Biodiversity Inventory within the ICHxw at Fort Shepherd

Prepared for the Columbia Basin Fish & Wildlife Compensation Program
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Final Report

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Photo: Front Cover: Looking NE from the rocky knoll at the confluence of the Pend d'Oreille and Columbia Rivers.

EXECUTIVE SUMMARY

Fort Shepherd, located south of Trail, B.C. and west of the Columbia River is the largest privately owned representation of the rare Interior Cedar Hemlock very dry, warm (ICH xw) ecosystem within the West Kootenay (Braumandl and Curran 1992). Little is known about the wildlife (other than ungulates) species that use this area therefore the Columbia Basin Fish and Wildlife Compensation Program (CBFWCP), Trail Wildlife Association (TWA) and the Regional District of Kootenay Boundary chose to undertake a biodiversity inventory, focusing on non-game species. Novus Consulting, Mirkwood Ecological Consultants and Ophiuchus Consulting directed the inventory of birds, small mammals, bats, reptiles, amphibians and noxious weeds. The area was stratified into five habitat types and surveyed using both a systematic and general approach. The project commenced in May 2002 and ended October 2002.

A total of 92 different animal species were found on site with four of these being blue or red listed (65 birds, 2 listed [Great Blue Heron, and Canyon Wren]; 19 mammals, 1 listed [Townsend's Big-eared Bat]; 6 reptiles, 1 listed [Racer]; and 2 amphibians). A number of noxious weeds and insects (Appendix 2), collected during the non-game surveys, were also identified.

Birds
Bird and owl surveys were conducted using various call techniques, transect searches, stand watches and nest searches. A total of 65 bird species were detected during five days of transect surveys. The most common species found on site were; Bank Swallows (*Riparia riparia*), Yellow Warblers (*Dendroica petechia*), Chipping Sparrows (*Spizella passerina*), Spotted Towhees (*Pipilo maculates*), and Brown-headed Cowbirds (*Bolothrus ater*). No owl species were located but a Northern Saw-whet Owl (*Aegolius acadicus*) was captured in a mist net during the bat survey. Two blue listed species (Fraser et al. 1999), the Canyon Wren (*Catherpes mexicanus*) and the Great Blue Heron (*Ardea herodias*) were observed in the project area.

Small Mammals
The small mammal trapping targeted two orders, Rodents (Rodentia) and Shrews (Insectivora). Survey techniques focused mainly on live trapping, but also included direct observations and animal sign surveys (track/scat analysis). Meandering trapping transects covered each of the five habitat types using various trap types (Sherman, Bolton, Tincat, Tomahawk for rodents and pitfall traps for shrews). Deer Mice (*Peromyscus maniculatus)* and Yellow-pine Chipmunks (*Tamias amoneus)* were captured, as well as one Common Shrew (*Sorex cinereus)*. Animal sign surveys (track analysis) showed evidence of Northern Pocket Gophers (*Thomomys talpoides*), Red Squirrels (*Tamiasciurus hudsonicus*), Northern Flying Squirrels (*Glaucomys sabrinus*), Bushy Tailed Woodrats (*Neotoma cinera*) and the Columbia Ground Squirrels (*Spermophilus columbianus*).

Other Mammals
The main focus of this inventory was on non-game species however, we also observed six species of larger mammals; Black bear (*Ursus americanus*), Bobcat (*Lynx rufus*), Coyote (*Canis latrans*), Mountain Goat (*Oreamnos americanus*), River Otter (*Lontra canadensis*), and White-tailed Deer (*Odocoileus virginianus*) within the project area.

Bats
Techniques used for detecting the presence and identity of bats included mist netting, recording and analyzing echolocation calls, and ground searches of caves roosts in the project area. Five species were captured and identified; Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasiurus noctivagans*), Western Long-eared Myotis (*Myotis evotis*), Yuma Myotis (*Myotis yumanensis*) and the Townsend's Big-eared Bat (*Corynorhinus townsendii*). The finding of significant importance was 20 female Townsend's Big-eared Bats (blue listed, Cannings et al.1999) within one of the caves. There is some possibility that Western Red Bats (red listed, Cannings et al.1999) also inhabit the area as echolocation calls resembling this species were detected at two separate stations in the project area.

Reptiles
Daylight surveys for reptiles included searching under cover objects (rocks, coarse woody debris) and searching for active or basking individuals. The Racer (*Coluber constrictor*), one of six species observed, is considered a vulnerable (blue) species (Cannings et al.1999). The other species observed were the Common Garter Snake (*Thamnophis sirtalis*), Western Terrestrial Garter Snake (*Thamnophis elegans*), Rubber Boa (*Charina bottae*), Northern Alligator Lizard (*Elgaria coerulea*) and the Western Skink (*Eumeces skiltonianus*). The most significant finding was the Racer, because there is a high potential for hibernacula and breeding sites to be located within the project area.

Amphibians
Amphibian surveys involved direct observations, uncovering, listening, calling (tape recorded playback), and night lighting. Search sites were restricted to Sheppard Creek, a small un-named creek in the southeast corner of the project area and the Peace Pond. This survey revealed the Pacific Treefrog (*Hyla regilla*) and the Columbia Spotted Frog (*Rana luteiventris*).

Noxious Weeds
Habitat Conservation Trust Fund (HCTF) and the Ministry of Wildlife Lands & Air Protection (WLAP) mapped Spotted knapweed (*Centaurea maculosa*) at Fort Shepherd in 1986. We revisited the original mapped sites and mapped the migration of Spotted knapweed along roadways since the spread is due to increased road traffic and site disturbance from off-road vehicles. Additionally, Dalmatian Toadflax (*Linaria dalmatica*) has established itself and has spread along the Fort Shepherd flats adjacent to the Columbia River.

Land Use
Fort Shepherd has many values, which are of ecological, historical, and archaeological (pre-European) significance. Fort Shepherd was the location of a Hudson's Bay fort built in 1856 and burned in 1872. In recent times the impacts of unmanaged fire and acid rain denuded the vegetation. Recent construction of hydroelectric dams, and their transmission corridors have impacted the project area. Access roads developed for power-line maintenance has brought recreationalists to the project area. The access roads and close proximity to Trail, B.C. has also made the area useful for research purposes and military training and exercises. Open pit fires, off-road vehicle traffic and a general disregard for the sensitivity of the soils have left a legacy of soil disturbance and garbage dumping. All these activities are currently unmonitored.

Recommendations
We suggest that this inventory be shared with the landowner (Teck Cominco) and the transmission corridor users (Aquila, Teck Cominco and British Columbia Hydro and Power Authority). We strongly recommend that these three parties develop a management strategy/plan to reduce user impacts while protecting and enhancing the recovery of this unique ecosystem.

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1.0 PROJECT AREA OVERVIEW

Project Area Location

The project area is located on the west side of the Columbia River across from the Pend d'Oreille River near the Canadian and United States international border (Figure 1). The western part of the site is a flat, low elevation (400m asl) river terrace covered in shrubs with interspersed grassy openings and sparse stands of Douglas-fir and ponderosa pine. The site rises in elevation to be bordered on the east by the sharp rocky bluffs identified with rocky scree openings and steep stream channels intermittently vegetated with shrubs and deciduous trees. Access is along a 14-kilometre dirt road that starts in Trail, B.C. and runs south to the international border.

Background

The project area, locally referred to as "Fort Shepherd", is a significant mule deer winter range (Ferguson 1979; Gwilliam 1986; R. Fillmore, pers. comm.). The Columbia Basin Fish and Wildlife Compensation Program (CBFWCP) carried out bio-terrain mapping (Marcoux 1997) and the Trail Wildlife Association (TWA) has a history of ungulate management/habitat restoration activities on this land. Recently there have been numerous sightings of rare and endangered plant and animal species in Fort Shepherd (Marcoux 1997; McDonaugh and Hamilton 2000; Vonhof and Gwilliam 2000; L. Bursaw, pers. comm.; T. Antifeau, pers. comm.; and M. McDonaugh, pers. comm.) however, little is known about the non-game wildlife species that use this area. These sightings, in conjunction with the site's rare ICH xw biogeoclimatic variant has sparked interest in conducting a biodiversity inventory to better understand the complexities associated with such a sensitive ecosystem.

CBFWCP along with TWA and the Regional District of the Kootenay Boundary recognized this lack of information and chose to undertake a biodiversity, presence/not detected inventory, of the non-game wildlife species. Three consulting companies, Novus Consulting, Mirkwood Ecological Consultants and Ophiuchus Consulting teamed up, along with 25 volunteers, to complete this important project. The inventory focused on birds, small mammals, bats, reptiles, and amphibian species. Information was also collected on noxious weeds and land use.

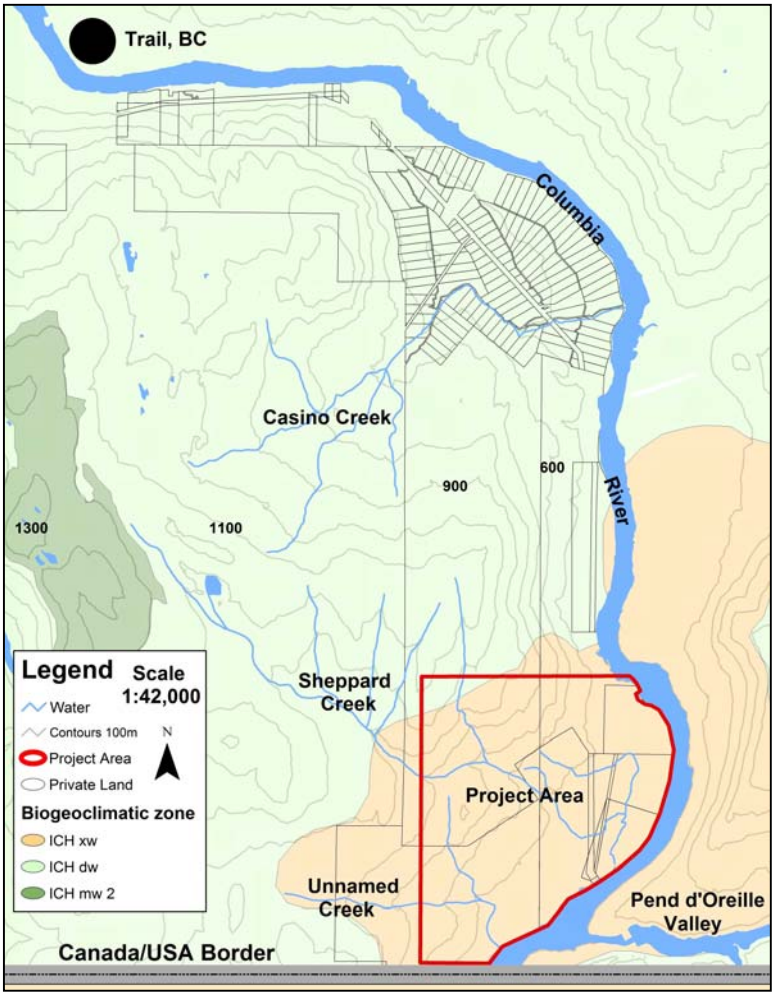

FIGURE 1. Map of the project area including biogeoclimatic zones.

The project area is the furthest western and southern extension of the 8000-hectare ICH xw biogeoclimatic sub-zone found in the West Kootenay. The ICHxw is a rare ecosystem nationally that is even more unique because it is poorly represented by the Provincial Park system in British Columbia (Scott-May 2002). Currently there is only 44 hectares of this ecosystem under park protection at Beaver Creek Provincial Park. An additional 1,432 hectares of ICHxw in the Pend d'Oreille is under the jurisdiction of the MWLAP, however, it is not a single contiguous unit. Approximately 1,100 hectares of contiguous ICHxw is privately owned by Teck Cominco (Schaeffer and Datchkoff 2002) as part of a much larger 2,600-hectare parcel of land. The project area of 800 hectares of ICHxw represents 1/10 of the entire ecosystem in the West Kootenay and is 18 times larger than the Provincial Park representation.

Manmade and natural events have affected the vegetation of this unique ecosystem. Vegetation resources have been significantly impacted by fire, logging, linear industrial development (roads and power line construction) and smelter SO_2 emissions. Remnant mature coniferous forests in an undisturbed state are limited within the project area. Presently the forest is a maturing deciduous forest type (McBride 1937; Hodson1971; McDonaugh and Hamilton 2000; Cantox 2001). Transmission line corridors provide access to the area for the public. The access has resulted in soil erosion impacts due to the off-road operation of 4 wheel drive vehicles, quads, and motorcycles. Additionally impacts related to recreationalists such as uncontained garbage and unrestricted campfire use has affected the area.

Additionally, Fort Shepherd is historically significant with high archaeological values (Handley and Lackowicz 2000) along the Columbia River and medium –high values along Sheppard Creek. The Hudson's Bay fort established within the project area in 1856 saw sporadic use until it was destroyed by fire in 1872 (Turnbull 1954). A historical cairn presently marks the site of the old fort.

Objectives

The project was developed to inventory a range of wildlife species at Fort Shepherd. Specifically, the following objectives were identified:

- Carry out ground based surveys in habitat having the highest potential for use by red and blue listed wildlife species
- Determine the breeding status of detected wildlife species
- Describe the land use practices and impacts occurring in project area
- Assess the current distribution of noxious weeds and identify potential remediation measures
- Map location of ground surveys and species encountered
- Summarize of the total number of each species noted
- Draft a set of recommendations for future restoration/conservation activities
- Photograph representative habitats and wildlife species

Methodology

Habitat Stratification

After reviewing several documents (Gwilliam 1986; Braumandl and Curran 1992; Marcoux 1997; Hurlburt et al.1998) we stratified the project area into five wildlife habitat types to direct our reconnaissance search efforts (Table 1 and Figure 2). The five habitat types: Open Forest, Grassland, Closed Forest (including riparian zone), Rocky and Shrubland reflect a divergence from the stratification in the documents we reviewed (Photo 1, 2, 3, 4, and 5). Our goal was to simplify our fieldwork. In addition we identified a small but important pond ("Peace Pond") in the northeastern section of the project area.

The ecological stratification was overlaid with access information then the sampling areas were identified. Sampling sites are representative of the ecological classification based on adaptive sampling methods (Krebs 1999) with sampling priorities given to sites with access and suspected higher concentrations of listed species.

TABLE 1. Wildlife habitat types and their characteristics used for stratification of project area.

Habitat Type	Characteristics	% Project area
Open Forest	Forested areas, with trees widely spaced and low canopy closure.	6%
Grassland	Devoid of shrubs and trees. Vegetation dominated by grass species.	4%
Closed Forest	Areas with moderate to full tree canopy closure consisting of mature and old seral stages of tree development. Riparian areas adjacent to streams with both deciduous and coniferous species.	35%
Rocky	Steep areas with little vegetation and rocky outcrops.	25%
Shrubland	Areas where the dominant vegetation is a woody-stemmed shrub. A low density of snags may also be present.	30%

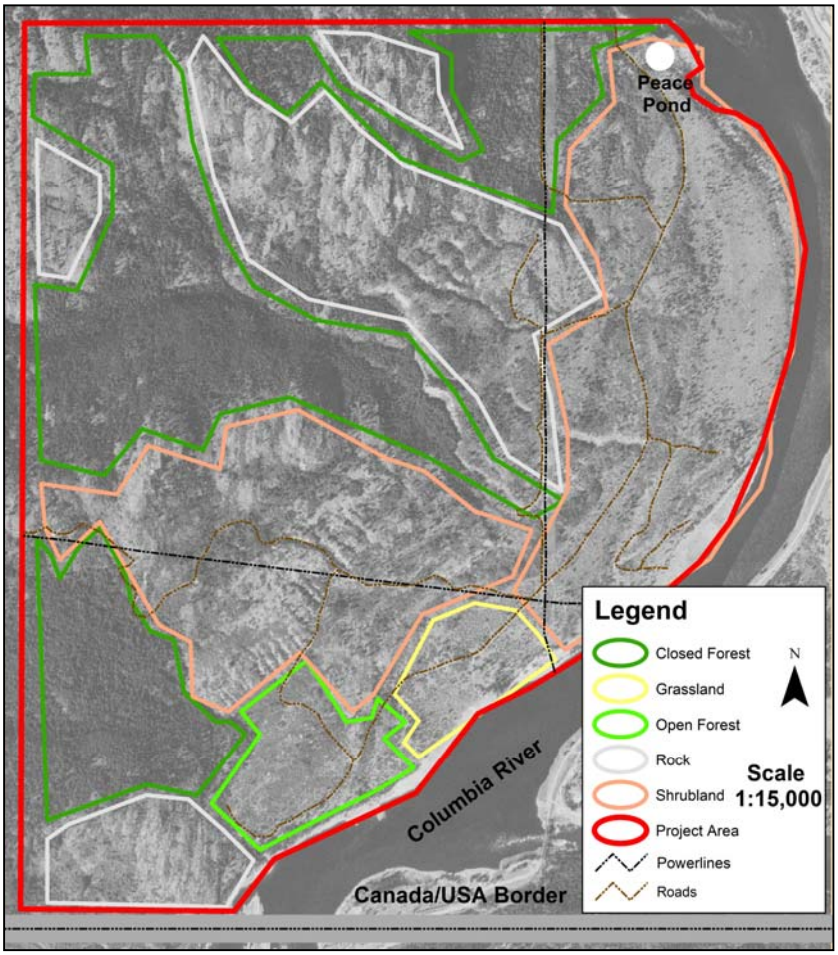

FIGURE 2. Stratification of the project area into five habitat types.

PHOTO 1. Open Forest.

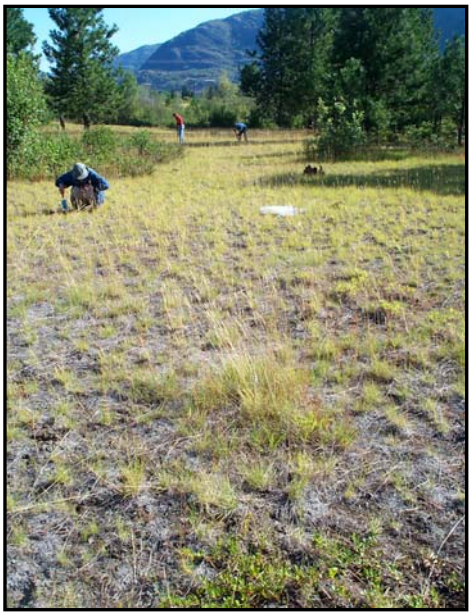

PHOTO 2. Grassland.

PHOTO 3. Closed Forest.

PHOTO 4. Rocky.

PHOTO 5. Shrubland.

Wildlife Surveys

As the Fort Shepherd area has undergone significant changes in vegetation over the last century, wildlife species found on the site may include: relic species, species adapted to the dry denuded environment (similar to the Okanagan) and species that are entering the environment now that vegetation is re-established (Cantox 2001).

The wildlife inventory was conducted using both systematic and general surveys. The systematic surveys followed the current presence/not detected survey protocols outlined by the Resource Inventory Committees Standards (RICS) where applicable for each species group however, most of the RIC standards restricted sampling to specific time periods for purposes of standardization (i.e. songbird surveys usually take place from 05:00-11:00 hours). Our experience has shown that a significant amount of wildlife data can be collected outside these times periods. Therefore, prior to (or after) standardized sampling periods we investigated areas that were outside the systematic survey area. This "generalized" approach helped to expand the species accounts for the project area. Sightings of all animals encountered when conducting surveys for specific animals throughout the spring and summer further enhanced the findings. Field observations and surveys for the inventory commenced in early May 2002 and carried forward until September 2002.

2.0 DIURNAL RAPTORS, PASSERINES, AND OWLS

Introduction

The Interior Cedar-Hemlock very dry (ICHxw) and dry warm (ICHdw) sub-zones have the second highest diversity of bird species in the Nelson Forest Region (Braumandl and Curran 1992). Prior to this inventory we had personal observations for at least two listed species of birds in or nearby the Fort Shepherd area. The inventory findings supported these observations and are discussed in detail below.

PHOTO 6. Spotted Towhee (Pipilio maculates) nest with young.

Methods: Diurnal Raptors and Passerines

Presence/not detected surveys of forest and grassland songbirds were conducted using a line transect to inventory birds utilizing the Fort Shepherd area (Resource Inventory Committee 1999). Each habitat stratum was sampled along a two kilometre transect (Songbird 1-5) during morning and late afternoon. Several techniques were used to attract species including playing taped calls, imitating a Northern Pygmy-Owl (*Glaucidium gnoma*), "pishing", and nest searches (Photo 6). Pishing mimics an alarm call of songbirds and in combination with the owl calls can often bring in birds that are otherwise inactive. Stick nests, cavities, or caves observed during the transect surveys were investigated further to determine which species are using them. Areas with particularly good visibility and known "hotspots" of wildlife activity were surveyed using the standwatch technique. Standwatches have been relatively successful in other studies for detecting raptors moving to and from nest sites (Chytyk et al.1997).

Five transects were traversed: May 19 (two transects), May 31, June 28 and July 02, 2002 (Figure 3). Songbird transects 4, 5, and owl call stations are shown as geographical positions.

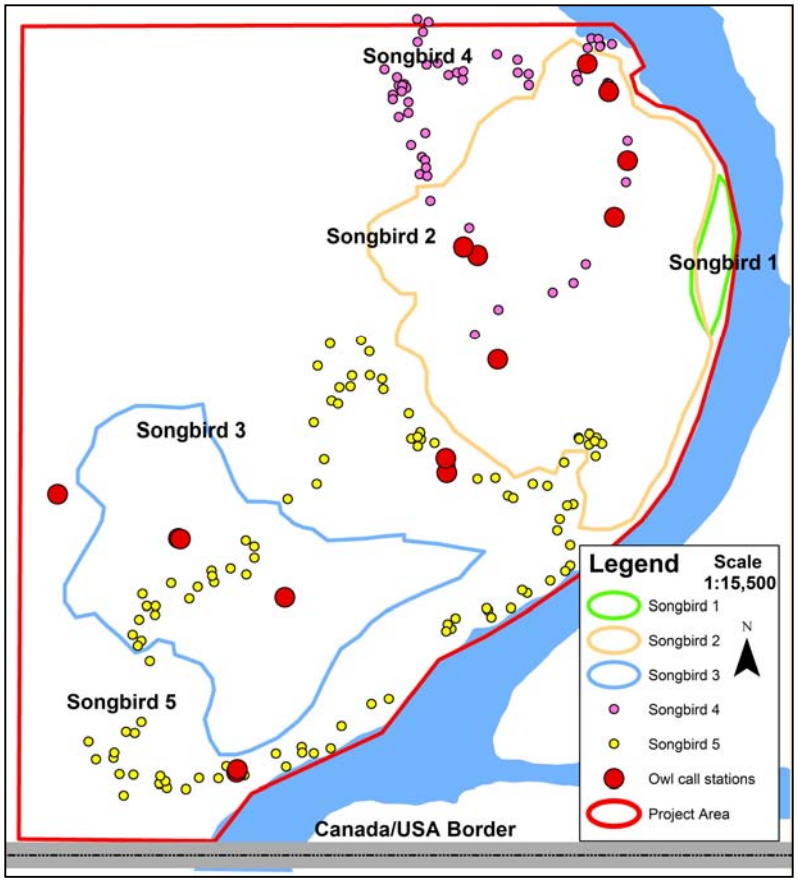

FIGURE 3. Bird and owl transects at Fort Shepherd.

Methods: Owls

Call playbacks for owls were used to elicit responses during two evening surveys. Owl surveys followed a road transect that covered the majority of the project area. Call stations were established approximately 400-600 m apart depending on habitat type. We played the calls of Northern Saw-whet Owls (*Aegolius acadicus*) and Western Screech-Owls (*Otus kennicottii*) at each call playback station based on our experience in the area, as other species of owls will often respond to calls of the smaller owls.

We conducted two nocturnal owl surveys between 2100 and 0100 hours on May 27 and July 08, 2002 (Figure 3).

Results and Discussion: Diurnal Raptors and Passerines

Approximately 25 km of transects were surveyed, covering most of the project area and all the major habitat types (Figure 3). The most common habitat type surveyed was the "Shrubland" composed of a mixture of mallow ninebark, ocean spray, chokecherry, saskatoon, and snowbush. Correspondingly this was also the habitat where the most bird species were observed. A total of 65 bird species were detected during five days of transect surveys (Appendix 1) including a juvenile Merlin (*Falco columbarius)* observed perched on a cottonwood tree along the river, just north of the project area.

The most common species observed in the project area were: Bank Swallows (*Riparia riparia)*, Yellow Warblers (*Dendroica petechia)*, Chipping Sparrows (*Spizella passerina*), Spotted Towhees (*Pipilo maculates*) (Photo 6), and Brown-headed Cowbirds (*Bolothrus ater*). Breeding was confirmed for ten bird species based on the presence of nests (with either eggs (Photo 7) or young) or recently fledged young (Table 2). A Red-tailed Hawk (*Buteo jamaicensis*) nest was also strongly suspected to be present based on the behaviour of two adults, but a nest was not located. The Shrubland habitat supports diverse and dense populations of many songbirds and likely has the highest density of nests in the project area (excluding the Bank Swallow colony). While nest densities were not tabulated we feel that the project area is heavily used by several species some of which are not found in many other areas of the Kootenays. Species identified were: Grey Catbirds (*Dumetella carolinensis)*, Lazuli Buntings (*Passerina amoena*), Black headed Grosbeaks (*Pheucticus melanocephalus*), Chipping Sparrow (*Spizella passerina*) and Yellow Warbler (L. Van Damme, pers. comm.).

PHOTO 7. Nighthawk (Chordeiles minor) nest with eggs.

TABLE 2. Habitat type and indicator for breeding bird species within the project area.

Species	Spotted Towhee	Canyon Wren	Common Nighthawk	Violet-green Swallow	Northern Flicker	Bank Swallow	Yellow Warbler	Cedar Waxwing	Chipping Sparrow	Gray Catbird
Habitat type	Shrubland	Rocky	Shrubland and Rocky	Shrubland	Riparian	Riparian	Shrubland	Shrubland	Shrubland	Shrubland
Obs.	Eggs and Hatchlings	Fledged	Eggs	Fledged	Fledge and Eggs	Fledged	Eggs and Hatchling	Eggs	Eggs	Eggs

Results and Discussion: Owls

No owls were detected during two night surveys or any of our daytime bird surveys however; one Northern Saw-whet Owl was captured during the bat survey on August 10, 2002. We suspect the area provides some hunting and roosting habitat but limited nesting habitat for most owls present in the West Kootenay. Northern Saw-whet Owls have been observed roosting in old western larch snags near Glenmerry just south of the Trail Hospital. Northern Saw-whet Owls could use larch snags, which are in abundance at Fort Shepherd however; the lack of mature forest cover within the project area may limit the amount of nesting habitat available for most forest owls (i.e. Barred (*Strix varia*), Great Horned (*Bubo virginianus*), Long-eared (*Asio otus*), Northern Pygmy, and the Flammulated (*Otus flammeolus*)). Short-eared Owl (*Asio flammeus*) habitat also appears limited because of a lack of grassy openings. Again they may occasionally use the area for hunting, but the lack of their preferred habitat (open tall grassland) likely limits nesting by Short-eared Owls at Fort Shepherd.

Listed Birds

The only listed bird species observed at Fort Shepherd were the blue listed Canyon Wren (*Catherpes mexicanus*) and Great Blue Heron (*Ardea herodias*). A family group of six Canyon Wrens was observed while walking across a talus slope just north of the B.C. Hydro transmission corridor. The group was startled from a rock crevice in the talus slope. We suspect that a nest was present because there was a significant amount of whitewash around the crevice entrance and both adults and 3-4 young were observed exiting the crevice. The Great Blue Heron was observed fishing along the Columbia River near the Peace pond. Based on an assessment of habitat types and the documented habitat requirements of each species, we have compiled a table of red and blue listed species possibly occurring at Fort Shepherd (Table 3).

TABLE 3. Red and blue listed birds present or possibly occurring in the project area.

Species	Preferred Habitat	Habitat Suitability of Fort Shepherd for Breeding
Great Blue Heron *(Ardea herodias)* **(Blue listed)**	Breeding/Feeding – nest in mature riparian and mixed forests, usually near water (Campbell et al. 1990a).	Feeding Confirmed Presence/ Low/Moderate Breeding Potential– there is a lack of wetland/riparian forest within the project area, particularly along the Columbia River. There is potential for some nesting along Sheppard Creek upstream of the power line crossing (Closed Forest) where there are some extensive mature birch forests with some cottonwood along the stream banks. Feeding sites are limited to the lower reaches of Sheppard Creek and the "Peace Pond" along the Columbia at the north end. Grassy openings are likely too disturbed to provide good hunting opportunities.
	Winter – along Columbia River; particularly near Waldie Island (Machmer 2002; Pers.Observations).	Moderate Winter Potential – the bedrock pond (Peace Pond) at the north end may provide some hunting habitat. Back channels just north of project site and cottonwood habitat along the Columbia River and lower section of Sheppard Creek may provide some winter roosting and feeding areas.
Prairie Falcon (*Falco mexicanus***) (Red listed)**	Breeding/Feeding – nests in canyons with steep cliffs and escarpments throughout the Southern Interior (Campbell et al. 1990b)	Low/Moderate Breeding/Feeding Potential – there are numerous potential nesting sites in the rock outcrops and cliffs along the western edge of the project site. The abundance of ground squirrel burrows suggests that there is sufficient prey to support falcons in the area.
	Winter – grasslands and sparsely treed areas.	Low Winter Potential – open habitat is likely not extensive enough to support falcons during the winter; prey may also be limiting.

Species	Preferred Habitat	Habitat Suitability of Fort Shepherd for Breeding
**Turkey Vulture (*Cathartes aura*) (Blue listed recently yellow-listed *)*	Breeding/Feeding – nests in areas with cliffs, rock outcrops and mixed forest with large scree slopes (Campbell et al. 1990b).	High Breeding/Feeding Potential – sightings of Turkey Vultures are very common in the area and they were observed hunting along the west ridge on each of the five survey days. It is very likely they regularly nest in the project area or nearby.
	Winter – open areas including cliffs, pastures, and rangeland.	Low Winter Potential – not seen very frequently during the winter and likely migrate to southern USA or Okanagan Valley to winter.
Flammulated Owl (*Otus flammeolus*) (Blue listed)	Breeding/Feeding – nests in mature Douglas-fir and ponderosa pine forests with cliffs, rock outcrops and mixed forest with large scree slopes (Campbell et al. 1990b).	Low/Moderate Breeding/Feeding Potential – virtually no mature Douglas-fir or ponderosa pine forests in the project site. At the southern end of the project area a young conifer patch may be suitable in the future (Open Forest). Also, numerous larch snags on benches and scattered mixed forest at upper elevations could be used for nesting and roosting. Birch and aspen stands may also be used as Flammulated owls have been know to use mature deciduous forests in Northern Utah (Marti 1997).
	Winter – migratory.	No Winter Potential
Western Screech-Owl (*Otus kennicottii*) (Red listed)	Breeding/Feeding – nests in mature mixed and riparian forests (Cannings 1997, Pers. Obs.).	Low/Moderate Breeding/Feeding Potential – there is a lack of wetland/riparian forest within the project area, with the most prominent being along Sheppard Creek upstream of the power line crossing where there are some extensive mature birch forests with some cottonwood along the stream banks.
	Winter - same as above.	Low/Moderate Winter Potential – same as above.
Short-eared Owl (*Asio flammeus*) (Blue listed)	Breeding/Feeding – marshes, tundra, and grasslands (Holt and Leasure 1993).	Low/Moderate Breeding/Feeding Potential – limited grassland habitat to allow for nesting. Habitat may be too disturbed as frequent trails and vehicle tracks noted throughout grassy areas. Some potential for occasional hunting.
	Winter – migratory.	Low Winter Potential
Lewis's Woodpecker (*Melanerpes lewis*) (Blue listed)	Breeding/Feeding - burned conifer, open mature ponderosa pine, rangeland with isolated veteran trees, and riparian cottonwood (Cooper and Beauchesne 1999).	Moderate Breeding/Feeding Potential -- Virtually no mature Douglas-fir, ponderosa pine, or riparian forests in the project site. At the southern end of the project area a conifer patch may be suitable in the future (Open Forest). Also, numerous larch snags on benches and scattered mixed forest at upper elevations may be used.
	Winter – migratory.	Low Winter Potential

Species	Preferred Habitat	Habitat Suitability of Fort Shepherd for Breeding
Canyon Wren (Blue listed)	Breeding/Feeding – rock canyons, cliffs, and rock outcrops (Cannings 1995).	Confirmed Breeding Presence – Likely year round residents of Fort Shepherd and breed every year. Talus slopes (Rocky) with large (> 0.8 m diameter) rocky areas seem to be preferred for nesting (Pers. Obs.).
	Winter – migratory.	High Winter Potential
White-throated Swift (*Aeronautes saxatilis)* **(Blue listed)**	Breeding/Feeding – steep cliffs, rock bluffs, and canyons (Campbell et al. 1990b).	Moderate/High Breeding/Feeding Potential – it does not appear that White-throated Swifts are currently using the area for breeding however, there are several Violet-green Swallows using the cliff habitat along the west ridge for nesting and we suspect swifts may use the same habitat in the future.
	Winter – migratory.	No Winter Potential
Bobolink (*Dolichonyx oryzivorus)* **(Blue listed)**	Breeding/Feeding – tall grass areas, wet meadows, cultivated fields (Van Damme 1999).	Low Breeding/Feeding Potential – lack of wet meadows and extensive grassland limit potential for breeding in the area.
	Winter – migratory.	No Winter Potential
Long-billed Curlew (*Numenius americanus)* **(Blue listed)**	Breeding/Feeding – Large tracts of open grassland with absence of trees or shrubs (Campbell et al. 1990b).	Low Breeding/Feeding Potential - lack of extensive grassland habitat and occurrence of scattered shrubs and trees in the Grassland habitat, that is present, limits potential for breeding in the area.
	Winter – migratory.	No Winter Potential
Yellow-breasted Chat (*Icteria virens)* **(Red listed)**	Breeding/Feeding – dense riparian thickets (Cannings 1994)	Moderate Breeding/Feeding Potential – A lack of dense riparian/wetland habitats limits potential for breeding in the area, however, during extremely wet years shrub habitat along Sheppard Creek may be suitable.
	Winter – migratory.	No Winter Potential

3.0 SMALL MAMMALS

Introduction

Of the 11-biogeoclimatic zones identified in the Nelson Forest region, the ICHxw and dw support the third largest number of mammal species (Braumandl and Curran 1992. Photo 8). The previous work in the project area focused upon ungulate management activities and very little information has been compiled on the small mammals. In fact, very few small mammal studies have been carried out in the Kootenay region, (i.e. Darling and Gerbauer 1996; Panian 1996; Fraker et al. 1997; Fraker and Nagorsen 1998; and Marinelli and Schaeffer 2001) and none of them have been located in the ICHxw.

PHOTO 8. Flying squirrels (Glaucomys sabrinus).

Given the unique dry warm characteristics of this ecosystem and that very little is known about the small mammal species that may be found here, we felt that there was a potential to discover listed species. We used mammals found in the dry ecosystems of the Okanagan to identify listed species that potentially could be discovered in the ICHxw of Fort Shepherd (Table 4). The probability of occurrence was determined from local knowledge and assessing the known habitat requirements of each species and their distribution as cited in Cannings et al. 1999.

Our systematic approach was dependant upon using baited live traps. Live trapping focused upon capturing animals from two mammal orders, rodents (Rodentia) and shrews (Insectivora), while our general approach included direct observations, scat analysis, and track traps. Our general approach allowed us to identify all mammal species including those small mammals not trapped.

TABLE 4. List of the potential rare and endangered small mammal species and their probable occurrence in the project area.

Common name	Latin	Status	Probability of Occurrence
Great Basin Pocket Mouse	*Perognathus parvus*	Blue	Low*
Preble`s Shrew	*Sorex preblei*	Red	Low**
Merriam`s Shrew	*Sorex merriami*	Red	Low**

*Species occur in the dry warm interior grasslands
** Recently discovered in the dry warm Okanagan

Methods: Rodents

A variety of techniques were used to document the presence of rodent species within the project area, including live trapping, chance direct observations, and track analysis (RIC 1998b, RIC 1998c, RIC 1998f, RIC 1998g). Sampling was conducted in the late summer after the breeding season. This reduced the stress on lactating females and increased the likelihood of capturing animals, as the sub-adults begin to move as adults and are therefore trappable.

Systematic Approach: Live Trapping

Live traps were placed along both short and long meandering transects in each of the five habitat types (Figure 4). We conducted 3 days of live trapping: August 25, 26, and 27 using 75 Tomahawks®, 89 TinCat®, 34 Sherman® and 75 Bolton® traps.

Two types of traps were used in transect 1 in the Open forest habitat type; 24 TinCat® and 2 Tomahawks® at 13 sampling points. Transect 2 in the Grassland habitat type used two subtended transects "A" with 40 Tin Cat® and 4 Tomahawk® traps placed at 20 sampling points and "B" 10 TinCat® at five points. Transect 3 in the Closed forest habitat type was systematically surveyed using 15 Bolton®, 15 TinCat® and 3 Tomahawk® traps at 15 sample points. Transect 4 required 34 Sherman® and 7 Tomahawk® traps. The Shrubland habitat type transect 5 (T5) was surveyed using 60 Tomahawk® and 60 Bolton® traps. A Tomahawk® and Bolton® trap was placed at each of the 15 sampling point along four sub transects A, B, C, and D. Various trap styles were used because of their availability and adaptability to different habitat types. Sherman® traps on the rocky slope (light weight, single capture), Tomahawks (for the larger small mammals, single capture), Bolton® traps (single capture), and TinCat® (multiple capture). Prior to trapping the traps were baited with Hagen Nutri Blocks® for the first 12 days, and with Nutri Blocks® and peanut butter/oat balls for an additional 2 days. The traps were also furnished with a section of bedding material one week before trapping. The trapping session was conducted over three evenings. The traps were set at sunset, and checked and locked open at sunrise.

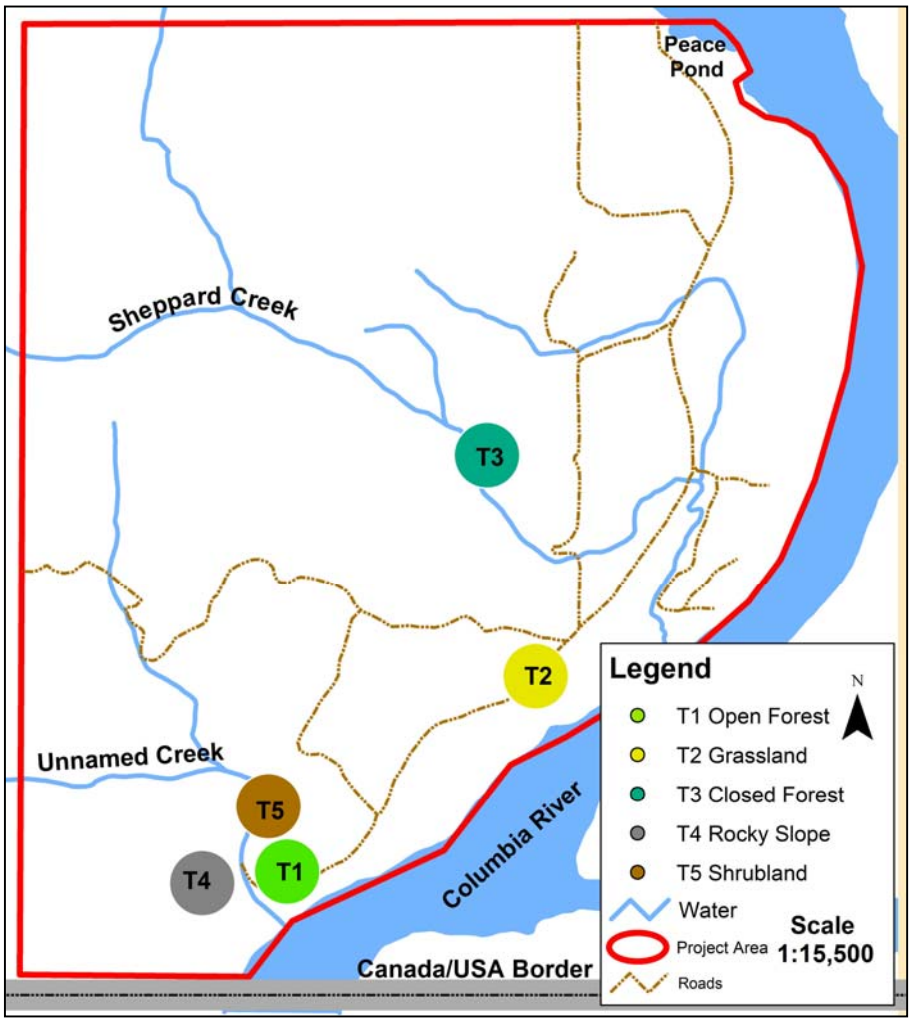

FIGURE 4. Location of small mammals transects at Fort Shepherd.

Assessing trap intensity for each habitat type was based on obtaining optimal coverage while considering access and safety for personnel (Table 5).

TABLE 5. Identifying the relative area of each habitat and the respective trapping intensity based upon the distribution of rodent and shrew traps.

Habitat Type	Project Area (ha)	% of Project Area	Optimal Total Traps	Optimal Rodent Traps	Actual Rodent Traps	%	Optimal Shrew Traps	Actual Shrew Traps	%	Actual Total Traps	%
Open Forest	48	6	22	16	26	9	6	26	25	52	14
Grassland	32	4	17	12	54	20	5	50	47	104	27
Closed Forest	280	35	133	96	33	12	37	30	28	63	17
Rocky	200	25	94	68	41	15	26	0	0	41	11
Shrubland	240	30	114	82	120	44	32	0	0	120	32
TOTALS	**800**	**100**	**380**	**274**	**274**	**100**	**106**	**106**	**100**	**380**	**100**

Each animal caught was sexed, weighed, aged, its reproductive status determined, and its total tail length measured. Also, the trap type and diagnostic features used to determine species were recorded. In addition animals were marked by either clipping hair from their posterior or by ear tagging. While this did not add information to the survey in terms of presence or presence not detected it did facilitate biometric information collection as animals recaptured were simply released.

General Approach

The general approach utilized direct observations during all of the field work and animal sign surveys. Animal sign surveys consisted of walking the trapping transects and looking for any animal attribute that would indicate it being present. In addition, three track traps were established within the T5 Shrubland, as this was the largest representative habitat type in the project area. Track traps consisted of approximately $1m^2$ of smoothed sand on game trails. The track traps were checked throughout the pre-baiting and baiting portion of the survey.

We conducted 15 days of track/print trap observations: August 12-27.

Methods: Shrews

Systematic Approach: Live Trapping

We used a live pitfall traps placed along meandering transects to detect shrew presence. The opportunity to capture red or blue listed shrew species in a potentially lethal pitfall trap required that the traps be checked at intervals throughout the night. The pitfall traps (11 cm diameter) consisted of two, one litre plastic containers, stacked within each other, dug into the ground and flush with the surface level. Traps were placed along transects within the Open Forest (T1), Grassland (T2), and Closed Forest (T3) habitat type (Figure 4). These habitats and transects were chosen due to the potential of finding shrews, access, and for personnel safety reasons. The remaining habitat types, Rocky and Shrubland, were difficult to travel to or within at night and therefore were excluded from sampling. The open forest had 26 shrew traps placed two per sampling point. The Grassland habitat type had 50 shrew traps distributed in pairs at each sampling point. There were two sub transects, "A" which had 15 sample points and "B" which had 5 sample points. Within the Closed Forest habitat 30 traps were set, with two traps at each of the 15 sampling points. Pitfall traps were not pre-baited. Bait, would only exacerbate the problem of bears disturbing the traps. During trap nights,

the trap lids were removed at sunset and each trap was baited with a teaspoon of ground beef liver. The traps were checked every 3 hours and the lids replaced after the last check.
We conducted 3 days of live trapping: August 25, 26, and 27 using a total of 106 traps.

General Approach: Scat Analysis

In addition to live trapping, we derived information from an animal sign survey (RIC 1998c). Scat analysis provided a simple method to collect bone samples from predators. A small population of coyotes live within the project area and they periodically left scat marks that could be investigated for bone fragments or skulls.

Results and Discussion

In total, eight small mammals, (not including bats) were confirmed as present in the project area. Live trapping captured three species and general observations identified the remaining mammals. No red or blue listed small mammals were captured or identified within the project area.

Rodents

Rodent live trapping had a trap capture rate of 3.5 animals per 100 trap nights. Trapping results from similar studies (Marinelli and Schaeffer 2001; Darling and Gerbauer 1996; and L. Marinelli pers. comm.) had capture rates ranging from 1.1/100 to 14.4/100. The two species captured were the Deer Mouse (*Peromyscus maniculatus;* Photo 9), and the Yellow-pine Chipmunk (*Tamias amoneus;*Photo 10). Both of these species are generalists omnivorous and can adapt and thrive in a variety of habitats including highly disturbed sites. The greatest number of animals captured per trap effort (4.9/100) was in the rocky habitat type with the fewest being captured in the Open Forest type (Table 6).

TABLE 6. Small mammals caught per 100 trap nights.

Animal	Open Forests	Grassland	Closed Forest	Rocky	Shrubland	Total animals & trap nights
Rodents capture/100 trap nights	0 animals/78 trap nights **0/100**	13animals /309 trap nights **4.2/100**	1 animal / 99trap nights **1/100**	6 animals / 123 trap nights **4.9/100**	14 animals / 360 trap nights **3.9/100**	**34 animals 969 trap nights**
Shrews captured /100 trap nights	0/78 **0/100**	0/150 **0/100**	1/90 **1.1/100**	Not Sampled	Not Sampled	**1 animal 318 trap nights**

We also observed a number of other rodents in the project area, namely Red Squirrels (*Tamiasciurus hudsonicus*), Northern Pocket Gophers (*Thomomys talpoides*), Columbia Ground Squirrels (*Spermophilus columbianus*), Bushy-tailed Woodrats *(Neotoma cinera)* and Northern Flying Squirrels *(Glaucomys sabrinus)*. *S*ome small mammal species were thought to be on site, yet were undetected (Table 7). In addition Table 8 identifies the rodents, shrews, and large mammals that were present on site (excluding bats), the habitat(s) they were located in, and the method in which their presence was verified.

PHOTO 9. Deer Mouse (Peromyscus maniculatus).

PHOTO 10. Yellow-pine Chipmunk (Tamias amoneus).

Shrews

Five species of shrews are known to occur in the Southern Interior Mountains and in the ICH biogeoclimatic zone (Nagorsen 1996) but only one was captured within the project area. Capture rates were low at 0.3 animals per 100 trap nights (Table 6) when compared with other studies (Darling and Gerbauer, 1996). The one animal captured, a Common Shrew (*Sorex cinereus)* (Photo 11) was in the Closed Forest habitat, near Sheppard Creek, on an evening interrupted with rain showers. We investigated 8 samples of coyote scat in the hopes of finding evidence of additional shrews but found none.

Of the five shrew species known to occur in the ICH the Common Water Shrew (*Sorex palustris*), an extreme habitat specialist (RIC 1998b), was excluded from our survey because we had a limited number of constant flowing streams. Of the remaining four species that potentially could have been on site the least likely to be captured was the Vagrant Shrew (*Sorex vagrans)* because of its intolerance of acidic soils (RIC 1998b). In Fort Shepherd the soils have been impacted by SO_2 deposition, fires and logging, which have markedly reduced the pH of the soils (Cantox 2001).

The remaining three shrew species; Common (*Sorex cinereus*), Dusky (*Sorex monticolus*) and Pygmy (*Sorex hoyi*) all had the same possibility of being present. We included the rare species of Prebles' and Merriams' Shrews (Table 4) but neither shrew was observed within the project area at Fort Shepherd.

PHOTO 11. Common Shrew (Sorex cinereus).

In addition to the shrew, we captured a number of small insects that fell into the pitfall traps. We released all of the insects with the exception of the Carabid beetles (Appendix 2). These we killed, pinned, and sorted by habitat type and transect line.

Small Mammals

A number of species, initially considered to be on site were absent from the findings of this project. Potential species, their status, preferred habitat characteristics and the suitability of the habitat offered at Fort Shepherd are shown below in Table 7.

TABLE 7. Additional small mammal species that were considered to be on site but absent from the findings.

Species	Latin	Status (MWLAP 1998)	Preferred Habitat	Present Habitat Suitability of Fort Shepherd
Great Basin Pocket Mouse	*Perognathus parvus*	Blue listed	Sandy soils in shrubby arid areas. Interior grasslands valley's of the Okanagan, Similkameen, Kettle and Thompson (Nagorsen 2002). Capability of existing without water.	Low-moderate suitability Outside of its known range Large alluvial river terraces with sandy soils Grassland and Shrublands habitat (34% of project area).
Southern red-backed Vole	*Clethrionomys gapperi*	Yellow listed	Found throughout mainland British Columbia. (Nagorsen 2002). An omnivorous species living mainly in the forest and associated with litter of decaying trees. (RIC 1998b).	Moderate suitability 35% of the project area is Closed Forest
Western Jumping Mouse	*Zapus princeps*	Yellow listed	Found throughout mainland British Columbia. Thickets of shrubs at ecotone. Water is a necessity for this species. (Cowan & Guiget 1978).	Low suitability. Some sections along Sheppard Creek but water is limiting in project area.
Meadow Vole	*Microtus pennsylanicus*	Yellow listed	Found throughout mainland British Columbia. (Nagorsen 2002) Marshy moist areas (RIC 1998b).	Low suitability. Some sections along Sheppard Creek but water is limiting in project area.
Long-tailed Vole	*Microtus longicaudus*	Yellow listed	Found throughout mainland British Columbia. Wetland areas, occasionally dry situations (RIC 1998b).	Low suitability. Some sections along Sheppard Creek but water is limiting in project area.
Red-tailed Chipmunk	*Tamias ruficaudus*	Red list	Timberline ecotones with access to easy cover from shrubs, brush piles and fallen logs (RIC 1998c) Range is delimited by the Kootenay and Columbia Rivers (Nagorsen 2002).	Low-moderate suitability. 35% of the area is composed of Closed forest with edges against the four other habitat types.

Mammals

In addition to the findings of shrews and rodents we observed the presence of six larger animals. None of these animals are rare or endangered. Table 8 identifies the habitat that the animal was detected in along with the way in which its presence was determined. In total, 14 mammals (excluding bats) were documented within the Fort Shepherd project area.

TABLE 8. Mammal species, including small mammals, identified within the project area.

Common Name	Latin Name	Habitat	Identification
Coyote	*Canis latrans*	Most common in Shrubland also in Grassland	Scat, observed, calling, prints
Northern Flying Squirrel	*Glaucomys sabrinus*	Snags in Shrubland	Observed, nesting
River Otter	*Lontra canadensis*	Along the Columbia River	Observed
Bobcat	*Lynx rufus*	Shrubland	Observed, prints
Bushy Tailed Woodrat	*Neotoma cinera*	In the Rocky habitat	Whitewash, nesting, observed
White-tailed Deer	*Odocoileus virginianus*	Throughout area	Bedding, tracks, scat
Mountain Goat	*Oreamnos americanus*	In the Rocky habitat	Hair, tracks, observed
Deer Mouse	*Peromyscus maniculatus*	Most common in Grassland also in Shrubland	28 trap captures
Common Shrew	*Sorex cinereus*	Closed forest, near Sheppard Creek	1 trap capture
Columbia Ground Squirrel	*Spermophilus columbianus*	Only found in Shrubland	Whistling, observed, burrows
Yellow-pine Chipmunk	*Tamias amoenus*	Only found in Shrubland	6 trap captures, nesting
Red Squirrel	*Tamiasciurus hudsonicus*	Closed Forest	Observed
Northern Pocket Gopher	*Thomomys talpoides*	In the Rocky habitat, Open Forest, and Shrubland	Mounds, tracks
Black Bear	*Ursus americanus*	Most common in Closed forest, but sighted in Grassland and Shrubland	Observed, tracks, scat

4.0 BATS

Introduction

Some of the most intensive bat inventories in the West Kootenay have been conducted in the Pend d'Oreille Valley (Vonhof and Gwilliam 2000); across the Columbia River from the Fort Shepherd project area. Five-years of data were collected from 479 bats representing nine species. The "rarest" bat encountered was the blue-listed Townsend's Big-eared Bat (*Corynorhinus townsendii;* Photo 12). Breeding for this species was not confirmed as only males were observed. A summary of their findings for all bats is presented in Table 9.

The only bat surveys conducted in the Fort Shepherd project area prior to this project focused upon potential roosts (Vonhof and Gwilliam 2000). A single investigation of several caves revealed only one male Townsend's Big-eared Bat in July of 1996 (J. Gwilliam, pers. comm.).

PHOTO 12. Townsend's Big-eared Bat (Corynorhinus townsendii).

The Fort Shepherd project area is well suited to support a diverse array of bat species as the climate provides many favourable nights to hunt insects as well as adequate thermal characteristics for the development and rearing of young. Suitable roosting habitat features include cliffs, talus, mines and caves. There are few suitable wildlife trees for roosting due to historic logging, fires, and SO_2 vegetation damage (Hodson 1971). There are also no buildings except one small abandoned cabin to provide anthropogenic roosting opportunities. Therefore, it was anticipated that a similar array of bat species should be expected at Fort Shepherd, as compared with the Pend d'Oreille, except possibly fewer tree-roost dependent bats and more rock-roost dependent bats.

TABLE 9. Summary of five years of bat studies in the Pend d'Oreille (adapted from Vonhof and Gwilliam 2000).

Bat Species	Relative Abundance	Gender	Tree Roosts Characteristics	Other Roost Types
Little Brown Myotis	Most Common (n=184)	Mostly males	None observed	Building
Silver-haired Bat	Common	Mostly females	N=46; mostly At; decay class 2; mostly in hollows & cavities	
Big Brown Bat	Common	Mostly females	N=46; mostly At; decay class 2; mostly in hollows & cavities	Building
California Myotis	Common	Mostly females	N=20; mostly Fd also Bg & Pw; decay class 4/5; beneath bark	
Western Long-eared Myotis	Common	Mostly females	N=9; mostly Pl, Bg, Fd also Pw, Lw; decay class 4/5; beneath bark	
Long-legged Myotis	Uncommon	Both genders	N=3; Fd, Pw, Bg; decay class 4/5; beneath bark	
Hoary Bat	Uncommon/Difficult to Capture (n=2)	Males only	None observed	

Bat Species	Relative Abundance	Gender	Tree Roosts Characteristics	Other Roost Types
Yuma Myotis	Uncommon (n=2)	Females only	None observed	
Townsend's Big-eared Bat	Uncommon (n=4)	Males only	None observed	1 Mine, 1Cave, 1Harp trap and 1 Building

Methods

Three techniques were used for detecting/not detecting presence and identity of bats in the Fort Shepherd project area. All inventories were done to a presence/ absence level, suitable for this type of reconnaissance level of inventory (RIC 1998a), although several roosts were more rigorously inspected. The three techniques consisted of mist netting areas suspected to have high foraging potential, recording and analyzing the echolocation calls of flying bats, and searches for roosts in the rugged hillsides of the project area.

Mist nets were set at four stations. Each station contained a minimum of four nets in configurations that were likely to intercept flying bats along flyways and foraging circuits. Nets were set about one half hour before sunset. Habitats at netting stations varied from riverside (Peace pond), creek-side riparian (Lower Sheppard Creek), Closed and Open Forest, and Shrubland.

Netting took place in August 2002 to take advantage of capturing less experienced young that might be feeding in the area. Captured bats were identified to species, weighed, sexed, aged, forearms measured, reproductive condition noted, and then released within one hour of capture.

Echolocation calls were detected using Anabat II ® detectors, and recorded onto handheld cassette recorders. Recordings were made during netting sessions to both detect bats that were not captured, and to obtain reference calls from captured bats. Echolocation calls that were not associated with a bat capture were analysed using Anabat® software. Five different stations were sampled for a single night over a total of three nights.

Potential roost sites were identified by L. Bursaw of the Trail Wildlife Association, and had been inspected during July with M. Vonhof in 1996. These caves were inspected again during this project, including searches for other cavernous roost sites. All inspections of roosts were done with the least amount of disturbance. Most potential roosts were investigated more than once to determine whether there were any seasonal changes in bat occupation. Descriptions of each potential roost were recorded, and photographs taken where appropriate. A map of all bat observations, derived from, mist net captures, selected echolocation calls and potential roost inspections are depicted in Figure 5.

Results

Roost Searches

Bat roosts in the project area are mostly restricted to rock or foliage and bark opportunities. Mature and old growth stands are absent due to past logging and fires. The historic effect of SO_2 deposition has hampered forest re-establishment and growth (Hodson 1971). Rock features are extensive, consisting of moderate sized cliffs, rock outcroppings, and blocky colluvium.

A total of six cavernous rock features (4 colluvial caves, a mine adit, and a large fracture) were inspected for roosting bats (Table 10). Each site was given a name to reflect the local character of the site and to act as reference for future assessments.

Only the Townsend's Big-eared Bat was observed throughout these cave features, including roosting bats in two cave structures and guano in another. The structures that had roosting bats were both natural cavernous features created from very large fractured bedrock.

PHOTO 13. Townsend's Big-eared Bats (Corynorhinus townsendii).

"Miner's Cache", a large slab still lying against the cliff face, was initially assessed as having poor roosting habitat attributes due to the openness of the crevice however, a single bat was observed roosting there on one occasion. It was assumed to be an adult male. "Big-ear Cave" was the cave in which Vonhof and Bursaw originally saw a roosting adult male Townsend's Big-eared Bat in July 1996 (Vonhof and Gwilliam 2000). The first time the roost was inspected during this project, it harboured over twenty female bats (only one individual in the cluster was sexed). The "ear ball" or tightly packed cluster of bats was low on an overhanging wall and was only observed once in early May (Photo 13). There was no guano beneath the cluster. Solitary bats were seen on two occasions through the summer and none were observed during September.

TABLE 10. Observations of Townsend's Big-eared Bats in Inspected Caves at Fort Shepherd.

Roost Name	24/07 1996*	11/06 2002	08/07 2002	10/08 2002	20/09 2002**	25/09 2002**	02/10 2002**	08/10 2002**	11/10 2002**	16/10 2002**
Bear Cave	0	0	n/a	n/a	0	0	0	0	n/a	n/a
Big-ear Cave	1 male	22 females	1 unidentified	1 unidentified	0	0	0	0	0	0
Mine Adit	0	0	n/a	0	0	0	0	0	0	0
Miner's Cache	0	0	n/a	1 u	0	0	0	0	1 male	1u
New Cave	n/a	0	n/a	guano	n/a	n/a	n/a	n/a	n/a	n/a
Low Ceiling	n/a	n/a	n/a	n/a	0	0	0	0	0	1

* Vonhof and Bursaw
** CBFWCP

Mist Netting

Mist net stations were established for a single night at four locations. Each station consisted of at least four mist nets. A total of 11 bats were captured, not including one that flew away before being retrieved from the net (Table 11). Big Brown Bat (n=6), Silver-haired Bat (n=1) (Photo 14), Western Long-eared Myotis (n=1), and Yuma Myotis (n=1) were captured at single locations. Only the Townsend's Big-eared Bat was captured at two locations (n=2). These were captured only at the two inland sites. Both captures were males one an adult and the other a juvenile.

PHOTO 14. Silver-haired Bat (Lasionycteris noctivagans).

TABLE 11. Summary of mist netting results at Fort Shepherd.

Mist Net Station	Date	Captures
Mouth of Sheppard Ck	09/08/2002	6 Adult female *Eptesicus fuscus,* 1 Adult female *Lasionycteris noctivagans*
Inland along Sheppard Ck	09/08/2002	1 Juvenile male *Corynorhinus townsendii*
North Camp along Columbia	10/08/2002	1 Juvenile female *Myotis yumanensis*
Old Cabin Road (inland)	10/08/2002	1 Adult male *Corynorhinus townsendii,* 1 Adult female *Myotis evotis*

Capture success was considered reasonable (0.7 captures per net night), but less than the average annual captures at Pend d'Oreille (range of 0.9 to 3.5 captures per net night). The bulk of the captures were of Big Brown Bats in a small bay during a Caddisfly emergence. The species diversity of captured bats was considered to be very good considering the sampling intensity.

Echolocation Call Analysis

Echolocation calls were recorded at five stations over three nights. Early efforts to do transect sampling were largely thwarted by extensive cricket stridulations. Almost 60 separate files of echolocation calls were made later in the season. An analysis of all of these calls revealed a possibility of up to six bat species (Table 12). The most common bats detected were Big Brown and Silver-haired Bats. The very similar calls of Yuma and Little Brown Myotis were detected at three stations. A possible California Myotis or Western-small Footed Myotis were detected at one location.

TABLE 12. Bat species identified through echolocation call analysis at Fort Shepherd.

Station	Location	Date	Species Detected
0	Fort Shepherd – north camp	10/06/2002	*Myotis lucifugus/M. yumanensis, Lasiurus blossevillii (?)*
1	Mouth of Shepherd Creek	09/08/2002	*Eptesicus fuscus, Lasionycteris noctivagans*
2	Sheppard Creek road crossing	09/08/2002	*L. noctivagans, E. fuscus (?), M. californicus/ M. ciliolabrum *(?), L. blossevillii (?)*
3	Fort Shepherd – north camp	10/08/2002	*L. noctivagans, E. fuscus (?), Corynorhinus townsendii (?), M. lucifugus/M. yumanensis **(?), L. blossevillii (?)*
4	Intersection near old cabin	10/08/2002	*E. fuscus (?), L. noctivagans, C. townsendii (?), M. lucifugus/M. yumanensis **(?)*

***Myotis californicus/ Myotis ciliolabrum calls cannot be distinguished*
*** Myotis lucifugus/ Myotis yumanensis calls cannot be distinguished*
? not confirmed

Echolocation calls resembling a Western Red Bat (*Lasiurus blossevillii*) were detected at three locations. Although no typical calls of Townsend's Big-eared Bats were recorded, calls resembling those captured animals were recorded at two locations. Figure 6 shows typical or representative calls recorded for the other five species detected.

FIGURE 6. Representative sonograms recorded for five species of bats at Fort Shepherd: (a) Big Brown Bat; (b) Yuma/Little Brown Myotis; (c) California/Western Small-footed Myotis; (d) Silver-haired Bat; (e) Western Red Bat.

Discussion

The diversity of bats in the Fort Shepherd project area is likely to be high compared with much of the West Kootenay. Five species of bats were observed in roosts and/or captured in mist nets over two nights. Up to three additional species could occur within the area based on echolocation call analysis. Two of these, the Western Red Bat and the Western Small-footed Myotis, would be significant additions to the recorded bat fauna of the West Kootenay.

The possibilities of other species of bats inhabiting the Fort Shepherd project area is high based on habitat suitability and the proximity to the rich bat fauna of eastern Washington State. A list of all bats known to inhabit the southern interior of the province, and the likelihood of them inhabiting the project area (based on Nagorsen and Brigham 1993) was compiled (Table 13).

TABLE 13. Based upon the habitat suitability the following bat species are likely to occur in the Fort Shepherd project area.

Common Name	Scientific Name	Prov. Status	Federal Status	Potential Occurrence
Little Brown Myotis	*Myotis lucifugus*	Yellow	None	Not detected but very likely occurs, as in Pend d'Oreille; possible echolocation calls detected
Yuma Myotis	*Myotis yumanensis*	Yellow	None	One adult female captured; breeding roosts likely within Fort Shepherd
Long-legged Myotis	*Myotis volans*	Yellow	None	Unknown; not detected
California Myotis	*Myotis californicus*	Yellow	None	Probable; one site with possible echolocation calls
Western Small-footed Myotis	*Myotis ciliolabrum*	Blue	None	Probable; one site with possible echolocation calls but never detected in the Kootenay previously
Western Long-eared Myotis	*Myotis evotis*	Yellow	None	Breeding evident; one adult female captured
Northern Long-eared Myotis	*Myotis septentrianalis*	Blue	None	Unlikely; require wet ICH
Fringed Myotis	*Myotis thysanodes*	Blue	Spec. Concern	Possible; roost in rock crevices and ponderosa pine snags
Hoary Bat	*Lasiurus cinereus*	Yellow	None	Likely; known from Pend d'Oreille
Western Red Bat	*Lasiurus blossevillii*	Red	None	Possible; echolocation calls possibly at three sites
Silver-haired Bat	*Lasionycteris noctivagans*	Yellow	None	Common; captured at one location and calls at several others
Big Brown Bat	*Eptesicus fuscus*	Yellow	None	Common; captured at one location and calls at several others
Spotted Bat	*Euderma maculatum*	Blue	Spec. Concern	Unlikely; no detections
Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Blue	None	Significant; the only females observed in W Kootenay
Pallid Bat	*Antrozous pallidus*	Red	Threatened	Possible but unlikely; very limits of habitat suitability

Townsend's Big-eared Bat (Blue): Only males had been previously documented in the Pend d'Oreille. Inventories in the Fort Shepherd project area revealed foraging habitats in at least two locations and roosting in at least two locations. At least one of the roosts also temporarily harbours adult female Townsend's Big-eared Bats in the spring. Maternity roosts remain, as yet, unknown. Potential hibernacula have not been investigated but may include some of the potential cave roosts investigated during this project.

Western Long-eared Myotis (Yellow): Although not considered rare, this bat appears to occur in low numbers throughout its range. Nine roosts were found in trees in the Pend d'Oreille over five years. This bat appears to breed in the project area (adult female captured), despite the very low density of wildlife trees, suggesting that rock crevices may be used for roosting.

Big Brown Bat (Yellow): This large bat is common throughout much of North America. It has broad roosting requirements and uses a broad variety of foraging habitats. Adult females were captured at one location, and echolocation calls suggest they were foraging at most of the sample stations in the project area. The adult females appeared to still be pregnant in August. It is possible that their reproductive condition was misinterpreted as an enormous emergence of Caddisflies could have provided fodder for their diet prior to capture. Not all were lactating but all had enlarged mammaries; suckle patches were only evident on one bat. Parturition may have been delayed due to poor weather conditions during 2002.

Silver-haired Bats (Yellow): Silver-haired Bats were captured at one location and detected at an additional two sites. They are considered to be fairly common, especially near watercourses. They typically roost in trees, either on the bark or in the foliage, and are dependent on wildlife tree attributes for roosting.

Yuma Myotis (Yellow): The Yuma Myotis is often less commonly encountered than its sibling species, the Little Brown Myotis (Vonhof and Gwilliam 2000). One juvenile female Yuma Myotis was captured. Echolocation call analysis suggests that Brown Myotis are uncommon or locally restricted.

Western Red Bats (Red): Echolocation calls resembling those of Western Red Bats were detected at three locations. These bats roost amongst the foliage of deciduous shrubs and trees, usually 2 to 3 metres off the ground. All three sites have suitable roosting shrubs and trees. Further inventories are required to confirm their presence by locating roosting individuals or mist netting these high-flying bats.

There is a distinct possibility that other species of bats (e.g. Fringed Myotis, Western Small-footed Myotis) occur in the project area as bedrock crevices and flakes are often used by other species of bats. These were not inspected, nor were emergence observations made due to the difficulties and hazards associated with accessing these remote bedrock areas, particularly in the dark. Further inventory efforts are required to sample these bat species.

5.0 REPTILES

Introduction

Reptile diversity and distribution has been sporadically documented from the West Kootenay. Some studies have looked at specific populations but overall distributions are unknown and it is possible that cryptic and secretive reptiles remain undetected. It was not until recently that blue-listed Racers (*Coluber constrictor*) were known to inhabit the south Columbia area. Prior to this survey, they were documented in the Pend d'Oreille (T. Antifeau, pers. comm.), at Beaver Creek (Dulisse 1999a; Sarell and Alcock 2001), and a single record from near the Fort Shepherd project area (McDonough and Hamilton 1999).

PHOTO 15. Western Skink (Eumeces skiltonianus).

All but the latter sightings were in the very dry and warm Interior Cedar Hemlock biogeoclimatic sub-zone, as is the Fort Shepherd project area. Other reptile surveys in the West Kootenay have been conducted on Rubber Boas (*Charina bottae*) (St. Clair 1999; Sarell and Alcock 2001), Northern Alligator Lizards (*Elgaria coerulea*) (Rutherford and Gregory 2001), Western Skinks (*Eumeces skiltonianus*) (Photo 15) (Rutherford and Gregory 2001; Sarell and Alcock 2001), and Painted Turtles (*Chrysemys pieta*) (Gillies 1998; Herbison 1998; Maltby 2000). All of these studies focused on specific populations excluding broad surveys and this project area.

All the terrestrial reptile studies found that there was a strong correlation to rocky habitats with warm aspects. These characteristics provide the thermal regimes necessary for ectotherms in temperate climates. The Fort Shepherd project area is the hottest and driest of the Interior Cedar Hemlock biogeoclimatic zones and contains extensive rock features including; exposed bedrock, colluvium, and fluvial rock deposits. Some of these rock features could serve as hibernacula if the fissures permit reptiles (not including turtles) to gain access to refugia below the frostline.

The open river terraces of the project area are comprised of fine textured soils. The terraces provide excellent rodent habitat essential for reptile foraging and fossorial existence. The edge of rivers and creeks also provide great foraging areas. There were no documentations of reptiles in the project area prior to this project. The following table provides a list of potentially occurring reptiles in the Fort Shepherd project area.

TABLE 14. Reptiles that could potentially occur in the Fort Shepherd project area.

Reptile Species	Status (Prov/Fed)	Distribution Comments
Painted Turtle	Blue	Unlikely: Known in the south West Kootenay requires ponds of which there is only one in the project area
Northern Alligator Lizard	Yellow	Likely: Known from Beaver Creek and other locals throughout the south West Kootenay
Western Skink	Yellow/ Special Concern	Likely: Known from Beaver Creek and other locals throughout the south West Kootenay
Rubber Boa	Yellow (formerly Blue)	Likely: Known from Beaver Creek and other locals throughout the south West Kootenay
Common Garter Snake	Yellow	Likely: Occurs throughout West Kootenay
Terrestrial Garter Snake	Yellow	Likely: Occurs throughout West Kootenay
Great Basin Gopher Snake	Blue	Likely: Distribution in Washington state to edge of Fort Shepherd project boundary (Brown *et al*. 1995)
Racer	Blue	Likely: Known from about 2km west of project area and across the Columbia River at Pend d'Oreille and Beaver Creek

Reptile Species	Status (Prov/Fed)	Distribution Comments
Desert Night Snake	Red/ Endangered	Possible but unlikely: Occurs about 170km downstream at Keller's Ferry in Washington. (Sarell & McGuinness 1993).
Western Rattlesnake	Blue/ In prep	Possible: Distribution in Washington extending northerly and easterly to edge of project area (Brown *et al*. 1995); distribution east to Christina Lake and possibly to Waneta (Klauber 1972); RBCM sight record at Castlegar (Orchard *cited by* Erickson and Torrance 1989); anecdotal record in Pend d'Oreille (Sarell and Alcock 2001).

Methods

Surveys for reptiles employed searching under cover objects (e.g. rocks, coarse woody debris) and searching for active or basking individuals. The only pond surveyed for turtles was the Peace pond but there were no turtles found. The intensity of searches varied, depending on the habitat type. Rocky terrain was searched methodically through multiple transects. Open habitats were searched by random transects and by road cruising where appropriate. Representative habitats were selected for inventory based on optimizing geographic extent, habitat variability (and stratification), habitat uniqueness, and access constraints. Searches were usually conducted during the morning when reptiles were likely to be basking. The level of inventory was compatible with the RIC standards for presence/not detected level information of snake inventories (RIC 1998a).

Surveys were conducted during or after reptiles had emerged from hibernacula and were dispersing.

Reptiles encountered were captured whenever possible, and identified. The age, gender, reproductive condition, and activity were recorded where evident. The location of each observation was geo-referenced (UTM NAD 83) and the habitat and weather described. Records have been compiled as per Species Inventory Fundamental (RIC 1998g).

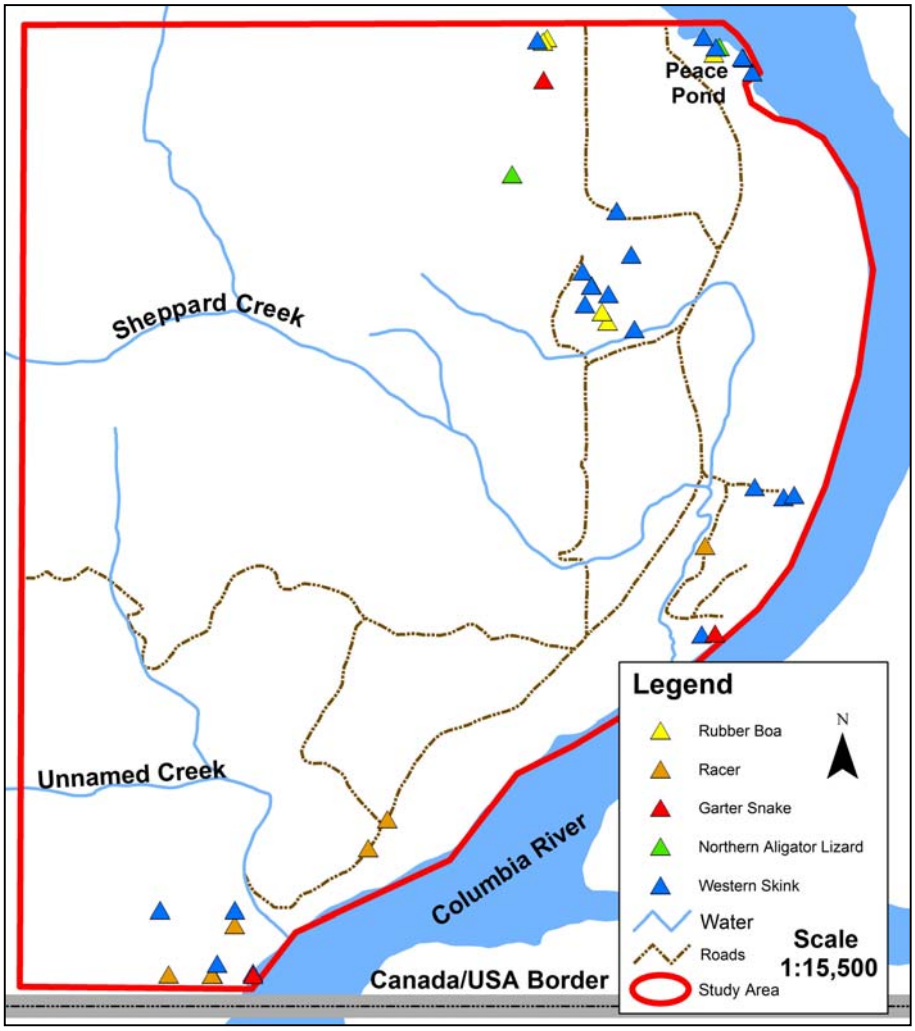

FIGURE 7. Reptile observation sites within the project area.

Results

Ground searches for reptiles, including extensive debris searches, were conducted throughout much of the project area. Thirty-three reptiles were observed, representing six species (Table 15, Figure 7). Racers were the most common snakes observed and Western Skinks were the most common lizards observed.

TABLE 15. Reptile observations at Fort Shepherd.

Reptile Species	Prov.Status	No. Obs.
Rubber Boa	Yellow	5
Racer	Blue	8
Common Garter Snake	Yellow	1?
Terrestrial Garter Snake	Yellow	1?
Alligator Lizard	Yellow	2
Western Skink	Yellow/SC	25

Most of these observations were of lizards (n=27) were of Western Skinks (Yellow-listed but Federally Special Concern). In contrast, only two Alligator Lizards were observed. Skinks were found on rocky hillsides and along the river. The two Alligator Lizards were both found on rock outcroppings but one was on a side-hill and the other was along the river.

Snakes were observed on 16 occasions. The most abundant observations were of the Blue-listed Racer (n=8). Racers were only observed in the southern half of the project area. Five Rubber Boas were found at four locations in the north and south ends of the project area (Photo 16). Only one observation was near the Columbia River. Two species of garter snakes were observed.

PHOTO 16. L. Bursaw with his first Rubber Boa, demonstrating their cryptic behaviour, despite Laurie's decades of hiking the area.

Discussion

Racers

The most significant reptile observations (8) were that of the Racer which were restricted to the southern portion of the project area. All observations were of adults. Individuals observed on the flats appeared to be using Down Woody Debris and Ceanothus for cover. These shrubs provide a maze of basal stems and lots of over-story cover, providing excellent protection from predators. The ability of the Racer to climb into these bushes was observed and suggests that the Racer may sometime prey on eggs or young of bird species using these shrubs.

Foraging behaviour was not observed but it is assumed that lizards and insects probably make up most of the Racers' diet. Lizards are most abundant on the upper rocky slopes and along the river. Insects, such as large crickets, are probably hunted throughout much of the project area but are likely most abundant on the flats.

There seems to be many opportunities for laying eggs, especially along the terrace banks near the Columbia River, where glaciofluvial deposits provide excellent egg laying sites. It is not known why there were no juveniles observed.

A previous observation of a Racer (McDonough and Hamilton 1999), west of the project area near Morris Creek (late September), suggests that hibernaculum occurs there. The snakes observed during our surveys may have migrated into

the project area from there but more likely came from a den located in the southwest portion of the Fort Shepherd project area, as there appears to be ample hibernacula opportunities.

Rubber Boas

Rubber Boas appear to be broadly distributed throughout the project area. It is very likely that at least three hibernacula occur. All observations of Rubber Boas were associated with rock cover features, consistent with observations in the Creston Valley (St. Clair 1999). Most observations were of juveniles, suggesting that reproduction occurs within the project area.

Western Skinks

Western Skinks are widely distributed in the project area but appear most abundant along the Columbia River bank. Rock outcroppings and fluvial cobbles provide the bulk of Skink habitat. Reproduction was evident by the presence of hatchlings near the south end of the project area along the river.

Alligator Lizards

Alligator Lizards were only observed twice. Both were on rock outcroppings, consistent with observations in the Creston Valley (Rutherford and Gregory 2001). One appeared to be gravid during early July.

6.0 AMPHIBIANS

Introduction

The Fort Shepherd project area is the driest ecosystem variant within the West Kootenay, which will limit the presence of amphibians. We targeted salamanders, toads and frogs (Photo 17). The creeks and ponds within the project area (Figure 8) were the focus of the amphibian surveys.

PHOTO 17. Columbia Spotted Frog (Rana luteiventris).

Methodology

Three amphibian survey techniques were used to determine the presence/not-detected within the project area: Auditory Survey (listening and calling), Road Survey and Visual Encounter Survey (RIC 1998d). Search sites were restricted to three areas, Sheppard Creek (from its mouth to the waterfall) (Photo 18), a small, unnamed creek in the southeast corner of the project area (Figure 8) and the Peace pond (Photo 19) located in the northwest corner of the project area. Additionally a nocturnal survey along roads was conducted during a spring rainfall.

Auditory and road surveys were conducted on May 21st, 2002 (two observers), May 28th and June 1st, 2002 (one observer). In addition a visual encounter survey was conducted on June 17th, 2002 (four observers)

Based on an assessment of habitat types and previous work in the Arrow Forest District (Dulisse 1999a; Dulisse 1999b; Schaeffer 2001) and in the Nelson Forest Region (Ohanjanian 1999), Table 16 shows the amphibian species expected to be present at Fort Shepherd.

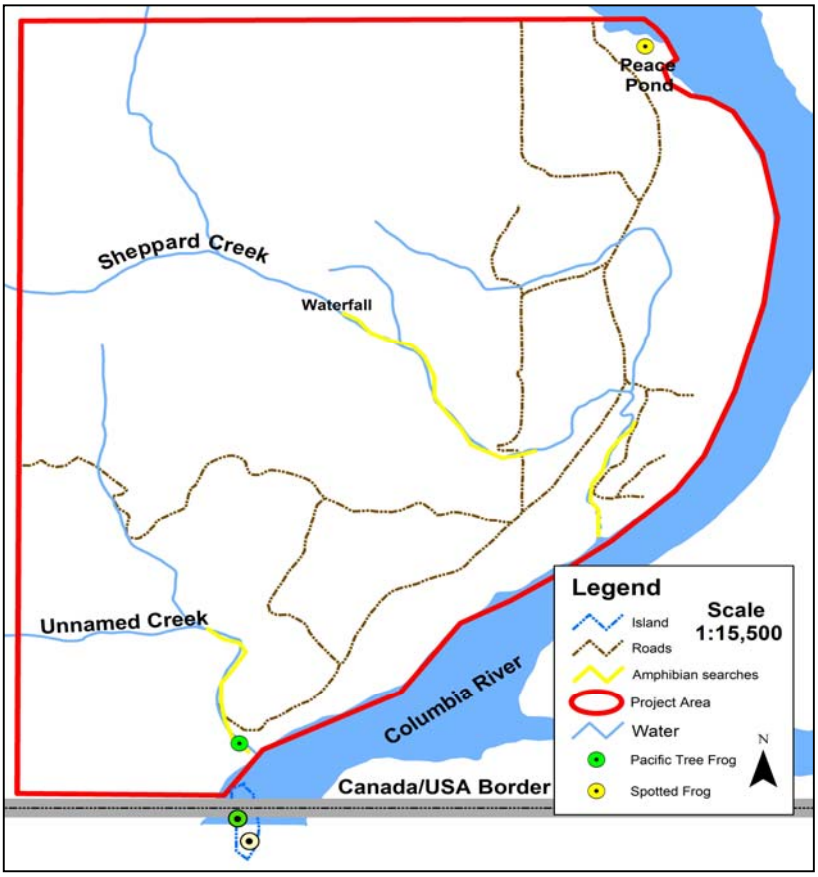

FIGURE 8. Map identifying sites surveyed for amphibians at Fort Shepherd.

TABLE 16. A list of the potential amphibian species for the Fort Shepherd area. Species include those previously confirmed at the site or in the immediate area (High), those strongly suspected to occur in the area (Moderate) and species that have not been recorded in the region but could occur based on their known habitat preferences (Low).

Common name	Latin name	Status	Probability of Occurrence
Pacific Treefrog	*Hyla regilla*	Yellow	High
Coeur d'Alene Salamander	*Plethodon idahoensis*	Red	Moderate
Tailed Frog	*Ascaphus truei*	Red	Low
Great Basin Spadefoot	*Spea intermontana*	Blue	Low
Northern Leopard Frog	*Rana pipiens*	Red	Low
Long-toed salamander	*Ambystoma macrodactylum*	Yellow	High
Columbia Spotted Frog	*Rana luteiventris*	Yellow	High
Western Toad	*Bufo boreas*	Yellow	High

Results and Discussion

Road and auditory surveys (May 21) revealed a Pacific Treefrog within the unnamed creek, near the mouth of the Columbia River. While a chorus of frogs could be heard at the unnamed creek, it was discovered that the calling was from a small inaccessible island in the middle of the Columbia River (Figure 8). Night lighting along road transects during May 21 during a rainfall revealed no frogs or salamanders.

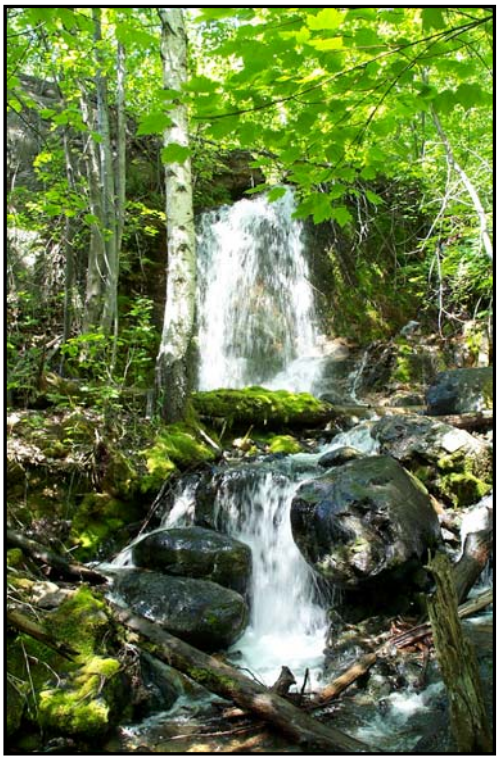

PHOTO 18. Sheppard Creek waterfall.

Road, auditory and visual encounter surveys on the evening of May 28th and during the day of June 1st at the Peace Pond revealed two adult Columbia Spotted Frogs (Photo 17) resting in the pond vegetation. The frogs were captured with a net, photographed and identified. The pond was returned to throughout the project and searches conducted for additional species, egg masses, and larvae, but none were found. In the fall the water level had dropped 60cm leaving a much reduced "deep pond" (Cowardin 1979; Corkran and Thoms 1996). Mud depths at this time revealed 30cm of soft substrate. The pond (Photo 19) is slightly acidic having a pH of 5.0. These characteristics identify the site as being a moderately good habitat for a variety of frogs but having a reduced potential as a breeding site for ambystomatid salamanders (Kutka and Bachmann 1990; Warner and Dunson 1998).

Visual encounter surveys and uncovering techniques were used during the day of June 17th along Sheppard Creek. Daytime was chosen as observers were in the creek and this would have been unsafe to do during the night. No amphibian species were found, although flow was sufficient and terrain and habitat were ideal for Coeur d'Alene Salamander. The splash zone surrounding the creek and waterfall were filled with wet, damp fissures, which is ideal habitat (Ohanjanian 1999) (Photo 18). A small ancillary pond adjacent to the creek was also found and investigated during the creek traverse.

The ancillary pond had no signs of amphibians however; this would be a suitable breeding pond for amphibians. We also searched the lowest portion of the creek where it flows into the Columbia River but found no amphibians.

Searches for other species brought us close to the creek in late August and September when the creek flow was significantly less, and the lower section of the creek had no flow. This suggested an unstable environment for amphibian species in the lower reaches of Sheppard Creek. The outflow of the creek however, received water from the Columbia River as part of a back channel.

PHOTO 19. Peace Pond.

7.0 NOXIOUS WEEDS

Introduction

Noxious weeds are typically non-native plants that grow aggressively and have no insect predators or plant pathogens to help balance and control their populations. They can be highly destructive, competitive and difficult to control, especially in disturbed areas where they spread rapidly.

The Fort Shepherd area has had an increase in site traffic and activity, which has increased noxious weed populations throughout points of access. The site currently contains approximately 12 km of roadway, with much of this (3-5km) being unnecessary access.

PHOTO 20. Spotted knapweed (Centaurea maculosa).

Biological agents have been released at Fort Shepherd within the ICHxw and dw (one release adjacent to the project area) and include *Agapeta zoegana*, *Larinus minutes* and *Cyphodeonus achates* (J. Craig, pers. comm.). The success of these agents was not addressed in this project but the biological controls were released in areas where Spotted knapweed currently occurs at high densities (Photo 20).

Methods

As the RIC currently has no standards for noxious weeds, we developed a technique to maximize our limited time on the site. Our work focused on a provincial priority rating (V. Miller, pers. comm.) and a mapping exercise conducted for the Habitat Conservation Trust Fund, which mapped the extent of Spotted knapweed (C*entaurea maculosa*) throughout the Fort Shepherd area (Gwilliam 1986). Our original proposal had suggested the noxious weed survey be conducted along small mammal and bird transects but was altered due to extremely low weed concentrations in these areas.

The survey was divided into 3 sections of data collection: 1) current concentrations in comparison to 1986 work (Spotted knapweed), 2) rating for spread potential (Spotted knapweed) and 3) casual observations throughout the project (all weed species encountered). These methods of data collection are discussed separately below.

Current Spotted Knapweed Concentrations

It became obvious that the Spotted knapweed concentrations occurred along the roadways, power lines and disturbed areas. We investigated the roadways and sites identified by the HCTF 1986 survey, with the exception of one polygon near the Columbia River. The Spotted knapweed concentrations were recorded along the roads and rated as high, medium or low (Table 17). The sites identified in 1986 were revisited and the size approximated.

TABLE 17. Noxious weed concentration categories.

Category	Verbal Description	Numeric Description
LOW	A few sporadically occurring individuals	< 10% cover
MEDIUM	Several well-shaped patches or slumps of a species	10-30% cover
HIGH	A continuous dense occurrence of a species	> 30% cover

Weed concentrations categorized as high, medium or low weed along the main dirt road (west bound) (Photo 21, 22 and 23).

PHOTOS 21, 22 and 23. High, medium and low categories for Spotted knapweed concentration respectively, within the project area.

Spread Potential

The provincial priority ratings (V. Miller, pers. comm.) were modified and used to estimate the risk or potential to spread to currently un-infested areas. The priority ratings were based on the presence of knapweed (infestation in proximity) and the vigour of the surrounding vegetation (competition from knapweed) (Table 18).

TABLE 18. Priority Ratings for the potential spread of Spotted knapweed.

Priority Rating	Surrounding Vegetation	Knapweed Present
P1 Extremely High Risk	Predominantly bare sand or highly disturbed areas	Yes
P2 High Risk	Predominantly Grassland	Yes
P3 Moderate Risk	Predominantly Shrubland	Yes
P4 Low Risk	Predominantly Shrubland and trees	Yes

Casual Observations

Professionals and volunteers throughout the entire course of the inventory collected casual observations. The focus of this method was presence or absence of species; neither concentrations nor priority ratings were identified.

Results

Current Concentrations

Spotted knapweed, in varying concentrations was found bordering roadways within the Fort Shepherd project area. As mentioned above, 3-5 km of the road (total 12 km) is unnecessary and could be rehabilitated or restored. In most situations the weed is restricted to five meters on either side of the roadway because thick vegetation or terrain have prohibited the spread. In other, less common cases the weed has spread into open areas where sand or grass is the dominant cover.

Spotted knapweed patches with HIGH concentrations have generally developed at road intersections where drivers have cut corners, disturbing the vegetation and soil in-between. The main access road (west bound) has high concentrations of knapweed, which may be present in such large concentrations due to vehicular traffic to the Violin Lake area via the 500kv access road. The power lines also present a corridor for the spread of knapweed, as a large patch is present near the junction of the two power lines, measuring approximately 100 by 200 meters.

Figure 9 shows the high, medium and low Spotted knapweed concentrations throughout the project area in comparison to the 1986 distribution, which is delineated in black. In a comparison between the surveys (1986 and 2002 inventory), it appears that most knapweed patches have remained similar in size however, the exact size and shape of these patches may be distorted due to original data input onto the map and again when transferred into Arcview 8.2. The spread of Spotted knapweed is more obvious along road corridors, where the 1986 survey showed no infestations.

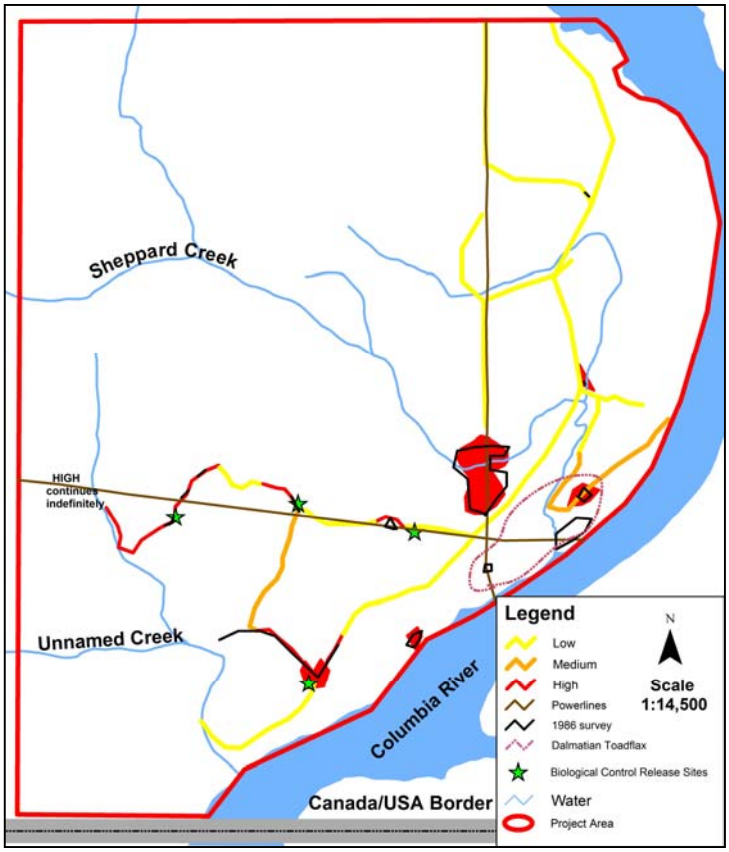

FIGURE 9. Map identifying 1986 HCTF data and spread of noxious weeds at Fort Shepherd.

Spread Potential

The priority ratings shown in Figure 10 identify the areas where Spotted knapweed has an extremely high possibility of spreading and should therefore be considered the highest priority when rehabilitating these areas. Areas labelled P1 (extreme priority) have knapweed infestations near to sandy openings or scarcely vegetated areas. Areas labelled P2 (high priority) contain knapweed infestations near to areas dominated by grass. The P3 (moderate priority) and P4 (low priority) areas contain knapweed infestations near to shrubby vegetation and Shrubland/forest vegetation respectively.

Areas labelled P1 are generally found at road intersections, where native vegetation cannot establish. This evidence suggests that deactivation of unnecessary roads; in combination with noxious weed elimination (chemical, manual etc.) and traffic control may help to reduce the spread of Spotted knapweed throughout the Fort Shepherd area.

Casual Observations

A total of five noxious weed species were found on site, which correspond to weeds classified as noxious in British Columbia and in the Central Kootenay Region (Cranston et al. 1996) (Table 19 and 20).

Spotted knapweed, as compared to other species found, is present on the site in the largest concentrations and occurs along roadways or access points. Dalmatian toadflax (*Linaria dalmatica*) is located along the lowest bench of Shepherd Flats, near the Columbia River.

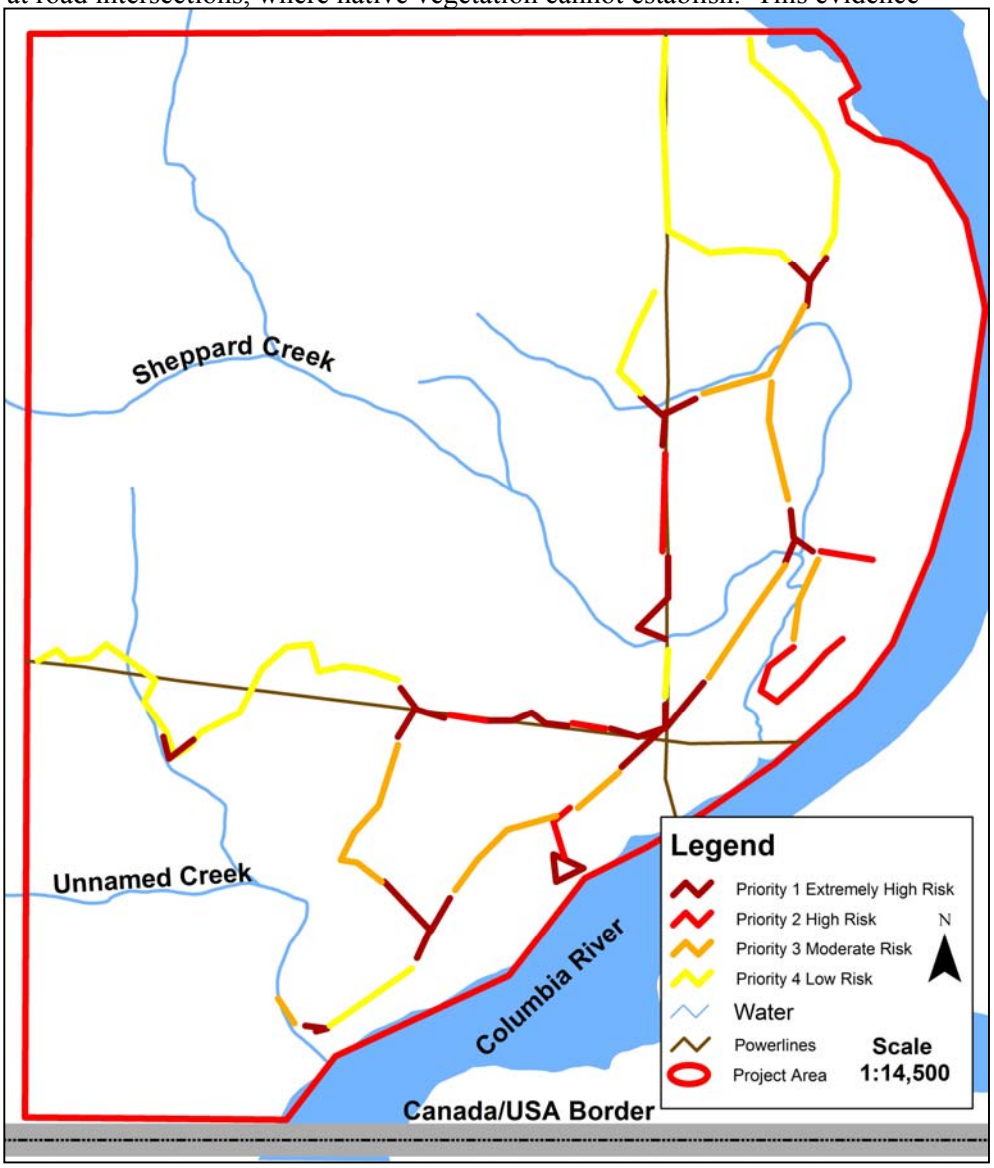

FIGURE 10. Map identifying priority ratings for knapweed infested sites.

TABLE 19. Weed species identified throughout inventory and their provincial rating.

Latin Name	Common Name	Category
Centaurea maculosa	Spotted knapweed	1: Extremely Invasive
Linaria dalmatica	Dalmation Toadflax	1: Extremely Invasive
Centaurea diffusa	Diffuse Knapweed	2: Very Invasive
Linaria vulgaris	Common Toadflax	3: Invasive
Hypericum perforatum	St. Johns Wort	4: Aggressive or under biocontrol

TABLE 20. Noxious weed classifications within British Columbia and the Central Kootenay Region.

	Category 1 Extremely Invasive	Category 2 Very Invasive	Category 3 Invasive	Category 4 Aggressive or under biocontrol
Noxious within British Columbia	Rush Skeletonweed Sulphur Cinquefoil Leafy spurge Marsh thistle Spotted knapweed Dalmatian toadflax Perennial pepperweed Gorse Scotch Broom Purple loosestrife Yellow star thistle Puncturevine Common crupina	Diffuse knapweed Hound's-tongue Field scabious Tansy ragwort King devil hawkweed Mouse-ear hawkweed Yellow king devil Flagellate hawkweed Canada thistle	Burdock Russian knapweed Common toadflax Bull thistle Scotch thistle Oxeye daisy Hoary cress Hoary alyssum Scentless chamomile	Nodding thistle St. John's wort
Noxious within Central Kootenay Region		Common tansy Orange Hawkweed Plumeless thistle Blueweed		

Other weed species (Royer and Dickinson 1999) not labelled provincially or regionally as being noxious but found within the project area include:

1) Sourweed (*Rumex acetosella)* occurs in great concentrations throughout the project site, flourishing within disturbed areas
2) Cheatgrass (*Bromus tectorum*)
3) Hairy Vetch (*Vicia villosa*) found along the rocky hillside in the Rocky habitat
4) Panic Grass (*Panicum spp*.) found along the rocky hillside in the Rocky habitat
5) Great mullein (*Verbascum thapsus)* found along the roadways (particularly the main west bound road)
6) Crested Wheat Grass (*Agropyron cristatum*) found along gas line (not in project area)
7) Timothy (*Phleum pratense*) found along the rocky hillside in the Rocky habitat
8) Black Locust (*Robinia pseudoacacia*) throughout Fort Shepherd area (Cairn)

Discussion

Noxious weeds have recently been described as a "biological wildfire" (Dewey 1995), as they have a permanent impact upon native plant and animal communities. We noted thirteen established and spreading weed species, five of which are considered noxious under the Noxious Weed Act (B.C. Weed Control Act 1996 Chapter 487). Weed species, especially noxious weeds, are highly competitive, invading disturbed areas and then displacing native plant species. They can significantly alter ecological processes, increase soil erosion, damage watersheds, eliminate rare plants and reduce wildlife forage and habitat (Sheley et al. 2001). The continuous anthropogenic disturbances at Fort Shepherd and an ad hoc weed management strategy is creating a "wildfire" that could potentially undermine the recovery of this fragile ecosystem.

8.0 LAND USE

Introduction

The Fort Shepherd area has a long history of use and anthropogenic disturbance (Hodson 1971; Archibold 1974). The Sinixt (Interior Salish people) used the Columbia River Valley and the Fort Shepherd area for hunting (Pryce 1999). The Hudson Bay Company also used the site in the mid 1800s as a fur trading post. Beginning in the 1900's the area was heavily impacted by smelter emissions (Cantox 2001), SO_2, forest fires and logging (Hodson 1971; Parminter 1997 *cited by* Cantox 2001). More recently, impacts have been focused on the installation of hydroelectric transmission lines for B.C. Hydro (Norelco 1991) and Teck Cominco as well as mining (Cantox 2001) within the area (Figure 11).

Approximately 35 years ago, activities to restore the area were started by the owners of the land and members of the Trail Wildlife Association. Ad hoc efforts to re-establish vegetation of shrubs, coniferous trees, orchards and fertilization were carried out along with an ungulate winter feeding program (R. Fillmore pers. comm.). Efforts were also directed at increasing ungulate population levels through habitat restoration (Gwilliam 1986).

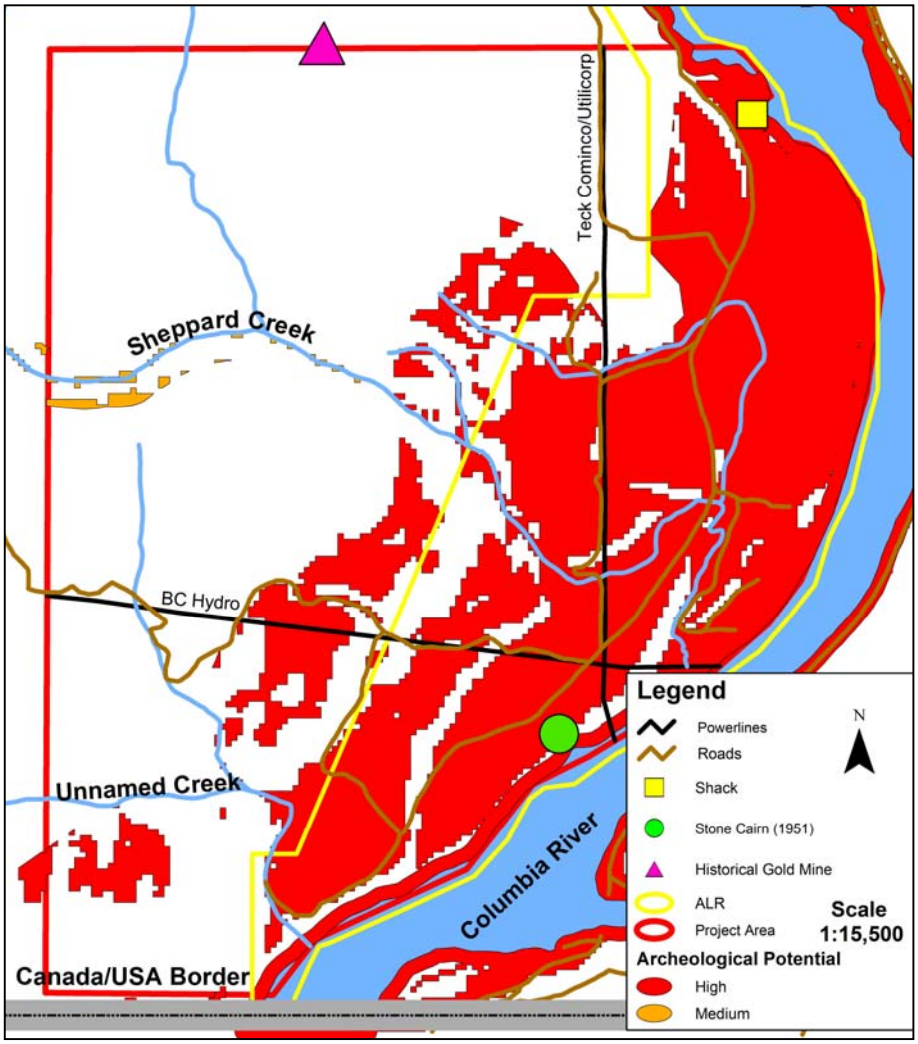

FIGURE 11. Map identifying land use within the project area.

The area has now become a popular place for recreationalists, with such activities as hunting, camping, riding horses, motor biking, off-road driving, cycling, orienteering and fishing. With these activities a number of impacts have become apparent including unattended fires, dumping of garbage, damage to vegetation and soil disturbance. The project area and most of the surrounding area is private land and ownership is in the hands of one company. They have recently initiated a program to make users aware of the importance and fragility of the Fort Shepherd area and periodically patrol the site trying to curb the use of campfires and camping. It is not the intention of the company (land owner Teck Cominco) to stop access to the Fort Shepherd lands but rather educate the users of this area on its value (W. Taylor pers. comm.).

Methods

We identified users on the property by organization and identified the types of activities that are taking place. We further photographed some of the impacts of soil disturbance, garbage dumping and unauthorized construction (Photos 24, 25 and 26).



PHOTOS 24, 25 and 26. Unauthorized building construction, garbage dumping and excess roadways at Fort Shepherd.

Results

We have adapted Table 21 from a report commissioned by the landowners in which groups or organizations using the Fort Shepherd area are identified (Schaeffer and Datchkoff 2002). The proliferation of unnecessary roads (increasing by 25% over that which is required for utility corridor maintenance) is adding to the area of disturbed soils and creating potential sites for noxious weed establishment. Figure 11 also shows the areas of archaeological significance, the power lines (including ownership), the historical cairn built in 1951, the unauthorized building, areas zoned agricultural and one gold mining site.

TABLE 21. Industrial and recreational activities at Fort Shepherd.

Group or Organization	Industrial and recreational activities at Fort Shepherd
Rossland Orienteering Group	Navigation exercises
B.C. Hydro	Power transmission corridor and pole access
Teck Cominco/Aquila	Power transmission corridor and pole access
CBFWCP	Research (Biodiversity Project in Lower Fort Shepherd)
Teck Cominco	Research/ Monitoring (Eco Risk Assessment)
Dirtbikers/ATV riders	Riding
Picnicking, hiking etc	Local people enjoying the scenery
Trail Wildlife Assoc	1970's: Fertilizing of the flats (donated by Cominco and the TWA) 1970's: Apple trees planted (grown in Cominco's nursery) 1975-2000: Site clean-up 1980's: Burning to increase browse (3-4 events)

Group or Organization	Activity at Fort Shepherd
Trail Wildlife Association	1980-1990's: Coniferous pruning to protect trees from wildfires (2-3 events) 1985: Collected and planted Ceanothus (1000 plants) 1990's: Planted ponderosa pine and Douglas-fir near cairn (2000-3000) 1994: White-tailed bucks harvested from area because of seasonal aberration 50 1996: White-tailed bucks harvested from area because of seasonal aberration 25 Early 1990`s: American cattle range into Canada and onto property. 2000: The West Kootenay Archers planted Ceanothus 2000: Proposal written by The Trail Wildlife Association, supported by the Elk Foundation and the Land Conservancy to purchase property. Cominco estimated property value at 1.5 million. Miscellaneous placement of salt licks for management of deer 1990`s: Deer feeding during heavy snowfall years
Historical Society	Historical work related to the cairn
West Kootenay Fly Fishermen	Accessing pools along the Columbia River from Fort Shepherd
Selkirk College	Vegetation studies
Trail Horseman Society	Horse back riding 2-3 times per year
Militia (Trail 44th Engineers)	Manoeuvres
Mining	Claims have been staked within the properties and some trenching work has been carried out.

Discussion

In Fort Shepherd public access is negatively affecting the project area. Access has created an increase in soil disturbance that, in turn, is aiding in the spread of noxious weeds. Teck Cominco has initiated a campaign to monitor activities in the area. We suggest that this campaign be expanded to minimize destructive activities such as off-road "4 wheeling" and "dirt biking."

9.0 RECOMMENDATIONS

Overall Recommendations

Fort Shepherd is a unique place that presents an important opportunity for the people of the West Kootenay. This site is the single largest contiguous tract of undeveloped ICHxw land. Not only is it ecologically unique; it is both archeologically and historically significant. The historical detrimental effects of SO_2, fires and mining are now being counteracted by the re-establishment of vegetation. This inventory confirmed that the project area has a number of listed animal species with a strong possibility that many use the area for breeding

Presently there is no development planned for the site (Urban Systems 2001) however, in the past the area has been proposed as: a transportation corridor for rail and road (Railex Republic Partners 2002; Urban Systems 2001), a potential change to the transmission corridor (Urban Systems 2001), and as a conservation area (Schaeffer and Datchkoff 2002). The site has not been archaeologically assessed. The existence of the old Fort is now identified by a cairn, which can be accessed by vehicles. There is a present and growing concern that the ecosystem, has not fully recovered from historical impacts and is in a fragile state. The present use of the area by recreationalists is impairing the recovery of this ecosystem.

After completing this project we believe that this unique area is an important ecosystem that requires conservation. We strongly recommend to the CBFWCP and TWA that they pursue a number of different approaches to try and insure that the area is properly conserved.

The first approach would be to deal directly with the owners of the land to ascertain their management goals for the site. This may lead to a sharing of management activities, purchasing of the land, or acting as an intermediary for a third party interested in conserving the area (possibly provincial park status). The second approach is to team up with local user groups and act as an intermediary between them and the owners. This would be an educational effort in which the users would be educated as to the ecological and cultural value of the site. The third approach would to be request permission to continue inventories in the area. The main focus of this would be to collect species data, determine the health of the ecosystem, and solidify the importance of the area as compared to other threatened ecosystems in the West Kootenay.

In order to achieve these approaches we recommend that:

1) The information from this project is shared with the landowners. The intent is to develop a management strategy/plan to reduce impacts and enhance the recovery of this unique ecosystem. This may include identifying biological indicators of recovery and setting goals.
2) The landowners are approached with concerns about impacts and potential solutions. These may include:
    - Limiting access to this sensitive site by constructing a gate at the narrowest portion of the area.
    - Approaching B.C. Hydro, a major transmission corridor user, and get their assistance in dealing with extraneous roads, noxious weeds, creek crossings, and access issues.
    - Complete an archaeological assessment.
    - Identify permanent sampling points to measure recovery. Potentially photo monitoring plots.

- Conduct more detailed inventories to fully understand the diversity on site. This was a relatively quick estimation of the non-game species on site.
- Conduct a vegetation survey that includes a rare and endangered plant survey. A number of rare plant species have been identified in adjacent areas and there is a high potential for these to be on site.
- Conduct further surveys on bats shrews and other small mammals. Make permanent trap sites.
- Conduct a snag inventory, which includes species utilization of the snags.
- Conduct an insect inventory to assess the diversity of insects in this unique area.

Species specific recommendations

Birds

We propose that the area be managed for wildlife diversity and that adjacent property development consider the impacts of their development upon this large relatively intact low elevation ecosystem. Conduct a nest density inventory, especially for the, Grey Catbird, Lazuli Bunting, Black-headed Grosbeak, Veery Yellow Warbler and Chipping Sparrow.

Small mammals

Further inquiry into the species that are using the site should be carried out. We suggest that an assemblage of snap traps be used to gather information over a longer period of time. Findings would then focus further species-specific inventories. We also suggest that the area be used as part of other ICHxw studies to extend and compare findings.

Bats

Further inventory is required for the Townsend's Big-eared Bat to determine the importance and use of roosts in the Fort Shepherd project area, especially for reproduction sites (including copulation, parturition, and rearing) and hibernacula. Ensure thorough inventories for roosting bats are conducted, during all seasons, prior to permitting disturbances in rugged, rocky terrain.

Forest roosting bats are also poorly represented in the project area, probably due to the lack of suitable wildlife trees. Tree roosting bats could benefit from the protection of existing wildlife trees, the creation of new wildlife trees, and the installation of bat boxes.

The diversity of bats is still poorly understood in the Fort Shepherd project area. Further inventories are needed to determine whether Western Red Bats really inhabit the project area, as suggested by echolocation call analysis.

Reptiles

The location of Racer hibernacula should be determined, in part to protect their occurrence, and in part to provide a focus for additional reptile research as these snakes often den with other reptiles and would increase the likelihood of discovering any additional reptile species.

Amphibians

Conduct additional surveys, especially nocturnal surveys at the waterfall on Sheppard Creek for the Coeur d'Alene Salamander. Many amphibians are secretive and difficult to find and require significant effort (Ohanjanian 1999).

Return to the project area, during the spring snow melt, to identify and survey vernal pools for early breeding amphibians (Long-toed Salamander).

Complete a wetland restoration plan for the Peace pond to maximize the potential of this unique pond.

Noxious weeds

Prevent the further spread of knapweed and other noxious weeds by:

1) Reducing traffic on site by physically blocking the road entering the area.
2) Creating a strategy to control noxious weed species on site (i.e. chemical, biological or physical control).
3) Seeding native perennial grasses on any disturbed areas to compete with the weeds.

APPENDIX 1: CONFIRMED WILDLIFE SPECIES

TABLE A1. A list of wildlife species confirmed as present on the Fort Shepherd project area.

	Common name	Latin Name
	Birds	
1	American Coot	*Fulica Americana*
2	American Robin	*Turdus migratorius*
3	Bald Eagle	*Haliaeetus leucocephalus*
4	Black-capped Chickadee	*Poecile atricapilla*
5	Brown-headed Cowbird	*Bolothrus ater*
6	Black-headed Grosbeak	*Pheucticus melanocephalus*
7	Bank Swallow	*Riparia riparia*
8	Canada Goose	*Branta canadensis*
9	Calliope Hummingbird	*Stellula calliope*
10	Cassin's Vireo	*Vireo cassinii*
11	Canyon Wren	*Catherpes mexicanus*
12	Cedar Waxwing	*Bombycilla cedrorum*
13	Chipping Sparrow	*Spizella passerina*
14	Clark's Nutcracker	*Nucifraga columbiana*
15	Cliff Swallow	*Petrochelidon pyrrhonota*
16	Cooper's Hawk	*Accipiter cooperii*
17	Common Loon	*Gavia immer*
18	Common Merganser	*Mergus merganser*
19	Common Nighthawk	*Chordeiles minor*
20	Common Raven	*Corvus corax*
21	Dark-eyes Junco	*Junco hyemalis*
22	Dusky Flycatcher	*Empidonax oberholseri*
23	Eastern Kingbird	*Tyrannus tyrannus*
24	Evening Grosbeak	*Coccothraustes vespertinus*
25	Great Blue Heron	*Ardea herodias*
26	Grey Catbird	*Dumetella carolinensis*
27	Least Flycatcher	*Empidonax minimus*
28	Lazuli Bunting	*Passerina amoena*
29	MacGillivray's Warbler	*Oporornis tolmiei*
30	Mallard	*Anas platyrhynchos*
31	Merlin	*Falco columbarius*
32	Mourning Dove	*Zenaida macroura*
33	Nashville Warbler	*Vermivora ruficapilla*
34	Northern Flicker	*Colaptes auratus*
35	Northern Pygmy-Owl	*Glaucidium gnoma*
36	Northern Saw-whet Owl	*Aegolius acadicus*
37	Orange-crowned Warbler	*Vermivora celata*
38	Osprey	*Pandion haliaetus*
39	Pine Siskin	*Carduelis pinus*
40	Pacific-slope Flycatcher	*Empidonax difficilis*

41	Red-breasted Nuthatch	*Sitta Canadensis*
42	Ruby-crowned Kinglet	*Regulus calendula*
43	Red-eyed Vireo	*Vireo olivaceus*
44	Red-tailed Hawk	*Buteo jamaicensis*
45	Ruffed Grouse	*Bonasa umbellus*
46	Rufous Hummingbird	*Selasphorus rufus*
47	Song Sparrow	*Melospiza melodia*
48	Spotted Sandpiper	*Actitis macularia*
49	Spotted Towhee	*Pipilo maculates*
50	Sharp-shinned Hawk	*Accipiter striatus*
51	Steller's Jay	*Cyanocitta stelleria*
52	Swainson's Thrush	*Catharus ustulatus*
53	Townsend's Solitaire	*Myadestes townsendi*
54	Tree Swallow	*Tachycineta bicolour*
55	Turkey Vulture	*Cathartes aura*
56	Vaux's Swift	*Chaetura vauxi*
57	Veery	*Catharus fuscescens*
58	Violet-green Swallow	*Tachycineta thalassina*
59	Warbling Vireo	*Vireo gilvus*
60	Western Kingbird	*Tyrannus verticalis*
61	Western Tanager	*Piranga ludoviciana*
62	Western Wood-Peewee	*Contopus sordidulus*
63	Wild Turkey	*Meleagris gallopavo*
64	Yellow Warbler	*Dendroica petechia*
65	Yellow–rumped Warbler	*Dendroica coronata*
	Mammals	
1	Black Bear	*Ursus americanus*
2	Bobcat	*Lynx rufus*
3	Bushy Tailed Woodrat	*Neotoma cinera*
4	Columbia Ground Squirrel	*Spermophilus columbianus*
5	Common Shrew	*Sorex cinereus*
6	Coyote	*Canis latrans*
7	Deer Mouse	*Peromyscus maniculatus*
8	Mountain Goat	*Oreamnos americanus*
9	Northern Flying Squirrel	*Glaucomys sabrinus*
10	Northern Pocket Gopher	*Thomomys talpoides*
11	Red Squirrel	*Tamiasciurus hudsonicus*
12	River Otter	*Lontra canadensis*
13	White-tailed Deer	*Odocoileus virginianus*
14	Yellow-pine Chipmunk	*Tamias amoenus*
	Bats	
15	Big Brown Bat	*Eptesicus fuscus*
16	Sliver-haired Bat	*Lasionycteris noctivagans*
17	Townsend's Big-eared Bat	*Corynorhinus townsendii*
18	Western Long-eared Myotis	*Myotis evotis*
19	Yuma Myotis	*Myotis yumanensis*

Reptiles		
1	Alligator Lizard	*Elgaria coerulea*
2	Common Garter Snake	*Thamnophis sirtalis*
3	Racer	*Coluber constrictor*
4	Rubber Boa	*Charina bottae*
5	Terrestrial Garter Snake	*Thamnophis elegans*
6	Western Skink	*Eumeces skiltonianus*
Amphibians		
1	Columbia Spotted Frog	*Rana luteiventris*
2	Pacific Tree Frog	*Hyla regilla*
Noxious Weeds		
1	Common Toadflax	*Linaria vulgaris*
2	Dalmation Toadflax	*Linaria dalmatica*
3	Diffuse Knapweed	*Centaurea diffusa*
4	Spotted knapweed	*Centaurea maculosa*
5	St. Johns Wort	*Hypericum perforatum*

APPENDIX 2: INSECTS

The Arthropods of the Fort Shepherd Project area (ICHxw)
Identified by Jeffrey R. Jarrett, (December 2002)

TABLE A2. A list of insects found on site during the non-game inventory.

Carabidae
1) Cicindela nebraskana Casey
2) Calosoma moniliatum (LeConte)
3) Carabus taedatus agassii LeConte
4) Scaphinotus relictus (G.H.Horn)
5) Scaphinotus angusticollis (Fischer von Waldheim)
6) Zacotus matthewsii LeConte
7) Pterostichus mutus (Say)
8) Pterostichus melanarius (Illiger)
9) Pterostichus herculaneus Mannerheim
10) Amara obesa (Say)
11) Harpalus animosus Casey
12) Harpalus fraternus LeConte
13) Harpalus cautus Dejean
14) Cymindis borealis LeConte

Silphidae
15) Nicrophorus investigator Zetterstedt

Tenebrionidae
16) Coniontis ovalis LeConte
17) Eleodes pimelioides Mannerheim
18) Coelocnemis californicus Mannerheim

Cerambycidae
19) Monochamous scutellatus oregonensis (LeConte)

Chrysomelidae
20) Chysochus cobaltinus LeConte

Oecanthidae
21) Oecanthus fultoni T.J.Walker

Alydidae
22) Alydus calcaratus (Linnaeus)

Antrodiaetidae
23) Antrodiaetus hageni (Chamberlin)

The Butterflies of the Fort Shepherd Project area.
Identified by Norbert Kondla (October 2002)

TABLE A3. A list of butterflies identified from the project area.

Genus	Species	Subspecies
Amblyscirtes	*vialis*	
Aricia	*icarioides*	
Celastrina	*echo*	*nigrescens*
Coenonympha	*california*	
Erynniss	*persius*	
Lycaena	*helloides*	
Nymphalis	*californica*	

PHOTO A1 and A2. Larval and pupae stages of the California tortoiseshell (Nymphalis california)

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