

Eagles Nest Management Plan Summary Report

Ross Drive and Birney Avenue
Vancouver, BC

July 8, 2022



Submitted to:

UBC Properties Trust
Suite 200 – 3313 Shrum Lane
Vancouver, BC
V6S 0C8



DIAMOND HEAD


3559 Commercial Street
Vancouver, BC 604.733.4886



Corporate Information and Contacts

The following Diamond Head Consulting staff performed the site visit and prepared the report. All general and professional liability insurance and individual accreditations have been provided below for reference.

If the recommendations of this report are implemented as described, the development will not be in contravention of Section 34(b) of the Wildlife Act.



Alison Kwan
Biologist, RPBio
BSc. Ecological Restoration



Cassandra Cummings
Biologist & Planner, RPBio, MCIP, RPP
MSc Biology, MSc Planning



Mike Coulthard
Senior Biologist & Forester, RPBio, RPF
Principal

Contact Information

Phone: 604-733-4886
Fax: 604-733-4879
Email: cassandra@diamondheadconsulting.com, alison@diamondheadconsulting.com
Website: www.diamondheadconsulting.com

Insurance Information

WCB: # 657906 AQ (003)
General Liability: Northbridge General Insurance Corporation - Policy #CBC1935506, \$10,000,000
Errors and Omissions: Lloyds Underwriters – Policy #1010615D, \$1,000,000

Table of Contents

CORPORATE INFORMATION AND CONTACTS	2
1.0 BACKGROUND	5
2.0 PROTECTED SPECIES MANAGEMENT PLAN.....	5
2.1 Nest Description.....	5
2.2 Site Description	7
2.3 Management Plan Recommendations.....	8
3.0 SUMMARY OF CONSTRUCTION HISTORY	10
4.0 NEST HISTORY	12
4.1 Monitoring 2017	18
4.1.1 March/April 2017 – Noise Monitoring Study.....	18
4.1.2 May 2017	18
4.1.3 June 2017	19
4.2 Monitoring 2018	19
4.2.1 January – February 2018.....	19
4.2.2 May 2018	19
4.2.3 June 2018	20
4.3 Monitoring 2019	20
4.3.1 January – February 2019.....	20
4.3.2 March – April 2019.....	20
4.3.3 May 2019	21
4.3.4 Summer and Fall 2019	22
4.4 Monitoring 2020	22
4.4.1 January – February 2020.....	22
4.4.2 March – May 2020	23
4.4.3 May 2020	23
4.4.4 June – September 2020	24
4.5 Monitoring 2021	26
4.5.1 January – February 2021.....	26
4.5.2 March 2021	26
4.5.3 April 2021	27
4.5.4 May 2021	27

4.6	Monitoring 2022	28
4.6.1	March 2022	28
4.6.2	April 2022	28
4.6.3	May 2022	28
4.6.4	June 2022	29
5.0	DISCUSSION.....	30

List of Figures

Figure 1.	Eagle’s nest location and surrounding areas, pre-development. The orthophoto is from 2015. .	6
Figure 2.	The 60m vegetation buffer and 160m noise buffer for the eagle nest	8
Figure 3.	Eagle’s nest location and surrounding area. The orthophoto is from 2020, post development.	11
Figure 4.	Changes in canopy cover near the Eagles’ Nest at UBC.....	12
Figure 5.	Summary of the maximum and minimum noise monitoring data from 2017 to 2022.	17
Figure 6.	Alternate nest location, with future development, and a 300 m buffer showing the distance between the existing nest and new proposed nest.....	25
Figure 7.	This graph shows the number of known offspring of the breeding pair at Ross Drive and Birney Avenue (blue) and construction activity (orange).	31

1.0 Background

The University of British Columbia Properties Trust (UBCPT) has constructed two multi-residential developments along Ross Drive on the UBC South Campus since 2018. The construction of one additional multi-residential development is planned to start in the fall of 2022, with an elementary school to be built at an undetermined future date.

In 2017, UBCPT was made aware of an active bald eagles' nest at the corner of Ross Drive and Birney Avenue, immediately adjacent to their development lots. UBCPT adjusted development plans to retain and protect the nest tree and adjacent mature trees (0.18 ha). Diamond Head Consulting (DHC) was then retained to develop a Protected Species Management Plan for the bald eagles' nest, and to follow up with monitoring. Over the following four nesting seasons (2017 to 2020), the eagles was unsuccessful at rearing young. During that period, UBCPT worked with Diamond Head, project developers and contractors, provincial biologists, and a local non-profit organization (Hancock Wildlife Foundation) to determine how best to manage this nest.

2.0 Protected Species Management Plan

Bald eagle's nests are legally protected under the British Columbia *Wildlife Act, 1996*. Under this Act:

It is an offense to possess, take, injure, molest, or destroy a bird or its eggs, or the nests of birds when occupied by a bird or egg. In addition, the nests of all species of eagles and herons, as well as ospreys, peregrine falcons, gyrfalcons, and burrowing owls are protected year-round, whether or not the nest is in use.

DHC developed a protected species Management Plan for the bald eagles and their nest in the spring of 2017. The Protected Species Management Plan references current best practices *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia* and *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia* (2013), which are published by the BC Ministry of Environment (MoE).

The following subsections summarizes the Protected Species Management Plan, including the description of the nest, site description, nearby land uses, and management recommendations.

2.1 Nest Description

The eagle nest is located close to the top of a large Douglas-fir (*Pseudotsuga menziesii*) tree, approximately 125 cm in diameter and 41 m in height. This tree is located on Ross Drive, between Birney Avenue and the UBC Farm access road (Figure 1). It is located 9 m from the sidewalk and appears healthy with no signs of structural instability. The nest is approximately 120 cm in diameter and 50 cm deep, and was constructed close to the main stem at a natural crotch of large branches approximately 8 m down from the top of the tree.

This nest was built sometime before 2014 and was added as an inactive nest to the Stanley Park Ecology Society's (SPES) Vancouver Bald Eagle Update 2014 report¹. At the time, the nest was considered “a relatively new nest which is believed to have been established by the breeding pair that abandoned the nearby Wesbrook nest.” It is possible that the pair of eagles may have had a second nest in the territory and decided to lay their eggs there instead. Most bald eagle pairs have more than one nest and will often switch nests from year to year². No eagle observation data from SPES or the Hancock Wildlife Foundation was available to confirm or deny this.



Figure 1. Eagle's nest location and surrounding areas, pre-development. The orthophoto is from 2015.

¹ Stanley Park Ecology Society. 2014. Urban Bald Eagles in Vancouver. Retrieved June 30th, 2017 from <http://stanleyparkecology.ca/conservation/urban-wildlife/bald-eagles/>. Note this link is no longer active and the report is no longer available on the SPES website. Please contact the Stanley Park Ecology Society or Diamond Head for a copy.

² Moul, I., and T. Martin. 2010. Bald Eagle Nesting Results: Comox Valley, Vancouver Island. Federation of BC Naturalists, Wildlife Tree Stewardship (WiTS) Local Area Report 2010:2. Retrieved July 7, 2017 from <http://www.wildlifetree.ca/docs/reports/ComoxValleyEagleReport.pdf>. Note this link and website are inactive.

2.2 Site Description

The nesting tree is located in a linear band of forest that is between Ross Drive and the UBC Farm. The surrounding area to the north and east is largely developed with high density commercial and residential buildings, playing fields, and historically cleared lands. At the time of the initial assessment (March 2017), there was active construction in the area > 160 m east of the site. The UBC Farm, which includes various fields with scattered small shrub and treed areas, is located south of the nest tree. Fragmented tree stands remain in this area, with a larger forest patch (approximately 100 ha) located 200 m to the northwest.

The patch of forest that contains the nest is ~1800 m² and comprises of six large Douglas-firs that are 40-42 m tall and 60-140 cm in diameter. There is a suppressed layer of 10-15 m tall western redcedar (*Thuja plicata*), Douglas-fir, big-leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), and cherry (*Prunus sp.*). The understory includes fragmented patches of salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), and bracken fern (*Pteridium aquilinum*). Invasive English holly (*Ilex aquifolium*) and scotch broom (*Cytisus scoparius*) are also growing in this area.

The surrounding mature tree stands are similar in species composition and structure. There is a 1500 m² stand located about 20 m to the south, by an inactive road and temporary power station. To the east, the closest forest patch is 55 m away. These stands support a moderate density of mature Douglas-fir, with a codominant layer of mostly 15-30 m tall western redcedar, Douglas-fir, and big-leaf maple.

There is an area that was historically clear of vegetation to the northwest of this stand of trees. This area has been cleared since the 1980s. There is a smaller area to the southeast adjacent to the UBC Farm access road, about 30 m south of the nest, that was cleared for the installation of a temporary power station.



Photo of the eagle's nest, taken June 26, 2022



Photo of the base of the nest tree, taken April 14, 2022

2.3 Management Plan Recommendations

The following is a summary of best management practices (BMPs) that are recommended for the UBC eagles nests³. This is a summary account of the BMPs, for the detailed recommendations please refer to the DHC Protected Species Management Plan (2017):

1. Retain existing habitats and features; minimize loss of natural vegetation.

The minimum recommended buffer of undisturbed natural vegetation for urban raptor nests is 1.5 tree lengths, which is equivalent to about 60 m for the nest tree. Much of the area that is within the 60 m radius has been historically cleared of vegetation. **All remaining trees and vegetation within this 60m buffer zone were recommended to be retained and protected during construction (Figure 2).**

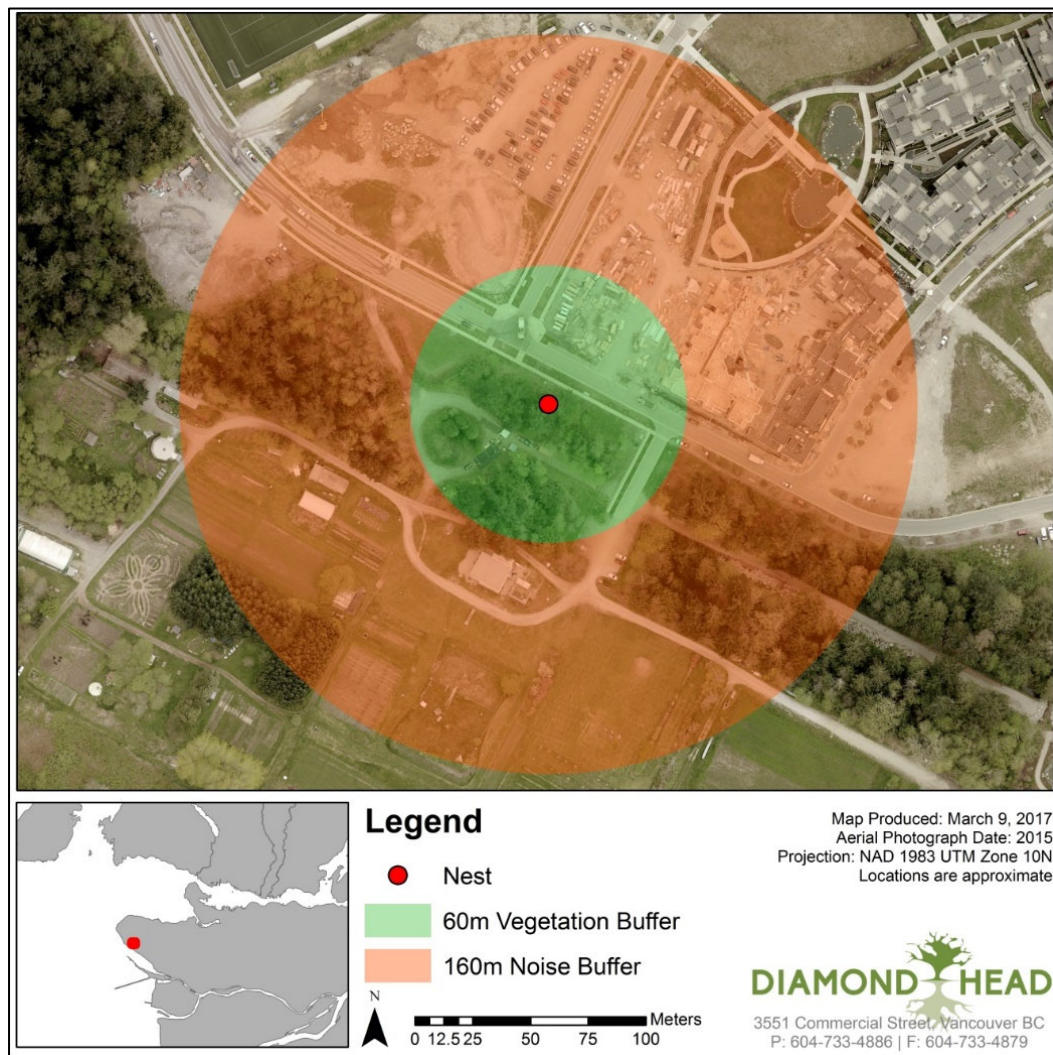


Figure 2. The 60m vegetation buffer and 160m noise buffer for the eagle nest

³ British Columbia. 2013. Guidelines for Raptor Conservation. Retrieved from: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/raptor_conservation_guidelines_2013.pdf

2. Protect raptor nest sites

Bald eagles are considered tolerant of human activity with a moderate to high ability to co-exist. Following provincial BMPs, a 60 m vegetated buffer and an additional 100 m noise buffer were recommended to be in effect during the breeding season.

Noise levels from construction activities vary depending on the type of work and the equipment used, which in turn affects how it will impact wildlife. Typical noise levels for construction activities such as pile drivers, jack hammer, rock drills and blasting are between 75 and 90 dBA⁴.

Nesting Eagles have been shown to be resistant to noise disturbances as loud as 94 dBA; however, all individual birds have unique tolerance levels, and the long-term impacts of noise disruption on eagle health and productivity are largely unknown⁵. As of 2017, this site regularly experienced moderate to high noise disturbance from ongoing construction outside the noise buffer and traffic within the buffer.

Construction activity causing loud (>90dBA) and sudden noises were recommended to be avoided within the 160 m noise buffer during the breeding and nesting season (January 1 to August 31). A Qualified Environmental Professional (QEP) was required to be retained to develop a noise monitoring program and monitor the effects on nesting activity if work was done during the nesting season.

3. Protect raptor roosting/perching sites and foraging areas

Nesting eagles tend to roost in close proximity to their nest site. Existing trees within the vegetation buffer should be protected, and tree protection measures employed to ensure trees and their roots are not damaged during demolition and construction.

4. Avoid disturbance of sensitive habitats during and after development

New trails, buildings, and roads should be located as far as possible from the nest site, roosting, and foraging areas. Machinery, people and pets should be similarly kept away from nesting, brooding, and rearing areas.

5. Manage, restore or enhance raptor habitat and features

There are areas within the vegetation management zone that are clear of vegetation. It was recommended these be restored back to native plant communities, and planned pathways minimized through this area.

6. Minimize the risk of accidental mortality

A number of efforts were suggested to reduce the probability of mortality from power lines, windows, and sundeck enclosures.

⁴ Hanson, CE; Towers, DA; Meister, LD. 2006. Transit Noise and Vibration Impact Assessment. US Department of Transportation Federal Transit Administration: FTA-VA-90-1003-06

⁵ Johnson, NP. 1990. Nesting bald eagles (*Haliaeetus leucocephalus*) in urban areas of southeast Alaska: assessing highway construction and disturbance impacts. Transportation Research Record 1279

7. Avoid the use of pesticides and herbicides

Use integrated pest management strategies and avoid the use of chemical pesticides. Use traps instead of poisons to control rodents.

8. Educate the public about the importance of maintaining raptors in urban and rural environments

It was recommended that interpretive materials be used to make the public aware of the need to protect raptor habitats and to prevent disturbance to the nest site and locals encouraged to observe and record the eagles' activities.

Monitoring:

DHC recommended establishing a monitoring program to evaluate and report on the success of the nest site. This recommendation has been implemented by UBCPT. Monitoring has been ongoing since 2018.

3.0 Summary of Construction History

Ross Drive and Birney Avenue were constructed in 2011. Sometime after that, the nest was discovered and believed to be inactive. It was first recorded by the Stanley Park Ecology Society in 2014 as an inactive nest (see Section 2.1 for details).

In 2017, Diamond Head started monitoring the eagle nest. At this time construction was underway outside the noise buffer to the east of the nest. While this construction activity was outside of the protected vegetation and noise buffers, traffic frequency and volume along Ross Drive increased due to the adjacent construction activity.

In 2018, tree falling began for development to the northwest of the nest. Trees were felled in February of 2020. Felled trees were dragged off site to chip outside of the noise buffer.

In 2019, construction was well underway and a regular monitoring program was established. A crane was used for construction west of the eagles nest. UBCPT and the contractor worked with DHC to select a location for the crane to minimize the impact of the crane on the nest.

The majority of construction was completed by 2020 (Figure 3). An alternate nest was constructed after the completion of the nesting season to provide another nesting option for the breeding pair. This was done in anticipation of future construction planned across Ross Drive from the nest.

In 2021 and 2022 there was no ongoing construction in the vegetative or noise buffers. Traffic had slowed considerably to regular maintenance vehicles, buses, and residential traffic. Figure 4 shows the changes in vegetation, canopy cover, and land use from 2011 to 2020.

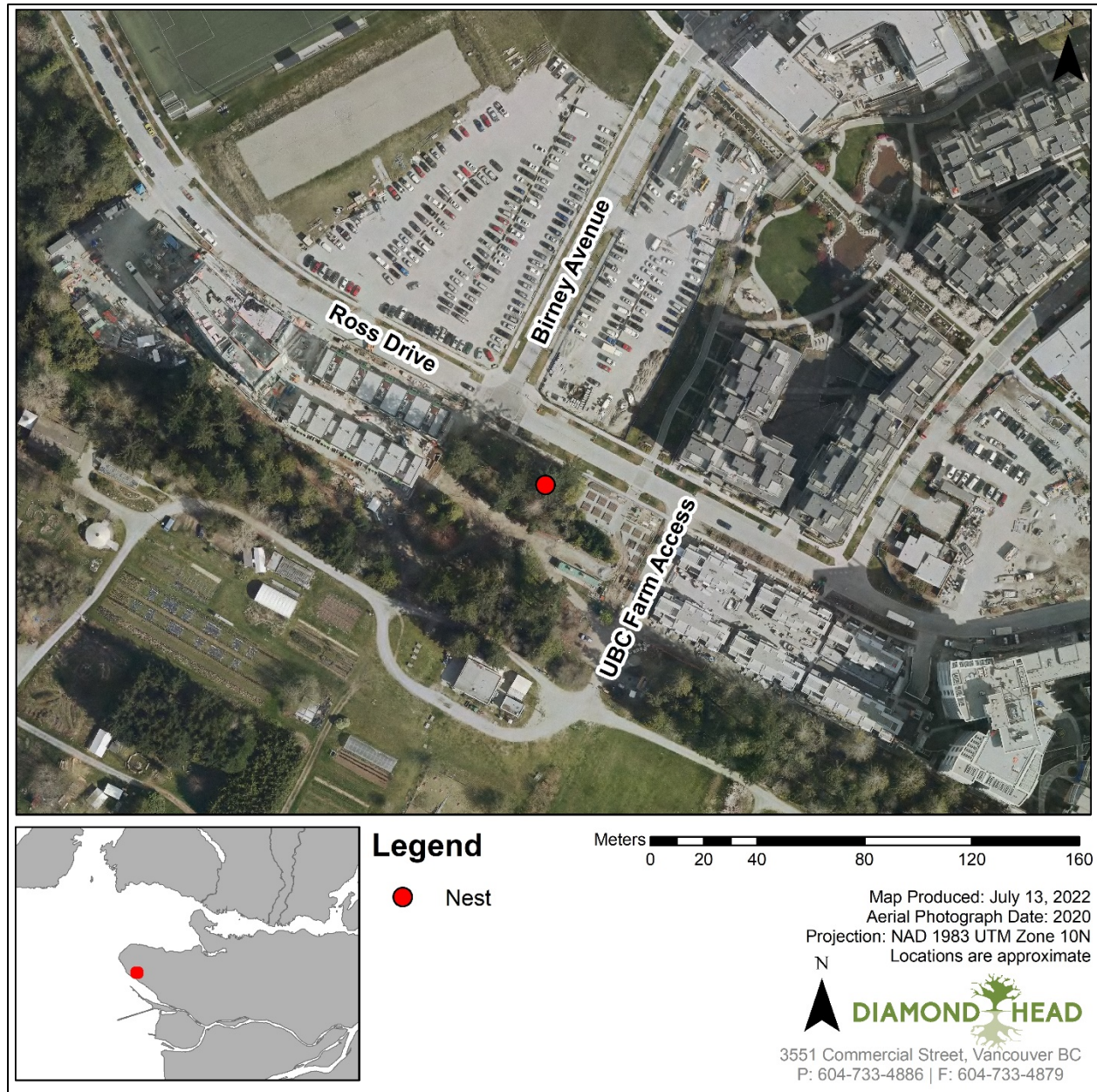
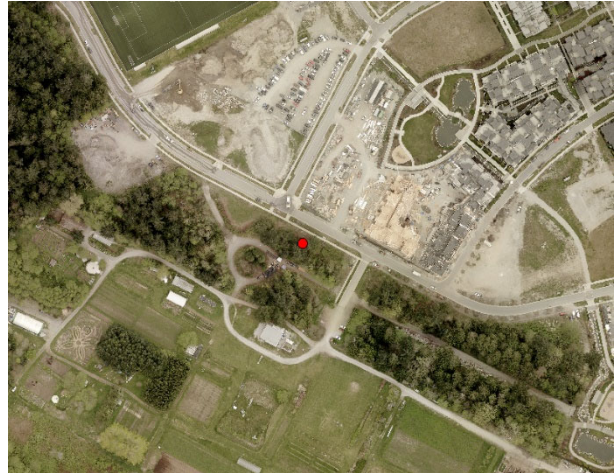


Figure 3. Eagle's nest location and surrounding area. The orthophoto is from 2020, post development.



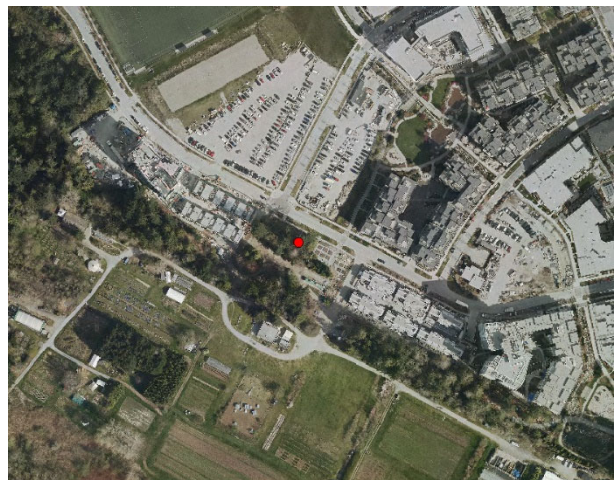
Nest (red) on the 2011 orthophoto, prior to the construction of Ross Drive and Birney Avenue.



Nest (red) on the 2015 orthophoto, after the construction of Ross Drive and Birney Avenue.



Nest (red) overlaid on the 2018 orthophoto, after tree clearing for development.



Nest (red) overlaid on the 2020 orthophoto, after the completion of most of the on-site construction.

Figure 4. Changes in canopy cover near the Eagles' Nest at UBC.

4.0 Nest History

Table 1 provides a general summary of the monitoring conducted at the UBC eagles nest since 2017. Monitoring includes observations of the eagles behaviour, nest conditions, breeding success of the pair of eagles, and the construction activity occurring near the nest. Maximum and minimum noise conditions during monitoring sessions across the six nesting seasons are summarized in Figure 5.

Table 1. Summary of eagle's nest monitoring and construction activities.

Date(s)	Construction Activity	Eagle Behaviour	Notes
March 8, 2017	General traffic and nearby construction outside the noise buffer.	2 adult bald eagles were observed perching close to the nest.	Protected Species Management Plan: Bald Eagle developed.
April 2017	Noise meter installed at nest. Monitors ~a week of activity in early April 2017.	Not monitored beyond installation.	Noise Monitoring Study
June 27, 2017	Drilling for geotechnical studies of Lots 7/8	2 eagles were in and out of the nesting tree. One eagle was in the nest for 2 minutes. They did not appear to react to the drilling.	
June 29, 2017	Drilling for geotechnical studies of Lots 7/8 & 11	Eagles were not in the nest or tree. One flew overhead at 2 pm.	Eagles were considered unsuccessful this year.
January 30, 2018		Eagles were in the nest tree, but not in the nest.	Lot 11 pre-tree clearing assessment of eagle breeding and nesting activity
February 13, 2018	Lot 11 Tree Falling & chipping. Tree chipper moved to far side to reduce impact.	The eagles were perched on top of the nest tree outside of the nest prior to the beginning of work. They were perched on top of the nest tree, or a tree 200 m east for most of the day.	
February 14, 2018	Lot 11 Tree Falling & chipping.	Only one eagle was in the adjacent tree upon arrival. The 2 eagles were in and out of the nest tree all day. One perched in a tree temporarily to the west of Lot 11. They did not enter the nest all day, and were often not in the immediate area.	
February 16, 2018	Lot 11 Tree Falling & chipping.	The eagles were not on site for the first few hours of the day. They were in and out of the nest tree all day, but did not enter the nest.	
May 18, 2018	Minimal construction activity outside the noise buffer, with some passing trucks, quiet by the nest.	Upon arrival, 2 eagles are sitting at the top of the nest tree. The flew in and out of the nest tree and adjacent tree. Eagle 1 spend 6 minutes in the nest adjusting twigs. Eagle 2 sat in the nest for 54 minutes before both flew off.	Monitoring of Bald Eagles Nest to Determine Breeding Success
June 6, 2018	Minimal background noise from cars and construction.	Eagles were in and out of the nest tree, but did not enter the nest.	Eagles were unsuccessful for 2018.
January 25, 2019	Minimal machine noise, crane moving and vehicles passing	The eagles are in and out of the nest tree, but did not enter the nest.	

Date(s)	Construction Activity	Eagle Behaviour	Notes
February 20, 2019	Minimal machine noise, crane moving and vehicles passing	One eagle is in the tree adjacent to the nest. It does not appear to react to the crane. It flies off, and does not return prior to the end of monitoring.	
March 6, 2019	Minimal construction activity and noise	Eagles mostly not on site. One perched in the adjacent tree for 45 minutes, second returns and they spend 5 minutes in the nest tree prior to departing for the rest of the morning.	
March 20, 2019		Eagle 1 was in the nest for five minutes shortly after our arrival. Eagle 2 arrived and they copulated at the top of the tree. They were in and out of the nest tree for the rest of the morning.	
April 3, 2019	Light construction noise and crane activity	The eagles were in and out of the nest tree. One eagle was in the nest for 3 minutes, the second for 8 minutes.	
April 17, 2019	Construction, crane activity, hammering	Eagles are not on site upon arrival. The arrive and copulate shortly thereafter. They perch in the nest and adjacent tree, prior to departing 2.5 hours later.	
May 1, 2019	Construction noise at normal levels. Crane Activity and hammering Lot 7/8, 11	One eagle in nest tree upon arrival. It leaves shortly thereafter. The 2 eagles are in and out of the nest tree for the rest of the morning.	
May 9, 2019	Excavator 25 m away from nest in the terrestrial buffer zone. Emits noises up to 80 dB.	Eagles in tree upon arrival. 1 eagle in the nest for 5 minutes, the second for 10 minutes.	
May 10, 2019		After the eagles had left the nest, a drone was used to take a picture of the nest from a safe distance. There was no evidence of eggs or chicks in the nest or on the ground around the base of the tree.	
May 15, 2019	Generator running below nest trees, Crane activity Lot 11.	Eagles are mostly not present. One is in the nest tree for 40 minutes.	Eagles considered unsuccessful for 2019
January 23, 2020	Trucks passing, construction activity, hammering.	Eagles perched in the nest tree and adjacent tree. Flew off for the rest of the monitoring period.	Monitoring for greenway clearing
February 5, 2020	Light construction, tree removal and chipping.	No eagles visible during monitoring period.	
February 10, 2020	Construction, vehicles passing, boulder relocation	No eagles visible during monitoring period.	Boulders moved out of the existing greenway.

Date(s)	Construction Activity	Eagle Behaviour	Notes
February 12, 2020	Light construction	One eagle present upon arrival. Flies away within the hour. Both return 5 hours later, in the nest tree and briefly in the nest.	
March 31, 2020	Light construction	One eagle upon arrival. Eagles leave the area and return intermittently throughout the monitoring period. Possible mating activity observed.	
April 3, 2020	Hydro vacuuming and jack hammering	Eagles not present upon arrival. Spotted circling overhead. One eagle returns and perch on adjacent tree, leaves after 30 mins. Both eagles return to nest and area after an hour, occasionally leaving to collect nest material.	
April 17, 2020	Light construction	Eagles in nest and leave the area, circles, and returns. One eagle observed gathering nest material. One or both eagles intermittently leave nest, with neither eagles present at the end of monitoring period.	
April 24, 2020	Light activity, passing trucks	Both eagles present upon arrival. Eagle vocalizations in the morning. Both eagles depart late morning and do not return for the rest of the monitoring period.	
May 1, 2020	Light construction, trucks passing	One eagle circling north of the nest tree. No eagles in the area for the entire monitoring period	
May 8, 2020	Construction activity, truck and hiab transporting materials	Eagles perched in nest tree upon arrival. Vocalizations heard. Both eagles depart south late morning and do not return for the rest of the monitoring period.	
May 15, 2020	Light construction	Eagle perched on tree upon arrival. Second eagle arrives. Both eagles leave and circle the area S of UBC Farm. Another breeding pair and juvenile spotted overhead. Eagles do not return for the remainder of the monitoring period.	Drone flight conducted and eagles considered unsuccessful for 2020
May 20, 2020	Light construction	No eagles present for the entire monitoring period. One juvenile eagle spotted overhead. One adult eagle circling to the east in the afternoon.	
May 27, 2020	Light construction, machinery in Lot 11	Both eagles perched on nest tree. Both eagles depart at 9 am and do not return for the rest of the monitoring period.	
January 27, 2021	No activity, passing cars	No eagles present for entire monitoring period.	
February 24, 2021	No activity, passing cars	No eagles present for entire monitoring period	
March 25, 2021	No activity, passing cars	Eagles not visible upon arrival. One eagle returns 10 mins after monitoring start. Second eagle spotted in the nest. Both eagles circle area and return to nest. One eagle intermittently departs and returns	

Date(s)	Construction Activity	Eagle Behaviour	Notes
		to nest area. Vocalizations throughout monitoring period and nesting behaviour observed.	
April 22, 2021	No activity, passing cars	No eagles present upon arrival. Eagles return to nest late morning. Both eagles remain in the area for 30 mins, occasionally leaving and returning. Both eagles depart and do not return for the rest of the monitoring period.	
May 12, 2021	No activity, passing cars	Eagles not present for the duration of the monitoring period.	Drone flight conducted and eagles were considered unsuccessful for 2021
March 30, 2022	No activity, passing cars	One eagle on nest tree upon arrival, departing shortly. One eagle returns after 1 hour, perches on nest trees, stays for 30 mins before departing again. Nest is empty for 30 mins. One eagle returns to the nest, stays for 10 mins before departing again.	
April 14, 2022	No activity, passing cars	No visible eagle upon arrival. Movement spotted in nest at 8:23 AM. One eagle is in the nest for entirety of the monitoring period. One vocalization heard.	Eagle suspected to be incubating eggs
May 2, 2022	No activity, heavy rain	One eagle visible in nest, observed guano released over the side. Second eagle not seen. One eagle confirmed in the nest for the entire monitoring period.	
May 12, 2022	No activity, heavy rain	Eagle not visible in nest upon arrival. One eagle returns to the nest with captured prey, second eagle seen in the nest. One eagle is in the nest for the entire monitoring period.	
May 24, 2022	No activity, passing cars, and landscaping	No eagle activity upon arrival. Eagle vocalizations from the nest, second eagle returns with captured prey.	Drone confirms eagle presence in the nest. Eaglet vocalizations suspected
June 9, 2022	No activity	No visual sign of eagles upon arrival. Eagle vocalizations from the nest, eagle returns in response and leaves after a few minutes. Eaglet calls can be heard from the base of the tree. One eagle remains in the nest for the entire monitoring period.	
June 24, 2022	No activity.	No visual or vocal signs of eagles upon arrival. One eagle returns to nest and departs shortly. Movement spotted in the nest, confirming second eagle is in the nest. One eagle is in the nest for the entire monitoring period.	

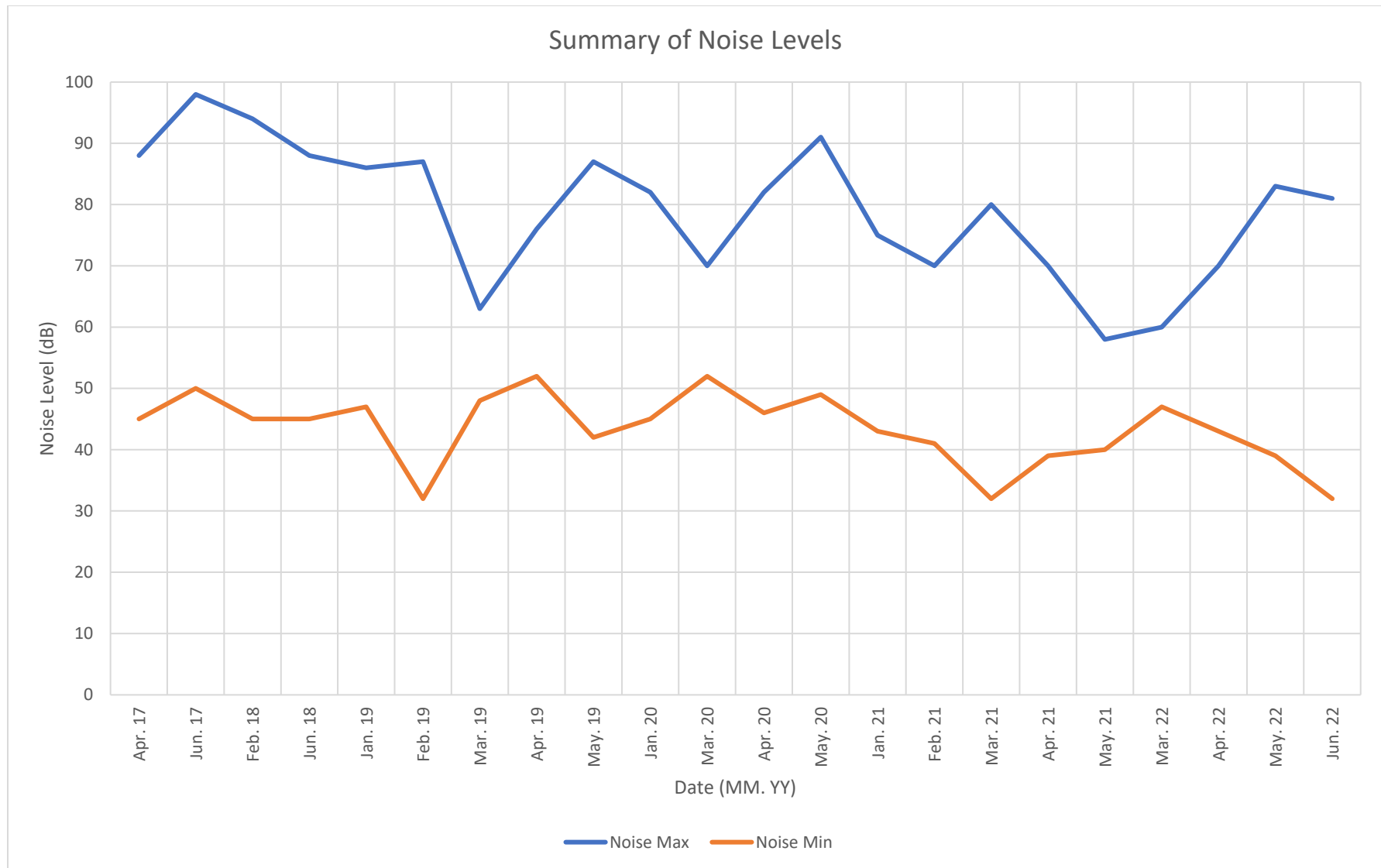


Figure 5. Summary of the maximum and minimum noise monitoring data from 2017 to 2022.

The following sections provide a general summary of construction activities, monitoring efforts, and recommendations collated from Diamond Head site visits. This is a summary account of the conditions. For more details, please refer to the Protected Species Management Plan, Monitoring Memos, and Noise Study reports.

4.1 Monitoring 2017

DHC began monitoring the eagles' nest following the development of the Protected Species Management Plan in March 2017.

4.1.1 March/April 2017 – Noise Monitoring Study

A noise monitoring study was conducted by DHC to determine the level of noise that was experienced by the eagles' nest based on the ongoing construction activities nearby. A noise monitoring system was installed by BAP Acoustics the morning of March 30th 2017, in an adjacent tree at a height approximately equal to that of the eagles' nest (about 30 m high). Efforts were made to situate the system in an open area of the tree crown to maximize noise detection. In this location, the monitoring system is expected to have detected similar noise as would be experienced by the eagles' nest over the study period, despite the horizontal separation and some potential muffling from surrounding foliage.

Installation of the noise monitoring system was accomplished by a single tree climber, minimizing noise and disruption to the birds. A biologist was present during installation to monitor bird activity. The monitoring system remained in the tree for 12 days before being removed by a tree climber.

The noise monitoring study found that daytime noises were generally louder during weekdays than weekends. On weekdays average noise levels increased dramatically around 6:00 AM, presumably in response to the start of the workday and nearby construction, and then gradually declined throughout the day. Noise levels were highly variable during workdays with regular peaks of 82 to 88 dB. Evening and nighttime noise levels were quieter, averaging 50 dB. Weekend peaks rarely exceeded 80 dB and the variability in noise was much lower.

4.1.2 May 2017

In May 2017, a technical memo was developed in response to planned geotechnical drilling at Lots 7, 8, and 11 during the month of June. All of the drill holes were located within the noise buffer of the eagles' nest. The drilling was to be completed by GeoPacific with a MST 1100 Track-mounted drill that had an estimated peak noise of 85 dB. DHC recommended that all activities that produced high decibel noise be delayed till after the breeding season; however, due to strict project schedules and the requirement for detailed information on soil conditions the geotechnical drilling proceeded with a mitigation plan developed.

The geotechnical drilling was allowed to proceed under the supervision of a Qualified Environmental Professional (QEP). The QEP monitored the work and observed for responses or impacts to eagle behaviour. The QEP had the authority to require the contractor to stop work if the construction activity is deemed to be disturbing the nesting activity of the bald eagles. If the eagles displayed signs of

distress, the contractor would be required to install measures (i.e. a noise dampening barrier) to reduce noise levels. All drilling proceeded sequentially and progressively worked toward the nest, beginning with the test hole furthest away from the nest, with the intention of acclimating the eagles to the noise.

4.1.3 June 2017

Monitoring of geotechnical drilling activities occurred on June 27th and June 29th 2017. Four of the five test holes were drilled, with the final test hole not completed due to concerns about hitting concrete. During the June 29th drilling and monitoring, the order of test holes was changed to start at the holes within the vegetation buffer after the eagles were still absent from the nest and area by 10:30 AM. The decision was made after discussions were held between the EIT from the GeoPacific and the QEP on site.

Over the two monitoring days, eagle activity was limited to short visits to the nest and adjacent trees with long periods of absences from the nest. The eagles' behaviours and absence from the nest, and lack of eaglet feeding activity or noise indicates that the breeding pair were deemed to be unsuccessful at having young for the 2017 breeding season. The reason for their lack of success is unclear. Based on SPES monitoring from 2004 to 2014, nesting success in Vancouver is quite variable from year to year with some breeding seasons experiencing success rates as high as 100% and others as low as 46%.

With the eagles being unsuccessful for the breeding season, further monitoring was not required. Since eagles often reuse their nest, monitoring was recommended to restart in January 2018 to determine if the nest remains active. If the nest remained active, a QEP would be retained to monitor and mitigate impacts of any further construction activity on site. All tree falling was recommended to be completed prior to the start of the 2018 breeding season.

4.2 Monitoring 2018

4.2.1 January – February 2018

A site visit was conducted to determine if the eagle nest was active. Significant activity was observed in the nest tree and surrounding area during this monitoring period. The January monitoring session confirmed that the eagle pair had returned and were actively using the nest. Construction activity for Lot 11 was limited during this period. Tree falling was not completed prior to the start of the breeding season and was recommended to be completed as soon as possible to reduce impacts to the eagles.

4.2.2 May 2018

Following the tree falling in February, the majority of construction activity occurred outside of the vegetation and noise buffers. The only construction activity within the buffers were the continued passing of trucks and vehicles along Ross Drive and in and out of the Lot 11 construction area. Noise levels averaged lower than the 2017 monitoring periods, averaging between 50 and 55 dB with occasional louder noises from passing trucks. Both eagles were observed outside of the nest for the majority of the monitoring period. Conversations with local residents and construction workers suggested that mating behaviour has been observed; however, fledglings have yet to be seen or heard in the nest.

4.2.3 June 2018

Similar to the May monitoring session, construction activity was outside of the noise and vegetation buffers and activity within the buffers were limited to vehicles passing along Ross Drive and in and out of the Lot 11 construction area. The eagles were outside of the nest for the majority of the monitoring session. The eagles' behaviour during the May and June 2018 monitoring periods suggested that they were not successful in producing fledglings in 2018. Both eagles were observed away from the nest for long periods, combined with the lack of visible or audible confirmation of fledglings suggested that the eagles did not have young in the nest. At this point in the breeding season, it was highly unlikely that an egg will be in the nest.

With the eagles being unsuccessful for the breeding season, further monitoring was not required. Since eagles often reuse their nest, monitoring was recommended to restart in January 2019 to determine if the nest remains active. If the nest remained active, a QEP would be retained to monitor and mitigate impacts of any further construction activity on site.

4.3 Monitoring 2019

4.3.1 January – February 2019

Eagles' nest monitoring commenced in January 2019 as construction in Lot 11 was ongoing and construction in Lots 7 and 8 had begun. A crane was erected on the far side of Lot 11 prior to the start of the 2019 breeding season. The pair of bald eagles were present on site throughout these monitoring periods. The eagles were observed perched on the nest tree, adjacent trees, or absent from the area. Construction noise continued to be variable throughout these periods and under the recommended threshold. The eagles do not appear to react to any construction activities.



View of the location of the crane at Lot 11.



The crane on Lot 11 comes close to the edge of the furthest east tree in the vegetative buffer around the nest.

4.3.2 March – April 2019

Construction in Lots 11, 7, and 8 continued. The pair of bald eagles were present on site and mating behaviour was observed. Mating behaviours included nest maintenance, vocalizations, and copulation.

These behaviours suggested the eagles were attempting to nest. Observations showed that the eagles continued to be acclimated to the construction noise levels and did not appear to react to construction activities. Continued monitoring was recommended to monitor potential impacts from the construction activity and determine if the pair successfully lays eggs.



Eagles perched in the nest tree at Ross Drive and Birney Avenue (9:17 AM, March 20th, 2019)



Eagles copulating in the nest tree at Ross Drive and Birney Avenue (8:10 AM, March 20th, 2019)

4.3.3 May 2019

Eagle behaviour observed during May 2019 suggest that the pair were not successful in producing an egg. The eagles were often observed outside of the nest. Typically, in a successful nesting year, at least one eagle would be in the nest incubating the egg or taking care of the newly hatched young. The absence of both eagles from the nest makes it highly unlikely for an egg or young to be present. This was further confirmed through drone photographs that showed an empty nest. Drone photographs were taken while the eagles were absent from the area.

With the eagles being unsuccessful for the breeding season, further monitoring was not required. Since eagles often reuse their nest, monitoring was recommended to restart in January 2020 to determine if the nest remains active. If the nest remained active, a QEP would be retained to monitor and mitigate impacts of any further construction activity on site.



Drone photographs of the eagles' nest confirming absence of young or eggs, May 2019

4.3.4 Summer and Fall 2019

Conversations were held between DHC, UBC Properties Trust, the Hancock Wildlife Foundation, and a Provincial representative to discuss further actions and management of the nest moving forward. An alternate nest platform was proposed to provide an alternate location and opportunity for the eagles to nest away from the construction sites. The alternate nest was not initiated and completed prior to the start of the 2020 breeding season due to concerns of creating competition with another nesting pair.

4.4 Monitoring 2020

4.4.1 January – February 2020

The construction in Lots 11, 7, and 8 were still ongoing at the start of monitoring for the 2020 breeding season. In addition, construction of the Western Greenway trail was underway and required tree removals, boulder movement, and splitting within the 160 m noise buffer. A QEP was onsite to monitoring the falling and boulder splitting activity associated with the Western Greenway trail and the construction activities occurring in Lots 11, 7, and 8.

Tree falling was completed without any reactions from the eagles. The chipper was situated approximately 100 m for one day of tree removal and tripping; subsequent chipping activities were

located further away from the nest tree. Three trees scheduled for removal were located within 60 m of the nest tree and were recommended to not be removed until the end of the 2020 breeding season.

Boulder movement was completed using an excavator and flatbed truck, and a hydraulic machine was used to split the boulders in the UBC Farm parking lot approximately 100 m southwest of the nest. Noise level at the splitting location exceeded 80 dB during the splitting process, but noise levels at the nest tree during splitting were low (57 dB). The eagles were not in the area when boulder splitting began but returned during the splitting process. The eagles had no reactions to the boulder splitting noises and remained in the area and nest for the remainder of the monitoring period. No tree falling or boulder splitting were planned for the remainder of the breeding season

4.4.2 March – May 2020

Construction activities continued in Lots 11, 7, and 8 during March and April and consisted of typical construction noises such as machinery movement, truck and vehicle passing, and hammering and drilling. A QEP was scheduled to be on site for hydro vacuuming and excavation that occurred approximately 30 m from the nest tree. The eagles were not in the area when hydro vacuuming began but returned later in the day. The eagles did not react to the hydro vacuuming noise levels and exhibited nesting and mating behaviours during the process. DHC recommended that any hydro vacuuming and jack hammering activities be delayed to the end of the breeding season to minimize disturbance.

4.4.3 May 2020

Construction in Lots 11, 7, and 8 continued with average construction activity and noise levels. A new community garden was constructed adjacent to the nest tree. The area was a previously cleared lot vegetated with weeds and invasive plant species. The vegetation was removed prior to construction of the garden beds. Upon discovery of the construction work, DHC recommended halting construction in the vegetative buffer during the breeding season. UBC Properties Trust halted the work and erected fencing around the gardens to ensure no one entered the vegetative buffer during the remainder of the breeding season.

It was recommended that area be revegetated with native species and the gardens would be relocated elsewhere. However, given the corner was previously cleared and the eagles have been tolerant of people walking under the nest, the new community garden was left as it was unlikely to be a major new disturbance.

The eagles' behaviour during the May monitoring period suggests they were not successful in producing fledglings during the 2020 breeding season. Both eagles spent long periods of time away from the nest and there was a lack of visible or audible confirmation of fledglings. A drone flight was conducted to confirm the status of the nest and showed an empty nest.

With the eagles being unsuccessful for the breeding season, further monitoring was not required. Since eagles often reuse their nest, monitoring was recommended to restart in January 2021 to determine if

the nest remains active. If the nest remained active, a QEP would be retained to monitor and mitigate impacts of any further construction activity on site.



Drone photographs of the eagles' nest confirming absence of young or eggs, May 2020

4.4.4 June – September 2020

Conversations regarding the construction of an alternate nest resumed following confirmation that the pair of eagles were again unsuccessful in having young. Discussions were again held between DHC, UBC Properties Trust, the Hancock Wildlife Foundation, and a Provincial representative. Given that additional construction is anticipated within the noise buffer of the current nest, it was decided that a temporary alternate nest should be provided to provide the eagles with the best possible chance of breeding success. DHC was retained as the lead consultant in conducting the new nest work, with support from the Hancock Wildlife Foundation.

The area within 300 m of the nest was walked by the provincial biologist, DHC biologists, and representatives from Hancock Wildlife Foundation to find a suitable alternative nest tree. A 40 m tall Douglas-fir (tree tag #8973) with a diameter at breast height (DBH) of 86 cm, was selected as the new alternate nest tree (Figure 6). This tree was selected as a suitable nest tree because of its moderate health and structure value, high retention value, location within 300 m of the original nest, and the presence of a crotch located approximately 20 m from the ground with a wide union from a previous failure. With the removal of some branches, this crotch provides a large enough area to build a platform and provide access for the eagles. The alternate nest tree is located close enough for the eagle pair to find and access and also located away from any other known eagles' nests in the area. The tree is

located along Ross Drive, providing easy access to build the nest and monitor the eagles. Adjacent to this tree, there are trees large enough for perching with clear site lines.

Installation of a nest camera was also discussed and highly recommended by both organizations; however, Hancock Wildlife Foundation decided that there wasn't a good place to set up the camera in the alternate nest and it was not installed. when construction , a wildlife permit application will be submitted to the Province to temporarily block the original nest with a cone, as recommended by the Provincial representative and agreed upon by the Hancock Wildlife Foundation.

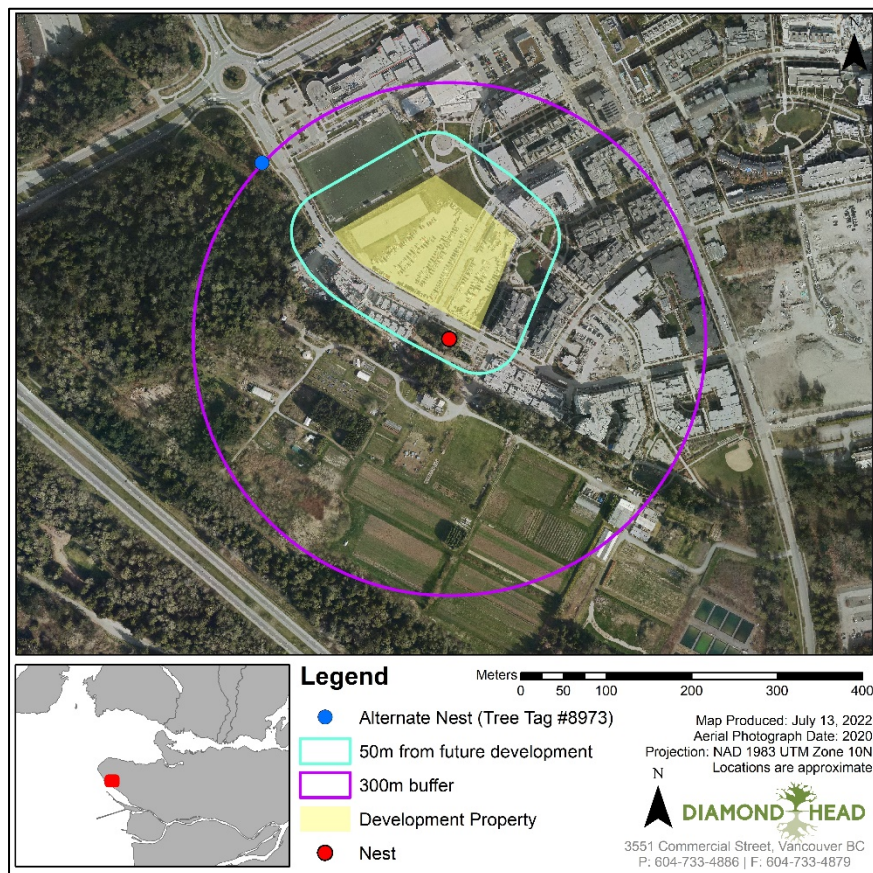


Figure 6. Alternate nest location, with future development, and a 300 m buffer showing the distance between the existing nest and new proposed nest.

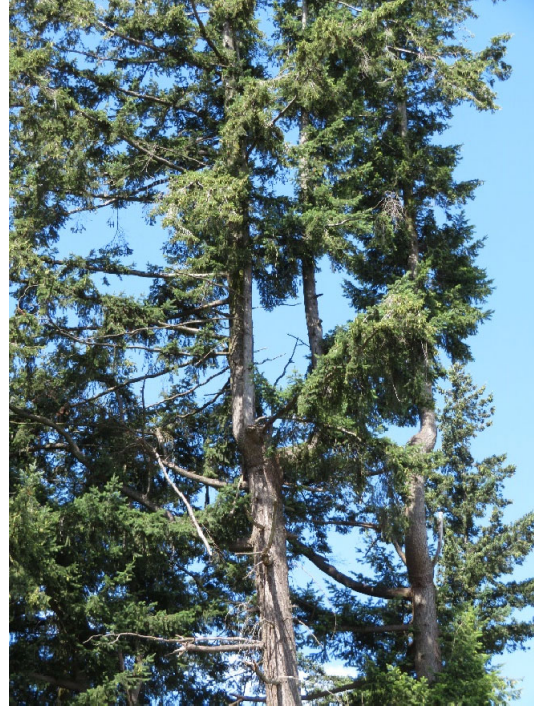


Photo of Tree #8973 and the new constructed nest from Ross Drive

4.5 Monitoring 2021

4.5.1 January – February 2021

Construction for Lots 11, 7, and 8 was completed during the pause in monitoring during the Fall of 2020. Construction for the lots across from the eagles nest are anticipated to start in the fall of 2022. With the pause in construction, the plans to cone the original nest were postponed and the eagles were given a choice to nest in the original nest or the new alternate nest. The eagles decided to remain at the original nest at Ross Drive and Birney Avenue. Although construction was paused for the 2021 breeding season, UBC Properties Trust continued monitoring for baseline data at the recommendation of DHC. The monitoring schedule for the 2021 breeding season was changed to occur monthly instead of bi-weekly due to the pause in construction.

The eagles were absent from the nest throughout the entire January and February monitoring sessions; however, DHC confirmed that the eagles returned to the area and were seen in the original nest. On average, noise levels were lower than the previous years.

4.5.2 March 2021

Eagle activity during the March monitoring period was extensive. Both eagles were seen in and out of the nest tree and surrounding area, and were exhibiting mating behaviour, including vocalizations, carrying sticks into the nest, and spending time in the nest. No construction activity occurred. On average, noise levels were lower than the previous years, with the loudest noises coming from passing vehicles.

4.5.3 April 2021

Eagle activity during the monitoring period was limited. Both eagles were absent for the majority of the monitoring period, returning briefly for 30 minutes, before leaving again. No mating or nesting behaviour was observed and time spent inside the nest was minimal. Construction activity continued to be paused. On average, noise levels were lower than the previous years, with the loudest noises coming from passing vehicles.

4.5.4 May 2021

Eagles were absent for the beginning of the May monitoring session. A drone flight was conducted to confirm the status of the nest. The eagles' behaviour throughout the 2021 breeding season suggested that they were not successful in producing fledglings. Drone photographs confirmed the absence of eggs or eaglets.

With the eagles being unsuccessful for the breeding season, further monitoring was not required. Since eagles often reuse their nest, monitoring was recommended to restart in January 2022 if construction activities were to resume as planned. DHC recommended that a discussion be held between UBC Properties Trust, the project QEP, and the Provincial representative to determine best steps for managing the nest going forward, including determining if the original nest should still be coned to encourage the use of the alternate nest. If the nest remained active, a QEP would continue to be retained to monitor and mitigate impacts of any further construction activity on site.



Drone photographs of the eagles' nest confirming absence of young or eggs, May 2021

4.6 Monitoring 2022

4.6.1 March 2022

Construction was once again paused for the 2022 breeding season and the UBC Properties Trust confirmed that construction would resume Fall 2022. In preparation for the resumption of construction activities, the monitoring schedule was changed back to bi-weekly sessions.

The first monitoring session of the 2022 breeding season confirmed that the eagles had returned and were using the original nest. Eagle activity was observed throughout the monitoring period, with at least one eagle seen at different points during the monitoring. It is unknown if two separate eagles were observed alternating time at the nest or if it were the same eagle. On average, noise levels were lower than in previous years, with the loudest noises being from passing vehicles.

4.6.2 April 2022

Eagle activity was not observed at the beginning of the monitoring period until movement was spotted approximately 45 minutes into monitoring. One eagle was visually confirmed to be in the nest. A second eagle was not spotted at any point during the monitoring period. This nesting behaviour is new for this nest. In previous monitoring years, the breeding pair were typically absent from the nest for long durations, or in one area but not sitting in the nest. The presence of one eagle within the nest indicates that eggs may have been laid and are currently being incubated.



Views of one eagle perched on the edge of the nest



View of the eagle in the nest, red arrow points to the tail

4.6.3 May 2022

One of the eagles continued to remain in the nest for the May monitoring period. Again, only one eagle was visually confirmed. The area around the base of the tree showed signs of increased use of the nest. Guano and shells were spotted in several places at the base of the tree. This activity suggested higher uses of the nest compared to previous years. Higher human usage was also noted at the base of the nest tree. Vegetation around the base of the tree has been trampled with garbage littered behind the base of the tree.

A drone flight was conducted at the end of May and confirmed that the pair of eagles were successful in breeding. During the monitoring session, the eagle within the nest called and the second eagle was observed returning and bringing medium sized prey back to the nest. The drone flight was conducted with a spotter and at a distance to reduce the stress for the nesting eagles.

Vocalizations and calls from the nest are consistent with feeding calls made by eagle fledglings; however, visual confirmation was not possible due to the eaglets' size at this stage of growth. This is the first confirmed instance of successful breeding in this nest since monitoring began in 2017. DHC recommended that monitoring of this nest continue until the young have departed the nest and planning can resume for the coming year.



Drone photograph confirming one eagle present in the nest at 9:30 AM, May 2022

4.6.4 June 2022

Monitoring of the eagles nest and eaglet activity is ongoing. Both eagles are actively in and around the nest. One eagle remained in the nest for the entire monitoring period and was observed providing care to the eaglets in the nest. The vocalizations and observed eagle behaviour suggest the presence of young hatchlings in the nest; however, the young are still too small to be visually confirmed from the ground.



View of both eagles tending to the eaglets in the nest following eaglet vocalizations



View of eagle that remained in the nest for the monitoring period

5.0 Discussion

There has been a history of construction in the vicinity of this eagle's nest over the past decade. While it wasn't determined exactly when the nest was built, it was reported to be inactive in a Stanley Park Ecology Society's 2014 report. Without additional reporting, it is difficult to know if the adjacent roads or the nest was built first, and when the nest may have been first active.

The nest was identified to be active in 2017. UBCPT took steps at that time to address the nest and manage the conflicts with development. The resident eagles displayed courtship and mating behaviour between 2017 and 2022. 2022 is the first year that there were eaglets in the nest. Construction occurred outside the noise buffer in 2017, within the noise buffer in 2018-2020, and was complete in 2021 and 2022. Despite the cessation of construction for the 2021 season, the eagles were not successful at rearing young that year. (Figure 7). An alternative nest was constructed nearby and further away from the development sites in the fall of 2020.

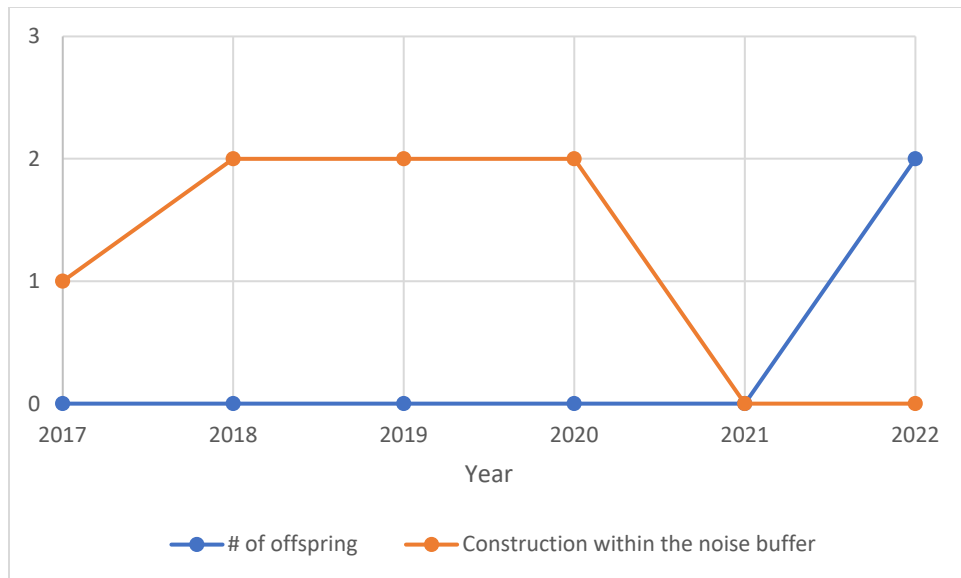


Figure 7. This graph shows the number of known offspring of the breeding pair at Ross Drive and Birney Avenue (blue) and construction activity (orange). Construction activity is described graphically using numbers 0-2 (0 - no construction, 1 - adjacent construction outside noise buffer, 2 - construction within noise buffer).

This nest which now supports eaglets continues to be monitored. UBCPT is planning a new development across the street from Ross Drive. Prior to this, the Province of BC along with Handcock Foundation were encouraging UBCPT to temporarily close this nest and encourage the pair to move to the constructed nest. This closure would extend until construction is complete at which time it would be made available again.

Appendix A

This document was prepared by **Diamond Head Consulting Ltd.** Should this report contain an error or omission then the liability, if any, of Diamond Head Consulting Ltd should be limited to the fee received by Diamond Head Consulting Ltd for the preparation of this document. Recommendations contained in this report reflect Diamond Head Consulting Ltd.'s judgment in light of information available at the time of study. The accuracy of information provided by Diamond Head Consulting Ltd is not guaranteed.

Neither all nor part of the contents of this report should be used by any party, other than the client, without the express written consent of Diamond Head Consulting Ltd This report was prepared for the client for the client's own information and for presentation to the approving government agencies. The report may not be used or relied upon by any other person unless that person is specifically named by Diamond Head Consulting Ltd as a beneficiary of the report, in which case the report may be used by the additional beneficiary Diamond Head Consulting Ltd has named. If such consent is granted, a surcharge may be rendered. The client agrees to maintain the confidentiality of the report and reasonably protect the report from distribution to any other person. If the client directly or indirectly causes the report to be distributed to any other person, the client shall indemnify, defend and hold Diamond Head Consulting Ltd harmless if any third party brings a claim against Diamond Head Consulting Ltd relating to the report.