

2008 vascular plant inventory of supplementary wind turbine sites, Dalhousie Mountain, Nova Scotia



Squashberry (*Viburnum edule* – ranked S2 and Sensitive provincially), found 80m from the central point of turbine P1-19.

August 1, 2008

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for RMSenergy Ltd.

METHODS

The present (2008) study is supplemental to the survey conducted by Sean Blaney and David Mazerolle in June 2007, which covered all proposed turbine sites and corridors. Sean Blaney covered six turbine sites in 2008, along with a linear powerline corridor, all within the general area covered in 2007. This report covers only the 2008 survey results and the 2007 results from the immediate area of the six turbine sites and powerline corridor covered in 2008.

Vascular Plant Inventory

I visited the study site on June 23, 2008, spending 7.5 hours on site. Figure 1 indicates site coverage in 2008 and in 2007 within the same areas, as recorded by a Garmin GPS 76Cx set to record location approximately every 15 seconds while moving (the “more often” track point setting). For certain turbine sites (P1-4, I visited the proposed site but was driven between the sites, meaning I covered only the turbine site itself and not the corridors between sites (which were along existing logging roads through largely cut-over forest with extensive conifer plantations). Figure 1 distinguishes areas walked vs. driven. I had pre-programmed the proposed turbine sites into a GPS unit before fieldwork and at each turbine site I took photographs, recorded notes on species composition, stand age for forested sites and any obvious disturbance history of the plant community present. I concentrated my search efforts on the footprint of the proposed development sites.

I compiled a full vascular plant list for the site as a whole and for plant species tracked by the Atlantic Canada Conservation Data Centre (those ranked S1, S2, S3 or S3S4 in Nova Scotia, for which all locations are databased), I recorded GPS locations along with habitat descriptions and more precise estimates of local abundance. Definitions for S-ranks and for Nova Scotia National General Status ranks (the primary ranks by which species’ significance is determined by Nova Scotia Department of Natural Resources), are given below. Both sets of ranks for Nova Scotia were developed through the consensus of the NS Flora Ranking Committee, led through the cooperation of NS Department of Natural Resources (NS DNR) and Atlantic Canada Conservation Data Centre. The ranks reflect the best understanding of plant status at the time of ranking, but are subject to revision as new information becomes available.

Definitions of provincial (subnational) ranks (S-ranks):

- S1 Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
- S2 Rare throughout its range in the province (usually 6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
- S3 Uncommon throughout its range in the province (usually 21 to 100 occurrences), or found only in a restricted range, even if abundant in at some locations.

- S4 Usually widespread, fairly common throughout its range in the province (usually 100+ occurrences), and apparently secure, but the element is of long-term concern.
- S5 Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions (100+ occurrences).
- S#S# Numeric range rank: A range between two consecutive numeric ranks. Denotes range of uncertainty about the exact rarity of the Element (e.g., S1S2).
- SE Exotic: An exotic species established in the province (e.g., Purple Loosestrife or Coltsfoot); may be native in nearby regions.
- ? Is used as a qualifier indicating uncertainty: for numeric ranks, denotes inexactness, e.g., SE? denotes uncertainty of exotic status. (The ? qualifies the character immediately preceding it in the SRANK).

Definitions of National General Status Ranks (from *Wild Species: the General Status Program in Canada*, Lisa Twolan and Simon Nadeau, 2004, Canadian Wildlife Service, Ottawa)

- *Extirpated*: species that have disappeared from (or are no longer present in) a given geographic area but which occur in other areas
- *Extinct*: species that are extirpated worldwide (i.e., they no longer exist anywhere)
- *At Risk*: species for which a formal detailed risk assessment (COSEWIC assessment or provincial or territorial equivalent) has been completed, and which have been determined to be at risk of extirpation or extinction (i.e., Endangered) or are likely to become at risk of extirpation or extinction if limiting factors are not reversed (i.e., Threatened)
- *May Be At Risk*: species that may be at risk of extirpation or extinction and are, therefore, candidates for a detailed risk assessment by COSEWIC or the provincial or territorial equivalent
- *Sensitive*: species that are believed to not be at risk of extirpation or extinction but which may require special attention or protection to prevent them from becoming at risk
- *Secure*: species that are believed to not belong in the categories At Risk, May Be At Risk, Extirpated, Extinct, Accidental, or Exotic. This category includes some species that show a declining trend in numbers in Canada but which remain relatively widespread or abundant. In such instances, the decline will be highlighted by an asterisk and an associated comment.
- *Undetermined*: species for which insufficient data, information, or knowledge is available with which to reliably evaluate their general status
- *Not Assessed*: species that are known or believed to be present in the geographic area in Canada to which the general status rank applies but which have not yet been assessed
- *Exotic*: species that have been moved beyond their natural range as a result of human activity. In the *Wild Species 2005* report, exotic species have been purposefully excluded from all other categories.
- *Accidental*: species occurring infrequently and unpredictably outside their usual range

Results and Discussion

I. Site Coverage

Figure 1 maps the tracks covered during the site visits in 2007 and 2008. No site inventory is ever entirely complete, but with 2008 fieldwork combined with that in 2007, I sampled the full diversity of habitats within the turbine footprints. I am confident that the turbine sites are relatively thoroughly covered for vascular plants, especially for native species, and that there is a very low probability of significant numbers of additional rare vascular plant species being present within the turbine sites.

II. Plant Communities

General descriptions of the plant communities at the proposed turbine sites are given in Table 1, with detailed descriptions of species composition for herbaceous and shrub species available from Sean Blaney. Photos taken at the central point of each turbine are shown in Figures 3 to 10. The species composition of the plant communities at the proposed turbine sites and elsewhere in the study site were not rare in a provincial or even a local context. Potential issues relative to plant communities were as follows:

- 1) Most of the proposed footprint (50m radius) of turbine P1-46 was within a wetland, though upland areas were immediately adjacent to the 50m radius turbine footprint on three sides.
- 2) Turbine P1-19 was within intermediate-aged deciduous forest but the centre point was within 10m of a young spruce plantation. Moving the turbine centre roughly 50m northward into the plantation would eliminate impacts on the natural community that is in good condition.

Avoiding impacts on the more mature, natural forest where possible will improve the overall level of environmental impacts of the project, but obviously does not guarantee the persistence of any particular stand in a working landscape in which forest harvesting is actively taking place.

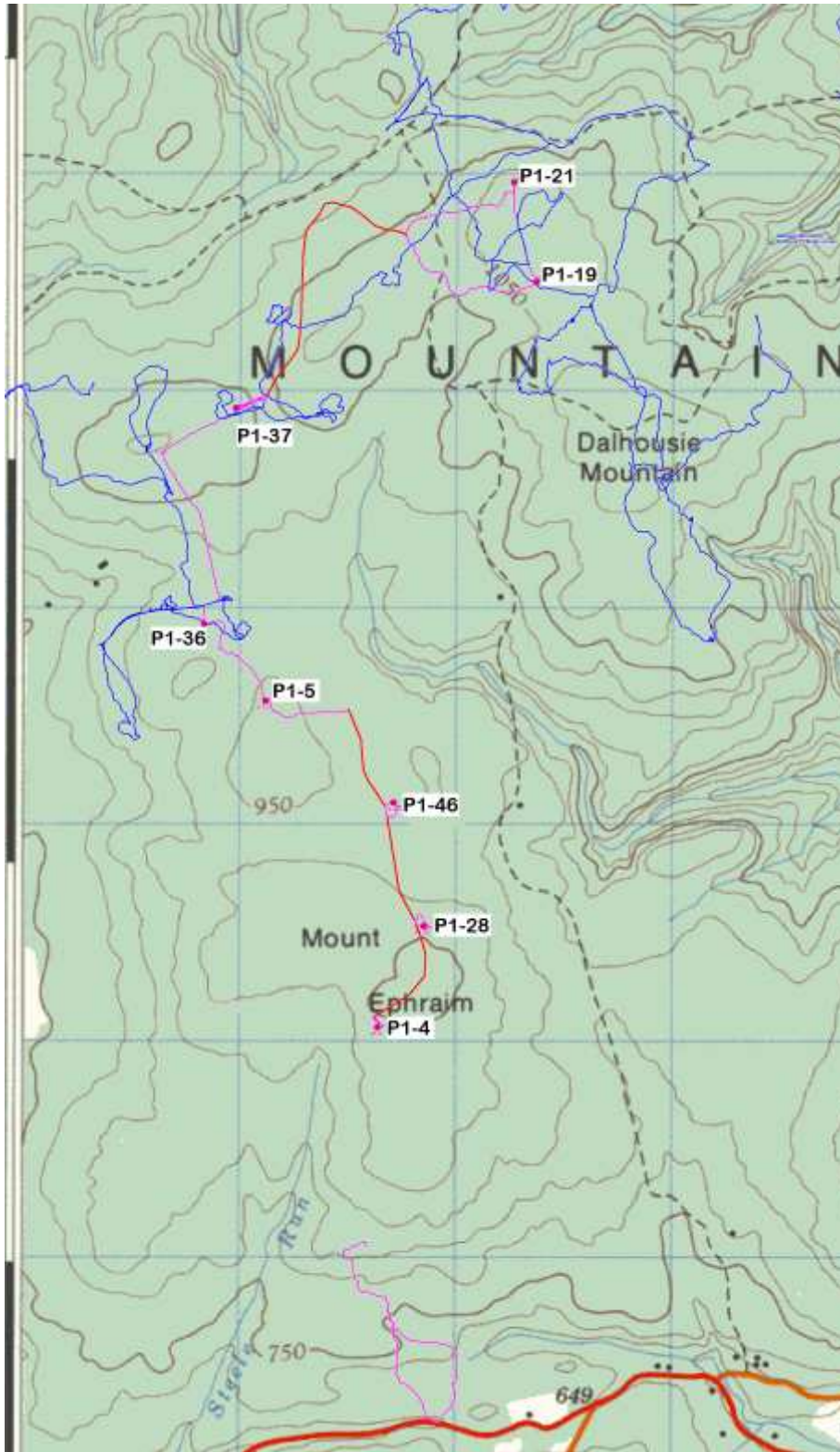


Figure 1. Map of site coverage within area surveyed in 2008. The labelled turbine sites are indicated by pink dots. Magenta lines are areas walked in 2008, red lines are areas driven in 2008, blue lines are areas walked in 2007.

Table 1. Plant communities of proposed turbine sites surveyed in 2008. Turbine sites correspond to those mapped in Figure 1. Common names for species listed here are given in the site plant list in Table 2. Species names in round brackets () are minor constituents.

Turbine#	Estimated Stand Age	Tree Composition	% Tree Cover	Community Description	Notes on Turbine Placement
P1-4	20	Norway spruce, white spruce, yellow birch, balsam fir (white birch, gray birch)	65%	Young spruce plantation	No rare plant species or significant plant community concerns.
P1-28	20	Norway spruce, white spruce, yellow birch, balsam fir (white birch, gray birch)	80%	Young spruce plantation	No rare plant species or significant plant community concerns.
P1-46	8	[Balsam fir – 30%, white birch – 30%, yellow birch – 20%, gray birch – 20%, (trembling aspen)] – almost entirely tall saplings	~10% as trees, 40% as saplings	Regenerating clearcut of peaty conifer swamp and adjacent upland; wettest portion of 50m radius circle around proposed turbine is the northeast quadrant, outer margins of other quadrants extend outside of wetland	No rare plant species or significant plant community concerns. Wetland the only potential issue with this site.
P1-5	15	Black or red spruce – 50%, balsam fir – 40%, white spruce – 10%	60%	Young spruce plantation, pre-commercial thinning about 4 years ago	No rare plant species or significant plant community concerns.
P1-36	15	Balsam fir, red or black spruce	35%	Open, regenerating mixed forest following cutting	No rare plant species or significant plant community concerns.
P1-37	25	Norway spruce, white spruce, balsam fir	80%	Young spruce plantation	No rare plant species or significant plant community concerns.
P1-21	15	Yellow birch – 60%, sugar maple – 20%, balsam fir – 20%, (striped maple)	95%	Centre of turbine site is on small logging trail regenerated to old field species but most of proposed footprint is within young deciduous forest regenerating following clearcutting	No rare plant species or significant plant community concerns.
P1-19	50	Sugar maple – 60%, yellow birch – 30%, beech – 10%	85%	Intermediate-aged deciduous forest near edge of recently cut deciduous forest converted to spruce plantation	Dwarf Ginseng (S3-Secure) present at turbine centre point. Squashberry (S2 – Sensitive, and very rare on mainland NS) occurs 80m WSW of turbine site. Moving turbine impacts into adjacent plantation would reduce impacts on natural community here.

III. Vascular Plants

Table 2 lists the 266 vascular plant taxa (223 native, 43 exotic) identified during fieldwork in 2007 and 2008 with their provincial status under both the S-rank system used continent-wide by all conservation data centres and the National General Status rank system, used by each province and territory.

Table 2. Vascular plants recorded in the study area, with abundance estimates and provincial status ranks. Site Status codes and provincial S-ranks are defined above. Taxonomy follows Kartesz (1999) – *Synthesis of the North American Flora*, CD-ROM. Status ranks in square brackets refer to an indefinite identification for which all potential species have the same rank.

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
LYCOPODIACEAE	Clubmoss Family				
<i>Huperzia lucidula</i>	Shining Fir-Clubmoss	c	S5	Secure	
<i>Lycopodium annotinum</i>	Stiff Clubmoss	r	S5	Secure	
<i>Lycopodium clavatum</i>	Running Pine	r	S5	Secure	
<i>Lycopodium dendroideum</i>	Treelike Clubmoss	f	S4?	Secure	
EQUISETACEAE	Horsetail Family				
<i>Equisetum arvense</i>	Field Horsetail	c	S5	Secure	
<i>Equisetum sylvaticum</i>	Woodland Horsetail	c	S5	Secure	
OSMUNDACEAE	Flowering-Fern Family				
<i>Osmunda cinnamomea</i>	Cinnamon Fern	c	S5	Secure	
<i>Osmunda claytoniana</i>	Interrupted Fern	c	S5	Secure	
DENNSTAEDTIACEAE	Hay-Scented Fern Family				
<i>Dennstaedtia punctilobula</i>	Eastern Hay-Scented Fern	c	S5	Secure	
<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	Bracken Fern	f	S5	Secure	
THELYPTERIDACEAE	Marsh-Fern Family				
<i>Phegopteris connectilis</i>	Northern Beech Fern	c	S5	Secure	
<i>Thelypteris noveboracensis</i>	New York Fern	c	S5	Secure	
DRYOPTERIDACEAE	Wood-Fern Family				
<i>Athyrium filix-femina</i>	Lady-Fern	c	S5	Secure	
<i>Deparia acrostichoides</i>	Silvery Spleenwort	c	S4	Secure	
<i>Dryopteris campyloptera</i>	Mountain Wood-Fern	c	S5	Secure	
<i>Dryopteris carthusiana</i>	Spinulose Shield Fern	r	S5	Secure	
<i>Dryopteris cristata</i>	Crested Shield-Fern	u	S5	Secure	
<i>Dryopteris intermedia</i>	Evergreen Woodfern	c	S5	Secure	
<i>Gymnocarpium dryopteris</i>	Northern Oak Fern	c	S5	Secure	
<i>Matteuccia struthiopteris</i>	Ostrich Fern	f	S5	Secure	
<i>Onoclea sensibilis</i>	Sensitive Fern	c	S5	Secure	
<i>Polystichum acrostichoides</i>	Christmas Fern	c	S5	Secure	
<i>Polystichum braunii</i>	Braun's Holly-Fern	r	S3S4	Secure	
PINACEAE	Pine Family				
<i>Abies balsamea</i>	Balsam Fir	c	S5	Secure	
<i>Picea abies</i>	Norway Spruce	c	SE	Exotic	planted only
<i>Picea glauca</i>	White Spruce	c	S5	Secure	
<i>Picea mariana</i>	Black Spruce	r	S5	Secure	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
<i>Picea rubens</i>	Red Spruce	f	S5	Secure	
<i>Tsuga canadensis</i>	Eastern Hemlock	r	S4S5	Secure	
RANUNCULACEAE	Buttercup Family				
<i>Actaea rubra</i>	Red Baneberry	c	S5	Secure	
<i>Aquilegia vulgaris</i>	European Columbine	r	SE	Exotic	
<i>Coptis trifolia</i>	Goldthread	c	S5	Secure	
<i>Hepatica nobilis var. obtusa</i>	Round-Leaved Hepatica	r	S1	May be at-risk	
<i>Ranunculus abortivus</i>	Kidney-Leaved Buttercup	c	S4S5	Secure	
<i>Ranunculus acris</i>	Tall Butter-Cup	u	SE	Exotic	
<i>Ranunculus recurvatus</i>	Hooked Crowfoot	f	S4	Secure	
<i>Ranunculus repens</i>	Creeping Butter-Cup	c	SE	Exotic	
<i>Thalictrum pubescens</i>	Tall Meadow-Rue	c	S5	Secure	
FUMARIACEAE	Fumitory Family				
<i>Dicentra cucullaria</i>	Dutchman's Breeches	c	S4	Secure	
MYRICACEAE	Bayberry Family				
<i>Morella pensylvanica</i>	Northern Bayberry	r	S5	Secure	
FAGACEAE	Beech Family				
<i>Fagus grandifolia</i>	American Beech	c	S5	Secure	
BETULACEAE	Birch Family				
<i>Alnus incana ssp. rugosa</i>	Speckled Alder	u	S5	Secure	
<i>Alnus viridis ssp. crispa</i>	Green Alder	r	S5	Secure	
<i>Betula alleghaniensis</i>	Yellow Birch	c	S5	Secure	
<i>Betula papyrifera var. papyrifera</i>	Heart-Leaved Paper Birch	c	S5	Secure	
<i>Betula populifolia</i>	Gray Birch	c	S5	Secure	
<i>Corylus cornuta</i>	Beaked Hazelnut	c	S5	Secure	
<i>Ostrya virginiana</i>	Eastern Hop-Hornbeam	r	S5	Secure	
PORTULACACEAE	Purslane Family				
<i>Claytonia caroliniana</i>	Carolina Spring-Beauty	c	S4	Secure	
CARYOPHYLLACEAE	Pink Family				
<i>Moehringia lateriflora</i>	Grove Sandwort	r	S5	Secure	
<i>Stellaria borealis</i>	Northern Stitchwort	r	S4	Secure	
POLYGONACEAE	Smartweed Family				
<i>Polygonum cilinode</i>	Fringed Black Bindweed	f	S5	Secure	
<i>Polygonum hydropiper</i>	Marshpepper Smartweed	u	SE	Exotic	
<i>Polygonum sagittatum</i>	Arrow-Leaved Tearthumb	u	S5	Secure	
<i>Rumex acetosa</i>	Garden Sorrel	r	SE	Exotic	
<i>Rumex acetosella</i>	Sheep Sorrel	c	SE	Exotic	
<i>Rumex crispus</i>	Curly Dock	u	SE	Exotic	
<i>Rumex obtusifolius</i>	Bitter Dock	r	SE	Exotic	
CLUSIACEAE	St. John's-wort Family				
<i>Hypericum ellipticum</i>	Pale St. John's-Wort	r	S5	Secure	
<i>Hypericum perforatum</i>	A St. John's-Wort	f	SE	Exotic	
VIOLACEAE	Violet Family				
<i>Viola blanda</i>	Smooth White Violet	c	S5	Secure	
<i>Viola cucullata</i>	Marsh Blue Violet	c	S5	Secure	
<i>Viola macloskeyi</i>	Smooth White Violet	f	S5	Secure	
<i>Viola pubescens</i>	Downy Yellow Violet	r	S4	Secure	
<i>Viola renifolia</i>	Kidney-Leaf White Violet	r	S4	Secure	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
SALICACEAE	Willow Family				
<i>Populus grandidentata</i>	Large-Tooth Aspen	r	S5	Secure	
<i>Populus tremuloides</i>	Quaking Aspen	c	S5	Secure	
<i>Salix bebbiana</i>	Bebb's Willow	c	S5	Secure	
<i>Salix discolor</i>	Pussy Willow	c	S5	Secure	
<i>Salix eriocephala</i>	Heart-Leaved Willow	u	S5	Secure	
<i>Salix humilis</i>	Prairie Willow	u	S5	Secure	
<i>Salix petiolaris</i>	Slender Willow	r	S3	Secure	
<i>Salix pyrifolia</i>	Balsam Willow	u	S5	Secure	
BRASSICACEAE	Mustard Family				
<i>Barbarea vulgaris</i>	Yellow Rocket	r	SE	Exotic	
<i>Cardamine diphylla</i>	Two-Leaf Toothwort	c	S4	Secure	
<i>Cardamine pensylvanica</i>	Pennsylvania Bitter-Cress	c	S5	Secure	
ERICACEAE	Heath Family				
<i>Kalmia angustifolia</i>	Sheep-Laurel	u	S5	Secure	
<i>Ledum groenlandicum</i>	Common Labrador Tea	r	S5	Secure	
<i>Rhododendron canadense</i>	Rhodora	u	S5	Secure	
<i>Vaccinium angustifolium</i>	Late Lowbush Blueberry	c	S5	Secure	
<i>Vaccinium myrtilloides</i>	Velvetleaf Blueberry	r	S5	Secure	
PYROLACEAE	Pyrola Family				
<i>Moneses uniflora</i>	One-Flower Wintergreen	r	S5	Secure	
<i>Pyrola elliptica</i>	Shinleaf	u	S5	Secure	
MONOTROPACEAE	Indian Pipe Family				
<i>Monotropa uniflora</i>	Indian-Pipe	u	S5	Secure	
PRIMULACEAE	Primrose Family				
<i>Lysimachia terrestris</i>	Swamp Loosestrife	r	S5	Secure	
<i>Trientalis borealis</i>	Northern Starflower	c	S5	Secure	
GROSSULARIACEAE	Gooseberry Family				
<i>Ribes glandulosum</i>	Skunk Currant	c	S5	Secure	
<i>Ribes hirtellum</i>	Smooth Gooseberry	u	S5	Secure	
<i>Ribes lacustre</i>	Bristly Black Currant	u	S5	Secure	
<i>Ribes triste</i>	Swamp Red Currant	u	S4	Secure	
CRASSULACEAE	Stonecrop Family				
<i>Hylotelephium telephium</i>	Witch's-Moneybags	r	SE	Exotic	
SAXIFRAGACEAE	Saxifrage Family				
<i>Chrysosplenium americanum</i>	American Golden-Saxifrage	f	S5	Secure	
<i>Mitella nuda</i>	Naked Bishop's-Cap	c	S5	Secure	
ROSACEAE	Rose Family				
<i>Agrimonia striata</i>	Woodland Agrimony	r	S5	Secure	
<i>Amelanchier bartramiana hybrid</i>	Bartram's Serviceberry x serviceberry species	r			
<i>Amelanchier interior</i>	Shadbush	u	S?	Secure	ID probable only
<i>Amelanchier laevis</i>	Allegheny Service-Berry	r	S5	Secure	ID probable only vs. <i>A. arborea</i>
<i>Crataegus monogyna</i>	A Hawthorn	r	SE	Exotic	
<i>Fragaria virginiana</i>	Virginia Strawberry	c	S5	Secure	
<i>Geum macrophyllum</i>	Large-Leaved Avens	c	S5	Secure	
<i>Geum rivale</i>	Purple Avens	f	S5	Secure	
<i>Photinia melanocarpa</i>	Black Chokeberry	r	S5	Secure	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
<i>Potentilla norvegica</i> ssp. <i>monspeliensis</i>	Norwegian Cinquefoil	u	S5	Secure	
<i>Potentilla recta</i>	Sulphur Cinquefoil	r	SE	Exotic	
<i>Potentilla simplex</i>	Old-Field Cinquefoil	c	S5	Secure	
<i>Prunus pensylvanica</i>	Fire Cherry	f	S5	Secure	
<i>Prunus serotina</i>	Wild Black Cherry	r	S5	Secure	
<i>Prunus virginiana</i>	Choke Cherry	c	S5	Secure	
<i>Rosa virginiana</i>	Virginia Rose	r	S5	Secure	
<i>Rubus</i> (X <i>Hispidi</i> group)	Trailing Blackberry species	r			perhaps <i>R. provincialis</i>
<i>Rubus allegheniensis</i>	Allegheny Blackberry	r	S5	Secure	
<i>Rubus canadensis</i>	Smooth Blackberry	c	S5	Secure	
<i>Rubus idaeus</i> ssp. <i>strigosus</i>	American Red Raspberry	c	S5	Secure	
<i>Rubus pubescens</i>	Dwarf Red Raspberry	c	S5	Secure	
<i>Sorbus americana</i>	American Mountain-Ash	f	S5	Secure	
<i>Sorbus aucuparia</i>	European Mountain-Ash	r	SE	Exotic	
<i>Sorbus decora</i>	Northern Mountain-Ash	u	S4	Secure	
<i>Spiraea alba</i> var. <i>latifolia</i>	Northern Meadow-Sweet	u	S5	Secure	
<i>Spiraea tomentosa</i>	Hardhack Spiraea	r	S5	Secure	
FABACEAE	Bean Family				
<i>Lotus corniculatus</i>	Birds-Foot Trefoil	r	SE	Exotic	
<i>Trifolium campestre</i>	Low Hop Clover	r	SE	Exotic	
<i>Trifolium hybridum</i>	Alsike Clover	r	SE	Exotic	
<i>Trifolium pratense</i>	Red Clover	r	SE	Exotic	
<i>Trifolium repens</i>	White Clover	r	SE	Exotic	
<i>Vicia cracca</i>	Tufted Vetch	u	SE	Exotic	
ONAGRACEAE	Evening-Primrose Family				
<i>Chamerion angustifolium</i>	Fireweed	c	S5	Secure	
<i>Circaea alpina</i>	Small Enchanter's Nightshade	c	S5	Secure	
<i>Epilobium ciliatum</i>	Hairy Willow-Herb	f	S5	Secure	
<i>Epilobium leptophyllum</i>	Linear-Leaved Willow-Herb	u	S5	Secure	
<i>Epilobium palustre</i>	Marsh Willow-Herb	r	S5	Secure	
<i>Oenothera biennis</i> or <i>parviflora</i>	Evening-Primrose species	f	[S5]	[Secure]	
<i>Oenothera perennis</i>	Small Sundrops	f	S5	Secure	
CORNACEAE	Dogwood Family				
<i>Cornus alternifolia</i>	Alternate-Leaf Dogwood	c	S5	Secure	
<i>Cornus canadensis</i>	Dwarf Dogwood	c	S5	Secure	
ACERACEAE	Maple Family				
<i>Acer pensylvanicum</i>	Striped Maple	c	S5	Secure	
<i>Acer rubrum</i>	Red Maple	c	S5	Secure	
<i>Acer saccharum</i>	Sugar Maple	c	S5	Secure	
<i>Acer spicatum</i>	Mountain Maple	c	S5	Secure	
OXALIDACEAE	Wood-Sorrel Family				
<i>Oxalis montana</i>	White Wood-Sorrel	c	S5	Secure	
<i>Oxalis stricta</i>	Upright Yellow Wood-Sorrel	u	S5	Secure	
GERANIACEAE	Geranium Family				
<i>Geranium robertianum</i>	Herb-Robert	r	S4S5	Secure	
BALSAMINACEAE	Touch-Me-Not Family				
<i>Impatiens capensis</i>	Spotted Jewel-Weed	c	S5	Secure	

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ARALIACEAE	Sarsaparilla Family				
<i>Aralia hispida</i>	Bristly Sarsaparilla	r	S5	Secure	
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	c	S5	Secure	
<i>Panax trifolius</i>	Dwarf Ginseng	c	S3	Secure	
APIACEAE	Carrot Family				
<i>Hydrocotyle americana</i>	American Water-Pennywort	u	S5	Secure	
<i>Osmorhiza claytonii</i>	Hairy Sweet-Cicely	u	S4S5	Secure	
SOLANACEAE	Nightshade Family				
<i>Solanum dulcamara</i>	Climbing Nightshade	r	SE	Exotic	
LAMIACEAE	Mint Family				
<i>Galeopsis tetrahit</i>	Brittle-Stem Hempnettle	f	SE	Exotic	ID refers to the species in the broad sense, including <i>G. bifida</i>
<i>Lycopus americanus</i>	American Bugleweed	r	S5	Secure	
<i>Lycopus uniflorus</i>	Northern Bugleweed	c	S5	Secure	
<i>Mentha arvensis</i>	Corn Mint	r	S5	Secure	
<i>Prunella vulgaris</i>	Self-Heal	c	S5	Secure	
<i>Scutellaria lateriflora</i>	Mad Dog Skullcap	c	S5	Secure	
PLANTAGINACEAE	Plantain Family				
<i>Plantago lanceolata</i>	English Plantain	r	SE	Exotic	
<i>Plantago major</i>	Nipple-Seed Plantain	f	SE	Exotic	
OLEACEAE	Olive Family				
<i>Fraxinus americana</i>	White Ash	f	S5	Secure	
SCROPHULARIACEAE	Snapdragon Family				
<i>Chelone glabra</i>	White Turtlehead	c	S5	Secure	
<i>Verbascum thapsus</i>	Great Mullein	r	SE	Exotic	
<i>Veronica officinalis</i>	Gypsy-Weed	c	S5SE	Exotic	
<i>Veronica serpyllifolia</i> ssp. <i>serpyllifolia</i>	Thyme-Leaved Speedwell	u	SE	Exotic	
RUBIACEAE	Bedstraw Family				
<i>Galium asprellum</i>	Rough Bedstraw	c	S5	Secure	
<i>Galium mollugo</i>	Great Hedge Bedstraw	u	SE	Exotic	
<i>Galium palustre</i>	Marsh Bedstraw	c	S5	Secure	
<i>Galium trifidum</i>	Small Bedstraw	u	S5	Secure	ID refers to the species in the broad sense, including <i>G. tinctorium</i>
<i>Galium triflorum</i>	Sweet-Scent Bedstraw	c	S5	Secure	
<i>Mitchella repens</i>	Partridge-Berry	r	S5	Secure	
CAPRIFOLIACEAE	Honeysuckle Family				
<i>Diervilla lonicera</i>	Northern Bush-Honeysuckle	u	S5	Secure	
<i>Linnaea borealis</i>	Twinflower	f	S5	Secure	
<i>Lonicera canadensis</i>	American Fly-Honeysuckle	c	S5	Secure	
<i>Sambucus racemosa</i>	Red Elderberry	c	S5	Secure	
<i>Viburnum edule</i>	Squashberry	r	S2	Sensitive	
<i>Viburnum lantanoides</i>	Alderleaf Viburnum	f	S5	Secure	
<i>Viburnum nudum</i> var. <i>cassinoides</i>	Wild Raisin	r	S5	Secure	
<i>Viburnum opulus</i> var. <i>americanum</i>	Highbush Cranberry	r	S5	Secure	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
ASTERACEAE	Aster Family				
<i>Achillea millefolium</i>	Common Yarrow	c	S5	Secure	
<i>Anaphalis margaritacea</i>	Pearly Everlasting	c	S5	Secure	
<i>Antennaria neglecta or howellii</i>	Pussytoes species	r			neither species rare
<i>Arctium minus</i>	Lesser Burdock	r	SE	Exotic	
<i>Bidens frondosa</i>	Devil's Beggar-Ticks	r	S5	Secure	
<i>Cirsium arvense</i>	Creeping Thistle	r	SE	Exotic	
<i>Doellingeria umbellata</i>	Parasol White-Top	c	S5	Secure	
<i>Erigeron strigosus</i>	Daisy Fleabane	u	S5	Secure	
<i>Eupatorium maculatum</i>	Spotted Joe-Pye Weed	u	S5	Secure	
<i>Eupatorium perfoliatum</i>	Common Boneset	r	S5	Secure	
<i>Eurybia macrophylla</i>	Large-Leaf Wood-Aster	r	S5	Secure	
<i>Euthamia graminifolia</i>	Flat-Top Fragrant-Golden-Rod	c	S5	Secure	
<i>Hieracium caespitosum</i>	Meadow Hawkweed	c	SE	Exotic	
<i>Hieracium canadense</i>	Canada Hawkweed	r	S4S5	Secure	
<i>Hieracium lachenalii</i>	Common Hawkweed	c	SE	Exotic	
<i>Hieracium pilosella or x flagellare</i>	Hawkweed species (white leaf undersides)	c	[SE]	[Exotic]	
<i>Hieracium scabrum</i>	Rough Hawkweed	u	S5	Secure	
<i>Hieracium x floribundum</i>	Smoothish Hawkweed	f	SE	Exotic	
<i>Lactuca biennis</i>	Tall Blue Lettuce	f	S5	Secure	
<i>Lactuca canadensis</i>	Canada Lettuce	u	S5	Secure	
<i>Leontodon autumnalis</i>	Autumn Hawkbit	u	SE	Exotic	
<i>Leucanthemum vulgare</i>	Oxeye Daisy	f	SE	Exotic	
<i>Leucanthemum vulgare</i>	Oxeye Daisy	c	SE	Exotic	
<i>Matricaria discoidea</i>	Pineapple-Weed Chamomile	r	SE	Exotic	
<i>Oclemena acuminata</i>	Whorled Aster	c	S5	Secure	
<i>Packera schweinitziana</i>	Robbins Squaw-Weed	c	S4S5	Secure	
<i>Petasites frigidus var. palmatus</i>	Sweet Coltsfoot	r	S4S5	Secure	
<i>Prenanthes altissima</i>	Tall Rattlesnake-root	c	S4S5	Secure	
<i>Prenanthes trifoliolata</i>	Three-Leaved Rattlesnake-root	u	S5	Secure	
<i>Senecio jacobaea</i>	Tansy Ragwort	u	SE	Exotic	
<i>Solidago bicolor</i>	White Goldenrod	u	S5	Secure	
<i>Solidago canadensis</i>	Canada Goldenrod	c	S5	Secure	
<i>Solidago flexicaulis</i>	Broad-Leaved Goldenrod	f	S5	Secure	
<i>Solidago juncea</i>	Early Goldenrod	r	S5	Secure	
<i>Solidago macrophylla</i>	Large-Leaf Goldenrod	u	S4	Secure	
<i>Solidago puberula</i>	Downy Goldenrod	c	S5	Secure	
<i>Solidago rugosa</i>	Rough-Leaf Goldenrod	c	S5	Secure	
<i>Solidago uliginosa</i>	Bog Goldenrod	u	S5	Secure	
<i>Sonchus arvensis</i>	Field Sowthistle	r	SE	Exotic	
<i>Symphotrichum lateriflorum</i>	Farewell-Summer	c	S5	Secure	
<i>Symphotrichum novi-belgii</i>	New Belgium American-Aster	r	S5	Secure	
<i>Symphotrichum puniceum</i>	Swamp Aster	c	S5	Secure	
<i>Taraxacum officinale</i>	Common Dandelion	c	SE	Exotic	
<i>Tripleurospermum maritima</i>	False Mayweed	r	SE	Exotic	
<i>Tussilago farfara</i>	Colt's Foot	u	SE	Exotic	
ARACEAE	Arum Family				
<i>Arisaema triphyllum</i>	Swamp Jack-In-The-Pulpit	r	S4S5	Secure	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
<i>Calla palustris</i>	Wild Calla	r	S4	Secure	
JUNCACEAE	Rush Family				
<i>Juncus balticus</i> var. <i>littoralis</i>	Baltic Rush	r	S5	Secure	
<i>Juncus brevicaudatus</i>	Narrow-Panicled Rush	r	S5	Secure	ID probable only – very young
<i>Juncus bufonius</i>	Toad Rush	u	S5	Secure	
<i>Juncus effusus</i>	Soft Rush	c	S5	Secure	
<i>Juncus filiformis</i>	Thread Rush	r	S5	Secure	
<i>Juncus tenuis</i>	Slender Rush	f	S5	Secure	
<i>Luzula acuminata</i>	Hairy Woodrush	r	S5	Secure	
<i>Luzula multiflora</i>	Common Woodrush	c	S5	Secure	
CYPERACEAE	Sedge Family				
<i>Carex arctata</i>	Black Sedge	c	S5	Secure	
<i>Carex brunnescens</i> ssp. <i>sphaerostachya</i>	Brownish Sedge	c	S5	Secure	
<i>Carex canescens</i>	Hoary Sedge	u	S5	Secure	
<i>Carex communis</i>	Fibrous-Root Sedge	c	S5	Secure	
<i>Carex crawfordii</i>	Crawford Sedge	r	S5	Secure	
<i>Carex crinita</i>	Fringed Sedge	r	S4S5	Secure	
<i>Carex debilis</i>	White-Edge Sedge	c	S5	Secure	
<i>Carex deweyana</i>	Short-Scale Sedge	c	S4	Secure	
<i>Carex disperma</i>	Softleaf Sedge	c	S5	Secure	
<i>Carex flava</i>	Yellow Sedge	u	S5	Secure	
<i>Carex gracillima</i>	Graceful Sedge	u	S4S5	Secure	
<i>Carex gynandra</i>	A Sedge	c	S5	Secure	
<i>Carex interior</i>	Inland Sedge	f	S4S5	Secure	ID probable only
<i>Carex intumescens</i>	Bladder Sedge	c	S5	Secure	
<i>Carex lenticularis</i>	Shore Sedge	r	S4	Secure	
<i>Carex leptalea</i>	Bristly-Stalk Sedge	c	S5	Secure	
<i>Carex leptoneuria</i>	Finely-Nerved Sedge	c	S5	Secure	
<i>Carex magellanica</i> ssp. <i>irrigua</i>	A Sedge	r	S5	Secure	
<i>Carex novae-angliae</i>	New England Sedge	c	S5	Secure	
<i>Carex pallescens</i>	Pale Sedge	u	S5	Secure	
<i>Carex projecta</i>	Necklace Sedge	c	S4S5	Secure	
<i>Carex scabrata</i>	Rough Sedge	u	S5	Secure	
<i>Carex scoparia</i>	Pointed Broom Sedge	f	S5	Secure	
<i>Carex stipata</i>	Stalk-Grain Sedge	c	S5	Secure	
<i>Carex torta</i>	Twisted Sedge	r	S5	Secure	
<i>Carex trisperma</i> var. <i>trisperma</i>	Three-Seed Sedge	u	S5	Secure	
<i>Eleocharis tenuis</i>	Slender Spike-Rush	r	S5	Secure	ID refers to the species in the broad sense, including <i>E. elliptica</i>
<i>Scirpus atrocinctus</i>	Black-Girdle Bulrush	r	S5	Secure	
<i>Scirpus cyperinus</i>	Cottongrass Bulrush	c	S5	Secure	ID probable only vs. <i>S. atrocinctus</i>
<i>Scirpus hattorianus</i>	Bulrush	f	S5	Secure	
<i>Scirpus microcarpus</i>	Small-Fruit Bulrush	f	S5	Secure	
POACEAE	Grass Family				
<i>Agrostis gigantea</i>	Black Bentgrass	u	SE	Exotic	
<i>Agrostis perennans</i>	Perennial Bentgrass	u	S4S5	Secure	ID probable only
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	u	SE	Exotic	

Species / Family Name	Family / Species Common Name	Site Status	NS S-rank	NS General Status Rank	Note
<i>Brachyelytrum septentrionale</i>	Bearded Short-Husk	u	S4S5	Secure	
<i>Bromus ciliatus</i>	Fringed Brome	r	S4S5	Secure	
<i>Calamagrostis canadensis</i>	Blue-Joint Reedgrass	f	S5	Secure	
<i>Cinna latifolia</i>	Slender Wood Reedgrass	c	S5	Secure	
<i>Dactylis glomerata</i>	Orchard Grass	r	SE	Exotic	
<i>Danthonia spicata</i>	Poverty Oat-Grass	c	S5	Secure	
<i>Dichantherium acuminatum</i>	Panic Grass	c	S5	Secure	
<i>Dichantherium boreale</i>	Northern Witchgrass	r	S5	Secure	
<i>Elymus repens</i>	Quackgrass	r	SE	Exotic	
<i>Festuca filiformis</i>	Hair Fescue	c	SE	Exotic	
<i>Festuca rubra</i>	Red Fescue	u	S5	Secure	
<i>Glyceria canadensis</i>	Canada Manna-Grass	r	S5	Secure	
<i>Glyceria striata</i>	Fowl Manna-Grass	c	S5	Secure	
<i>Milium effusum</i> var. <i>cisatlanticum</i>	Tall Millet-Grass	u	S3	Secure	
<i>Phalaris arundinacea</i>	Reed Canary Grass	u	S5	Secure	
<i>Phleum pratense</i>	Meadow Timothy	r	SE	Exotic	
<i>Poa alsodes</i>	Grove Meadow Grass	u	S4	Secure	
<i>Poa annua</i>	Annual Bluegrass	u	SE	Exotic	
<i>Poa compressa</i>	Canada Bluegrass	u	SE	Exotic	
<i>Poa palustris</i>	Fowl Bluegrass	f	S5	Secure	
<i>Poa pratensis</i>	Kentucky Bluegrass	c	S5	Secure	
<i>Poa saltuensis</i>	Drooping Bluegrass	r	S4S5	Secure	
<i>Torreyochloa pallida</i> var. <i>fernaldii</i>	Pale Manna Grass	r	S4S5	Secure	
TYPHACEAE	Cattail Family				
<i>Typha latifolia</i>	Broad-Leaf Cattail	r	S5	Secure	
LILIACEAE	Lily Family				
<i>Clintonia borealis</i>	Clinton Lily	c	S5	Secure	
<i>Erythronium americanum</i>	Yellow Trout-Lily	c	S4S5	Secure	
<i>Maianthemum canadense</i>	Wild Lily-of-The-Valley	c	S5	Secure	
<i>Maianthemum racemosum</i>	Solomon's-Plume	c	S4S5	Secure	
<i>Medeola virginiana</i>	Indian Cucumber-Root	f	S5	Secure	
<i>Polygonatum pubescens</i>	Downy Solomon's-Seal	c	S4S5	Secure	
<i>Streptopus amplexifolius</i>	Clasping Twisted-Stalk	f	S4S5	Secure	
<i>Streptopus lanceolatus</i>	Rosy Twistedstalk	c	S5	Secure	
<i>Trillium cernuum</i>	Nodding Trillium	f	S4	Secure	
<i>Trillium erectum</i>	Red Trillium	f	S3	Secure	
<i>Trillium undulatum</i>	Painted Trillium	r	S5	Secure	
IRIDACEAE	Iris Family				
<i>Sisyrinchium montanum</i>	Strict Blue-Eyed-Grass	u	S5	Secure	
ORCHIDACEAE	Orchid Family				
<i>Corallorhiza trifida</i>	Early Coralroot	u	S3	Secure	
<i>Cypripedium acaule</i>	Pink Lady's-Slipper	u	S5	Secure	
<i>Listera convallarioides</i>	Broad-Leaved Twayblade	r	S3	Secure	
<i>Platanthera dilatata</i>	Leafy White Orchis	u	S4S5	Secure	
<i>Platanthera orbiculata</i>	Large Roundleaf Orchid	r	S3	Secure	ID probable only vs. <i>P. macrophylla</i>
<i>Platanthera psycodes</i>	Small Purple-Fringe Orchis	u	S4	Secure	ID probable only vs. <i>P. grandiflora</i>

IV. Rare vascular plants

Six rare plant species tracked by the Atlantic Canada Conservation Data Centre (S-ranks of S1 to S3S4) were found on the site, with locations and status given in Table 2. Their status on the site and within Nova Scotia is described in detail below. Only one of these rare species has General Status rank of *Maybe at Risk* or *Sensitive*, which make them of concern to NS DNR. The remaining seven species are ranked *Secure* in Nova Scotia under the National General Status of Wildlife process and are thus of limited concern to NS DNR. Figure 2 maps rare species locations.

Table 2. Rare plant observations from 2007 and 2008 within area surveyed in 2008, with status ranks. Site numbers correspond to those mapped in Figure 2.

Site#	Species	Common Name	Latitude	Longitude	S-rank	General Status Rank	Year Observed
01	<i>Viburnum edule</i>	Squashberry	45.572369	-62.966668	S3	Sensitive	2007
10	<i>Corallorhiza trifida</i>	Early Coralroot	45.56936	-62.968342	S3	Secure	2007
31	<i>Panax trifolius</i>	Dwarf Ginseng	45.574426	-62.977276	S3	Secure	2007
32	<i>Panax trifolius</i>	Dwarf Ginseng	45.573863	-62.976953	S3	Secure	2007
33	<i>Panax trifolius</i>	Dwarf Ginseng	45.572501	-62.980501	S3	Secure	2007
34	<i>Panax trifolius</i>	Dwarf Ginseng	45.568403	-62.984621	S3	Secure	2007
35	<i>Panax trifolius</i>	Dwarf Ginseng	45.569361	-62.987024	S3	Secure	2007
36	<i>Panax trifolius</i>	Dwarf Ginseng	45.560894	-62.99049	S3	Secure	2007
62	<i>Panax trifolius</i>	Dwarf Ginseng	45.571249	-62.964063	S3	Secure	2007
63	<i>Panax trifolius</i>	Dwarf Ginseng	45.570521	-62.965492	S3	Secure	2007
69	<i>Panax trifolius</i>	Dwarf Ginseng	45.56951	-62.969589	S3	Secure	2007
71	<i>Panax trifolius</i>	Dwarf Ginseng	45.57363	-62.964401	S3	Secure	2007
119	<i>Salix petiolaris</i>	Slender Willow	45.57666	-62.975319	S3	Secure	2008
121	<i>Panax trifolius</i>	Dwarf Ginseng	45.573963	-62.96875	S3	Secure	2008
122	<i>Viburnum edule</i>	Squashberry	45.57368	-62.969694	S3	Sensitive	2008
124	<i>Milium effusum</i> var. <i>cisatlanticum</i>	Wild Millet	45.533928	-62.979573	S3	Secure	2008
126	<i>Trillium erectum</i>	Red Trillium	45.53371	-62.980129	S3	Secure	2008

i) Very rare species, of concern to Nova Scotia Department of Natural Resources, mapped in Figure 2.

Squashberry - *Viburnum edule* (S2, Sensitive)

In 2007, One small patch was found over a 3m x 3m area in balsam fir – black spruce swamp 250m southeast of turbine P1-19. This represented the first mainland Nova Scotia record for this northern species, 190 km from the nearest records in Cape Breton, where it is locally fairly frequent along rivers in the Cape Breton Highlands and 160 km from records in Fundy National Park in New Brunswick. In 2008, another small population of about 15 shoots in 203 clones were found in a moist area within mature sugar maple – yellow birch forest, 80m from the central point of turbine P1-19.

ii) Marginally rare species, tracked by Atlantic Canada Conservation Data Centre but of limited concern to Nova Scotia Department of Natural Resources, mapped in Figure 3 except for Dwarf Ginseng

Early Coralroot - *Corallorhiza trifida* (S3, Secure)

Plants were seen in three areas in 2007, one of which was within 500m of turbine P1-19 (sites separated by 90m). This site was unusually large for the species with hundreds of stems. In all cases, plants were in small, wet, seepage areas with *Sphagnum* moss and Cinnamon Fern (*Osmunda cinnomomea*) within sugar maple – yellow birch forest. The species is widespread but uncommon across northern Nova Scotia from the Annapolis Valley to Cape Breton and is rare in southern Nova Scotia.

Tall Millet-Grass - *Milium effusum* var. *cisatlanticum* (S3, Secure)

Plants were seen in three sites outside the area surveyed in 2008 and at a single site in 2008 in mature sugar maple-beech forest along the proposed powerline south of the Mount Thom quarry. This grass species is uncommon to locally common in richer, higher elevation sugar maple forests in the Cape Split area, the Cobequid Mountains and in Cape Breton. It is very rare in lowland deciduous forests in Nova Scotia.

Dwarf Ginseng - *Panax trifolius* (S3, Secure)

This species was present in large numbers, primarily in more mature deciduous forests, in 54 recorded sites within the proposed development area (mapped in Figure 4), including many stretches where it was present for many metres. Recent 2007 fieldwork by Sean Blaney and the AC CDC in Cobequid Mountain sites between Portapique and Marshy Hope has found this species to be widespread and locally abundant in deciduous forests. If this level of abundance (which is not known in other regions of the Maritimes) is general across the eastern part of the Cobequid Mountains, this species' S-rank should be revised to S4. Dwarf Ginseng occurrences observed on site are mapped in Figure XX, but these undoubtedly under-represent the total distribution of the species in the study area. It appears to be present in most deciduous forest on-site. Because of the widespread occurrence of Dwarf Ginseng, avoiding impacts on more mature and less-disturbed forest habitats, where possible, is probably more valuable for conserving the natural heritage value of the site than is concern over particular Dwarf Ginseng populations, especially the few that occur in already significantly disturbed habitats. The locations where Dwarf Ginseng is most abundant do, however, tend to correlate with the highest quality deciduous forest habitats on site.

Red Trillium - *Trillium erectum* (S3, Secure)

This species was scattered in sugar maple forest outside the 2008 survey area, with only a few plants found at one site along the proposed powerline south of the Mount Thom quarry. It has a relatively limited distribution in Nova Scotia, being restricted to the Annapolis Valley and Cobequid Mountains north to about the New Glasgow area but it can be locally abundant within those regions to the point where it is a strong candidate for ranking revision to S4, which would remove it from the AC CDC tracking list.

Slender Willow – *Salix petiolaris* (S3, Secure)

Seven small clumps were observed over 2m in a moist area at the edge of a recently cut stand regenerated from an old field, 450m from turbine site P1-21. This species was not found in Nova Scotia until relatively recently (after 1969), but has recently been shown to be widely scattered in Cumberland County and occurring from the Stewiacke area south almost to Kejimikujik National Park. It often occurs in highly disturbed sites such as ditches or logging road margins and may be increasing in association with those habitats. As a result, it was given a General Status rank of Secure by the Nova Scotia Department of Natural Resources.

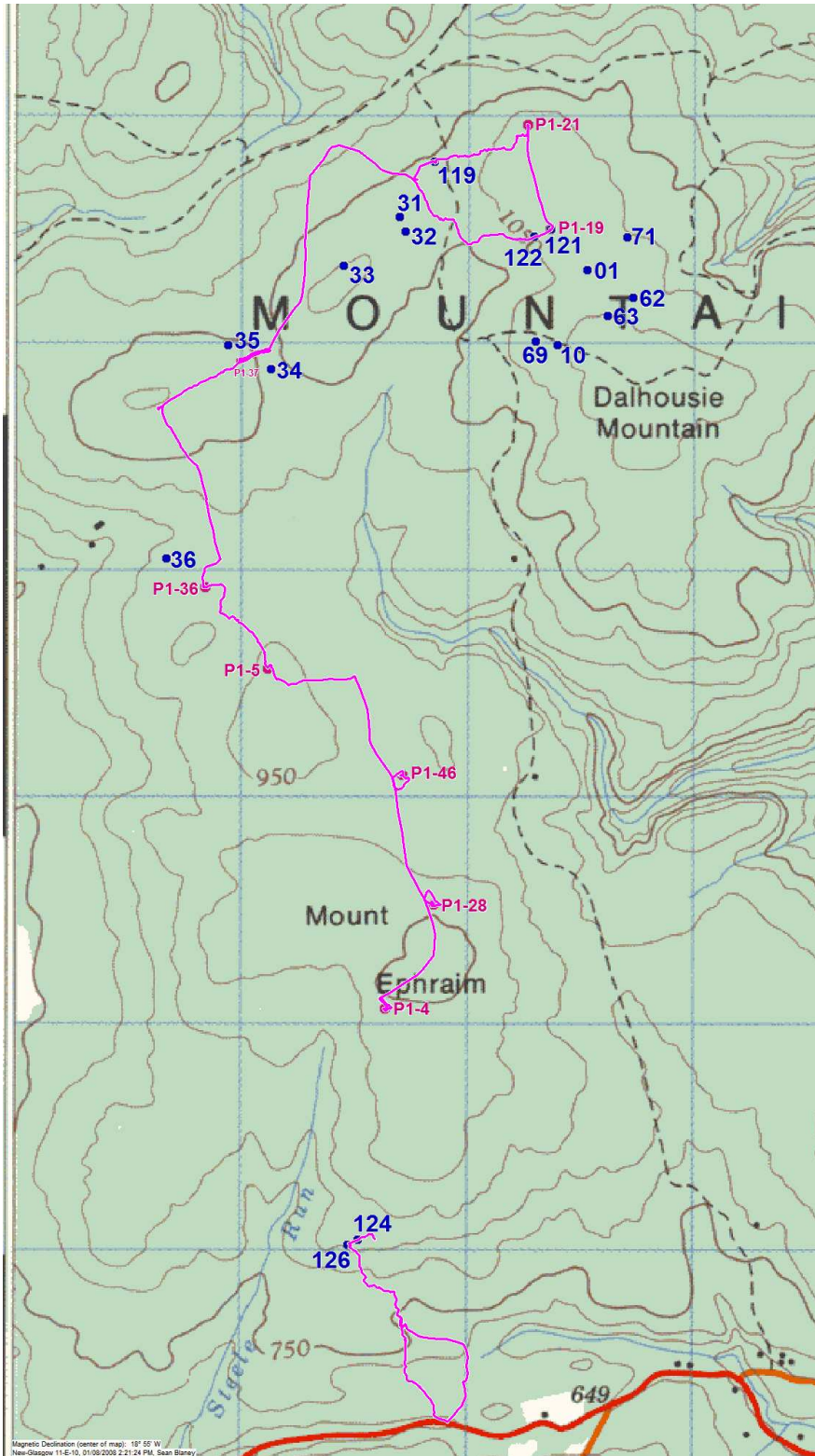


Figure 2. Rare vascular plant locations (blue numbered dots) relative to turbine locations (pink numbered dots) and tracks taken in the field in 2008 (magenta lines). Rare plant location numbers correspond to those given in Table 2.

V. *Photographs of proposed turbine sites*



Figure 3. Turbine site P1-4, looking in from the existing logging road. The turbine centre point is within the low trees at the back of the picture.

Figure 4. Turbine site P1-5 at turbine centre point.



Figure 5. Turbine site P1-19 at turbine centre point.



Figure 6. Turbine site P1-21 at turbine centre point.



Figure 7. Turbine site P1-28, from existing logging road. Turbine centre point is within the spruces at the back of the picture.



Figure 8. Turbine site P1-36 at turbine centre point.



Figure 9. Turbine P1-37, from turbine centre point.



Figure 10. Turbine P1-46, from turbine centre point.