

Fraser Valley Parkway Boreal Toad Habitat Inventory
A report to the Grand County Planning Commission
August 2005

Prepared for:
The Grand County Board of Commissioners

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Project Summary

The Colorado Natural Heritage Program (CNHP) conducted an inventory for the boreal toad (*Bufo boreas boreas*) within and adjacent to the proposed Fraser Valley Parkway project area during the spring and summer breeding season of 2005. The objectives of the project were to quantify the amount and quality of habitat, find potential breeding sites, and evaluate historic or current activity of boreal toads along the proposed roadway. A total of 5 visits to the impacted areas were made between the 20th of May and 18th of July, 2005. Our results suggest that there is currently no occupied habitat within the surveyed areas. However, GIS analysis found that occupied boreal toad breeding sites are known to occur within a practical dispersal distance, and within the Pole Creek drainage, which will be crossed by the road if the proposed alignment is implemented. Potential breeding and summer habitat is quantified and other landscape qualities such as apparent hibernacula, upland habitat, and suitable water levels are discussed as they pertain to the areas where impacts are most likely to occur. Direct (e.g., road building) and indirect (e.g., associated housing development) impacts on both short and long-term time scales are addressed, along with options for offsetting potential adverse impacts.

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Introduction and Species Information

Project Background

The proposed Fraser Valley Parkway runs generally north to south covering about five miles, from Tabernash to Fraser, Colorado (Figure 1). The parkway would connect County Road 5221 in the north with County Road 72 in the south. The stated objectives of the Grand County Road and Bridge Department (GCRBD) for the proposed road are to ensure emergency health services for the residents of the western portion of Fraser and to increase traffic safety by providing local traffic with an alternative north-south route to US 40 (GCRBD 2004).

The proposed Parkway will cross through four principal drainages, two of which have had recent sightings of boreal toads (*Bufo boreas boreas*) (Figure 2), an endangered species in Colorado (Appendix 2) and a candidate for federal listing under the Endangered Species Act. In response to concerns over potential adverse impacts to this species from road construction, Grand County contracted with the Colorado Natural Heritage Program (CNHP) to evaluate boreal toad habitat within the proposed road corridor, and to identify impacts that could result from implementation of Fraser Valley Parkway project. CNHP conducted surveys for the boreal toad within and adjacent to the proposed Fraser Valley Parkway alignment during the spring and summer breeding season of 2005 (Figure 1). CNHP's field objectives addressed in this report were to quantify the amount and quality of habitat for historic boreal toad sites, as well as potential breeding sites and current activity of boreal toads along the proposed roadway. Other project objectives were to describe localized trends and predictions, identify and quantify the availability of food sources, estimate the current boreal toad population within the project area, and identify potential mitigation options for reducing adverse impacts to the boreal toad and its habitat in the project area.

Status of the Boreal Toad

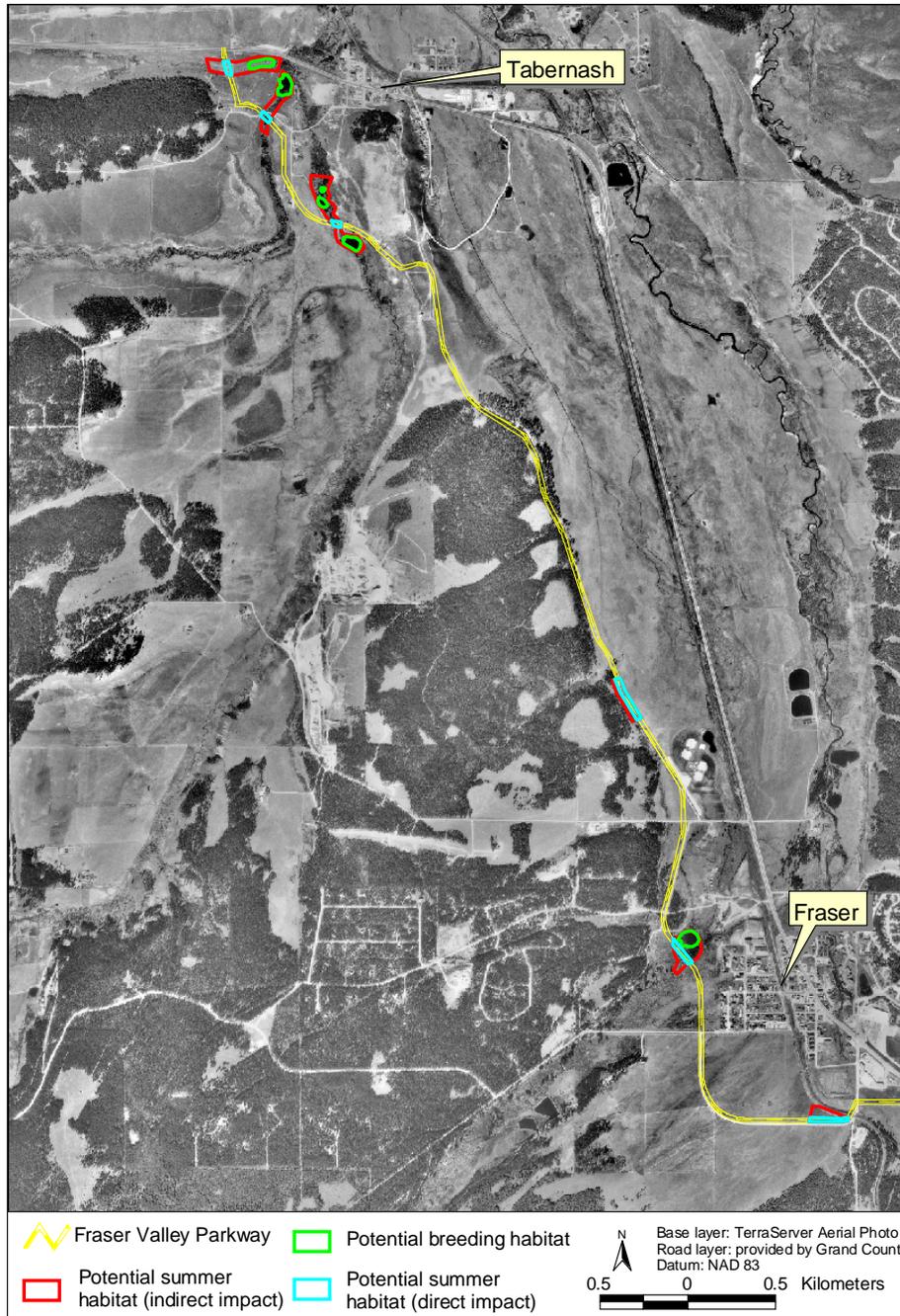
The subject of this report is the Southern Rocky Mountain population (SRMP) of the boreal toad (referred to hereinafter as boreal toad, or toad).¹ Beginning in the early to mid-1980s, the boreal toad experienced dramatic declines in its population in Colorado, New Mexico, and Wyoming (USFWS 2004). Because of these declines, the boreal toad is currently listed as endangered by the State of Colorado, and is a Candidate for federal listing under the Endangered Species Act. In 1995, the USFWS published their 12-month finding on the listing petition, which concluded that listing was “warranted but precluded”² (Loeffler 2001a). Status reviews in 2002 and 2004 by the USFWS upheld the “warranted but precluded” designation.

¹ The SRMP is currently recognized as a subspecies of the western toad (*Bufo boreas*), but preliminary genetics work suggests that it may, in fact, be a separate species. For the purposes of this report, the SRMP is referred to as the species level.

² I.e., available information supports federal listing under the ESA, but completion of the listing process for the boreal toad is precluded by higher priority species.

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Figure 1. Proposed Fraser Valley Parkway with potential boreal toad habitat impact areas. Direct impacts were considered to be within a 30-meter buffer of the road alignment. Indirect impacts were estimated by the field biologist. Potential future development is not included.



The boreal toad is currently found in 67 known breeding locations comprising 32 populations, only two of which are considered viable (T. Jackson, CDOW, pers. comm.). This species has disappeared from 83 percent of its historic locations in Colorado, 94 percent in Wyoming, and is believed to be extirpated from New Mexico (USFWS 2004). The boreal toad was once known from 25 counties in Colorado, including Grand County, where it was considered common. Its distribution in Colorado is now restricted to 14 counties. Available information suggests that boreal toad populations continue to decline (Keinath and McGee 2005).

Reasons for the declining toad population are still being investigated. Proposed causes include chytrid fungus (*Batrachochytrium dendrobatidis*), acid rain, drought, pollution, increased UV radiation, natural population flux, or some synergistic combination of these and/or other factors (USFWS 2004). The major source of decline is believed to be chytrid fungus, which has been linked to major declines in proximate areas such as Rocky Mountain National Park (Muths et al. 2003, USFWS 2004). Examinations of infected toads show that chytrid fungus suppresses the immune system to a point that a secondary infection (e.g. red-leg disease) is usually the ultimate cause of death (USFWS 2004). Researchers hypothesize that one or a combination of environmental stressors is reducing the toads' ability to survive this pathogen (Loeffler 2001a). At this time, researchers do not know whether or not populations can persist in the presence of chytrid fungus. Research is on-going, but it may be several more years before this question can be answered (T. Jackson, CDOW, pers. comm.).

Boreal Toad Habitat, Behavior, Diet, and Movement Patterns

The boreal toad occupies habitat mainly between 8,500 and 11,500 feet, with higher and lower occurrences in some locales (Hammerson 1999). The majority (about 90 percent) of known boreal toad breeding habitat falls on federal land (USFWS 2004). Breeding habitat occurs in beaver (*Castor canadensis*) ponds, high elevation lakes and ponds, glacial kettle ponds, and human excavated ponds. Ideally, breeding ponds have a gradually sloping shallow margin (≤ 10 cm deep) and persistent water levels lasting into August (Holland 2002). Adult males and females congregate at ponds to breed in May and early June depending on elevation. The tadpoles generally hatch within 1-2 weeks after the eggs are laid. Metamorphosis is usually completed in 60-90 days. Summer habitat can consist of the breeding ponds, or toads may become more terrestrial and occupy wetlands, floodplains, meadows, shrubland, or forests. Generally, though, upland habitat is damp and close to water. Inactive toads often use rocks, logs, or rodent burrows to hide beneath or within (Hammerson 1999). Winter hibernacula are found in areas below the frost line, or in areas where the flow of ground water maintains a microclimate above freezing. These may include burrows created by rodents such as ground squirrels (*Spermophilus* sp.) or beaver lodges and dams. Hibernacula are usually not far from summer habitat (Hammerson 1999, USFWS 2004).

Boreal toads are mainly insectivorous. They eat wide varieties of invertebrates, including grasshoppers, beetles, mosquitoes, flies, spiders, moths, ants, wasps, bees, mites, and snails (Hammerson 1999). The diet of boreal toads is relatively flexible. Toads appear to

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Figure 2. Boreal toad sightings in the Fraser Valley Parkway vicinity. This map displays records of boreal toad observations currently in the Colorado Natural Heritage Program database. This database is continuously updated, but absence of data does not necessarily mean that the boreal toad does not occur in other locations. Though other observation sites may exist, this map accurately portrays the general distribution of the boreal toad in the project area. Toads are currently documented in Pole Creek, its tributary Skunk Creek, and Crooked Creek.



feed primarily on prey that is plentiful and easy to catch. Ants, beetles, and spiders make up the majority of their diet (Keinath and McGee 2005).

Maximum yearly movements of the boreal toad in Colorado have been estimated at 0.97 km for males and 2.3 km for females (Muths 2003). Similar results were found in Idaho (0.94 km for males and 2.44 km for females; Bartelt 2000), suggesting the validity of the Colorado results and giving researchers a baseline for yearly toad dispersal patterns. However, between 1999 and 2002 a mark/recapture study documented an individual male toad traveling between breeding sites 8 km apart (Lambert 2004).

Inventory

Methods

CNHP biologists and conservation planners conducted field inventories, GIS analysis, and developed mitigation strategies for the target species, boreal toad. The targeted inventory involved field surveys of the riparian crossings, isolated pond/wetland areas, and selected upland areas occurring within and adjacent to the proposed alignment of the Fraser Valley Parkway. Survey areas were identified by a preliminary GIS analysis using hydrology layers, Division of Wildlife wetland data, digital elevation models, TerraServer digital black and white aerial photos, digital USGS quad maps, and boreal toad data from CNHP databases (CNHP 2005). On-site surveys of the riparian crossings, isolated pond/wetland areas, and selected upland areas were conducted during May, June, and July, 2005. The inventories concentrated on, but were not limited to, wetland areas impacted. Upland areas were also surveyed at the discretion of the field biologist. Providing documentation of the boreal toad in a given area is most reliable during the spring and summer seasons. CNHP survey dates were scheduled to occur during the most critical as well as most conspicuous stages of the boreal toad's life cycle. The areas of potential habitat were mapped in ArcView (ESRI Redlands, CA) over TerraServer aerial photos at a scale of 1:3,000 using field data collected (Figure 1). Direct impacts were considered to be within a 30-meter buffer of the road alignment. Indirect impacts were estimated by the field biologist. Potential future development was not included.

Results

A preliminary GIS analysis of the project area showed the entire roadway to be within the elevation range of the boreal toad, albeit at the lower extent. The road begins at about 8,600 feet, south of Fraser, dropping to about 8,400 feet, west of Tabernash. There were no historic records of breeding or toad sightings within the proposed alignment in CNHP's databases. Therefore we have no knowledge of historical occupied breeding habitat in the Fraser Valley Parkway alignment. However, our database shows toad sightings as close as about 0.5 km (approximate location taken from a topographic map), and productive breeding sites within 4 km. The breeding sites on Pole Creek and Skunk Creek have been persistent for at least six years and this year contained >40 adults, 7 egg masses, 1000's of tadpoles, and 100's of metamorphs (Greg Horstman, pers. comm.). Other unconfirmed sightings have been reported on adjacent properties downstream from

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the Crooked Creek crossing (Greg Horstman, pers. comm.), but these records are not in CNHP's database.

Boreal toad habitat is most often associated with montane riparian and wetland zones, so the focus of the inventory was narrowed to the areas where the proposed road will cross Pole Creek, Crooked Creek, the ball fields wet meadow, St. Louis Creek, and the railroad underpass wetland near Elk Creek. These areas were surveyed multiple times by three different CNHP biologists. Most of the remaining road alignment was at least driven at slow speeds while looking for toads, potential upland habitat, or additional wet habitat.

Field surveys on the 20th of May, the 3rd and 16th of June, and the 11th and 18th of July, 2005, found no toads, tadpoles, egg masses, or metamorphs in any of the surveyed areas along the road alignment. CNHP biologists estimated about 2.3 ha of summer habitat and no breeding habitat would be directly affected by the road. About 3 ha of possible breeding habitat and about 14 ha of possible summer habitat within and/or adjacent to the proposed parkway would be affected (Table 1). Habitat for possible winter hibernacula most likely exists in all areas with beaver activity or burrowing mammals. Site-specific descriptions are listed below by locality.

Table 1. Potential and occupied boreal toad habitat within and adjacent to the proposed Fraser Valley Parkway.

Site	Historic or current occupied habitat	Distance to occupied breeding habitat (km)	Potential summer habitat directly impacted (ha)	Potential breeding habitat indirectly impacted (ha)	Potential summer habitat indirectly impacted (ha)
Pole Creek	0	~4.0	~0.45	~1.3	~5.0
Crooked Creek	0	~4.3	~0.15	~0.8	~3.4
Ball fields	0	~6.5	~0.80	0	~1.3
St. Louis Creek	0	~7.3	~0.46	~0.7*	~2.7
Railroad underpass	0	~8.5	~0.45	0	~1.3

Notes: Direct impacts were considered to be within a 30 meter buffer of the road alignment; indirect impacts were estimated by the field biologist; neither considered future development. ~ Acreages are approximate, based on field notes and onscreen digitizing at a scale of 1:3,000 (Figure 1).

* Under the observed water management scenario, this pond would most likely act as a population sink if used for breeding.
(1 ha=2.47 acres, 1 km=0.62 miles)

Figure 3. Pole Creek crossing looking downstream.



Pole Creek Crossing

GIS analysis with the Biodiversity and Tracking System (CNHP 2005) for this crossing showed two boreal toad sites occur approximately 4 km and 7 km upstream on Pole Creek. Another site occurred approximately 6.5 km upstream on Skunk Creek, a tributary of Pole Creek (Figure 2). Jungwirth (2003) lists the Pole Creek Golf Course sites as having breeding success over multiple years between 1995 and 2003. Jungwirth (2003) also notes that these sites have tested positive for chytrid fungus since 2002, which brings their long-term viability into question.

Field visits to the Pole Creek crossing failed to find boreal toad adults, juveniles, egg masses, tadpoles, or metamorphs. The area is dominated by a riparian corridor with meanders, oxbow areas with standing water, and beaver ponds. Dominant wetland vegetation consisted of beaked sedge (*Carex utriculata*) and Geyer willow (*Salix geyeriana*). Upland vegetation was dominated by sagebrush (*Artemisia* spp.). This reach of Pole Creek has potential breeding habitat (e.g., beaver ponds), foraging habitat (wet floodplain meadow), and hibernacula (beaver dams and lodges) for boreal toads (Table 1, Figure 3). The dry sagebrush upland and the distance to the nearest forested area may not be ideal for terrestrial habitat use, because boreal toads generally prefer damp or forested areas and boreal toad dispersal may be constrained to the riparian corridor. This area would support the food requirements for the boreal toad.

Figure 4. Crooked Creek looking upstream toward the crossing.



Crooked Creek Crossing

GIS analysis with the Biodiversity and Tracking System (CNHP 2005) for this crossing showed two sightings within the Crooked Creek drainage. The closest known occurrence to the project was two juvenile boreal toads observed in 2000 approximately 0.5 km upstream near Crooked Creek (Figure 2). This sighting was documented as reliable by Loeffler (2001b) but provided only an approximate location. Another sighting on Crooked Creek was approximately 8 km upstream from the crossing. Approximately 0.5 km downstream, an abutting landowner is an active participant in the Crooked/Pole Boreal Toad Recovery Project; they have had boreal toad-specific habitat improvements on their property and have apparently seen an adult and a juvenile toad in their wetland complex in 2000 and 2001 (Greg Horstman, pers. comm.).

Field visits to the Crooked Creek crossing failed to find boreal toad adults, juveniles, egg masses, tadpoles, or metamorphs. The area is dominated by a riparian corridor with meanders, oxbow areas with standing water, a man-made pond, and beaver ponds. Dominant wetland vegetation consisted of beaked sedge (*Carex utriculata*) and Geyer willow (*Salix geyeriana*); upland vegetation was dominated by sagebrush (*Artemisia* spp.). This reach of Crooked Creek has potential breeding habitat, foraging habitat, and hibernacula for boreal toads (Table 1, Figure 4). Potential breeding habitat includes the

man-made farm pond upstream of the crossing and the beaver flowage downstream, depending on yearly variables (e.g., runoff, beaver activity). Potential hibernacula include beaver dams and rodent burrows. The dry sagebrush upland as well as the distance to the nearest forested area may not be ideal for terrestrial habitat use, because boreal toads generally prefer damp or forested areas and boreal toad dispersal may be constrained to the riparian corridor. This area would support the food requirements for the boreal toad.

Figure 5. Ball Fields wetland looking east.



Ball Fields Wetland

GIS analysis with the Biodiversity and Tracking System (CNHP 2005) for this crossing showed no historic occurrences of boreal toads in the vicinity. Field visits to the Ball Fields area failed to find boreal toad adults, juveniles, egg masses, tadpoles, or metamorphs. The area is dominated by a wet meadow and grassland that is currently grazed. Dominant wetland vegetation consisted of sedges (*Carex* spp.) and willows (*Salix* spp.). Upland vegetation was grazed grassland to the east and a lodgepole pine (*Pinus contorta*) forest to the west. This ephemeral wetland does not hold standing water long enough to support breeding, and is most likely not boreal toad foraging or winter habitat due its relative isolation from possible breeding habitat (Figure 5). This area would support the food requirements for the boreal toad.

Figure 6. St. Louis Creek wetland.



St. Louis Creek Wetland

GIS analysis with the Biodiversity and Tracking System (CNHP 2005) for this crossing showed no historic occurrences of boreal toads in the vicinity. The area is dominated by a riparian corridor with a diversion ditch feeding a man-made pond and wetland. Dominant wetland vegetation consisted of sedges (*Carex* spp.) and Geyer willow (*Salix geyeriana*). Upland vegetation was dominated by sagebrush (*Artemisia* spp.) to the north and a lodgepole pine forest to the south. This site contained the best example we observed of upland habitat adjacent to potential breeding habitat, with the lodgepole pine forest to the south of the pond and wetlands dominated by willows to the west (Figure 6).

Field visits to the St. Louis Creek area failed to find boreal toad adults, juveniles, egg masses, tadpoles, or metamorphs. Chorus frogs (*Pseudacris triseriata*) were heard calling on the May 20 visit. The man-made pond at this site could possibly be used by boreal toads as breeding habitat. However, on the July 19 visit the water level had been artificially dropped a significant amount. If this occurred with tadpoles present, they would most likely perish and the pond would serve as a population sink.³ If the water management regime noted during July 2005 represents normal management, the area

³ A population sink is an area of apparently high quality habitat that attracts a species for breeding, but where mortality is high, ultimately resulting in failed reproduction and possibly a drop in population numbers.

would most likely not serve as a productive breeding site. This area would support the food requirements for the boreal toad.

Figure 6. Railroad underpass wetland.



Railroad Underpass Wetland

GIS analysis with the Biodiversity and Tracking System (CNHP 2005) for this area showed no historic occurrences of boreal toads in the vicinity. This wetland is not directly linked with a riparian area. Rather, it is fed by a number of irrigation ditches to the north as well as artesian ground water flow. It is then passed through a culvert toward Elk Creek.

Field visits to the Railroad underpass area failed to find boreal toad adults, juveniles, egg masses, or tadpoles. Chorus frogs were heard calling on the June 3 visit and tiger salamander (*Ambystoma tigrinum*) larvae were seen on the July 11 visit. Boreal toads are more likely to breed at ponds without tiger salamanders (USFWS 2004). The area is dominated by a small pond and wetland. Dominant wetland vegetation consisted of sedges (*Carex* spp.), and upland vegetation was dominated by grazed grassland. This area would support the food requirements for the boreal toad.

Discussion

Localized Trends and Predictions

Local trends for the boreal toad in the Fraser Valley are mixed. Successful breeding has been documented at the Pole Creek breeding sites since at least 1995. Active habitat restoration directly targeted for the boreal toad in the area has most likely benefited the species. This area is an asset to understanding the species and will be studied to try to understand further how chytrid fungus affects boreal toads. Conversely, the area has been known to be chytrid positive since at least 2002. Chytrid fungus is widely recognized as a primary factor in the decline of the boreal toad. Until the fungal infection is fully understood, it is assumed that a population infected will continue to decline and will not be able to persist. Also, adverse impacts to boreal toad ecology and habitat are likely to result from anticipated future development in the area (see following discussion on potential impacts).

Regionally, this area makes up one of only 32 known populations of the Southern Rocky Mountain boreal toad. Other CNHP surveys from the 2005 breeding season in 14 Grand County drainages have failed to find additional occupied habitat.

Estimate of Current Boreal Toad Populations within the Project Area

Our findings suggest that boreal toads do not currently breed within the surveyed portion of the road alignment. We also failed to find toads migrating or foraging during our surveys. However, breeding populations in the Pole Creek drainage occur within a potential dispersal distance to the road alignment area. Therefore, future sightings and/or breeding within the proposed project corridor are possible. Population estimates for the area are not obtainable without further detailed studies, such as a mark/recapture study. However, >40 adults, 7 egg masses, 1000's of tadpoles, and 100's of metamorphs were reported from the Pole Creek watershed in 2005 (Greg Horstman, pers. comm.). This would suggest a minimum of 7 breeding pairs, but most likely many more given that females often skip 1-3 years between return to breeding ponds (USFWS 2004).

Relative Quality of the Local Toad Populations and Habitat

The relative quality of existing boreal toad occurrences and potential habitat in the vicinity of the Fraser Valley Parkway is not as high as the quality of other known toad locations. The presence of chytrid fungus at nearby sites, local landscape context (e.g., proximity to developed areas), poor upland habitat at most sites, and potential threats from on-going development suggest that the long-term viability of toads in this area is not necessarily secure. Given the status of the boreal toad (absent from 83% of previously known sites, and only two remaining viable breeding locations), all adverse impacts to toads and to suitable habitat are potentially significant. The chances of long-term conservation success are greater if all remaining known localities can be conserved. Thus, efforts to protect existing habitat in the Fraser Valley Parkway area are warranted.

Potential Impacts

Suitable boreal toad habitat exists in the project area, and adverse impacts to that habitat are likely. We do not know enough at this point to ascertain whether or not boreal toads will be adversely impacted. As previously noted, the 2005 surveys failed to document boreal toads in the project area. However, they occur within dispersal distance, and there is enough habitat connectivity to support colonization of the project area within the likely timeframe of project implementation. It is possible that toads from the Pole Creek population or other nearby sites will persist, reproduce successfully, and disperse to the project area. It is also possible that the Pole Creek population will be extirpated because of the chytrid fungus, or some combination of other threats, much reducing the possibility of toads being impacted by the project. It is possible that currently unknown populations exist on any of the drainages that traverse the project area, which could serve as other source populations, effectively increasing the possibility that toads will be impacted.

Even if toads are present, some may argue that the impacts will not be as significant from an overall species perspective, based on the relative low quality of the habitat and landscape context, and other existing threats. However, given that this species currently exists in only 1% of its historical range (Keinath and McGee 2005) and continues to decline, it could be argued that any impact is significant and should be avoided. Certainly, all reasonable efforts to prevent further declines and trends toward federal listing are in everyone's best interest. From a species conservation perspective, a low-risk (i.e., err on the side of caution) approach would assume that the project will impact toads, and would mitigate accordingly. The following discussion is based on that assumption.

Short-term Impacts

The most immediate impact will be direct loss of habitat. Depending on final alignment design and construction practices employed, this could be either temporary habitat loss during construction, or permanent habitat conversion (which would also constitute a long-term impact), or both. Based on the proposed road alignment in relation to potential habitat mapped in 2005, we estimate that approximately 2.3 ha (Table 1; 5.6 acres) of potential summer habitat for boreal toads will be lost.

There is also potential for degradation of remaining habitat, if implementation of the project results in adverse changes to water quality or velocity, or vegetation. Increased velocity would be of particular concern if stream-crossing structures increased water velocity to the point where the shallow standing waters necessary for breeding were lost. Any changes to local hydrology or water quality that resulted in a decrease in insects (the primary food source for boreal toads) would have a negative effect on boreal toads.

Adverse impacts to vegetation could include reduced cover and altered composition. Construction projects commonly result in the introduction or spread of weeds. From an ecological system standpoint, increased weed cover is not a desirable condition. To our

knowledge, there are no data on whether or not the spread of weeds per se would have direct negative effects on boreal toads. However, use of chemicals to control weeds would adversely affect boreal toads. These chemicals are known to impact amphibians through direct mortality, reduced resistance to disease, alteration in growth and development, and reduced reproductive success (Relyea 2005, Keinath and McGee 2005).

If boreal toads are present during construction activities, direct mortality from construction machinery and trampling is a potential short-term impact.

Long-term Impacts

The most obvious long-term impact will be permanent conversion of habitat. Some short-term impacts, such as reduced water quality, increased water velocity, and changes in vegetation could become long-term impacts if not adequately managed. In part, these impacts could be on-going as a result of routine maintenance, such as mowing, weed control, and winter maintenance, as well as runoff of pollutants from the road. Chemical contaminants and their detrimental effects can persist in amphibian habitats for many years (Russell et al. 1995, Keinath and McGee 2005). If stream crossings prohibit movement between habitat patches along the riparian corridor, the resulting barrier effect would constitute a long-term impact.

The most problematic long-term impacts, however, are the indirect impacts that will be associated with increased access into the area. Construction of the Fraser Valley Parkway would be expected to lead to increased development; in fact, some developments are already proposed. The inevitable impacts associated with this development will extend beyond the local habitat at the road crossing, and may affect boreal toads in large reaches of the streams addressed in this report, as well as sub-drainages.

Additional development will result in higher traffic volume and speed of vehicles, which will increase the likelihood of direct mortality for any toads in the area attempting to cross the road. If development proceeds in a fashion that significantly alters the hydrology of the area, the ability to sustain functioning riparian and wetland habitats could be compromised. Examples of significant hydrological alteration could include loss of beaver activity, loss of creek meanders that create oxbows and pools, and lowered water table. Development has the potential to change surface and ground water levels, which would impact most aquatic species including toads.

Increases in human population have been linked to localized increases in adaptable wildlife (DeStefano and DeGraaf 2001). For the boreal toad and tadpoles this would most likely increase the number of predators such as raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), western terrestrial garter snake (*Thamnophis elegans*), grey jay (*Perisoreus canadensis*), American robin (*Turdus migratorius*), mallard (*Anas platyrhynchos*), and domestic dog (*Canis familiaris*) (USFWS 2004).

Other potential hazards to the toad from an increase in human population along the proposed roadway would include runoff of chemicals such as lawn fertilizers, de-icing salts or cinders, vehicle anti-freeze and oil, insect foggers, and possibly the most destructive would be the increased movement between watersheds of chytrid fungus. Long-term indirect impacts may also include increased access into, and trampling of, the riparian corridor.

Chances are that the Fraser Valley Parkway project, or any individual development project, may not result in significant long-term impacts in and of itself. However, cumulative impacts could be significant, and could eventually reduce or preclude the option of having this as area available for future toad use.

Options for Offsetting Adverse Impacts

In terms of offsetting impacts, there are two approaches to consider. One approach is to avoid, minimize, and mitigate take of individuals. The other approach is to focus on strategic contributions to the recovery of the species overall. A comprehensive mitigation plan would do both. The recommendations provided below offer options for offsetting both local and regional scale impacts. These recommendations are consistent with the proposed strategies in the Boreal Toad Conservation Plan (Loeffler 2001a), which include protection of existing breeding sites, occupied habitat, unoccupied suitable habitat, and research.

1. Employ appropriate design and Best Management Practices. If possible, the final alignment of the Fraser Valley Parkway should avoid boreal toad habitat. If this is not possible, the use of appropriate design and on-site Best Management Practices (BMPs) can help avoid and minimize direct impacts to toads and their habitat during construction and on-going road maintenance. The following suggestions should help reduce adverse impacts to boreal toads and their habitat within the project area:

- If possible, schedule construction activities for areas containing suitable boreal toad habitat (about 350 meters or 0.2 miles of road where it crosses Pole, Crooked, and St. Louis Creeks, but not the ball fields or railroad underpass wetlands outlined in blue in Figure 1) for prior to early May or after early September.
- If construction activities are scheduled from May through the end of August in areas that contain boreal toad habitat, survey for presence of boreal toads during the breeding season prior to any disturbance. If evidence of toad activity is found, consult with a qualified biologist to identify necessary site-specific measures for avoiding direct impacts.
- If eggs, tadpoles, or toads are present, avoid de-watering ponds and other areas of standing water, and trampling (by foot or machinery) individuals or emergent/bank vegetation. Clearly communicate with construction personnel regarding the sensitivity of boreal toads, the location(s) of their habitat, and the importance of avoiding impacts.

- Implement measures to control erosion or sedimentation that could bury egg masses.
- Design stream crossings such that boreal toads can travel along the riparian corridor underneath the road, rather than being forced to traverse upland habitats and cross the road. This will require a crossing method that leaves banks and vegetation intact underneath the road. It is also important that the design of crossings maintain natural flows to avoid eliminating potential downstream breeding sites, either by drying out, inundating, or washing out shallows. Finally, crossings should be wide enough to accommodate high flow events and still allow for natural stream banks necessary for movement of toads. It is worth noting that appropriate design of crossing structures will benefit an array of other species in addition to the boreal toad.
- Restore riparian and wetland vegetation, and maintain habitat connectivity. Isolation of small populations is often a threat to the persistence of sensitive species. It will be important to maintain the ability of toads to move between suitable patches in response to changing local conditions, and to accommodate dispersing individuals.
- Complete construction and re-vegetation in as timely a fashion as possible.
- The Boreal Toad Conservation Plan and Agreement (copy provided) recommends maintaining a 300 ft. (100m) buffer zone between suitable toad habitat and human disturbances in wetlands. The plan also calls for lost wetlands to be mitigated at a 2:1 ratio.
- Avoid use of pesticides in boreal toad habitat. These chemicals are likely to at least reduce food supply, and at worst, could cause direct toad mortality (Relyea 2005). As much as possible, use non-chemical methods of weed control in these areas. Keinath and McGee (2005) recommend avoiding the use of chemicals within 100m of wetlands.
- Minimize use of winter maintenance additives in boreal toad habitat and upstream of potential habitat patches.

2. Sponsor off-site habitat protection and enhancement. Construction design and BMPs may offset the direct impacts to local individuals and habitat that result from the installation of the road, but they will not be sufficient to offset the more broad-scale indirect impacts that result from the associated increase in development. An appropriate mitigation strategy should include habitat protection and enhancement at a scale sufficient to offset development build-out. All else being equal, chances of maintaining long-term population persistence are assumed to be greater in higher quality habitats that are experiencing fewer threats. Thus, protection of core habitat in more remote settings would make a greater contribution to the species as a whole than protection of small, individual sub-populations in areas that are under high development pressure. Fortunately, the majority of known breeding sites is on public land, and therefore considered protected from habitat conversion. However, there may be high quality habitat on private lands that could be protected through conservation easement, management agreement, or some other measure. Also, efforts to improve and enhance degraded or sub-optimal habitats, similar to efforts underway at Pole Creek Golf Course, could increase the number of successful breeding localities in Grand County.

Enhancement efforts at Pole Creek appear to have improved breeding success of boreal toads at that site, at least in the short-term. Similar efforts at other carefully chosen sites in the County would increase Grand County's contribution to boreal toad conservation. Coordinate with the Boreal Toad Recovery Team to identify, prioritize, and pursue these opportunities.

There is one important caveat to the concept of habitat enhancement for boreal toads in Grand County: protection of existing natural systems is preferable to created wetlands. Created wetlands that are isolated in fields and not connected to functioning riparian systems would not likely provide viable toad habitat, and would probably not benefit toads. The conceptual framework that Grand County has used to assign quality rankings to existing wetlands (i.e., high, moderate, and low) in the project area is not consistent with boreal toad needs. From the perspective of boreal toad biology, high quality breeding habitat would specify north shorelines on open water (east and south facing), with shallow water present May – August, and emergent vegetation. Areas where breaks in shrub or tree canopy that allow sunlight to reach the ground are used frequently (Bartelt 2000, Keinath and McGee 2005). The boreal toad habitat that will be directly impacted by construction of the Fraser Valley Parkway is not high quality habitat based on boreal toad requirements. However, the differences in approach to defining “high quality” are important to note for mitigation purposes. Holland (2002) provides the following characterization of optimal boreal toad breeding sites:

- shallows \leq 10 cm deep are preferred for breeding;
- tadpoles develop best in sites where water temps are warmest and least variable, and water levels are persistent (i.e., persistent enough to prevent dessication of eggs);
- Breeding sites with gradually sloping banks are desirable to “ensure that suitable breeding habitat exists at a variety of water levels;”
- Old, active beaver pond complexes provide good breeding habitat because they have shallow ponds and beaver maintain water levels.

The existing conservation easement on Denver Water Board property is not considered appropriate boreal toad habitat, and does not make a meaningful contribution to boreal toad conservation.

3. Support Research. The Boreal Toad Recovery Team has identified research needs on a number of key factors that could help inform conservation strategies. According to the USFWS (2004), many of the conservation activities undertaken to date have not been able to reverse boreal toad declines. Additional information on how various threats are interacting to drive these declines is needed. Part of Grand County's approach to mitigation could include providing funds or other resources to further boreal toad research, coordinated through the Boreal Toad Recovery Team. Refer to the Boreal Toad Conservation Plan and Agreement, revised 2001, for additional information (copy provided).

4. Participate in Partner Based Conservation Initiatives. The Southern Rocky Mountain boreal toad is only known from 14 counties in Colorado and 2 counties in Wyoming (USFWS 2004). To our knowledge, none of these counties has signed a boreal toad conservation agreement, or committed to a significant role in recovery of this species. Given the current distribution of the toad, the bulk of responsibility for recovery of the species will fall to the state and federal land and wildlife management agencies. However, activities on local and private lands can and will impact the overall viability of the boreal toad. A coordinated approach to strategic conservation on the part of all counties within the range of the boreal toad would help focus everyone's efforts toward strategies that are most likely to make the greatest contribution to boreal toad recovery. Again, these efforts should be coordinated with the Boreal Toad Recovery Team.

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Appendix 1. Excerpts from CNHP Biodiversity Tracking and Conservation System Metadata
(complete metadata can be found on-line at <http://www.cnhp.colostate.edu/gis.html>).

Originator: The Colorado Natural Heritage Program, Colorado State University

Publication Date: 20050506

Title: Element Occurrence Polygons (SENSITIVE DATA!)

Database Version: Biodiversity Tracking and Conservation System, Version 4.0

Description:

Abstract:

The Colorado Natural Heritage Program (CNHP) collects data on rare and imperiled species, subspecies and unique natural communities in Colorado. An element occurrence (EO) represents a location in which a species, subspecies or natural community is, or was, present. An EO has potential continued (or historic) presence and/or regular recurrence at a given location and has practical conservation value.

Purpose:

CNHP provides information on the distribution of Colorado's rare and imperiled species, subspecies and unique natural communities to public and private agencies and individuals for environmental review, proprietary land management, resource planning, biological and ecological research and general scientific reference.

Supplemental Information:

Data were derived from field surveys performed by CNHP and other credible sources such as Forest Service personnel, Bureau of Land Management staff, etc. Data are available in Arc/Info export format (subclass eors) or ArcView shapefile format; feature type is regions or multi-part shapes. Note attributes for the EO regions coverage are stored in .pateors.

Access Constraints:

The distribution of polygon EO data is restricted to land managers and land owners, although some special circumstances may warrant polygon data. Hence, the enclosed data are CONFIDENTIAL AND SHOULD BE TREATED AS SUCH. The user must comply with any additional criteria specified in the Memorandum of Understanding (MOU) or Data Use Agreement. If other individuals or agencies are interested in these data, contact CNHP's Data Distribution Coordinator directly at (970) 491-7331.

Use_Constraints:

Note that the bounding coordinates, bounding altitudes and taxonomic information reflect statewide values. These data are strictly "on loan" and should be considered "works in progress". Under no circumstances are data to be DISTRIBUTED in any fashion to outside parties. Only element occurrence locations on properties owned or managed by the data receiver can be displayed on external maps. All other maps must be made for internal use only and labeled as such. Acknowledgement of the Colorado Natural Heritage Program would be appreciated in products derived from these data. Please cite this particular dataset as follows: Colorado Natural Heritage Program. 2005. Element Occurrence Polygons. Biodiversity Tracking and Conservation System. Colorado State University, Fort Collins, Colorado, U.S.A. Data exported 05/06/2005.

The element occurrence coverage is a product and property of the Colorado Natural Heritage Program, a sponsored program at Colorado State University. CNHP data are supplemental and care should be taken in interpreting these data. CNHP data include spatial, tabular and narrative components. While element locations are defined by spatial components, the tabular and narrative components define quality and usability of the EO record. To ensure accurate application of CNHP data, tabular and narrative components must be evaluated in conjunction with spatial components. Failure to do so constitutes as misuse of the data.

These data are dependent on the research and observations of many scientists and institutions and reflect our current state of knowledge. Data are acquired from various sources, with varying levels of accuracy, and are continually updated and revised. Many areas have never been surveyed and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. These data should not be regarded as a substitute for on-site surveys required for environmental assessments. Absence of evidence is NOT evidence of absence. Absence of any data does not mean that other resources of special concern do not occur, but rather CNHP files do not currently contain information to document this presence.

The data contained herein are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

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Appendix 2. Colorado State Laws concerning Threatened and Endangered Species.

33-2-101. Short title.

This article shall be known and may be cited as the "Nongame, Endangered, or Threatened Species Conservation Act".

Source: L. 84: Entire article R&RE, p. 862, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. Provisions of this section, as it existed in 1984, were similar to those contained in § 33-8-101 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

33-2-102. Legislative declaration.

The general assembly finds and declares that it is the policy of this state to manage all nongame wildlife, recognizing the private property rights of individual property owners, for human enjoyment and welfare, for scientific purposes, and to insure their perpetuation as members of ecosystems; that species or subspecies of wildlife indigenous to this state which may be found to be endangered or threatened within the state should be accorded protection in order to maintain and enhance their numbers to the extent possible; that this state should assist in the protection of species or subspecies of wildlife which are deemed to be endangered or threatened elsewhere; and that adequate funding be made available to the division annually by appropriations from the general fund.

Source: L. 84: Entire article R&RE, p. 862, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. Provisions of this section, as it existed in 1984, were similar to those contained in § 33-8-102 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

33-2-103. Definitions.

As used in this article, unless the context otherwise requires:

(1) "Management" means the collection and application of biological information for the purposes of increasing the number of individuals within species and populations of wildlife up to the optimum carrying capacity of their habitat and maintaining such levels. The term includes the entire range of activities that constitute a modern, scientific resource program including, but not limited to, research, census, law enforcement, habitat acquisition and improvement, and education. Also included within the term, when and where appropriate, is the periodic or total protection of species or populations. "Management" may include artificial propagation to maintain threatened or endangered species populations, in concert with the exercise of water rights, and may also include restriction of stocking of species which are in competition with threatened or endangered species for the available habitat.

Source: L. 84: Entire article R&RE, p. 863, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. Provisions of this section, as it existed in 1984, were similar to those contained in § 33-8-103 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

33-2-104. Nongame species - regulations.

(1) The division shall conduct investigations on nongame wildlife in order to develop information relating to population, distribution, habitat needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully.

On the basis of such determinations, the commission shall issue regulations and develop management programs designed to insure the continued ability of nongame wildlife to perpetuate themselves successfully. Such regulations shall set forth species or subspecies of nongame wildlife which the commission deems in need of management pursuant to this section, giving their common and scientific names by species and, where necessary, by subspecies. The commission shall conduct ongoing investigations of nongame wildlife and may from time to time amend such regulations by adding or deleting therefrom species or subspecies of nongame wildlife.

(2) The commission shall by regulation establish limitations relating to the taking, possession, transportation, exportation, processing, sale or offering for sale, or shipment as may be deemed necessary to manage nongame wildlife.

(3) Except as provided in regulations issued by the commission, it is unlawful for any person to take, possess, transport, export, process, sell or offer for sale, or ship nongame wildlife deemed by the commission to be in need of management pursuant to this section. Subject to the same exception, it is also unlawful for any common or contract carrier to knowingly transport or receive for shipment nongame wildlife deemed by the commission to be in need of management pursuant to this section.

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Source: L. 84: Entire article R&RE, p. 863, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. This section, as it existed in 1984, was the same as § 33-8-104 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

33-2-105. Endangered or threatened species.

(1) On the basis of investigations of nongame wildlife provided for in section 33-2-104 and other available scientific and commercial data and after consultation with other state wildlife agencies, the Colorado water conservation board, the Colorado water and power development authority, water conservancy districts, and other water conservation districts of the state, and other water resource development agencies within the state, appropriate federal agencies, and other interested persons and organizations, the commission shall by regulation adopted pursuant to the procedures specified in sections 33-1-111 and 24-4-103, C.R.S., establish a list of those species and, where necessary, subspecies of wildlife indigenous to this state which are determined to be endangered or threatened within this state, giving their common and scientific names by species and, where necessary, by subspecies.

(2) The commission shall:

(a) Conduct, by July 1, 1986, and at least once every five years thereafter, a review of all species included in the state lists of endangered or threatened species established pursuant to subsection (1) of this section; and

(b) Determine on the basis of such review whether any such species should:

(I) Be removed from such list;

(II) Be changed in status from an endangered species to a threatened species; or

(III) Be changed in status from a threatened species to an endangered species.

(3) Except as otherwise provided in this article, it is unlawful for any person to take, possess, transport, export, process, sell or offer for sale, or ship and for any common or contract carrier to knowingly transport or receive for shipment any species or subspecies of wildlife appearing on the list of wildlife indigenous to this state determined to be endangered within the state pursuant to subsection (1) of this section.

(4) Except as otherwise provided in this article, it is unlawful for any person to take, possess, transport, export, process, sell or offer for sale, or ship and for any common or contract carrier to knowingly transport or receive for shipment any species or subspecies of wildlife appearing on the list of wildlife indigenous to this state determined to be threatened within the state pursuant to subsection (1) of this section.

Source: L. 84: Entire article R&RE, p. 863, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. Provisions of this section, as it existed in 1984, were similar to those contained in § 33-8-105 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

33-2-105.5. Reintroduction of endangered species - legislative declaration.

(1) The general assembly determines and declares that pursuant to the tenth amendment of the United States constitution, the state of Colorado has primacy over affairs that are of statewide concern and that matters concerning the environment, including the introduction or reintroduction of species that are currently not found or no longer found in this state is a statewide concern and should be conducted by the state through specific legislation. Reintroduction drives enormous land use questions and impacts property and water rights throughout Colorado.

(2) Before any species may be introduced or reintroduced into this state through action by any state or local government entity, the general assembly shall act by bill to specifically name such species and to specify the manner of introduction or reintroduction. The species to be introduced or reintroduced shall be:

(a) Not, or no longer, found in this state; and

(b) A candidate for listing or has been placed in the threatened or endangered species list pursuant to the federal "Endangered Species Act of 1973", 16 U.S.C. sec. 1531 et seq., as amended.

Source: L. 99: Entire section added, p. 415, § 1, effective October 15. L. 2000: (1) amended, p. 23, § 5, effective August 2.

33-2-105.6. Reintroduction of the bonytail and the black-footed ferret.

(1) In accordance with section 33-2-105.5, the general assembly hereby determines that the following species are not currently found in the state and are listed under the federal "Endangered Species Act of 1973", 16 U.S.C. sec. 1531 et seq., as amended, and therefore require approval by the general assembly prior to reintroduction by the division. The general assembly hereby approves the reintroduction of the following species into the state of Colorado:

(a) (I) The bonytail (*gila elegans*).

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(II) The reintroduction of the bonytail shall be conducted consistent with the five-year stocking plan for endangered Colorado river fish species in Colorado, as approved by the Colorado river fishes recovery program biology committee on September 1, 1998, or as may be amended.

(b) (I) The black-footed ferret (*Mustela nigripes*).

(II) The reintroduction of the black-footed ferret shall be conducted consistent with the approach described in the black-footed ferret cooperative management plan dated June, 1995, developed by the division, the United States fish and wildlife service, and the United States bureau of land management. The reintroduction program shall provide for regular updates for the local community on the status of the reintroduction and shall involve representatives of local government and affected interests in resolving issues that may arise during the reintroduction effort.

(2) Reintroduction of the species listed in subsection (1) of this section shall commence before December 31, 2002.

(3) The division shall submit annual reports, no later than January 15 of each year, to the house agriculture, livestock, and natural resources committee and the senate agriculture, natural resources, and energy committee on the status of the reintroduction of the bonytail and the black-footed ferret and the progress towards meeting the goals of the recovery program and the removal of the species from the federal "Endangered Species Act of 1973", 16 U.S.C. sec. 1531 et seq., as amended.

(4) In addition to the requirements of paragraph (b) of subsection (1) of this section, the reintroduction of the black-footed ferret shall be conducted in accordance with the following requirements:

(a) Each annual report prepared pursuant to subsection (3) of this section shall include an assessment evaluating whether the reintroduction of the black-footed ferret will impair any use of private land or beneficial use of water existing at the time of such reintroduction. If the assessment in any annual report concludes that any such use of land will be impaired by reintroduction of the black-footed ferret, the annual report shall also describe the reason for the impact and possible actions to reduce such impact.

(b) Any effort to reintroduce the black-footed ferret in any areas outside the experimental population boundaries described in the black-footed ferret cooperative management plan dated June, 1995, shall require further legislative approval.

(c) The state of Colorado shall ensure enforcement of the provisions of the black-footed ferret cooperative management plan dated June, 1995, up to and including litigation if the memorandum of understanding between Colorado and any federal agency implementing such plan is violated.

(d) If requested, the state of Colorado shall relocate any black-footed ferrets within the state of Colorado that move outside of the experimental population boundaries described in the black-footed ferret cooperative management plan dated June, 1995, into the area originally designated in the plan.

(e) Nothing in the black-footed ferret cooperative management plan dated June, 1995, shall affect current prairie dog management efforts on private lands.

Source: L. 2000: Entire section added, p. 436, § 1, effective April 18.

33-2-105.7. Reintroduction of species - legislative declaration - report.

(1) (a) As used in this section, unless the context otherwise requires, "introduction" means the release of a nonaquatic wildlife species that is currently not found or no longer found in this state into the environment of Colorado, and shall include reintroduction; except that introduction shall not include any nonaquatic wildlife species the actual initial release of which occurred prior to May 24, 2000, or any release that has previously been approved by the general assembly acting by bill.

(b) The general assembly determines and declares that the introduction of species is a matter of statewide concern and should be conducted by the state through specific legislation. Such introduction may cause substantial harm to the state's overall ecosystem, including native plants and animal wildlife. The introduction of wildlife species also has far-reaching impacts on benefits from the use of both public and private lands within the state.

(2) Before any wildlife species may be introduced, the department shall prepare a report that includes, at a minimum, the following information:

(a) The potential ecological and economic impacts, including whether the introduction of a wildlife species will prevent or impair the then-existing use or uses of private land, and the benefits of the introduction;

(b) The probable survival rates of the introduced animals;

(c) The possible impacts should the introduction not take place; and

(d) An assessment evaluating whether the introduction of the wildlife species will impair any use of private land or beneficial use of water existing at the time of such introduction. If the assessment concludes that

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any such use will be impaired by the introduction, the report shall also describe the reason for the impact and possible actions to reduce such impact.

(3) The department shall deliver the report prepared pursuant to subsection (2) of this section to the general assembly, in accordance with section 24-1-136 (9), C.R.S., within thirty days after its completion.

(4) The department shall annually prepare a report for each of the five years after an introduction occurs that shall include, at a minimum, the following information:

(a) The status of the introduction effort;

(b) A report on the estimated survival rates of the introduced wildlife species and their progeny;

(c) If the survival rate of the introduced wildlife species and their progeny is below the initial projected range, an assessment of why the survival rate is lower than expected and the steps that have been considered and put in place to increase survival rates; and

(d) The recovery goals and anticipated timelines of the recovery program.

Source: L. 2000: Entire section added, p. 812, § 1, effective May 24
33-2-106. Management programs.

(1) The division shall establish such programs including acquisition of land or aquatic habitat as are deemed necessary for management of nongame, endangered, or threatened wildlife.

(2) In carrying out programs authorized by this section, the division may enter into agreements with federal agencies or political subdivisions of this state or with private persons for administration and management of any area established under this section or utilized for management of nongame, endangered, or threatened wildlife.

(3) The commission may permit, under such terms and conditions as may be prescribed by regulation, the taking, possession, transportation, exportation, or shipment of species or subspecies of wildlife which appear on the state lists of endangered or threatened species for scientific, zoological, or educational purposes, for propagation in captivity of such wildlife, or for other special purposes.

(4) Upon good cause shown and where necessary to alleviate damage to property or to protect human health, endangered or threatened species may be removed, captured, or destroyed but only pursuant to permit issued by the division and, where possible, by or under the supervision of an agent of the division. Provisions for removal, capture, or destruction of nongame wildlife for the purposes set forth in this subsection (4) shall be set forth in regulations issued by the commission pursuant to section 33-2-104 (1).

Source: L. 84: Entire article R&RE, p. 864, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. Provisions of this section, as it existed in 1984, were similar to those contained in § 33-8-106 as said section existed in 1983, the year prior to the repeal and reenactment of this article.

ANNOTATION

Law reviews. For article, "Plans and Studies: The Recent Quest for a Utopia in the Utilization of Colorado's Water Resources" which discusses endangered species legislation in Colorado, see 55 U. Colo. L. Rev. 391 (1984). For article, "Property Rights and Endangered Species", see 61 U. Colo. L. Rev. 283 (1990).

33-2-107. Regulations.

The commission shall issue such regulations as are necessary to carry out the purposes of this article.

Source: L. 84: Entire article R&RE, p. 865, § 1, effective January 1, 1985.

Editor's note: This section was contained in an article that was repealed and reenacted in 1984. This section, as it existed in 1984, was the same as § 33-8-107 as said section existed in 1983, the year prior to the repeal and reenactment of this article.