort Bodd Hill National Historic Park is currently being expanded from an area of 46 acres to one of approximately 248 acres. Land acquisition has included purchase of privately owned lands as well as the transfer of property from the Department of National Defense to Parks Canada. It is the intention of Parks Canada to develop a day use area within the recently acquired lands that will complement the historic park aspects of Fort Bodd Hill. In order to appropriately plan the day use area, e. g. location and types of trails, picnic sites, etc., additional natural resource data is required. Some aspects of the natural resources are adequately covered with existing information, e. g. climatology and geology. Other aspects of the natural resource documentation have been initiated by Parks Canada staff but require additional field work and mapping. Because of manpower limitations, additional resource documentation that is required will be done by contract with outside agencies rather than in-house.

This contract covers the provision of all professional, technical

and other services necessary for the mapping and description of the soils, vegetation and wildlife (mammals and ori-fauna) resources, as well as the mapping of streams and springs. This information is not only required for the planning of the day use area, but will be used for the interpretation and management of the natural resources around Fort Hood Hill. This contract constitutes a one and one half month project which will conclude in early May, 1976.

2. PROJECT AREA

The project area included in this contract is the entire area of the original Fort Hood Hill National Historic Park (64 acres) as well as the properties being acquired, i. e. Cavalish and DND properties. The Attached map indicated the specific boundaries of the study area.

3. REVIEW OF LITERATURE AND RECORDS

The contractor will search and review the pertinent material and records relating to the soils, vegetation and wildlife of the study area and will assemble and compile this information into a concise and readable statement.

- 3.1 The majority of this material (although very limited) will be available at the Park, from regional planning groups,

(e.g., Western Community Association, and the Capital Regional District, B. C.) and adjacent wildlife sanctuaries.

- 3.2 A bibliography covering the literature search and review will be included in the report. The format used in citing literature will follow current editorial standards. In addition to using conventional notations, the contractor will identify the location of each article pertinent to Fort Ross Hill National Historic Park.
- 3.3 Analysis and compilation of reviewed material will be included and cited within the appropriate portions of the text.

4. SOIL INVESTIGATION REQUIREMENTS

4.1 Soil map unit definition:

The data requirements for the management and planning of the lands of Fort Ross Hill National Historic Park are basically directed toward the soil fertility and capability to withstand uses such as picnic sites and trails. In this light classification of the soils in the study area will be based on identification of distinct soil units each of which will be defined by the following characteristics:

- 4.1.1. slope,
- 4.1.2. texture,
- 4.1.3. drainage,
- 4.1.4. organic matter,
- 4.1.5. depth to lithic contact, and
- 4.1.6. chemical analysis and pH.

Soil taxonomy per the Canada Soil Survey Classification (great group level) will be required. Soil units will be mapped at 1:2,500.

4.2 Soil Unit Descriptions

Each map unit will be described in text and tabular format. More specifically, but without limiting the generality of the foregoing, the map unit descriptions will include:

- 4.2.1. A brief discussion of the dominant soil characteristics which would influence past decisions for management within that unit.
- 4.2.2. For each soil unit (identified by an alphanumeric code), a table presenting the following information in an appendix to the final report: slope, texture, drainage, pH, particle density, bulk density, organic matter*, depth to lithic contact, chemical analysis* (to include N, P, K, Ca, and Mg).

* Laboratory analysis required.

4.2.3. A number of symbols for each map unit including:

- 4.2.3.1. Identification of the soil unit by alphanumeric code. The code used by the contractor shall appear on the soil unit map, the soil unit description, and on the tabular presentation of analytical data.
- 4.2.3.2. Identification of the slope class as defined by CSE Land Surface terminology.

4.2 Sampling Frequency for Laboratory Analysis

For each different well with defined well log study area, a minimum of three well samples, one sample from each of three different well sites will be taken for identical analysis. The well samples will be taken from the casing ring or per conventional agricultural well analysis.

4.3 Special Interpretive Overlay

The following overlay providing special interpretation of the well characterization shall be provided by the contractor at a scale of 1:2,000.

4.3.1 Well susceptibility to water erosion:

Susceptibility of the well annuli to surface water erosion will be noted by examining and describing relevant well characteristics including, but not limited to, well annulus, well structure, well gravel filter, estimated permeability, contrast and slope.

The erosion susceptibility rating scale will have a maximum of four classes. Terminology for defining the classes are:

1. Extreme erosion risk,
2. High erosion,
3. Moderate erosion risk,
4. Low erosion risk.

The criteria developed by the contractor in establishing the rating system will be thoroughly outlined in the text of the report. For reference to an example of such a classification system refer to Coen, S. W. and Holland, W. D. 1979, Soils of Watkins Lakes National Parks, Parks Canada, Resource Inventory Reports (reference attached).

Soil susceptibility to water erosion will be depicted visually by a transparent overlay depicting areas of uniform susceptibility to water erosion using various Leibniz or mechanical screens.

4.4.2. Soil Drainage Classes

Soil drainage classes will be expressed in terms of actual moisture content in excess of field capacity and the extent of the period during which such excess water is present in the plant root zone. The specific definition of soil drainage classes will be based on criteria established by the CSRC drainage classes:

1. rapidly drained;
2. well drained;
3. moderately well drained;
4. imperfectly drained;
5. poorly drained;
6. very poorly drained.

In such cases where variability of soil drainage within a map unit does not lend itself to the above classification the contractor shall develop a classification nomenclature to reflect such variation.

Soil drainage classes will be depicted visually by a transparent overlay depicting areas of uniform soil drainage classes using various Letrafont or mechanical screens.

- 4.6 The contractor will define and delineate the shoreline of Fort Ross Hill National Historic Park by examining the surface material, and using it to classify the shoreline types (e. g. rock, coarse sand, fine sand).

5. VEGETATION COMMUNITY INVENTORY REQUIREMENTS

The following information on vegetation will be obtained:

- 5.1 Existence of the Park checklist currently developed by R. L. Clapp.
- 5.2 Definition and description of the vegetation communities.
- 5.2.1. Vegetation Community Definition

The vegetation community type shall be defined at the plant association level (Simsen-Brown-Flanagan as modified by Kravitz). Due to the scale of mapping, additional modifications to the plant association level definition will be accepted following discussion with and approval by the contract supervisor. Basically the plant association level is defined by a characteristic species or characteristic combination of species in the tree, shrub and herbaceous layers. The characteristic species

may be a species having a high frequency of occurrence (percentage cover) or may be a species which is particularly indicative of a community. In the latter case, the characteristic species may not be dominant.

Vegetation communities will be mapped at a scale of 1:5,000. Those species not indigenous to the area will be so identified.

8.2.3. Description of the Vegetation Community Type

The following information, based on representative samples in each vegetation community type will be provided by contractor:

- 8.2.3.1. Species Diversity - approximate total number of species present in a plant community.
- 8.2.3.2. Identification of Species - identification of the plants in the vegetation type will be at the species level for all vascular plants.

Identification to the genera level will be adequate for non bryophytes and lichens.

Because of the short field season in which the study must be conducted, it will be impossible to get a complete listing of all species due to varying phenologies, etc.

This factor is recognized.

5.2.2.3. Stratification and Cover Estimates - the total vegetation community structure will be described in terms of the following layers:

- i) Tree layer (sub layers will be described if the tree canopy is multi-layered - this is expected to be the case in that many of the types are not even aged);
- ii) shrub layer, and;
- iii) herb and moss-lichen layer.

Each species in each layer will be identified and described in terms of percentage cover in that layer. In the case of species in the tree and shrub layer, an estimate of height class will also be given.

5.2.2.4. Mensurational Data - the following additional information will be gathered for the dominant species within each tree layer:

- age class (as it relates to succession);
- height class;
- stems per hectare;
- regeneration estimates.

- 5.2.2.5. Environmental Circumstances - In a descriptive form, any significant influences on the vegetation community will be described. Such influences will include, but not be limited to slope, elevation, aspect, land form, moisture regime, presence of water, erosion and nearby disturbance.
- 5.2.2.6. Distribution of the Vegetation Type - approximate coverage of each vegetation type will be noted.
- 5.2.2.7. Successional Stages of Each Vegetation Type - In descriptive form the successional stage of each vegetation type will be identified and described. Identification will be in the following manner:
- i) type of successional stage - primary, secondary, etc. that succession which occurs following a major disturbance, and;
 - ii) whether the successional stage can be considered young, intermediate or advanced.
- 5.2.2.8. Final Stage of Vegetation Succession - assuming no disturbance the final stage (climax stage of the succession) of each vegetation community will be predicted in the descriptive text.

- 1.1.2.6. additional descriptive interpretations - for each vegetation community, those pertaining to the suitability of that community for various recreational uses, e.g. trails, picnic areas, etc., will be discussed. This information need not be exact.
- 1.1.2.7. hazard locations - potential hazard conditions due to unstable areas, water depth to what trees, etc., will also be discussed within each descriptive portion for each vegetation community.
- 1.1.2.71. Rare or Scarce Species or Vegetation Substrates - through the course of the study any species or species that may be considered unusual within the Park Study PFTI area or rare in the regional context will be identified.

4. VEGETATION APPRAISAL

One of the most interesting natural resources of the Park Study PFTI area is the presence of our native tree botanical communities. It is not our intention in inventory the total number of species within the boundaries of the Park but it is essential that complete descriptions of the various within the Park and in the immediate area of the Park be identified and described.

NOTE: The contractor shall submit for approval by the contract supervisor a proposed methodology for description and documentation of the mammals and air-borne birds within the study area.

6.1 Delineation of the Deer Habitat Within Fort Radd H113

Based on the known habitat requirements of deer for feeding, resting, breeding etc., and an indication of habitat utilization by the extent of browse and/or presence of pellet groups, the contractor shall define the areas most heavily used by deer. Descriptive discussion of the relative usage of the different habitats and movements of the deer will also be presented. This information will be developed through field investigation, literature review and verbal communications with local residents, Park staff, local wildlife officers and biologists. The information will also be mapped, using a scale of 1:2,500. The contractor will give an estimation of the total number of deer in the study area and immediate adjacent lands.

6.2 Mammals Other than Deer

Quantitative estimates of populations, relative abundance and distribution will not be required within the terms of this contract. The contractor, however, shall through field inspection, literature review and discussion with Park staff and other local authorities, describe and map the species which could be anticipated or are known to be within the

The study area. Any species that are relatively new or appear within the regional context will be identified and described in greater detail.

5.3 Wetlands

Due to the presence of neighboring wetland communities, the threats associated to the study area will have a varying importance at the presence of wetlands to the area of focus being will. Areas may are known habitats for the various wetlands species will be identified, assessed, and mapped. Of particular importance would be wetland areas of relatively rare water associated species.

F. WATER QUALITY AND QUANTITY

The water quality will address the occurrence of springs or streams within wetlands, flow through, or contribute to the study area. This information will be summarized in the text of the report and presented in detail as a map, at a scale of 1:2,500.

G. EXISTENCE OF WILDLIFE, PLANTS, AND A REGIONAL CONTEXT

A brief description and discussion of the current resources of the field study area to their regional context will be presented in the final report.