

# Recovery Strategy for the Contorted-pod Evening-primrose (*Camissonia contorta*) in Canada

## Contorted-pod Evening-primrose



2011

**Recommended citation:**

Parks Canada Agency. 2011. Recovery Strategy for the Contorted-pod Evening-primrose (*Camissonia contorta*) in Canada. *Species at Risk Act Recovery Strategy Series*. Parks Canada Agency. Ottawa. vi + 30 pp.

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 Species at Risk Public Registry ([www.sararegistry.gc.ca](http://www.sararegistry.gc.ca)).

**Cover illustration:** Photograph of Contorted-pod Evening-primrose by M. Fairbarns.

Également disponible en français sous le titre  
« Programme de rétablissement de l'onagre à fruits tordus (*Camissonia contorta*) au Canada »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2011. All rights reserved.

ISBN 978-1-100-19149-2

Catalogue no. En3-4/116-2011E-PDF

*Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.*

## PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) 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 within five years.

The Minister responsible for the Parks Canada Agency and the Minister of the Environment are the competent ministers for the recovery of the Contorted-pod Evening-primrose and with the assistance of the Contorted-pod Evening-primrose Recovery Advisory Team have prepared this strategy, as per section 37 of SARA. Its preparation has been led by the Parks Canada Agency, in cooperation with the Government of British Columbia and Environment Canada.

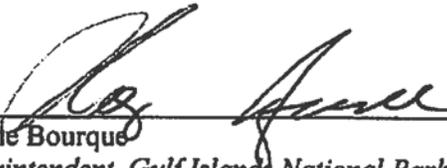
Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by the Parks Canada Agency, Environment Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Contorted-pod Evening-primrose 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 the Parks Canada Agency, Environment Canada or 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.

## RECOMMENDATION AND APPROVAL STATEMENT

*The Parks Canada Agency led the development of this federal recovery strategy, working together with the other competent minister(s) for this species under the Species at Risk Act. The Chief Executive Officer, upon recommendation of the relevant Park Superintendent(s) and Field Unit Superintendent(s), hereby approves this document indicating that Species at Risk Act requirements related to recovery strategy development (sections 37-42) have been fulfilled in accordance with the Act.*

Recommended by:

  
\_\_\_\_\_  
**Wayne Bourque**  
*Superintendent, Gulf Islands National Park Reserve*

Recommended by:

  
\_\_\_\_\_  
**Dale Redford**  
*Acting Field Unit Superintendent, Coastal British Columbia Field Unit*

Approved by:

  
\_\_\_\_\_  
**Alan Latourelle**  
*Chief Executive Officer, Parks Canada*

## **ACKNOWLEDGMENTS**

Matt Fairbarns of Aruncus Consulting and Ross Vennesland of the Parks Canada Agency were the authors of this recovery strategy. An advisory group of technical experts oversaw its development. Members of this technical advisory group were Brenda Costanzo of the B.C. Ministry of Environment, Matt Fairbarns, Ted Lea of the B.C. Ministry of Environment and Ross Vennesland and Conan Webb of the Parks Canada Agency. The Parks Canada Agency provided the funding for the production of the strategy. Louise Blight, Jeff Brown, Diane Casimir, Trudy Chatwin, Marilyn Fuchs, Todd Golumbia, Stephanie Hazlitt, Greg MacMillan, Bonnie McKenzie, Kari Nelson, Jillayne Peers, Richard Pither, Lucy Reiss, Dan Shervill, Kara Vlasman, Leah Westereng and Patrick Yarnell provided input into the strategy.

## EXECUTIVE SUMMARY

Contorted-pod Evening-primrose (*Camissonia contorta*) was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 2006 and was added to Schedule 1 of the *Species at Risk Act* (SARA) in December 2007.

Contorted-pod Evening-primrose is an annual plant that occurs from British Columbia (B.C.) to California, east to Idaho and western Nevada. The species is considered to be globally secure. There are nine known populations in Canada, one of which has been extirpated (last observed in 1893). In Canada, Contorted-pod Evening-primrose is limited to the southeast coast of Vancouver Island and the southern and northern Gulf Islands, the northern limit of its global range. Within Canada, it is restricted to sandy backshore habitats. It prefers low elevation (under 100 m) open areas that are moist in the winter and spring and very dry by mid-summer.

Contorted-pod Evening-primrose faces threats from habitat destruction, recreational activities, invasive plants, and limiting factors such as constraints from small population sizes (all populations likely are under a minimum viable size).

The overall aim of this recovery strategy (for the period 2011 to 2020) is to attain nine viable populations of Contorted-pod Evening-primrose in Canada. To meet this aim, this recovery strategy has four population and distribution objectives. Objectives are not listed in order of priority (see Table 4 for prioritization of activities).

1. Maintain the known extent of occurrence for the species in Canada (by 2015).
2. Maintain population sizes for all extant locations at current or higher levels (by 2015).
3. Ensure all eight extant populations reach, and are maintained at, no less than their minimum viable population size (by 2020).
4. Establish one additional population (to replace the single known extirpated population) at a site with suitable habitat within the known range of the species in Canada, and maintain it at no less than its minimum viable population size (by 2020).

Additional broad approaches recommended for recovery include activities around conserving populations, conducting priority research to fill crucial knowledge gaps, mapping, surveying and monitoring of extant populations as well as candidate areas for recovery of the one extirpated population, population restoration/augmentation and public education and outreach.

An identification of critical habitat is included in this strategy for the survival and limited expansion of seven of eight extant populations. This identification is not sufficient to meet the population and distribution objectives. Plans are outlined for identifying further critical habitat to meet the population and distribution objectives.

One or more action plans for Contorted-pod Evening-primrose will be posted on the SAR Public Registry by March 2015.

## RECOVERY FEASIBILITY SUMMARY

The recovery of Contorted-pod Evening-primrose in Canada is considered feasible based on the criteria set by the Government of Canada (2009):

Recovery criteria	Feasibility for Contorted-pod Evening-primrose
1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?	Yes. All existing populations produce seeds.
2. Is sufficient habitat available to support the species, or could it be made available through habitat management or restoration?	Yes. While Contorted-pod Evening-primrose requires specialized habitat conditions there are occupied locations and other areas of unoccupied habitat which appear capable of sustaining the species.
3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions	Yes. Threats can be mitigated through the actions outlined in Table 4.
4. Do the necessary recovery techniques exist and are they known to be effective.	Yes. Over the short term, recovery techniques consist primarily of threat mitigation techniques. Over the longer term, techniques for re-establishing extirpated populations are recommended to be developed.

## TABLE OF CONTENTS

PREFACE .....	i
RECOMMENDATION AND APPROVAL STATEMENT .....	ii
ACKNOWLEDGMENTS .....	iii
EXECUTIVE SUMMARY .....	iv
RECOVERY FEASIBILITY SUMMARY .....	v
1. COSEWIC Species Assessment Information .....	1
2. Species Status Information .....	1
3. Species Information .....	1
3.1 Species Description .....	1
3.2 Population and Distribution .....	2
3.3 Needs of the Contorted-pod Evening-primrose .....	4
4. Threats .....	6
4.1 Threat Assessment .....	6
4.2 Description of Threats .....	7
5. Population and Distribution Objectives .....	8
6. Broad Strategies and General Approaches to Meet Objectives .....	9
6.1 Actions Already Completed or Currently Underway .....	9
6.2 Strategic Direction for Recovery .....	10
7. Critical Habitat .....	11
7.1 Identification of the Species' Critical Habitat .....	12
7.1.1 Attributes of critical habitat .....	12
7.1.2 Location of critical habitat .....	14
7.2 Schedule of Studies to Identify Critical Habitat .....	24
7.3 Activities Likely to Result in the Destruction of Critical Habitat .....	24
8. Measuring Progress .....	26
9. Statement on Action Plans .....	26
10. References .....	27
APPENDIX A: Effects on the Environment and Other Species .....	29

## 1. COSEWIC SPECIES ASSESSMENT INFORMATION

**Date of Assessment:** April 2006

**Common Name (population):** Contorted-pod Evening-primrose

**Scientific Name:** *Camissonia contorta*

**COSEWIC Status:** Endangered

**Reason for Designation:** An annual herb restricted to several dry, open and sandy coastal habitats of very small size. The small fragmented populations are impacted by ongoing habitat loss, high recreational use and competition with several invasive exotic plants.

**Canadian Occurrence:** British Columbia

**COSEWIC Status History:** Designated Endangered in April 2006.

## 2. SPECIES STATUS INFORMATION

Contorted-pod Evening-primrose is ranked globally secure (G5; NatureServe 1988), but critically imperiled in Canada (N1; NatureServe 1988) and in British Columbia (S1; B.C. Conservation Data Centre 2011). Its status in Washington, Oregon, California, Nevada and Idaho has not been ranked (NatureServe 1988). It was ranked critically-imperiled in Vermont but this was based on a misidentification and should be rejected as the species does not occur in that jurisdiction (NatureServe 1988). There is no estimate of global abundance, but the Province of British Columbia considers the species to have less than 10% of its global abundance in the province (B.C. Conservation Framework 2010).

## 3. SPECIES INFORMATION

### 3.1 Species Description

Contorted-pod Evening-primrose (Figure 1) is a slender, annual herb, occasionally growing to 40 cm long, arising from a slender taproot. Its stem is wiry, usually branched, peeling below and often sprawling. Its leaves are linear to narrowly elliptic, 5-30 mm long and entirely to remotely toothed. The flowers are borne on a short stalk or are unstalked. Each flower consists of four sepals and four petals. The petals are 3-5 mm long and yellow, fading to red. The stems, leaves and capsules are often deep red, particularly in unshaded environments.

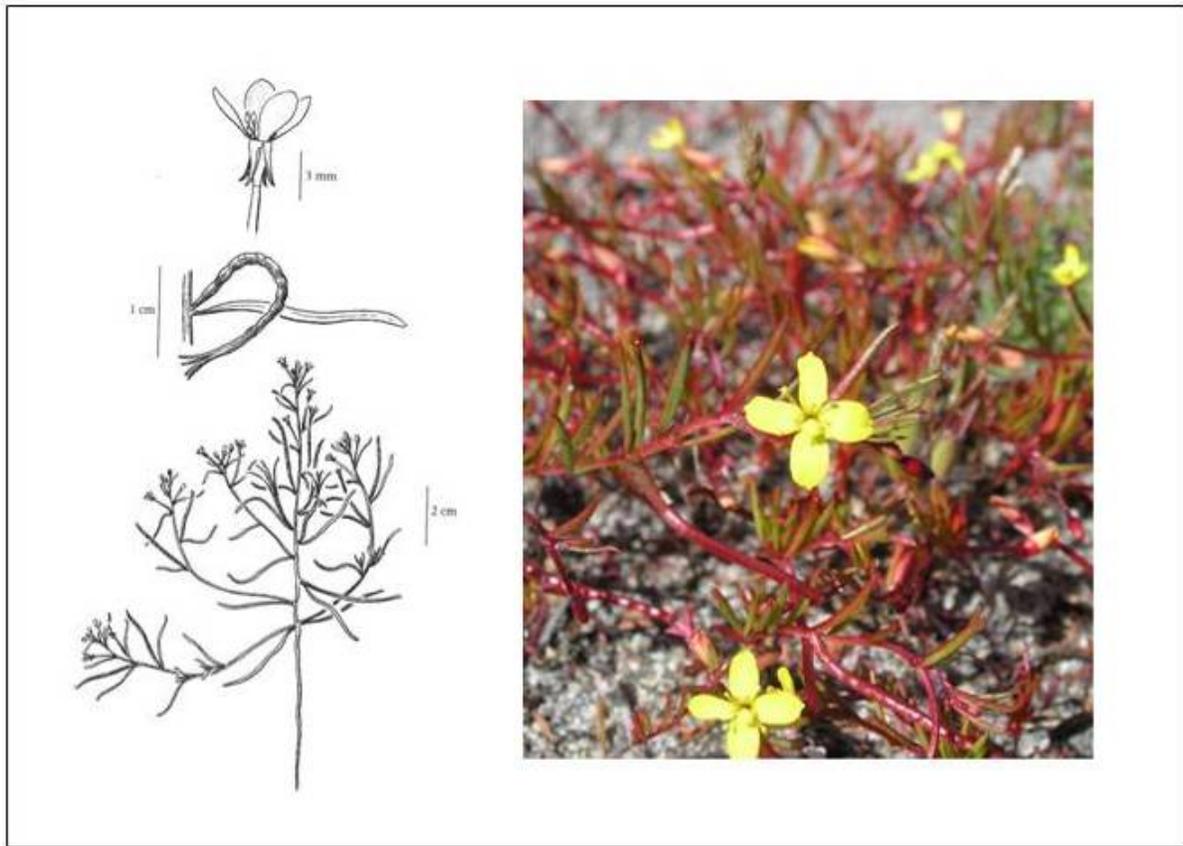


Figure 1. Illustration of Contorted-pod Evening-primrose (from *Vascular Plants of the Pacific Northwest*, by L.C. Hitchcock, A. Cronquist and M. Ownbey, with illustration by J.R. Janish), published by the University of Washington Press (1969); and photo by Matt Fairbarns. Both images used with permission.

### 3.2 Population and Distribution

Contorted-pod Evening-primrose ranges from British Columbia (B.C.) to California, east to Idaho and western Nevada (see COSEWIC 2006 for additional details). In Canada, it is at the northern edge of its global range (Natureserve 1988).

In Canada, populations of Contorted-pod Evening-primrose occur in an approximately 750 km<sup>2</sup> extent of occurrence near the coast on southeast Vancouver Island and the Gulf Islands of B.C. (Figure 2). There are records of nine populations in Canada (Figure 2, Table 1), one of which has been extirpated (Population 9 was last observed in 1893). Due to loss and degradation of sandy habitats on the coast of B.C., the historical number of populations might have been higher than nine. Thirty sites with sandy habitats that appear suitable for this species were surveyed between 2004 and 2006 to confirm that no undetected populations were present in the region (COSEWIC 2006).

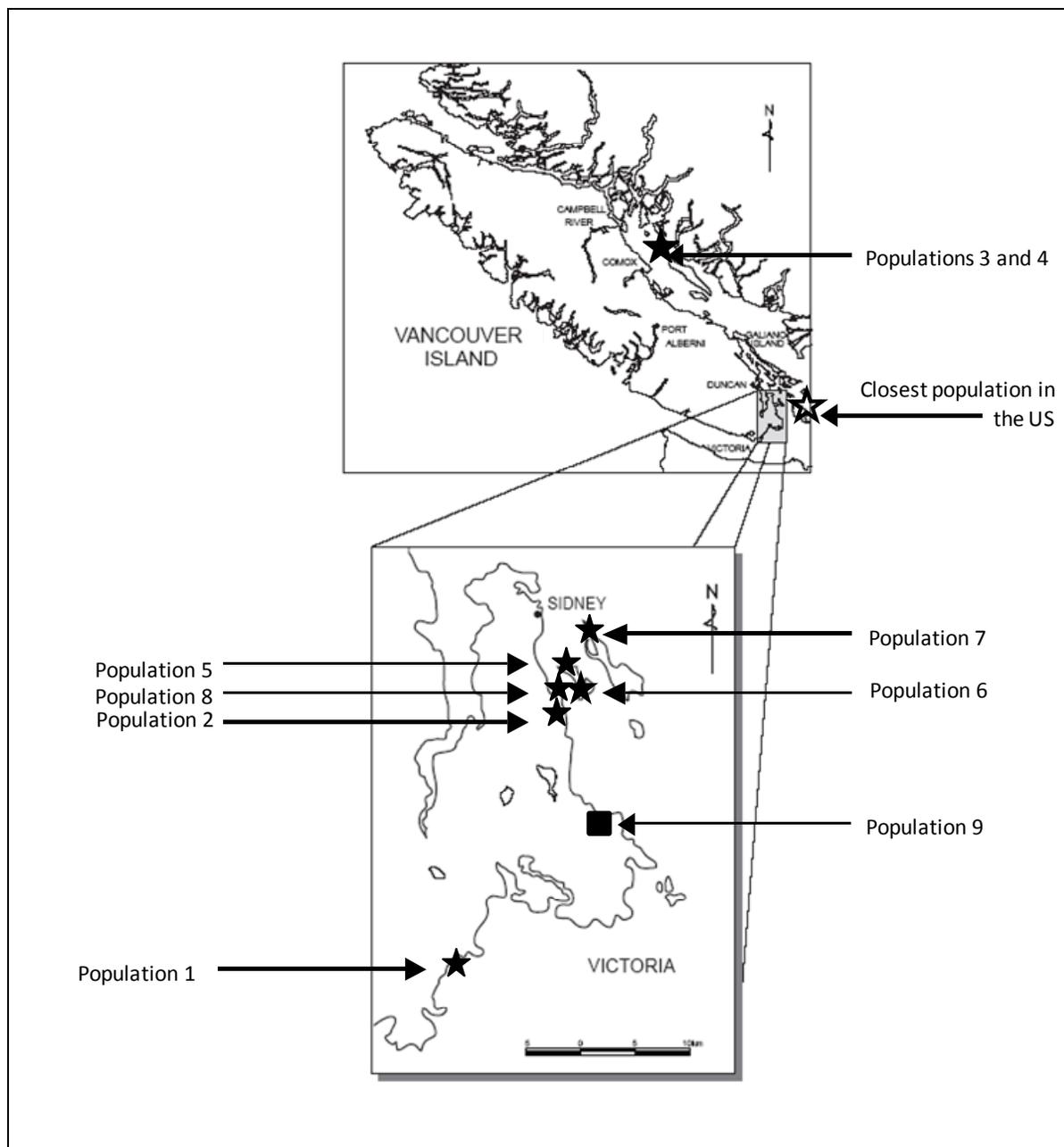


Figure 2. Distribution of Contorted-pod Evening-primrose in Canada (from COSEWIC 2006). Extant populations are shown by solid stars and the one extirpated population is shown by a solid square. Due to the scale used for this map, Northern Gulf Island Populations 3 and 4 are shown as a single symbol. The open star shows location of nearest U.S. population.

In the status report (COSEWIC 2006), the Canadian population was estimated at 3,500 – 4,500 individuals with an area of occupancy of 7.84 ha (surveys conducted in 2004). In 2005, Population 7 expanded slightly into areas unoccupied in 2004 and increased in abundance. Surveys in 2006 (after the last status assessment by COSEWIC) revealed that all plants at Population 6 had been destroyed during a land development project, but in 2007 a small number of plants were observed in or near the original location (Table 1). The exact location of these

plants is not known, and it is not clear if they were in the same location as the extirpated population or at a different location nearby. Similarly, as described in COSEWIC (2006) Population 8 was destroyed by off road vehicle use, but that threat has been at least partially mitigated through the use of barriers and the population has since naturally re-colonized the site (Table 1).

Revising population totals since the field work was completed for the COSEWIC assessment, the total Canadian population was estimated to have declined overall from 2004 to 2006 to about 2,250-2,850 individuals (due primarily to destruction at one site), occupying about 38.1 ha. This constitutes an estimated decline in total population size of approximately 36% (following COSEWIC standard of using the lowest population numbers when provided with a range of values), with a possible range from 19-50%. The reason why the area of occupancy has risen while population numbers have fallen is because a small number of new plants have been discovered over a relatively large area, so this small discovery of individuals has greatly expanded the known area of occupancy. Thus, area of occupancy is currently a poor measure of overall population trend for this species.

**Table 1. Summary of Populations of Contorted-pod Evening-primrose in Canada.**

Population number and name <sup>1</sup>	Status	Recent records		Land Tenure
		Last year observed	Last population census (year)	
1. Metchosin	Extant	2006	253 (2004)	Capital Regional District Park
2. Saanich A	Extant	2006	500-1,000 (2004)	Capital Regional District Park
3. Savary Island A	Extant	2006	190 (2004)	B.C. Ministry of Transportation and Infrastructure
4. Savary Island B	Extant	2004	700 (2010)	Private
5. Saanich B	Extant	2006	500-600 (2004)	Private (James Island)
6. Saanich C	Extant	2007	100 (2007)	Private (James Island)
7. Saanich D	Extant	2005	114 (2005)	Gulf Islands National Park Reserve and Canadian Coast Guard
8. Saanich E	Extant	2007	200-250 (2007)	Cordova Spit Municipal Park
9. Cedar Hill	Extirpated	1893	0 (2005)	Exact location unknown

### 3.3 Needs of the Contorted-pod Evening-primrose

For a detailed description of the biology of the species, see COSEWIC (2006). Contorted-pod Evening-primrose does not reproduce asexually (i.e., from cuttings or pieces of the plant). Thus, reproduction and dispersal of the species is dependent on seeds. It is an annual species so populations are replenished either by recruitment from a local seed bank and/or by dispersal from other populations. It is not known if Contorted-pod Evening-primrose is capable of banking dormant seeds in the substrate for two or more years and there are no studies on its population processes that might advise on its ability to bank seeds. Dispersal between populations is probably an uncommon event.

In Canada, Contorted-pod Evening-primrose inhabits sandy backshore<sup>1</sup> habitats in the Southern Gulf Islands and Strait of Georgia Ecosections, where it occurs in the Coastal Douglas-fir Biogeoclimatic Zone (B.C. Ministry of Environment n.d., B.C. Ministry of Forests 2003). Key site characteristics are listed in Table 2.

**Table 2. Key habitat attributes of sites where Contorted-pod Evening-primrose is found in Canada.**

Attribute	Description
Elevation (m)	0-20
Aspect (degrees)	Various, usually 145-270 if slope > 5%
Slope Angle (%)	0-50
Meso-slope Position	Lower slope or level
Exposure	Moderately exposed to wind and salt spray
Drainage	Very rapidly
Mineral Soil Texture	Sandy
Surface Organic Horizon	< 0.5 cm
Root-restricting Layer	None
Coarse Fragments	< 1%
Terrain	sandy aeolian blanket or thick veneer

Contorted-pod Evening-primrose appears to tolerate light levels of sand erosion and deposition and may require such disturbances in order to escape competition (Fairbarns, pers. obs.). In Canada, it is absent from more active areas of sand dunes and other sites with unvegetated sand. In the nearby San Juan Islands of Washington State, however, it sometimes occurs in slightly more active dune blow-outs, where individual plants may develop a spreading patch up to one metre in diameter.

Contorted-pod Evening-primrose is restricted to sites that have negligible tree or shrub cover, although the non-native and invasive Scotch Broom (*Cytisus scoparius*) sometimes grows nearby. Herbs, mosses and lichens tend to be sparse. The cover of herbaceous plants usually varies from 1-20% but may be as high as 50%. Native herbaceous species such as Tall Peppergrass (*Lepidium virginicum*), Native Red Fescue (*Festuca rubra*), Sea-blush (*Plectritis congesta*) and Blue-eyed Mary (*Collinsia parviflora*) are often present. Contorted-pod Evening-primrose often grows with mosses (primarily Roadside Rock Moss, *Racomitrium canescens*, and Awned Haircap Moss, *Polytrichum piliferum*) but it is usually absent from microsites where the moss cover exceeds 30%.

Demographic collapse constitutes a probable, moderate and ongoing issue because all populations of Contorted-pod Evening-primrose are threatened simply by their small size. Annual species, such as Contorted-pod Evening-primrose, that do not produce offshoots and

<sup>1</sup> Defined as the coastal zone lying between the beach berm and the backshore slope, affected by waves only during severe storms.

which survive because they can tolerate levels of stress too high for most species tend to be particularly prone to extirpation and thus have comparatively high Minimum Viable Population (MVP) sizes (Pavlik 1996, Traill et al. 2007). Pavlik (1996) reviewed three studies and reported that a reasonable working definition of MVP size for plant reintroduction projects would range from about 50–2500 individuals, depending on the life history of the species in question. Based on a review of 22 papers, Traill et al. (2007) reports for plants (annual and perennial) a median MVP size of about 4,824 individuals. For Contorted-pod Evening-primrose, several life history traits would predispose it to having a relatively large MVP compared to most plants (e.g., annual, herbaceous, occurring in habitat with high environmental variation, etc), so MVP likely will fall at the higher end of the range for plants. The specific MVP size for Contorted-pod Evening-primrose has not been determined, but determining it is a recommended action for research (see Table 4).

## 4. THREATS

### 4.1 Threat Assessment

Table 3. Threat Assessment Table.

Threat	Level of Concern	Extent	Occurrence	Frequency	Severity	Causal Certainty
<b>Habitat Loss and Degradation</b>						
Land development	High	Widespread	Current / anticipated	Recurrent	High	High
Recreation – vehicles	High	Widespread	Current / anticipated	Recurrent	High	High
Recreation – foot traffic	Medium	Widespread	Current / anticipated	Continuous	Medium	High
Road maintenance	Low	Localized	Anticipated	Unknown	Medium	Low
<b>Exotic or Invasive Species</b>						
Non-native plants - competition	High	Widespread	Current / anticipated	Continuous	High	High
Non-native animals - herbivory	Low	Widespread	Anticipated	Unknown	Unknown	Low
<b>Climate</b>						
Climate Change	Low	Widespread	Unknown	Continuous	Unknown	Low

## 4.2 Description of Threats

The following section is adapted from the species description provided in the status report (COSEWIC 2006).

### *Habitat destruction and degradation*

Although several sites are currently protected in parks, land development constitutes a demonstrated, severe and ongoing threat at several sites across the species range. All plants at Population 6 were destroyed during the development of a golf course on private land, though a small number of plants have since recolonized the area (Table 1). Population 3 is on a Crown land right-of-way belonging to the B.C. Ministry of Transportation and Infrastructure. At this time, there are no development plans for this site (C. Wheeler, pers. comm.).

Recreational use (by pedestrians and vehicles such as all terrain vehicles) constitutes a demonstrated, severe, extensive and ongoing threat to sandy backshore habitats at almost all sites within the Canadian range of Contorted-pod Evening-primrose. There is heavy trampling associated with visitors to some of the sandy backshore habitats where this species occurs (e.g., from hiking, dog-walking, sunbathing and picnicking). Trampling is especially pronounced at Populations 1, 2, 4, 7 and 8. The site that Population 8 occupies has suffered from heavy use by off-road vehicles. Less severe off-road vehicle impacts were also observed at Populations 5 and 6, and there is the potential for damage from off-road vehicles at Population 2 due to its proximity to Population 8, although barriers have recently been erected that are at least partially mitigating the threat from off road vehicles.

### *Exotic and invasive species: plants*

Exotic and invasive plant species constitute a demonstrated, severe and ongoing threat. A number of exotic and invasive species have invaded habitats favoured by Contorted-pod Evening-primrose, especially at Populations 5 and 7.

The exotic and invasive Scotch Broom (*Cytisus scoparius*) is present immediately adjacent to or within all eight extant populations. It competes for space with Contorted-pod Evening-primrose. It also shades sites during part of the day and may gradually stabilize semi-active sand areas by forming dense thickets. This will facilitate succession and eliminate open habitats.

Other exotic and invasive species that pose a serious threat at one or more sites include Crow Garlic (*Allium vineale*), an aggressive onion, which is spreading rapidly in areas where it has become established (especially at Population 5), and European Beachgrass (*Ammophila arenaria*), which tends to stabilize dunes and thereby alter substrate dynamics, especially at Population 7. A portion of Population 7 appears to have been lost, likely as a result of invasion by Scotch Broom and European Beachgrass (M. Fairbarns, pers. obs.). This population is already at low numbers, so further loss is a significant threat to its persistence. Other exotic species that occur in the vicinity of Contorted-pod Evening-primrose and pose a potential threat include grasses such as Early Hairgrass (*Aira praecox*), Silver Hairgrass (*A. caryophylla*), Cheatgrass (*Bromus tectorum*), Soft Brome (*B. hordeaceus*), Ripgut Brome (*B. rigidus*), Rattail Fescue (*Vulpia myurus*) and Barren Fescue (*Vulpia bromoides*). Frequent non-native forbs include

Sheep Sorrel (*Rumex acetosella*), Sticky Chickweed (*Cerastium glomeratum*), Hairy Hawkbit (*Leontodon taraxacoides*), Hairy Cat's-ear (*Hypochaeris radicata*) and Stork's-bill (*Erodium cicutarium*).

#### *Exotic and invasive species: animals*

Herbivory by non-native animals constitutes a possible, minor and ongoing threat. Plants in Populations 1, 2, 5 and 7 have experienced light to moderate levels of herbivory (M. Fairbarns, pers. obs.). It is assumed that this herbivory is from Eastern Cottontails (*Sylvilagus floridanus*), as rabbit droppings are abundant at most of these sites as well as in the location that Population 8 occupies. However, the impact of rabbit grazing on competing vegetation, which is quite evident, may offset the minor impacts of grazing on Contorted-pod Evening-primrose.

#### *Climate change*

Climate change is seen as an emerging threat, but one that has unknown consequences for Contorted-pod Evening-primrose. Sea level changes and alterations to rainfall patterns could have implications for this species.

## **5. POPULATION AND DISTRIBUTION OBJECTIVES**

The overall aim of this recovery strategy (for the period 2011 to 2020) is to attain nine<sup>2</sup> viable populations of Contorted-pod Evening-primrose in Canada. To meet this aim, this recovery strategy has four population and distribution objectives. Objectives are not listed in order of priority (see Table 4 for prioritization of recommended activities).

1. Maintain the known extent of occurrence<sup>3</sup> for the species in Canada (by 2015).
2. Maintain population sizes for all extant locations at current<sup>4</sup> or higher levels (by 2015).
3. Ensure all eight extant populations reach, and are maintained at, no less than their minimum viable population size<sup>5</sup> (by 2020).
4. Establish one additional population<sup>6</sup> (to replace the single known extirpated population) at a site with suitable habitat within the known range of the species in Canada, and maintain it at no less than its minimum viable population size (by 2020).

---

<sup>2</sup> Currently, there are nine known populations. The number of populations should therefore be recovered to at least this number. The actual number of populations that occurred historically cannot be determined with certainty at this time. The target of nine populations will be reconsidered at the action plan stage once further surveys and analyses of potential habitat have been completed (see research approaches listed in Table 4).

<sup>3</sup> Known extent of occurrence = the extent of occurrence of the combined 8 known extant and 1 extirpated populations. Historical extent of occurrence is currently unknown.

<sup>4</sup> Current population levels are defined as those listed in Table 1 of this recovery strategy.

<sup>5</sup> Minimum viable population size cannot currently be identified with certainty, but see Section 1.4.1 for current knowledge and Table 4 for further recommendations towards development of a specific target population size that will ensure viability for each location.

<sup>6</sup> The objective to establish only one new site may change at the action plan stage if further analyses suggest there were more than nine historical populations in Canada.

## 6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

### 6.1 Actions Already Completed or Currently Underway

A report on proposed management actions for Capital Regional District (CRD) Parks (Populations 1 and 2) has been prepared (Fairbarns 2004). Eighteen recommendations were made, including the following four key points:

- Improve the conservation of the existing populations of Contorted-pod Evening-primrose in CRD Parks.
- Encourage awareness of conservation values, with an emphasis on plant species at risk.
- Monitor the populations of rare sand dwelling plants as well as their habitat and park use.
- Restore degraded habitat and encourage the establishment of new subpopulations of Contorted-pod Evening-primrose or expansion of existing ones.

CRD Parks began implementation of management recommendations in 2007, with the establishment of a fence and signage to reduce traffic in the habitat occupied by Population 2. Regrettably, there is still evidence of frequent, heavy trampling by people climbing over the fence (Fairbarns, pers. obs., 2008). No recovery actions recommended for this species have been implemented for Population 1.

CRD Parks, the Municipality of Central Saanich, and the Tsawout First Nation are currently developing a management plan for an area that includes all sandy habitats stretching from Population 2 to Population 8. This project includes habitat mapping, rare species mapping and development of a coordinated access management plan both for walkers and off-road vehicle users. At Population 8, concrete barriers, fencing and signage have been utilized south of Cordova Spit Municipal Park on Tsawout First Nation lands to protect and inform visitors of this fragile ecosystem.

The private landowner whose property includes Populations 5 and 6 has instituted a conservation covenant under Sec. 219 of the B.C. *Land Titles Act* for all of Population 5 and part of the original location of Population 6. The covenant is monitored by the Nature Conservancy of Canada and restricts most access to the site. The Nature Conservancy of Canada is currently planning for the restoration of Population 5.

## 6.2 Strategic Direction for Recovery

Table 4 outlines the detailed approaches recommended for recovery of Contorted-pod Evening-primrose. Each approach relates to one or more of the population and distribution objectives.

**Table 4. Recovery Planning Table.**

<b>Threat or Limitation</b>	<b>Priority</b>	<b>Broad Strategy to Recovery</b>	<b>General Description of Research and Management Approaches</b>
<ul style="list-style-type: none"> <li>Habitat loss and degradation</li> </ul>	Urgent	Habitat and species conservation	<ul style="list-style-type: none"> <li>Identify and establish effective measures for the conservation of existing known populations.</li> <li>Ensure that conservation measures ensure the viability of each location and fully mitigate all significant threats.</li> </ul>
<ul style="list-style-type: none"> <li>Habitat loss and degradation</li> <li>Exotic and invasive species</li> </ul>	Urgent	Stewardship / habitat management	<ul style="list-style-type: none"> <li>Prepare Best Management Practices to mitigate threats for species in coastal sand ecosystem areas, including Contorted-pod Evening-primrose (to support landowners and managers in stewardship activities).</li> <li>Contact landowners to inform them of the species, its needs and what they can do to help in recovery.</li> <li>Engage all landowners and managers in habitat stewardship to ensure cooperation.</li> </ul>
<ul style="list-style-type: none"> <li>Species demographics</li> </ul>	Urgent	Research	<ul style="list-style-type: none"> <li>Determine minimum viable population size for the species in Canada, and set population targets for each location.</li> <li>Enhance knowledge of meta-population dynamics (e.g., frequency of dispersal between locations).</li> <li>Determine appropriate recovery and adaptive management techniques for existing populations and their habitat.</li> <li>Develop techniques and priorities to augment and establish populations.</li> <li>Determine whether population bottlenecks are resulting in issues with pollination / reproduction, dispersal, seed production, recruitment, and recruit survival.</li> </ul>
<ul style="list-style-type: none"> <li>Habitat loss and degradation</li> <li>Exotic and invasive species</li> </ul>	Necessary	Mapping, surveys and monitoring	<ul style="list-style-type: none"> <li>Identify and prioritize areas and activities for surveys and conduct population and habitat inventories throughout the species' extent of occurrence.</li> <li>Monitor habitat and abundance of extant populations annually, for at least five years, to determine responses to changing habitat conditions.</li> <li>Assess sandy backshore areas throughout the extent of occurrence to prioritize for establishment of new populations and to update knowledge on the historical extent of occurrence and historical number of populations.</li> </ul>

<b>Threat or Limitation</b>	<b>Priority</b>	<b>Broad Strategy to Recovery</b>	<b>General Description of Research and Management Approaches</b>
<ul style="list-style-type: none"> <li>• Habitat loss and degradation</li> <li>• Species demographics</li> <li>• Exotic and invasive species</li> </ul>	Necessary	Population restoration	<ul style="list-style-type: none"> <li>• Develop and implement a population-level recovery plan for locations with existing populations that need to be augmented.</li> <li>• Increase the area of occupancy and abundance of existing populations that are predicted to be below minimum viable population size.</li> <li>• Conduct trials for Contorted-pod Evening-primrose population establishment.</li> <li>• Develop and implement a translocation plan and establish new populations as per the population and distribution objectives.</li> </ul>
<ul style="list-style-type: none"> <li>• Habitat loss and degradation</li> <li>• Exotic and invasive species</li> </ul>	Beneficial	Public education and outreach	<ul style="list-style-type: none"> <li>• Increase general public awareness of the existence and conservation value of Contorted-pod Evening-primrose and associated species at risk.</li> <li>• Develop priorities for and deliver public education and outreach concerning Contorted-pod Evening-primrose, its habitat, its management and associated species at risk and/or ecosystems.</li> <li>• Evaluate success in education/outreach every five years (preferably using a multi-species approach for coastal sand ecosystems and species).</li> </ul>
<ul style="list-style-type: none"> <li>• Exotic and invasive species</li> </ul>	Beneficial	Research	<ul style="list-style-type: none"> <li>• Quantify the effect of introduced herbivorous animals.</li> </ul>

## 7. CRITICAL HABITAT

The *Species at Risk Act* defines critical habitat 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 a recovery strategy or in an action plan for the species.” An identification of critical habitat towards the survival and recovery of existing populations of Contorted-pod Evening-primrose is included in this recovery strategy. This identification is based on the best currently available scientific information, and will be updated as further information arises. This critical habitat identification is only for the immediate survival and limited expansion of seven of the eight extant populations of Contorted-pod Evening-primrose in Canada, and is not sufficient to meet the population and distribution objectives.

No critical habitat can be identified for Population 6 because of uncertainty of the location of plants that might occur at the site. Although the population was lost to the development of a golf course between 2004 and 2006, there was a report of a small number of plants occurring there in 2007 (Table 1). However, it is not known if the plants had recolonized remnant habitat patches in the original location or were in a new nearby location. Some additional expansion habitat occurs

south of Population 8 on the Tsawout Indian Reserve. Parks Canada is currently working with the Tsawout First Nation to incorporate this habitat into the identification of critical habitat. Critical habitat mapping will be updated once this work is complete. No critical habitat for the re-establishment of the extirpated Population 9 can be identified at this time because the exact location of the original site is unknown due to the age of the record (last observed in 1893). See Table 7 for recommendations to fill these gaps in the critical habitat identification.

## **7.1 Identification of the Species' Critical Habitat**

Critical habitat for Contorted-pod Evening-primrose in this recovery strategy includes occupied and unoccupied habitat as follows:

- Occupied habitat – consisting of all known occupied habitat plus adjacent areas needed to maintain the habitat attributes as described below.
- Expansion habitat – additional habitat contiguous to the occupied habitat that is capable of sustaining Contorted-pod Evening-primrose with little or no intervention (for expansion of populations and/or seasonal flux in occupied area), but is currently unoccupied. Unoccupied but contiguous habitat is being included as a precautionary measure to ensure where possible that sufficient habitat is available for the populations to reach population and distribution objectives at each site. Predicted minimum viable population size is approximate for this species at this time, but currently all of the Canadian populations of Contorted-pod Evening-primrose are smaller than the predicted size expected for plant populations to be viable over the long term (see Section 3.3), so all suitable or potentially suitable sites adjacent of each population are considered critical habitat. As further scientific information is gained on minimum viable population size, the polygons will be expanded or contracted as necessary. Expansion habitat as currently mapped will not necessarily provide enough area to meet the population and distribution objectives.

### **7.1.1 Attributes of critical habitat**

Figure 3 shows typical habitat for Contorted-pod Evening-primrose in Canada. Both physical and biological features important to the conservation of Contorted-pod Evening-primrose were considered in determining which areas to propose as critical habitat. These habitat attributes include: space for individual and population growth, water, minerals, light and other nutritional or physiological requirements; and sites for germination or seed dispersal.



Figure 3. Typical habitat for Contorted-pod Evening-primrose in Canada.

**Site and Soil:** Sites occur between 1-30 m above sea level although most plants are found <2 m above sea level. The slope angle varies from 0-35% although most plants occur on slopes of <3%. Where the slopes are steeper, the populations generally occur on west or south facing aspects. Soil pits were not excavated due to the potential for damage to Contorted-pod Evening-primrose and other rare plants occurring on the occupied sites and similar nearby habitat. The soils, which are rapidly drained, consist of deep ( $\geq 30$  cm) sand usually with a negligible component of coarse fragments, fine soil particles or organic matter. In the early growing season (February and March) the soil tends to remain moist for prolonged periods. The soil moisture level diminishes as the growing season progresses so that by the time the fruits are developing and the plants are senescing the soil experiences significant water deficits for prolonged periods. The surface is characterized by a high proportion of exposed mineral soil and very little vegetated cover or litter.

**Plant community:** Contorted-pod Evening-primrose is restricted to dune and sandy backshore ecosystems with no trees or tall shrubs. Associated species are as follows. Low native shrubs are usually absent although small amounts of Tall Oregon-grape (*Mahonia aquifolium*) may occur along the periphery of some populations. The herb layer is usually sparse and Contorted-pod Evening-primrose occurs in gaps between other herbaceous species, where competition is reduced. Native herbaceous species are generally uncommon although low-growing sand-loving species such as Black Knotweed (*Polygonum paronychia*), Indian Consumption Plant (*Lomatium nudicaule*) and Yellow Sand-verbena (*Abronia latifolia*) are occasionally abundant. Haircap moss (*Polytrichum piliferum*) also is often present.

**Biological processes:** Summer drought causes the herbaceous vegetation to die back in June and July so moisture competition is probably a critical stressor and plant adaptations to moisture stress undoubtedly play a critical role in determining species competition. Contorted-pod

Evening-primrose plants possess a moderately deep taproot which accesses soil moisture below the rooting zone of some co-occurring herbaceous species, but generally dies by mid-summer.

**Physical processes:** Contorted-pod Evening-primrose does not appear to depend upon seepage, salt spray or wind to prevent encroachment by woody species. Summer drought, often exacerbated by rapidly-drained soils, probably plays a major role in limiting competition from less drought-tolerant species. Wildfire may have also played a significant role in maintaining ecosystem properties and functions in the past but current policies have led to the strong suppression of fire.

### 7.1.2 Location of critical habitat

This section describes the physical location of the critical habitat areas. See Table 5 for a list of each site and the geographic area of the polygons in relation to land tenure. Critical habitat polygons are based on recent field data (2004-2010) conducted at all eight currently extant sites and general habitat attributes from all Canadian sites as well as a large population on San Juan Island (Washington State), about 20 km east of the nearest Canadian population. Polygons also incorporate spatial uncertainties associated with sampling techniques (e.g., spatial errors associated with GPS equipment). All values are UTM's in zone 10 using the NAD83 datum. Boundaries were established using a hand-held GPS unit (Garmin E-TREX). During the growing season, habitat attributes of known populations were documented using Ground Inspection forms according to methods outlined in *Describing Ecosystems in the Field* (Luttmerding *et. al.* 1990). Winter field work was not necessary because Contorted-pod Evening-primrose is not dependant on winter seepage.

#### *Population 1 (Metchosin)*

Population 1 occurs in Witty's Lagoon Regional Park (Capital Regional District). Critical habitat includes occupied and expansion habitat (Figure 4, Table 5). The existing population consists of fewer than 300 plants (Table 1; Fairbarns pers. obs. 2004).

#### *Population 2 (Saanich A)*

Population 2 occurs in Island View Beach Regional Park (Capital Regional District). Critical habitat includes occupied and expansion habitat (Figure 5, Table 5). The existing population consists of fewer than 600 plants (Table 1; Fairbarns pers. obs. 2008).

#### *Population 3 (Savary Island A)*

Population 3 occurs on Savary Island at The Meadow Beach, just east of the Juilan Road Right of Way on the crown perimeter managed by the B.C. Ministry of Transportation and Infrastructure. Critical habitat includes occupied and expansion habitat (Figure 6, Table 5). The existing population consists of approximately 200 plants (Table 1; Fairbarns pers. obs. 2004).

#### *Population 4 (Savary Island B)*

Population 4 occurs on private land on Savary Island. Critical habitat includes occupied and expansion habitat in three areas of the property (Beacon Point, Death Camas Meadow and Duck

Bay; Figure 7, Table 5). The existing population consists of approximately 700 plants (Table 1; Fairbarns pers. obs. 2004; C. Cadrin pers. comm.).

#### *Populations 5 (Saanich B)*

Population 5 occurs on James Island, an area of private land. Critical habitat includes only occupied habitat because no expansion habitat has been identified at this location (Figure 8, Table 5). The existing population has not been recently surveyed, but in 2007 consisted of 500-600 plants. (Table 1).

#### *Population 7 (Saanich D)*

Population 7 occurs on Gulf Islands National Park Reserve lands and Canadian Coast Guard Agency lands on the northern spit of Sidney Island . The Coast Guard land is in the process of being formally transferred to Parks Canada Agency (R. Walker, pers. comm.). Critical habitat includes occupied and expansion habitat (Figure 9, Table 5). The existing population consists of less than 100 plants (Table 1; Fairbarns, pers. obs.).

#### *Population 8 (Saanich E)*

Population 8 occurs in Cordova Spit Municipal Park (District of Central Saanich). Critical habitat includes occupied and expansion habitat (Figure 10, Table 5). The existing population consists of fewer than 300 plants (Table 1; Fairbarns 2007).

**Table 5. Approximate area of Contorted-pod Evening-primrose critical habitat for relevant land tenures (in hectares).**

Population	Provincial	Federal	Regional	Municipal	Private	Total
	*MOTI	*CCGA *PCA	*CRD	Central Saanich		
Population 1 - Metchosin (occupied)			0.17			0.17
Population 1 – Metchosin (expansion)			0.41			0.41
Population 2 – Saanich A (occupied)			0.41			0.41
Population 2 – Saanich A (expansion)			0.54			0.54
Population 3 – Savary Island A (occupied)	0.28					0.28
Population 3 – Savary Island A (expansion)	1.08					1.08
Population 4 – Savary Island B (occupied)					0.38	0.38
Population 4 – Savary Island B (expansion)					2.18	2.18
Population 5 – Saanich B (occupied)					4.07	4.07
Population 7 – Saanich D (occupied)		0.20				0.20
Population 7 – Saanich D (expansion)		0.03				0.03
Population 8 – Saanich E (occupied)				0.20		0.20
Population 8 – Saanich E (expansion)				5.07		5.07
Land tenure total	1.36	0.23	1.53	5.27	6.63	15.02

\*MOTI = B.C. Ministry of Transportation and Infrastructure, CCG = Canadian Coast Guard Agency, PCA = Parks Canada Agency, CRD = Capital Regional District.

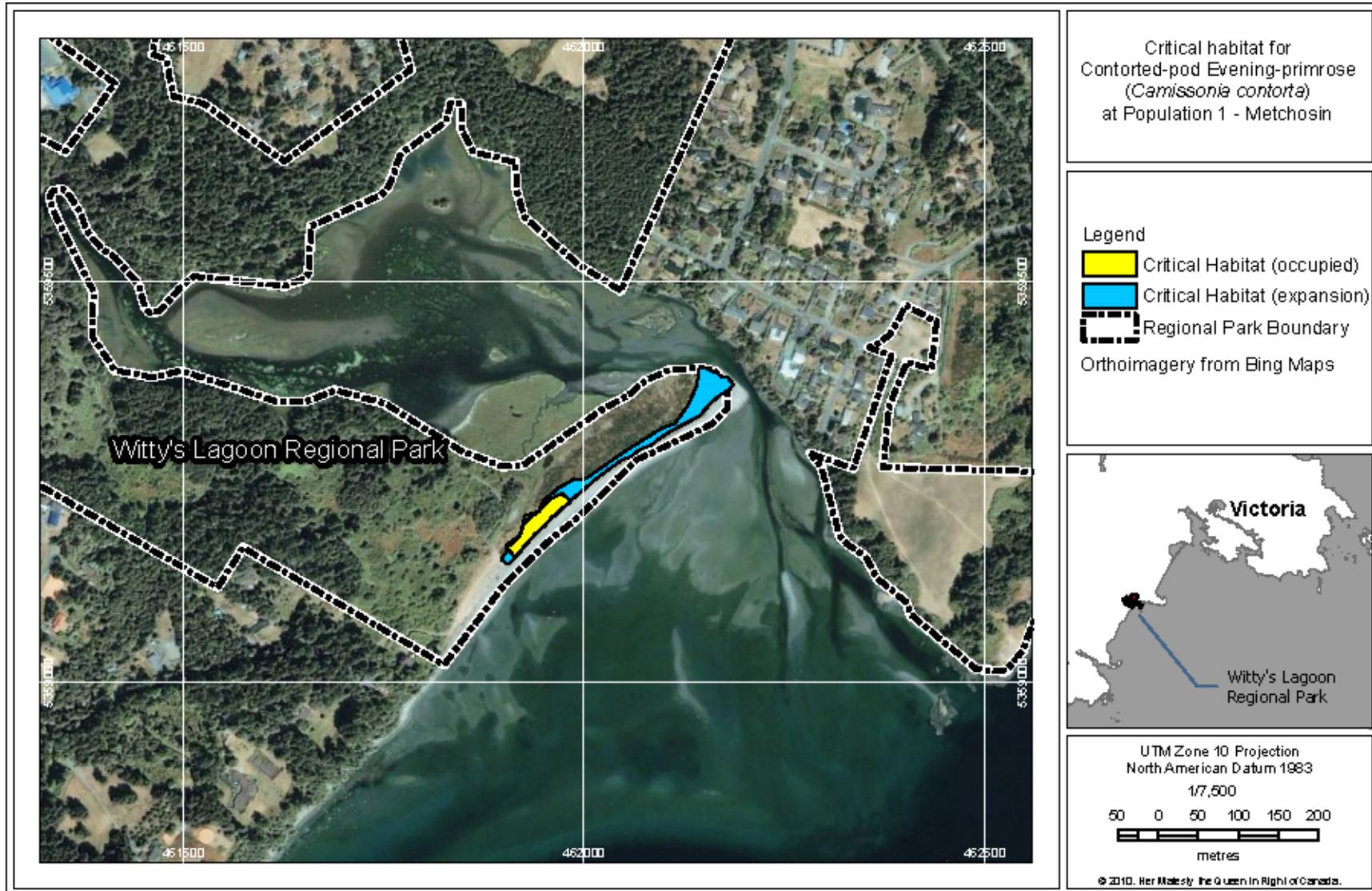


Figure 4. Location of critical habitat for Population 1 (Metchosin) at Witty's Lagoon Regional Park.

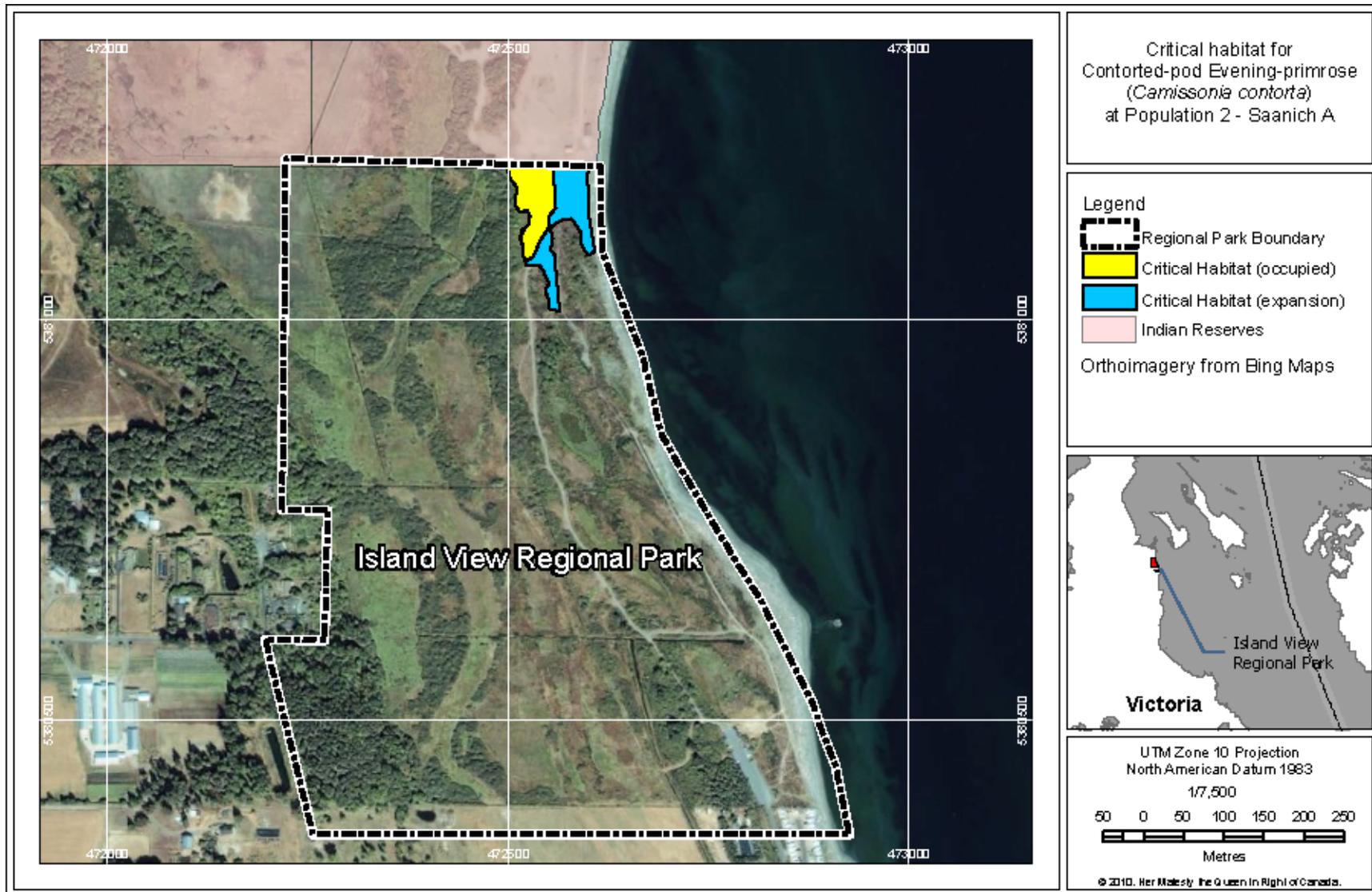


Figure 5. Location of critical habitat for Population 2 (Saanich A) at Island View Regional Park.



Figure 6. Location of critical habitat for Population 3 (Savary Island A) at The Meadow Beach on Savary Island.

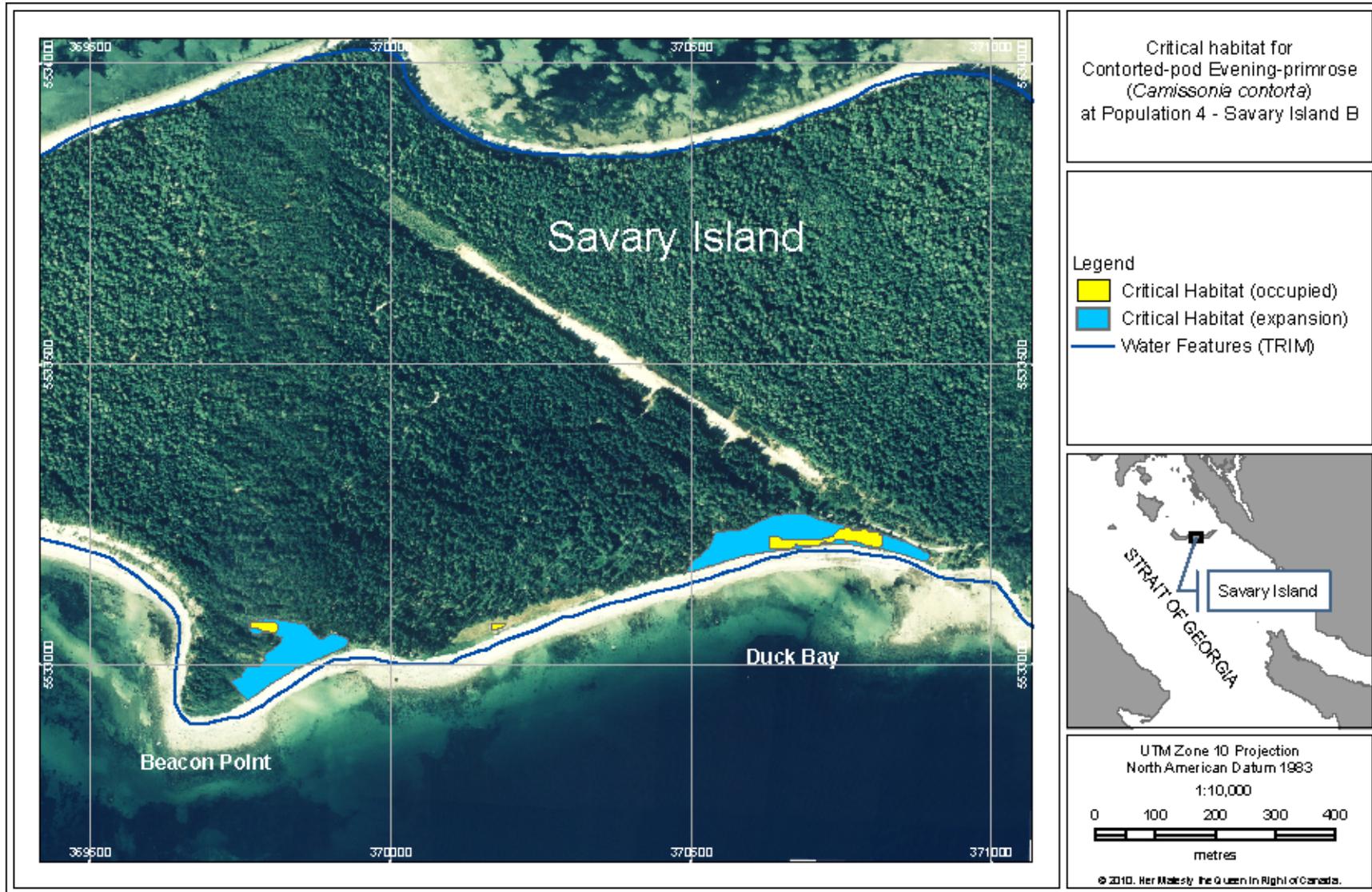


Figure 7. Location of critical habitat for Population 4 (Savary Island B) at Beacon Point, Death Camas Meadow and Duck Bay on Savary Island.

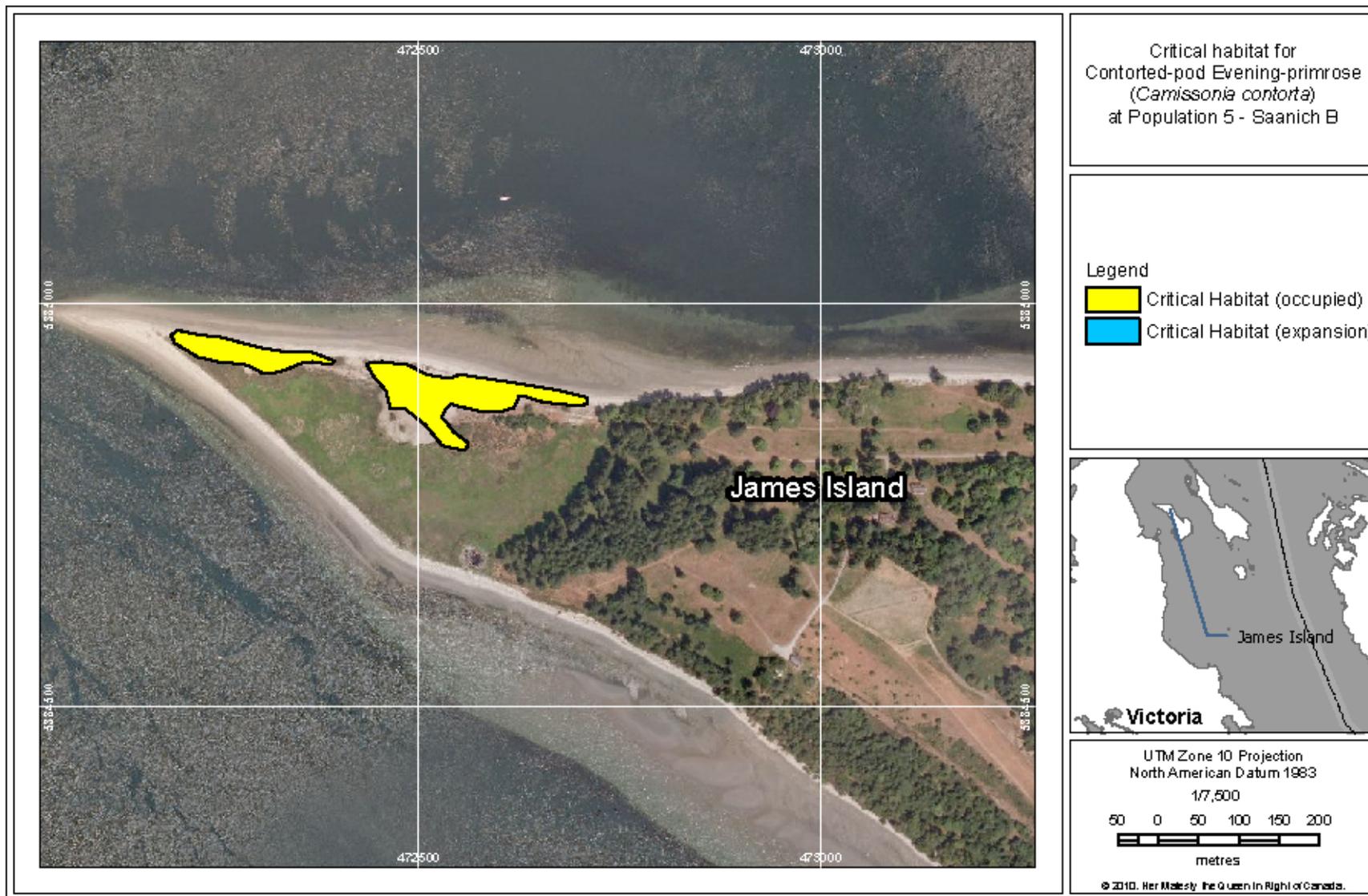


Figure 8. Location of critical habitat for Population 5 (Saanich B) at North Spit, James Island.

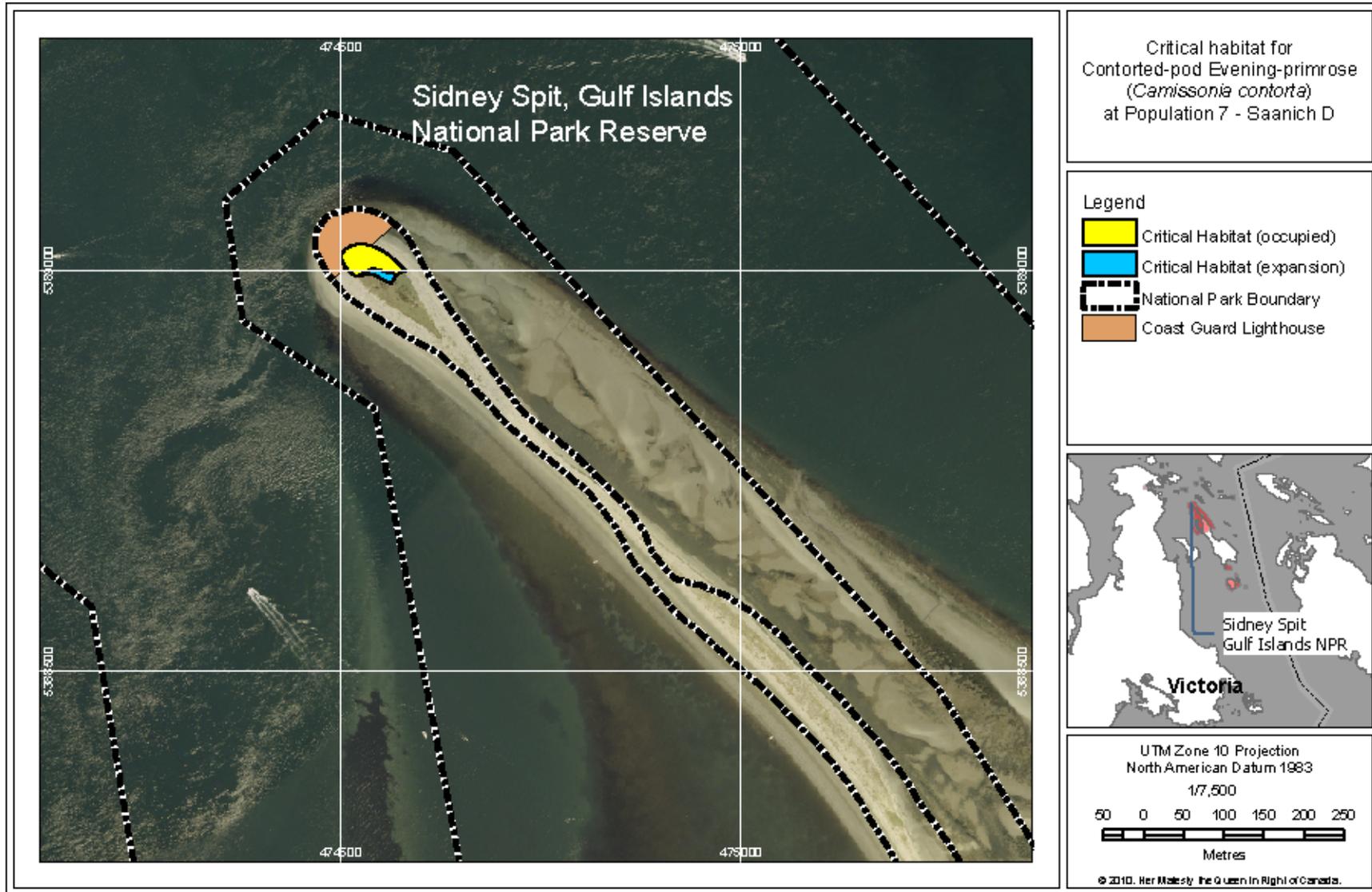


Figure 9. Location of critical habitat for Population 7 (Saanich D) at Sidney Island in Gulf Islands National Park Reserve.

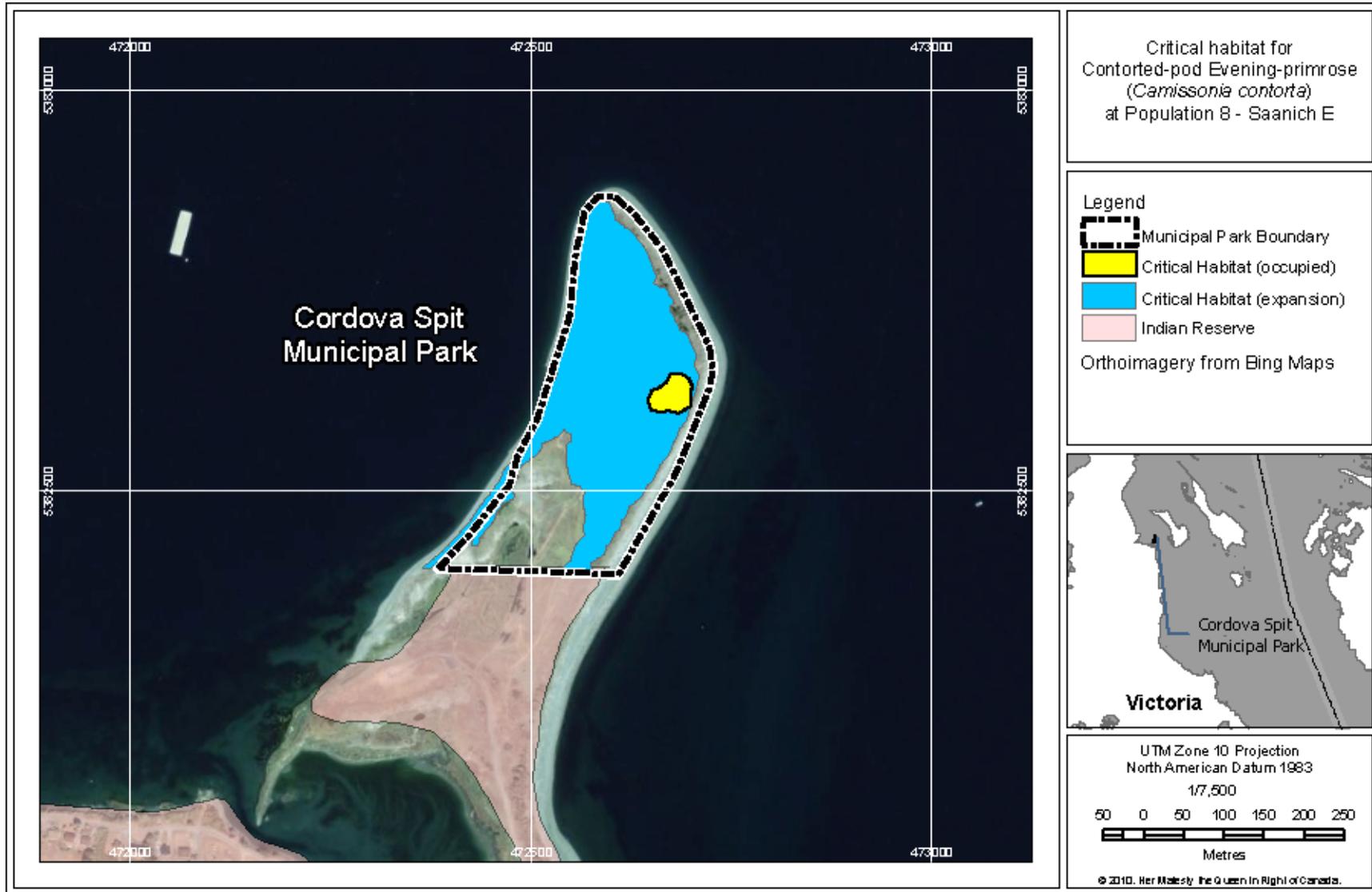


Figure 10. Location of critical habitat for Population 8 (Saanich E) at Cordova Spit Municipal Park.

## 7.2 Schedule of Studies to Identify Critical Habitat

Further activities are required to facilitate critical habitat identification. Critical habitat will need to be identified at Population 6, where information currently does not allow for a critical identification. In addition, the population and distribution objectives recommend increasing population size at all locations, so further critical habitat identification likely will be required at all locations. And finally, the population and distribution objectives recommend that one additional population be established, so once established critical habitat will need to be identified at this location. It should be noted that several of the approaches listed in Table 4 (research; mapping, surveys and monitoring; population restoration) are required before the activities listed in Table 7 can be achieved.

**Table 7. Schedule of Studies.**

Description of activity	Rationale	Timeline
<ul style="list-style-type: none"> <li>Obtain permission to use habitat data from Tsawout First Nation to expand critical habitat for Population 8</li> </ul>	<ul style="list-style-type: none"> <li>It is known that habitat occurs on the Tsawout Indian Reserve that would be appropriate for expansion habitat, but permission to the use the data has not yet been granted.</li> </ul>	Complete by 2011
<ul style="list-style-type: none"> <li>Survey and map Population 6 to facilitate the inclusion of this site into the critical habitat identification.</li> </ul>	<ul style="list-style-type: none"> <li>Currently it is not known if plants still occur at this location (last seen in 2007, but not known where at the location they were seen), so surveys and mapping are required before critical habitat can be identified.</li> </ul>	Complete by 2012
<ul style="list-style-type: none"> <li>Map and identify critical habitat for expanded populations.</li> </ul>	<ul style="list-style-type: none"> <li>After completing research and restoration work recommended in Table 4, some populations will have expanded populations that will require new mapping to ensure that all occupied habitat is included in the identification of critical habitat to ensure the population and distribution objectives can be met.</li> </ul>	Complete by 2020
<ul style="list-style-type: none"> <li>Map and identify critical habitat for the one new population that will be established.</li> </ul>	<ul style="list-style-type: none"> <li>The population and distribution objectives recommend the establishment of one new population. Once established, critical habitat will need to be identified.</li> </ul>	Complete by 2020

## 7.3 Activities Likely to Result in the Destruction of Critical Habitat

The primary threats to Contorted-pod Evening-primrose critical habitat include loss or degradation of habitat from land development, recreation and/or exotic/invasive species. These threats can remove habitat completely or reduce its ability to provide the attributes necessary for population viability. The habitat attributes considered necessary for the survival or recovery of Contorted-pod Evening-primrose are outlined in Section 7.1.1.

Destruction must be 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 not serve its required function for Contorted-pod Evening-primrose. Destruction may result from single or

multiple activities at one point in time or from the cumulative effects of one or more activities over time. Destruction may originate from activities inside or outside of critical habitat polygons.

It is recognized that existing facilities and land uses in and adjacent to critical habitat already affect critical habitat, to various degrees, and may decrease the quality of certain portions of critical habitat. Lower quality or sub-optimal areas may nonetheless be included as critical habitat because they serve a biological function for the species (e.g., expansion habitat). Any new, additional, or increases in activity (including the construction of new facilities) inside or outside of critical habitat polygons may cause destruction of critical habitat. Some human activities in or adjacent to critical habitat will require careful assessment for possible effects, including cumulative effects on critical habitat and the potential for destruction.

Examples of scenarios that can damage or destroy critical habitat include, but are not limited to:

Habitat loss and destruction – direct destruction or loss of critical habitat can occur from the construction of buildings, breakwaters, golf courses, foot paths, roadways, transmission lines, and other similar activities, as well as from the introduction of exotic or invasive species. All these activities can completely remove all the habitat attributes that Contorted-pod Evening-primrose requires.

Habitat degradation – critical habitat can be degraded by nearby development such as buildings, footpaths or breakwaters, from the introduction of exotic or invasive species, and from recreational uses such as hiking, dog walking and off-road vehicle use. Degradation from these and other activities can occur through increased erosion (e.g., a breakwater can alter water flow and affect erosion), shading (e.g., structures can block sunlight), compaction or churning of sand or soil substrate (e.g., from vehicle use or running dogs), impacts to sand supply and sand dynamics (e.g., structures can block sand supply) and pollution (e.g., stormwater or pesticide use can poison plants and the environment they depend on).

It is important to note that a minimal level of activities such as hiking or dog walking may not result in destruction of critical habitat because this species likely is adapted to a low level of disturbance. However, it is not currently known how much of such activities can be absorbed by a population before the activities would be defined as destruction. All other activities listed above may cause destruction at any level of impact.

The introduction of invasive plant species occurs largely as a result of human activity and is included in this section because the quality of critical habitat will not be maintained if the spread of invasive species is not controlled.

Areas surrounding these critical habitat areas may require specific management action to provide effective conservation to the populations of Contorted-pod Evening-primrose. For example, structures placed outside the critical habitat polygon may still create shading or affect sand movement and therefore could result in degradation of habitat that would be considered destruction. Land owners and managers should exercise caution when working near these critical habitat areas.

## 8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Specific progress towards implementing the recovery strategy will be measured against indicators outlined in subsequent action plans. A successful recovery program will achieve the overall aim of attaining nine viable, self-sustaining and protected populations of Contorted-pod Evening-primrose distributed throughout its historical extent of occurrence in Canada. Listed here are performance indicators for the four population and distribution objectives.

1. Maintain the known extent of occurrence for the species in Canada (by 2015).
  - By 2015, there has been no reduction in the known extent of occurrence for the species.
2. Maintain population sizes for all extant locations at current or higher levels (by 2015).
  - By 2015, population sizes have been maintained at current or higher levels (note, the population sizes listed in Table 1 are considered current).
3. Recover all eight extant populations to no less than their minimum viable population size (by 2020).
  - By 2015, propagation and translocation methods have been established to facilitate population augmentation.
  - By 2020, all eight extant populations are recovered to at least a minimum viable population size (note, minimum viable population size will be defined during action planning).
4. Establish one additional population (to replace the single known extirpated population) at a site with suitable habitat within the historical range of the species in Canada, and maintain it at no less than its minimum viable population size (by 2020).
  - By 2020, one further site has been established either at the extirpated Cedar Hill location or elsewhere in the historical range of the species.
  - By 2020, the new site has a population size that is no less than the minimum viable population size for the species (note, minimum viable population size will be defined during action planning).

## 9. STATEMENT ON ACTION PLANS

One or more action plans for Contorted-pod Evening-primrose will be posted on the SARA Public Registry by March 2015.

## 10. REFERENCES

- B.C. Conservation Data Centre. 2011. B.C. Species and Ecosystems Explorer. B.C. Ministry of Sustainable Resource Management. Victoria, British Columbia, Canada. Available: <http://a100.gov.bc.ca/pub/eswp/> (Accessed: January 21, 2011).
- B.C. Conservation Framework. 2010. Conservation Framework Summary: *Camissonia contorta*. BC Ministry of Environment. Available from: <http://a100.gov.bc.ca/pub/eswp/> (accessed September 10, 2010).
- B.C. Ministry of the Environment. n.d. Ecoregions of British Columbia. <http://www.env.gov.bc.ca/ecology/ecoregions/> (Accessed April 2011).
- B.C. Ministry of Forests. 2003. Biogeoclimatic Ecosystem Classification Subzone/Variant Map for South Island Forest District, Vancouver Forest Region. Victoria, British Columbia. 1:300,000.
- COSEWIC 2006. COSEWIC assessment and status report on the contorted-pod evening-primrose (*Camissonia contorta*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 21 pp. ([http://www.sararegistry.gc.ca/sar/assessment/status\\_e.cfm](http://www.sararegistry.gc.ca/sar/assessment/status_e.cfm)). (Accessed: January 21, 2011).
- Fairbarns, M.D. 2004. Potential Recovery Actions for Contorted-pod Evening-primrose In CRD Parks. 16 pp.
- Government of Canada 2009. *Species at Risk Act* Policies, Overarching Policy Framework [Draft]. *Species at Risk Act* Policy and Guidelines Series. Environment Canada, Ottawa. 38 pp.
- Hitchcock, C.L., A. Cronquist, M. Ownbey and J.W. Thompson. 1961. Vascular plants of the Pacific Northwest volume 3: Saxifragaceae to Ericaceae. University of Washington Press. Seattle. 614 pp.
- NatureServe. 1988. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.6. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: November 1, 2010).
- Pavlik, B.M. 1996. Defining and measuring success. In: *Restoring Diversity: Strategies for Reintroduction of Endangered Plants*. D.A.Falk, C.I.Millar and M.Olwell (eds), pp. 127-156. Island Press, Washington D.C.
- Trall, L.W., C.J.A. Bradshaw and B.W. Brook. 2007. Minimum viable population size: a meta-analysis of 30 years of published estimates. *Biological Conservation* 139:159-166.
- Turner, Don. 2006. Telephone conversation, October 4, 2006. Regional Planner, Powell River Regional District. Don.turner@powellriverrd.bc.ca 604-483-2229.

Webster, Liz. 2006. E-mail communication, October 4, 2006. Executive Director, Savary island Land Trust Society. webstere@mala.bc.ca.

## APPENDIX A: 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*. 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.

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.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Contorted-pod Evening-primrose. Activities to meet recovery objectives are unlikely to result in any important negative environmental effects, as they are limited to habitat protection, research activities, fostering stewardship, increasing public awareness, improving knowledge on habitat requirements and population threats, and conducting habitat/species mapping, inventory and restoration.

The recovery strategy identifies current threats (Section 4) to the Contorted-pod Evening-primrose and its habitat as well as current knowledge gaps (Section 6.2). Recovery objectives clearly focus on resolving these threats and filling information gaps. The greatest potential for environmental effects comes from fieldwork activities aimed at population restoration (e.g. invasive species removal and restoration of natural sand dynamics), however these effects can be mitigated at the project level phase with known technology and proper field procedures. Activities may also benefit non-target species and the environment (Table 9).

Some recovery strategy activities (e.g. translocations and habitat restoration) may require project-level environmental assessment as required under the Canadian Environmental Assessment Act (CEAA). Any activities found to require project-level environmental assessments will be assessed at that time pursuant to the provisions of the Act. The SEA process has concluded that this recovery strategy will have several positive effects on the environment. No important negative effects are expected.

A number of other species at risk have been reported from the vicinity of one or more extant populations of Contorted-pod Evening-primrose. These species are listed in Table 9 to ensure land managers are able to consider all relevant species when designing management actions.

Although overall the strategy for the recovery of Contorted-pod Evening-primrose is positive for the environment in general, there is some potential for negative effects on non-target species, natural communities and natural processes. For example, invasive species removal may have

negative impacts on species at risk, plant communities and natural processes. These can be avoided or minimized by:

- surveying and marking the occurrence of species at risk in the treatment areas prior to commencing control treatments, to avoid trampling damage.
- conducting treatments during the dormant season for other species at risk.
- avoiding non-target herbicide impacts by directly applying herbicides to the target plants.
- avoiding soil disturbance by using low-impact techniques to remove invasive species (e.g., removing Scotch broom using loppers and secateurs rather than weed wrenches).

**Table 9. Co-occurring species at risk. Status: E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, P = Proposed for COSEWIC listing, NA = Not Assessed. S-ranks assigned by as per B.C. Conservation Data Centre and NatureServe.**

Species	Common name	Conservation Rank	COSEWIC Status
<i>Copablepharon fuscum</i>	Sand-verbena Moth	S1	E
<i>Carex tumulicola</i>	Foothill Sedge	S2	P
<i>Psilocarphus tenellus</i> var. <i>tenellus</i>	Slender Woollyheads	S2	NAR
<i>Leymus triticoides</i>	Creeping Wildrye	S1	NA
<i>Lathyrus littoralis</i>	Grey Beach Pea-vine	S2	NA
<i>Coenonympha tullia</i> ssp. <i>insulana</i>	Island Common Ringlet	S2	NA
<i>Triglochin concinna</i>	Graceful Arrow-grass	S2	NA
<i>Jaumea carnosa</i>	Fleshy Jaumea	S2S3	NA
<i>Convolvulus soldanella</i>	Beach Morning-glory	S3	NA
<i>Hesperia colorado</i> ssp. <i>oregonia</i>	Western Branded Skipper	S3	NA
<i>Abronia latifolia</i>	Yellow Sand-verbena	S3	NA
<i>Glehnia littoralis</i> ssp. <i>leiocarpa</i>	American Glehnia	S3	NA
<i>Polygonum paronychia</i>	Black Knotweed	S3	NA
<i>Carex macrocephala</i>	Large-headed Sedge	S3S4	NA
<i>Claytonia rubra</i> ssp. <i>depressa</i>	Low Redstem Springbeauty	S3S4	NA