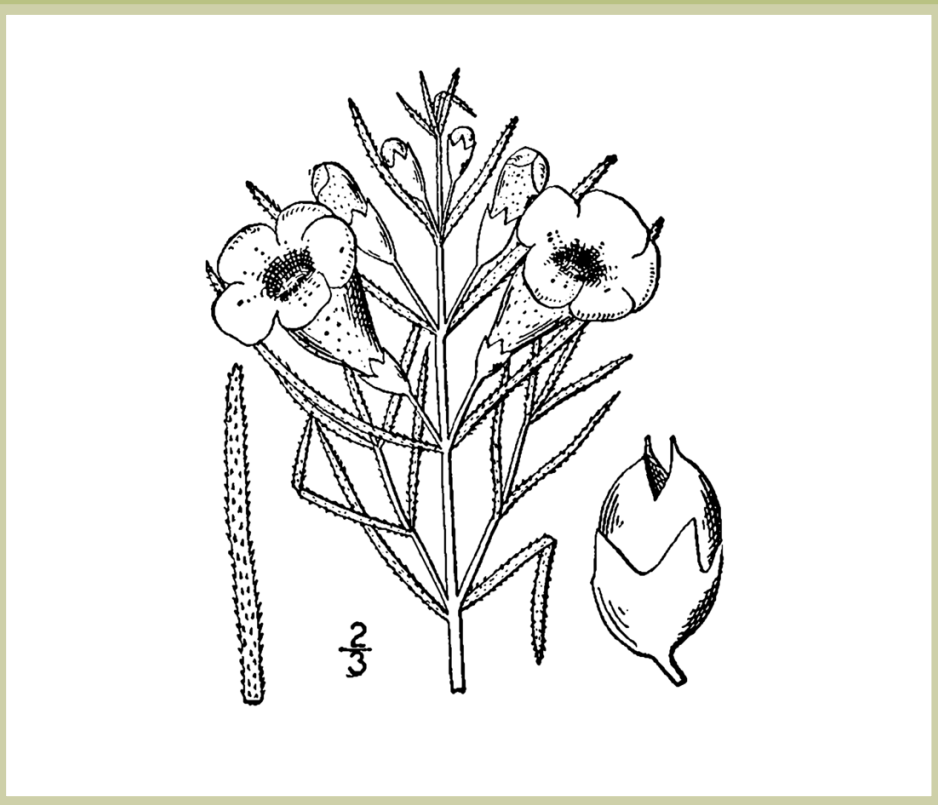
PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Rough Agalinis (*Agalinis aspera*) in Canada

Rough Agalinis



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For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the SAR Public Registry[1].

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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment is the competent minister under SARA for the Rough Agalinis and has prepared this strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with provincial jurisdictions in which this species occurs: Manitoba.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Rough Agalinis and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

Acknowledgments

The recovery strategy was prepared by Candace Neufeld (Environment Canada). An early draft based was prepared by Andy Horn (contractor) based on the COSEWIC status report. Valuable reviews were also provided by M. Wayland, V. Snable, W. Dunford (Environment Canada), and C. Friesen (Manitoba Conservation). The Manitoba Conservation Data Centre provided updated element occurrences and C. Friesen provided valuable insight on the species occurrences and habitat requirements. The co-operation of all the landowners, lessees and land managers who granted access to their land to do surveys and who continue to provide habitat for species at risk is greatly appreciated.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

Executive Summary

- The Rough Agalinis (*Agalinis aspera*) is a slender annual plant growing up to 35 cm tall, with narrow leaves and racemes of purple-pink, bell-shaped, lobed flowers. In Canada, it is associated with both dry and moist sparsely-vegetated tallgrass prairie with full sun exposure over gravelly (primarily calcareous dolomitic limestone) or sandy-gravelly soils in Manitoba.

- In Canada, as of 2013, there were 15 confirmed extant populations in southern Manitoba, along with 1 unconfirmed population, and 3 historical populations which are likely extirpated. The most recent estimates at each population indicate a total of approximately 836 Rough Agalinis plants, although counts fluctuate due to its annual nature. The population trend is unknown. Rough Agalinis is listed as Endangered under the *Species at Risk Act*.

- Additional loss of habitat quantity or quality among the known populations of Rough Agalinis could adversely affect the species' survival in Canada. Threats are mainly related to loss or degradation of habitat from the following: road construction and maintenance; gravel extraction; cultivation; invasive alien species; alteration to, or suppression of, natural fire and/or grazing regimes; alteration to hydrological regimes; off-road vehicle use.

- Recovery is deemed biologically and technically feasible. The population and distribution objectives for Rough Agalinis are to maintain or increase the population size and distribution (area of occupancy) of Rough Agalinis at all extant populations in Canada, as well as any newly discovered or relocated populations, within the natural range of variation. Broad strategies and approaches to address the threats to survival and recovery of Rough Agalinis are presented in the Strategic Direction for Recovery section.

- Critical habitat for Rough Agalinis is identified in this recovery strategy for all confirmed populations in Canada. Critical habitat consists of the occurrences of Rough Agalinis, plus all natural landforms, soil and vegetation within a 300 m critical function zone of the occurrences.

- One or more action plans detailing activities for the implementation of this recovery strategy will be posted on the Species at Risk Public Registry within five years of posting the final strategy.

Recovery Feasibility Summary

Under the *Species at Risk Act* (Section 40), the competent minister is required to determine whether the recovery of the listed species is technically and biologically feasible. Based on the following criteria outlined by the Government of Canada (2009) for recovering species at risk, recovery of the Rough Agalinis (*Agalinis aspera*) is considered biologically and technically feasible.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. Breeding individuals are currently available and distributed throughout the Canadian range as well as in the United States. Although long-term viability of these populations is unknown, under proper management regimes, individuals are likely to continue to reproduce and persist at these sites as they have historically.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. Suitable remnant prairie habitat currently exists where extant populations occur and with proper management the habitat should be sufficient to maintain species persistence at current levels, with natural population fluctuations. Beneficial management practices have the potential to maintain and enhance Rough Agalinis habitat, possibly creating additional suitable habitat within their current distribution. Unoccupied suitable habitat may also be available in small quantities.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. With the possible exception of low genetic diversity, identified threats are anthropogenic, related to loss in habitat quality and quantity, and can be mitigated through beneficial management practices, protection, or stewardship of species and their habitat.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Recovery techniques related to habitat conservation and adaptive habitat management can be implemented. Remaining areas could be secured through stewardship arrangements and by implementing beneficial management practices with public and private landowners.

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1. COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2006

Common Name: Rough agalinis

Scientific Name: *Agalinis aspera*

COSEWIC Status: Endangered

Reason for Designation: An herbaceous annual having a restricted geographical range and occupying small prairie remnants mainly along roadsides in southern Manitoba. The few small populations are at risk from such impacts as late season mowing, burning, overgrazing and road expansion.

Canadian Occurrence: Manitoba

COSEWIC Status History: Designated Endangered in April 2006.

*COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. SPECIES STATUS INFORMATION

Rough Agalinis (*Agalinis aspera*) has been listed as Endangered under Schedule 1 of the *Species at Risk Act* (SARA; S.C. 2002, c. 29) since 2007. It is listed as Endangered under the Manitoba *Endangered Species Act*. The conservation status of Rough Agalinis throughout its global range is described in Table 1. It is estimated that Canada holds less than 1% of the species' global range, although this is difficult to estimate because the species abundance is not tracked in many states in the U.S (Table 1).

Table 1. NatureServe (2014b) conservation ranks for Rough Agalinis.

Global Rank (G) [1]	**National Rank (N)** [1]	**Sub-National Rank (S)**[1]
G5	N1N2	S1S2 (Manitoba) SNR (Illinois, Kansas, Louisiana[2], Minnesota, Missouri, North Dakota, Oklahoma, South Dakota, Texas, Wisconsin) ; S4 (Iowa); S3S5 (Nebraska)[3]

[1]Rank 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure; NR – status not ranked

[2] NatureServe (2014b) reports Rough Agalinis from Louisiana but USDA (2014) and Kartesz (2013) do not and there is no evidence for its occurrence there. COSEWIC (2006) did not include this state on their global range map.

[3] USDA (2014) records Rough Agalinis as being in Arkansas. NatureServe (2014b) and Kartesz (2013) do not report this but COSEWIC (2006) included Arkansas in their global range map.

3. SPECIES INFORMATION

3.1 Species Description

Rough Agalinis is a slender annual herb from the Broomrape family (Orobanchaceae). In Manitoba, plants grow up to 35 cm tall, with narrow, linear-shaped leaves opposite each other on the stem; leaves are covered with rough, stiff hairs on the upper surface, giving the plant its name. Rough Agalinis plants start flowering in late July and continue until early September, producing numerous purplish-pink, bell-shaped, 5-lobed flowers (up to 25 mm long), arranged in a raceme on upward-angling stalks. The flower and reproductive organs are specialized for pollination by bees, but flowers might also be capable of self-fertilization (Neel 2002; COSEWIC 2006). Tiny, dark brown seeds are diamond-shaped, and found inside oblong seed capsules in September. Seeds are probably dispersed locally by wind, but might be dispersed by animals as well (COSEWIC 2006).

Figure 1. Rough Agalinis flowers. © Marjorie Hughes.

The species is also called Rough Purple Agalinis (Britton and Brown 1970), Rough Gerardia (NPWRC 2005), and Rough False Foxglove (USDA 2014). Particular care must be taken to distinguish this species from several other species of *Agalinis* that are found in its range (COSEWIC 2006), including Gattinger's Agalinis (*Agalinis gattingeri*), listed as Endangered under SARA and occurring in Manitoba and Ontario.

3.2 Population and Distribution

Rough Agalinis is found in the central plains of North America, from Manitoba straight down to northern Texas, and as far east as Illinois and Wisconsin (Figure 2). In Canada, Rough Agalinis has a small range and small area of occupancy[3], and is known to occur only in small populations[4] in three general areas in Manitoba: south of Brandon, the southern Interlake, and south of Bird's Hill Provincial Park (Figure 3). As

[3] *Area of occupancy is the portion within or range of a species that is actually occupied by the species (COSEWIC 2012). For the purpose of this recovery strategy, an occurrence is a grouping of plants separated from another grouping of plants, either temporally or spatially, and sometimes referred to as a patch, source feature, or sub-element occurrence.*

[4] *Each population is composed of one or more occurrences and for the purposes of the recovery strategy will be equivalent to an element occurrence, as defined by NatureServe (2014a).*

of 2013 in Manitoba, there were 15 extant[5] populations known, one population unconfirmed[6] and 3 populations likely extirpated[7] (Appendix A).

The total population count of Rough Agalinis in Manitoba is difficult to determine in any given year. Population estimates based on the most recent surveys of each population indicate approximately 836 Rough Agalinis plants (Appendix A). However, as an annual, the plant's rates of germination, seed production and seedling establishment vary across years (COSEWIC 2006). The plant is also virtually undetectable when not in flower, which adds to the difficulty of obtaining accurate population counts (Krause Danielsen and Friesen 2009; COSEWIC 2006). In addition, many populations have just recently been located, and not all populations are visited in a given year. Due to these factors, population comparisons between or among years are of limited use. For example, population counts have ranged from a high of 2400 plants in 2010 to a low of under 100 plants in 2012, increasing to over 450 plants in 2013 (Friesen and Murray 2010; MB CDC, 2014 unpublished data). The loss of three populations, the first in the 1940s (Morden), the second in the 1980s (Poplar Point), and the third in 2012 (Woodlands), as well as a portion of a fourth population (Bird's Hill) in 2013, shows an observed decline in number of populations (Appendix A; COSEWIC 2006). New populations continue to be discovered and reports state that some additional suitable but, as yet, unsurveyed habitat exists (Appendix A; COSEWIC 2006; Foster and Reimer 2007; Foster 2008; Krause Danielsen and Friesen 2009; Hamel and Dow 2010; Friesen and Murray 2010; Friesen and Murray 2011).

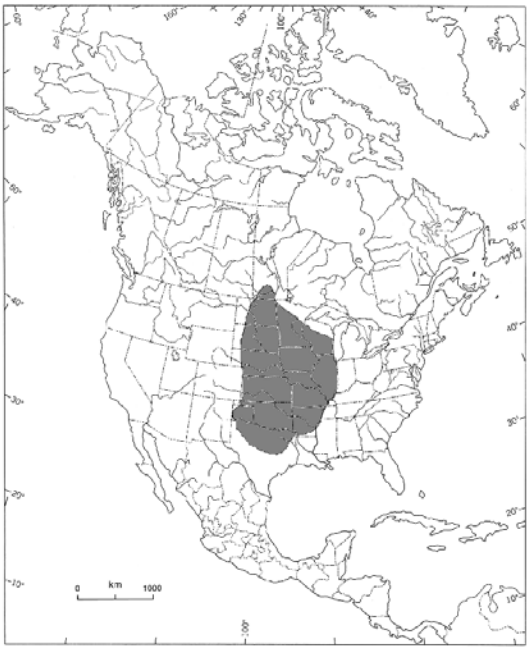

Figure 2. Current range of Rough Agalinis in North America (from COSEWIC 2006).

[5] *Extant means the occurrence has been recently verified as still existing, information on the location is accurate, and habitat still exists at the time of writing the recovery strategy.*

[6] *Unconfirmed means that the occurrence is less than 20 years old (not historic) but has inaccurate or vague location information usually associated with a high level of mapping uncertainty with a Conservation Data Centre, and has not been relocated for confirmation.*

[7] *Extirpated either means that conditions or habitat no longer exist at an occurrence to support the species, or sufficient surveys have taken place at the occurrence over an adequate time period (over 20 years) and during good growing years, conducted by experienced surveyors, yet failed to relocate the species at the occurrence (NatureServe 2014c).*

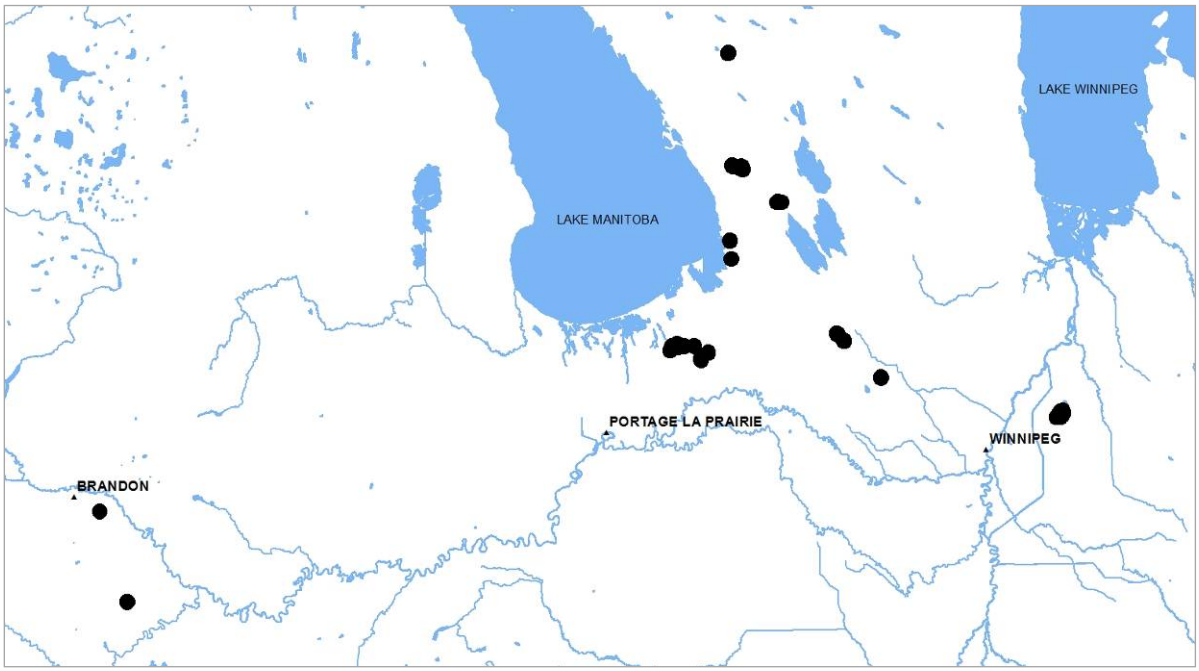

Figure 3. Range of Rough Agalinis in Manitoba, Canada. Note that extirpated or unconfirmed populations are not shown on this map.

3.3 Needs of the Rough Agalinis

In Manitoba, Rough Agalinis has been found occupying both dry (xeric) and moist (mesic) sparsely-vegetated tallgrass prairie with full sun exposure over gravelly (calcareous dolomitic limestone, primarily) or sandy-gravelly soils (COSEWIC 2006; Foster 2008; Hamel and Dow 2010; Friesen and Murray 2011). The majority of known populations are remnants of mesic tallgrass meadows and seepy areas, mostly along the slopes of road allowances or road/train track verges, while the drier habitat is found in intact upland tallgrass prairie or meadow (C. Friesen, pers. comm. 2014). The most abundant populations appear to be in habitat with some amount of soil disturbance and higher levels of bare soil with sparse vegetation and little to no overhanging shrub or tree cover, although woody vegetation may be in the general area (Foster 2008, Friesen and Murray 2010; Hamel and Dow 2010). Declining or smaller populations seemed affiliated with taller vegetation or greater litter levels (Foster 2008; C. Friesen, pers. comm. 2014). Some habitat contains naturally sparse vegetation due to soil or other microsite conditions while other habitat requires regular natural or manipulated disturbances (e.g., periodic prescribed burns, compatible grazing, haying/mowing) to achieve bare ground and sparse vegetation (C. Friesen, pers. comm. 2014).

The majority of occurrences of Rough Agalinis have been recently found (Appendix A); historical habitat descriptions for Rough Agalinis prior to European settlement is sparse. Therefore, it is uncertain whether the relatively high occupancy of the mesic roadside habitat is just an artifact of what little suitable sparsely-vegetated tallgrass prairie remains in MB, or whether Rough Agalinis in MB simply occupies a slightly different habitat than has been described in the U.S., or previously described in MB, as Rough Agalinis habitat (i.e. prairies and dry hillsides, sandy or stony soils; Pennell 1929;

COSEWIC 2006; US FS NRS 2014). There also have been fewer targeted surveys for Rough Agalinis in the drier tallgrass prairie habitat compared to the mesic roadsides, with reports indicating further surveying of the former is warranted (COSEWIC 2006; Friesen and Murray 2011; Hamel and Dow 2010; C. Friesen pers. comm. 2014)

Limiting Factors

The species is hemi-parasitic, which means that it needs to connect to a host plant using specialized roots in order to obtain water and dissolved nutrients for survival. *Agalinis* species parasitize a broad range of host species of vascular plants, although the size and vigour of plants depends on the availability of particular hosts (Musselman and Mann 1978). *Agalinis* seeds may be able to germinate and grow into seedlings in the absence of a host plant, but formation of haustoria, the structure attaching the hemiparasite to the host plant, usually requires the presence of chemical stimulants exuded from the host plant roots (Baskin and Baskin 2001); without haustoria attaching to a host plant, the hemiparasite seedling will eventually die or fail to complete its life cycle into an adult plant (Baskin and Baskin 2001). The plant species that provide the best hosts for Rough Agalinis are unknown (COSEWIC 2006). The absence or scarcity of host plants at a site may be a factor that limits the persistence or expansion of Rough Agalinis.

Factors such as low population size, fluctuating populations from year to year, high fragmentation of habitat, disjunct populations and low dispersal distance of seeds are factors that may limit outcrossing, thereby reducing genetic diversity. The degree to which these factors may be affecting genetic diversity and long-term survival of populations of Rough Agalinis are not known. However, based on the most recent year of estimates at each population (836 individuals divided among 15 populations), maintenance of sufficient genetic diversity long-term may be a concern.

4. THREATS

4.1 Threat Assessment

Table 2. Threat Assessment Table

Threat	Level of Concern[1]	Extent[2]	Occurrence[3]	Frequency[4]	Severity[5]	Causal Certainty[6]
Habitat Loss or Degradation						
Construction and maintenance of right-of-ways	High	Widespread	Current	Seasonal	High	High
Gravel extraction	High	Local	Current	One-time or recurrent	Low-Moderate	High
Cultivation	Low-Medium	Widespread	Historic, Current	One-time	High (historic), Low (current)	High
Exotic, Invasive or Introduced Species						
Invasive alien species	Low-Medium	Local	Current	Continuous	Low	Medium
Changes in ecological dynamics or natural processes						
Alteration to, or suppression of, natural fire and/or grazing regimes	Low-Medium	Widespread	Current	Seasonal	Unknown	Low
Alteration to hydrological regimes	Low-Medium	Widespread	Historic, Current	Recurrent	Unknown	High
Disturbance or Harm						
Off-road vehicle use	Low	Local	Current	Recurrent	Low	Low

[1] *Level of concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*
[2] *Extent – Defined as widespread, localized or unknown across the species range.*
[3] *Occurrence is defined as historic (contributed to decline but no longer affecting the species), current (affecting the species now), imminent (is expected to affect the species very soon), anticipated (may affect the species in the future), or unknown.*
[4] *Frequency is defined as a one-time occurrence, seasonal (either because the species is migratory or the threat only occurs at certain times of the year), continuous (on-going), recurrent (re-occurs from time to time but not on an annual or seasonal basis), or unknown.*
[5] *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low or Unknown).*
[6] *Causal certainty reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

4.2 Description of Threats

Known threats are listed below according to a decreasing level of concern.

Construction and maintenance of right-of-ways

Many of the populations in Manitoba are on remnant pieces of native prairie along roadsides or railways (Appendix A). Habitat and plants can be destroyed by road construction activities such as ditch widening or deepening, trenching, utility line installments, drainage projects, and straightening or improving the road. Habitat and plants can also be affected by incompatible or inappropriately-timed road or railway maintenance activities on shoulders and in ditches, such as spraying pesticides, grading, haying or mowing. These maintenance activities can sometimes maintain appropriate native prairie conditions for Rough Agalinis. However, if these activities are conducted in late summer when Rough Agalinis plants are present, the activities can destroy or damage plants and/or pollinators, including removal of the flowering head before seeds are mature (COSEWIC 2006; Foster and Reimer 2007; Foster 2008); for an annual plant, seed dispersal is a crucial stage for population persistence. Mowing may also leave thatch behind, increasing shading or changing the microhabitat. There have been a few Rough Agalinis populations recently extirpated by road construction activities (i.e., Poplar Point, Woodlands) or possibly affected by these activities (e.g. Brandon, Grosse Isle) (Appendix A).

Gravel Extraction

The soil that many Rough Agalinis plants grow on is gravelly; therefore, some Rough Agalinis populations have the potential to be developed as gravel pits. Gravel extraction results in direct habitat loss, loss of plants and the seed bank, alters hydrology, and increases the potential for invasive plant species to colonize disturbed areas. Currently, there is an active extraction pit within the Bird's Hill population, and some of the plants, seed bank, and habitat were destroyed from expansion of the pit in 2013 (MB CDC, pers. comm. 2014; Appendix A). There is also a gravel pit operation close to the Brandon population (Appendix A). With the continued need for aggregate it is likely that the gravel under populations in the upland prairie will be considered as a source.

Cultivation

In Manitoba, it is estimated that the tallgrass prairie habitat has declined 99.9% from its original 600,000 hectares, largely due to cultivation for forage and cereal crops (Samson and Knopf 1994). This has resulted in considerable historical habitat loss for tallgrass species like Rough Agalinis. Many of the remaining populations are in remnant strips of native prairie between cultivated fields and roadsides and may be further impacted by pesticide spray or encroachment of tame forage species from adjacent cultivated fields. Those populations still in larger tracts of native pasture may

be at risk of future cultivation in years where crop prices are high (Honey and Oleson 2006; Farm Credit Canada 2013; Wright and Wimberly 2013).

Invasive alien species

Invasive alien plants can pose a direct threat through competition because they can displace native species, decrease species diversity or richness through their superior competitive ability and/or result in overall negative effects on ecosystem functioning (Wilson 1989; Wilson and Belcher 1989; Reader et al. 1994; Dillemuth et al. 2009; Koper et al. 2010). Smooth Brome (*Bromus inermis*), Kentucky Bluegrass (*Poa pratensis*) and Spotted Knapweed (*Centaurea maculosa*) have been observed in some areas occupied by Rough Agalinis in Manitoba and pose a threat to its habitat. These species are aggressive and can spread into degraded prairies, roadsides and ditches, dominating vegetation cover and displacing or negatively impacting the growth and establishment of native species. Other species such as European Common Reed (*Phragmites australis* spp. *australis*) and Reed Canary Grass (*Phalaris arundinacea*; European form) may pose a threat to populations occupying ditches in the future (Environment Canada 2014a; Environment Canada 2014b). Inappropriate use of herbicide intended to control invasive species has the potential to directly kill Rough Agalinis plants, to kill the host plant of Rough Agalinis thereby affecting the Rough Agalinis plant itself, or to negatively alter habitat occupied by Rough Agalinis.

Alteration to, or suppression of, natural grazing and fire regimes

Pre-settlement, habitat containing Rough Agalinis would have evolved under periodic natural disturbances like fire, grazing and drought (Samson and Knopf 1994). These disturbances interacted independently and/or together (Collins 1987), to maintain the open, early successional habitat with low litter levels suitable for Rough Agalinis. In the absence of these disturbances, woody vegetation or invasive alien species can encroach and litter levels can increase, leading to a change in the plant community (Higgins et al 1989; Milchunas et al. 1989; Milchunas et al. 1992; Samson and Knopf 1994; Hayes and Holl 2003). Post-settlement, fire suppression and alterations to grazing from what traditionally occurred with wild ungulates, have contributed to changes in the plant and animal communities and ecosystem processes of tallgrass prairie habitat (Samson and Knopf 1994; Knapp et al. 1999; Fuhlendorf and Engle 2001; Towne et al. 2005). However, studies have shown combinations of grazing and fire, or grazing alone can help maintain or increase numbers of annual plants in mesic prairie (Collins 1987; Hayes and Holl 2003). Although overgrazing and frequent fires were previously mentioned to be a concern for Rough Agalinis (i.e. Poplar Point for grazing and Grosse Isle for fires; COSEWIC 2006), the impact of fire and/or grazing in terms of frequency, scale and intensity on Rough Agalinis populations and habitat is unknown. Rough Agalinis has been found in pastures where grazing and prescribed burning currently occur, including areas with habitat recently disturbed by cattle hoof action (COSEWIC 2006; Hamel and Dow 2010). If grazing intensity, frequency, and duration are excessively high or incompatible with Rough Agalinis needs, it may result in

negative effects such as trampled plants, reduced seed set if plants are foraged on, reduced habitat quality or altered species composition.

Alteration of hydrological regimes

Since many of the Rough Agalinis populations occur in mesic areas on the slopes of ditches, alterations to local hydrology by drainage projects or ditch maintenance activities like dredging could have a negative impact on plants and habitat. The negative impact could come from either an increase in moisture (e.g., flooding) or drying the site out (since Rough Agalinis is also found in drier habitat, it is unknown the impact this would have on populations). Changes in moisture availability can also influence the plant community in an area. For example, an increase in moisture can increase the amount of woody species encroachment or invasive alien species (e.g. European Canary Reed; Environment Canada 2014a). One population is located next to a drainage ditch, drainage of land is listed as a threat for a second population, and as the possible reason for extirpation for a third population (Appendix A).

Off-road Vehicle Use

The presence of vehicle tracks in ditches and off-road vehicle use in pastures containing Rough Agalinis were reported as a threat for many Rough Agalinis populations (Appendix A). The off-road vehicle use can lead to trampling or killing of plants, compaction of soil, and unnatural disturbance to habitat which increase opportunities for colonization by invasive alien plants. It can also introduce invasive alien plant seeds that fall from vehicles.

5. POPULATION AND DISTRIBUTION OBJECTIVES

Although there have been a few new populations documented in the last few years as survey effort increased, substantial increases in the number of populations or area of occupancy are less likely to be documented in the future given that 1) the suitable habitat for Rough Agalinis is now limited in MB, severely fragmented and declining in quality and quantity, and 2) the population size and area of occupancy of occurrences documented to date have been relatively small. However, it is likely some additional populations will be found with future survey effort. If habitat quality and quantity continue to decline, known populations may also decline as a result. Therefore, the population and distribution objectives have been set in the context of reversing or preventing further declines in quality and quantity of habitat through beneficial management practices and stewardship arrangements in order to maintain, and if possible, increase existing populations over the long term.

The population and distribution objectives for Rough Agalinis are to maintain or increase the population size and distribution (area of occupancy) of Rough Agalinis at all extant

populations in Canada, as well as any newly discovered or relocated[8] populations, within the natural range of variation.

Rationale:

The Canadian population is represented by under a thousand plants at 15 extant locations. There exists at least one year of population estimates for each of the extant populations. However, these estimates are insufficient for setting specific quantitative population objectives or trends, other than maintaining or increasing population size, for the following reasons: 1) there are too few years of monitoring data; 2) methods for surveying and monitoring have been inconsistent; 3) variation or accuracy in estimates has not been measured; and 4) there is insufficient information on year-to-year fluctuations in population size which is likely large given the annual nature of this species. In addition, an enumeration of mature individuals for annual plants is usually an unreliable indicator of actual population size in the short term given that the largest component of the population exists as seed in the seed bank and this seed bank can fluctuate (Harper 1977; Silvertown and Charlesworth 2001; Brigham and Thompson 2003); therefore, population estimates for annual plants should be conducted over the longer term and should consider the natural inter-annual variation in population size. Similarly, because the spatial distribution of plants can change from year to year depending on the distribution and abundance of the seed bank, and how many seeds germinate and grow to maturity, many years of monitoring using consistent methodology are required to obtain an accurate estimate of area of occupancy and the natural range of variation in area of occupancy. This data is also lacking for Rough Agalinis and so it is not possible to set a specific, quantitative distribution objective other than maintaining or increasing the area of occupancy within the natural range of variation. It is not known whether these small populations will be viable over the long-term, and as a result, supplementation or creation of new populations should not be the priority until this is determined.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Targeted surveys for Rough Agalinis were conducted in 2004, 2006-2010, 2012-2013 (COSEWIC 2006; Foster and Reimer 2007; Foster 2008; Krause Danielson and Friesen 2009; Friesen and Murray 2010; Hamel and Dow 2010; Friesen and Murray 2011). New populations have been discovered and all previously reported populations have been revisited at least once in recent years (Appendix A).

[8] *Note that occurrences or populations that are considered historic or unconfirmed are excluded from these objectives until such time as they are reconfirmed.*

The Manitoba Conservation Data Centre has produced maps of road allowances where species at risk occur to address threats related to road maintenance and construction. The maps include general rare plant population locations along stretches of road, identification information, and management recommendations to minimize disturbance to plants and avoid destruction of roadside habitat. The maps are intended mainly to guide road maintenance and construction activities undertaken by rural municipalities and the provincial government (Foster 2008; Friesen and Murray 2011). A more general management summary intended for the public and landowners/land managers has also been produced (Friesen, pers. comm. 2014).

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
All	High	Habitat conservation and stewardship	• Mitigate the impact of threats to populations and habitat by engaging landowners and land managers in conservation or stewardship arrangements aimed at implementing beneficial management practices (BMPs) and protecting critical habitat; monitor effectiveness of conservation or stewardship arrangements in conserving habitat. • Using adaptive habitat management, monitor the effectiveness of BMPs to improve habitat; amend BMPs as necessary. • Support and expand existing communication and awareness strategies for road maintenance personnel, city and municipal planners, and land users, to minimize or eliminate habitat deterioration or destruction during road maintenance or construction activities. • Integrate habitat management with that for other species occurring in the same habitat and surrounding management area (Appendix C). • Promote consistent enforcement or implementation of existing protection measures and regulations.
Alteration/ suppression of fire and grazing; Alteration to hydrological regimes; Construction and maintenance of right-of-ways; Invasive alien species; Knowledge gaps; Limiting factors	High Medium-High	Research	• Determine long-term impacts of threats and existing management practices on populations and habitat quality. • Conduct research to develop an understanding of the species ecology and habitat needs (e.g., suitable host plants, seed bank, germination). • Apply findings to develop or refine beneficial management practices for the species, particularly for mowing, burning and grazing. • Determine effect of population size and isolation for genetic diversity and population viability
All	Medium-High	Inventory and monitoring	• Use models (e.g., habitat suitability and/or species distribution models) to predict priority search areas for new populations. • Using consistent survey techniques (e.g. Henderson 2010a), continue surveys to locate new populations. Continue to survey for presence of plants at historical/possibly extirpated sites during good growing years if habitat still exists. • Using consistent monitoring techniques, determine range of natural variation for population size and area of occupancy of extant populations.

6.3 Narrative to Support the Recovery Planning Table

Due to the continued loss of habitat quality and quantity, and the limited number of populations, the most important recovery activity will be habitat conservation and stewardship through conservation arrangements and implementation of beneficial management practices. Research into some of the threats and species' needs will be required initially to create the BMPs, and adaptive monitoring is warranted before and after implementation of BMPs to determine the habitat and population response. Best practices for mowing, burning and grazing are initially the most important activities to investigate because they may represent a threat if applied intensively or at inappropriate times in the life cycle of Rough Agalinis, but are useful management practices for maintaining habitat when applied appropriately.

Research is needed to clarify the habitat needs of Rough Agalinis, including whether there is a host plant species that best promotes growth and reproductive output. Research is also needed to determine aspects of Rough Agalinis ecology such as seed bank dynamics, seed viability, seed germination requirements, seed dormancy, seedling survival, etc. Finally, research is needed to determine whether the small size and isolation of many local populations of Rough Agalinis represents a threat to genetic diversity and/or population viability of the population as a whole.

Regular monitoring is needed to determine natural range of variability, trends, and health of the populations. Monitoring will also track whether the population and distribution objectives are being met at extant sites. Surveys of potential habitat are needed because there are still a few large tracts of native pasture where Rough Agalinis was recently detected in drier upland habitat (Hamel and Dow 2010). Presence of Rough Agalinis at a given site is easily missed, giving further support for repeated surveys in suitable habitat.

7. CRITICAL HABITAT

7.1 Identification of the Species' Critical Habitat

Critical habitat is defined in the *Species at Risk Act* (S.C.2002, c29) section 2(1) as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species". Section 41 (1)(c) of *SARA* requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction.

Critical habitat for Rough Agalinis is fully identified in this recovery strategy, to the extent possible, based on best available information[9], and reflects what is needed to

[9] *Information on Rough Agalinis occurrences known to Environment Canada as of April 2014 was used in this recovery strategy.*

achieve population and distribution objectives. The approach used for identifying critical habitat for Rough Agalinis is based on a decision tree developed by the Recovery Team for Plants at Risk in the Prairie Provinces as guidance for identifying critical habitat for terrestrial and aquatic prairie plant species at risk (see Appendix A in Environment Canada 2012 for the full decision tree).

Rough Agalinis inhabits moist to dry grasslands with sparse vegetation, full exposure to sun with no shrub or forest overstory, and gravelly or sandy-gravelly limestone soils (see Section 3.3). The habitat may be characterized as early successional, and is influenced by some level and type of soil disturbance, resulting in it being hard to define in space and time.

Thus, identification of critical habitat for the Rough Agalinis is occurrence-based rather than habitat-based. Critical habitat is identified as the area encompassing the occurrence (area of occupancy) and all natural landform, soil, and vegetation features within a 300 meter critical function zone of each occurrence[10]. Existing human developments and infrastructure within the area identified as critical habitat are not considered to be critical habitat. Although the exact extent of habitat needed to surround Rough Agalinis plants to fulfill the reproductive, dispersal and long-term survival needs of the population are currently unknown, the 300 m critical function zone is based upon a detailed literature review that examined edge-effects of various land use activities that could affect resource availability for native prairie plants generally, and could contribute to negative population growth (for literature review, see Henderson 2010b and Appendix B in Environment Canada 2012).

More precise boundaries may be identified, and critical habitat may be refined in the future, as new information (e.g. from research, surveys or monitoring) is obtained but until that time, the 300 m critical function zone will represent the minimum distance that is thought to be needed to maintain the habitat required for long term survival of the species at each occurrence.

The area containing critical habitat is approximately 1040 hectares (10.4 km^2). This occupies or overlaps into approximately 84 quarter sections of land in the Dominion Land Survey in Manitoba. Generalized geographic locations at the scale of standardized 1x1 km grids and critical habitat unit polygons are provided in critical habitat maps (Appendix B). All jurisdictions and landowners who are controlling surface access to the area, or who are currently leasing and using parts of this area, may be provided with geo-referenced spatial data or large-format maps delineating the boundaries of critical habitat displayed in Appendix B, upon request.

7.2 Activities Likely to Result in the Destruction of Critical Habitat

Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would

[10] *Rivers, wetlands, and forested areas are exempt from the definition of natural landforms and vegetation.*

not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009). Activities described in Table 4 outline examples of activities likely to cause destruction of critical habitat for Rough Agalinis; however, destructive activities are not limited to those listed.

Table 4. Activities Likely to Result in the Destruction of Critical Habitat

Description of activity	Description of effect (on biophysical attribute or other) in relation to function loss of critical habitat	Additional information
Compression of soil (e.g. creation or expansion of permanent/temporary structures, trails, roads, repeated motorized traffic, concentrated livestock activity from things like bales, new corrals, additional watering sites)	Compression can damage soil structure and porosity, or reduce water availability by increasing runoff and decreasing infiltration, such that critical habitat is destroyed.	This activity must occur within the bounds of critical habitat to cause its destruction, can be a direct or cumulative effect, and is applicable at all times, with the exception of winter months when the ground is snow covered and frozen solid (soil temperature below -10^0C).
Covering of soil (e.g. creation or expansion of permanent/temporary structures, spreading of solid waste materials, roadbed construction)	Covering the soil prevents solar radiation and water infiltration needed for germination and survival of plants, such that critical habitat is destroyed.	This activity must occur within the bounds of critical habitat to cause its destruction, is a direct effect, and is applicable at all times.
Inversion/excavation/extraction of soil (e.g. new or expanded cultivation, sand and gravel extraction pits, dugouts, certain road construction and maintenance activities, pipeline installation, removal of topsoil)	Soil inversion or extraction can alter soil porosity, and thus temperature and moisture regimes, such that vegetation communities change to those dominated by competitive invasive species; thus critical habitat is destroyed.	This activity must occur within the bounds of critical habitat to cause its destruction, can be both a direct and cumulative effect, and is applicable at all times.
Alteration to hydrological regimes (e.g., temporary or permanent inundation from construction of impoundments downslope or downstream, releases of water upslope and upstream, including but not limited to damming, ditching, drainage, culvert installation, road widening or straightening, that affect hydrology of habitat)	As the seed bank and plants of Rough Agalinis are adapted to moist to dry conditions, flooding or inundation by substances like water, even for a short period of time, can be sufficient to alter habitat enough to be unsuitable for survival and re-establishment. Where the species currently occurs in moister conditions, alteration of hydrology could also result in conditions that are too dry. For example, road construction can interrupt or alter overland water flow, altering habitat conditions and threatening the long-term survival of the species at this occurrence. An increase in moisture may also lead to increased encroachment by woody vegetation and some invasive plant species.	This activity can occur within and outside the bounds of critical habitat to cause its destruction, can be a direct or cumulative effect, and is applicable at all times.

Description of activity	Description of effect (on biophysical attribute or other) in relation to function loss of critical habitat	Additional information
Indiscriminate application of fertilizers or pesticides	Fertilizer runoff can alter soil or water nutrient status, creating conditions suitable for some plant species and unsuitable for others, such that species composition in the surrounding plant community can change. Changes to soil or water nutrient status will also influence the outcome of interspecific competition for nutrients. Pesticide runoff and drift can alter plant and pollinator communities, thereby possibly reducing the capability of the habitat to support Rough Agalinis.	This activity can occur within and outside the bounds of critical habitat to cause its destruction (e.g. chemical drift, groundwater or overland flow of contaminated water), can be a direct or cumulative effect, and is applicable at all times.
Spreading of wastes or release of deleterious materials (e.g., spreading or release of materials such as hydrocarbons, manure, drilling mud, and septic fluids)	These have the potential to negatively alter soil resource availability, nutrient status, species composition, and increase surrounding competitor plants, effectively destroying the critical habitat. These liquid or semi-liquid materials can infiltrate the surface in the short-term, but leave little long-term evidence at the surface that could point to the cause of negative changes observed thereafter.	This activity can occur within and outside the bounds of critical habitat to cause its destruction (e.g. drift, groundwater or overland flow of contaminated), can be a direct or cumulative effect, and is applicable at all times.
Deliberate introduction or promotion of invasive alien species (e.g., intentional dumping or spreading of feed bales containing viable seed of invasive alien species, or seeding invasive alien species onto a disturbed area within critical habitat where the invasive alien species did not already occur, use of uncleaned motorized vehicles contaminated with invasive species material) or planting of woody vegetation (shrubs and trees)	Once established, these species can alter hydrology, soil nutrient and moisture availability, and create shade, resulting in direct competition with Rough Agalinis, such that population declines occur, effectively destroying the critical habitat. Critical habitat may be destroyed by invasive alien species mentioned in Section 4.2, as well as by other noxious prohibited weeds. It may also be destroyed by the following species which are not restricted by any legislation due to their economic value: Smooth or Awnless Brome (*Bromus inermis*), Kentucky Bluegrass (*Poa pratensis*), Crested Wheatgrass, Yellow Sweet Clover (*Melilotus officinalis*), White Sweet Clover (*Melilotus alba*). This form of destruction is often a cumulative effect resulting from the first four examples of critical habitat destruction.	This activity can occur within or adjacent to the bounds of critical habitat to cause its destruction, can be a direct or a cumulative effect, and is applicable at all times.

While the human activities listed above can destroy critical habitat, there are a number of activities that may be beneficial to Rough Agalinis and its habitat. These activities are described in Appendix D.

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Beginning in 2020 and every five years thereafter, success of recovery strategy implementation will be measured against the following performance indicators:

- Population size and distribution (area of occupancy) of all extant populations and any newly discovered or relocated populations are maintained, within the range of natural variability.
- Habitat quality and quantity are maintained at a level that supports Rough Agalinis populations.

9. STATEMENT ON ACTION PLANS

One or more action plans will be posted on the Species at Risk Public Registry by 2020.

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APPENDIX A: SUMMARY OF ROUGH AGALINIS POPULATIONS IN CANADA

Table A1. Summary of Rough Agalinis Populations in Manitoba[1]. Grey shading indicates that the population is extirpated or unconfirmed.

Population Name [EO_ID][2]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats
Poplar Point [3310][3]	1982	1982	0 [2004]	>0 [1982]	Possibly extirpated by road maintenance, hydro line, invasive species, mowing.
Woodlands [4206][3]	2004	2010	0 [2013]	18 [2010]	Extirpated by road construction (2013).
Morden [6106][3]	1939	1943	0 [2004]	>0 [1943]	Likely extirpated by altered hydrological regimes (drainage of land)
Bird's Hill [5651][3]	2009	2013	56 [2013]	>>1960 [2010]	Partially extirpated by sand/gravel extraction (2013); also road maintenance, mowing, off-road vehicle use (and ATV).
Grosse Isle [4212][4]	1986	2010	0 [2013]	13 [2010]	Road maintenance, mowing, off-road vehicle use.
Warren [4203]	2004	2010	0 [2013]	102 [2009]	Invasive species, Mowing, Off-road vehicle use.
Warren [5632]	2009	2013	24 [2013]	183 [2009]	Road maintenance, mowing
St. Laurent [4216]	2004	2013	>281 [2013]	>281 (2013)	Haying, altering hydrological regimes (drainage of land), woody vegetation encroachment
St. Laurent East [5047]	2007	2010	17 [2010]	275 [2009]	Road maintenance, mowing
St. Laurent North [6097]	2010	2010	>115 [2010]	>15 [2010]	Road maintenance, mowing
St. Laurent South [6098]	2010	2013	18 [2013]	40 [2010]	Road maintenance, mowing
St. Laurent South [7151]	2012	2013	13 [2013]	13 [2013]	Road maintenance, mowing
Lundar [5049]	2007	2009	0 [2012]	>100 [2007]	Road maintenance, mowing

Population Name [EO_ID][2]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats
Wawanesa [5650]	2009	2013	12 [2013]	52 [2009]	Road maintenance, mowing
Poplar Point – East [5628]	2009	2009	0 [2013]	15 [2009]	Road maintenance, mowing
Poplar Point [4209][5,6]	2004	2009	198 [2009]	287 [2007]	Road maintenance, mowing, overgrazing/ trampling; invasive species
Poplar Point [4210][6]	2004	2009	98 [2009]	98 [2009]	Road maintenance, mowing
Brandon [4208]	2001	2009	4 [2009]	20 [2001]	Road maintenance; invasive species; mowing; off-road vehicle use; gravel extraction.
Poplar Point [4211][7]	2004	2004	0 [2013]	1 [2004]	Road maintenance, mowing

[1] Values and populations in the table are those known to Environment Canada as of April 2014, and were obtained from the Manitoba Conservation Data Centre.
[2] The population number and names assigned in COSEWIC (2006) are being used here for consistency and comparison.
[3] Extirpated population (COSEWIC 2006, MB CDC 2014) with the exception of Bird's Hill (5651), where a portion of the population was recently extirpated by sand and gravel extraction activities but a large portion still remains (MB CDC, unpublished data).
[4] There are a few historic occurrences within this population.
[5] COSEWIC (2006) has Poplar Point as 4 populations (population 5-8). However, based on the Natureserve (2014a) habitat-based plant delimitation guidance they are being considered as one element occurrence.
[6] There are some unconfirmed/inaccurate occurrences within this population.
[7] This population is considered unconfirmed at this time; location information is vague and plants have not been relocated since it was reported. It is possible this was misidentified and is actually Gattinger's Agalinis (Foster 2008); confirmation is required. The population in COSEWIC (2006) listed as Population 9, Popular Point, was later confirmed to be Gattinger's Agalinis, and not Rough Agalinis as initially reported; it is only 4 km South of this population (Foster 2008).
Data for this table was obtained from the Manitoba Conservation Data Centre, published reports and unpublished data, and COSEWIC 2006.

APPENDIX B: CRITICAL HABITAT MAPS FOR ROUGH AGALINIS IN CANADA

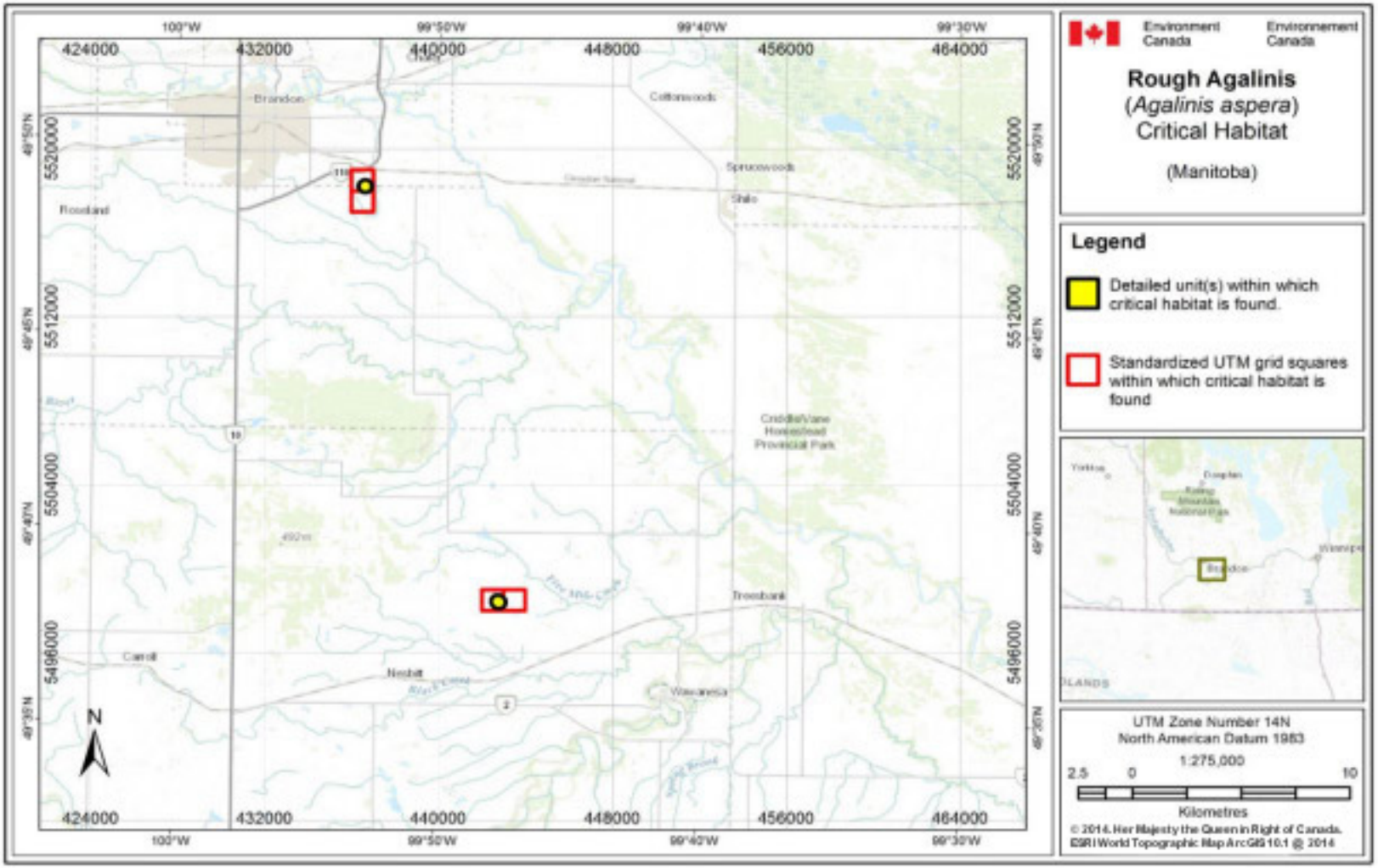

Figure B1. Critical habitat for Rough Agalinis in Manitoba (Brandon and Wawanesa populations as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat.

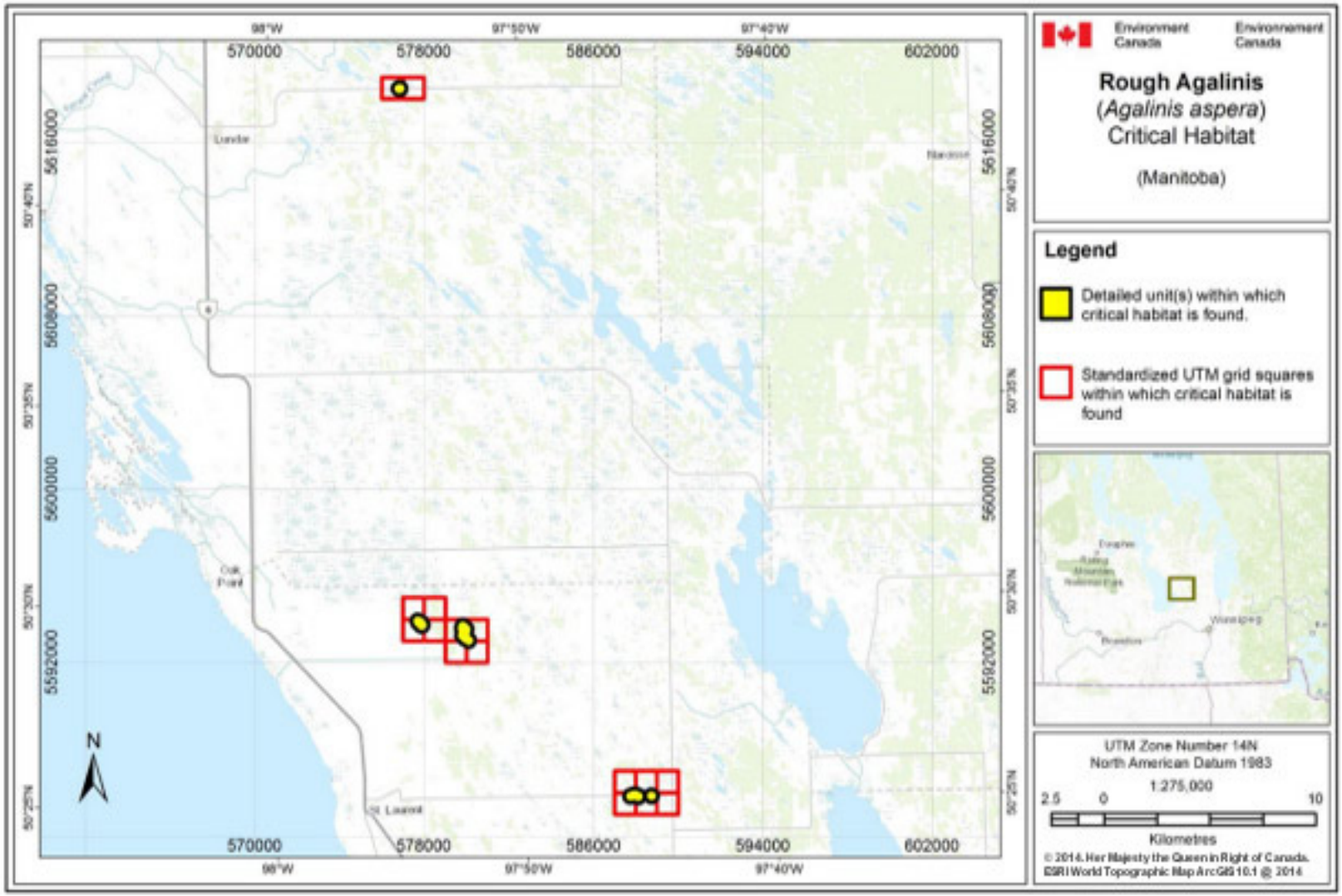

Figure B2. Critical habitat for Rough Agalinis in Manitoba (Lundar, St. Laurent 5047, 5049 and 6097 populations as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat.

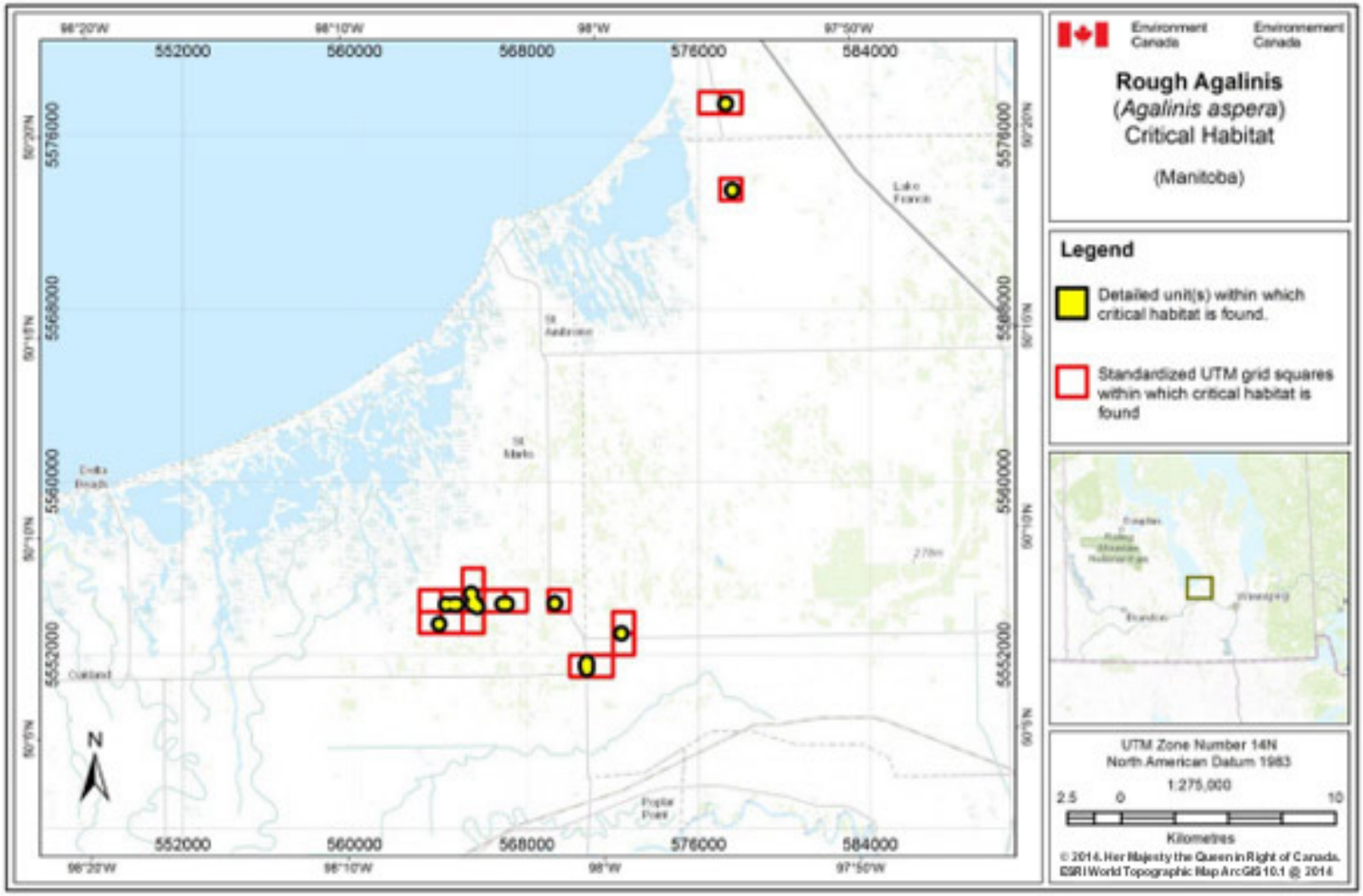

Figure B3. Critical habitat for Rough Agalinis in Manitoba (Poplar Point, St. Laurent 6098 and 7151 populations as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat.

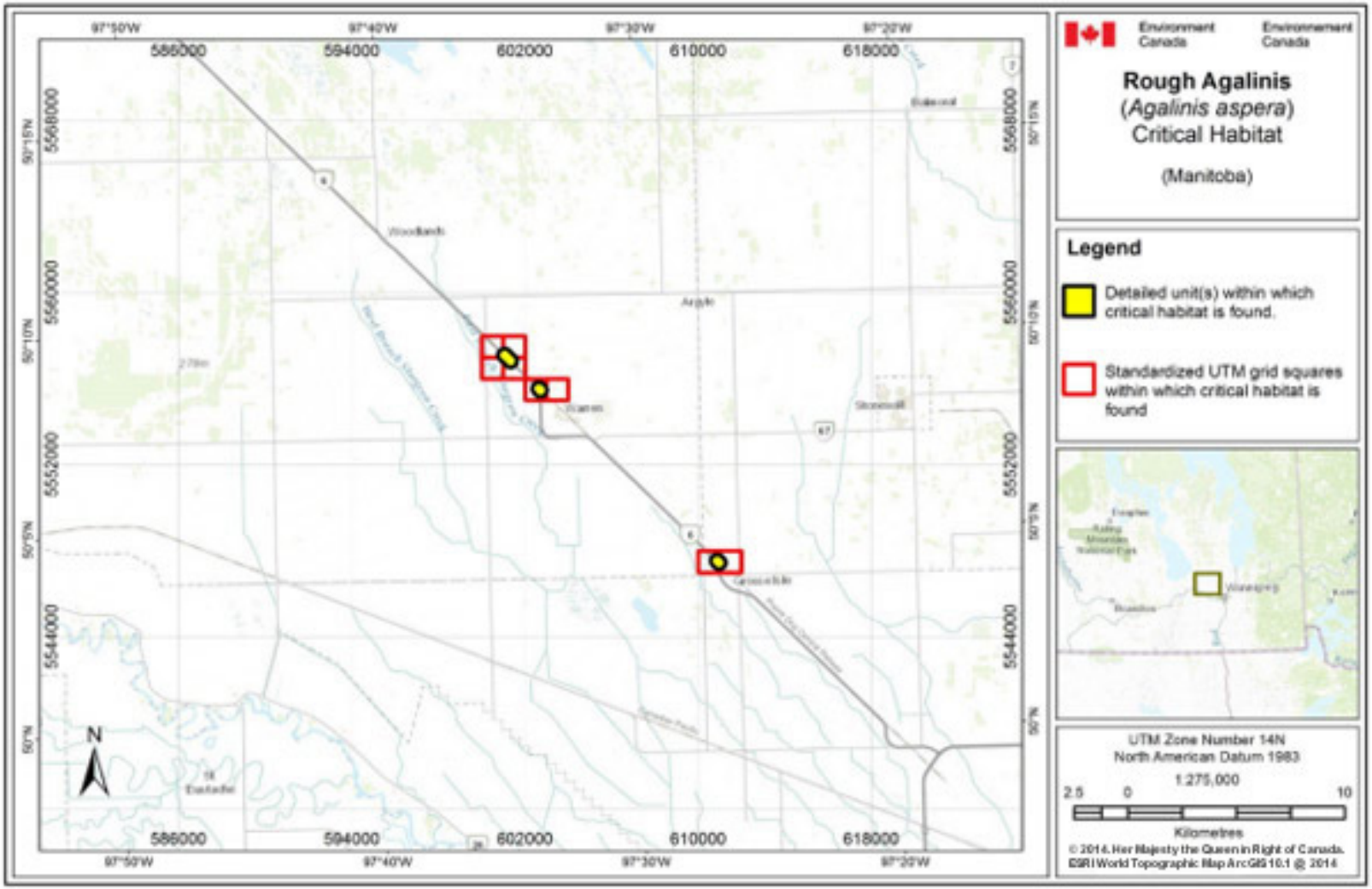

Figure B4. Critical habitat for Rough Agalinis in Manitoba (Warren and Grosse Isle populations as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat.

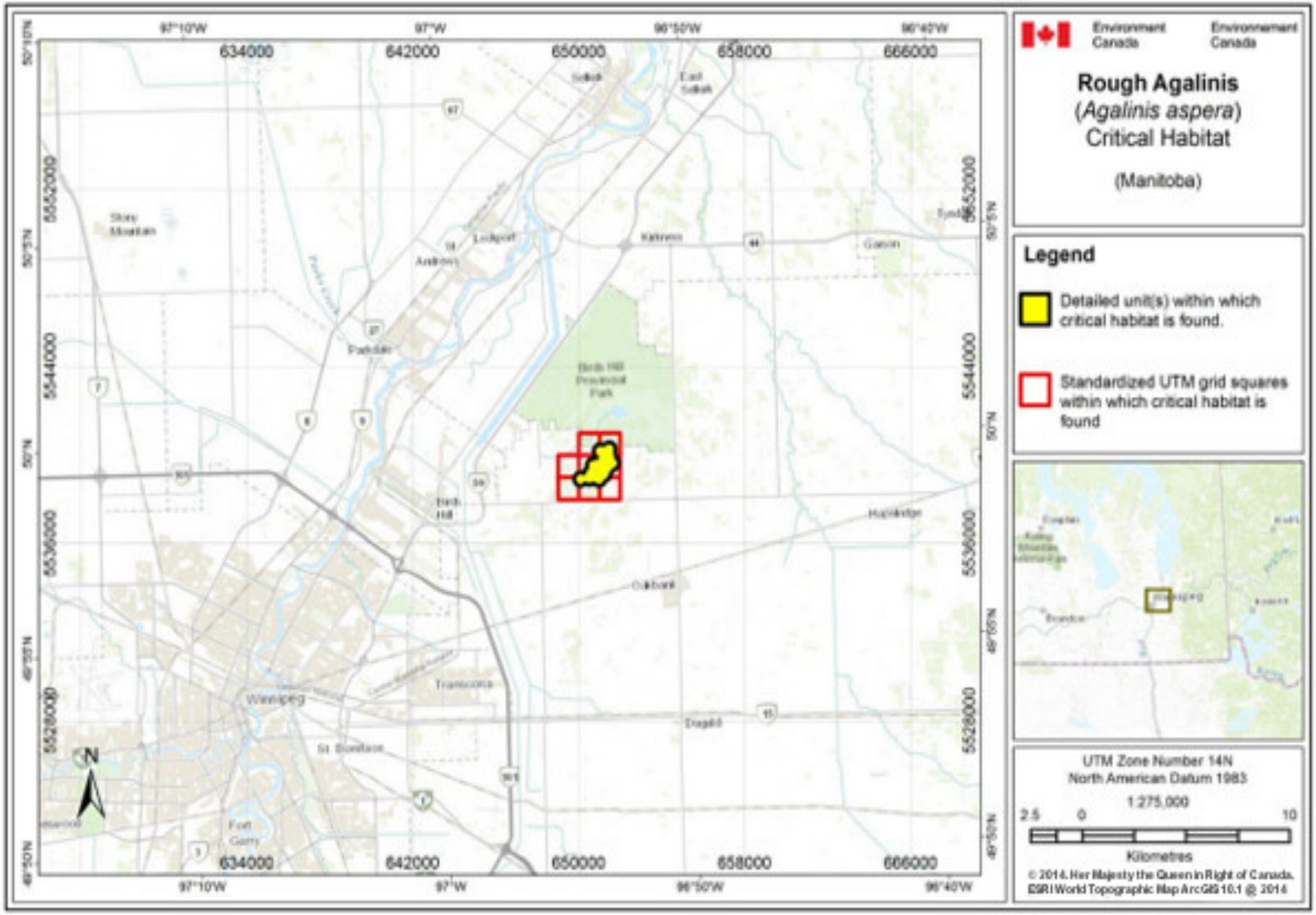

Figure B5. Critical habitat for Rough Agalinis in Manitoba (Bird's Hill populations as described in Table A1) is represented by the yellow shaded units, where the criteria set out in Section 7.1 are met. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area containing critical habitat.

APPENDIX C: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals[11]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[12] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

Many provincially rare and federally at-risk species in Manitoba are found in habitat also occupied by Rough Agalinis (Table C1). Most, if not all, of these species will benefit from recovery activities and management of threats intended to maintain tallgrass prairie habitat for the benefit of Rough Agalinis.

The potential for the strategy to inadvertently lead to adverse effects on other species was considered. Rough Agalinis management practices are aimed at maintaining or improving remnant native prairie habitats. For the most part managing for healthy native ecosystems will benefit non-target species, natural communities, or ecological processes. As a general rule, management actions that incorporate or mimic natural disturbance regimes (e.g., fire and grazing) are natural components of prairie ecosystems and are not likely to negatively impact the persistence of other native species particularly if the timing, intensity and frequency mimic those natural processes (Samson and Knopf 1994). However, some management practices, including prescribed burns, mowing or grazing, and some forms of integrated weed management, have the potential to affect other species negatively in the short or long-term. Dakota Skipper (*Hesperia dacotae*), Western Silvery Aster (*Symphyotrichum sericeum*) and Rough Agalinis, for example, can be negatively affected by mowing if done in late summer/fall whereas Small White Lady's-slipper (*Cypripedium candidum*) can be harmed if the area is mowed during the spring and early summer (Environment Canada 2014a, Manitoba Conservation unpublished management summaries). Therefore, it is important that management actions resulting from recovery activities, action plans and beneficial management plans are developed from an ecosystem perspective (including

[11] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[12] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

development of multi-species action plans and ecosystem beneficial management plans), incorporating as many species needs as possible, and evaluating the ecological risks of any action, in order to reduce any possible negative effects to other species. A rigorous monitoring program should also be in place to evaluate short and long term effects of management actions on the ecosystem, habitat quality, and individual species at risk populations. Efforts should be coordinated with other recovery teams and organizations working in the tallgrass prairie ecosystem to ensure the most efficient use of resources and to prevent duplication of effort or conflicts with research.

Table C1. Federal species at risk which co-occur, or may co-occur, in areas occupied by Rough Agalinis.

Species Name	SARA Designation
Vascular Plants	
Gattinger's Agalinis (*Agalinis gattingeri*)	Endangered
Small White Lady's-slipper (*Cypripedium candidum*)	Endangered
Western Prairie Fringed-orchid (*Platanthera praeclara*)	Endangered
Western Silvery Aster (*Symphyotrichum sericeum*)	Threatened
Riddell's Goldenrod (*Solidago riddellii*)	Special Concern
Invertebrates	
Dakota Skipper (*Hesperia dacotae*)	Threatened
Monarch Butterfly (*Danaus plexippus*)	Special Concern

APPENDIX D: BENEFICIAL RANGELAND MANAGEMENT PRACTICES

Rough Agalinis occupies habitat varying in ecology, land use history, and land tenure, as well as occupying habitat containing other species at risk (Appendix C). For these reasons, it is difficult to propose a general beneficial management plan that would be appropriate to encompass all habitat and needs. Instead, specific recommendations will be made in one or more action plans or beneficial management plans at scales appropriate for the habitat, land use, suite of species, and application. Any management undertaken will require baseline data on habitat and species at risk populations, followed up by regular monitoring so that adaptive management practices can occur and knowledge gaps on impacts of threats and management practices can be answered. At this time only a few general statements can be made regarding on-going activities that should benefit Rough Agalinis.

Careful and deliberate application of grazing by one or more classes of livestock may help maintain open and slightly disturbed prairie habitat needed by Rough Agalinis. Management of these livestock requires occasional and randomly dispersed overland access on-foot, on-horseback, by all-terrain vehicle, or on existing trails by vehicles up to 1 tonne. In light of these facts, no changes are recommended at this time to current stocking rates, grazing seasons, classes of livestock, or access methods used by property owners with Rough Agalinis on their land. Research is needed to determine ideal stocking rates, and if alternative grazing systems could enhance habitat, reproductive output, or dispersal of Rough Agalinis. In habitat where grazing is not feasible (e.g. roadsides), mowing and subsequent removal of thatch during times of the year appropriate to the life cycle of Rough Agalinis may be beneficial in maintaining open habitat and managing invasive species or woody vegetation growth; timing of mowing will need to consider the life cycles of other species at risk co-occurring in these habitats (Appendix C).

Integrated weed management to control invasive alien species and management to control encroachment of woody vegetation could directly reduce competition with Rough Agalinis. Approaches used to reduce the occurrence and density of invasive alien species or woody vegetation in Rough Agalinis habitat need to be dealt with on a site-specific basis or in one or more action plans.

Fires resulting from accidental or deliberate ignition by people will not destroy Rough Agalinis habitat nor harm individual plants under most circumstances. In fact, prescribed burns that are carefully managed and that mimic the timing, frequency and intensity of natural processes may improve habitat by reducing or preventing invasion of woody vegetation, invasive alien species, grass litter, insect pests and pathogens.

Environment Canada will work with all of its partners to define and improve best practices for conserving the Rough Agalinis across its range and to incorporate multi-species requirements and management practices.