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**Natural Environment Implications
of the
Terry Fox Drive Alignment
in the South March Highlands,

Kanata,
Regional Municipality of Ottawa-Carleton,
Ontario**

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INTRODUCTION

A review and assessment of the natural environment implications of the proposed Terry Fox Drive alignment between Richardson Side Road and Morgan's Grant subdivision, Kanata, has been undertaken in light of the recommendations of Region of Ottawa-Carleton Planning and Development Approvals Department (Tunnacliffe *in lit.*, 17 April 2000). This area is presently designated as Natural Environment Area (B) in the Regional Official Plan (Region of Ottawa-Carleton 1999) and, within Natural Environment System Strategy (NESS) Natural Area 539, contains a wide variety of Regionally uncommon to rare natural environment features and values (Brunton 1997). Selection of route 4-1 as the preferred route raises issues regarding environmental boundaries between the route 4-1 and the existing urban boundary (First Line road allowance).

The primary focus of this assessment, therefore, concerns the ecological implications for the "115 ha area of NEA land *between* the option 4-1 and 4-2 alignments which would be affected by the selection of alignment option 4-1 (hereafter, the 4-1/4-2 study area) (Figure 1). The present investigation considers the following questions:

- 1) would the assessment of significance and recommended Natural Environment Areas be likely to change significantly given the Terry Fox Drive Extension Alignment 4-1 ?
- 2) what factors or ecological functions within the significant areas, if any, are likely to take on added importance given the Terry Fox Drive extension ?

To answer these questions, existing documentation was reviewed, particularly the 1992 natural environment inventories of the South March Highlands and Kanata Lakes areas (Brunton 1992a; 1992b), and new field investigations were undertaken.

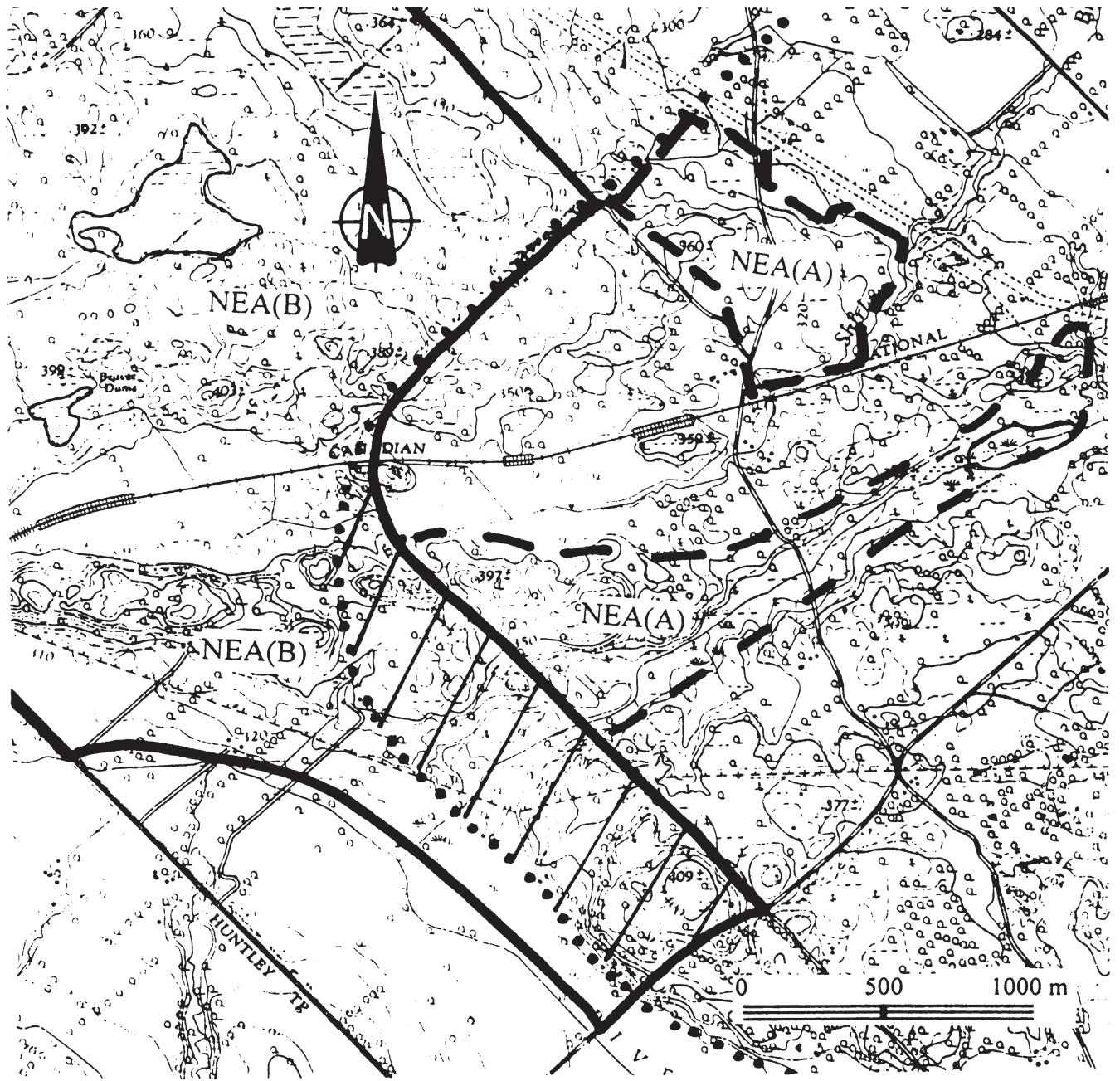


Figure 1: The 4-1/ 4-2 study area (hatched area) (route 4-1 (approx.) = dotted line)

WORK PLAN

Subsequent to access approvals arranged by ROC personnel, field investigations were undertaken throughout the 4-1/ 4-2 study area, with all affected boundaries being examined directly, all major habitats visited, and potential natural corridors to other NEA areas investigated. The area south of Richardson Side Road between the edge of the Hazeldean Escarpment and First Line Road (i.e. by the communications tower) which had not previously been evaluated, was also inventoried. Notes were recorded and voucher specimens made of known or potentially significant native plant species. Faunal studies, particularly breeding bird and herptiles (amphibians and reptiles) were also conducted in the 4-1/ 4-2 study area in the spring/ early summer to fill out the biological information base on the area.

Field examinations were conducted in spring, early summer and late summer (18 April, 29 May, 27 June, 4 July and 16 August 2000) in order to develop a fuller appreciation of seasonal variation within the study area landscape. Several of these field investigations were undertaken in the company of David Miller, Regional Planner, Planning and Development Approvals Branch, Region of Ottawa-Carleton. Elements of the investigation included:

1. *the range of significant natural features and assets existing in the 4-1/ 4-2 study area, including:*
 - an on-site proofing of existing documentation of representation vegetation, habitats and species;
 - the identification/ confirmation of study area habitats and features supporting local/ regional ecological functions;

2. *the boundaries of the area(s) required to enclose and protect sustainable representation of the natural assets of the 4-1/ 4-2 study area, focussing on 1992 proposed NEA boundaries, including:*
 - the size and location of significant features and populations (individual species, breeding/ hibernation/ and/or feeding sites, etc.);
 - size and extent of core representative natural area (including representative and Regionally exceptional vegetation);
 - size and extent of natural corridors and connections to ecologically contributing satellite areas;
 - on-site wetland resources and functional watercourse connections with adjacent drainage systems;

3. *identification of linkage opportunities:*
 - existing/ potential linkages between the proposed 4-1/ 4-2 study area protected area(s) and neighbouring significant natural landscapes in the South March Highlands (Trillium Woods, Natural Environment Area (B)).

4. *identification of assumptions and conditions concerning site restoration and impact mitigation along the Terry Fox Drive corridor:*
 - approaches in associated lands during and after construction.

From these inventory efforts and the review of existing documentation, ecological clarifications (as noted below) were documented to assist in the resolution of outstanding planning issues.

STUDY AREA CONTEXT

The natural environment resources of the 4-1/ 4-2 study area are summarized in Tunnacliffe *in lit.* (17 April 2000) and discussed in greater detail within the natural environment inventories of the Highlands (Brunton 1992a; 1992b). The study area is situated at the southern end of the Precambrian Shield bedrock outcrop known as the Carp Ridge, which extends from Kanata northwestward to the Ottawa River in the Galetta area. This wetland-rich landform is unique in the Ottawa-Carleton, constituting a 'island' of rugged, heavily-glaciated, rocky, Gatineau Hills-like habitat on the otherwise "level, sedimentary lowlands. The end result is a landscape with severely limited agricultural potential and substantial challenges to residential/ commercial development. It has remained largely undeveloped, constituting the wildest landscape of Ottawa-Carleton. The more or less original natural state coupled with a uniquely complex geology has resulted in the southern portion of the Carp Ridge (the South March Highlands) supporting a diverse and significant natural biodiversity including Provincially and Regionally significant features and habitats (Brunton 1992a; 1992b; 1997).

Straddling the western rural/ urban boundary, the 4-1/ 4-2 study area constitutes a small portion of a larger NEA (B) landscape surrounded by Business Park (south and east), Agricultural Resource (west), General Urban (east) and NEA (A) (northeast) lands (Region of Ottawa-Carleton 1999).

Virtually all of the drainage in the 4-1/ 4-2 study area is westward down the Hazeldean Escarpment slope and into the Carp River. Only the northeastern corner of the 4-1/ 4-2 study area drains eastward, flowing into the South Branch of Shirleys Brook. Numerous small and/ or intermittent drainage channels occur in the many depressions and ravines occurring in this rugged landscape. The Watts Creek watershed commence immediately east of the First Line road ROW in the southern half of the area and there may be some cross-over in either direction. Aquatic systems except in the severely disturbed drains immediately south of the railway corridor at the northern end of the study area seem to be in good condition. There was little evidence of over-nutrication or serious non-native plant infestations in these wetlands.

ECOLOGICAL RESOURCES

As noted in Tunnacliffe *in lit.* (17 April 2000), most of the highland portion of the 4-1/ 4-2 study area is forested, although a substantial area of agricultural land (pasture) occurs in the southern portion. On-site investigations confirm that the habitats and the extend of agricultural incursion remain substantially as previously documented, although the area of deciduous swamp forest half way along and west of the First Line Road is more extensive than was described previously. Figure 2 (below) provides an up-dated version of a portion of the vegetation mapping included as Figure 9 in Brunton (1992b) and Figure 8 (Brunton 1992a). The only conspicuous change along this eastern edge of the 4-1/ 4-2 study area is the up-grading of power lines and poles (post- ice storm ?), with an accompanying clearing of the ROW. Water levels substantially lower than 1992 levels were noted in the small Shield wetlands in the area. This is believed to be indicative of the low-water conditions apparent in such wetlands across the ROC in recent years.

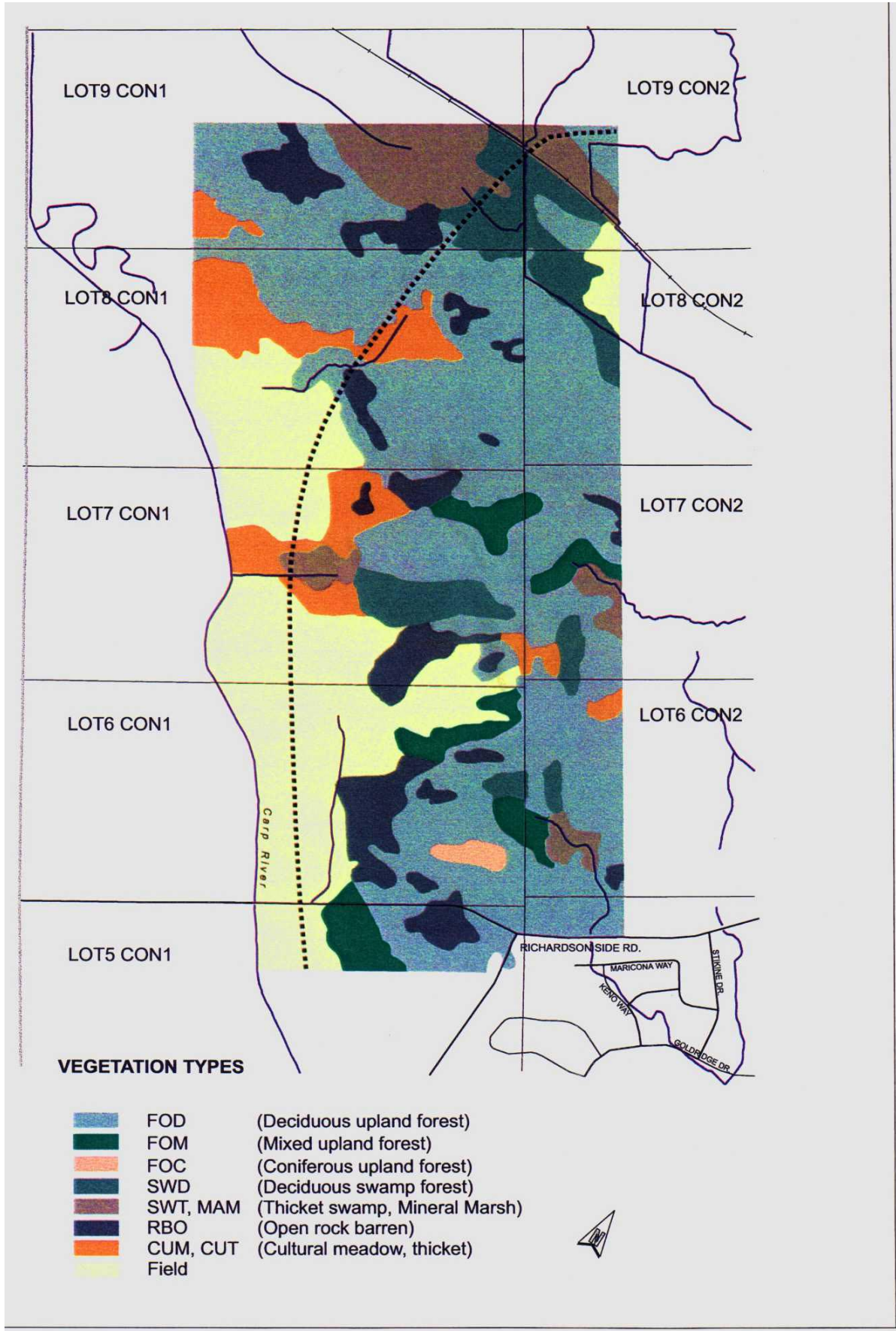


Figure 2: Vegetation types in the 4-1/4-2 study area and adjacent NEA lands
(adapted from Brunton 1992a; 1992b)

Vegetation

As noted above, field investigations during the present study confirmed the distribution and composition of the 4-1/ 4-2 study area to be as described in the earlier South March Highlands natural environment inventory (Brunton 1992b). In terms of the vegetation classification now employed in southern Ontario by the Ontario Ministry of Natural Resources (Lee et al. 1998), seven major habitats can be described here. They, with their appropriate vegetation codes noted (in brackets), are as follows:

Habitat 1: *Sugar Maple Deciduous Forest (FOD6)* - ca. 45% of study area (Vegetation Types 7 and 8 of Brunton 1992b);

- Sugar Maple dominated upland forest, particularly mature in the northern half of the study area; small patches of Hardwood-Hemlock Mixed Forest (FOM3) occur throughout (probably reduced by selective logging) with inliers of swamp forest and bedrock outcrop (see below);

- most extensive vegetation type in the study area with diverse spring floristic development; relatively undisturbed understory with few non-native plant species; good representation of breeding bird species typical of extensive, "mature deciduous forest (see Appendix 1);

Habitat 2: *Hardwood-Hemlock (FOM3) and Poplar-White Pine Mixed Forest (FOM5)* - ca. 15% of study area (Vegetation Type 9 of Brunton 1992b);

- young deciduous (Red Maple, Sugar Maple, Trembling Aspen, White Ash) upland forest species in complex mixture with Eastern Hemlock, White Pine and White Cedar; pure coniferous forest, swamp forest and rock inliers occur (see below); predominantly in southern half of the study area and also south of Richardson Side Road; relatively undisturbed understory with few non-native plant species; typical representation of upland mixed and coniferous forest breeding birds noted (see Appendix 1);

Habitat 3: *Pine Coniferous Forest (FOC1)* - ca. 5% of study area (Vegetation Type 10 of Brunton 1992b);

- young to mature White Pine dominated forest, commonly grading into FOM5 mixed forest on drier, rockier sites and FOM3 forest in mesic situations; concentrated in the southern half of the study area (including mature grove known as 'Cathedral Grove'); typical representation of upland mixed and coniferous forest breeding bird noted (see Appendix 1);

Habitat 4: *Deciduous Swamp Forest (SWD)* - ca. 10% of study area (Vegetation Types 4 and 5 of Brunton 1992b);

- young to mature Red Maple (SWD6) or Black Ash, Green Ash (SWD5) dominated wetlands with White Elm, Yellow Birch, Balsam Fir, over organic deposits (SWD6) in bedrock depressions and drainage channels across the study area; both standing water and ephemeral wetland areas present; supports representative and uncommon breeding bird and herptile species (Appendix 1);

Habitat 5: *Thicket Swamp (SWT2)* - <5% of study area (Vegetation Type 2 of Brunton 1992b);

- small section of large willow-Red-osier Dogwood (SWT2-2, SWT2-5) thicket over mineral soil at northeastern corner of study area; small areas of Mineral Meadow Marsh (MAM) east of the First line ROW; low floristic and faunal diversity noted (Appendix 1);

Habitat 6: *Open Rock Barren (RBO)* - ca. 20% of study area (Vegetation Type 'R' of Brunton 1992b);

- dry, hot, open areas of gneissic bedrock with sparse associated vegetation along escarpment edge and within forested uplands, with woodland and scrub 'islands' in areas of thin soil; supports Regionally significant native vegetation but low faunal diversity (Appendix 1);

Habitat 7: *Meadow & scrub (CUM, CUT)* - ca. 10% of study area (Vegetation Types 'S' and 'M' of Brunton 1992b);

- small areas of regenerating farmland along lower portions of escarpment, with largest example in southern portion of the study area; high faunal diversity, with representative breeding birds of fields and woodland edges (Appendix 1) but severely limited natural floristic diversity.

Flora

As noted above, the vascular flora of the various 4-1/ 4-2 study area habitats was found to be a continuation of the flora recorded in comparable habitats across the South March Highlands (Brunton 1992a; 1992b). The extent of unfragmented habitat and relative isolation of the site has encouraged unusually large populations of some mature deciduous forest plant species such as Wild Leek (*Allium tricoccum*). One additionally Regionally significant species was found in the study area during the present investigation, that being a large population of Short-headed Sedge (*Carex brevior*) (see Significant features, below).

Fauna

The breeding bird, mammal and herptile (amphibian and reptile) observations made during the present field investigations are noted in Appendix 1. Species considered significant in the Region of Ottawa-Carleton (cf. the preliminary lists of Brownell & Larson 1997) are also listed below.

Birds: the diversity of breeding bird species includes a number which are typical of extensively forested areas and thus are otherwise rare in the fragmented habitat which constitute much of the forested portions of Ottawa-Carleton. These include Scarlet Tanager, Yellow-bellied Sapsucker, Pileated Woodpecker and Wood Thrush. Several Regionally significant species were also noted:

Red-shouldered Hawk

Black-throated Blue Warbler

Winter Wren

Black-throated Green Warbler

Golden-winged Warbler

Pine Warbler

All of these except the Golden-winged Warbler are typical of more mature, extensive upland or swamp forest areas (Winter Wren in the latter); they were found sparingly in such habitat at the northern end of the 4-1/ 4-2 study area. A singing male Golden-winged Warbler was heard and observed along the margin of the extensive Thicket Swamp habitat at the north end of the study area on 29 May 2000. This predominantly southern species has rarely been recorded breeding within the Region of Ottawa-Carleton, previous breeding-season reports also being from the Carp Ridge area.

Amphibians & reptiles: few herptiles were observed in the 4-1/ 4-2 study area, perhaps at least in part due to the drought which apparently has negatively affected wetland species during the last three or four years in the Region of Ottawa-Carleton. No salamander species were observed although potential breeding pools were searched in mature hardwood forest habitat. Only in July were frogs noted with frequency, these being the common Green Frog and Wood Frog.

Blanding's Turtles, considered Regionally Significant in the Region of Ottawa-Carleton in the preliminary list of Brownell & Blaney (1997), were observed basking on a log in a small pond along the First Line Road allowance in the Carp River watershed by the height-of-land with the Watts Creek watershed. This " 40 m long pond exhibited an unusual diversity of turtles, with Painted, Snapping and Blanding's Turtles all being observed there on different occasions.

Mammals: Relatively few mammal species were observed during the natural environment assessment of the 4-1/ 4-2 study area. None are considered to be Regionally Significant (cf. preliminary list of Brownell & Larson 1997). White-tailed Deer are common here, as they have been throughout the western portion of the Region of Ottawa-Carleton for several years now (Broadfoot and Voigt 2000).

ECOLOGICAL FUNCTIONS

The contribution of the 4-1/ 4-2 study area to the ecological integrity of the larger NEA area within which it is contained is an important element of its overall significance and conservation value. The following include the ecological attributes reviewed in assessing candidate NESS areas in this area of Ottawa-Carleton (Region of Ottawa-Carleton 1997; Brunton 1997).

Representation and condition: being virtually continuous natural woodland, particularly one with a diversity of upland and wetland habitats with little non-native intrusion, the study area contains an extensive complex of common and rare habitats demonstrating a high degree of ecological integrity. Over 80% of the study area supports Regionally rare vegetation types (Geomatics International 1993) and represents a continuation of similar vegetation types in the NEA (B) area to the north and the NEA (A) area to the east. As noted above, a number of the nesting bird species noted within the 4-1/ 4-2 study area are successful breeders only in extensive woodlands. Fragmentation is rare here, with the First Line Road ROW providing the only physical interruption crossing the length of the site. Agricultural development intrudes from the west in some sections.

Natural biodiversity: the 4-1/ 4-2 study area is known to support a rich diversity of native plant and animal species typical of superior examples of the habitats represented here (Brunton 1992b; 1997). None of the habitats and only a few particular species, however, are unique to this area of the South March Highlands (see Special features, below)

Hydrological values: The First Line Road ROW virtually forms the height of land between the Watts Creek and Carp River watersheds, with drainage westward to the river being through a myriad of ephemeral ponds, deciduous swamps and tiny drains. The northern half of the 4-1/ 4-2 study area with deeper soils and more extensive water-filled depressions contributes most of the water retention and regulatory function of the area.

Special features: a substantial number of Regionally significant plant and animal species are documented from the habitats noted in the 4-1/ 4-2 study area, the mature upland deciduous forest habitat in the northern half of the study area contributing the greatest number of these (Brunton 1992b). Few of these are unique to the 4-1/ 4-2 study area in the South March Highlands. The largest Ottawa-Carleton population of the Regionally Rare Short-headed Sedge (*Carex brevior*) found during the present inventory on the bedrock outcrops south of the Richardson Side Road, however, is one such locally unique feature. Another was an apparently territorial and possibly breeding Regionally Rare Golden-winged Warbler noted at the edge of the large thicket swamp at the north end of the study area. Amongst the otherwise typical herptile species, a Regionally uncommon Blandings Turtle was noted in a small woodland pond along the First Line Road adjacent to the Watts Creek watershed. This species has also been observed both east and north of the study area in the South March Highlands (Brunton 1992a; 1992b).

Linkages: The western half of the study area forms a direct and continuous link with identical significant habitat to the north. The southern half of the study area, however, protrudes into developed or slated-for-development lands and will be impacted on the west, south and east by agricultural and urban development.

NATURAL ENVIRONMENT SIGNIFICANCE WITHIN THE SOUTH MARCH HIGHLANDS

The extensive escarpment and upland forest landscape in the northern half of the 4-1/ 4-2 study area identified as areas 3 and 4 in Tunnacliffe *in lit.* (17 April 2000) has been documented as being of Regional and Provincial ecological significance (Brunton 1992b). That assessment was supported by observations made during the present investigation. As noted above, few of the natural environment assets of the 4-1/ 4-2 study area are unique to the area. The rich natural biodiversity of the area, and of adjacent natural lands to the east and north, is directly related to the relatively high state of ecological integrity in this area. That, in turn, is directly related to the contribution each portion of the Highlands makes to each other - particularly to adjacent lands.

Identification and designation of areas of significant vegetation as being of conservation or preservation priority is of only of academic interest if conditions are not in place to ensure that such areas/ features/ values are naturally sustainable over the long term. The self-sustainability of an area is dependent on characteristics such as natural diversity, hydrological condition and ecological integrity. A major consideration regarding the sustainability of significant natural environment values within the 4-1/ 4-2 study area, then, is the potential impact of development options on the linkage of this area with other significant natural landscapes to the north and east. The effective ecological communication between such areas is necessary for the movement of plant and animal species between them.

The 4-1/ 4-2 study area provides considerable ecological significance within the NEA (B) of which it is a part (Brunton 1997), and the South March Highlands as a whole (Brunton 1992). Virtually all of these floristic, faunal, habitat and ecological function values are replicated elsewhere in South March Highlands NEA lands. While reduction of the size of the NEA in the 4-1/ 4-2 study area would reduce the quantity of protected ecological assets, its ecological diversity would remain essentially unchanged.

Boundaries of representative area:

As noted above, few natural environment assets in the study area are unique. While a substantial block of this area would have to be maintained intact if significant species, populations and functions are to prevail, not all of the 4-1/ 4-2 study area is essential in that regard. Protection of the more extensive escarpment edge and mature Sugar Maple dominated upland of the northern half will contain the majority of significant values and contributions of the study area. This reduced area would align along its southern border with the NEA (A) land to the east (Figure 3). With the development of the General Urban lands to the east of the First Line Road allowance the ecological integrity of the southern half of the 4-1/ 4-2 study area will be impacted - possibly severely - by fragmentation and edge effect. As noted above, however, the vegetation types and biodiversity assets of the southern half contribute less to the conservation value of the larger NEA area than those of the northern portion. The ecological assets of the southern half also largely represented in the southeastern section of the NEA (B) area immediately west of the Second Line Road.

MITIGATION OF LOSS OF NEA SIGNIFICANCE

Although ecological diversity will not be appreciably lessened by an NEA size reduction, mitigation will be required if compensation for the resulting reduction in overall ecological value is to be effective. The preferred route for mitigating the loss of such land would be the addition of comparable quality natural lands elsewhere to the NEA. With additional natural lands unavailable to the south or west, such compensation appears to be possible only to the east towards the 'Trillium Woods' NEA(A) area along Goulbourn Forced Road. Since adjacent development will eventually isolate this important site, the addition of protected land here would also secure an important ecological linkage between the two NEAs.

Mitigation of a reduction in NEA area within the 4-1/ 4-2 study area could include:

- 1) up-grading the retained portion from NEA(B) to NEA(A) in keeping with the adjacent zoning to the east and to better reflect its ecological significance;
- 2) replacing lost NEA features and securing future ecological linkage functions between the 'Trillium Woods' NEA(A) and remaining NEA lands to the west through the addition of NEA lands between them (i.e. north of the Trillium Woods east of the Second Line ROW and/ or west of the Trillium Woods south of the new Terry Fox Drive ROW);
- 3) closing Goulbourn Forced Road to vehicle traffic through the Trillium Woods NEA(A) and encouraging natural revegetation of the roadbed;
- 4) relocating the transmission line from the First Line Road ROW to the Terry Fox Drive ROW and permitting natural revegetation along the First Line Road ROW;
- 5) providing protection for Regionally significant floristic values found in Bedrock Barrens habitat south and west of the communications tower south of Richardson Side Road.

TERRY FOX DRIVE MITIGATION CONSIDERATIONS

Construction of Terry Fox Drive along route 4-1 will involve a crossing of the Hazeldean Escarpment. This will require substantial construction activity involving such activities are rock blasting and earthfill. While the upland nature of much of this proposed roadway corridor reduces the threat to drainage systems, the finished roadway would constitute 1) a significant impediment to wildlife movement along the Hazeldean Escarpment, raising public safety as well as wildlife mortality issues, and 2) increased fragmentation of the habitat.

Wildlife corridor impacts can be reduced by bridging rather than filling some steep/ deep sections of the roadway at the escarpment crossing, permitting at least small mammals and herptiles to cross in safety beneath the roadway. The fragmentation issue can be mitigated by maintaining the narrowest possible roadway ROW (excluding paved shoulders or a wide central median, for example) and by encouraging natural revegetation of roadway margins. Pre-construction salvage of on-site, native trees and shrubs for later transplantation along the corridor can also reduce the advance of non-native weeds which may degrade native biodiversity in adjacent forested areas.

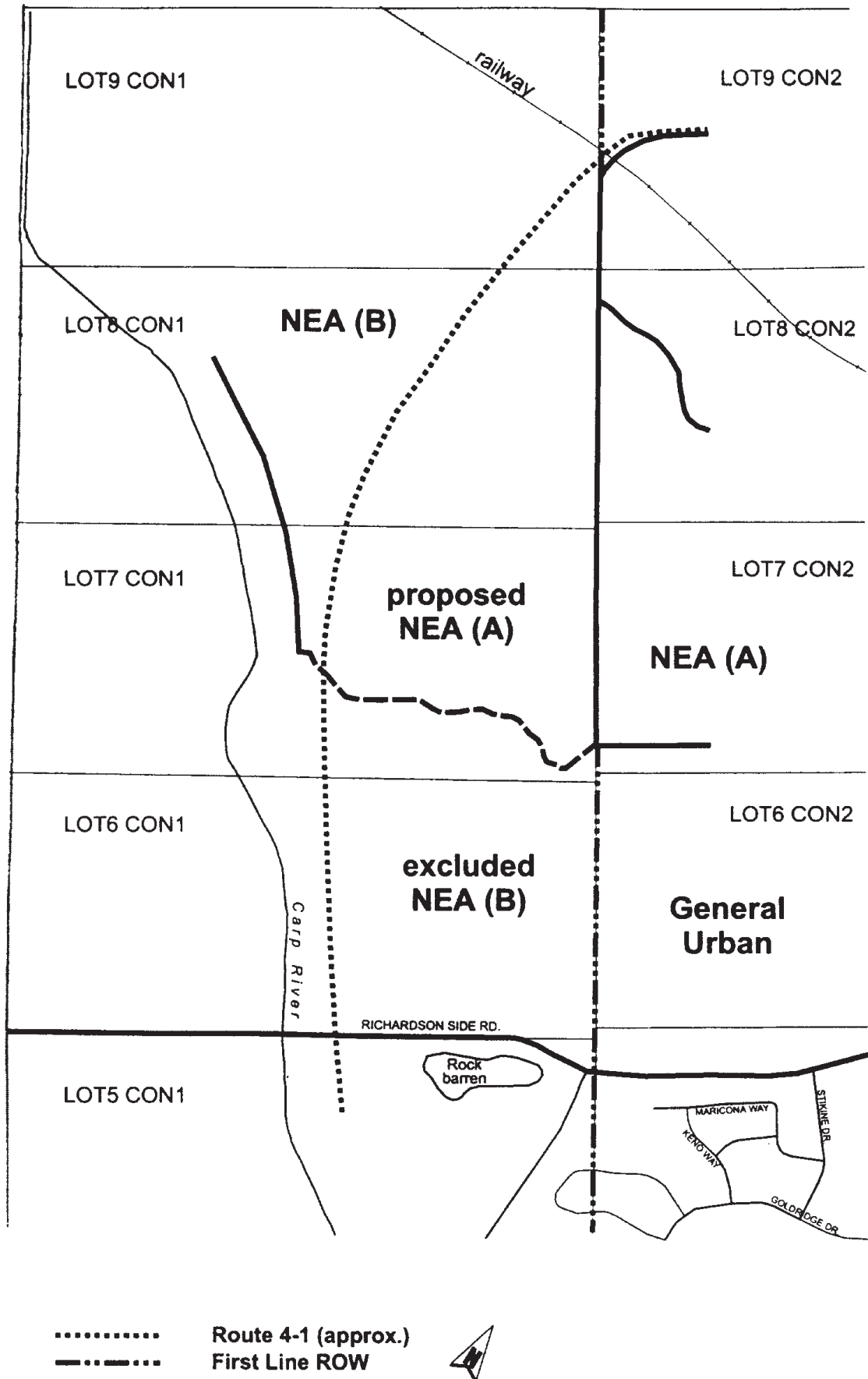


Figure 3: Revised NEA boundaries

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Appendix 1: Fauna observed in the 4-1/ 4-2 study area

1) BREEDING BIRDS

The following lists the breeding status of bird species observed between 18 April and 4 July 2000 in the 4-1/ 4-2 study area. Breeding status was determined by the use of Ontario Breeding Bird Atlas criteria (Cadman et al., 1987) as follows:

- Possible breeding:*
- species observed in its breeding season in suitable nesting habitat.
 - single male(s) present or call heard in suitable nesting habitat in breeding season.
- Probable breeding:*
- pair observed in suitable nesting habitat in breeding season.
 - territorial behaviour observed on at least two days, a week or more apart, at the same site.
 - courtship display, including copulation or courtship feeding.
 - visiting probable nest site.
 - agitated behaviour of an adult.
 - nest building or excavation of a nest hole.
- Confirmed breeding:*
- distraction display or injury feigning.
 - used nest or egg shells found.
 - recently fledged or downy young found.
 - adults carrying faecal sacs or food for young.
 - adults leaving or entering apparently occupied nests.
 - nest with young or eggs found.

The listing order and nomenclature follows standard Ontario checklist format (Ontario Field Ornithologists 1997). Significant breeding species in the Region of Ottawa-Carleton are determined from the preliminary list in Brownell & Larson (1997). The names of these species are noted in **bold** and CAPITALS. If such species were noted in the study area but not as breeding species (e.g. flying over and not utilizing any study area habitat), however, their name is not bolded and no further discussion of their status occurs.

Status codes employed for bird species observed during the 4-1/ 4-2 study area are as follows:

- M migrant
- * possible breeding species
- probable breeding species
- confirmed breeding species
- x flying over

Species	Young/ submature upland forest	Mature upland forest	Upland scrub & meadow	Swamp forest	Thicket swamp	No habitat use (flying over)
Great Blue Heron						X
TURKEY VULTURE						X
CANADA GOOSE						X
Wood Duck				*		
American Black Duck						X
Mallard						X
RED-SHOULDERED HAWK		*				
Red-tailed Hawk	●		*			
American Kestrel			*			
Ruffed Grouse						
Killdeer			○			
American Woodcock				*		
Ring-billed Gull						X
Rock Dove						X
Mourning Dove			○			
Black-billed Cuckoo	*					
Ruby-throated Hummingbird	*					

Species	Young/ submature upland forest	Mature upland forest	Upland scrub & meadow	Swamp forest	Thicket swamp	No habitat use (flying over)
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Belted Kingfisher						X
Yellow-bellied Sapsucker	○	○				
Downy Woodpecker	●			○		
Hairy Woodpecker		*				
Northern Flicker	○		○			
Pileated Woodpecker		●				
Eastern Wood Pewee	○	○				
Alder Flycatcher					○	
Least Flycatcher	○	○		○		
Eastern Phoebe			*			
Great Crested Flycatcher	○			*		
Eastern Kingbird				*		
Tree Swallow			○	○		
Barn Swallow			*			
Blue Jay	○	*		*		
American Crow	○	*	○			
COMMON RAVEN						X
Black-capped Chickadee	○	○	○	●		
White-breasted Nuthatch	*	○				
House Wren			○			
WINTER WREN				○		
Veery	○					
Wood Thrush		○				
American Robin	●	●	○	○		
Gray Catbird	○		○			

Species	Young/ submature upland forest	Mature upland forest	Upland scrub & meadow	Swamp forest	Thicket swamp	No habitat use (flying over)
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Brown Thrasher			○			
Cedar Waxwing	○		○			
European Starling	○		○			
Red-eyed Vireo	○	○				
GOLDEN-WINGED WARBLER					○	
Nashville Warbler	●					
Yellow Warbler			○		○	
Chestnut-sided Warbler	○		*			
Magnolia Warbler	M					
BLACK-THROATED BLUE WARBLER		*				
BLACK-THROATED GREEN WARBLER		○				
PINE WARBLER		○				
Blackpoll Warbler	M	M	M			
Black & White Warbler		*	*			
American Redstart	○		○			
Ovenbird	○	○				
Northern Waterthrush				○		
Mourning Warbler	*					
Common Yellowthroat			○		○	
Scarlet Tanager		○				
Rose-breasted Grosbeak	○	○				
Chipping Sparrow			○			
Song Sparrow	○		○		○	
Swamp Sparrow					○	

Species	Young/ submature upland forest	Mature upland forest	Upland scrub & meadow	Swamp forest	Thicket swamp	No habitat use (flying over)
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White-throated Sparrow	●					
Bobolink			*			
Red-winged Blackbird	*		○		●	
Common Grackle			*	○		
Brown-headed Cowbird	●	○	○			
Baltimore Oriole	●					
Purple Finch	*					
American Goldfinch	○		○			
EVENING GROSBEAK	*					

2) AMPHIBIANS & REPTILES

Few amphibian and reptile species were observed in the 4-1/ 4-2 study area. Observations are listed below, with the names of significance species (cf. preliminary list of Brownell & Larson 1997) denoted with **bold** and CAPITALS.

salamanders *none* observed despite searching in April and May (for Blue-spotted Salamander, Red-backed Salamander in particular); suitable breeding pool habitat in mature hardwood forest at the north end of the 4-1/ 4-2 study area searched 29 May.

American Toad rare - one noted at wetland edge.

Bullfrog rare - two observed in Blanding's Turtle pond (see below).

Gray Tree Frog heard uncommonly in upland deciduous forest habitat, particularly mature forest habitat.

Green Frog common in woodland pools along the First line Road allowance in May; uncommon by mid summer.

Wood Frog recently hatched young observed in pools in mature hardwood forest habitat in the northern portion of the 4-1/ 4-2 study area.

Leopard Frog rarely observed along wetland edges in later summer.

BLANDINGS TURTLE	2 large (7+ inches) animals sunning on a log in a woodland pool at 31 G/5 262195 along the First line Road allowance on 29 May; not observed subsequently.
Painted Turtle	observed rare in woodland pools along the First line Road allowance.
Snapping Turtle	one large individual observed 4 July in the Blanding's Turtle pool (above).

3) MAMMALS

The relatively few mammals species noted during vegetation, floristic and breeding bird studies are listed below.

Snowshoe Hare	droppings noted regularly throughout woodlands.
Meadow Vole	tunnels observed in open meadows.
Eastern Chipmunk	common in woodlands.
Woodchuck	burrows encountered in open areas and along woodland edges.
Beaver	active dams maintained along several drainage channels.
Red Squirrel	uncommon in woodlands, particularly in association with coniferous forest.
White-tailed Deer	common throughout; evidence of winter concentrations along bare rock areas near coniferous cover is conspicuous immediately north of Richardson Side Road; tracks, trails, pellet groups and browse are evident throughout.
Striped Skunk	tracks noted along wetland edges.
Porcupine	animals or evidence of feeding noted rarely.
Raccoon	tracks noted along wetland edges; recently born young observed south of Richardson Side Road.
Red Fox	tracks observed near Richardson Side Road.
Coyote	droppings noted south of Richardson Side Road; reported to be common in and about the study area (<i>fide</i> L. Richardson).