ASSESSMENT OF POTENTIAL TREE NURSERY SITES NEAR HUDSON BAY, SASKATCHEWAN

BY

I.K. EDWARDS, W.D. HOLLAND AND L.W. CARLSON

INFORMATION REPORT NOR-X-119
DECEMBER, 1974

NORTHERN FOREST RESEARCH CENTRE
CANADIAN FORESTRY SERVICE
ENVIRONMENT CANADA
5320-122 STREET
EDMONTON, ALBERTA, CANADA
T6H 3S5

Edwards, I.K., W.D. Holland, and L.W. Carlson. 1974. Assessment of potential tree nursery sites near Hudson Bay, Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Inf. Rep. NOR-X-119.

ABSTRACT

Eight potential tree nursery sites near Hudson Bay, Saskatchewan were examined and assessed at the request of the Saskatchewan Department of Tourism and Renewable Resources. Soil survey maps, soil survey reports and aerial photographs were used in the selection of these sites on the basis of biological, physical and economic prerequisites.

Soil samples were collected from six of the sites and analysed physically and chemically. The remaining two sites were considered too remote.

Site 5 is recommended on account of its soil characteristics, accessibility and good quality water supply. The other sites are ranked in descending order as follows: Site 6, Site 1, Site 4, Site 7, Site 2, Site 3 and Site 8.

Forested sites should be cleared judiciously to form shelterbelts. At Site 5 the use of a mobile thermo-dew-point recorder is advised to locate possible frost pockets.

RESUME

A la demande du Department of Tourism and Renewable Resources de la Saskatchewan, les auteurs examinèrent et évaluèrent huit sites possibles de pépinières forestières près de Hudson Bay, Saskatchewan. Des cartes et rapports d'inventaire des sols et des photos aériennes

furent utilisés pour faire le choix de ces sites selon des normes biologiques, physiques et économiques.

Les auteurs récoltèrent des échantillons de sols de six sites pour l'analyse chimique et physique. Les deux autres sites furent rejetés vu leur éloignement.

Le site n° 5 est recommandé en raison des caractéristiques de son sol, de son accessibilité et d'une réserve d'eau de bonne qualité. Voici les rangs, par ordre décroissant de valeur, des autres sites: site n° 6, n° 1, n° 4, n° 7, n° 2, n° 3 et n° 8.

La forêt devrait être défrichée de facon à laisser des rideaux d'arbres. Au site 5, on fera bien d'utiliser un enregistreur mobile de température et point de rosée afin de localiser les lieux bas à gelées tardives.

TABLE OF CONTENTS

INTRODUCTION

Early in 1974, the assistance of the Canadian Forestry Service (CFS) was requested by the Saskatchewan Department of Tourism and Renewable Resources (SDTRR) in locating a suitable site for a tree nursery in the Hudson Bay area. Following the use of soil survey reports and aerial photographs, eight potential sites in the area were selected for examination. Subsequently, the sites were visited jointly by CFS and SDTRR personnel. The soils at each site were examined and samples from six of them were collected and returned to the laboratory for analysis. The remaining two sites were not sampled because of outstanding biological and economic limitations that became apparent when they were visited. This report represents an assessment of the eight sites that were visited, with particular emphasis on those that were sampled for laboratory analysis.

METHODS

The ideal site conditions for a coniferous tree nursery, as previously stated (7,8,10), were used as a guide in the assessment of these sites. Soil survey maps and reports (5), unpublished information[1] as well as aerial photographs were used in selecting prospective sites with suitable biological, physical, and economic prerequisites. Eight sites were examined; soil pits to the C horizon were dug in each case. Soil samples from six of these sites were collected and brought to the laboratory for analysis. In addition, a potential peat source near Simpson's industrial plant was sampled for analysis and the water quality of two rivers in the area was evaluated for irrigation purposes.

---

[1] Personal communication with Dr. D. Acton, Saskatchewan Institute of Pedology, University of Saskatchewan, Saskatoon.

Soil samples were air-dried, ground to pass a 2-mm sieve, and analyzed for texture, pH, electrical conductivity, organic matter, nitrate nitrogen, available phosphorus, extractable calcium, magnesium, sodium, and potassium. Texture was determined by the Bouyoucos hydrometer method (2) and pH and electrical conductivity were determined in a soil-water paste (4). Organic matter was determined by the wet oxidation method (4). Nitrate nitrogen was extracted with copper sulphate and determined colorimetrically with nitrophenoldisulphonic acid (4). Phosphorus was extracted with sodium bicarbonate and determined colorimetrically using the ascorbic acid method (10). Calcium, magnesium, sodium, and potassium were extracted with ammonium acetate (4) and determined by atomic absorption spectrophotometry. The sum of these cations was expressed as Total Extractable Bases. Alkaline samples were tested for the presence of free carbonates, using 10% hydrochloric acid.

The peat sample was analysed for pH, electrical conductivity, organic matter, nitrate nitrogen, phosphorus, and potassium according to the methods indicated above.

The water samples were analyzed for pH, electrical conductivity, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulphate, and chloride by standard methods (6,9). From these data, Sodium Adsorption Ratio was calculated. Sub-samples were titrated with sulphuric acid to pH 6.0 to determine their acid requirement.

SITE DESCRIPTION

Table 1 shows the location and legal description of the eight sites selected for examination. Six of these only were sampled

for analysis; the other two were considered somewhat remote, and moreover, the soils of one of them are believed to have been mapped inaccurately. The location of the sites is also indicated in Figures 1, 2, 3, 4, and 5. Figure 1 shows the general location of all sites relative to Hudson Bay. Figure 2 shows a more detailed location of Sites 1-4 and Figure 3 is a detailed location of Site 5. Figures 4 and 5 show detailed location of Sites 7 and 8, respectively.

Site 1--near Hudson Bay airport. Located adjacent to the Red Deer River and to the south of it, the land slopes moderately towards the river valley. The soil is coarse textured and the subsoil is extremely well drained. A sand and gravel pit is located at its south edge but a mature jack pine stand covers the site.

Site 2--between the Fir and Red Deer Rivers. It consists of slightly undulating farmland and appears to be imperfectly drained in the depressions. Mottling was found 16 in. below the surface.

Site 3--community pasture. The topography is variable with many wet depressions, especially on the south rim. Free carbonates were found at 12 in. and the water table fluctuated between the surface (towards the centre) and a depth of 15-18 in. on the southern boundary. The eastern portion is similarly undulating with many wet depressions apparently due to clay lenses within 12-18 in. of the surface. Soils near the remnants of brush piles are extremely calcareous. Generally, this site lacks suitable drainage and topography.

Site 4--farms beyond the north and east boundaries of the community pasture. Undulating land used for growing wheat.

Depressions are poorly drained and there is mottling at 15-18 in. The subsoil is heavy textured and is extremely calcareous.

Site 5--Greenbush River, west side of river, north of Highway 3. The topography is level to slightly undulating. The texture is moderately coarse and appears suitable for a tree nursery. There is a sand excavation immediately north of the highway. Mature stands of jack pine are present along with white spruce, aspen, and birch. Alder and willow are found in low-lying areas. The site is near a water supply and some of the trees present could be retained for shelterbelt, should the site be selected.

Site 6--Veillardville, farm along south side of Highway 3 and about 6 miles west of Hudson Bay. The land is level and is presently used for growing wheat. The texture of the A and B horizons is moderately coarse loam and might be suitable except for the fine calcareous C horizon at depths of 24-32 in. Drainage is reduced on account of this. The land is already cleared and shelterbelts would have to be planted in the event that a nursery is sited here. It is readily accessible.

Site 7 - Mile 13 (13 miles north of Veillardville). The soils are similar in texture (coarse) to those of the Greenbush River site. The area is slightly rolling and carries mature jack pine and some aspen. Biologically, it appears suitable for a nursery but it is not readily accessible. Roads would have to be improved and power lines installed in order to utilize this site. It was not sampled owing to its remoteness.

Site 8 - Overflowing River (13 miles north of Hudson Bay). The soils are heavier and the drainage poorer than was indicated in soil survey reports. The site is unsuitable for a tree nursery. It is also somewhat remote. No samples were collected at this site.

Table 2 summarizes the features of the sites and indicates their biological and economic ranking.

Climatic Data

Climatic information is lacking for the individual sites[2] but data exist for Hudson Bay and three regional stations. Table 3 gives the average values for temperature, precipitation and length of frost-free period. Data for Prince Albert are included for comparison. Temperature and precipitation data are similar among stations in the Hudson Bay region but mean frost-free period fluctuates, probably on account of differences in topography and elevation. The average frost-free period at Prairie River, about 10 miles from the Greenbush site, is only 66 days but owing to differences in elevation, this probably is not representative of the site. A mobile thermo-dew-point recorder should be used to locate possible frost pockets at the site, in view of the otherwise favourable characteristics.

Disease

The incidence of disease is negligible at all sites. No layout problems are anticipated. The forested sites, such as Sites 1 and 5, should be cleared judiciously to provide shelterbelts.

[2] Personal communication with Dr. D. Acton, Saskatchewan Institute of Pedology, University of Saskatchewan, Saskatoon.

RESULTS AND DISCUSSION

Soil Analyses

The results of the soil analyses for the six sites sampled are shown in Table 4.

pH

Sites 1 and 5 are most suitable, being in the 5.5-6.0 range for the A and B horizons (7,10). Conversely, Sites 3, 4, and 6 are least suitable on account of their alkalinity.

Electrical Conductivity

All sites are sufficiently low (less than 4.0 mmhos/cm) to present no hazards due to soluble salts (9).

Texture

Loamy sand is the ideal texture for a nursery (7,10). The silt plus clay content should not exceed 25%. Site 1 has loamy sand A horizon whereas Sites 3, 4, and a portion of 5 have sandy loam textures. Subsoil textures are sufficiently coarse only at Sites 1 and 5 to be suitable, although the texture at site 1 is too coarse. Soil textures at the other sites are too heavy to be suitable. Sites 2 and 6 are especially unsatisfactory because of their high silt-plus-clay content.

Carbonates

Free carbonates were present in the C horizon of all soils except Site 1. Only at Site 5 were the free carbonates sufficiently deep not to affect plant growth.

Organic Matter

Except for Site 1 (low) all sites had 5-8% organic matter in the A horizon and would be suitable (10). However, with cropping, additional organic matter such as green manure or peat would be required. Site 6 had approximately 17% organic matter in the A horizon, while the LFH horizon at Site 5 had 24.5%. This could be plowed into the subsoil during land preparation.

Nitrate Nitrogen

The soils of all sites are extremely low in nitrate nitrogen. The required level is around 50 ppm. Therefore, nitrogen fertilization will be necessary at all of these sites.

Phosphorus

A minimum level of 20 ppm is required (7). With the exception of Site 5, all sites are deficient in phosphorus.

Extractable Bases

Calcium is adequate at all sites except Site 1. A minimum of 3 me/100 g has been suggested (7) for nursery soils. For horizons in which free carbonates are present, calcium values will include some amount of soluble calcium as well.

Magnesium is adequate except at Sites 1 and 5. A minimum of 1.0 me/100 g is required. On a portion of Site 5, the LFH horizon (Sample No. 18) has adequate magnesium and should be plowed into the A horizon during preparation of the site for nursery seedbed.

Sodium is uniformly low in all soils and should present no problems of soil management.

Potassium is low in most of the samples. Only Site 2 has adequate (in excess of 0.25 me/100 g) potassium in the root zone, and the application of potash fertilizers will be necessary at all other sites.

The Total Extractable Bases is adequate in all sites except Sites 1 and 5. This is expected on account of their coarser texture and low amounts of organic matter. A minimum exchange capacity of 8-10 me/100 g has been suggested for the growth of jack pine and white spruce (7). Exchangeable hydrogen was not determined and this value would contribute to the exchange capacity. However, the pH values and textures indicate that exchangeable hydrogen would not be significant at these sites.

Peat Analyses

Table 5 shows the analytical results for the peat. The peat sample is moderately acid and sufficiently low in electrical conductivity to pose no salinity problems. It is very low in nitrate nitrogen, phosphorus, and potassium. It is an adequate source of organic matter and could therefore be used to increase water-holding capacity at the coarse-textured sites.

Water Analyses

The results of the water analyses are shown in Table 6. Both samples are slightly alkaline. Electrical conductivity readings indicate low and medium salinity hazard for the Greenbush and Red Deer rivers, respectively.

An electrical conductivity of 0.750 millimhos/cm is the permissible maximum level for most irrigation waters (9) unless highly tolerant crops are used and rapid leaching is present.

The ratio of sodium to calcium plus magnesium as expressed by the Sodium Adsorption Ratio is well within safe limits. It is 0.12 and 0.68 for the Greenbush and Red Deer rivers, respectively. This ratio is a measure of the sodium or alkali hazard present. Assuming similar conductivity levels, the Sodium Adsorption Ratio could be as high as 7.0 without significantly increasing the sodium hazard (9).

The ideal pH of water being used for nursery irrigation is 6.0. The amount of concentrated sulphuric acid required by these samples to reduce their pH to 6.0 has been calculated. The Greenbush River, besides a lower initial pH, is less buffered and will require only about 105 ml of acid per 1000 gal compared to 221 ml per 1000 gal required by the sample from the Red Deer River. The overall quality of the Greenbush River is superior and is to be preferred as an irrigation source.

CONCLUSIONS

The Greenbush River site (Site 5) is considered most favourable. The texture and pH of the soil are suitable. Organic matter is low, but this could be supplemented either with peat or by plowing under a green manure crop such as oats. The site is accessible, and near power lines and an adequate, high-quality water supply. Shelterbelts for a nursery could be provided through judicious clearing of the land in preparing the site.

Veillardville (Site 6) is the second best site. The land is level and readily accessible. The soil is moderately fine textured and has calcareous clay at 30 in. below the surface. It is adequately supplied with organic matter. Shelterbelts would have to be planted; well water appears to be the most economical source of water.

The airport site (Site 1) is the third most suitable. Soil texture is coarse and organic matter could be supplemented with either peat or a green manure. The site is close to Hudson Bay and to water supply but uneven topography limits the useable acreage. Shelterbelts could be formed from the existing trees.

The other sites are too fine textured, imperfectly drained, or too remote. Their ranking, in descending order, is as follows: Site 4, Site 7, Site 2, Site 3, and Site 8.

Climatic data from Prairie River, the closest recording station to Site 5, indicate that traverses with a mobile thermo-dew-point recorder should be made at the site to locate possible frost pockets.

ACKNOWLEDGMENTS

The assistance of Mr. Peter Etheridge, Saskatchewan Department of Tourism and Renewable Resources, is appreciated in supplying soil survey maps and aerial photographs, providing transportation to some sites, and collecting soil samples.

Dr. Don Acton, Saskatchewan Institute of Pedology, University of Saskatchewan, Saskatoon, along with his staff provided some aerial photographs, soil survey reports, and valuable information on soil descriptions and climatic data.

Mr. R. Huber assisted in the examination of the sites for layout design.

Mr. Z. Nemeth assisted in the sampling of the sites and prepared the site location maps.

Mr. J. van Dyk assisted in the laboratory analysis of the soil and water samples.

REFERENCES

1. Anon., 1972. Temperature and precipitation 1941-1970. Prairie provinces. Atmospheric Environment Service, Environment Canada.

2. Bouyoucos, G.J. 1951. A recalibration of the hydrometer method for making mechanical analysis for soils. Agron. J. 43: 434-438.

3. Hemmerick, G.M. and G.R. Kendall. 1972. Frost data 1941-1970. Atmospheric Environment Service, Environment Canada.

4. Jackson, M.L. 1958. Soil chemical analysis. Prentice Hall Inc., Englewood Cliffs, N.J. 498 pp.

5. Mitchell, J., H.C. Moss and J.S. Clayton, 1950. Soil Survey of Saskatchewan. Saskatchewan Soil Survey Report No. 13. University of Saskatchewan, Saskatoon.

6. Rainwater, F.H. and L.L. Thatcher. 1960. Methods for collection and analysis of water samples. Geological Survey Water-Supply Paper 1454. U.S. Government Printing Office, Washington, D.C.

7. Stoeckler, J.H. and G.W. Jones. 1957. Forest nursery practice in the Lake States. U.S. Dept. of Agriculture, Forest Service. Agriculture Handbook No. 110.

8. Stoeckler, J.H. and P.E. Slabaugh. 1965. Conifer nursery practice in the Prairie Plains. U.S. Dept. of Agriculture, Forest Service. Agriculture Handbook No. 279.

9. United States Salinity Laboratory Staff. 1954. Diagnosis and improvement of saline and alkali soils. U.S. Dept. of Agriculture. Agriculture Handbook No. 60, Washington, D.C.

10. van der Driessche, R. 1969. Forest nursery handbook. British Columbia Forest Service, Research Notes No. 48.

11. Watanabe, F.S. and S.R. Olsen. 1965. Test of an Ascorbic Acid method for determining phosphorus in water and $NaHCO_3$ extracts from soil. Soil Sci. Soc. Amer. Proc. 29: 677-678.

Table 1. Location of prospective nursery sites examined near Hudson Bay, Saskatchewan.

Site No.	Location	Legal Description
1	Near Hudson Bay air-strip	Sec. 22&27, Tp.44, Rg.3, W.2.
2	Between mouth of Fir River and Red Deer River (south of townsite).	Sec. 28&33, Tp.44, Rg.3, W.2.
3	Community Pasture (southeast of townsite).	Sec. 4, Tp.45, Rg.2 W.2. Sec. 19,30,31,32&33, Tp.44, Rg.2, W.2. Sec. 23,24,25&26, Tp.44, Rg.3, W.2.
4A	Farmer's field (east of Hudson Bay, north of community pasture).	Sec.9, Tp.45, Rg.2, W.2.
4B	Farmer's field (just east of community pasture).	Sec.3, Tp.45, Rg.2, W.2. Sec.34, Tp.44, Rg.2, W.2.
5A	Greenbush River (¼ mi. north of Hwy. #3 at gravel pit).	Sec.32, Tp.44, Rg.S., W.2.
5B	Greenbush River (2 mi. north of Hwy. #3 and 14 mi. east of Hudson Bay).	Sec.5,6,7,8,17&18, Tp.45, Rg.5, W.2.
6	Veillardville (farm 6 mi. east of Hudson Bay, just south of Hwy. #3).	Sec. 5, Tp.45, Rg.4, W.2.
7*	Mile 13 (along provincial road, 13 mi. north of Veillardville, nr. lookout tower).	Sec. 20,21,22,26,27,28&29, Tp.46, Rg.5, W.2.
8*	Overflowing River (13 mi. north of Hudson Bay, along Hwy. #109).	Sec. 6, Tp.47, Rg.2, W.2. Sec. 1, Tp.47, Rg.3, W.2.

* No samples taken for analysis. Sites considered too remote.

Table 2

SITE SUITABILITY RATINGS FOR PROPOSED TREE NURSERY NEAR HUDSON BAY, SASKATCHEWAN

Site No.	Location	Approximate Elevation, ft	Soil Series[1]	Estimated Available Acreage	Present Land Use	Limitations to Establishment of Tree Nursery	Advantages of Site	Biological Suitability Rating	Economic Suitability Rating	Comparative Overall Rating
1	Airport vicinity Sec. 22 & 27, Tp. 44, Rg.3, W. 2nd Mer.	1200	Pine - s and Bodmin - ls	100 acres	Airport 2 Cemeteries Industrial	Limited acreage. Soil texture too coarse. Wind erosion hazard.	Location close to Hudson Bay. Existing trees may be retained for shelterbelts	4	2	3
2	Between mouth of Fir and Red Deer Rivers Sec. 28 & 33, Tp. 44, Rg.3, W. 2nd Mer.	1200	Shellbrook - sl and Carrot River - ls	200 acres	Wheat farming	Calcareous near soil surface. Clay too close to soil surface. Restricted drainage in sub-horizons.	Location close to Hudson Bay.	5 Biologically Unsuitable	4	6
3	Community Pasture Sec. 4, Tp.45, Rg. 2. Sec.19, 30, 31, 32 33, Tp.44, Rg. 2. Sec.23,24,25 26, Tp. 44, Rg.3, W.2nd. Mer.	1150	Carrot River - ls - sl	1,000 acres	Pasture	Too variable in topography. Brush pile remnants are calcareous. Numerous poorly drained areas, because of clay close to surface.	Crown land.	5	3	7
4	Farmer's Fields east of Hudson Bay. Sec. 3, Tp.45, Rg. 2. Sec.34, Tp. 44, Rg.2, W. 2nd Mer. Sec. 9, Tp.45, Rg. 2, W.2nd Mer.	1100	Carrot River - ls - sl Carrot River - fl	160 acres 200 acres	Wheat farming	Too wet. Gently undulating topography and clay too close to surface.	Location close to Hudson Bay.	3	3	4
5	Greenbush River Sec.5,6,7,8, 17, 18, Tp.45, Rg. 5. Sec. 32, Tp.44, Rg.5, W.2nd Mer.	1450	Pine - ls and Sylvania - ls	415 acres	Forest 1 gravel pit	Some acreage pattern limitation,because of poorly drained depressions (mapped as partially suitable) occurs mainly north and north-east portions.	Close to irrigation water. Low water lift. Power and gas available. 13 miles from Hudson Bay to Greenbush River. Soil texture and Btj horizons very suitable. Crown land. Peat nearby. Existing trees may be retained for shelterbelts.	1	1	1
6	Veillardville Sec. 5, Tp.45 Rg. 4, W.2nd Mer.	1300	La Corne - sl and Shellbrook - scl	200 acres	Wheat farming	Too far from water (4½ miles). Some drainage restriction (mainly in centre of farm. Probably too costly to purchase. Some variability in texture. Surrounded by cleared land - no immediately available shelterwood.	Topography. Close to Hudson Bay.	2	4 Economically unsuitable because of high cost of acquiring land.	2
7	Mile 13. Sec.20,21,22, 26,27,28, 29, Tp.46, Rg.5, W. 2nd Mer.	1850	Pine - ls and Sylvania - ls	1500 acres	Forest	Too distant from Hudson Bay. Require too much road construction. Too far from power.	Fine gravel at 30 inches. Large acreage available. Crown land.	1	5 Economically unsuitable because of remote location.	5
8	Overflowing River. Sec. 6, Tp.47, Rg. 2, Sec. 1, Tp.47, Rg. 3, W.2nd Mer.	1200	Pine - ls (Incorrectly mapped)	250 acres	Forest	Stony glacial till. Too wet. No power.	None	6 Unsuitable - poorly drained soil.	6 Unsuitable - poor location.	8

[1] Saskatchewan Soil Survey Report No. 13, 1950.

Table 3. Climatic data for selected stations in the Hudson Bay region.

STATIONS	Elevation (feet)	Average annual temperature (°F)	Average annual precipitation (inches)	Average frost-free period (days)	Longest frost-free period (days)	Shortest frost-free period (days)	No. of years' record[1]
Hudson Bay	1219	32.1	17.62	87	112	31	28
Prairie River	1547	31.0	17.11	66	105	12	15
Porcupine Plain	1635	31.9	17.87	95	110	81	18
Somme	1482	32.6	18.19	81	105	50	11
Prince Albert[2]	1414	32.3	15.31	93	110	66	28

[1]Data were collected during the 30-year period, 1941-1970 (see References 1 and 3).

[2]These data are given for comparison.

Table 4. Results of analysis of soils from prospective nursery sites near Hudson Bay, Saskatchewan.

Sample No.	Site No.	Hor./Depth in	pH[1]	E.C.[2] mmhos/cm	Sand %	Silt %	Clay %	Textural[3] Class	Carbonates[4]	O.M.[5] %	NO_3-N ppm	P	Ca	Mg	Na	K	T.E.B.[6]
													me/100 g				
1	1	A_e 0-2	5.6	0.10	85.4	2.8	11.8	LS	-	3.4	Nil	9.1	2.20	0.44	0.16	0.07	2.87
2		B_m 2-20	5.7	0.04	94.4	2.0	3.6	S	-	0.1	Nil	15.2	0.82	0.23	0.06	0.01	1.12
3		C 20-27	6.0	0.04	100.0	0	0	S	-	0.1	Nil	8.2	1.17	0.09	0.07	0.01	1.34
4	2	A_p 0-8	6.6	0.15	54.4	19.2	26.4	SCL	-	5.8	1.0	10.7	15.65	5.50	0.04	0.48	21.67
5		B_t 8-11	7.1	0.10	54.4	19.2	26.4	SCL	-	1.0	Nil	3.6	10.23	5.05	0.10	0.27	15.65
6		C_k 11-18	7.5	0.15	60.4	19.2	20.4	SCL	+	0.4	Nil	2.7	14.73	4.50	0.11	0.16	19.50
7	3	A_{ej} 0-4	7.1	0.32	82.4	5.2	12.4	SL	-	5.9	2.5	10.5	4.75	1.48	0.09	0.12	6.44
8		B_{tj} 4-15	7.4	0.17	84.4	5.2	10.4	LS	-	0.3	0.8	1.4	28.40	5.36	0.06	0.04	33.86
9		C_k 15-24	7.8	0.19	8.4	57.2	34.4	SiCL	+	0.6	Nil	0.9	13.75	1.77	0.17	0.20	15.89
10	4-A	A_p 0-7	7.6	0.26	64.8	21.6	13.6	SL	-	2.5	0.5	7.5	10.75	1.65	0.09	0.07	12.56
11		B_c 7-18	7.9	0.31	86.4	4.8	8.8	LS	-	0.2	1.3	1.4	23.98	0.75	0.08	0.01	24.82
12	4-B	A_p 0-4	7.2	0.34	78.4	9.2	12.4	SL	-	5.8	2.0	8.5	14.70	2.90	0.06	0.12	17.78
13		B_{jg} 4-12	7.4	0.20	84.4	11.2	8.4	LS	-	0.3	Nil	1.1	5.91	2.59	0.07	0.05	8.62
14		BC_g 12-21	7.8	0.24	4.4	59.2	36.4	SiCL	+	0.6	Nil	Nil	29.40	5.33	0.11	0.17	35.01
15		C_{k1} 21-27	7.6	0.23	4.4	63.2	32.4	SiCL	+	0.4	Nil	Nil	27.73	6.69	0.27	0.18	34.87
16		C_{k2} 27-30	7.7	0.30	88.2	5.6	6.2	S	+	0.1	1.8	0.9	27.40	7.56	0.13	0.03	35.12
17		C_{k3} 30-42	7.6	0.21	8.4	55.2	36.4	SiCL	+	0.4	Nil	0.9	15.08	2.97	0.39	0.35	18.79
18	5-A	LFH 3-0	5.9	0.37	-	-	-	-	-	24.5	Nil	28.2	25.15	4.56	0.08	0.11	29.90
19		A_h 0-4	4.9	0.10	77.4	9.8	12.8	SL	-	1.5	Nil	40.3	3.61	0.85	0.14	0.09	4.69
20		A_{ej} 4-12	5.6	0.31	93.4	0.8	5.8	S	-	0.3	3.3	36.4	5.14	0.75	0.18	0.22	6.29
21		B_{tj} 12-22	6.1	0.64	77.4	9.8	12.8	SL	-	0.1	Nil	12.7	1.99	0.45	0.12	0.09	2.65
22		C 22-23	7.6	0.23	50.8	23.6	25.8	SCL	+	1.4	Nil	2.0	29.05	1.52	0.10	0.09	30.76
23		IIC_1 at 33	7.9	0.11	94.4	1.8	3.8	S	+	0.1	Nil	2.7	22.25	0.19	0.07	0.02	22.53
24		IIC_2 at 48	8.0	0.13	100.0	0	0	S	+	0.1	Nil	0.9	22.20	0.17	0.05	0.01	22.43
25	5-B	A_h 0-1	5.4	0.20	66.8	11.6	21.6	SCL	-	6.6	0.3	4.5	5.71	0.87	0.06	0.41	7.05
26		A_{ej} 1-5	4.7	0.05	88.4	9.8	1.8	S	-	0.4	Nil	20.1	1.13	0.26	0.07	0.15	1.61
27		B_{tj} 12-15	4.8	0.06	50.8	19.6	29.6	SCL	-	0.3	Nil	28.5	4.38	0.82	0.06	0.17	5.43
28		BC 15-30	5.7	0.06	90.4	1.8	7.8	S	-	0.1	Nil	15.6	3.26	0.46	0.06	0.10	3.88
29		C_k at 36	7.7	0.13	94.4	0.8	4.8	S	+	0.1	Nil	4.2	21.98	0.20	0.06	0.03	22.27
30	6	A_p 0-4	7.0	0.31	62.8	15.6	21.6	SCL	-	16.8	4.3	9.1	32.75	4.42	0.12	0.19	37.48
31		B_t 4-12	7.4	0.14	60.8	19.6	19.6	SL	-	0.7	0.3	0.9	10.20	2.77	0.14	0.17	13.28
32		BC 12-30	7.8	0.16	76.8	9.6	13.6	SL	+	0.4	0.3	Nil	24.95	1.09	0.12	0.10	26.26
33		C_k 30-36	7.5	0.18	18.4	29.2	52.4	C	+	0.2	0.5	Nil	30.75	5.06	0.29	0.22	36.32

[1] pH determined in soil-water paste.

[2] Electrical conductivity of soil-water paste and expressed in millimhos per cm.

[3] Texture: S = sand; LS = loamy sand; SL = sandy loam; SCL = sandy clay loam; SiCL = silty clay loam; C = clay.

[4] Free Carbonates: +, Present; -, Absent.

[5] Organic Matter.

[6] Total Extractable Bases or Ca + Mg + Na + K.

Table 5. Results of analysis of peat sampled near Simpson's industrial plant*.

pH	6.4
Electrical conductivity	0.28 mmhos/cm
Organic Matter	86.1 %
Nitrate - nitrogen	0.5 ppm
Phosphorus	4.5 ppm
Potassium	25.4 ppm

* Sampled just north of highway, approximately 1 mile east of plant.

Table 6. Results of analysis of water samples from the Hudson Bay area.

Constituent	Red Deer River (below point of entry of Fir River)	Greenbush River (at bridge along Hwy. #3)
pH	7.8	7.2
Elect. Cond.[1]	0.460	0.150 mmhos/cm
Calcium	2.73	1.13 me/1
Magnesium	1.98	0.49 me/1
Sodium	1.05	0.11 me/1
Potassium	0.15	0.02 me/1
Carbonate	Nil	Nil
Bicarbonate	2.63	1.23 me/1
Sulphate	0.98	0.06 me/1
Chloride	0.09	0.04 me/1
S.A.R.[2]	0.68	0.12
Acid Req.[3]	221	105 ml

[1] Electrical Conductivity is a measure of the concentration of soluble salts or salinity hazard.

[2] Sodium Adsorption Ratio = $\frac{Na}{\sqrt{(\frac{Ca + Mg}{2})}}$ and is a measure of the sodium hazard or the tendency of water to yield sodium to the soil.

[3] Acid Requirement is the volume of concentrated sulphuric acid required by 1000 gallons of water to lower its pH to 6.0

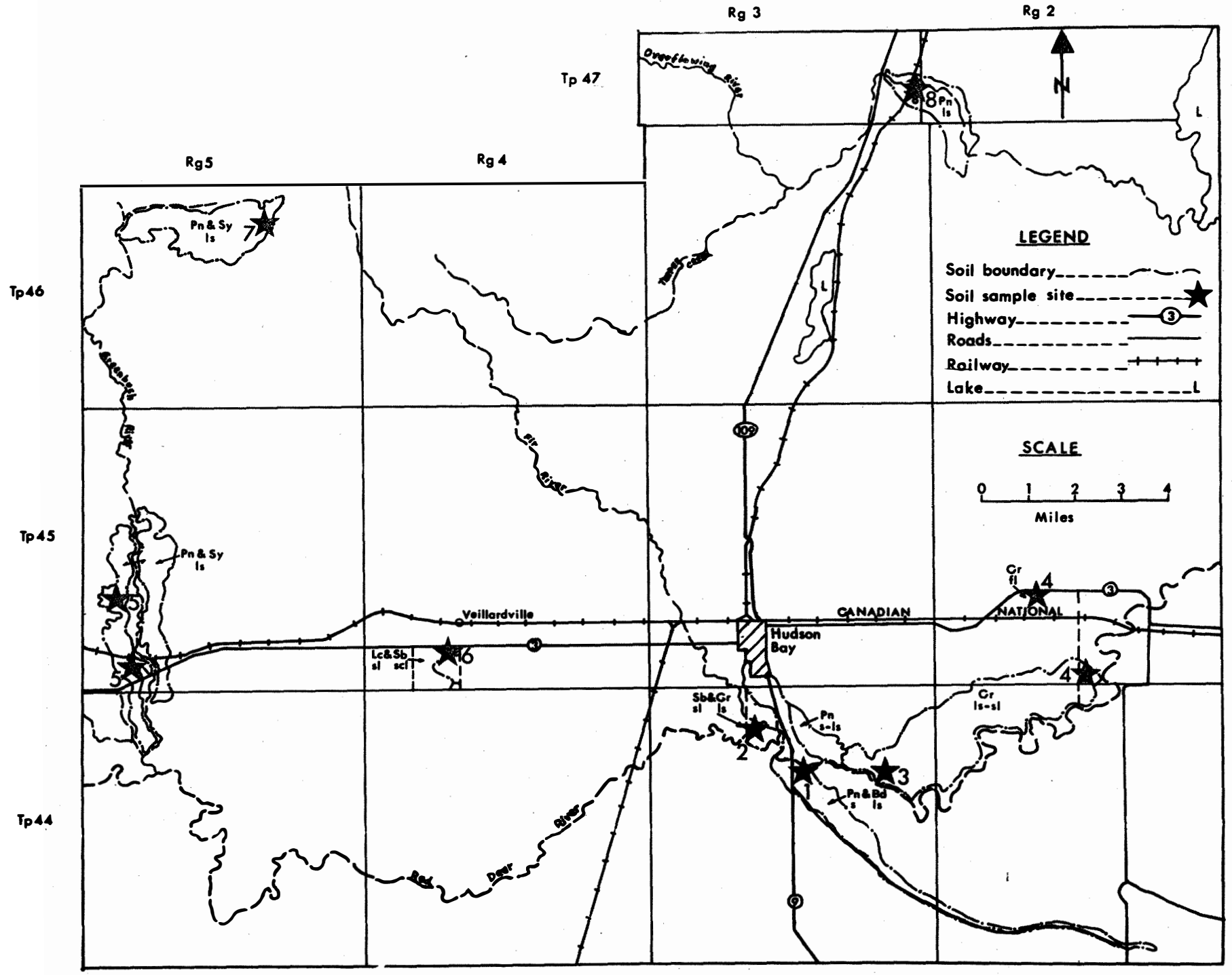

Figure 1. General location of potential nursery sites near Hudson Bay.

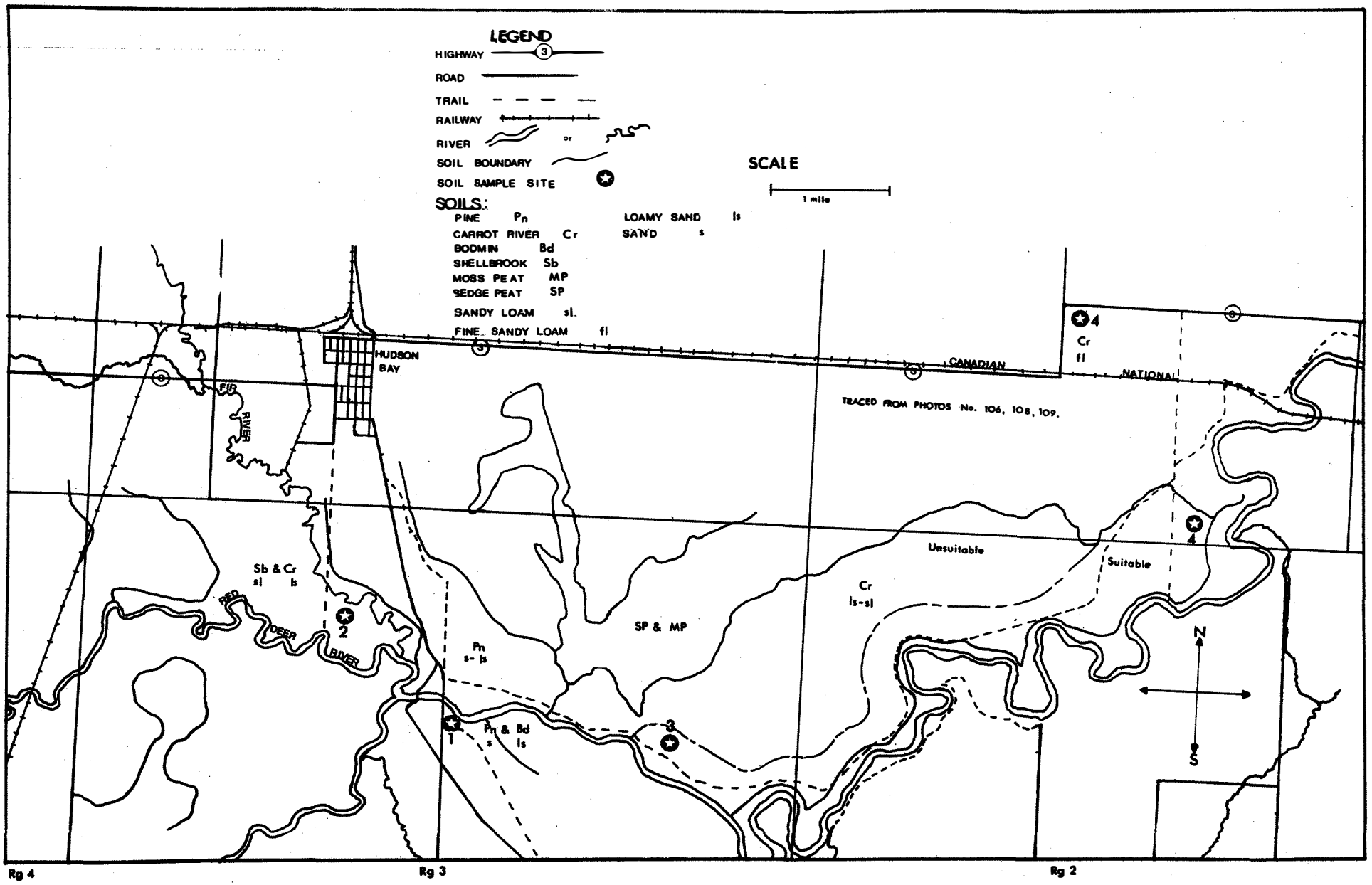

Figure 2. Detailed location of Sites 1, 2, 3 and 4.

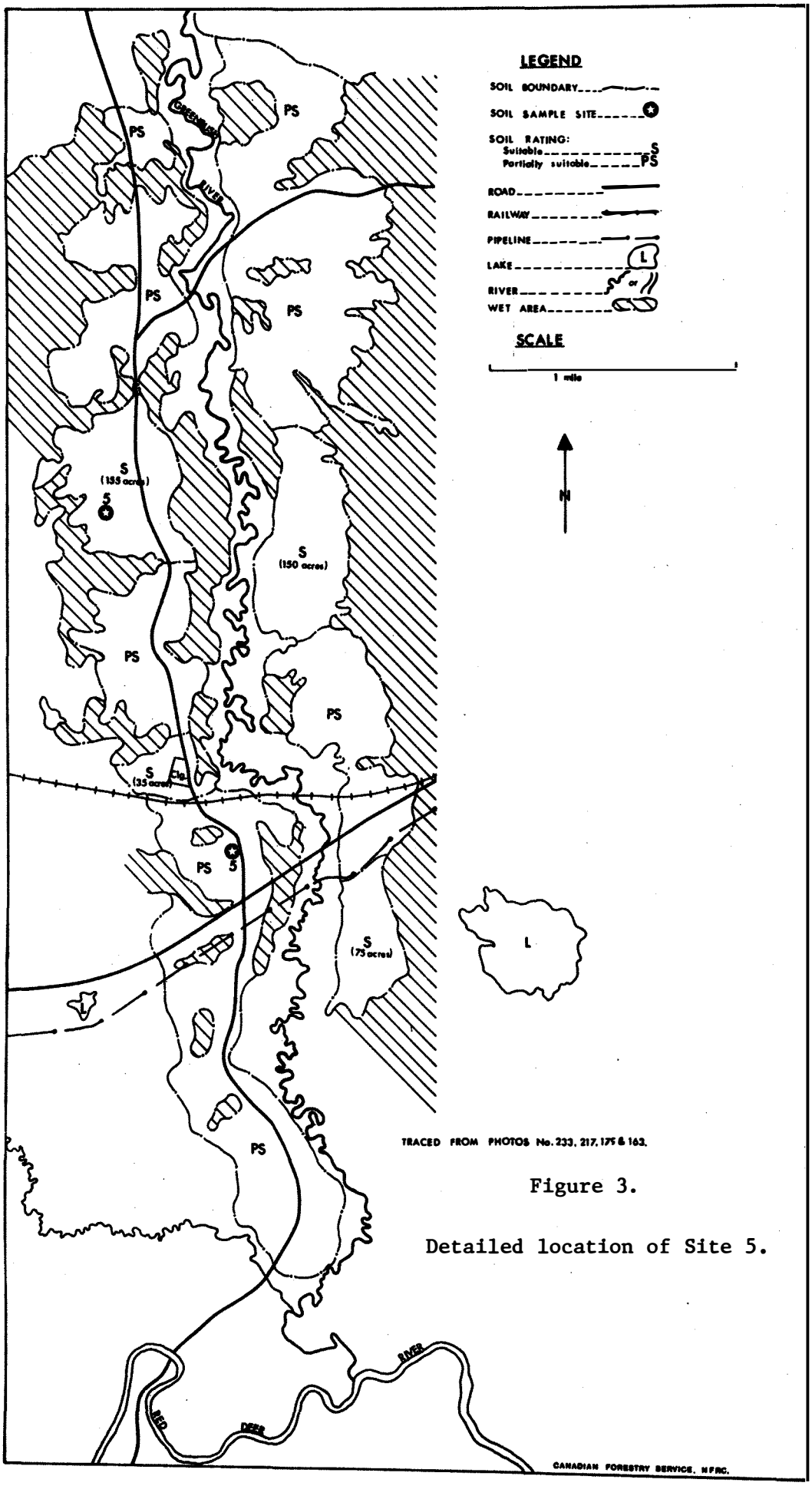

Figure 3.

Detailed location of Site 5.

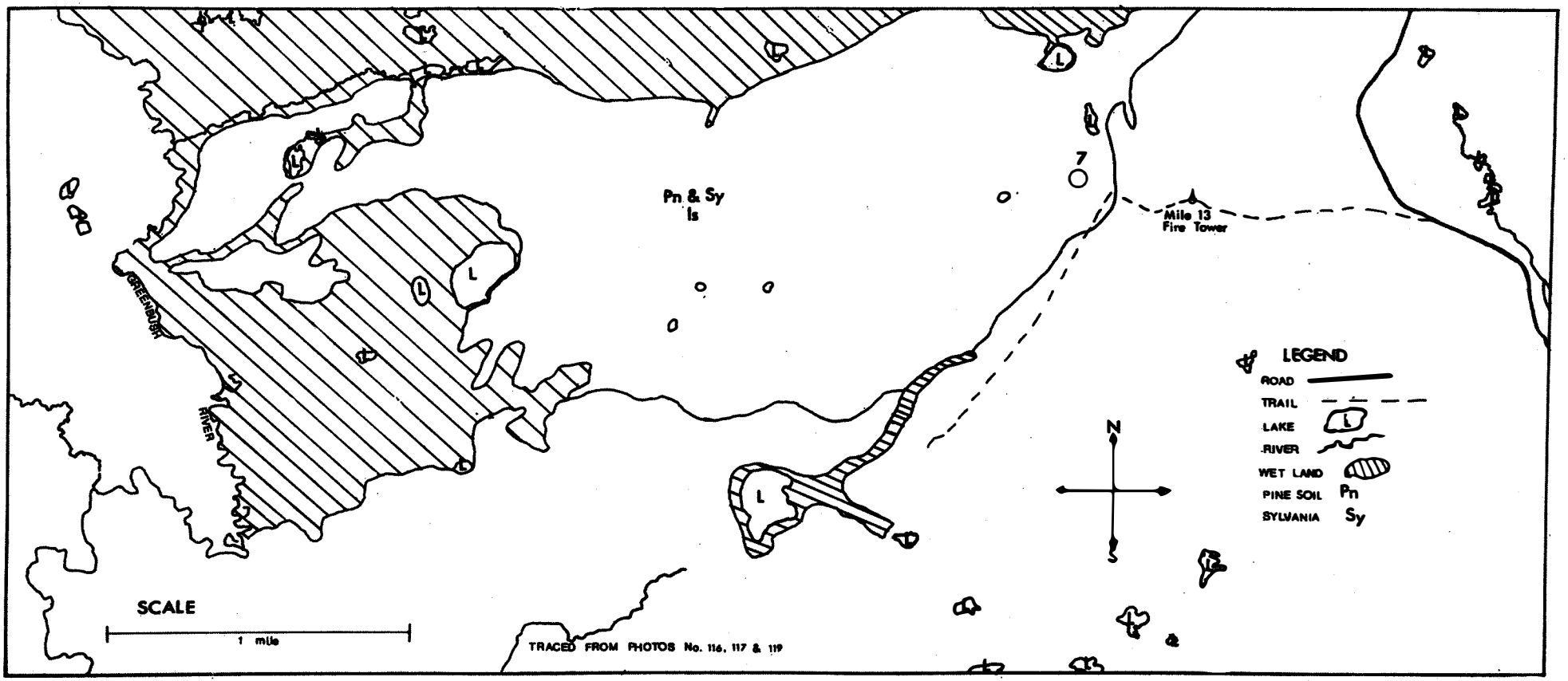

Figure 4. Detailed location of Site 7.

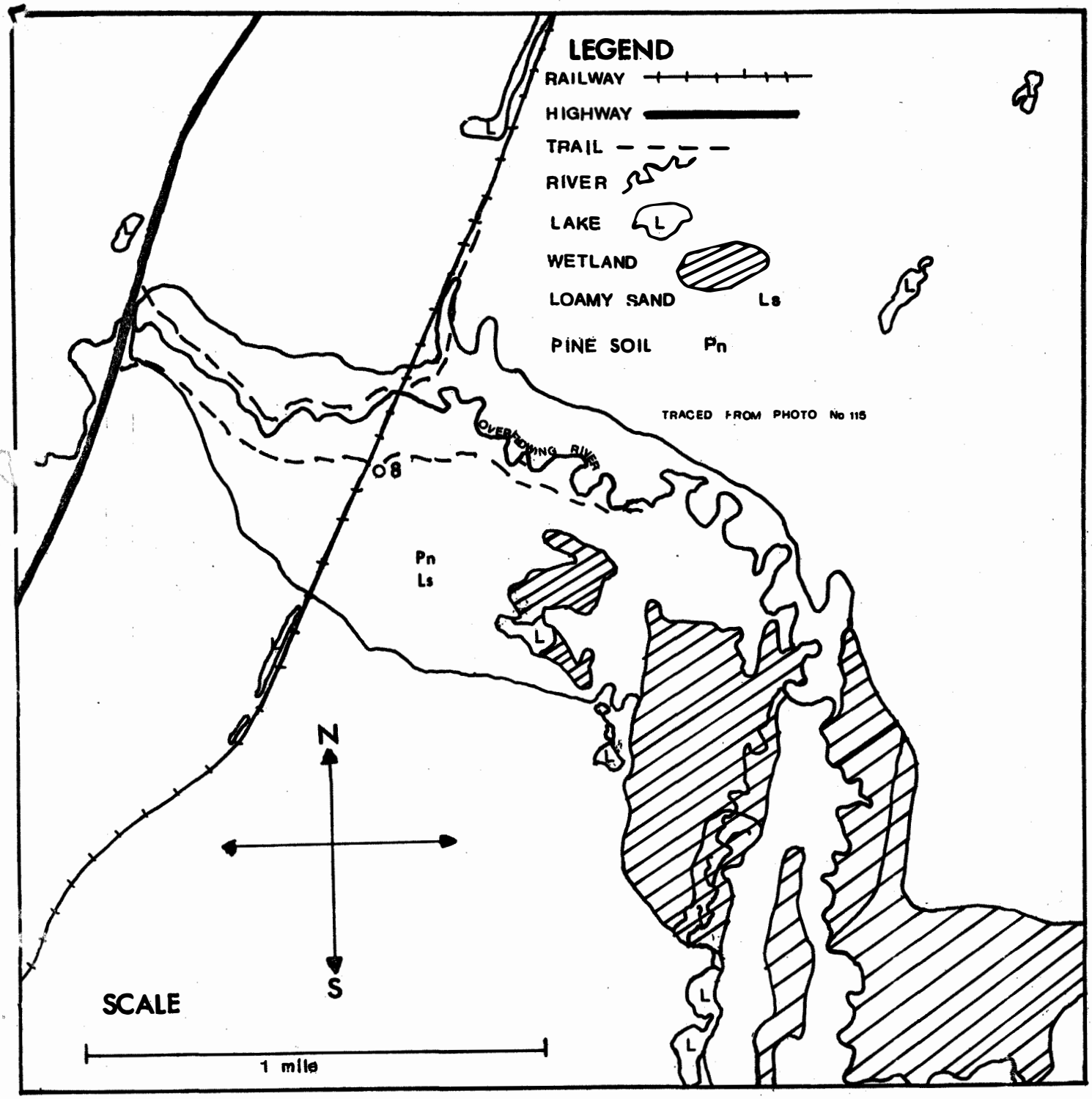

Figure 5. Detailed location of Site 8.