Upper Columbia Swallow Habitat Enhancement Project

2021-2025 Final Report

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Executive Summary

The Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) (2021–2025) was developed in response to significant population declines in aerial insectivores, particularly Bank Swallows (*Riparia riparia*) and Barn Swallows (*Hirundo rustica*), both of which are listed as Threatened under the Canadian Species at Risk Act (SARA). The project aimed to increase breeding habitat availability, improve habitat connectivity, support stewardship on working lands, and generate knowledge to inform long-term conservation of swallow populations in the Upper Columbia region of British Columbia. This work was designed to address both local habitat limitations and broader conservation needs for at-risk swallow species.

This project aligns most closely with the Fish and Wildlife Compensation Program's (FWCP) Wetland and Riparian Action Plan (Priority Action 37), which focuses on enhancing wildlife habitat features, and secondarily with the Rivers and Riparian Action Plan (Priority Action 6), which emphasizes improving habitat connectivity. Both actions are identified as the highest priority within FWCP action plans. As such, UCSHEP directly contributes to priority habitat-based conservation objectives identified by FWCP.

Between 2021 and 2025, UCSHEP implemented swallow habitat enhancement and restoration initiatives at 29 sites, representing a significant investment in swallow conservation across the region. Actions included Bank Swallow habitat restoration (e.g., bank re-sloping and vegetation removal), installation of artificial nesting structures (ANS) for both Bank and Barn Swallows, nest cup installations, and disturbance mitigation measures at key sites. Collectively, these efforts increased the availability and distribution of safe nesting habitat across the Upper Columbia.

A major outcome of the project was the substantial expansion in knowledge of swallow breeding distribution. UCSHEP documented 97 Bank Swallow colonies that were active at least once during the study period, building on approximately 30 previously known colonies, and identified 69 Barn Swallow breeding sites comprising 140 nesting structures. These results represent a significant increase in known breeding habitat and provide a critical baseline for future swallow monitoring and conservation planning.

Using a landscape-scale approach based on swallow foraging behaviour, the project is estimated to have enhanced approximately 2,175 hectares of habitat. This reflects the functional ecological footprint of nesting habitat within the surrounding foraging landscape and demonstrates that project benefits extend beyond 'on-the-ground' footprints. As a result, UCSHEP contributed to improved habitat availability and connectivity at a broader spatial scale.

Monitoring results indicated that habitat enhancement can be effective, particularly where natural bank conditions are restored; however, outcomes were variable among sites. A key finding was that many Bank Swallow colonies were unoccupied in 2025 despite being active in previous years, and that burrow occupancy was generally low relative to available nesting habitat. Together, these results suggest that factors beyond nesting habitat availability—such as prey availability, broader environmental conditions, or drivers of population decline occurring outside the breeding season—may be limiting colony occupancy and size. These findings have important implications for conservation, indicating that increasing habitat availability alone may not be sufficient to support population recovery. They also highlight the importance of understanding swallow ecology across the full annual cycle, including post-breeding, migration and

wintering periods. Continued research and monitoring are therefore critical to informing effective conservation strategies for Bank Swallow recovery.

The project also demonstrated the importance of stewardship and engagement. Outreach to landowners, industry, and local stakeholders increased awareness of swallow conservation and contributed to reduced nest removal and improved coexistence at several sites. Volunteer participation and partnerships were critical to project success, enabling expanded monitoring coverage and implementation across multiple land jurisdictions.

Threats identified during the project included recreational disturbance at shoreline Bank Swallow colonies, nest removal at Barn Swallow sites, and habitat alteration. These findings highlight the need for conservation approaches that integrate habitat enhancement with threat mitigation and stewardship. Continuing to address these threats will be essential for improving nesting success and for both swallow species.

Building on UCSHEP outcomes, the Columbia Valley Bank Swallow Conservation Project (2026–2027) is underway to address priority threats, particularly recreational disturbance at colonies along Lake Windermere. This initiative will also continue monitoring at key sites and support adaptive management of conservation actions. These efforts represent a continuation of the work initiated under UCSHEP.

Overall, UCSHEP delivered measurable conservation outcomes by increasing nesting habitat availability, improving habitat connectivity, expanding knowledge of swallow species and their at-risk status, and strengthening stewardship and partnerships. The project provides a strong foundation for continued conservation efforts in the Upper Columbia. Ongoing work will be critical to supporting the long-term persistence of Bank and Barn Swallow populations in the region.

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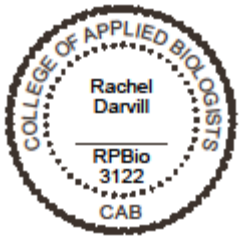

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Table of Contents

Table of Figures

List of Tables

1.0 Introduction

1.1 Background

Bird populations across North America have experienced significant declines over the past several decades. Since 1970, approximately 2.9 billion birds have disappeared from Canada and the United States, representing a 29% reduction in overall bird abundance (Rosenberg et al., 2019). Globally, nearly half of all bird species are experiencing population declines (BirdLife International, 2024). Among the most affected groups are avian aerial insectivores—birds such as swallows, swifts, flycatchers, and nightjars that forage primarily on flying insects. These declines are believed to be driven by multiple factors, including reductions in aerial insect populations, habitat loss, climate change, pesticide use, and changing conditions along migratory routes and wintering grounds.

Two swallow species that breed in the Columbia Valley—the Bank Swallow (*Riparia riparia*) and the Barn Swallow (*Hirundo rustica*)—have experienced substantial population declines across Canada. The Bank Swallow has declined by an estimated 93–98% over the past four decades and was listed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2013 and under Schedule 1 of the Species at Risk Act (SARA) in 2017 (Environment and Climate Change Canada, 2022; COSEWIC, 2013: Smith et al., 2020). Barn Swallows have also experienced major declines, with populations decreasing by approximately 76% in Canada over a similar time period (COSEWIC, 2011). They are blue-listed in British Columbia and were listed as Threatened under SARA in 2017.

Bank Swallows nest colonially in burrows excavated in near-vertical banks composed of friable soils such as silt or fine sand. In the Columbia Valley, suitable nesting habitat is often associated with glacial lacustrine deposits found along riverbanks, lake shores, and exposed slopes. However, natural geomorphic processes that historically created and maintained these vertical banks have been altered through river regulation, shoreline stabilization, land development, and other landscape changes. In particular, the construction of large dams, including the Mica Dam, altered sediment transport and erosion processes along the Columbia River system and likely resulted in the loss of historical Bank Swallow breeding habitat in areas now flooded by the Kinbasket Reservoir.

Barn Swallows build mud nests on anthropogenic structures such as barns, bridges, and other buildings. Changes in agricultural practices and building materials have reduced the availability of suitable nesting sites across many rural landscapes. To address these conservation challenges, biologist Rachel Darvill (Goldeneye Ecological Services) developed and led the Upper Columbia Swallow Habitat Enhancement Project (UCSHEP), a five-year initiative (2021–2025) administered by Wildsight Golden. The project was designed to improve habitat availability for at-risk swallow species while increasing knowledge of swallow populations in the Upper Columbia Valley between Canal Flats and Donald, British Columbia.

The UCSHEP used a multifaceted approach that included identification and monitoring of swallow nesting sites, habitat restoration and enhancement, construction of artificial nesting structures, community engagement, and collaboration with partners to better understand swallow ecology and movements. A key component of the project has been the involvement of volunteer citizen-scientists who assisted with swallow inventory and monitoring throughout the study area.

Although the primary focus of the UCSHEP has been on Bank Swallows and Barn Swallows, Cliff Swallows (*Petrochelidon pyrrhonota*) were also recorded during monitoring activities. While not a focal species for the project, Cliff Swallow nesting sites were documented when encountered, and several colonies were monitored opportunistically. This additional monitoring occurred largely as a result of the strong volunteer participation in the project, which allowed for expanded observation efforts at multiple swallow colonies across the region.

1.2 Statement of Project Need

Despite the presence of suitable foraging habitat throughout much of the Upper Columbia Valley, the availability of suitable nesting habitat varies across the region and may limit breeding opportunities for swallows in some areas. In particular, portions of the North Columbia have relatively few natural vertical banks suitable for Bank Swallow nesting, while some existing colonies are vulnerable to disturbance, vegetation encroachment, or other land-use pressures.

Given the significant population declines experienced by aerial insectivores and the importance of the Columbia Valley for breeding swallows, targeted conservation actions have been needed to identify and conserve existing nesting sites, and expand breeding habitat where it is limited. Habitat restoration and enhancement, combined with monitoring and community engagement, has helped maintain swallow colonies and improve breeding opportunities for these species. The UCSHEP was developed to address these needs through a coordinated, landscape-scale approach. By combining habitat enhancement and restoration, artificial nesting structure installation, long-term monitoring, research collaborations, and community engagement, the project worked to conserve existing swallow colonies while expanding breeding habitat opportunities for two at-risk swallow species in the region.

1.3 Goals and Objectives of the UCSHEP

The UCSHEP was a five-year initiative (2021–2025) developed to address key habitat limitations and knowledge gaps affecting at-risk swallow populations in the Upper Columbia Valley. The project combined habitat enhancement, monitoring, research collaboration, and community engagement to support swallow conservation at both site and landscape scales. The overarching goal was to increase the availability and protection of breeding habitat for at-risk swallow species while improving knowledge of their distribution, habitat use, and conservation needs in the Upper Columbia Valley. To achieve this goal, the UCSHEP pursued the following objectives:

1. Inventory and monitor swallow nesting sites throughout the study area, including Bank Swallow colonies and Barn Swallow nest sites on anthropogenic structures.
2. Enhance and restore breeding habitat through actions such as vegetation removal, slope modification at Bank Swallow colonies, construction of artificial nesting structures, and installation of nest cups on suitable existing structures.
3. Evaluate the effectiveness of habitat enhancement actions through multi-year monitoring at natural colonies, artificial nesting structures, and restored habitats.
4. Collaborate with research partners to improve understanding of Bank Swallow movements and migration through participation in the Motus Wildlife Tracking System.
5. Engage volunteers, Indigenous communities, landowners, and local organizations in swallow conservation through monitoring programs, outreach, and stewardship initiatives.

6. Promote best management practices and increase public awareness of swallow conservation and species-at-risk legislation.

Although the primary focus of the UCSHEP was on Bank Swallows and Barn Swallows, Cliff Swallows were also recorded during monitoring activities when encountered.

1.4 Linkage of FWCP Action Plans and Specific Actions

The UCSHEP aligns most closely with the Fish and Wildlife Compensation Program (FWCP) Columbia Region Action Plan for Wetlands and Riparian Areas. Specifically, the project supported the following priority action:

Wetland and Riparian Action Plan
Action Type: Species of Interest
Priority Action: Habitat-based actions – enhancing wildlife habitat features
Through the restoration and enhancement of swallow nesting habitat and the installation of artificial nesting structures, the UCSHEP directly contributed to improving habitat conditions for at-risk wildlife species associated with wetland and riparian ecosystems.

The project also aligns with the:
Rivers and Riparian Action Plan
Action Type: Cross-Ecosystem Plan
Priority Action: Habitat-based actions – connectivity habitat
By conserving existing swallow colonies and expanding breeding habitat across multiple locations in the Upper Columbia Valley, the UCSHEP contributed to improving habitat connectivity and supporting landscape-scale conservation for aerial insectivores. Through these actions, the UCSHEP supported FWCP's broader objective of conserving and enhancing wildlife populations affected by BC Hydro dams within the Columbia River basin.

2.0 Study Area

The study area for the UCSHEP encompassed the Upper Columbia Valley in southeastern British Columbia, Canada. The project area extended approximately from Canal Flats in the south to Donald in the north, following the Columbia River corridor and associated wetland and riparian ecosystems. This region lies within the Rocky Mountain Trench, a broad north–south valley characterized by extensive wetlands, floodplains, agricultural lands, and forested slopes. Elevations within the study area ranged from approximately 800 meters above sea level on the valley floor to over 2,500 m in the surrounding mountain ranges. The Columbia River and its associated wetlands form the dominant hydrological feature of the region, including the internationally recognized Columbia Wetlands, one of the longest intact wetland systems in North America.

The valley floor contains a mosaic of habitat types including wetlands, riparian forests, open agricultural lands, gravel pits, sand banks, and human infrastructure such as bridges and buildings. These habitats provide important breeding and foraging opportunities for aerial insectivores, including six swallow species. Wetlands and riparian areas are particularly important for swallows because they support abundant populations of aerial insects, which form the primary food source for these birds.

Suitable nesting habitat for Bank Swallows occurs where steep, near-vertical banks composed of friable substrates such as fine sand or silt are exposed. In the Columbia Valley, these substrates are often associated with glacial lacustrine deposits along riverbanks, lake shores, and other eroding slopes. However, suitable habitat is not evenly distributed across the study area. While portions of the valley between Canal Flats and Brisco contain numerous natural banks suitable for Bank Swallow nesting, fewer suitable nesting sites occur farther north due to differences in geology, land use, and geomorphic processes.

High streamflow and erosional processes are key drivers in maintaining the vertical bank habitats required by breeding Bank Swallows (Golet et al., 2025). River regulation has influenced the availability of suitable Bank Swallow habitat. In particular, the construction of Mica Dam and the resulting Kinbasket Reservoir inundated sections of the Columbia River valley and likely resulted in the loss of historical Bank Swallow nesting habitat in the North Columbia region. Barn Swallows rely primarily on anthropogenic structures for nesting, including barns, bridges, sheds, and other buildings. As a result, Barn Swallow nesting sites are distributed throughout rural and agricultural areas of the Columbia Valley where suitable structures are present.

The UCSHEP study area includes a mixture of public and private lands, including provincial parks, wildlife management areas, agricultural lands, and residential properties (Figure 1). Many swallow nesting sites occur on private land, making landowner collaboration an important component of this project. Within this landscape, the UCSHEP focused on identifying swallow nesting locations, monitoring colonies and nest sites, and implementing habitat enhancement projects at locations where suitable nesting habitat could be created, restored, or protected.

Figure 1. Project area in the Columbia Valley, British Columbia, Canada.

3.0 Methods

3.1 Project Start-Up and Coordination

Project start-up activities involved coordinating partnerships, securing site access, recruiting volunteers, and maintaining communication with landowners and partner organizations. Collaboration occurred with multiple organizations and agencies whose lands or activities intersect with swallow habitat, including BC Parks, the Ministry of Water, Land and Resource Stewardship (WLRS), Kicking Horse Mountain Resort, Panorama Resort, Pacific Woodtech, Canfor, Terus Construction, Ducks Unlimited Canada (DUC), The Nature Trust of BC (TNTBC), Canadian Pacific Kansas City Railway (CPKC), Town of Golden, District of Invermere, numerous private landowners, and other regional partners.

A strong emphasis was placed on initial inventory and identification of swallow nesting sites across the study area. A broad public outreach campaign was undertaken to solicit information on the location of Bank Swallow colonies and, in particular, Barn Swallow nest sites, which frequently occur on private residences and outbuildings. This outreach included posters, social media, website updates, press releases, farmer's markets, and direct communication with landowners and community members. This effort resulted in the identification of numerous previously undocumented nesting locations across the region.

Regular communication and site visits occurred with private landowners and land managers to discuss swallow conservation, artificial nest cup placement, and strategies for coexisting with nesting swallows. Particular attention was given to large Barn Swallow colony sites located on industrial or commercial properties where landowner/land management cooperation was essential for maintaining nesting habitat. The project also maintained communication with Indigenous Nations in the region, including the Shuswap Band and ʔakisq̓nuk Nation, regarding opportunities for collaboration and monitoring of swallow colonies located on Indigenous lands. Volunteers were recruited through posters, social media, website updates, press releases, farmer's markets, and electronic newsletters. Volunteer participation was a core component of the project, allowing monitoring to occur across a large geographic area while also increasing community awareness of swallow conservation.

3.2 Field Work

Field work was conducted throughout the study area between Canal Flats and Donald. Field work focused on inventorying and monitoring potential nest sites, monitoring known swallow nest sites, and evaluating the effectiveness of habitat enhancement actions implemented throughout the project. This included both natural nesting locations and enhancement sites, including Bank Swallow colonies located in natural banks, Barn Swallow nests located on anthropogenic structures, artificial nesting structures, restoration and enhancement works constructed through the project, and nest cups installed on pre-existing structures. Monitoring visits were conducted by project staff and trained volunteers and were coordinated with partner organizations where possible to increase coverage across the region. Natural nesting sites were also monitored and each species had its own monitoring protocol.

3.2.1 Bank Swallow Colony Monitoring

Bank Swallow colonies were located, documented, and monitored throughout the study area to record the presence of Bank Swallows each year, and breeding activity levels (number of active burrows/nests)

where possible. The entirety of the Columbia River was surveyed for Bank Swallow colonies by kayak. Columbia Lake was inventoried by motorboats provided by volunteers, and Lake Windermere was inventoried in collaboration with the Lake Windermere Ambassadors with a small boat provided by the District of Invermere. After colony locations were identified, they were typically surveyed three times annually during the breeding season, with visits occurring between mid-June and mid-July to capture peak nesting activity. Where only one or two visits were possible, surveys were conducted during early to mid-July when adults were actively provisioning young and detection of active burrows was highest. Additional observations outside of this window were used to document arrival and burrow excavation timing.

New colonies encountered were recorded using GPS coordinates and detailed location descriptions. At each colony, observers recorded total number of usable burrows (structurally intact; older or collapsed burrows were not included in counts of usable nesting habitat), number of active burrows, number of adult Bank Swallows present, breeding activity or stage, presence of other burrow-nesting species, general colony condition, and notable observations including (potential) threats to the colony. Additional metadata was collected at each colony including colony habitat-type, dominant habitats within 200 meters of the colony, whether it was human made (e.g., mine pit) or not, distance to nearest colony, detailed access descriptions. Active burrows were identified based on direct observation of birds entering or exiting burrows, or the presence of nestlings visible at burrow entrances. Observations were conducted from a distance using binoculars to minimize disturbance to colonies.

To improve accuracy in counting burrows and identifying active nests, photographs of colony faces were used as reference maps. Observers marked active burrows on printed or digital photographs across successive visits to track burrow use and improve consistency in counts over time. This approach was particularly important at large or complex colonies where burrow density was high. Monitoring visits typically lasted a minimum of 30 minutes. No particular time of day was preferred for surveys, but they were done when there was no precipitation. Observations were conducted from vantage points that allowed clear visibility of colony faces while minimizing disturbance to birds. Where observed, the presence of other species using burrows was recorded (i.e., Northern Rough-winged Swallow, Belted Kingfisher, Violet-green Swallow). Data collected from colony monitoring were used to estimate relative colony size (number of breeding pairs), track changes in colony occupancy over time in some cases, and evaluate the effectiveness of habitat enhancement efforts.

3.2.2 Barn Swallow Nest Monitoring

Barn Swallow nesting activity was monitored at a subset of nest sites throughout the study area, including agricultural buildings, residential structures, bridges, industrial facilities. UCSHEP created artificial nesting structures, and locations where artificial nest cups were installed. Monitoring was conducted to document breeding phenology, nest locations, threats to nest sites and reproductive success. Nest monitoring was conducted from early May through late August or mid-September, corresponding with the Barn Swallow breeding season. Nest sites were typically visited once per week, where feasible, throughout the nesting period, although monitoring frequency varied depending on site accessibility and volunteer capacity. The time spent monitoring varied greatly across sites, but they did allow sufficient time to observe nest activity.

Surveys were usually conducted during periods of high bird activity, typically early morning or late afternoon, and under favourable weather conditions (i.e., low wind and minimal precipitation) to maximize detection of swallow activity. At each site, all visible nests were recorded, including new, active, and inactive nests. Observations focused on behavioural indicators to determine nest status, including adult presence at or near nests, incubation behaviour, adults carrying food or removing fecal sacs, presence of nestlings (visual or auditory cues), and evidence of fledging.

Where possible, observers recorded nest stage (e.g., nest building, egg laying, incubation, nestling, fledged) and nest outcome (successful or failed). Barn Swallows are known to produce multiple broods per season, and monitoring protocols were designed to capture breeding activity across successive nesting attempts. Nest locations were documented for each site, and where multiple nests occurred, site maps and/or photographs were used to ensure consistent identification of individual nests (or nesting structures) across visits. New nest sites encountered during the monitoring period were recorded using GPS coordinates and detailed location descriptions.

Monitoring was conducted from a distance using binoculars to minimize disturbance to nesting birds. Observations were designed to reduce the risk of nest abandonment or premature fledging, particularly during sensitive nesting stages. Data collected through nest monitoring were used to assess nest site use, productivity, spatial distribution, and to inform UCSHEP's conservation planning efforts.

3.2.3 Cliff Swallow Monitoring

Cliff Swallow colonies were monitored as a secondary, targeted component of the project, primarily when sufficient volunteer capacity was available after all priority Bank and Barn Swallow monitoring sites had been assigned. While not a focal species, Cliff Swallows are also experiencing population declines (Smith et al., 2020), and monitoring efforts were undertaken to contribute to a broader understanding of Cliff Swallow distribution within the study area. Monitoring focused on known Cliff Swallow colonies, locations that were primarily identified through UCSHEP's inventory efforts for Barn Swallows.

Colonies were typically visited a minimum of three times during the breeding season, between mid-May and late July, with approximately 10–14 days between visits. During each visit, observers recorded total number of nests present, number of active nests based on adults entering or exiting nests or presence of young, number of adults observed, general adult behaviour, colony substrate or structure type, and weather and environmental conditions. Counts focused on complete nests, with partial or inactive nests noted where relevant. Monitoring was conducted from a distance to minimize disturbance to nesting birds. This targeted monitoring approach allowed the project to expand data collection to an additional at-risk aerial insectivore without compromising core monitoring objectives for Bank and Barn Swallows.

3.3 Bank Swallow Habitat Restoration and Enhancement

Habitat enhancement projects were implemented throughout the study area to increase the availability of suitable breeding habitat for Bank Swallows by restoring or creating steep, friable substrates required for burrow excavation. These enhancement approaches were designed to address both the lack and loss of natural nesting habitat and the degradation of existing colony sites, and were applied across a range of site conditions.

3.3.1 Bank Restoration and Slope Enhancement

At the Athalmer Neighborhood Restoration Site, and in collaboration with the District of Invermere, a large anthropogenic sandy substrate pile located adjacent to an existing Bank Swallow colony (Figure 2a) was mechanically re-shaped using heavy equipment (Figure 2b) (Darvill, 2024; Darvill, 2025). Prior to restoration, the slope had gradually sloping and vegetated faces that limited nesting suitability (Figure 2a). Excavation and re-contouring created a vertical face composed of friable material suitable for burrow excavation (Figure 2b). Work was conducted outside of the breeding season to avoid disturbance.

At Birchlands Creek, within the Columbia Wetlands Wildlife Management Area, habitat enhancement was undertaken to restore Bank Swallow nesting opportunities in an area where an active colony had previously occurred but where suitable nesting habitat had been lost following collapse of the occupied bank. Project planning identified Birchlands as an important restoration site because habitat for Bank Swallows is limited in the northern portion of the UCSHEP focal area, and this site had supported a colony until 2020. The enhancement approach was to repurpose anthropogenically created substrate piles already present at the site and reshape them into near-vertical nesting faces suitable for Bank Swallow burrow excavation.

The Birchlands works used an excavator to modify two existing substrate piles created through previous CPKC Rail excavation activities associated with bedrock removal and protection of nearby bridge infrastructure. The proposed treatment created slopes of approximately 70–90 degrees, consistent with the near-vertical bank conditions required by Bank Swallows for breeding (Darvill, 2025). One pile on the north side of the creek was located approximately 12 m from the natural creek bank, and the second on the south side was approximately 7 m from the natural creek bank. Access to the south-side pile required a rail bridge crossing by the excavator (with CPKC's permission), and access to the site overall required crossing private land with landowner permission obtained. Work was scheduled within the approved regional timing window and conducted outside the breeding season to avoid disturbance to nesting birds. Planning and implementation involved coordination with multiple parties, including MWLRS, CPKC Rail, the private landowner, and archaeological review requested by the province prior to works proceeding.

At Windermere Lake Provincial Park and in partnership with BC Parks, restoration efforts addressed both habitat structure and anthropogenic disturbance. Restoration actions included mechanical re-sloping of the nesting face to restore a near-vertical bank, deactivation of informal trails that intersected the colony, installation of rope barriers to restrict access to sensitive areas, and installation of regulatory and interpretive signage to reduce disturbance and increase public awareness (Figures 3a & b) (Darvill, 2022; Darvill, 2023; Darvill, 2024; Darvill, 2025). These actions were implemented in response to documented impacts including trampling, burrow disturbance, and unauthorized access through active colony areas.

Additional measures were implemented to protect and maintain existing Bank Swallow colonies, recognizing that habitat degradation and disturbance are key limiting factors. Vegetation removal was conducted at a colony site in the Blaeberry to maintain open flight paths and preserve visibility of nesting faces. Encroaching shrubs and small trees were selectively removed to reduce obstruction, improve access to nesting areas, and reduce potential predator perching opportunities.

(a)

(b)

Figure 2. (a) Substrate pile at Athalmer prior to enhancement for Bank Swallows; (b) post-enhancement condition, showing the re-sloped substrate mound with active Bank Swallow burrows visible across the slope.

(a)

(b)

Figure 3. Restoration and access management at Windermere Lake Provincial Park. (a) Barriers and signage; (b) interpretive signage and restored nesting bank.

3.3.2 Artificial Nesting Structure for Bank Swallows

The project piloted the construction of an artificial nesting structure (ANS) for Bank Swallows at Spike Elk Farm / Moberly Marsh on land owned by Ducks Unlimited Canada (DUC). This site was selected because it occurs within an open, wetland-associated landscape with abundant aerial insect prey, lies between existing Bank Swallow breeding areas, and helps address a gap in suitable nesting habitat in the northern portion of the Columbia Valley. The site is adjacent to Burgess James Gadsden Provincial Park and forms part of a larger floodplain and wetland complex where hydrologic restoration is being planned, making it a strong candidate for long-term habitat enhancement. The project rationale also recognized that this location is relatively close to areas where Bank Swallow breeding habitat was lost following the creation of the Mica Dam and Kinbasket Reservoir.

The ANS was designed to mimic natural Bank Swallow nesting habitat while also incorporating structural elements intended to improve nest persistence and predator protection. The design consisted of two concrete slab walls, each approximately 2.1 m wide, 2.4 m high, and 15 cm thick, installed side-by-side and supported by wooden posts (Figure 4). The rear of the walls was backfilled with sandy substrate suitable for burrow excavation, and additional sandy embankments were created along the sides of the structure to provide further nesting habitat. The concrete walls were drilled with holes to encourage nesting within the structure itself, reflecting design concepts used successfully in Quebec (e.g., Berube & White, 2024; Écogénie Inc., 2024; Laberge & Houde, 2015). Approximately 160 yd^3 of substrate was trucked in to create the structure, covering an area of about 55 m^2. Low native vegetation was planted on the upper surfaces of the sandy banks to stabilize the substrate and reduce digging access by predators such as skunks, coyotes, and domestic dogs (Darvill, 2024).

This structure represents a pilot application of a Bank Swallow ANS in British Columbia. While smaller than examples developed in Quebec, the structure applies the same core design principles. The reduced scale reflects higher-than-anticipated construction costs, highlighting important considerations for future design and implementation. As such, the structure serves both as a local habitat enhancement measure and as a pilot to inform future projects in the province.

Figure 4. Artificial nesting structure for Bank Swallows constructed at Spike Elk Farm / Moberly Marsh.

3.4 Artificial Nesting Structures and Nest Cups for Barn Swallows

Barn Swallows rely heavily on anthropogenic structures for nesting; however, the availability and suitability of these structures have declined due to modern building materials (e.g., open wooden barns replaced with metal and closed structures), changes in agricultural practices, and increased removal of nests from buildings. These changes have reduced the availability of suitable nesting substrates and contributed to broader declines in Barn Swallow populations. As a result, the creation of alternative nesting opportunities is an important conservation strategy for this species.

Recognizing that there is no single optimal design for artificial nesting structures for Barn Swallows, the UCSHEP incorporated a structured, adaptive approach to testing different ANS designs. The intent was that results would inform future swallow conservation efforts both regionally and beyond. Given that many organizations—including BC Parks, Parks Canada, BC Hydro, and industry partners—are actively seeking to enhance swallow habitat, this work provides valuable applied knowledge for a growing field of conservation practice.

To address habitat limitations, the project implemented both artificial nesting structures (ANS) and artificial nest cup installations across the study area from 2021–2025. Artificial nesting structures were constructed using a range of designs to evaluate which configurations were most effective. Design variables included structure size (12’ × 18’; 18’ × 24’), degree of enclosure (or openness), roof type (peaked or slanted), and placement relative to surrounding habitat (Figures 5a/b). Two different types of insulation were used: rockwool and a reflective vapour barrier. One structure (Parson Air B&B) was designed to provide multi-species benefits, incorporating features suitable for bat roosting in addition to swallow nesting.

Artificial nest cups were installed on both artificial structures and existing buildings, including barns, industrial facilities, and residential structures. Nest cups provide a stable base for nest construction and can improve nesting success on modern building materials where adhesion is otherwise limited. They were also used strategically to encourage nesting at suitable locations and reduce conflicts between swallows and landowners. All nest cup and structure installations were completed in collaboration with landowners and partner organizations, with ongoing communication with landowners regarding maintenance and coexistence strategies. This collaborative approach helped ensure long-term support for swallow conservation measures at each site.

(a)

(b)

Figure 5. Barn Swallow artificial nesting structures (ANS). (a) 12’ × 18’ with peaked roof and metal predator guard installed along the base; and (b) 18’ × 24’ with slanted roof type.

3.5 Threats and Disturbance Observations

During monitoring visits, observers recorded evidence of threats and disturbances affecting swallow colonies and nesting structures. Observations included, but were not limited to, human disturbance, nest removal, predation, habitat alteration, and mortality events. Threat observations were recorded opportunistically during routine monitoring and site visits. Additional records of mortality events and nest removal were compiled separately based on field observations and reports received during the project period. Due to the opportunistic nature of these observations, threat data are presented as qualitative summaries and minimum counts rather than comprehensive or standardized estimates of frequency.

3.6 Volunteer Monitoring and Training

Volunteers were typically trained through one-on-one, site-based training sessions conducted by the project biologist and assistant. This approach ensured volunteers were familiar with site-specific monitoring protocols and conditions. Species-specific monitoring protocols were developed by previous projects and the UCSHEP built upon the foundations of those protocols previously developed [(BANS TAC, 2017; Bird Studies Canada, 2010; British Columbia Swallow Conservation Project. (n.d.)]. Volunteers contributed significantly to monitoring coverage and also helped identify new nesting sites through ongoing inventory efforts.

3.7 Effectiveness Monitoring of Enhancement Sites

A core component of the UCSHEP was the evaluation of enhancement effectiveness across all restoration and artificial nesting sites. Effectiveness monitoring was conducted at Bank Swallow restoration sites, Bank Swallow ANS and enhancement sites, Barn Swallow ANSs, and Barn Swallow nest cup installations. Monitoring assessed presence or absence of swallows, number of active nests or burrows, evidence of breeding success where observable, and structural condition and any maintenance requirements. Data from effectiveness monitoring were used to evaluate which enhancement approaches were most successful, identify factors influencing site occupancy, inform adaptive management and future enhancement design, and provide guidance to land managers and conservation practitioners.

3.8 Motus Wildlife Tracking Collaboration

In collaboration with Environment and Climate Change Canada (ECCC), Motus Wildlife Tracking System infrastructure was installed by UCSHEP in the Columbia Valley to support Canada-wide research on Bank Swallow migratory connectivity. Over the course of the project, three large free-standing Yagi antenna stations were established at Brisco, on Shuswap Band land, and at Windermere Lake Provincial Park. Four smaller stations with single omni-directional antennas were also installed. Two of these smaller stations were hosted by The Nature Trust of BC at Columbia Lake North Wetlands and Hoodoos properties.

Together with ECCC, Bank Swallows were captured, banded, and tagged at two colonies in 2022 and 2023: one on Shuswap Band land and one on Columbia National Wildlife Area (Wilmer Unit). Fifty birds were tagged in each year, with 25 birds tagged at each colony. Feather samples were also collected from birds in hand for stable isotope analysis. ECCC collaborations occurred with a Cambridge University Master's student who analyzed Motus detection data from birds tagged as part of the broader Canada-wide Bank Swallow migratory connectivity initiative. At the time of writing, work on the feather isotopes on samples collected through this banding effort is still underway by ECCC. The goal of the Canada-wide Motus effort

is to use a combination of tracking with the Motus Wildlife Tracking System and stable isotopes to determine migration routes and winter locations for Bank Swallow populations that are experiencing different trends across the breeding range in Canada (T. Imlay, personal communication, November 2021).

3.9 Data Management and Analysis

Field data were recorded by project staff and volunteers using standardized field forms and online spreadsheets. Species-specific monitoring data were entered into project spreadsheets for compilation, review, and analysis. Spatial information for swallow nest locations and enhancement sites was maintained and updated in GIS format throughout the project.

Inventory data were formatted to meet provincial database standards and were prepared for submission to provincial and federal agencies. Data were also used to support broader recovery and habitat-planning initiatives, including ongoing efforts to identify critical habitat for Barn Swallows and to support improved understanding of important breeding areas for Bank Swallows.

Summary analyses focused on documenting nesting distribution, enhancement uptake, site occupancy, breeding activity and nest descriptions at Barn Swallow breeding sites. Spatial datasets were also used to update shapefiles of known nesting locations and enhancement projects and to support regional conservation planning, including discussions related to Key Biodiversity Area values in the Columbia Valley.

3.10 Volunteer Participation, Partnerships, and Outreach Delivery

Volunteer participation was a core component of project delivery, supporting monitoring, inventory, and stewardship activities across the study area. Volunteers contributed to data collection at swallow nesting sites, including Bank Swallow colonies, Barn Swallow nesting structures, and Cliff Swallow locations. This approach enabled broad spatial coverage and repeated monitoring across the Upper Columbia region. Volunteer training was delivered primarily through site-based instruction, with new participants typically trained individually at their assigned monitoring locations. Supporting materials included written monitoring protocols, online resources, and regular communication through email updates. This approach allowed for adaptive training based on site conditions and participant experience.

A range of outreach and communication activities were implemented to support project objectives. These included digital communications (e.g., e-newsletters, website updates, and social media), print materials (e.g., posters and brochures, press releases), interpretive signage, public presentations, and participation in community events. Outreach efforts were designed to increase awareness of swallow conservation, support volunteer recruitment, and encourage reporting of nesting locations.

Interpretive signage was installed at enhancement and restoration sites to inform the public about swallow ecology, species-at-risk status, and the sensitivity of nesting areas. In some cases, signage content was developed in collaboration with the Ktunaxa Nation and Shuswap Band (Secwépemc Nation), incorporating Indigenous perspectives and knowledge. These materials supported both education and protection of nesting sites.

Engagement with private landowners and land managers was an important component of project delivery. Site visits were conducted to support nest monitoring, assess habitat suitability, facilitate

installation of nesting structures or nest cups, and provide information on best management practices. These interactions also supported stewardship and helped reduce potential conflicts between swallows and human activities. Community members were also engaged through volunteer opportunities, public presentations, and field-based learning experiences. These activities supported knowledge sharing, increased awareness of swallow conservation, and contributed to broader participation in monitoring and stewardship efforts.

4.0 Results and Outcomes

4.1 Habitat Enhancement, Restoration, and Effectiveness Monitoring

Between 2021 and 2025, a total of 29 swallow habitat enhancement and restoration project areas were implemented across the study area (Appendix 1; Figure 6). These included Bank Swallow habitat restoration and slope enhancement, one Bank Swallow artificial nesting structure (ANS), Barn Swallow artificial nesting structures, nest cup installations on pre-existing structures, and smaller-scale maintenance and protection measures.

4.1.1 Bank Swallow Habitat Restoration and Enhancement

Bank Swallow habitat restoration produced variable outcomes across sites, with rapid uptake observed at some locations and no use recorded at others during the monitoring period. At the Athalmer Neighbourhood site, restoration resulted in immediate and substantial use. In 2024, approximately 400 total burrows were documented, including 195 active nests. In 2025, the site was visited 12 times, with a peak of 246 total available burrows and 36 active nests (Figure 2b).

At Birchlands Creek, restoration works were completed in November 2024. Monitoring in 2025 documented no Bank Swallow use during the first breeding season post-construction. At the Blaeberry site, vegetation removal was completed in 2022 to improve access to previously occupied habitat. Monitoring in 2023–2025 documented no Bank Swallow use, although Northern Rough-winged Swallows were observed annually breeding at the site, and 26 useable burrows were present in 2025. A single Bank Swallow artificial nesting structure was constructed at Spike Elk Farm / Moberly Marsh in fall 2024. Monitoring during the 2025 breeding season documented no use by Bank Swallows.

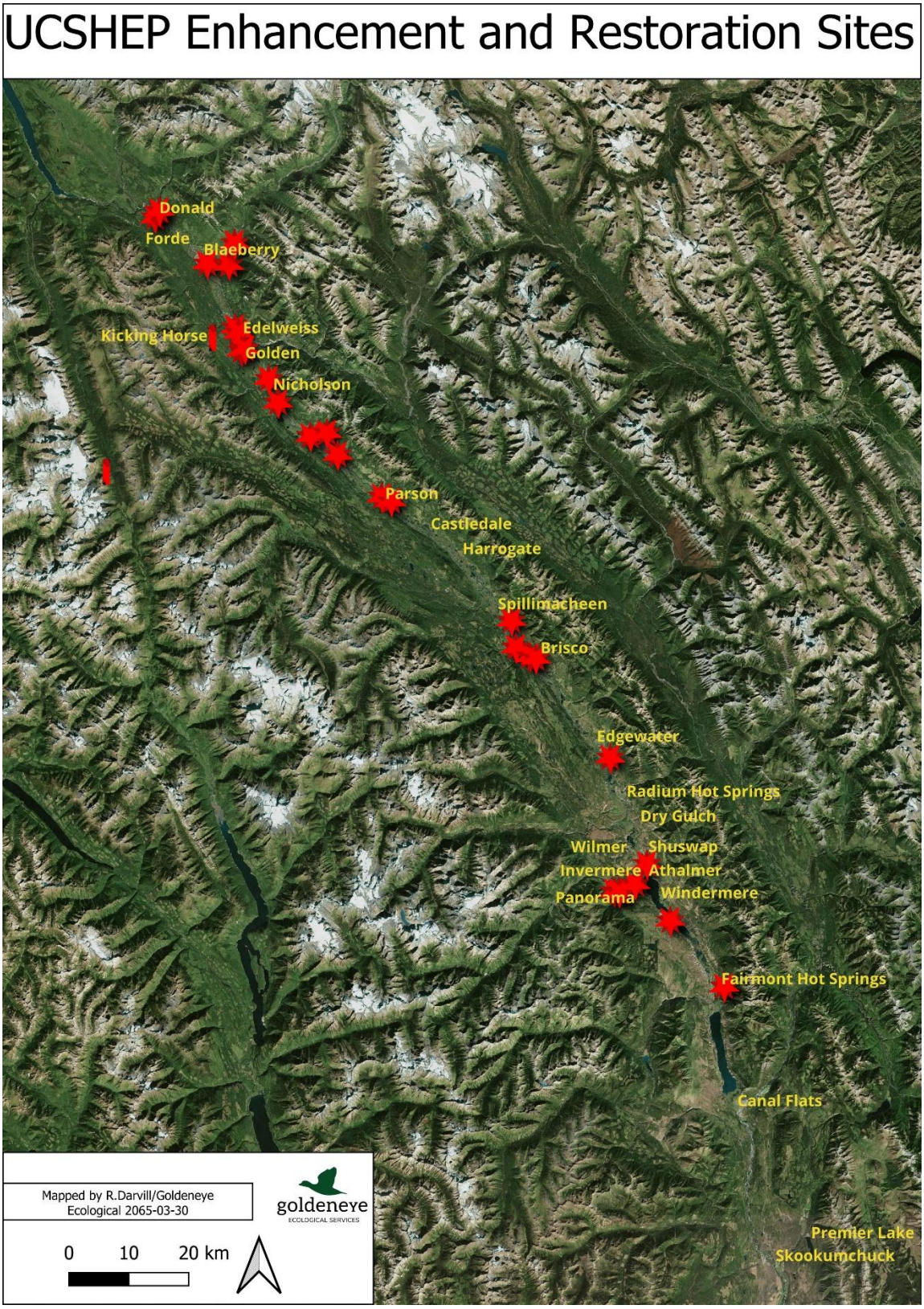

Figure 6. Map depicting the locations of all UCSHEP enhancement projects across the Upper Columbia Valley, as well as Bank Swallow and Barn Swallow breeding sites.

4.1.2 Barn Swallow Artificial Nesting Structures and Nest Cups

A total of seven Barn Swallow artificial nesting structures (ANSs) were constructed between 2021 and 2023. Five structures were 12' × 18' and one was 18' × 24', while two additional 18' × 24' structures were planned but not completed after landowners withdrew from agreements. Among the constructed structures, two had peaked roofs and four had slanted roofs, and the Parson Air B&B incorporated a mixed roof design (Figure 7). The Parson Air B&B was developed as a multi-species structure to support both bats and Barn Swallows and was constructed in collaboration with the Wildlife Conservation Society, the Lake Windermere District Rod and Gun Club, and community volunteers.

Use of artificial nesting structures varied among sites and years, with evidence of nesting, repeated use, and nest-building activity observed at several locations (Table 1). At the Zehnder ANS, one nest was recorded in 2022, followed by increased use in subsequent years. In 2024, two nests produced three and five fledglings, respectively, and in 2025, repeated nesting at the same site produced four and six fledglings, while one additional nest cup contained an egg that was later abandoned.

At the Parson Air B&B ANS, monitoring in 2025 documented Barn Swallow activity in multiple nest cups, including fecal deposits, nesting material, and one old egg (Figure 8) (Table 1). At the Donald ANS, two nest cups contained grass in 2025. At Sole's ANS, four nest cups contained twigs and vegetation indicating nest-building activity. These observations suggest active prospecting and early-stage nesting behaviour at those structures, even where full nesting attempts were not confirmed. Repeated use was also observed at The Nature Trust (TNT) of BC Edgewater structure; one active nest was documented in 2023, 2024, and 2025, indicating consistent reuse of the same nesting location (Table 1). Use by non-target species was also recorded, including three active American Robin nests at the Golden ANS in 2025 (Table 1).

A total of 109 nest cups were installed throughout the study area between 2021 and 2026, including installations on both artificial structures and pre-existing buildings (Table 2). Use of nest cups on pre-existing structures was documented in multiple years. In total, 17 of the nest cups saw some degree of use (Table 2).

4.1.3 Effectiveness Monitoring and Maintenance

Effectiveness monitoring was conducted at all enhancement sites to assess occupancy, nesting activity, and structural condition. Volunteer participation supported monitoring across enhancement sites, which led to the development of some adaptive management actions. Artificial nesting structures were generally in good condition, with only minor maintenance required. Maintenance actions included replacement of damaged boards at the Town of Golden structure and minor footing repairs at select sites.

Adaptive management actions were implemented at some sites to improve nesting success and address site-specific limitations. Predator guards were installed at two Barn Swallow artificial nesting structures following the 2025 breeding season in response to observed mammalian activity, including a Pine Marten depredating American Robin nests and a Red Squirrel occupying a structure. These measures included the installation of metal sheeting around the base of structures (Figure 5a) and the addition of a perching wire at a site where suitable perching habitat was lacking.

At some sites, salvaged nests from locations where removal was required were used to seed structures, and mud was applied near nesting areas as a visual cue to encourage occupancy by prospecting Barn

Swallows. Other modifications included installation of nesting substrates (e.g., long nails and wooden dowels), extension of eaves to attract Barn Swallows, and vegetation clearing to improve flight access in 2025.

Figure 7. Parson Air B&B, designed to meet the habitat requirements for breeding Barn Swallows and roosting bats.

Figure 8. Nest cup inside the Parson Air B&B structure, as seen during effectiveness monitoring in 2025.

Table 1. Summary of Barn Swallow artificial nesting structure type, overall effectiveness, and type of use.

Name	Date of completion	Enhancement type	# of nest cups	Size of area enhanced or restored (in hectares)	Insulated roof vs reflective material	Overall effectiveness of enhancement (2021-2025)	Evidence of nesting or prospecting birds (Y/N)	Species using structure
Donald ANS	7-1-2021	12x18 ANS/nest cup installation	8	75	rock wool insulation and reflective vapour barrier	18 site visits. Two nest cups with grass fragments seen in them with 5-7 BARS flying close by between the ANS and the old mill in August 2025. Often BARS seen flying around the old mill. Some structures at the old mill were removed winter of 2025-2026.	Y	Unknown, suspect Barn Swallow
Wharton's ANS	10-16-2023	12 x 18 ANS/nest cup installation	8	75	reflective vapour barrier	At least 5 site visits since 2023.No Barn Swallow activity.	N	
Golden ANS	4-1-2022	18x24 ANS/nest cup installation	8	75	rock wool insulation and reflective vapour barrier	47 site visits since 2022. No BARS nesting/activity although several robins nested there. A Pine Marten was seen in ANS in May 2024. Tin was placed on exterior of the building in fall 2025, to prevent predators from accessing interior.	Y	American Robin
Parson Air B&B (bat/swallow)	7-1-2023	bat/swallow ANS	8	75	rock wool insulation	12 site visits. Sept 2025 was the first time activity had been seen with 4 nest cups having been active. One nest cup had feces under it. The second one had one old egg in it but little feces below. The third and fourth nest cups had some nesting material but no feces below.	Y	Barn Swallow
Sole's ANS	7-1-2022	12x18 ANS/nest cup installation	8	75	reflective vapour barrier	43 site visits since 2022, when ANS constructed. In July 2025 twigs were seen in the nest cups.	Y	Unknown species, suspect Barn Swallow
Nature's Paradise ANS	Sept 2022 ANS, April 2023 nest cups	12x18 ANS/nest cup installation	8	75	rock wool insulation and reflective vapour barrier	14 site visits. A lot of bird droppings seen in the ANS by landowner. Nest cups haven't been used since installation.	N	
Zehnder ANS	7-1-2021	12x18 ANS/nest cup/installation	8	75	reflective vapour barrier	58 site visits. One nest cup used successfully two times, with a third time abandoned with one egg, and 4th time abandoned after initial nest rebuilding. One natural mud nest used three times successfully.	Y	Barn Swallow

Table 2. Number, location, and use of nest cups installed across the study area.

Nest Cup Site	Date of install	Easting	Northing	No. of nest cups	No. of nest cups used	Regional District	Notes in 2025
Donald ANS	June 2021	487246	5704111	8	2	CSRD	Two nest cups had grass in them
Donald Mill 2	Spring 2025, Spring 2026	487982	5705246	5	1	CSRD	Successful nest. Installed in spring 2025
Kettleston Rd	May 24, 2022	499575	5696234	1	0	CSRD	Not used
Wharton's ANS	April 2024	500650	5685737	8	0	CSRD	Not used
Golden Mill (Pacific Woodtech)		501203	5684894	2	NA	CSRD	Nest cups provided, but uncertain if they were installed
Golden ANS	April 2022	501682	5681909	8	0	CSRD	Not used
Golden School Bus Barn	Spring 2024	502266	5682205	2	0	CSRD	Not used
Murphy House	June 7, 2023	506242	5677169	1	0	CSRD	Not used
Sigi's - Horse Creek	May 2021	507793	5673221	2	0	CSRD	Not used
Tobler Farm Garage	May 2021	515960	5668162	5	2	CSRD	Two used; 1 additional with droppings underneath
Pole Barn - Hwy 95	May 2021	517736	5664520	4	0	CSRD	Not used
Parson Air B&B (bat/swallow)	March 2024	525110	5657549	8	4	CSRD	3 nest cups used
Sole's ANS	July 2022	526705	5656771	8	4	RDEK	Not used
Owens House	Spring 2024	546800	5636814	2	1	RDEK	One nest cup used by robins
Warner's (Hay shed)	May 2021	547533	5632349	3	0	RDEK	Not used
Nature's Paradise ANS	April 2023	547550	5632359	8	0	RDEK	Not used
Trescher Barn 1	May 2023	549897	5630865	4	2	RDEK	Once nest cup uysed by Barn Swallows; 1 by robins
BPP Mill		550852	5630519	2	0	RDEK	Sintalled in spring 2026.
Edgewater TNT	April 2024	563283	5613984	8	0	RDEK	Not used
Zehnder Ranch Pumphouse	April 2022	563946	5591652	2	0	RDEK	Not used
Zehnder ANS	July 2021	563993	5591653	8	1	RDEK	Nest cup used, had an egg, but was abandoned.
Zehnder Ranch Wood Shed	April 2022	564791	5591570	3	0	RDEK	Not used
Burkart Barn	May 2024	567464	5592887	4	0	RDEK	Not used
Fairmont HS Resort 5	Spring/Summer 2022	582291	5575752	1	0	RDEK	Not used
Fairmont HS Resort 2	Spring/Summer 2022	582357	5575782	1	NA	RDEK	Removed
Fairmont HS Resort 1	Spring/Summer 2022	582360	5575780	1	0	RDEK	Not used
TOTAL				**109**	**17**		

4.2 Bank Swallow Inventory and Monitoring Results

Bank Swallow monitoring documented a large number of colonies across the study area (Figure 9), with variable occupancy and generally low burrow use relative to available nesting habitat. Since 2020, a total of 128 colonies have been confirmed to support Bank Swallow nesting at least once. Of these, 97 colonies were documented during the UCSHEP (2021–2025), including the Athalmer enhancement site constructed in 2023, which supported nesting in 2024 and 2025 (Figure 2).

In addition, 59 potential colony sites were identified based on the presence of burrow entrances, indicating that they likely supported Bank Swallows historically (Figure 9). However, Bank Swallows were not observed at these sites during the UCSHEP, whereas Northern-rough Winged Swallows often were. These locations still represent suitable or restorable Bank Swallow habitat and highlight the potential for recolonization if conditions become favourable.

Between 2021 and 2025, the number of colonies documented and/or monitored annually ranged from 98 to 159, with the highest monitoring effort occurring in 2024. Due to capacity limitations and the large number of colonies identified—many of which required boat access—not all colonies were visited each year. Despite this, the number of confirmed active colonies ranged from 55 to 92 annually, with 80 active colonies documented in 2025.

In total, 1,446 Bank Swallow colony monitoring records were collected during the UCSHEP, supported by 18 to 37 volunteers annually. A small number of colonies each year had unknown species occupancy, most commonly due to volunteers having difficulty distinguishing between Bank Swallows and Northern Rough-winged Swallows, which are visually similar and often occupy the same habitats. In all cases, Bank Swallows were recorded where their presence could be confirmed.

The number of useable burrows per colony ranged from 0 to approximately 1,000. Colonies with zero useable burrows typically represented sites that had supported nesting in previous years but had subsequently collapsed prior to or during the monitoring period. These observations highlight the dynamic nature of Bank Swallow habitat and the importance of ongoing geomorphic processes in maintaining suitable nesting conditions.

Colonies with higher levels of activity were often more difficult to assess due to access and/or visibility constraints. However, relatively few colonies exhibited high levels of burrow occupancy across the study area. Accurate documentation of active burrows required prolonged observation by experienced observers, as detectability varied by breeding stage—being lower during incubation and higher during chick-rearing.

Across the 94 colonies with multi-year active burrow data, population trends varied (Appendix 3). Thirty-five colonies had no active Bank Swallow burrows in 2025 despite being active in at least one previous year. Ten colonies showed an increasing trend in active burrow numbers, nine showed a decreasing trend, and eleven were relatively stable with minor fluctuations. Nine colonies exhibited variable trends, while nineteen had unknown trends due to limited data or missing counts in recent years. These trends were based on UCSHEP monitoring data (2021–2025), supplemented by data from the 2020 Columbia Valley Swallow Project (Darvill, 2021).

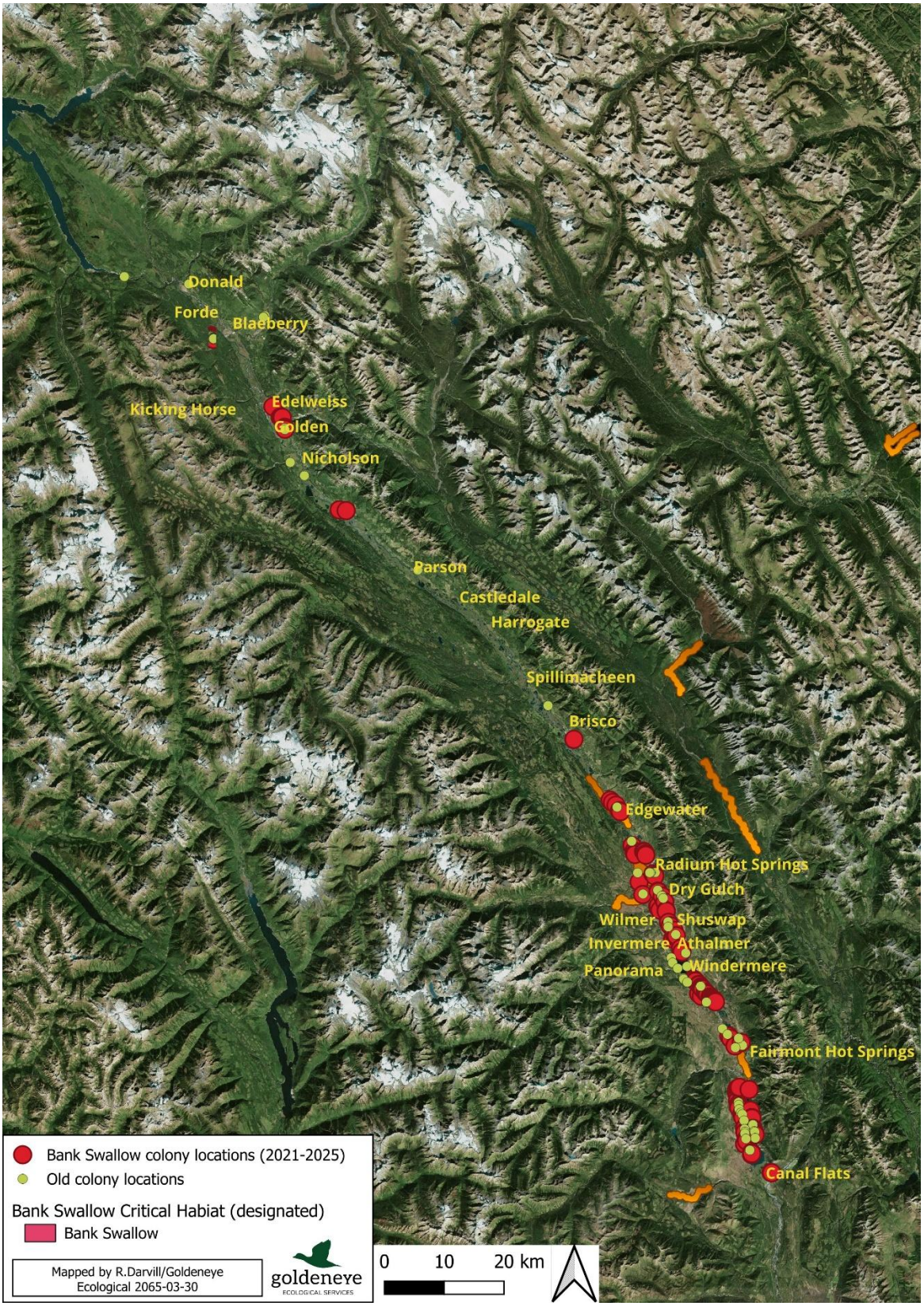

Figure 9. Bank Swallow colony locations across the study area.

4.3 Barn Swallow Inventory, Nest Monitoring, and Nest-Site Characteristics

Barn Swallow nest monitoring documented a substantial number of nesting sites and structures across the study area, with variable nesting activity and widespread use of anthropogenic structures (Figure 10). Between the 2020 pilot year of this project (Darvill, 2021) and the 2021-2025 UCSHEP, the number of known Barn Swallow sites increased from 24 to 69, while the number of known nesting structures increased from 45 to 140. The number of monitored sites increased from 27 in 2020 to 53 in both 2024 and 2025, and the number of monitored structures ranged from 47 to 106 annually. For the purposes of this report, a "site" refers to a discrete location (e.g., property or facility), while a "structure" refers to an individual nesting substrate within a site. Multiple structures may occur within a single site. Across the study period, UCSHEP documented 69 Barn Swallow breeding sites containing 140 nesting structures, within which hundreds of individual nests were recorded annually.

The number of known active nests ranged from 93 to 189 annually, with the highest number recorded in 2023. The number of known successful nests ranged from 53 to 112 annually, also peaking in 2023. The total number of nests recorded, including both active and inactive nests, ranged from 182 to 434 annually and included previously used nests that remained intact but were not active during the monitoring period. Second broods within the same nest were documented in all years and ranged from 9 to 23 nests annually. The number of structures with known broods ranged from 39 to 67 annually. These values reflect only those sites and structures where sufficient monitoring data were available to confirm nesting activity. Together, these results indicate widespread use of anthropogenic structures across the study area, with substantial nesting activity occurring annually within a relatively large and growing network of breeding sites.

4.3.1 Barn Swallow Nest Monitoring Summary

Not including the artificial nesting structures UCSHEP installed, a total of 140 structures (used by Barn Swallows for nesting) were located and monitored between 2021 and 2025; however, due to incomplete monitoring records and limited ability to confirm nest status at some sites, only 36% of structures (n = 51) had sufficient data for inclusion in detailed nest monitoring summaries. The summary is presented in Table 3, and is based on 1,384 monitoring records collected at 51 structures between 2021 and 2025. Across these structures, a total of 187 nests were monitored. Most nests supported a single brood (n = 164), while a subset of nests (n = 39) supported a second brood within the same breeding season (Table 3). Nest condition varied among monitored structures, with both newly constructed and reused nests documented. Reused nests represented the most common condition at 54.9% (this includes sites with mixed (new/reused nests), followed by newly constructed nests (41.2%), with a smaller proportion classified as unknown or mixed (Table 3). Nest activity was recorded using standardized activity codes, with multiple activities often documented during a single monitoring visit. The most frequently recorded activities were associated with occupied nests (ON), incubation or egg protection (NO), and empty nests (EN), with additional observations documenting the presence of young (YS) and other nesting stages (Table 3).

Monitoring effort varied among structures and suites, with the number of visits ranging widely. Variability in recorded nest activity and productivity reflects differences in site accessibility, observer experience, and the ability to confirm nest contents during monitoring visits. In many cases, nest contents could not be directly observed, and activity codes were used to infer nest status based on adult behaviour; observers

were not always able to differentiate swallow behaviours. Where sufficient observations were available, nest productivity was estimated using counts of fledglings and observations of young. Median numbers of young per nest, along with observed ranges (1-6 chicks per nest (n=51) and sample sizes, are summarized in Table 3 and reflect variability in both nesting success and data completeness across sites.

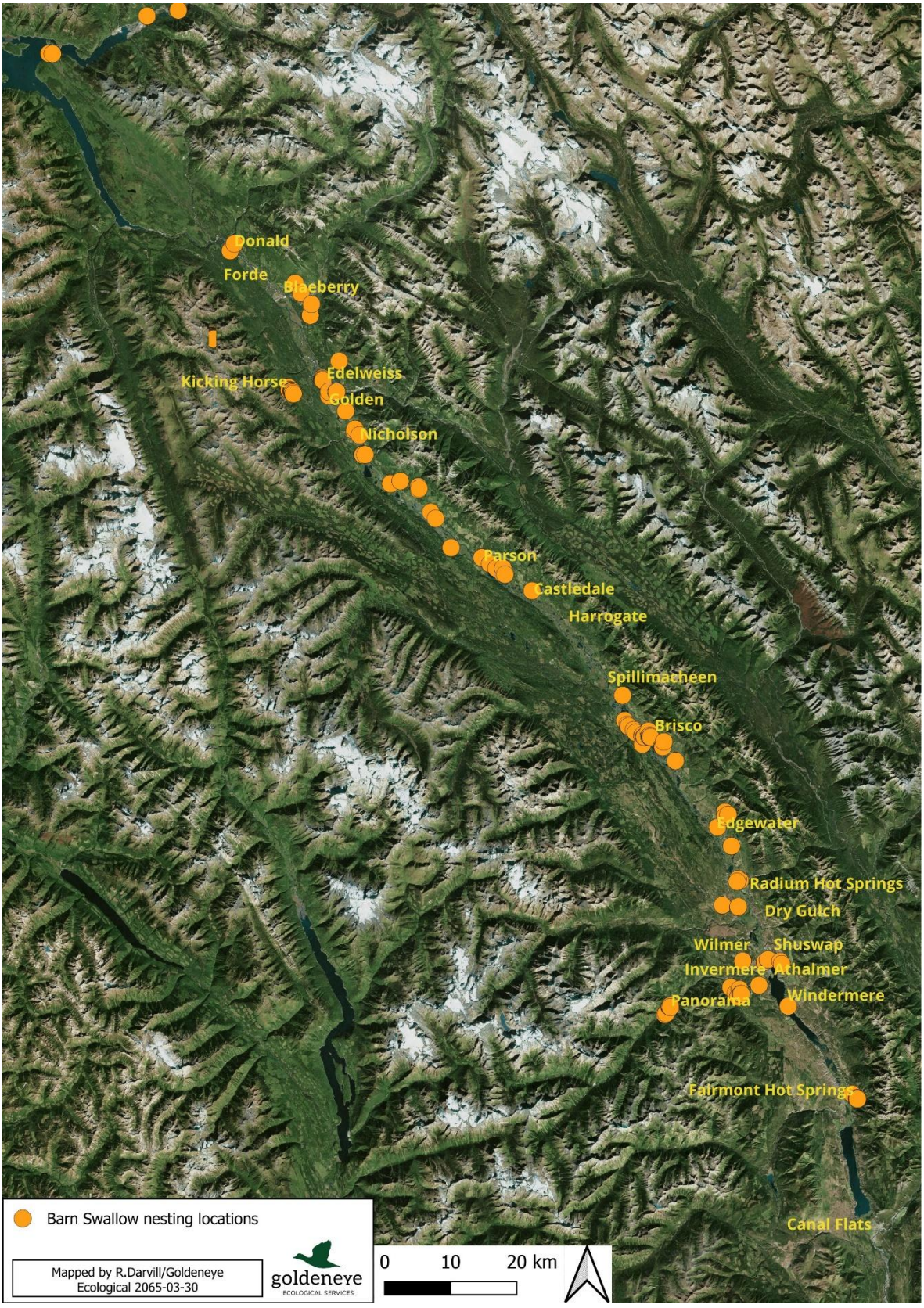

Figure 10. Barn swallow nest site locations across the study area.

Table 3. Summary metrics from Barn Swallow nest monitoring (2021-2025).

Structure Name	No. of Nests Monitored	No. of Single Broods	No. of Double Broods	Most Common Nest Condition	Median No. of Young (Range); n²	Total No. of Fledglings	No. of Monitoring Visits	Year(s) Monitored	Years with Active Nests
Bush Arm Causeway	1	U	U	-	unknown	-	5	2021-2022	2022
Joviet House	1	1	0	new	4; n=1	3	12	2025	2025
Marion House	1	2	0	mixed	3 (2,4); n=2	5	24	2024-2025	2024-2025
Selkirk Townhomes	1	2	0	reused	3 (2,4); n=2	U	8	2023-2025	2023-2024
Selkirk Townhomes 16	1	1	0	reused	3; n=1	3	12	2024-2025	2025
KH Day Lodge	34	37	2	reused	3 (1-4); n=39	81	95	2021-2025	2021-2025
KH Gondola Station	6	3	0	new	2 (2-4); n=3	8	26	2021-2025	2021-2024
Catamount Lift Station	1	0	0	new	0	0	6	2021-2025	2021
KH Jellybean Lift	2	0	0	reused	0	0	28	2021-2025	2021-2023
Glacier Lodge	19	20	4	reused	4 (2-5); n=24	93	66	2021-2025	2021-2025
KH Retail Store	7	3	4	new	4.5 (2-5); n=10	41	64	2021-2025	2022-2025
KH Storage Shed	3	1	1	new	3; n=2	6	31	2021-2025	2021, 2024-2025
Mountaineer Lodge	16	9	1	new	4 (1-5); n=10	35	68	2021-2025	2021-2025
Palliser Lodge	4	2	0	reused	3 (2,4); n=2	2	18	2021-2025	2022-2023
Whispering Pines 17	0	0	0	-	-	0	6	2024-2025	-
Kettleston Rd	3	4	0	reused	3 (2-4); n=4	12	26	2020-2025	2022-2024
Golden Hospital	2	0	0	reused	-	0	27	2021-2025	-
Golden Curling Club	1	1	0	unknown	unknown	-	13	2022-2025	2022
Golden Secondary School	8	10	0	new	2 (1-3); n=10	21	54	2021-2025	2021-2025
Broughton Farm	2	2	0	reused	2 (1,3); n=2	4	15	2022-2025	2022, 2023
Nicholson Bridge	1	1	0	unknown	3; n=1	3	25	2021-2025	2021
Sigi's - Horse Creek	2	1	1	new	4 (2-5); n=3	9	22	2022-2024	2021, 2023
St. Pierre farm	4	6	0	reused	4; n=6	23	59	2021-2025	2021-2023
2558 Hwy 95	1	1	0	new	5; n=1	4	16	2025	2025
Sole's Barn	22	14	3	new	2 (1-4); n=20	18	48	2021-2025	2021-2025
Owens House	4	2	2	new	4 (3-5); n=6	24	47	2023-2025	2023-2025
Panorama - Aurora 10	1	1	0	unknown	2; n=1	unknown	5	2023-2025	2023
Panorama - Aurora 19	1	1	0	new	unknown	unknown	8	2023-2025	2023
Panorama - Aurora 8	1	1	0	reused	4; n=1	4	8	2022-2025	2022
Panorama - Aurora 3	1	1	0	reused	unknown	unknown	28	2022-2025	2022
Panorama - Ski Patrol Hut	1	1	0	new	unknown	unknown	5	2024-2025	2024
Panorama - Lookout Townhs	1	1	U	new	4; n=1	4	6	2021-2025	2021
Panorama - Copper Crown	2	2	U	mixed	3; n=1	unknown	5	2025	2025
Zehnder Ranch 1	1	2	1	reused	5 (4-5); n=4	12	22	2021-2025	2021-2023
Zehnder Ranch Pumphouse	1	4	0	reused	3.5 (3-5); n=4	15	34	2021-2025	2021-2025
Zehnder Ranch 2	1	0	2	reused	3 (2-5); n=4	13	21	2022-2025	2022-2023
Zehnder Ranch Barn	1	0	1	new	3; n=2	6	7	2025	2025
Zehnder Ranch Main Shop	4	3	0	reused	3, n=3	6	8	2021-2025	2021, 2025
Zehnder Ranch Wood Shed	1	3	2	reused	3 (2-5); n=7	20	28	2021-2025	2021-2025
Zehnder's Neighbour	2	2	0	new	3; n=2	3	17	2021-2025	2021, 2023
Rona - Fencing Shed	2	1	0	unknown	3; n=1	3	8	2025	2025
Rona - Planer Shed	2	2	0	reused	3.5 (3,4); n=2	2	16	2024-2025	2024-2025
Rona - Saw Shed	1	2	0	mixed	2.5 (2-3); n=2	3	19	2024-2025	2024-2025
Home Hardware - Invermere	4	5	1	reused	3 (2-5); n=7	21	52	2021-2025	2021-2023
Fairmont HS Resort 5	1	0	5	reused	4 (3-5); n=10	38	69	2021-2025	2021-2025
Fairmont HS Resort 6	1	1	0	reused	5; n=1	5	28	2021-2025	2021, 2024-2025
Fairmont HS Resort 4	1	2	2	reused	4.5 (3-5); n=6	25	50	2021-2025	2021-2023, 2025
Fairmont HS Resort 2	3	4	3	reused	4 (3-5); n=10	39	70	2021-2025	2021-2025
Fairmont HS Resort 1	2	1	1	new	5(4-5); n=3	14	30	2021-2025	2021, 2022
Fairmont Resort Pool Office	2	1	2	new	4; n=5	20	29	2024-2025	2024-2025
Zehnder ANS	2	55	1	reused	4 (3-6); n=5	21	5	2021-2025	2022, 2024-2025
TOTALS	**187**	**164**	**39**			**352**	**1394**		

4.3.2 Barn Swallow Nest-Site Characteristics

A detailed summary of Barn Swallow nest-site characteristics is provided in Appendix 9.4, based on data collected from 65 monitored sites, representing 137 structures and 709 nests. Barn Swallows nested across a wide range of structure types, with most nests occurring on agricultural (35%) and residential buildings (18%), and additional use of commercial or industrial (12%), public or institutional (9%), and transportation-related structures (5%) (Appendix 4).

Nests were most commonly attached to horizontal structural elements, particularly posts (40%) and ledges (20%), although a diverse range of support features was used, including walls (11%) and light fixtures (6%). In total, 32 distinct support feature types were documented across all monitored sites. Structural materials were predominantly wood (73%), with smaller proportions of plastic (9%), metal (9%), and other materials. Nest placement occurred primarily on interior surfaces (52%), with a substantial proportion also located on exterior features (43%), and a small proportion occurring in both interior and exterior locations (5%) (Appendix 4).

Quantitative measurements of nest placement and structure characteristics, including ledge width, nest height above ground, and overhang, are reported as medians to account for uneven sampling across sites and variability in data availability. The median ledge width was 12 cm, the median nest height above ground was 3.5 m, and the median overhang above nests was 10 cm. Sample sizes varied among variables due to differences in site access, safety considerations, and the ability to measure nest characteristics in the field (Appendix 9.4).

4.4 Cliff Swallow Inventory and Monitoring Results

Cliff Swallow monitoring documented an increasing number of nesting sites across the study area over the course of the project. Between 2020 and 2025, the number of known sites increased from 25 to 59, with 2020 data derived from the Columbia Valley Swallow Project (Darvill, 2021). The number of sites monitored annually ranged from 24 to 54, with the highest monitoring effort occurring in 2024. The total number of nests recorded, including both active and inactive nests, ranged from 379 to 525 annually. Counts of active nests were available for a subset of sites between 2023 and 2025 and ranged from 253 to 422 nests per year. For example, in 2025, 253 active nests were documented across 35 of the 59 known breeding sites. In some cases, nest counts were not recorded due to limited volunteer effort, visibility, access constraints, or difficulty estimating nest numbers within large or densely clustered colonies. As a result, reported totals represent minimum counts of nests present during each monitoring year.

Volunteer participation in Cliff Swallow monitoring ranged from 10 to 25 individuals annually and contributed to both site inventories and repeated monitoring visits. While the primary focus of the UCSHEP was on Bank and Barn Swallows, the collection of Cliff Swallow data provided valuable additional information on species distribution and colony size across the study area. These data contribute to a broader understanding of aerial insectivore use of the region, despite more limited monitoring effort relative to other focal species.

4.5 Volunteer Participation, Partnerships, and Outreach Delivery

Volunteer participation was a key component of UCSHEP delivery and enabled broad spatial coverage and repeated monitoring across the study area. Annual participation ranged from 21 to 46 volunteers for Barn Swallow monitoring, 18 to 37 volunteers for Bank Swallow monitoring, and 10 to 25 volunteers for Cliff Swallow monitoring. In total, 168 volunteers contributed to the project between 2021 and 2025.

A wide range of outreach and communication activities were delivered throughout the project (Table 4). Monthly e-newsletters (eBlast) were distributed to Wildsight members and the broader community, providing project updates, volunteer recruitment opportunities, and educational content related to swallow ecology and conservation. Social media outreach included regular Facebook posts highlighting project activities and bird conservation topics.

Project information was also disseminated through regional media outlets, including articles published in The Golden Star and The Columbia Valley Pioneer (e.g., Appendices 9.5–9.13). Additional written materials included contributions to Canadian Wildlife Magazine, Kootenay Conservation Program communications, and BC Birding magazine. Presentations were delivered at multiple venues, including the Wings Over the Rockies Nature Festival, Wildsight Golden Annual General Meeting, Kootenay Conservation Program events, Columbia Basin Trust engagement sessions, and meetings with ʔakisq̓nuk First Nation leadership and staff.

Field-based learning opportunities included guided visits to Barn Swallow artificial nesting structures and Bank Swallow colonies, participation in the Wings Over the Rockies Nature Festival, Kootenay Conservation Program field tours, and educational sessions with the Akisqnuk Little Badgers Summer Camp at active Bank Swallow colonies. Educational materials developed during the project included posters, an updated brochure, and multiple videos providing project updates and training resources. Interpretive signage was installed at all Barn Swallow artificial nesting structures, at Bank Swallow colonies experiencing recreational disturbance, at the bat and swallow “Air B&B” structure, at Kicking Horse Mountain Resort, at the Athalmer Bank Swallow restoration site, and at Windermere Lake Provincial Park.

Private landowner engagement was an important component of project outcomes. A total of 51 landowner visits were conducted between 2021 and 2025 to support nest monitoring, habitat assessment, installation of nest cups, and outreach. These visits included responding to requests for nest inventories, assessing habitat suitability for enhancement actions, and providing information on swallow conservation and best management practices.

Project contractors and volunteers also participated in several community events, including events at Kicking Horse Mountain Resort, the Columbia Wetlands Stewardship Partners Annual General Meeting, and multiple events at the Golden Farmer’s Market in Golden and Invermere. These activities supported public engagement, increased awareness of swallow conservation, and contributed to volunteer recruitment and stewardship outcomes.

Table 4. Summary of UCSHEP communications (2021 - 2025)

Communication type	2021-2025
PR in newspaper	18
Presentation	14
eBlast	35
Facebook post	95
Field trip	8
Poster	28
Additional story piece	7
Webinar	4
Training session	51
Private landowner visit	51
Videos created	6
Brochure	2
Interpretive signage	10
Event	8

Figure 11. Field trip to view Bank Swallow colonies in Golden.

(a)

(b)

Figure 12. Signage designed and installed for the UCSHEP at: a) Windermere Lake Provincial Park, and b) at the Quonset structure (for bat and barn swallows) installed at The Nature Trust of BC's Edgewater property.

4.6 Motus Wildlife Tracking Collaboration Outcomes

As part of the project, three large Motus stations and four smaller stations were installed within the study area to support tracking of Bank Swallow movements. Bank Swallows were captured, banded and tagged at two colonies in 2022 and 2023, with 50 individuals tagged per year. Two tagged individuals from 2022 were last detected in Costa Rica prior to battery failure, suggesting overwintering in that region. Motus data and feather isotope samples were analyzed as part of a completed Master's thesis at the University of Cambridge (Endenburg, 2025), with a scientific publication in press (Endenburg et al., 2026, in press). Following completion of the primary tagging effort, most Motus stations were removed by Environment and Climate Change Canada's Canadian Wildlife Service with UCSHEP's assistance. UCSHEP continues to collaborate with BC Parks to maintain the large Motus station at Windermere Lake Provincial Park, supporting ongoing participation in the Motus network and enabling future research opportunities in the region.

4.7 Threats and Disturbance Observations

A range of threats affecting Bank Swallows, Barn Swallows, and Cliff Swallows were documented during monitoring and site visits between 2021 and 2025. Recreational disturbance was frequently observed at Bank Swallow colonies located along shorelines, particularly at Lake Windermere and Columbia Lake, where boating and shoreline access occurred in close proximity to nesting areas. Nest removal and disturbance were documented at multiple Barn Swallow nesting sites, particularly on anthropogenic structures. In some cases, nest removal occurred during the breeding season and were reported to Environment and Climate Change Canada (ECCC). Predator presence, including mammals such as squirrels and a Pine Marten, was observed at both natural and artificial nesting sites. Although neither species was directly observed preying on swallow species. Evidence of swallow mortality, including dead adults and young, was also recorded. The rationale behind the mortalities is unknown but, in several cases, corresponded to unusually warm weather events or heat domes. Additional threat observations included habitat alteration, structural changes to nesting sites, and general human disturbance. A summary of recorded threats is provided in Table 5.

Table 5. Summary of threats observed for Bank, Barn and Cliff Swallows.

Threat Category	Bank Swallow	Barn Swallow	Cliff Swallow
Recreational disturbance	✓		✓
Nest removal		✓	✓
Predation	✓	✓	✓
Habitat alteration	✓	✓	✓
Human disturbance (general)	✓	✓	✓
Mortality events observed	✓	✓	✓

5.0 Discussion

5.1 Project Context and Key Outcomes

The Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) was developed in response to substantial long-term declines in aerial insectivores, particularly Bank Swallows (Riparia riparia) and Barn Swallows (Hirundo rustica), both of which are listed as Threatened by COSEWIC and under the Species at Risk Act (SARA) (COSEWIC 2011; COSEWIC 2013; Environment and Climate Change Canada, 2022; Government of Canada, 2019). These declines are consistent with broader continental trends linked to changes in insect availability, habitat loss, and conditions across migration and wintering grounds (Nebel et al., 2010; Smith et al., 2015).

Between 2021 and 2025, UCSHEP implemented a range of monitoring, stewardship, and habitat-based conservation actions across the Upper Columbia. A key outcome of the project was the implementation of 29 enhancement and restoration sites, representing a substantial investment in on-the-ground conservation for swallow species in the region. The project substantially improved understanding of swallow breeding distribution in the study area. UCSHEP documented 69 Barn Swallow breeding sites comprising 140 nesting structures used for nest attachment. These findings represent a significant increase in known Barn Swallow breeding habitat and provide a strong baseline for future monitoring and conservation planning.

In addition, UCSHEP documented 97 Bank Swallow colonies that were active at least once during the study period, building on 30 colonies previously identified through earlier survey efforts conducted as part of the Kootenay Bank Swallow Project (Arndt 2020). These legacy data, collected between 2016 and 2019 and provided by Janice Arndt, contributed important baseline information on colony distribution in the region. Fifty-nine Cliff Swallow nesting locations were also documented by the UCSHEP in the study area.

UCSHEP also provided important insights into Barn Swallow nesting ecology and the effectiveness of enhancement approaches. Monitoring results demonstrated widespread use of anthropogenic structures, with nesting occurring across a diversity of agricultural, residential, and industrial settings. While uptake of artificial nesting structures and nest cups was variable, some sites supported repeated nesting and evidence of reproductive success. These findings highlight the importance of maintaining existing nesting structures, supporting coexistence with landowners, and continuing to refine enhancement approaches through long-term monitoring and adaptive management.

For Bank Swallows, a key finding from monitoring was that colony occupancy was highly variable across the study area, with many colonies supporting nesting in some years but not others. Within the subset of colonies with multi-year data, 35 of 94 colonies had no active Bank Swallow burrows in 2025 despite being active in at least one previous year. In addition, relatively few colonies exhibited high levels of burrow occupancy, and even at active colonies, the proportion of useable burrows that were occupied was generally low.

These patterns likely reflect a combination of ecological and environmental factors. Bank Swallow nesting habitat is inherently dynamic, with colonies frequently lost due to bank collapse or erosion, while new habitat is created elsewhere through geomorphic processes. As a result, colony presence and size can fluctuate substantially between years. Low occupancy across many colonies also suggests that factors

beyond nesting habitat availability—such as prey availability, weather conditions, or drivers acting during migration or wintering—may be limiting population size and colony use.

Interpretation of these patterns should also consider monitoring limitations. Colony accessibility, visibility, and observer experience influenced the ability to detect active burrows, particularly during early breeding stages when activity is less apparent. Despite these constraints, consistent patterns of low occupancy and variable colony use were observed across the study area, suggesting that these findings reflect broader ecological trends.

5.2 Habitat Limitation and Landscape-scale Benefits

Breeding habitat availability in the northern end of the study area is a key limiting factor for Bank Swallows due to their reliance on steep, friable banks composed of suitable substrates (Garrison, 1999; COSEWIC, 2013). In regulated or altered systems, reduced erosion and sediment processes can limit the formation of suitable nesting habitat. UCSHEP addressed these limitations by increasing the availability and distribution of nesting habitat across the study area while improving connectivity between breeding areas and surrounding foraging habitat. Importantly, the project adopted a landscape-scale approach, recognizing that the ecological benefits of enhancement extend beyond individual sites.

Both Bank and Barn Swallows typically forage within approximately 500–600 m of nesting sites during the breeding season, although movements can extend farther (Turner, 2006; Evans et al., 2007). Using a 1-km-radius buffer around enhancement sites, the project is estimated to have enhanced approximately 2,175 hectares of habitat within the breeding landscape. This approach reflects the functional ecological footprint of habitat enhancement, whereby the addition of nesting opportunities supports use of the surrounding foraging landscape. As a result, UCSHEP contributed to improved habitat availability and connectivity at a landscape scale, rather than solely at individual sites.

5.3 Effectiveness of Bank Swallow Habitat Restoration and Enhancement

Bank Swallow enhancement outcomes were variable and influenced by site conditions and time since implementation. The Athalmer site demonstrated that restoration of suitable bank morphology can result in rapid uptake, consistent with previous findings that Bank Swallows readily colonize newly exposed vertical faces where conditions are favourable (Garrison, 1999). In contrast, no use was documented at other Bank Swallow enhancement sites during the monitoring period. However, these sites were implemented in later project years and had limited post-construction monitoring. Given known variability in colony establishment and site discovery, it is premature to classify these sites as unsuccessful.

At the Spike Elk Farm / Moberly Marsh site, the artificial nesting structure has only been monitored for a single breeding season, and results should therefore be interpreted with caution. Additional monitoring is needed to evaluate longer-term effectiveness, particularly in light of the renaturalization project underway, which is expected to bring water closer to the site and may substantially improve habitat suitability. If limited or no use continues following these changes, design refinements may be warranted, particularly the addition of substrate to create vertical nesting faces above and along the sides of the structure. These design elements have been successfully implemented at a structure on Tekakwitha Island (Kahnawà:ke Environment Protection Office, 2023) and other locations in Quebec (i.e., Port of Montreal).

Overall, results suggest that naturalistic bank restoration is the most reliable approach, while artificial structures may require additional refinement and longer monitoring periods. With the support of landowners and industry, active colonies in anthropogenic habitats are likely to make an important contribution to a resilient Bank Swallow population (Pelletier, Arndt, Darvill & Cyr, 2022). Continued effectiveness monitoring is essential to determine long-term outcomes at the Spike Elk Farm / Moberly Marsh site.

5.4 Effectiveness of Barn Swallow Enhancements

Barn Swallow enhancement approaches included building artificial nesting structures (ANS) and installing nest cups on new ANSs and existing structures. These ANSs were designed to reflect known nesting preferences, including rough-sawn wooden materials, horizontal supports, and sheltered conditions. Despite this, results showed variable uptake and no clear preference for a specific structure design. While some structures and nest cups supported nesting activity, others remained unused during the monitoring period.

Nest monitoring and nest-site characteristic data (Table 3; Appendix 4) indicate that Barn Swallows most frequently nest on agricultural and residential structures with horizontal support features. Although these characteristics were incorporated into ANS design, the absence of a clear preference among structures suggests that site context, proximity to existing nesting activity, and time since installation may be more important than specific design parameters. These findings reinforce the importance of long-term monitoring and adaptive design, as well as strategic placement of structures in areas with existing swallow activity. In 2018 in the Creston Valley Wildlife Management Area, an ANS was installed close to a building that supported a Barn Swallow colony; that building was demolished but that ANS supported 16-17 active Barn Swallow nests in 2024 (M. Beaucher, personal communication, June 2024). That area also supports a high population of Barn Swallows. Environment and Climate Change Canada (ECCC) has suggested that alternative nesting structures be installed adjacent to existing nesting sites that are scheduled for removal, and that these structures be in place at least one year prior to removal. That approach reflects the tendency of Barn Swallows to prospect potential nesting locations in advance of use.

Results from UCSHEP also highlight the importance of nest reuse in Barn Swallow breeding ecology. Reused nests represented the most common nest condition (54.9%), indicating that a majority of breeding attempts relied on existing nest structures rather than new construction. Nest reuse is well documented in Barn Swallows and is thought to confer energetic and reproductive advantages by reducing the time and energy required for nest building, allowing individuals to allocate more resources toward egg production, incubation, and provisioning of young (Brown and Brown 1999; Turner 2006). Earlier initiation of breeding associated with nest reuse may also increase reproductive success by extending the breeding window or enabling additional broods (Brown and Brown 1999).

These findings have important implications for conservation and management. The high frequency of nest reuse underscores the importance of retaining existing nests wherever possible, even outside of the active breeding season. Removal of old nests may result in the loss of valuable nesting infrastructure and increase energetic costs for returning birds, potentially reducing breeding success. Where maintenance, safety, or biosecurity concerns necessitate nest removal, replacement options such as nest cups or artificial structures should be installed in advance and in close proximity to existing nesting sites to

facilitate continued use. Overall, the results emphasize that conserving existing nesting structures—including previously used nests—is likely as important, or more important, than installing new artificial structures in supporting Barn Swallow populations.

5.5 Stewardship, Partnership and Collaborative Conservation

UCSHEP demonstrated that effective swallow conservation depends not only on creating new habitat, but also on maintaining and protecting existing nesting sites, particularly on working lands such as agricultural, recreational, and industrial settings. Extensive engagement with landowners, industry, and local stakeholders increased awareness of swallow conservation, their at-risk status, and legal protections. These efforts contributed to improved coexistence and, in some cases, reduced nest removal in later years of the project. This outcome represents a significant conservation benefit, as the protection of existing nesting habitat is a critical component for sustaining local at-risk populations.

Volunteer participation and partnerships were central to the success of the UCSHEP. Citizen-science monitoring expanded geographic coverage, enabled repeated site visits, and contributed to the identification of new nesting locations, particularly on private lands. This level of participation substantially increased the spatial and temporal scope of monitoring beyond what would have been possible through staff-led efforts alone.

Collaboration with agencies, organizations, and Indigenous partners supported implementation of enhancement works, access to monitoring sites, and coordination across multiple land tenures. This collaborative approach strengthened project delivery and provides a strong foundation for continued conservation efforts in the region. The Motus component further reflects the value of collaboration at broader spatial scales. Contributions to the Motus network improved understanding of Bank Swallow movement and migratory connectivity, with detections of Invermere-tagged individuals in Central America highlighting the importance of international migration pathways. Continued collaboration within the Motus network will support future research and conservation planning across the full annual cycle.

5.6 Limitations and Data Considerations

Monitoring effort and data completeness varied among sites and years. Not all colonies or nests could be monitored with equal intensity, and some data gaps occurred due to access limitations and observer variability. In addition, several enhancement sites had limited post-construction monitoring, and results for these sites should be considered preliminary. Continued monitoring is required to fully evaluate effectiveness at all enhancement sites.

5.7 Threats to Swallows in the Upper Columbia

Threats documented during UCSHEP monitoring indicate that disturbance and anthropogenic pressures continue to influence swallow populations, even where suitable habitat is available. Recreational disturbance was a key concern for Bank Swallows at shoreline colonies, where boating and shoreline access occurred near active nesting areas. For Barn Swallows, nest removal and disturbance at anthropogenic structures remained an ongoing issue. Predator presence, mortality related to natural weather events, habitat alteration, and structural changes to nesting sites were also observed across species. While not all threats could be directly linked to observed outcomes, they represent important

pressures that may influence nesting success and habitat use. These findings highlight that habitat enhancement alone is insufficient, and that conservation efforts must also address disturbance, habitat protection, and stewardship. These observed threats may contribute to variability in site use across years.

5.8 Future Work and Ongoing Conservation Efforts

The results of the UCSHEP highlight the need for continued, integrated swallow conservation efforts in the Upper Columbia. A key priority is the continuation of long-term effectiveness monitoring, particularly for enhancement sites implemented in later years of the project. This will support evaluation of outcomes, refinement of enhancement approaches, and improved understanding of long-term trends.

The project also demonstrated that sustained stewardship and engagement with landowners, industry, and local stakeholders can lead to meaningful conservation outcomes. Increased awareness of swallow conservation, species-at-risk status, and legal protections contributed to reduced nest removal and improved coexistence at several sites. Continued outreach and relationship-building will be essential for continued protection at existing swallow nesting habitat.

The Columbia Valley Bank Swallow Conservation Project (2026–2027) builds directly on UCSHEP outcomes. It focuses on collaboration with the ʔakisq̓nuk First Nations community to address high-priority threats identified through colony protections and monitoring, particularly at shoreline colonies on ʔakisq̓nuk First Nation lands facing recreational disturbance. Monitoring and targeted conservation actions under this initiative will support ongoing threat mitigation and data collection. Additionally future work should continue to integrate habitat enhancement, long-term monitoring, threat mitigation, and collaborative partnerships to support the long-term persistence of swallow populations in the Upper Columbia.

6.0 Recommendations

6.1 Continue multi-year effectiveness monitoring at all enhancement sites

Monitoring should continue at all enhancement sites, particularly those implemented in the later years of the project, including Birchlands Creek, the Spike Elk Farm / Moberly Marsh Bank Swallow artificial nesting structure, and Barn Swallow structures or nest cup installations that have shown little or only recent use but have had recent modifications. At this stage, it is too early to determine the long-term effectiveness of several enhancements, and multi-year monitoring is needed before firm conclusions are made.

6.2 Prioritize restoration of naturalistic Bank Swallow nesting habitat where site conditions are suitable

Where suitable sandy or silty substrate is present, future Bank Swallow work should continue to prioritize restoration or creation of steep, friable nesting faces near existing or historic colony areas. Results from Athalmer suggest that this approach can produce rapid uptake where conditions are favourable. Site selection should continue to consider substrate, bank stability, surrounding foraging habitat, and open flight paths.

6.3 Protect and maintain existing nesting habitat

Because Barn Swallows in the Upper Columbia rely heavily on existing buildings and infrastructure, future conservation work should continue to prioritize the protection of occupied nest sites on anthropogenic structures. This includes discouraging nest removal during the breeding season, promoting compliance

with relevant legislation, and working collaboratively with landowners and managers to develop practical coexistence solutions at active sites. Additionally, future work should work on reducing recreational threats at Bank Swallow colonies.

6.4 Continue direct landowner engagement and stewardship

Direct contact with private landowners, agricultural operators, industrial sites, and businesses should remain a core part of swallow conservation in the region. Site visits, one-on-one discussions, signage, and practical support helped achieve meaningful conservation outcomes during this project and should continue as part of future work.

6.5 Maintain the volunteer and partner network established through UCSHEP

The volunteer and partner network developed through UCSHEP is a major project asset and should be maintained. Continued citizen-science monitoring would support tracking of colony occupancy, enhancement use, and distributional changes over time, while ongoing partnerships would improve the ability to work across the full range of land tenures and jurisdictions where swallows occur.

6.6 Apply project findings to future habitat planning in the Upper Columbia

The results of UCSHEP should be used to guide future swallow habitat enhancement, restoration, and stewardship in the Upper Columbia. In particular, project findings support a landscape-scale approach that considers not only individual nest sites and structures, but also the surrounding foraging habitat, connectivity among breeding areas, and the conservation value of existing nesting habitat on working lands. There are still several enhancements and threat protections that could occur to help conserve swallows in the study area.

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9.0 Appendices

9.1 All enhancement and restoration projects (2021-2025) with effectiveness monitoring summaries.

Site	Name	Date of completion	Type of work	Specific Type of enhancement	Target Species	Description of work	# of nest cups installed	Landowner or jurisdiction	Rationale	Overall Effectiveness of enhancement (2021-2025)	Evidence of nesting or prospecting (Y/N)
1	**Donald ANS**	7-1-2021	enhancement	artificial nesting structure	Barn Swallow	12x18 ANS/nest cup installation	8	Ministry of Transportation	Large structure in area provides significant Barn Swallow habitat. This nearby property recently purchased by new owner and likely to remove old structures. This ANS provides compensatory habitat.	18 site visits. Two nest cups with grass fragments seen in them with 5-7 BARS flying close by between the ANS and the old mill in August 2025. There were often BARS seen flying around the old mill. Some buildings at the old mill were demolished in winter of 2025-2026.	Y
2	**Donald Mill Site 2**	3-1-2026	enhancement	nest cups	Barn Swallow	Nest cups and ledges created in covered area of a new building	5	private	Create additional breeding habitat in area occupied by Barn Swallows.	In spring of 2025 two nest cups were installed. 1 site visit and reached out to landowners several times, who work there frequently. 1 of 2 nest cups was used by Barn Swallows with at least 3 fledged.	Y
3	**Spike Elk Farm /Moberly Marsh**	Spring 2025	enhancement	Bank Swallow structure	Bank Swallow	Bank Swallow nesting structure	NA	private	Create an artificial nesting structure and expand Bank Swallow breeding	Structure built in fall of 2024; wasn't occupied in 2025. A re-naturalization project is taking place at this site from 2025-2028, which will see more	N

									habitat in an area where habitat is lacking.	water brought close to the structure. Promising for Bank Swallow recruitment.	
4	**Kettleston Rd**	5-24-2022	enhancement	nest cups	Barn Swallow	nest cup installation. Landowner moved nest cup to a different location on cabin in spring 2026.	1	private	Create additional breeding habitat in area occupied by Barn Swallows.	Nest cups haven't been used since installation (2022). There is an active natural mud nest here.	N
5	**Blaeberry Washout**	10-4-2022	enhancement	slope enhancement	Bank Swallow	trees/brush removed from area in front of colony	NA	private	Vegetation blocking flight path to colony. Removed vegetation in front of colony.	No Bank Swallow use, although Northern Rough-winged Swallows do nest here annually.	Y
6	**Wharton's ANS**	10-16-2023	enhancement	artificial nesting structure	Barn Swallow	12 x 18 ANS/nest cup installation	8	private	Create additional breeding habitat in area occupied by Barn Swallows.	No Barn Swallow activity. ANS was modified in fall 2025 by installing perching wire outside of the structure.	N
7	**Golden Mill**	NA	enhancement	nest cups	Barn Swallow	nest cup installation	0	private	Large Barn Swallow colony, but preferred by landowner if they nested elsewhere. Swallow access to nests sometimes cut off. Provided nest cups to try to attract	Never received a response regarding whether the two nest cups UCSHEP provided were installed, despite reaching out numerous times. An annual site visit was made here from 2021-2024, promoting co-existance strategies. Posters were placed around the facilities in areas frequented by staff.	NA

									swallows to better sites.		
8	**Golden ANS**	4-1-2022	enhancement	artificial nesting structure	Barn Swallow	18x24 ANS/nest cup installation	8	Town of Golden	Create additional breeding habitat in area occupied by Barn Swallows.	47 site visits since 2022, when ANS built. No BARS nesting/activity although some robins nested there since 2023. A Pine Marten was seen in the ANS in May 2024. Tin was placed on exterior of the building in fall 2025, to prevent predators from accessing the interior of the ANS.	Y
9	**Golden School Bus Barn**	Spring/summer 2024	enhancement	nest cups	Barn Swallow	nest cups	2	private	Create additional breeding habitat in area occupied by Barn Swallows.	At least 4 updates via email from land manager. Nest cups haven't been used since installation (2024).	N
10	**Murphy House**	6-7-2023	enhancement	nest cups	Barn Swallow	nest cups	1	private	Create additional breeding habitat in area occupied by Barn Swallows.	3 updates via email from land owner. Nest cups haven't been used since installation (2023).	N
11	**Sigi's - Horse Creek**	5-1-2021	enhancement	nest cups	Barn Swallow	nest cup installation	2	private	Create additional breeding habitat in area occupied by Barn Swallows.	In 2021 the 2 nest cups were used by robins.	Y

12	**Birchlands**	10-17-2024	restoration and enhancement	slope enhancement	Bank Swallow	stalled due to new permission requests from March 2023	NA	crown provincial	Bank Swallow colony destroyed after dredging in creek by CPKC.	Substrate piles created from dredging were reshaped into suitable Bank Swallow nesting areas. At least 2 site visits since restoration in fall 2024. No occupancy.	N
13	**Tobler Farm Garage**	6-1-2021	enhancement	nest cups	Barn Swallow	nest cup installation	5	private	Create additional breeding habitat in area occupied by Barn Swallows.	6 visits since 2021 when nest cups installed. Aug 2025 - 2 nest cups had been used by Barn Swallows with one of them having feces under the cup, indicating nest success.	Y
14	**Pole barn - Hwy 95**	5-1-2021	enhancement	nest cups	Barn Swallow	nest cup installation	4	private	Create additional breeding habitat in area where Barn Swallows are seen foraging.	Many site visits. No nest cup usage.	N
15	**Parson Air B&B (bat/swallow)**	7-1-2023	enhancement	artificial nesting structure (bats and birds)	Barn Swallow and bat species	bat/swallow ANS	8	crown provincial	Bat hibernacula were destroyed close by, also in an area with Barn Swallows nesting nearby. Expand available habitat.	12 site visits. In Sept 2025, 4 nest cups were noted as active. One nest cup had feces under it. The second one had one old egg in it but little feces below. The third and fourth nest cups had some nesting material but no feces below.	Y
16	**Sole's ANS**	7-1-2022	enhancement	artificial nesting structure	Barn Swallow	12x18 ANS/nest cup installation	8	private	Create additional breeding habitat in area occupied by Barn Swallows.	43 site visits since 2022, when ANS constructed. In July 2025 twigs were seen in the nest cups.	Y

17	**Owen's House**	8-11-2023	enhancement	nest cups	Barn Swallow	nest cups	2	private	Create additional breeding habitat in area occupied by Barn Swallows.	Unknown number of site visits but landowner lives there so nest cups were frequently viewed. One nest cup used by robins in 2024, but no BARS occupancy.	Y
18	**Warner's (hay shed)**	5-1-2021	enhancement	nest cups	Barn Swallow	nest cup installation	3	private	Create additional breeding habitat in area occupied by Barn Swallows.	Unknown number of site visits. Nest cups haven't been used since installation (2021).	N
19	**Nature's Paradise ANS**	Sept 2022 ANS, April 2023 nest cups	enhancement	artificial nesting structure	Barn Swallow	12x18 ANS/nest cup installation	8	private	Barn Swallows were being excluded from buildings where they were attempting nests. ANS provides safe nesting habitat.	14 site visits. A lot of bird droppings were seen in the ANS by landowner in 2023. Nest cups haven't been used since installation (2023).	N
20	**Trescher Barn 1**	5-1-2023	enhancement	nest cups	Barn Swallow	4 nest cups installed	4	private	Create additional breeding habitat in area occupied by Barn Swallows.	At least 7 site visits. In 2023 a BARS briefly used one of the nest cups. Another nest cup was used by a robin in 2024.	Y
21	**BPP Mill**	3-1-2026	enhancement	nest cups	Barn Swallow	nest cups	2	private	Create additional breeding habitat in area occupied by Barn Swallows.	Nest cups were installed winter 25-26, so no monitoring to date.	NA

22	**Edgewater TNT**	Quonset: April 2024, Lean- to: Sept 2021	enhancement	artificial nesting structure (bats and birds)	Barn Swallow and bat species	Quonset enhancement	8	The Nature Trust of BC	Quonset provides habitat for bats and swallows. This structure was in disrepair and slated to be removed but rather was structurally restored to provide continuous and expanded habitat for Barn Swallows and bats.	14 site visits. At least 2 natural nests were used successfully 4 times since 2022 when Quonset was repaired.	Y
23	**Zehnder Ranch Pumphouse**	4-1-2022	enhancement	nest cups	Barn Swallow	nest cup installation	2	private	Create additional breeding habitat in area occupied by Barn Swallows.	Unknown number of visits. Nest cups were never used since 2022, when installed. There is an active natural mud nest here.	N
24	**Zehnder ANS**	7-1-2021	enhancement	artificial nesting structure	Barn Swallow	12x18 ANS/nest cup/installation	8	private	Create additional breeding habitat in area occupied by Barn Swallows.	58 site visits. One nest cup used successfully two times, with a third time abandoned with one egg, and 4th time abandoned after initial nest rebuilding. One natural mud nest used three times successfully.	Y
25	**Zehnder Ranch Wood Shed**	4-1-2022	enhancement	nest cups	Barn Swallow	nest cup installation	3	private	Create additional breeding habitat in area occupied by Barn Swallows.	Nest cups haven't been used since installation (2022). There is an active natural mud nest here.	N

26	**Burkart Barn**	Fall 2022	enhancement	restoration of structure	Barn Swallow	roof replacement, nest cups	4	private	Old barn was collapsing mainly due to lack of sturdy roof. Replaced roof since barn provides Barn Swallow habitat to several breeding pairs. Landowner helped with cost of roof repair. 4 nest cups were put up in May 2024: two on the second floor and two on the main floor north facing.	16 site visits. Nest cups haven't been used since installation (2023). Some white bird droppings seen on the side of one nest cup in 2025. There were at least two successful natural mud nests, but likely more nests that were not located due to inaccessibility into that part of barn.	Y
27	**Athalmer Neighbourhood**	10-4-2023	enhancement and conservation	slope enhancement	Bank Swallow	4.5m tall;16m long. Conservation of existing habitat and enhancement of additional habitat.	NA	District of Invermere	Prior to discovery, colony was going to be destroyed. Saved the pre-existing colony and expanded amount of available breeding habitat by resloping south facing slope.	25 site visits. In 2025 there were 246 burrows with 36 active ones. In 2024 there were about 400 burrows and 195 of those were active with nests.	Y

28	**Windermere Lk PP**	10-1-2021	restoration	slope enhancement	Bank Swallow	resloping breeding habitat, ropes/signage installed	NA	BC Parks	Large colony with few active burrows when first discovered, likely due to human disturbance observed. Restored steep face, removed trails on colony and put ropes and signs up to prevent access onto colony habitat.	23 site visits. Increase of hole usage by BANS from to at 4 in 2022 to least 11 active burrows in 2025. Additional active NRSW nests each year.	Y
29	**Fairmont Hot Springs Resort**	7-1-2022	enhancement	nest cups	Barn Swallow	nest cup installation	3 (1 removed so only 2 left)	private	Create additional breeding habitat in area occupied by Barn Swallows.	Unknown number of site visits. Nest cups haven't been used since installation (2022). There are natural mud nests present.	

Appendix 9.2 Effectiveness Monitoring Form for Barn Swallow Artificial Nesting Structures

Artificial Nest Structure (ANS) - Monitoring Form Barn Swallow Nests

Field surveys at each ANS should be checked and this data form filled out once a week from May-early September or last date of nest use (if later). Use one data sheet per nest monitored to track nest activity and status over the breeding season. Use a new/blank data sheet for each new nest or for a new nest attempt at a previously built nest. Note if a naturally built nest or a nest cup was used. Send completed forms to racheldarvill@gmail.com.

Surveyor name: _____ **ANS site name:** _____
Naturally-built nest: Y/N **Nest cup used:** Y/N
Nest cup number with active nest: _____ **Nest attempt # at this location, this season:** _____

Nest Monitoring

Survey Date	Nest Activity[1]	#Young (if known)	Nest Disturbance[2]	Visible Inspection of Structure[3]	Comments

Nest Summary Data (exact or approximate dates, if known). Enter n/a if not known.

Arrival Date	Departure Date	Date First Egg Laid	Total # Eggs	Date Eggs Hatched	Total # Young	Date Young Fledged	Total # Fledglings	Nest Fate	Total # Visits

- [1]*Nest Activity: Courtship (CO), Agitated/Alarm Calls (AG), Leaving/Occupying/Entering Nest Site Indicating Occupied Nest (ON), Collecting/Carrying Nest Material (CN), Nest Building (NB), Nest Occupied - Laying/Incubating/Protecting Eggs (NO), Nest Incomplete (IN), New Avian Nest Over Existing Nest (AN), Empty Nest (EN), Adult Flushed from Nest (AF), Nest with Eggs (NE), Eggs Not Hatched (NH), Eggs Broken/Damaged (ED), Chick Hatching (HY), Nest with Young Seen/Heard (YS), Naked Chick/Eyes Closed (NY), Wing Feathers/Eyes Open (PY), Mostly Feathered Young (FY), Vocal Young (VY), Adult Carrying Food/Feeding Young (CF), Adult Carrying Fecal Sac (FS), Young Fledged Naturally (FN), Young Fledged Prematurely (FP), Young Thrown/Fallen Out (YT), Young Dead in Nest (YD), Adult Dead (AD), Eggshells in Nest (ES), Eggshells on Ground (EG), Unknown Nest Use (NU), Other (Describe in Comments).*
- [2]*Nest Disturbance: Competition (CP), Parasitism (PA), Young Held in Nest (YH), Predation (PR), Nest Usurped (UN), Nest Covered by New Nest (CN), Natural Deterioration (ND), Nest Knocked Down (KD), Human Disturbance Intentional (HI), Human Disturbance Unintentional (HU), Heat Induced Mortality (HE), Wind (WI), Flooded (FL), Other Extreme Weather (WE), Unknown (U), Other (Describe in Comments), None (N). Competition may be from Barn Swallows that kill or displace young or adults from the nest. Predation may be from crow and Common Raven, Black-billed Magpie, European Starling, owl and other raptor, cat, rat, mouse, squirrel. Nest usurped (nest takeover) may be from Cliff Swallow or House Sparrow.*
- [3]*Visual inspection of structure: Key indicators to assess are overall stability and durability of structure materials (roof, wood, cement pads, etc.). List any structural issues that are observed.*

Comments:

Appendix 9.3 Bank Swallow colony sizes between 2020-2025.

Colony ID	2025 BANS present (Y/N/U/NA)	2025 Total No. Useable Burrows	2025 No. Active BANS Burrows	2024 BANS present (Y/N/U/NA)	2024 Total No. Useable Burrows	2024 No. Active BANS Burrows	2023 BANS present (Y/N/U/NA)	2023 Total No. Useable Burrows	2023 No. Active BANS Burrows	2022 BANS present (Y/N/U/NA)	2022 Total No. Useable Burrows	2022 No. Active BANS Burrows	2021 BANS present (Y/N/U/NA)	2021 Total No. Useable Burrows	2021 No. Active BANS Burrows	2020 BANS present (Y/N/U/NA)	2020 Total No. Useable Burrows	2020 No. Active BANS Burrows	General Population Trends
Canal Flats 3	Y	105	6	Y	98	25	Y	105	10	Y	84	25	Y	113	12	NA	NA	NA	Decreasing
Col 2N	Y	37	3+	Y	35	4	NA	NA	NA	Y	31	1	Y	30	25	Y	43	25	Decreasing
Col Lk 20-9	Y	81	1	N	103	0	Y	110	1	NA	NA	NA	N	110	0	Y	115	5	Decreasing
Edge-Brisco 2	Y	128	8	Y	132	14	Y	145	29	Y	152	64	Y	167	84	NA	NA	NA	Decreasing
Fairmont A	Y	109	7	Y	U	12	N	136	0	Y	136	16	Y	136	22	Y	153	39	Decreasing
Lk Wind 17	Y	272	72	Y	198	129	Y	224	58	Y	182	19	NA	NA	NA	Y	160	150	Decreasing
Reflection Lk	Y	232	10-11	Y	200	5	Y	220	3	Y	U	U	Y	200	20	Y	200	27	Decreasing
Reflection Lk 3	N	U	0	N	38	0	N	38	0	Y	75	3	NA	NA	NA	NA	NA	NA	Decreasing
Wilmer 6	Y	45	2	Y	43	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Decreasing
Athalmer Neighborhood	N	2	0	Y	U	10	Y	22	1	Y	29	7	NA	NA	NA	NA	NA	NA	Inactive in 2025
0	N	U	0	Y	160	U	NA	NA	NA	N	150	0	NA	NA	NA	Y	200	U	Inactive in 2025
Ath-Radium 5	N	U	0	Y	110	U	U	111	U	N	175	0	NA	NA	NA	Y	175	7	Inactive in 2025
Ath-Radium 6	N	U	0	N	60	0	U	63	U	Y	96	4	U	U	U	Y	100	U	Inactive in 2025
Birchlands Ck	N	0	0	N	0	0	N	0	0	N	0	0	N	0	0	Y	5	U	Inactive in 2025
Col 1N	N	0	0	N	0	0	NA	NA	NA	N	U	0	Y	75	10	Y	75	10	Inactive in 2025
Col 1S	N	0	0	N	0	0	NA	NA	NA	NA	NA	NA	Y	50	12	Y	50	10	Inactive in 2025
Col Lk 20-21	N	8	0	N	8	0	N	9	0	NA	NA	NA	Y	170	U	N	10	0	Inactive in 2025
Col Lk 20-24	N	31	0	Y	31	1	Y	32	2	Y	U	6	Y	155	U	Y	128	U	Inactive in 2025

Col Lk 20-29	N	34	0	Y	48	9	NA	NA	NA	N	50	0	N	50	0	Y	70	2	Inactive in 2025
Col Lk 20-3	N	35	0	N	39	0	N	35	0	NA	NA	NA	U	35	U	Y	50	U	Inactive in 2025
Col Lk 20-6	N	104	0	N	110	0	NA	NA	NA	N	110	0	N	110	0	Y	110	U	Inactive in 2025
Col Lk 20-7	N	143	0	Y	95	3	NA	NA	NA	NA	NA	NA	Y	90	U	Y	135	U	Inactive in 2025
Col Lk 24-3	N	54	0	Y	52	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Inactive in 2025
Col Lk M 17-4	N	195	0	N	185	0	NA	NA	NA	NA	NA	NA	N	173	0	Y	84	U	Inactive in 2025
Columbia Ridge	N	U	0	N	105	0	N	U	0	N	U	0	U	U	U	Y	102	U	Inactive in 2025
Edge-Brisco 1	N	0	U	N	U	0	N	U	0	N	U	0	Y	80	U	NA	NA	NA	Inactive in 2025
F19-1	N	195	0	Y	235	U	Y	270	U	Y	U	U	NA	NA	NA	Y	367	U	Inactive in 2025
Fairmont B	N	U	0	N	115	0	N	93	0	Y	85	4	Y	85	2	N	98	0	Inactive in 2025
Fairmont C	N	U	0	Y	282	12	Y	324	20	Y	274	12	Y	274	82	Y	300	250	Inactive in 2025
Fairmont D	N	U	0	N	92	0	N	59	0	Y	63	2	Y	63	13	N	40	0	Inactive in 2025
JC02	N	U	0	N	U	0	N	17	0	N	43	0	Y	60	2	Y	41	3	Inactive in 2025
Lk Wind 14	N	0	0	N	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	Y	27	1	Inactive in 2025
Lk Wind 15	N	18	0	U	20	U	NA	NA	NA	Y	23	1	Y	27	5	Y	48	U	Inactive in 2025
Lk Wind 16	N	52	0	U	60	U	NA	NA	NA	Y	57	1	NA	NA	NA	Y	43	U	Inactive in 2025
Lk Wind 22	N	7	0	N	3	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	Y	16	U	Inactive in 2025
Lk Wind 24	N	108	0	N	107	0	NA	NA	NA	NA	NA	NA	Y	70	7	Y	245	U	Inactive in 2025
Lk Wind 25	N	90	0	N	115	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	Y	114	U	Inactive in 2025
Lk Wind 4	N	77	0	N	54	0	N	55	0	N	54	0	NA	NA	NA	Y	46	1	Inactive in 2025

Lk Wind 5	N	32	0	NA	NA	NA	Y	70	6	Y	93	11	Y	100	12	Y	100	41	Inactive in 2025
Radium to Edge 1	N	42	0	N	40	0	Y	34	19	NA	NA	NA	NA	NA	NA	Y	234	U	Inactive in 2025
Radium to Edge 3	N	45	0	Y	67	7	Y	72	21	NA	NA	NA	NA	NA	NA	Y	96	U	Inactive in 2025
Radium to Edge 4	N	153	0	N	125	0	Y	U	22	NA	NA	NA	NA	NA	NA	Y	294	U	Inactive in 2025
Timber Ridge	N	31	0	N	36	0	N	32	0	NA	NA	NA	NA	NA	NA	Y	31	U	Inactive in 2025
Wilmer 4E	N	177	0	Y	155	3	Y	191	8	U	140	U	U	U	U	U	U	U	Inactive in 2025
Col Lk 20-15	Y	76	6+	N	78	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	Y	90	U	Increasing
Col Lk 20-23	Y	264	25+	Y	264	11	Y	415	15	Y	U	8	Y	418	U	Y	418	U	Increasing
JC01	Y	U	11	N	U	0	N	37	0	Y	17	2	N	35	0	Y	18	4	Increasing
Lakeview Meadows	Y	67	27	Y	69	14	Y	73	20	Y	67	17	Y	69	15	Y	65	10	Increasing
McKersie's	Y	589	158	Y	446	110	Y	335	65	Y	428	55	Y	400	32	Y	504	U	Increasing
Radium to Edge 5	Y	285	84	Y	271	30	Y	293	13	NA	NA	NA	NA	NA	NA	Y	270	U	Increasing
Radium to Edge 6	Y	233	106	Y	340	U	Y	350	50	Y	U	U	NA	NA	NA	Y	575	U	Increasing
Reflection Lk 2	Y	46	15	Y	44	14	Y	25	10	N	17	0	NA	NA	NA	N	2	0	Increasing
Winder LK PP	Y	140	11	Y	148	5	Y	164	3	Y	164	4	Y	164	4	Y	164	U	Increasing
Canal Flats 1	Y	140	59	Y	106	41	Y	128	32	Y	207	46	Y	140	43	Y	185	U	Increasing
Athalmer Bridge North	Y	21	6	Y	20	2	Y	18	5	Y	14	3	Y	10	5	Y	10	3	Stable
Ath-Radium 8	Y	U	1	Y	110	1	U	109	U	Y	140	U	N	105	0	Y	170	U	Stable
Col Lk 20-20	Y	49	2+	Y	56	1	Y	45	6	Y	46	1	NA	NA	NA	N	88	0	Stable
Col Lk 20-22	Y	94	6	Y	94	8	Y	33	1	Y	U	10	Y	72	5	Y	72	U	Stable
Col Lk 20-8	Y	171	10+	Y	170	6	Y	165	15	Y	180	19	Y	200	U	Y	200	U	Stable
Col Lk M 17-1	Y	291	12	Y	291	20	Y	250	19	NA	NA	NA	Y	250	U	Y	230	U	Stable

Col Lk M 17-3	Y	81	27	Y	85	35	Y	80	39	Y	100	31	Y	90	U	Y	86	U	Stable
Fairmont E	Y	U	U	Y	871	54	Y	845	50	Y	668	74	Y	668	41	Y	430	12	Stable
Golden MCG - 1	Y	20	12-31	Y	17	U	Y	36	U	Y	36	10	Y	48	23	Y	50	7	Stable
Golden MCG - 2	Y	25	1-4	Y	5	1	Y	16	U	Y	10	1	Y	20	2	Y	27	5	Stable
Wilmer 4W	Y	51	1	Y	53	2	Y	57	1	Y	30	1	U	U	U	U	U	U	Stable
Ath-Radium 13	Y	U	U	Y	200	U	Y	193	10	Y	200	64	NA	NA	NA	Y	160	U	Unknown
Ath-Radium 2	Y	U	U	Y	350	U	Y	360	U	Y	308	27	Y	308	26	Y	340	151	Unknown
Ath-Radium 4	Y	U	U	Y	60	U	Y	65	4	Y	108	9	Y	U	7	Y	85	U	Unknown
Canal Flats 2	U	87	U	N	115	0	N	115	0	U	107	U	Y	163	42	Y	70	U	Unknown
Col 3N	Y	186	U	Y	260	U	Y	100	23	Y	169	70	Y	165	25	Y	100	25	Unknown
Col Lk 20-1	Y	58	U	Y	63	5	NA	NA	NA	NA	NA	NA	Y	50	20	Y	60	25	Unknown
Col Lk 20-10	Y	82	U	Y	160	2	Y	155	4	NA	NA	NA	Y	135	U	U	150	U	Unknown
Col Lk 20-11	Y	420	20+	Y	502	U	Y	480	U	Y	480	47	Y	475	U	Y	425	U	Unknown
Col Lk 20-18	Y	64	U	N	8	0	N	23	0	NA	NA	NA	N	57	0	Y	65	U	Unknown
Col Lk 20-26	Y	400	U	N	400	0	Y	400	15	Y	404	17	Y	404	U	Y	404	U	Unknown
Col Lk 20-27	Y	128	U	Y	80	U	Y	110	8	Y	95	U	U	95	0	Y	95	U	Unknown
Col Lk 20-28	Y	240	U	Y	280	U	Y	271	20	Y	235	30	Y	180	U	Y	190	U	Unknown
Col Lk 22-2	N	100	0	U	133	U	Y	107	2	N	95	0	NA	NA	NA	NA	NA	NA	Unknown
Col Lk 24-5	Y	55	5	Y	23	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Unknown
F1863	NA	NA	NA	N	U	0	NA	NA	NA	N	6	0	N	U	0	Y	9	2	Unknown
Lk Wind 26	Y	187	U	Y	241	U	Y	70	5	Y	60	10	NA	NA	NA	Y	145	U	Unknown
Lk Wind 28	Y	29	6-7	Y	34	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Unknown
Trescher's	Y	176	U	Y	U	U	Y	U	U	Y	135	22	Y	146	20	NA	NA	NA	Unknown
Hospital Creek	Y	51	7	Y	62	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	unknown
Athalmer Bridge South	Y	35	2	Y	36	3	Y	24	9	Y	18	6	Y	18	6	Y	8	2	Variable
Ath-Radium 1	Y	61	U	Y	61	13	Y	61	5	Y	72	15	Y	35	16	Y	56	25	Variable

Col Lk 20-12	Y	163	U	Y	180	20	N	188	0	Y	188	12	Y	250	U	Y	305	U	Variable
Col Lk 20-31	Y	41	1+	N	56	0	Y	43	2	NA	NA	NA	N	42	0	N	42	0	Variable
Golden MCG - 3	Y	56	1-10	Y	56	6	Y	45	U	Y	45	11	Y	31	1	Y	45	27	Variable
Lk Wind 18	Y	119	38	Y	159	103	Y	164	53	Y	132	39	NA	NA	NA	Y	148	U	Variable
Radium to Edge 2	Y	80	23	N	73	0	Y	U	14	NA	NA	NA	NA	NA	NA	Y	105	U	Variable
Wilmer 1	Y	U	2	N	90	0	N	94	0	Y	100	2	N	12	0	N	200	0	Variable
Wilmer 3	Y	97	18	Y	110	9	Y	103	11	Y	92	U	Y	117	15	Y	117	45	Variable

Appendix 9.4 Summary of Barn Swallow nest site characteristics (2021-2025).

Nest Site Name / ID	No. of structures (per site)	Dominant Structure Category	Dominant Structure Used for Nesting	Type of Structure	No. of Nests Located	Primary Support Feature (Nest Attachment), n= # of nests used to document primary support feature	Structural material for nest attachment	Typical Nest Location on Structure	Ledge Width (cm)[1]	Nest Height Above Ground (m)[1]	Roof/Overhang Above Nest (cm)[1]
Bush Hrb Outhouse	1	outbuilding	outhouse	building	1	wall, n=1	wood	interior	-	1.6; n=1	0.6; n=1
Bush Hrb Outhouse Boat	1	outbuilding	outhouse	building	1	wall, n=1	concrete	exterior	-	-	-
Bush Arm Causeway	1	transportation	underneath bridge	bridge	7	wall, n=1	metal	exterior	-	-	-
Donald Mill Site 1	1	other	old sawmill building	building	3	-	-	-	-	-	-
Donald Mill Site 2	1	other	old sawmill building	building	26	light fixture, n=23	plastic	interior	-	-	-
Kicking Horse Mountain	15	public/institutional	daylodge at ski resort	building	121	mixed features, n=121	wood	exterior	20(1-200); n=60	6(2-21); n=95	8(3-50); n=77
Holmes-Deakin Rd	1	agricultural	barn	building	5	light fixture, n=1	plastic	interior	-	-	-
Kettleston Rd	1	outbuilding	shed	building	10	vertical beam, n=2	wood	interior	15; n=1	2.45; n=4	5.5 (5-6); n=4
Frisky Farm	1	residential	house	building	2	mixed features, n=2	mixed	multiple	-	-	-
Oberg Johnson Rd	1	outbuilding	shed	building	5	horizontal post, n=4	wood	multiple	-	-	-
Golden Mill	10	commercial/industrial	mill buildings	building	75	horizontal beam, n=unknown	wood	interior	-	-	-
Golden School Bus Barn	1	commercial/industrial	school bus garage	building	3	mixed features, n=2	wood	exterior	-	-	-
Golden General Hospita	1	public/institutional	hospital	building	2	mixed features, n=2	drywall	exterior	-	-	-
Golden Curling Club	1	public/institutional	recreational building	building	1	horizontal post, n=1	wood	exterior	-	14; n=1	20; n=1
Golden Secondary Schoo	1	public/institutional	school building	building	9	box of 2 supporting beams, n=	metal	exterior	4 (4-5); n=4	8.5 (5.48-9); n=5	7 (4-10); n=2
Broughton Farm	1	agricultural	barn	building	2	horizontal post, n=2	wood	exterior	10; n=2	9; n=2	10; n=2
CP Rail Spray Facility	1	commercial/industrial	shelter	building	1	horizontal ledge, n=1	wood	exterior	-	2; n=1	-
Nicholson Bridge	1	transportation	underneath bridge	bridge	1	horizontal ledge, n=1	metal	exterior	30; n=1	6.7; n=1	30; n=1
Murphy's	1	residential	under house deck	deck	1	light fixture, n=1	plastic	exterior	-	-	-
Darbyshire Farm	1	outbuilding	shed	building	1	dryer vent, n=1	metal	exterior	-	-	-
Golden Concrete	4	other	old buildings	building	7	horizontal ledge, n=3	wood	exterior	-	-	-
Sigi's - Horse Creek	1	residential	house	building	6	horizontal ledge, n=5	wood	multiple	5; n=2	4; n=2	7; n=2
Managh's home	1	residential	cabin	building	1	horizontal post, n=1	wood	exterior	-	-	-
St. Pierre farm	1	agricultural	barn	building	4	horizontal ledge, n=3	wood	interior	-	2.45 (2.4-2.5); n=3	10.15 (7.6-12.7); n=2
Tobler Farm	3	agricultural	barn	building	35	horizontal post, n=5	wood	interior	-	3 (2.45-3.6); n=3	50 (30-120); n=3
2558 Hwy 95	1	residential	house	building	1	horizontal ledge, n=1	wood	exterior	30; n=1	3; n=1	14; n=1
Matson's	1	outbuilding	boathouse	building	3	horizontal post, n=3	wood	exterior	-	-	-
4150 Thomas Road	1	agricultural	barn	building	1	horizontal ledge, n=1	wood	interior	-	-	-
Sole's Barn	2	agricultural	barn	building	25	horizontal post, n=19	wood	interior	10.16; n=13	3.65 (2.4-9); n=20	7.5 (5-10); n=2
Cox property	1	agricultural	barn	building	1	horizontal beam, n=1	wood	interior	-	-	-
Dunphy's	1	agricultural	barn	building	10	horizontal post, n=1	wood	interior	-	-	-
Wolfenden's	1	residential	house	building	1	wall, n=1	metal	exterior	-	6; n=1	-
Beard's Creek B&B	1	outbuilding	shed	building	3	horizontal post, n=1	wood	interior	-	-	-
Vogt Barn	1	agricultural	barn	building	3	unknown, n=3	unknown	interior	-	-	-
Owens House	1	residential	house	building	4	horizontal ledge, n=4	wood	exterior	19 (16-44); n=4	4; n=4	15; n=4
Patty's Greenhouse - Lw	1	agricultural	shed	building	3	horizontal post, n=3	wood	interior	-	-	-
Warner's	2	residential	workshop	building	3	horizontal post, n=3	wood	-	-	-	-
Patty's Greenhouse - Up	2	agricultural	shed	building	3	mixed features, n=3	wood	exterior	-	-	-
Rockaboo Ranch	2	other	house	building	5	wall, n=1	wood	interior	-	-	-
Trescher Barn 2	1	agricultural	barn	building	3	horizontal post, n=3	wood	interior	-	-	-
Bayley Shed	1	outbuilding	shed	building	1	horizontal post, n=1	wood	interior	-	-	-
Trescher Barn 1	1	agricultural	barn	building	10	horizontal post, n=10	wood	interior	-	-	-
Riverside Farm	3	agricultural	barn	building	9	horizontal post, n=4	wood	interior	-	-	-
Brisco Barns	1	agricultural	barn	building	6	horizontal post, n=6	wood	interior	-	2; n=3	10; n=3
BPP	9	commercial/Industrial	outbuildings	building	53	horizontal post, n=10	wood	exterior	20; n=1	5 (2-8); n=15	10 (4-20); n=11
Trescher's Home	3	residential	house	building	5	horizontal post, n=2	wood	-	-	-	-
Panorama	9	residential	townhouse	building	12	horizontal ledge, n=5	wood	exterior	20 (10-46); n=7	3.3 (2.5-7); n=11	5 (3-20); n=7
Zehnder Brisco Farm	1	agricultural	mixed	building	2	horizontal post, n=1	wood	interior	-	3.5; (2-5); n=2	-
Edgewater Arena	1	public/institutional	arena	building	1	slanted 2x4, n=1	wood	interior	-	10; n=1	30; n=1
Firlands	2	agricultural	barn	building	5	horizontal post, n=1	wood	interior	-	-	-
Hewitt Road	1	agricultural	barn	building	2	horizontal ledge, n=2	wood	interior	15; n=2	3.5; n=2	5.7 (5.08, 6.35); n=2
McKinnon House	1	residential	house	building	1	wall, n=1	wood	exterior	-	-	-
Kindersley Rd	1	agricultural	barn	building	5	rafter, n=2	wood	interior	-	2.5 (2.5-5); n=3	-
Edgewater - TNT	1	other	quonset	building	2	horizontal post, n=1	wood	interior	-	-	-
Zehnder's Farm	7	agricultural	workshop	building	135	horizontal post, n=2	wood	interior	15; n=1	2.5 (2-6); n=4	22.5 (15-30); n=2
Zehnder's Neighbour	1	residential	house	building	2	wall, n=2	plaster	exterior	-	2.7 (2.5-2.9); n=2	8.5 (5-12); n=2
Feldmann	2	agricultural	shed	building	7	light fixture, n=1	plastic	interior	-	-	-
Radium Mill	4	commercial/Industrial	sawmill buildings	building	8	mixed features, n=2	unknown	-	-	7 (2-9); n=3	-
Wrazej Barn	1	agricultural	barn	building	2	horizontal post, n=2	wood	interior	-	-	-
Burkart Barn	1	agricultural	barn	building	5	horizontal post=5	wood	interior	1	2.5 (2-3); n=2	-
TXN installations	1	commercial/Industrial	open building	building	1	angled wooden post, n=1	wood	interior	-	-	-
Rona	3	commercial/Industrial	building shed	building	5	horizontal post, n=3	wood	interior	8	4 (3-5); n=5	5 (5-10); n=5
Home Hardware - Inver	1	commercial/Industrial	commercial building	building	6	horizontal ledge, n=3	metal	exterior	4; n=2	3 (2.5-11); n=3	6 (5-8); n=3
Jane Creek Boathouse	1	transportation	boathouse	building	6	horizontal ledge, n=2	wood	exterior	-	-	-
Fairmont HS Resort	8	public/Institutional	resort buildings	building	19	horizontal ledge, n=6	wood	exterior	8 (2-20); n=14	2.73 (1.8-9); n=18	10 (2.1-14); n=5

Appendix 9.5 Press release in The Golden Star March 31, 2022.

www.thegoldenstar.net Golden Star Thursday, March 31, 2022 Page A5

Local conservation project seeking volunteers to help monitor swallows

By Claire Palmer

As weather warms, the Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) is set to resume as migratory birds return to the north for summer.

The project, which is in year two of five, is looking for volunteers to help with barn and bank swallow nest monitoring. The commitment would be between early spring in April and May, until September for barn swallows and from June to July for bank swallows.

Swallows have been experiencing a steep decline in numbers over the last few years across Canada. (Rachel Darvill photo)

Biologists are also looking for the location of any new barn and bank swallow nesting sites in the Columbia Valley, and are asking residents and volunteers to keep their eyes peeled.

"The swallow project has lots of exciting things lined up for 2022, including the installation of Motus Wildlife Tracking Stations in the Columbia Valley," stated project biologist Rachel Darvill.

"These stations, along with the tagging of about 100 bank swallows, will help us track local swallow movements during breeding periods, during post-breeding, and will identify migration routes and winter areas."

The project was will study swallows from Canal Flats to the Kinbasket Reservoir, as their populations decline across Canada.

The Columbia Wetlands and surrounding areas are amongst the best places to target swallow recover efforts, says Wildight Golden, who contracted Darvill for the project.

The project is also working on erecting more artificial nesting structures for barn swallows in strategic locations of the Columbia Valley, on restoring bank swallow breeding habitat that has been altered, and effectiveness monitoring at artificial nesting structures built in 2021.

Additionally, private landowner outreach and nest monitoring with volunteers will continue.

Regarding interpretive signage designed and installed for swallows, the UCSHEP will work with Indigenous peoples to share their perspectives on swallows.

Stay tuned to more updates about some of these exciting initiatives.

There two events coming up and April 11 and April 29, both led by the project biologist. Registration is required and to register for either event visit the UCSHEP website.

The partnership between Darvill and Wildsight is not new – the two have previously collaborated on a swallow project that wrapped up with a final report in January of this past year, which concluded that the Columbia Wetlands were a vital habitat for bank and barn swallows.

The project provided information to communities regarding the Migratory Birds Convention Act, including obligations under this Act by assisting private landowners with empowering education regarding their duties to protect nests.

Research from this previous project has now transformed into the five-year Upper Columbia Swallow Habitat Enhancement Project.

If you are interested in participating in this project or want more information, please contact the project biologist at racheldarvill@gmail.com.

Appendix 9.6 Press release in The Columbia Valley Pioneer, Aug 11, 2022.

August 11, 2022

Get involved with the Columbia Valley Swallow Project

By Chadd Cawson
Local Journalism Initiative Reporter

It's been a decades-long sad song for the bank and barn swallows of the passerine songbird family — their numbers have dropped significantly, a 98 per cent population decline over the last 40 years. Lovers of the acrobatic songbirds are nervous, and for good reason, with both the bank and barn swallows considered an at-risk species and labelled as threatened under Canada's Species at Risk Act. Barn swallows, known for their immense mosquito control, have been blue listed in the province of B.C., which simply means a light is shone on any species or ecosystem of special concern. Some contributing factors to the decline of certain swallow species are related to the decline of agriculture, regrowth of forests, suburbanization, urbanization and the common practice of closing up barns in some areas. As their name suggests, barn swallows have long found refuge in these buildings.

Seen here is a Motus Wildlife Tracking Station that was recently erected in the Columbia Valley with the assistance of BC Parks to monitor bank swallows in the region.
Photo by Ryan Wattmough

According to Nature Canada, these two varieties of the swallow have become listed as threatened species under Schedule 1 of the 2002 Species at Risk Act in Canada. It took many years for this to become official in 2017, following recommendations that the barn swallow be added to the list in 2011 and the bank swallow be added to it in 2013. It was then-Environment Minister Catherine McKenna who pushed those listings through in 2015. After much work and research to determine Columbia Valley nesting locations for bank and barn swallows, the Columbia Valley Swallow Project (CVSP) took flight in 2020, with its main goal that first year being locating more nesting sites. In all, 135 swallow colony sites were discovered in steep crumbly soils, with 96 of those confirmed as active bank swallow colonies.

The region between Canal Flats and Edgewater has proven to be popular with the tiny bird as the area is ideal and critical as a breeding habitat. The CVSP has brought on trained, volunteer citizen-scientists who involved with monitoring the species and documenting important information, such as breeding locations. Another aim of the CVSP is to educate and provide information to the public regarding the Migratory Birds Convention Act. Part of this includes empowering private landowners with their duties to protect nests. It is illegal to remove swallow nests on private lands and has of late become a great conservation concern.

The upper Columbia Swallow Habitat Enhancement Project is working on enhancement, restoration, monitoring and tracking initiatives for at-risk swallows in the region. As the 2022 field season wraps up preliminary numbers show that 70 volunteers helped on this project this year, monitoring 65 barn swallow nest sites, 72 bank swallow colonies and 40 cliff swallow nest sites. A fourth artificial nesting structure was completed in the Parson area last month while a fifth structure is in the works.

"We erected the third largest Motus Wildlife Tracking Station in the Columbia Valley with the assistance of BC Parks and the data from bank swallows we tagged in July 2022 is being received at all stations we installed," said Program Biologist Rachel Darvill. "All of these initiatives are working towards swallow conservation for these threatened species.

It is believed this data can be used to assist with biodiversity and sustainability goals, not to mention inform regional planning processes. Darvill who has been studying swallows for many years, suggests keeping outside lights off at night, as the glare can cause disorientation and can disrupt the nocturnal migratory behaviour of the small songbirds and many other birds. While the CVSP is only in its second year, there are other volunteer projects one can get involved in through Wildsight Golden, such as the Christmas Bird Count and the Swallow Citizen Science Project.

To learn more, visit Columbia Valley Swallow Project online at wildsight.ca/branches.golden.

Appendix 9.7 Press release in The Golden Star, 2022.

Motus network established in the Columbia Valley used to track Bank Swallows

Motus technology is helping track bank swallows in the Columbia Valley. (Rachel Darville photo)

Submitted by Wildsight

In late June 2022, Wildsight Golden started a new thread of the Upper Columbia Swallow Habitat Enhancement Project by putting 50 Motus tags (wildlife tracking devices) on 50 individual threatened Bank Swallows.

This was done in partnership with Environment and Climate Change Canada's Canadian Wildlife Service.

The collaboration also installed three large Motus wildlife tracking stations in the Columbia Valley, along with a smaller tower at one of the colonies located on Shuswap Band land, with their permission.

Motus wildlife tracking technology is being used to help identify the areas used during the breeding and postbreeding period (i.e., prior to fall migration) by Bank Swallows. This information is key for helping to protect Bank Swallows within the North Columbia/Upper Columbia (e.g. by learning what areas are important to conserve, enhance, or restore for Bank Swallows) and at other breeding locations across Canada.

In addition, using Motus receiving stations located throughout the western hemisphere tagged individuals will be tracked during fall migration providing unprecedented information on migratory timing, routes, stopover locations, and winter areas. This information is key for forming international collaborations that will conserve and recover swallow habitats and populations throughout the year.

This work is being financially supported by the Columbia Basin Trust's Ecosystem Enhancement Program, Fish and Wildlife Compensation Program, and the Columbia Valley Local Conservation Fund. Our sincere gratitude goes out to these funders.

The Shuswap Band (Secwepeme Nation) is supporting this program including permission for land access and use.

Appendix 9.8 Press release in The Golden Star, 2023.

Co-existing with bats and swallows in the Kootenays

At first glance, one might imagine the Kuskanook Chalet in a coffee table book on modern architecture – a slant roof cabin perched on stilts at the edge of a pine forest.

With its minimalist aesthetic and lake vista it seems set to score five stars on Airbnb. Except, small problem: there's no door.

At least not one for humans. This tiny chalet is designed and built for bats.

This project is one of a handful that provides important habitat for species at risk in the Kootenays.

Wildlife Conservation Society Canada installed the Kuskanook Chalet just north of the Creston Valley Wildlife Management Area. (Contributed)

Who benefits from these new builds? Bats and swallows.

And according to Marcy Mahr, Kootenay Connect manager for the Kootenay Conservation Program, their neighbours also benefit.

"Bats and swallows are 'aerial insectivores' meaning they catch food on the wing," said Mahr.

"Some people think they're a nuisance, but given how many mosquitoes they consume they're actually great neighbours."

Funded by Environment and Climate Change Canada, Kootenay Connect helps to sustain regional biodiversity by providing for the needs of federally-listed species at risk.

Although gobbling skeeters is a perk (bats eat their weight in insects every night, swallows dine on roughly 850 mosquitoes a day) it's their role within the entire ecosystem that makes them a target species for Kootenay Connect and its partners.

Wildlife Conservation Society Canada (WCSC) is one such partner. When a maternal colony of bats were evicted from a nearby home, WCSC north of the Creston Valley Wildlife Management Area, one of Kootenay Connect's focal areas.

Evictions like these are a big deal – half of the 16 bat species in B.C. are threatened, habitat loss of any kind is a potential blow to the population. "Bats are creatures of habit," said Cori Lausen, director of Bat Conservation with WCSC. "If they can't get into their familiar attic, sometimes they'll actually hang on the outside of buildings."

Add the fact some female bats live up to 40 years and return every year to the same roost to raise a single pup, it's no surprise WCSC built a new roost just 100 metres from the bats' original home.

A critical element of roosting habitat is temperature. Biologists now know bats need access to a variety of microclimates.

For a nursing mama and her pup, 42 C is cozy but 44 C can be lethal.

Informally called the 'Goldilocks approach', one solution is to provide habitat that won't leave bats or too cold: it needs to be juuust right.

Bats aren't the only mosquito-eating species who could use a boost. Throughout the Kootenays swallows can be seen gracefully feasting at high speed.

Like bats, these birds are colony-dwelling and sight of them may give an impression of abundance.

But according to Birds Canada, over the last 40 years bank swallow populations declined by 98 per cent in Canada. Over the same time, barn swallow populations declined by 76 per cent.

Statistics like these motivated biologist Rachel Darvill to start the Upper Columbia Swallow Habitat Enhancement Project (UCSHEP), a project administered by Wildsight Golden.

For the last three years Darvill and her team have been studying swallow colonies between Canal Flats and Edgewater.

"It's easy to disregard swallows or think they're all the same," said Darvill, highlighting the Columbia Valley is home to six different species.

"Many people don't understand the challenges these species face or critical the habitat in this region is."

Why swallow numbers have dropped is somewhat of a mystery. Although pesticide exposure, the massive decline of insects and climate change are factors, loss of nesting habitat is one cause Darvill feels her project can affect. To that end, UCSHEP has installed five artificial nesting structures and dozens of nesting cups throughout the Columbia Valley.

Although the presence of bats or swallows isn't always welcome, learning to coexist not only means less mosquitoes, it supports the future of entire species.

And with so many complementary habitat traits, cohabitation between these aerial insectivores seems ideal. This concept recently brought WCSC and UCSHEP together to build a dual-species home in Parson.

Wittily dubbed the 'Parson AirBnB' (for Bats n Birds), it's an example of habitat innovation through partnership.

Future monitoring will reveal the rating its new inhabitants

Appendix 9.9 Press release in The Columbia Valley Pioneer, April 13, 2023.

April 13, 2023

Dirt pile developed as critical bird habitat

Bank swallow habitat project to become part of new park

By Steve Hubrecht
steve@columbiavalleypioneer.com

There is no doubt that encroachment affects wildlife, some species move off and some turn human structures into homes. Sunken Second World War shipwrecks becoming artificial reefs is one happy accident. Another, much more local, example is the dirt pile by the Athalmer boat launch — now home to a nine pairs of breeding bank swallows.

The dirt pile has sat in Athalmer for more than three decades, but it wasn't until last year that a volunteer bird monitor realized it was habitat for the at-risk species. Now the pile is an official habitat protection project for the District of Invermere. The birds face danger from loss of habitat and exposure to pesticides in their diets, according to Nature Canada.

The project involves preserving the one-third of the pile the bank swallows are using, creating fencing barriers to keep people a safe distance away from the birds, and adding interpretive signs explaining the ecological significance of the species and their importance of bank swallows to the Shuswap Band and the Ktunaxa Nation.

Golden-based wildlife biologist Rachel Darvill spearheaded the efforts.

Darvill leads the Upper Columbia Swallow Habitat Enhancement Project, which focuses on bank swallows and barn swallows between Canal Flats and Kinbasket Lake. Both species are designated as at-risk in Canada.

Volunteers with this larger project do inventory of bank and barn swallow nesting sites. One Columbia Valley volunteer noticed banks swallows living in the dirt pile west of the boat launch and south of the boat launch parking lot in Athalmer.

Invermere planner Rory Hromadnik said he didn't know exactly how long the dirt pile has been sitting in Athalmer, but said it was part of the original resort development proposal at the site, and so likely dates to the 1980s.

The development was never complete, but "people were protesting down there, because they were filling in the wetlands," he said. The dirt pile was probably being used by the developers for compaction, he added.

The two-thirds of the pile that the district removed amounts to 3,000 cubic metres and will be used for landscaping or the natural amphitheater in the planned park, said Hromadnik.

Continued on page 8 . . .

. . . 'Dirt pile' from 5

Darvill came to investigate and identified nine breeding pairs (18 adults in total). She soon found out that the part of Athalmer containing the dirt pile is to be redevoped. The pile is part of the Lake Windermere Resort Lands, which the District of Invermere bought in 2019 and which it plans to turn into public parks and other green space.

She contacted the district and proposed not only conserving the pile, but also enhancing it as habitat. As far as the swallows are concerned her timing was excellent, since the district had initially planned to remove the entire pile and use it elsewhere on the site.

"It was lucky. They were going to destroy it," she said.

Darvill couldn't say with certainly how often bank swallows use manmade dirt piles as habitat, but explained that from what she understands it's not very common.

The reason she's not certain is because there is not a lot known about bank swallows in general. Darvill said she was not aware of any research on bank swallow colonies in urban habitats, and her experience in the Columbia Valley is that most of the bank swallow habitat tends to be on the lakeshores or in steep banks of the Columbia River.

In fact there are "not a lot" of bank swallow colonies north of the steep river banks on the Columbia north of Brisco, she said. Still, Darvill was clear that any bank swallow habitat that can be preserved should be. The species suffered a 93 per cent decline in population in Canada between 1970 and 2010.

Lake Windermere supports a "significant amount of bank swallow habitat," she said. But one of the swallows' favourite nesting site on the lake — Lake Windermere Provincial Park — has also recently seen a drop in nesting.

At one point Lake Windermere Provincial Park supported 260 documented bank swallow burrows. A few years ago there were only four nesting pairs occupying those burrows. Part of the problem was people using the park for recreation and disturbing the birds.

"There was a trail right through the colony, which caused some slumping. And people were coming right up to the nests and jamming sticks in the burrows," said Darvill. "It was quite a bit of negative impact."

The nesting areas at Lake Windermere Provincial Park have since been fenced off and signs put up telling the public to stay away.

The swallows probably chose the dirt pile in Athalmer because it is the right soil type. "Friable soil" has crumbly texture, and bank swallows like it because it is not too hard to dig in, but is still hard enough to retain its shape, said Darvill.

The pile will be enhanced as habitat by making the small vertical face where the bank swallows have burrowed into a more distinct vertical face. Bank swallows likely prefer vertical faces because this makes it hard for would-be predators to get at the burrows, said Darvill.

The bank swallow habitat project "fits very nicely" with the district's plans for the area, he said. This includes the park as well as Invermere's planned trail network expansion.

People will be able to read about bank swallows, see the habitat project, and then look across the Columbia River at the bank swallow burrows on the other side, he explained.

"It's a neat opportunity and will be a great educational piece," he said.

The project is set to be complete before mid-May, when bank swallow breeding season begins.

The total cost for the project is $22,500 — $5,000 from a grant and the remaining $17,500 from district reserves.

Appendix 9.10 Press release in The Columbia Valley Pioneer, June 13, 2024.

Swallow habitat getting boost by Wildsight

Submitted by Wildsight Golden

There have been some accomplishments in the Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) and we are looking ahead.

Populations of two species at risk, bank and barn swallows, have unfortunately significantly declined in the last few decades.

The UCSHEP, administered by Wildsight Golden, is working to help halt and reverse these population declines.

In 2023 the UCSHEP team was involved in the following conservation actions: coordinating 82 volunteers who helped monitor bank swallow colonies and barn swallow nests in the Upper Columbia Valley between Donald and Canal Flats; private landowner visits for swallow inventories and education about swallows; construction of artificial nesting structure (ANS) for barn swallows and a multi-species use structure for endangered bats and swallows.

Eight ANSs have been constructed since the program's inception in 2021. Twenty-nine nest cups were installed on various pre-existing buildings, which were made by volunteers from the Lake Windermere Rod and Gun Club. A bank swallow colony in Invermere was prevented from being destroyed during a development and instead was resloped for increased nesting opportunities.

In partnership with Environment and Climate Change Canada, six Motus Wildlife Tracking Stations were installed and 50 bank swallows tagged at two colonies near Invermere to provide information on post-breeding habitat and migration routes. At swallow enhancement sites, interpretive signs were installed and included Indigenous information about the swallows. Perspectives were provided by the Secwépemc and Ktunaxa Nations.

The UCSHEP has some exciting things coming up. We will continue to have volunteers monitor bank swallow colonies and barn swallow nests. We'll also continue to provide landowner outreach and education through farmer's markets, bird walks, presentations, and give nest cups for barn swallows to those people who qualify.

We plan to work more with businesses to help them learn how to co-exist with at-risk barn swallows. There will be a bank swallow restoration initiative near Parson.

In Edgewater we plan to make modifications to a pre-existing barn to make it structurally sound and more suitable for barn swallows and bats, partnering with The Nature Trust of BC and the Wildlife Conservation Society. And we will be building an artificial nesting structure at Moberly Marsh, collaborating with Ducks Unlimited Canada and BC Parks.

We cannot do this work without the help of volunteers and are once again looking for people with binoculars to help us until September. Volunteers will monitor swallow nests, or colonies, or possibly the effectiveness of conservation actions already on the ground. This is a great way to learn more about our local swallows and get outside at the same time. We provide training and support.

To learn more please visit the Wildsight Golden website or contact us at swallows@wildsight.ca.

Thank you to all of the volunteers that help make swallow conservation in the Columbia Valley a success.

This program is managed by local biologist Rachel Darvill and naturalist Verena Shaw.

We look forward to hearing from you!

Monitoring bank swallows along Lake Windermere.

PHOTO SUBMITTED

Chance discovery leads to conservation

Submitted by Lorene Keitch
Wildsight communications

A chance discovery by a group of Invermere birders led to a conservation success for a fledgling bank swallow colony in Invermere.

In the spring of 2022, local birder Greg Scott and his fellow birdwatchers noticed a small colony of bank swallows near a large dirt mound on a District of Invermere-owned lot bordering Lake Windermere. Upon closer inspection, they found nesting holes and estimated that about seven pairs of the swallows were residing there for the breeding season.

Greg, a volunteer with Wildsight Golden's Upper Columbia Swallow Enhancement Project, reported his findings to project lead biologist Rachel Darvill.

"She came to check it out and agreed it was a great find. She asked me to keep monitoring the site as part of the swallows project, and I've been watching it ever since," said Greg.

Bank swallows are a species at risk, facing near extinction in Canada with an estimated 93-98 per cent population loss over a recent 40-year period. The swallows project, launched in 2021, aims to inventory, monitor and enhance habitats for at-risk bank and barn swallows in the Columbia Valley.

The dirt pile on the District of Invermere land is estimated to have been undisturbed since the 1980s, but until 2022 had gone unnoticed as an important habitat for the at-risk species. Rachel reached out to district staff, urging them to protect the hill. Her timing couldn't have been better; the district had planned to level the dirt pile in preparation for landscaping and future development plans for a park.

In October 2023, the pile was cut away to create a more vertical cliff on one side. The mound was also fenced off to prevent human interference, a suspected cause of colony collapse in other nearby areas.

"Bank swallows need very specific conditions to thrive," Rachel said. "They look for near-vertical cliffs, proximity to water and specific types of substrate for their nests. We worked hard to ensure the dirt pile met those needs."

District of Invermere Mayor Al Miller said they were pleased to allocate habitat for the bank swallows that had found a home here.

"When we purchased this land, we saw a true opportunity to be able to increase our area for parks, for both our citizens and visitors," Miller said. "That particular bank that was there had become a great nesting home for swallows. So what better in a park than to add a little education as well? By being able to carve off a nice piece of it and protect it for the future, it adds that whole educational piece to the park."

When bank swallows came back north in the spring of 2024, they started to occupy the newly-created cliff.

"By early May of this year, I saw around nine nest holes, and then every time I came back, the numbers just kept going up. By late May, there were 52 nest holes, and by June it exploded to about 300 (nesting holes). In 2022, there were only seven breeding pairs," Greg said. "It's incredible to see the difference after the habitat enhancement!"

Continued on page 8

Continued from page 7

The result was nothing short of extraordinary.

"It was a hugely successful project," Rachel reflects. "We spent some hours observing the colony, trying to count the number of active burrows. It was challenging due to the sheer volume of activity—there were so many swallows coming and going."

Rachel and her team determined that at least 195 of those 300 nesting holes were active and produced chicks. With each burrow holding an average clutch size of three to four eggs, upwards of 800 chicks may have been produced at the colony this year.

This project is a testament to the power of collaboration and community-driven conservation.

"We're not aware of another enhancement project like this one," Rachel says. "It's an innovative, collaborative and successful effort for a species at risk, and I hope we can continue to share its success with others."

Thanks to volunteers like Greg working alongside Rachel in this five-year project, a colony of bank swallows now thrives, a reminder of how small conservation efforts can lead to significant results.

Appendix 9.12 Press release in The Golden Star, December 2024.

Golden Star www.thegoldenstar.net

Publisher: Megan Crandall
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Bank Swallow Habitat Enhancements Completed in Golden Area

Submitted by Wildsight Golden

Populations of avian aerial insectivores (e.g., swallows, swifts, nightjars) have been declining for decades and conservation actions must be put into place to help halt and reverse this alarming trend. Bank Swallows have faced one of the fastest population declines for a species in Canada with an estimated 98% population loss in Canada over a recent forty-year period.

"Bank Swallows have faced one of the fastest population declines for a species in Canada with an estimated 98% population loss in Canada over a recent forty-year period."

Reasons for the massive decline are cumulative and include the loss of breeding, foraging and winter habitat, collision with vehicles, widespread pesticide use, population decline of insects, climate change and destruction of nest sites.

With only 2% of their population remaining in Canada, Bank Swallows require urgent conservation action! They have very specific habitat requirements that we need to pay special attention to, especially sites with ideal breeding habitat, i.e. specific substrate (silty-fine sand), vertical banks, low-elevation (less than 900m) and near water. Bank Swallows dig burrows in vertical banks with the right type of conditions as mentioned.

In the Columbia Valley, ideal breeding conditions for Bank Swallows are found between Canal Flats and Edgewater. "We have discovered 126 Bank Swallow colonies through the Upper Columbia Swallow Habitat Enhancement Project [UCSHEP] and these critical breeding areas should be conserved, restored or enhanced where possible, especially given recent and significant population decline," states project biologist Rachel Darvill.

"There are considerable gaps in the amount of available breeding habitat north of Edgewater, with only scattered colonies located between Edgewater and Donald. We have been working to expand the amount of available breeding areas for this species at risk," says Rachel.

The Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) just completed two enhancement projects for Bank Swallows in the Golden area. One was in the Donald area at Moberly Marsh on private land owned by Ducks Unlimited Canada.

"There are considerable gaps in the amount of available breeding habitat north of Edgewater, with only scattered colonies located between Edgewater and Donald. We have been working to expand the amount of available breeding areas for this species at risk."

There, a large artificial structure was constructed this past October and November. The structure is a combination of a concrete slab wall with perforated holes and suitable breeding substrate on each side of the wall. Structures like these have been successful at attracting breeding Bank Swallows in Quebec, but this is the first of its kind in Western Canada.

Additionally, the UCSHEP recently finished reshaping sandpiles at Washout Creek (or Birchlands Creek) located just south of Golden, which were left behind from CPKC's protection of their bridge infrastructure. These sandpiles contain the perfect type of nesting substrate for Bank Swallows, and by making them more vertical, we were able to create ideal conditions for the swallows to nest.

Barn Swallows are also at risk, as their Canadian population has also severely declined in a recent 40 year period. Between 2021-2024, the UCSHEP implemented enhancement projects at 34 locations in the region between Canal Flats and Donald for both Bank and Barn Swallows. Effectiveness monitoring at all 34 enhancement sites is critical to determine how well these actions, including the two described above, are working for swallow conservation.

The UCSHEP is administered by Wildsight Golden and was developed and managed by RPBio, Rachel Darvill of Goldeneye Ecological Services. This project would not be possible without the financial support of the CBT Ecosystem Enhancement Program, Fish and Wildlife Compensation Program, and the provincial Gaming Grant. Ducks Unlimited also contributed financially to the enhancement structure on their lands at Moberly Marsh.

Appendix 9.13 Press release in The Golden Star, June 26, 2025.

Wildsight Golden supports Bank Swallow tracking

Submitted by Wildsight

Bank Swallows are a species at risk and have been facing one of the largest population declines for any species in Canada - an estimated 93-98% of the Canadian population has been lost in the last 40 years.

The Upper Columbia Swallow Habitat Enhancement Project (UCSHEP) is a multi-faceted, multi-year swallow conservation project that takes place in the Columbia Valley (Canal Flats to Kinbasket Reservoir), working to help halt and reverse population declines for Bank and Barn Swallows (both at-risk species).

The UCSHEP participated in a Canada-wide initiative led by Environment and Climate Change Canada (ECCC), with the help of project partners from many organizations, that used the Motus Wildlife Tracking System to describe migration routes and timing for Bank Swallows from breeding sites across Canada and in Alaska.

The UCSHEP located two appropriate tagging sites, and with the help of ECCC and other partners (BC Parks, The Nature Trust of BC, Shuswap Band), six Motus stations were installed at strategic locations.

Tagging of 100 Bank Swallows took place in the Invermere area in 2022 and 2023.

There were 890 Motus tags deployed across Canada and in Alaska, and literally millions of detections that came from Motus stations in North, Central and South America. ECCC enlisted a Master's student (Sarah Endenburg) from Carleton University (Ottawa, Ontario) who led the charge on the Motus data analysis for Bank Swallows.

"Understanding Bank Swallow migration ecology is an important first step for their conservation because it provides the necessary foundation to understand when and where drivers of population decline are acting, which can help determine the most appropriate conservation actions," says Endenburg.

"In regards to the UCSHEP, one of Sarah's most interesting findings is that one of our BC birds ended up in Costa Rica, and it is possible that it overwintered there," says UCSHEP biologist Rachel Darvill. "It is important to know where these birds go post-breeding so that we can look at what stressors may be impacting Bank Swallows outside of breeding areas."

Endenburg also discovered that there appear to be three different migratory routes for the Bank Swallows that were tagged across Canada. "Our Invermere birds headed directly south post-breeding, and possibly followed the Rocky Mountains southward."

In contrast, Endenburg explains that "swallows from northern British Columbia, the Yukon, Alaska and Saskatchewan headed east into the Canadian prairies and then down into central USA."

Swallows from breeding sites in Québec and the Maritimes stayed close to the Atlantic coast of North America as they migrated southwards.

As for likely wintering areas, the tags deployed had a limited battery life to reduce their weight, and since there are few Motus stations in Central and South America, they cannot be relied upon for determining the end points for migration routes.

However, feathers were also removed during the banding/tagging process. Feather stable isotopes will be used to determine likely winter locations for each individual.

Bank Swallows undergo most of their molt during the winter; therefore, the isotopic signature in feathers collected on the breeding grounds the following spring can be used to estimate likely winter locations.

Migratory connectivity profiles are being used by researchers to evaluate temporal and spatial connectivity from the migration route (radio-telemetry) and probable winter location (stable isotope) findings.

Results will inform whether connectivity throughout the year could explain differential population trends.

Endenburg's thesis research with her findings are now available. For more information on this and other aspects of the UCSHEP, visit the website or email program biologist racheldarvill@gmail.com.

This project was developed and is managed by Goldeneye Ecological Services and is administered by Wildsight Golden.

Both organizations gratefully acknowledge the financial support of the Columbia Basin Trust and Fish & Wildlife Compensation Program for their contributions to the Upper Columbia Swallow Habitat Enhancement Project.