A Bear Risk Assessment for Yukon Place:

Plans to Make the Yukon College Neighbourhood Bear Safe

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Yukon College

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YukonCollege

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Photo above: Biology 220 students gather for a class photo after completing a vegetation survey for natural bear foods along the campus perimeter, October 2014.

Front cover photographs:
Left photo: Live trap set to catch black bear on Yukon College campus. Photo credit: Yukon News Sept. 29, 2014.
Right photo: Black bear investigating live trap. Photo credit: Yukon News Oct. 1, 2014.

Executive Summary

A variety of government institutions share the campus of Yukon Place with Yukon College. The large campus lies within the City of Whitehorse adjacent to a greenspace that acts as a wildlife corridor following McIntyre Creek. The setting is unique and to our knowledge represents the only Canadian post-secondary institution that shares an adjacent green space with grizzly bears and spawning Chinook salmon. Our report set out to document the extent of wildlife activity in the area and identify options to reduce human-bear conflicts around Yukon Place.

Our study collected field data on the availability of natural foods that might attract bears to the campus perimeter and inventoried the human-related attractants that occurred on campus including solid waste storage, compost and gardens as well as ornamental fruiting trees and shrubs. We also summarized historical records of bear and other wildlife sightings and occurrences near campus from a variety of sources. Bears are regular visitors to the McIntyre Creek area and we noted four occasions when local conservation officers had to remove animals; a grizzly bear was shot on campus in 2006 after getting into garbage containers, a female grizzly bear and two black bears were live-trapped and relocated.

Our report lays out a variety of detailed options to reduce the potential for future human-bear conflicts. Public education can play a role and Campus Housing at Yukon College has already taken steps to provide orientation for students living on campus under the theme of "*Bear in Mind*". Yukon Government, in their role as "landlord" at Yukon Place, could take steps to deal with the attraction posed by ornamental plants such as Mayday cherry trees and Mountain Ash and grounds maintenance staff could help by replacing four wooden garbage cans with bear-proof receptacles.

The large number of people living and working at Yukon Place generate a considerable amount of solid waste that needs to be stored on site and this poses a strong attractant for wildlife in general and bears in particular. None of the current storage systems we surveyed would be considered bear-resistant. Our report lays out 6 approaches to changing solid waste storage so that Yukon Place could become a bear safe environment. Both Yukon College and the Seniors' Residence have vegetable gardens and associated composting areas that could attract bears at certain times of the year. We provide details on how electric bear fencing could be used to deter bears at a reasonable cost.

Administrators at Yukon Place face a challenge. At a minimum they must take steps to ensure that garbage and other human attractants are handled in a better way (for the benefit of both humans and wildlife). There is also the opportunity to enhance innovations for bear safety on campus to make Yukon Place a role model for the wider community.

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Introduction

Yukon College is located on a large campus that is adjacent to the undeveloped green space and wildlife habitat along McIntyre Creek. The overall McIntyre Creek corridor, running from Mount McIntyre to its confluence with the Yukon River, has been described as the largest contiguous significant wildlife corridor within the City of Whitehorse (Applied Ecosystem Management 2000). The green space closest to the campus is known as the Middle McIntyre area (Environmental Dynamics Inc. 2011). Sightings of birds and wildlife are common near the campus, and it is likely the only Canadian post-secondary institution that shares an adjacent green space with grizzly bears and spawning Chinook salmon .

There has been some history of human-wildlife conflicts in the area that prompts concern. On at least four occasions, Yukon Environment conservation officers have been called to the campus to deal with bears and there are anecdotal reports of foxes being fed by campus residents. This type of reactive management, where wildlife officers intervene after "wildlife problems" appear, leads to poor outcomes for wildlife and reflects an outdated paradigm. Once wildlife have become accustomed to using human sources of food in close quarters, the risk of adverse meetings between wildlife and humans increase. The approach favoured by Yukon Environment and other jurisdictions (e.g. British Columbia (Davis et al. 2002, Alberta (Lee et al. 2011)) is a proactive one that seeks to reduce conflicts by taking preventative measures such as removing attractants. Why steer this new course? Yukon College, at one time had formalized internal policies that encouraged College actions that did not result in undue harm to the environment. Similarly, the Yukon Government's overall interest in conservation and sustainable development is reflected in the *Environment Act* and section 93 of the *Wildlife Act* specifically prohibits leaving garbage accessible to dangerous wildlife. It seems easy to make the case that taking steps to reduce unnecessary harm to wildlife such as grizzly and black bears is justified on a variety of grounds – through legislation, policy and risk management.

The focus of this study is to identify the range of human-wildlife issues that occur in the area around Yukon College and suggest remedies that would enhance stewardship and long term sustainability. The land quantum currently used by the Ayamdigut Campus in Whitehorse has a relatively small footprint. In 2013, Yukon College was able to increase its property to approximately 97 hectares and work is currently underway to develop a Master Land Use Plan for this new campus boundary. Government of Yukon (YG) owns and maintains the buildings and infrastructure used by Yukon College as well as three other properties on the site: Yukon Archives, the Yukon Arts Centre (YAC) and the Seniors' Residence operated by the Yukon Housing Corporation (YHC). Yukon Place was the name originally given to the location of Yukon College and the Yukon Archives and Yukon Arts Centre and we use term in this report understanding that it also includes the YHC's Seniors' Residence. This report will focus on

wildlife concerns that may occur at any of these neighboring institutions at Yukon Place, recognizing that while they have separate administrations, they share a common landlord.

We followed the methodology suggested by Davis et al. (2002) and structured our research to address three areas: (i) a comprehensive review of the available information on bear activity in the area, (ii) an inventory of both the natural biological resources available for bears as well as human or anthropogenic attractants such as solid waste, compost, vegetable gardens and ornamental fruit, and (iii) an outline of the management options to reduce human bear-human conflicts including public education and specific ways to deal with natural and human derived attractants.

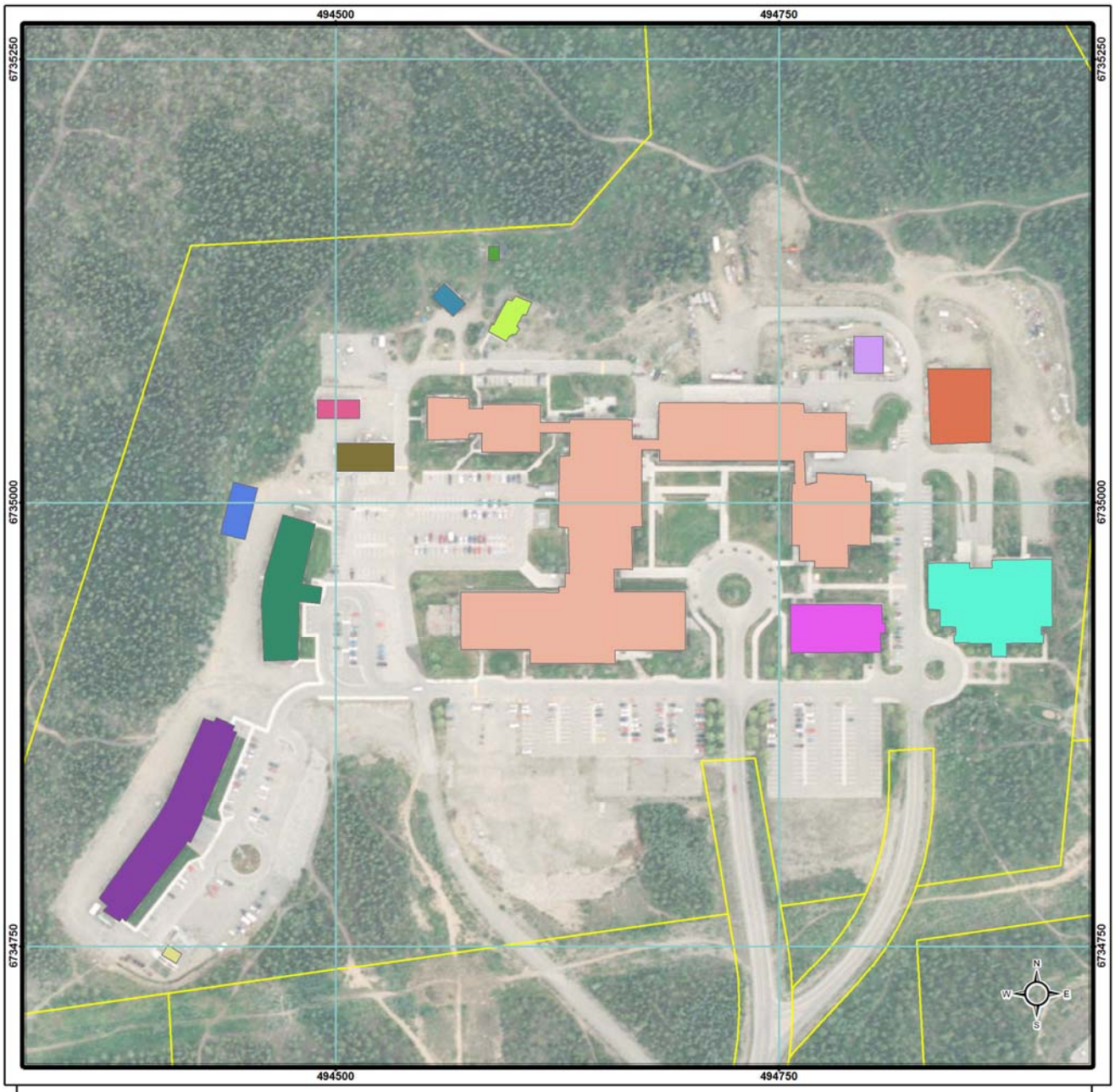

Figure 1

Study Area

0 100 200
Meters

- Surveyed Land Parcels

Building Names

- 510 College Drive
- 520 College Drive
- Centre for Northern Innovation in Mining
- Family Playground
- Multi-Use Building
- Roddy's Camp
- Seniors' Greenhouse
- Seniors' Residence
- YRC Residence
- YRC Shop
- Yukon Archives
- Yukon Arts Centre
- Yukon College
- Yukon Research Centre Labs

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters
Grid: 250m

Data Sources:
ESRI, Government of Yukon
A.G.Smith

National Topographic Sheet Reference:
105 D / 11

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Methods

Field Work

Our study started in mid-October, 2014 so we had limited opportunities for field work. Two Yukon College students were hired to carry out a survey of the entire campus to take photographs of anthropogenic attractants and mark the locations using a Garmin GPSMAP 76CSx. Sites of concern included naturally occurring foods, vegetable gardens, ornamental fruit trees and shrubs and storage locations for compost and garbage dumpsters; these locations were correlated in ArcMap 10.1.

On October 22, 2014, students in the BIOL 220 Ecology class spent time in the field helping to collect information on the distribution and relative abundance of potential bear forage along the campus perimeter. The survey methodology followed the technique used by Clarke and Jessup (2013) and Clarke (2014). As detailed below, it is designed as a quick reconnaissance method to highlight areas with concentrations of bear foods and should not be mistaken for a comprehensive inventory. We adopted a broad definition of what constituted potential bear forage species and included crowberry (*Empetrum nigrum*), soapberry (*Shepherdia canadensis*), low-bush cranberry (*Vaccinium vitis-idaea*), bear root (*Hedysarum alpinum*), bearberry (*Arctostaphylos rubra*), kinnickinnick (*Arctostaphylos uva-ursi*) highbush cranberry (*Viburnum edule*), rose (*Rosa acicularis*), horsetail (*Equisetum arvense*), fireweed (*Chamerion angustifolium*), river beauty (*Epilobium latifolium*) and locoweed (*Oxytropis campestris*). Our survey took place long after the end of the growing season, but before snow cover, and we may have underestimated the presence of herbs such as locoweed or river beauty. Students worked in pairs along two parallel transects that started at the southeast corner of the study area (behind the Seniors' Residence) and traced the campus perimeter to the north corner (north of the Yukon Arts Centre) as shown in Figure 2. The transects were approximately 5 m and 10-12m away from the developed edge of the campus and totaled 1,650m in length.

Students set up a total of 107 square quadrats (each $4m^2$) along the transects by choosing plot distances obtained from random numbers between each plot of 15 m and 30m. At each plot we recorded the percent cover of each bear forage species in one of four categories: 0–25%, 26–50%, 51–75%, and 76–100%. For each quadrat we also recorded the percent cover class for lichen, moss, and bare ground as well as the GPS location, slope, aspect, and species of tree canopy (if applicable).

We used a simple ranking scale, with scores between 1 and 3, to collect some qualitative estimate of the sightability at each plot location. Observers used a 15 m distance and asked themselves what their chance of seeing a bear would be (if it was there):

Excellent visibility: no chance of missing bear; no concern for personal safety. [Score 1]

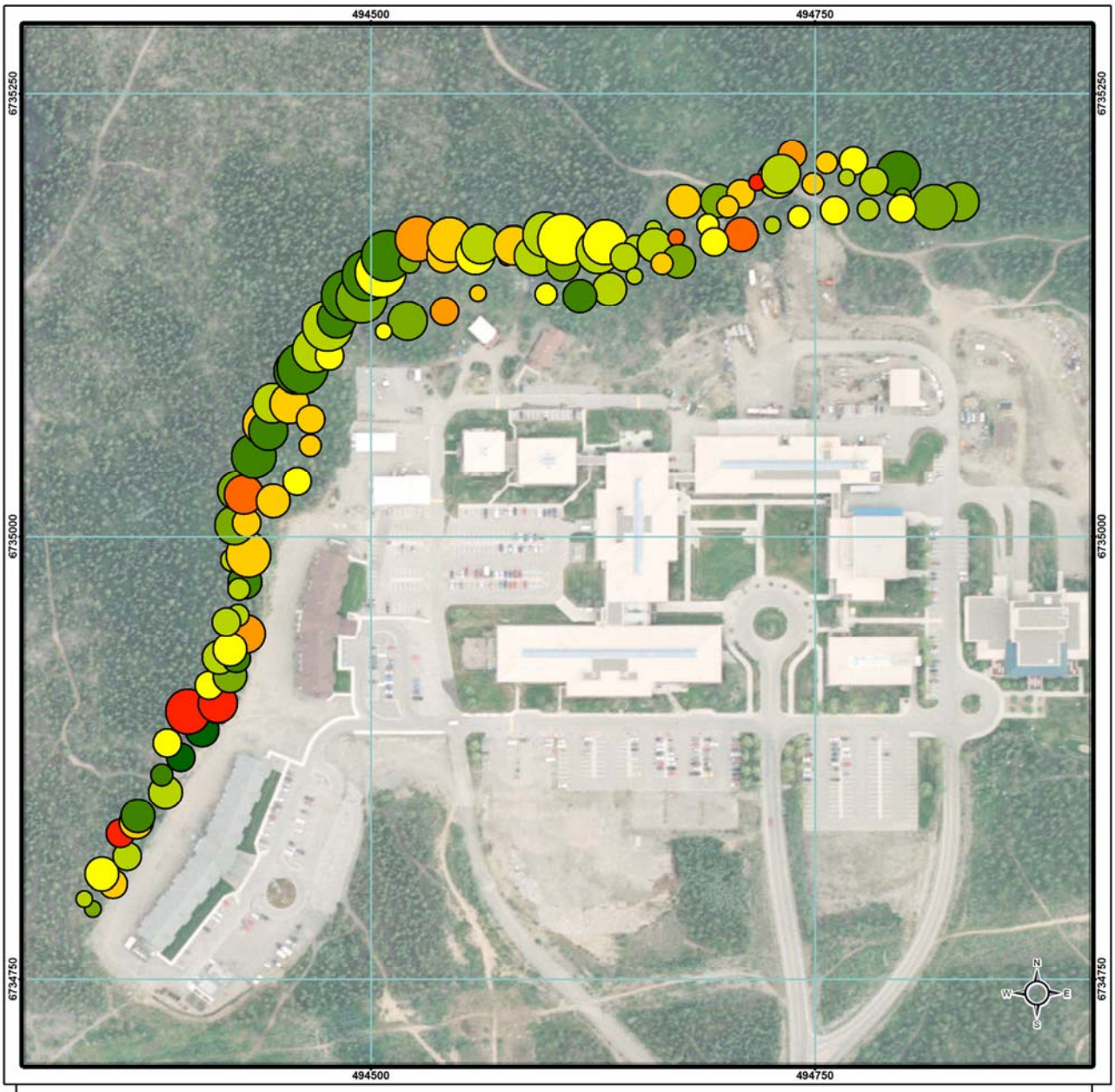

Figure 2

Vegetation Transects

Food Value 0 1 2 3 4 5 6 7 8

Symbols are interpreted by two metrics:
Colour represents food value.
Green (low food value) -> Yellow -> Orange -> Red (high food value).
Size represents sightability measurements.
Small = good sightability > Large = poor sightability.

0 100 200
Meters

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters
Grid: 250m

Data Sources:
ESRI, Government of Yukon,
A.G. Smith, BIOL220 Class

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Moderate visibility: a bear could have been hidden behind one bush or deadfall; some concern for personal safety. [Score 2]

Poor visibility: a bear could have many hiding spots; great concern for personal safety if bears had been in the area. Score 3]

We collected these qualitative observations by looking in three directions from each plot, back along the transect towards the last plot a distance of 15 m, perpendicular from the plot towards the campus a distance of 15 m and perpendicular away from campus into the green space 15 m. This admittedly crude method of ranking sightability should be sensitive to the perception of risk experienced by a hiker along the campus perimeter although we did not have time to measure variability between observers.

The raw data from this survey were transposed to numerical values in a spreadsheet (Table 1) which were then appended to the GPS waypoint file that was captured in the field using a join operation in ArcMap 10.1. Two new fields were added to the table: FOODVALUE and SIGHTVALUE. FOODVALUE is calculated by summing the number value of all of the plants on the collection list that bears are known to feed on for each quadrat. This analysis did not give a weighting to any particular species or food source so each plot was represented by an aggregate value. SIGHTVALUE was calculated by adding together the three sightability index numbers at each quadrat to create a single aggregate value for the plot.

Table 1: Values used to transpose raw data values of percent cover and sightability

Percent Cover Raw Data	Value in spreadsheet	Sightability Index	Value in spreadsheet
None (box unchecked)	Null	1 – Excellent	1
0 – 25%	1	2 – Moderate	2
25 – 50%	2	3 – Poor	3
50 – 75%	3		
75 – 100%	4		

Interviews and Historical Records

We looked for historical records of bear activity in our study area by consulting five sources. First we approached Yukon Environment and obtained two sets of records from the Conservation Officer Services: a listing of bear occurrence reports for the Whitehorse area from 2006-2014 (which may be incomplete) and a listing of bear sightings recorded through the TIPP line (Turn in Poachers Polluters) for the years 2008-2014. To present the listing of TIPP line sightings for Whitehorse in a map we first standardized the data set in Excel by reformatting the dates, and removing repeat sightings (within the same area on the same day). ArcMap was

then used to take the existing table and geocode each record by running the table along with an address locator for the City of Whitehorse. The result of geocoding added an X and Y coordinate to each record so the general location of each sighting could be displayed. Not all entries had exact addresses, so the best or most likely candidate for the location was selected from a list of scored matches.

Secondly we obtained a listing of 20 bear-related reports recorded by Yukon College Safety and Security staff between June 2011 and December 2014. Our third source of information was a simple query of the two local newspapers, the Whitehorse Star and Yukon News using the Canadian Newsstand Pacific database to turn up records dating back to 2006. Our fourth source of information was obtained by informally interviewing Yukon College, Yukon Arts Centre and Yukon Archives staff about their experiences and observations of wildlife near the campus. We did not attempt to collect any traditional knowledge about bear activity in our study area but did contact the Director of Lands and Resources from Kwanlin Dün First Nation for his insights on bear management problems in residential areas. Our final information source was a report prepared for the City of Whitehorse by Environmental Dynamics Inc. (2011) focused on Middle McIntyre Creek.

Overview of Historical Bear Activity in the Middle McIntyre Creek Area

The data on bear sightings obtained from the TIPP line database provided by Yukon Environment for three years (2012-2014) are summarized in Figure 3 and underscore the pertinence of the slogan chosen by the City of Whitehorse – the "Wilderness City". Bear sightings occur throughout the City including the fringes of the downtown core along the cliffs bordering the airport with clusters of heavier activity adjacent to some greenspaces. All of our sources indicate that both grizzly and black bears move through the Middle McIntyre Creek area near Yukon Place. Newspaper clippings from 2006 describe an event when a grizzly bear was frequenting the Yukon College perimeter to forage on garbage left in an open dumpster and was eventually shot and wounded on campus by conservation officers. During September and October of 2014, both newspapers carried accounts of a young black bear that was foraging throughout Yukon Place and was eventually live-trapped and relocated (see cover photographs).

When we narrow the focus to bear observations within Middle McIntyre Creek and the adjacent campus we find numerous records from all our sources (Figure 4). Yukon College Safety and Security reported some bear activity on campus in each year that records were available: 3 bear reports in 2011, 1 in 2012, 4 in 2013 and numerous reports of the black bear event in 2014. The bear occurrence database maintained by Yukon Environment shows 16 occasions, between 2006 and 2014, when a Conservation Officer attended a location to investigate a report of bear activity near our study area. Six of these reports occurred

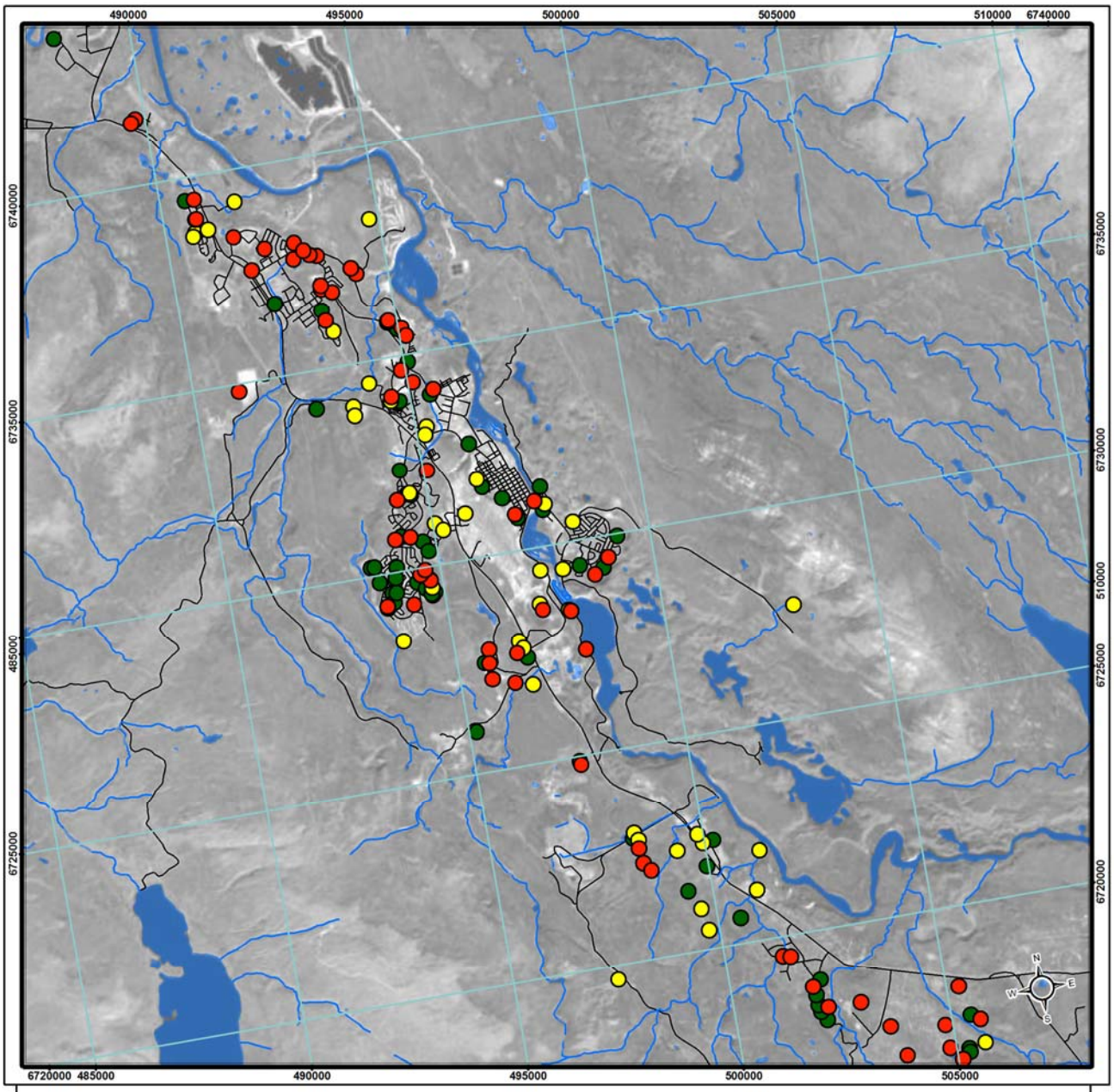

Figure 3

TIPP Line Reports from Whitehorse

Road

Season

- 2012
- 2013
- 2014

0 2.5 5
Kilometers

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters Grid: 5000m

Data Sources:
ESRI, Government of Yukon,
Environment Yukon, A.G. Smith,

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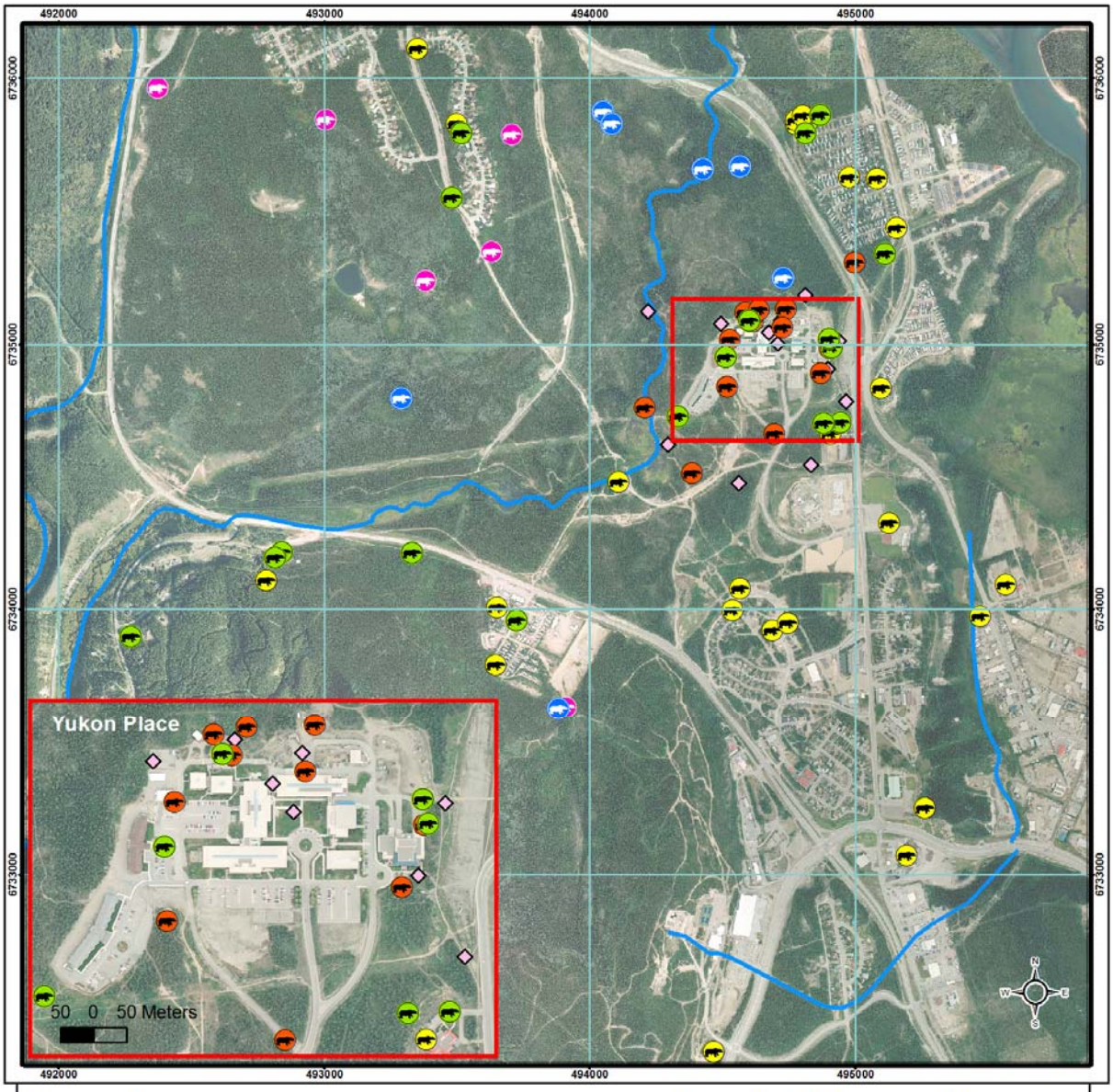

Figure 4

Historical Wildlife Sightings

- Conservation Officer Occurence Reports 2006-2014
- Bear Reports Based on Interviews
- TIPP Line Sightings 2012-14
- Bear Scat - data from EDI (2011 p.10)
- Bear Sighting - data from EDI (2011 p.10)
- Other Carnivore Sightings from Interviews

0 250 500 1,000
Meters

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters Grid: 1000m

Data Sources:
ESRI, Government of Yukon,
EDI, City of Whitehorse, A.G. Smith,
Interview subjects, YC Security

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on or adjacent to the campus; the remaining ten locations are on the distant perimeter of the study area such as Porter Creek (e.g. Ponderosa St.), trailer parks at Kopper King or Northland and the new Raven's Ridge subdivision. It is worth noting that four of these six occurrences near Yukon College have resulted in the "loss" of bears from the local population; one grizzly bear male was killed in 2006 and a grizzly bear female was trapped and relocated in July 2010 while a male and female black bear were trapped separately in 2014 and relocated. Figure 4 also includes locations where Environmental Dynamics Inc. (2011, p.10) reported bear occurrences (either from camera traps or indirectly from scats). A University of Alberta researcher reported that a camera trap in Middle McIntyre Creek near the campus showed no signs of bear activity during the 2014 season between June and November although the study did detect the presence of other small carnivores.[1]

The information we gathered from interviews with staff members who work at Yukon Place helped round out our understanding of bear and wildlife activity in the area (Figure 4). In the mid-1990s, archaeological digs conducted by students and staff a few hundred metres south of the College were visited by a grizzly bear on several nights while students were absent. Two respondents noted that they have seen Chinook salmon spawning beds in the area immediately downstream of Pumphouse Pond although we have no reports of bears actually foraging for salmon in that area. The spawning beds were used for several years in the early 2000's until beavers re-built a dam and the spawning bed was made inaccessible.

We received detailed descriptions of bear sightings, over several years, with many of the sightings clustered behind 510 College Drive building and the Lower Trades area. We learned that bears in several years have been seen traveling during the early evening from one end of the campus (near the YRC residence) to the other by wandering a route that took them behind 520 College Drive or in front of the same building by using the YC staff parking lot. Evidently bear sightings on or near campus are not a rare event and are possibly underreported.

[1]Alberto Suarez Esteban, pers. comm., March 2015

Results

Overview of Management Alternatives to Reduce Human-Bear conflicts

Our survey of the Yukon College campus and neighbouring properties generated an extensive list of potential natural and human-related (anthropogenic) attractants which could lead to conflicts with bears. In the following sections we detail the specific concerns and outline various options that could reduce or eliminate the threats of future conflicts with wildlife.

The northwest perimeter of the Yukon College campus has an abrupt transition from the wildland to urban zone as a result of the proximity of a wildlife corridor running along McIntyre Creek. We begin by presenting the results of our vegetation surveys in this area and then consider two habitat prescriptions which may help reduce the attractiveness of this zone for bears and help create some more space between wildlife and the areas where human activities occur.

The several hundred people who live or work in the campus area produce a considerable amount of waste and we begin by reviewing current management practices dealing with solid waste. Several of the institutions have programs to separate and store compostable wastes and we take up that case separately. There are vegetable gardens and composting operations found on two of the properties and we discuss the electric fencing options to make these activities bear-proof. Ornamental plants that produce fruit in the fall are a particularly strong attractant for bears as we learned in September 2014 when a bear spent many days on campus feasting outside Yukon College and the Yukon Arts Centre. These trees and shrubs play a prominent role in the local landscaping and we carefully consider the ramifications of various ways of eliminating the attractant.

The final component that must be considered in any plan to reduce conflicts with wildlife is the role of people. The institutions located around the Yukon College campus involve hundreds of people but the unique campus setting may make it easier to bring about changes to reduce conflicts with wildlife. First of all the waste management decisions on campus are centralized (unlike an urban area where garbage is dealt with by property owners on an individual basis). Secondly the local residents, made up of seniors, students and staff are likely inclined to respond favourably to notions of stewardship and changing behaviour to reduce conflicts with wildlife. We discuss various public education efforts in the last section of this report.

Vegetation Survey of Natural Attractants and Sightability

The results of our survey of potential bear foods are summarized in a map (Figure 2) where each study plot is represented by one circle. The colour of the circle represents the food value and increases from dark green (food value = 0) through yellow, to dark red (food value = 8). Our

subjective ranking of sightability is represented by the size of a circle. A smaller circle denotes good visibility with low concern and a large dot represents significant visibility problems. These data raise two concerns. First, we note the area behind the Seniors' Residence and the 520 Family Housing building show some areas with high levels of natural attractants (i.e. highest concentration of red). This area is also adjacent to the children's playground behind the 520 Family Housing building. With the high level of human activity and potential for food waste to be present in the playground this area merits special management consideration.

Sightability issues are apparent along many sections of the transects we surveyed. A moderate overall visibility would yield a score of 6 (a rank of "2" in each of three directions). The modal rank was 5 and the majority of sites scored 6 or higher. When we did a fine-scale analysis of the sightability estimates at each plot we found that 17% of plots scored the worst ranking (i.e. a bear could have many hiding spots within 15m) when looking *towards* the campus (18 of 107 plots with a rank of 3) while 49% scored the worst ranking looking *away* from campus (52 of 107 plots with a rank of 3). Given that our transects are located a short distance from the developed grounds of the campus this simply tells us that as you walk away from the campus the sightability gets worse. In some locations the steep slopes contributed to poor sightability. Our estimates suggest there are locations around the campus periphery where there is enough dense vegetation or deadfall to conceal bear activity and therefore raise the chance that a person could unexpectedly encounter a bear at close range (i.e. <15m).

It is important to qualify that our estimate of sightability is based on a subjective estimate of the observer's "perception of risk" and our methodology was further weakened by having numerous different observers. Nevertheless, if our estimates are valid, then a reduction in the amount of forest vegetation or the creation of a more open transition may be warranted. This would offer a double-dividend because thinning the forest along the edge of the campus perimeter, would effectively be firesmarting the area. However, Honeyman (2007), Homstol et al. (2011), and Vassal et al. (2003) have all raised concerns regarding the effect that firesmart activities have on the successional stages of an ecosystem and suggest that monitoring is necessary to detect whether natural foods, favoured by bears, proliferate as a result of increased sunlight. Monitoring by Yukon Environment has shown soapberry responds in areas that have been firesmarted compared with unmodified forests.[2]

[2] Dr. Ramona Maraj, pers. comm., May 2015

Options for Natural Habitat Interventions

Remove natural attractants such as soapberry

We could reduce the attractiveness of the natural greenspace area close to the developed footprint of the campus by selectively removing plants by hand. The area proposed for this habitat modification would be a narrow strip of natural shrub-forestland, perhaps 30 m wide, that runs along the campus perimeter from behind the Seniors' Residence to the area behind the MUB and Yukon Arts Centre. The goal of this habitat treatment would be to reduce the density of fruit-bearing shrubs adjacent to the campus to reduce the possibility of "luring" bears in to forage on these highly desired natural foods. Our vegetation survey indicates that highbush cranberry plants are rare along the perimeter and occurred at just 4 of 106 samplings sites. Soapberry bushes are dioecious, that is, male and female flowers are produced on separate plants, so only female plants would need to be removed. We found soapberry plants, of either sex, in 25 of our 106 plots and the majority of occurrences (22 of 25) had between 1 and 25 percent cover. Rather than try and further refine our estimate of the density of soapberry bushes with more field work we suggest sending out a crew in August or September, 2015 when the plants are bearing fruit and remove them by hand. This could be done with a small crew of two hired students for three or four days or a volunteer class of RRM students for one field exercise period (i.e. 24 students for 2.5 hours).

Improve sightability along the campus perimeter

Reducing the amount of dead and living vegetation ("habitat structural complexity") around a narrow band of the campus perimeter would improve sight lines so people could see bears, if they were present, in the area. This would help reduce potential human-bear conflicts by increasing the distances that humans and wildlife become aware of each other and give more time for each party to respond. From our field work it seems that some of the areas with poor sightability have dead, uprooted trees combined with live coniferous trees with lots of lower branches. Targeting these areas, for example behind the children's playground (Figure 1), would also contribute towards a second goal of firesmarting the perimeter. To be clear we are not advocating a firesmart treatment for large areas of the surrounding greenspace; rather we are addressing the concern of sight lines within a 30m buffer of the developed footprint of the campus. We assume that bears may occasionally pass through or forage on naturally occurring foods in the greenspace beyond that 30m buffer without human notice.

Waste Management Practices

Our survey of the institutions sharing the greater campus area found that all of them seem to use the same approach to solid waste management (Figure 5, Tables 2 and 3). Garbage is stored outside in metal dumpsters ranging in size from 4 to 6 cubic yards ($3m^3$ to 4.6 m^3) that are serviced once or twice a week by a contractor who provides waste hauling service to the City of Whitehorse Waste Management Facility. In 2015 Whitehorse had two large waste hauling companies, General Waste Management and Pacific Northwest Waste Hauling, and their business model appeared to be one of supplying dumpsters that they then serviced on a set schedule for a contracted price. None of the dumpsters we saw installed during our fall survey would prevent a bear from accessing stored garbage. Both local companies use trucks that can only handle "front-load" dumpsters.

In the following section we outline six different options that would reduce or eliminate the access that bears or other wildlife might have to the garbage storage areas at Yukon Place. We present the options *in rank order starting with the most effective solutions*.

Option 1 – Reducing the number of dumpster collection sites

The Seniors' Residence, Yukon Arts Centre and Yukon Archives each have a single dumpster site where garbage is collected and stored. Yukon College, by comparison, has 10 large dumpsters stored at six locations. It may be helpful for the College to explore the original reason for situating dumpsters at each location to determine if requirements have changed. In recent years the Yukon College Recycling Committee has been encouraging waste reduction and recycling. Their past accomplishments and future initiatives (e.g. composting options for students in residence) may obviate the need for so much waste storage capacity. The spatial footprint of the College is large and some of the dumpster locations may have historically been situated to accommodate the custodial staff. The custodial staff may have suggestions on ways they could adapt their collection system so that they could reduce the number of dumpster locations they regularly use.

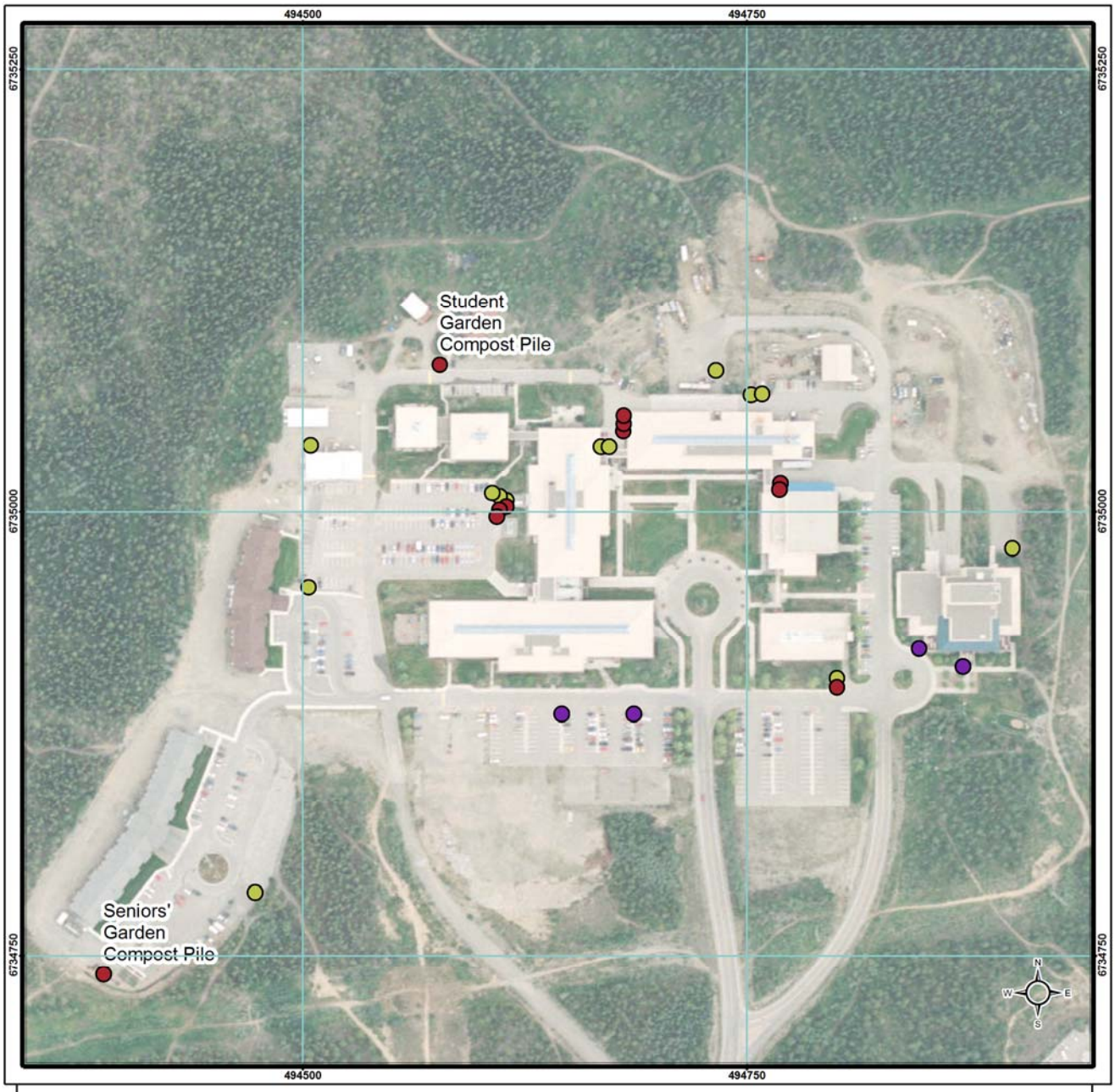

Figure 5

Garbage and Compost Locations

TYPE

- Compost
- Dumpster
- Wooden Trash Can

0 100 200
Meters

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters
Grid: 250m

Data Sources:
ESRI, Government of Yukon
A.G.Smith

National Topographic Sheet Reference:
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Table 2(a): Description of waste management sites at Yukon College

Institution	Yukon College
Location	Kitchen Service Entrance
Dumpsters	3
Compost bins	8
Cardboard bin	No
Recycling	No
Fencing	Open site
Comment	

Institution	Yukon College
Location	520 Residence
Dumpsters	1
Compost bins	0
Cardboard bin	Yes
Recycling	Yes
Fencing	Chain link - 3 sides
Comment	Looks like 6 yard dumpster

Institution	Yukon College
Location	Shipping-Receiving
Dumpsters	2
Compost bins	17
Cardboard bin	No
Recycling	No
Fencing	Hardened site
Comment	Looks like 6 yard dumpsters

Institution	Yukon College
Location	Welding Shop / Energy Centre
Dumpsters	2
Compost bins	0
Cardboard bin	No
Recycling	No
Fencing	Open site
Comment	

Table 2(b): Description of waste management sites at Yukon College.

Institution	Yukon College
Location	Lower Trades
Dumpsters	1
Compost bins	0
Cardboard bin	No
Recycling	No
Fencing	Open site
Comment	Adjacent to green space.

Institution	Yukon College
Location	YRC Compound
Dumpsters	1
Compost bins	0
Cardboard bin	No
Recycling	No
Fencing	Full chain link perimeter
Comment	

Table 3: Description of waste management sites at Yukon Government institutions at Yukon Place.

Institution	Yukon Arts Centre
Location	Rear loading dock area
Dumpsters	1
Compost bins	0
Cardboard bin	Yes
Recycling	No
Fencing	Open site
Comment	
Institution	Yukon Archives
Location	Near YAC entrance
Dumpsters	1
Compost bins	1
Cardboard bin	No
Recycling	No
Fencing	Wood fencing on 2 sides
Comment	
Institution	YHC Senior's Residence
Location	South end of property
Dumpsters	1
Compost bins	0
Cardboard bin	No
Recycling	No
Fencing	Chain link - 3 sides
Comment	

Option 2 – Install self-locking bear-proof dumpsters

The US Interagency Grizzly Bear Committee (IGBC) has a testing program in place to evaluate the effectiveness of various models of waste receptacles and some manufacturers supply dumpsters that are certified as Bear-Resistant under this program. For example, the Carcross Tagish First Nation reports good success using the Hyd-A- Way HL-45 model made by Haul-All Equipment Systems Ltd (Figure 6). CTFN was able to secure funding to introduce this system in their Choutla subdivision where they use 4 yard dumpsters (~$6,000 each) that are serviced with a specialty truck that cost approximately $80,000. We were unable to find a waste hauling company in Whitehorse who could service this particular model of dumpster.

Figure 6: *Bear-resistant dumpster (Model HL45). Photo credit: http://www.haulall.com/*

Wasteline Containers Ltd. in Abbotsford, B.C. offers a line of commercial-style front-loading dumpsters in various sizes that are described as bear-resistant (Figure 7). These front-loading models could be handled by the local waste haulers and are advertised as having several beneficial features in addition to their bear resistant design. The front opening doors are easier for users to open to deposit their garbage than a large metal top. The closed design means the garbage does not get water-logged during rainy weather (which provides a benefit when tipping fees that are based weight) and finally, the doors on the front at approximately 50 cm wide and this limit the size of material that can be deposited (e.g. mattresses, furniture). The cost of the 6 yard FF-6S model shown in Figure 7 is $1,729.00 FOB (Abbotsford, BC) and the smaller 4 yard model would be $1,434.00 (FOB Abbotsford, BC). These prices include the actual dumpster, the front loading top with two doors and the locking mechanism for the top. The locking mechanism can be secured with a simple carabineer that a bear cannot manipulate.

Figure 7: *Example of a self-closing, front-loading, "face feeder" dumpster offered by Wasteline Containers Ltd. Photo credit: http://wastelinecontainers.com/*

Option 2 – Install self-locking bear-proof dumpsters **(continued)**

Wasteline Containers Ltd also offers a "front load lid kit" that can be used to convert an existing 4 or 6 yard dumpster into a bear-resistant unit (Figure 8). The kit includes a lid assembly unit with two self-closing doors and must be welded or bolted to a dumpster, of the correct dimensions, that is supplied by the customer. The cost is $436.00 (FOB Abbotsford, BC).

Figure 8: *Example of retro-fit kits that can be used to convert existing 4 or 6 yd dumpsters bins into bear-resistant units offered by Wasteline Containers Ltd. Photo credit: http://wastelinecontainers.com/*

We were able to find a local supplier of "bear-proof" dumpster equipment made by Haul-All Equipment Systems and represented by 41266 Yukon Inc. The BT-4701 model (Figure 9) is described as a "Bear-resistant Top" which is retro-fitted to a customer supplied 4 yard dumpster. The garbage access doors for users are self-locking and there is a locking pin built into the lid that allows it to remain bear-proof during day to day use and then, with the release of the pin, allows the top to articulate so a front load waste hauler can empty the unit. The estimated cost per unit is $1,965.00 plus approximately $350.00 shipping to Whitehorse. There may be questions of risk on the clients' side given that they would be supplying the dumpster for the contractor to service.

Figure 9: *This bear-resistant topper, produced by Haul-All, is designed to be retro-fitted to an existing 4 yd dumpster supplied by the customer. Photo credit: www.haulall.com*

Option 3 – Install electric bear fencing at one centralized waste storage area

The situation that Yukon College presents may involve significant costs because of the need to acquire multiple bear-resistant dumpsters and compost carts. Another viable option, which may be more cost effective, would be to create a staging area or "corral" that is protected by bear-resistant electric fencing during the season that bears are active. This would allow the continued use of waste receptacles that are not bear-resistant. The neighbouring Yukon Place institutions, that currently only have one dumpster or compost cart, may not gain the same cost savings from this approach.

Figure 10 shows one possible layout of an electric bear fence set up against the wall of Yukon College at the kitchen service entrance. Jeff Marley of Margo Supplies Ltd. provided technical

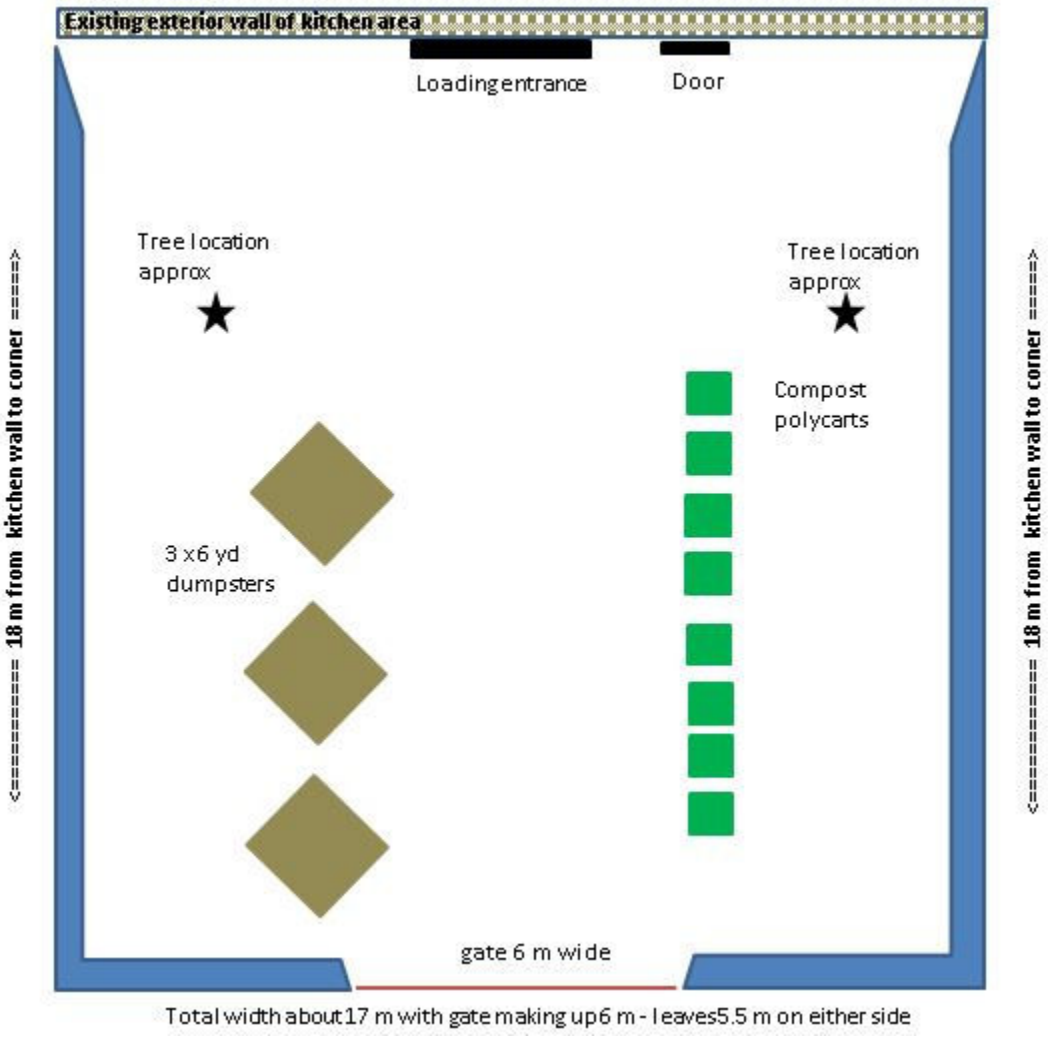

Figure 10: *Sketch showing the location of a proposed electric bear fence at the Yukon College kitchen service area to provide a bear-proof "corral" to store regular garbage dumpsters and regular compost carts. The fence would be located in the solid blue area on 3 sides and meet against the existing wall.*

advice on the design of this simple system. The drawing shows the layout of numerous compost carts and three large dumpsters. This service area is heavily used by at least three groups: (i) kitchen and custodial staff taking out garbage or compost by using the service entrance door, (ii) students and custodial staff bringing garbage from the nearby Campus Housing building by entering from the parking lot and (iii) companies make truck deliveries to the kitchen loading dock or servicing the dumpsters. The staging area requires a wide gate so trucks can back up to the service entrance and waste haulers can access the dumpsters and one design constraint is that a "slinky-style" gate can be a maximum of 6 m wide. The estimated cost of materials for a six-strand wire system on fiberglass posts is approximately $1,100.00 using a solar powered fencing charger with no associated operating cost. The fence should be operational during the season that bears are active (April to October) and could be turned off and on each day by the Safety and Security officer who was on duty (e.g. 7 AM visit to turn off the charger and open the gate followed by an 8 PM visit to close the gate and charge the system). The participation of the security officer each day would go a long way to ensuring the effective operation of the fencing system. The questions of safety for people or the consequences of accidental shock for someone who inadvertently touched the charged fence are discussed in Box 1.

Box 1. Are high voltage bear fences safe to use around people?

Electric bear fencing has been used for almost 20 years at Yukon landfill sites and is very effective at deterring bears. Portable electric bear fencing was used by the Renewable Resources Management class during a field course in 2008 to the Yukon North Slope. The question asked by many people, who are unfamiliar with the system, is how can it deter a large, powerful bear and still be safe for people?

The fencing systems proposed for use at Yukon Place would consist of 6 tightly strung wires held on fiberglass posts. The wire strung closest to the ground would be negatively charged and then each of the 5 wires placed above it would alternate between a positive and negative current. The wires would be spaced close enough that a bear trying to push its head and neck between two wires would push apart its outer fur and expose its skin to both a positively and negatively charged wire. The bear would receive a high voltage but low amperage shock and ideally, lunge backward. By comparison a shock from a typical 110V household receptacle can be very dangerous and potentially fatal because of the high amperage (e.g. 15-20 amps).

Will an accidental shock from a bear fence seriously harm a person? No.

Have bear fences been installed in locations where the public may encounter them? Yes. Parks Canada has used electric bear fences in parks in western Canada.

Box 1. (continued)

How could a person receive an accidental shock from an electric bear fence?

1. They would first have to ignore the yellow warning signs that display warnings, in symbols and both official languages, which are attached to the fence at multiple locations.
2. Secondly the fence would have to be turned on and operating.
3. If a person touched just one wire (and it happened to be one of the 3 positive wires) it is unlikely they would receive much of a shock as the dry, gravel surface or pavement in our area should not provide enough of a ground to complete the circuit needed to deliver a shock.
4. If a person accidentally touched two adjacent wires (one negative and one positive) they would receive a very strong, unpleasant shock causing a great surprise. They would yell (or swear) and it is very unlikely they would ever choose to repeat the experience!

Option 4 – Install bear-resistant metal lids with security bars

It seems reasonable to think that a steel dumpster could be made bear proof if you could attach a strong metal lid with a lock. The "weak" link in this approach is the operational demand that the user must unlock and then remember to lock the dumpster after every use. As a consequence of the likelihood of human mistakes this is considered a poor design and should be passed over in most situations in favour of a self-locking lid mechanism (Option 2 on page 20).

Some of the dumpsters provided by Whitehorse waste haulers include a flat metal lid (e.g. see Table 2a Welding Shop / Energy Centre photo) and these units can be fitted with an aftermarket locking mechanism. According to the Wasteline Containers Ltd. catalogue a bar lock to adapt to these dumpsters is available for the price of approximately $79.00. The retro-fit would require a bit of welding or bolting to attach the locking mechanism. The major drawback, as noted above, is that the bar lock must be undone each time a user wishes to add garbage to the unit. Based on past practice in Whitehorse neither of the current commercial waste haulers will ask their operators to get out of the vehicle to undue any latching mechanism on a dumpster. Therefore a staff member would be responsible for unlocking the mechanism before the waste hauler arrived.

Serious Industries in the United States also produces an aftermarket bar and locking mechanism (http://www.seriouslock.com/site/products/s_serieslock.html) that can be retrofitted to an existing dumpster. The S-Series Front Mount Automatic Dumpster Lock (Figure 11) can be

bolted to an existing dumpster with a tight-fitting metal lid. The user must use a padlock or carabineer to secure the locking mechanism after each use but when the padlock is removed the dumpster can be emptied "automatically" by the contract hauler.

According to Lori Homstol (pers. comm.) the use of security bars to keep garbage away from bears is seldom successful because of low rates of compliance by the staff using the dumpsters. Staff or users who are in a rush, forgetful or have not received an orientation may leave the units unlocked and accessible to bears. Her advice, based on much experience, is to choose a self-closing lid system and remove the element of human error in maintaining a bear-resistant garbage system.

Figure 11: *This locking bar mechanism, manufactured by Serious Industries, has been bolted on a conventional dumpster and shown here at Mesa Verde National Park, to deter black bears. Photo credit: S. Gilbert*

Option 5 – Install a bear alarm system at certain dumpster locations

The current location of the dumpsters (Figure 5) reveals that some dumpsters are close to forested areas, where bears could cautiously approach using security cover provided by nearby trees and shrubs (e.g. YC Lower Trades, Yukon Arts Centre); other sites are located near the interior of the campus where a bear would have to cross a large, lit parking lot (e.g. Yukon College kitchen area). An alarm system, such as the *Trip Wire Fence System* sold by Margo Supplies Ltd., would provide some limited deterrent effect on the first occasion that a bear tried to access the area (Figure 12).

Figure 12: *Example of a trip wire alarm controller supplied by Margo Supplies Ltd. Photo credit: Sowka 2013, p. 6-3.*

There are several pitfalls with this approach. First the trip wire itself would have to have a gate system so the dumpster could be serviced by truck once or twice a week. Therefore it would require operator diligence to ensure the system was kept operational during the active bear season. Secondly the deterrent (a loud noise and perhaps light) would not stop a hungry bear and might very well allow a wild bear to obtain some reward from accessing the

garbage. Finally the efficacy of this approach would be entirely dependent on recognizing when a bear had made a first approach and then immediately (ideally the night of the occurrence) moving to a bear-resistant form of waste storage. Delaying a response would give any inquisitive bear time to access the garbage. In practice it might be difficult for security personnel responding to an alert to distinguish between a false alarm (no bear present) and a bear intrusion where the bear had retreated temporarily (again no bear present). Adding a surveillance camera would help the responder to determine the actual cause of the alarm. The alarm system described here should not be considered a long term solution and would require a bear-resistant system available on immediate standby.

Option 6 - Stop using dumpsters at YC and store solid waste in secure buildings.

One final option, for the particular situation of Yukon College, is to consider a wholesale change in the traditional approach to storing and transporting solid waste to the City of Whitehorse facility. A holistic review of the manner in which waste is handled at Yukon College might note the following. The volume and weight of solid waste destined for the landfill could be reduced by a continued effort to support existing waste reduction and recycling efforts. The resulting smaller volumes might be able to be stored inside the building at some locations (e.g. Shipping Receiving) or in small, secure wooden outbuildings (e.g. kitchen service area) or small cargo trailers. The smaller volume would need to be moved by hand to a transport (e.g. pickup truck and trailer). The frequency of transporting waste could also be adjusted to meet the demands based on volume.

What would such a system cost? A new approach would have to reflect both capital costs (e.g. construction of any garbage storage outbuildings or purchase of a cargo trailer) and operating costs for labour, vehicle operation and tipping fees. The current cost of handling solid waste at Yukon College is based on a multi-year service contract that is put out for open bid and is in the range of $15,000 per year. Over the years the College has been working steadily to increase the amount of waste diversion yet, to the extent that success has been achieved, the reduction in waste tipping fees have accrued profit to the waste hauling contractors and not to the College. Internalizing the responsibility for waste hauling could bring some benefit in the long term as further waste diversion is achieved.

Outdoor Public Garbage Bins

The grounds keepers from Yukon Government's Facilities Management and Regional Services office have installed and service four wooden garbage bins at Yukon Place that are not animal proof. The Yukon College parking lot for students has two bins and two more are located at the entrances to the Yukon Arts Centre. The bins are intended to reduce littering by providing a convenient receptacle for garbage when people are walking through the parking lot. The open lid design however makes them vulnerable to attack by ravens or wind gusts which can draw out light weight trash (Figure 13). One option would be to remove the bins entirely and hope that littering in the area does not increase. This may prove the more likely scenario if the landlord at Yukon Place (Facilities Management and Regional Services) is unable to fund replacement units that are bear-proof. The second option would be to ask the Yukon Government to install bear-proof garbage bins as is the practice in Yukon Parks and rest stops along Yukon Highways. The model familiar to Yukon travelers (Figure 14) is available from a local supplier, Northern Environmental Management Systems, who has an arrangement with a local manufacturer, Duncans Ltd. The bear-proof latch has been certified by the US Interagency Grizzly Bear Committee (IGBC) and has been used successfully in the Yukon since the mid-1980s.

Figure 13: *In October 2014 ravens had removed garbage from the bin located in the student parking lot.*

Figure 14: *The Hyd-A-Bag container is a bear-proof solution for storing small amounts of garbage. The units are manufactured locally under licence to Haul –All and supplied by NEMS. Photo credit: www.haulall.com*

Compost Storage Carts

In January, 2009 Yukon College started an institutional composting program to divert compostable waste from the general waste stream. To support the program, 21 bear-resistant composting carts from BearSaver in the United States were purchased at a cost of $7,025.00 (including shipping, currency exchange and brokerage fees). The compost carts were stored outside the Kitchen Service area and serviced by the City of Whitehorse. These compost carts have a metal re-inforced lid with a locking mechanism and the lid has to be unlocked before the unit can be emptied (Figure 15). The City of Whitehorse uses a specialized truck to service the similar sized domestic compost bins (also called polycarts) so the operator does not have to leave the vehicle and can rely on a series of hydraulically operated arms to pick up and empty each polycart. Unfortunately when the City of Whitehorse staff were confronted with the new BearSaver bins and found they would not empty, they responded by pinching the hydraulic arms until the lid on the BearSaver carts was sprung and the lid popped open. As a result the cart could be emptied on that one occasion, but having damaged the lid, the locking mechanism would not work in future. As a result of damage during servicing, only 9 of the original BearSaver carts are still in operation. As of February, 2015 none of the units appeared to have functioning lock mechanism; the remaining 12 units were damaged beyond repair and taken out of service.

Figure 15: *BearSaver compost cart at Yukon College showing the damaged lock mechanism which has been sprung by excessive force during the process of emptying.*

There are other models of bear-resistant polycarts available on the market. The US company Bearicuda (http://www.bearicuda.com/) makes a Stealth II Bin model that is available online for $219 USD (plus a considerable freight charge because of the size of the unit). Their web site claims to have a superior design to the BearSaver model with a latch mechanism that does not freeze in winter. The BearSaver polycarts used in the Grand Canyon by the US National Parks Service each appeared to have damaged lock mechanisms and were not functional when one of us visited in 2015 (Figure 16) so this may be a general design flaw with

Figure 16: *BearSaver compost cart at Grand Canyon National Park in April, 2015 showing defective lock mechanism.*

the BearSaver model.

Yukon Archives uses one City of Whitehorse compost cart (Table 3) and their options for moving to bear-proof storage seem limited. Were they to invest in a new compost storage cart that was bear-proof it is likely to meet the same fate as the carts used at Yukon College. One solution may be to rely on a staff member who would ensure the cart was unlocked on the day the City of Whitehorse truck visits to empty the cart. The bear-proof cart would only need to be used during the active bear season (April to October) so perhaps a bear-proof cart, if one was acquired, could be retired from use during the winter season.

Dealing with Anthropogenic Attractants such as Gardens and Ornamental Plants

There are several locations around the campus perimeter where there is no sharp boundary between the green space and the urban area we work in. As a result wildlife can easily amble into the built-up human environment. For example, as wildlife move about foraging for natural foods, they may encounter attractive anthropogenic foods such as vegetable gardens, compost piles with high-protein human foodstuffs or fruit from introduced trees and shrubs that form part of the urban landscaping. To some hungry animals these human attractants may prove irresistible (Merkle et al. 2013). In this section we discuss the human-derived attractants we identified in our survey and outline various measures to reduce the attractiveness of these human food sources to wildlife.

Gardens and Composting Operations

There are two separate vegetable gardens with associated compost piles and greenhouse operations on properties controlled by Yukon College and the Yukon Housing Corporation (Figure 18). Our discussions with Jeff Marley of Margo Supplies Ltd. indicate that it is safe, feasible and cost-effective to install electric bear fencing to deter wildlife from the areas where the gardening is taking place.

Campus Housing has provided a small garden plot for students since 2009; it is located in front of the Yukon Research Centre residence (Figure 17). The trapezoid-shaped perimeter is approximately 50m long and could be made bear-proof each season by using electric bear net fencing. The netting (1.2m high) has step-in posts and rigid stays which makes it easy to set up and take down. It could be powered with a solar fencing charger. Gardeners could access the compound using a maze entrance. The fenced perimeter should be set back from any garden box to prevent vegetables from growing beyond the fence. The cost for 50m of Electra netting and a solar charger is approximately $800.00.

Figure 17: *The garden provided for students by Campus Housing consists of several raised garden beds and one small compost pile, shown here in mid-March, 2015.*

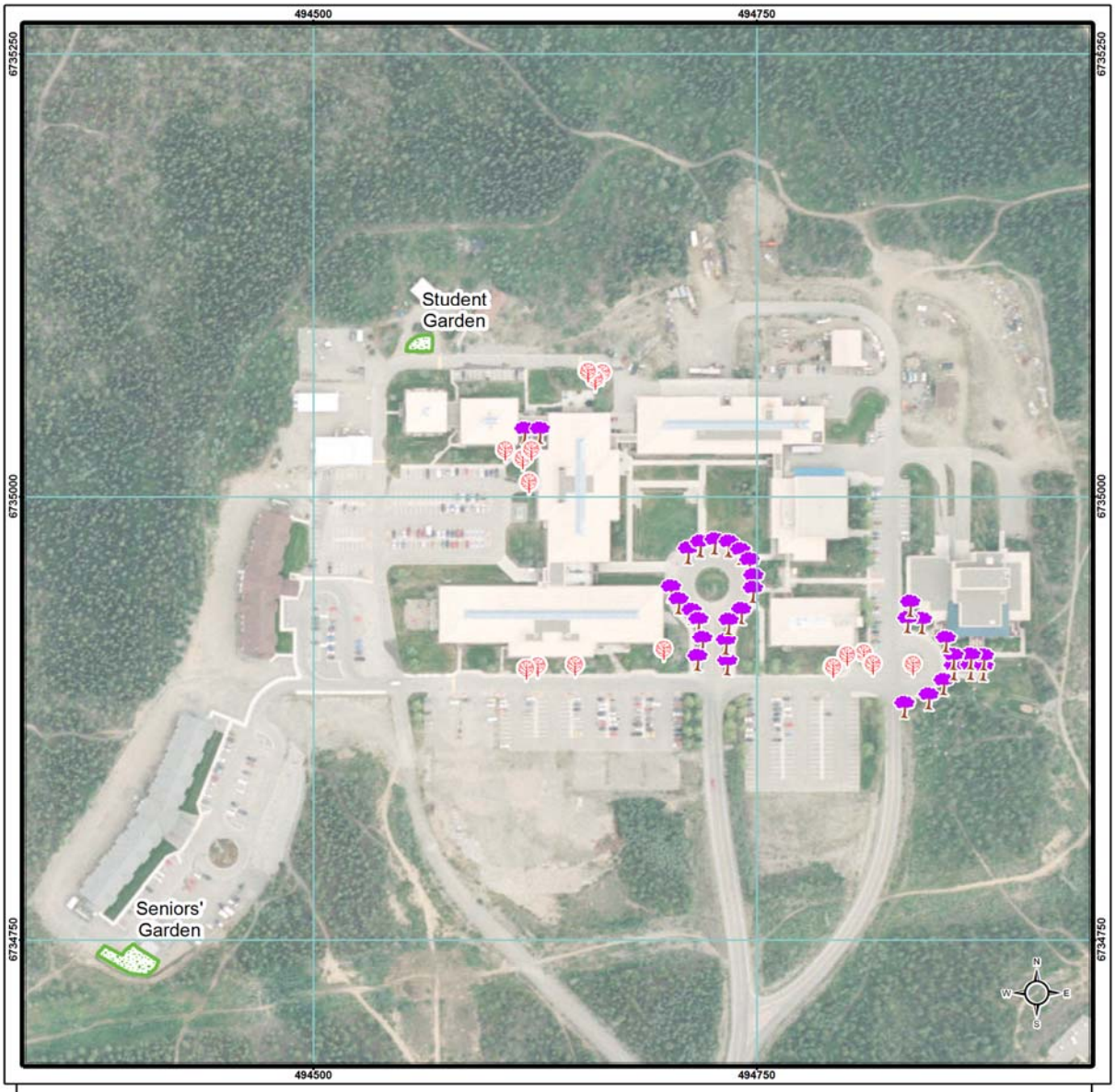

Figure 18

0 100 200
Meters

Ornamental Trees and Garden Locations

- Mountain Ash
- Mayday Cherry
- Gardens

Coordinate System: NAD 1983 UTM Zone 8N
Projection: Transverse Mercator
Units: Meters
Grid: 250m

Data Sources:
ESRI, Government of Yukon
A.G.Smith

National Topographic Sheet Reference:
105 D / 11

Author: Andrew G. Smith

Published Date: Friday, May 29, 2015

The Yukon Research Centre has a small greenhouse located adjacent to the Campus Housing garden. The greenhouse operations has a variety of bear attractants (e.g. fertilizer) and could be made bear proof with the use of temporary electric net fencing for less than $800.00.

The Seniors' Residence has an extensive set of raised garden beds, a greenhouse, compost pile and network of fruiting shrubs located in front of the building (Figure 19). We carried out a series of measurements of the perimeter and passed on the information to Jeff Marley to obtain some advice on possible designs of an electric fence to deter bears. We considered several design aspects. First there is a row of fruiting shrubs along an existing chain link fence at the back of the gardening area and as these shrubs grow they will potentially attract bears and the chain link fence will not be an effective deterrent. For this reason the design calls for six strands of electric wire to be attached to the exterior of the chain link fence using a series of outrigger brackets. There is a patio and gazebo area adjacent to the gardening area that would not need to be enclosed by the electric fence and this would make it easier for residents to come and go from the gazebo area. There is a large composting area that is surrounded on three sides by a low concrete barrier and the design would enclose this area for two reasons. First the compost pile itself can be a strong bear attractant and secondly it provides an option to relocate the existing dumpster (currently located at the northeast end of the property) to the area within the electrified fence.

Figure 19: *The Seniors' Residence includes a greenhouse (on left of photo), a series of raised garden bed (centre of photo), a line of fruit trees and shrubs along the interior of the chain link fence (background of photo) and a 3-sided concrete barrier and fencing screen where the composting area is located (on right of photo).*

In summary, the electric fence proposed for the Seniors' gardening compound would share some design similarities to the one proposed for the Yukon College kitchen service area (described on pages 19-21). It would consist of 6 strands of wire attached to either fiberglass

posts driven into the ground (for 60.5m) or outriggers attached to the existing sections of chain link fence (for 66m). It would be powered by a solar fencing charger and would have two access gates. The first small gate (6 feet or 1.8m wide) would be centred in front of the door to the greenhouse. The second gate would be located in front of the current composting area and would be 6m wide which should be sufficient to allow a Bobcat to access the compost pile to turn it or to allow a garbage truck to access the area if a dumpster was relocated there. The high voltage (7,000 volts or more) and low amperage fencing system would deliver a shock to a bear by situating the six, well tensioned, strands of wire close enough together to slightly separate the fur on an animal's neck as it pressed its way in and eventually received a shock to its underlying skin.

Our understanding is that there is no on-site security or maintenance staff to turn the fencing system on and off each day in the way that has been proposed for the Yukon College kitchen service compound. It may be possible to provide an override switch with a warning light that would allow residents to press a button and cut off power to the fence for a certain length of time (e.g. 1 hour) after which the fence would reactivate. The safety concerns of a person receiving an accidental shock are discussed in Box 1 on page 22-23. The preliminary estimate for materials required to assemble the electric fence, including the two gates, solar powered fencing charger and six strands of wire is $1,980.00 plus GST.

Fruiting Trees and Shrubs

The original construction of Yukon College, Yukon Archives and the Yukon Arts Centre provided a landscaping plan which included a variety of ornamental fruiting trees and shrubs. We identified the location, species and relative size of 36 fruiting ornamental shrubs/trees (Figure 18). We know from a black bear visit to campus in October, 2014 that many of these fruit trees are attractive to bears. The close proximity of these human attractants and the adjacent McIntyre Creek green space make it highly likely that bears will visit in future (Merkle et al. 2013). We outline a simple flow chart of how these trees might be managed to make the area more bear-proof (Figure 20).

We have tentatively identified three of the ornamental species as (i) tartarian or Siberian honeysuckle growing as a low shrub (*Lonicera tatarica)*, (ii) European bird cherry or Mayday cherry (*Prunus padus*) growing as a tree and (iii) mountain-ash trees (*Sorbus decora*)[3]. If our identification is correct, then all three species are non-native and the Mayday Cherry tree is considered a strong bear attractant (City of Coquitlam nd). Ciarniello (2009) reports that *S. decora* is considered a moderate to high bear attractant and points out that mountain ash trees

[3] Dennison Bohmer, pers. comm., May, 2015

have been planted as diversionary food sources to draw bears away from Whistler, B.C. According to the Yukon Invasive Species Council (2010) both the Mayday Cherry tree and honeysuckle shrubs are considered invasive and it would not be advisable to move them off site by transplanting them elsewhere.

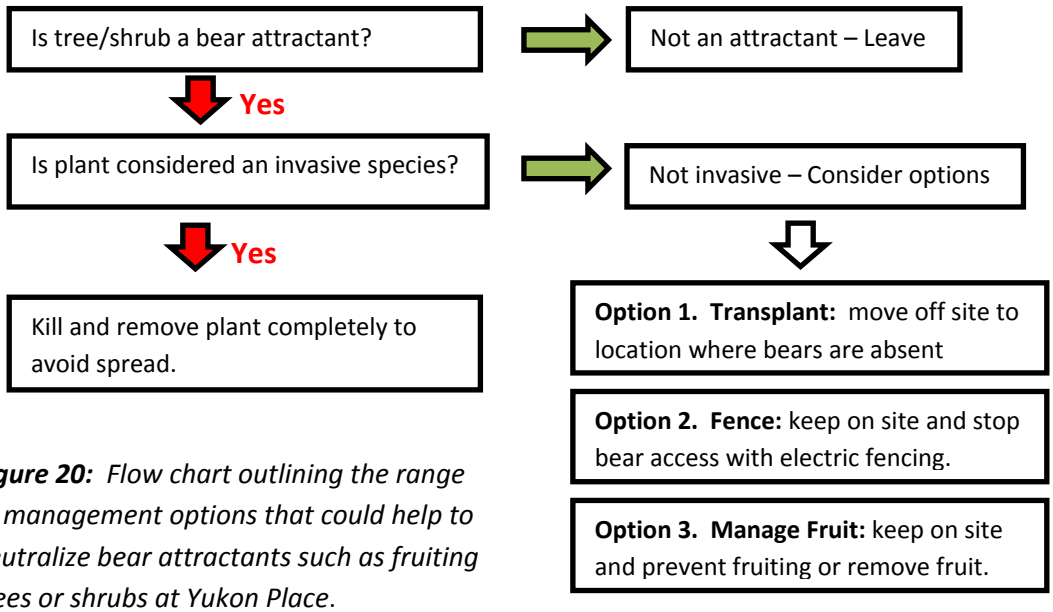

Figure 20: *Flow chart outlining the range of management options that could help to neutralize bear attractants such as fruiting trees or shrubs at Yukon Place.*

What options are available if the there was an interest in keeping some of the fruit trees that are bear attractants on site for a year or two while landscaping alternatives are explored? Electric bear fencing has been used with great success in orchard situations to repel bears (Sowka 2013). The landscaping geography at our site could make this difficult because the fruiting trees and shrubs are isolated, widespread and would require extensive fencing efforts. At best, it might be a consideration to protect a small number of trees or shrubs that were clustered in one area. Another electric fencing product that can used on a more temporary basis (e.g. during months when trees are in fruit) is prefabricated electrified net fencing (Annis 2014). This net fencing comes in rolls that can be strung along temporary fence posts (e.g. T-posts) around fruit trees making sure that the fence perimeter protects the ground footprint where any fruit may fall.

If it is not feasible or desirable to stop bears from gaining access to the fruit trees then the last alternative is to ensure there is no fruit to be eaten. This is the most labour-intensive solution and would require constant vigilance each fall. While it is not a recommended long term solution it could work for a year or two while other options are explored. The fruiting cycle could be disrupted during the early blossom stage by using a high pressure water hose to

mechanically break off the blossoms. The follow up, in the late summer or early autumn, requires cutting down the green fruit (to decompose on the ground) or picking and removing the fruit before they are mature.

In the Kootenay region of southern BC, where fruit trees (apples, pears, plums etc.) are an attractant for bears, the Kootenay Bear Smart Chapter provides a contact for a NGO group that runs a Harvest Rescue Program. Volunteers help landowners by harvesting their fruit, thereby removing the bear attractant and donating the fruit to a local food bank. It is unlikely any of the fruit available at Yukon Place are palatable for humans but it may be possible to recruit volunteers to help remove the fruit.

In summary, three of the landscaping ornamentals we found at Yukon Place are introduced, non-native species that are considered bear attractants. The professional advice, from several staff members at Environment Yukon, predicts that these fruiting plants will lead to more conflicts with bears in the future and should be removed. The alternative options outlined in Figure 20 constitute a stop gap measure at best and any failure in execution (e.g. removing fruit before it ripens each season) could contribute to the loss of more bears in future.

Public Education for Employees and Residents at Yukon Place

Wildlife managers often note that it is not wildlife that needs managing but rather humans. The final, important piece needed to make the Yukon Place campus secure for both people and bears will require some change in our human activities. Public education can help ease this transition by providing information about the benefit of adopting behaviours or practices that will reduce the likelihood of negative encounters with wildlife.

Between January and April 2015, Marilou Aguillon, a student in the Multimedia Communication program at Yukon College worked on a Capstone Project developing bear safety communication pieces. For example she prepared a brochure that will be used during orientation for students staying in Campus Housing units. Figure 21 shows one of the posters she developed that will be placed in each housing unit to provide residents with a checklist of how to properly deal with potential bear attractants. Figure 22 provides a sample of the detail included in an educational brochure for campus residents. Several of these handouts could be made available to other institutions at Yukon Place if they wished to adapt them to their particular situation.

Wildwise Yukon (http://www.wildwise.ca) which is run by the Centre for Human-Wildlife Conflict Solutions Society is a local, non-profit group that focuses on education and research to reduce negative conflicts with wildlife. Their volunteer members have been very helpful in providing advice about how to shape the public education messages to make them most effective and would be an excellent resource for institutions at Yukon Place.

DID YOU KNOW? Bears struggle to put on fat before hibernation and spend much of their active time feeding or looking for food. **Keep them wild and don't leave out attractants.**

BEAR in MIND

BEAR ATTRACTANT CHECKLIST

Black bear in front of the Yukon Arts Centre. Photos taken by Jessica McNabb.

- ✓ **GARBAGE:** Store your garbage and recyclables inside and then dispose of them in the appropriate outdoor bins.
- ✓ **COMPOST:** Collect and store compost inside before moving it to the bear-proof compost area outside. Recycle cooking oil in containers provided in Campus Housing Kitchens.
- ✓ **BBQs:** Bears will be attracted to the smell of grease left on barbeques. Burn off grills after using, empty any grease collectors safely and keep a tight cover over the unit during storage.
- ✓ **PETROLEUM / ANTI-FREEZE PRODUCTS:** Bears will investigate the smell of fuel products, e.g. oil containers left in the back of a pickup truck. Store oil, fuel or anti-freeze containers in a secure location.
- ✓ **DECKS:** Keep your deck clean to discourage bear visits - dont't leave food, bird seed or other attractants out.

YukonCollege
start here. go anywhere.

Campus Housing

Figure 21. This poster was developed by Marilou Aguillon from the Multimedia Communication program for use by Yukon College's Campus Housing. The poster will encourage residents to manage potential bear attractants in a way that will reduce conflicts with wildlife.

Some of the proposed changes to waste management storage at Yukon Place may be implemented without any need for public education (e.g. switching from regular dumpsters to units that have a self-locking lid) while other changes may require some effort to inform campus residents (e.g. the installation of electric bear fencing around gardens).

CONTACTS

- **To Report a Bear Sighting:** Phone the TIPP line at 1-800-661-0525
- **To Report a Concern with Bears on Campus:** Contact Safety and Campus Security at 867-334-6042
- **To Report a Serious Bear Threat:** Contact the Whitehorse Conservation Office of Yukon Environment at 867-667-8005 (and then call Campus Security)

WildWise Yukon is a local, non-profit group that focuses on education and research to reduce conflicts with wildlife. For more info, visit wildwise.ca or find them on Facebook.

wild wise YUKON

Figure 22. This excerpt from a 6-panel brochure, prepared by Marilou Aguillon from the Multimedia Communication program, will be distributed to students staying in Campus Housing. The list of contacts identifies the appropriate authorities to contact when dealing with bear issues.

Summary of Management Issues

Moving to a Bear Safe Management Culture

Our report has tried to provide a comprehensive overview of the history of bear activity along Middle McIntyre Creek and the adjacent campus at Yukon Place. It shows that there has been regular bear activity in the area around Yukon Place and, in several years, this has led to human-bear conflicts with adverse impacts on bears. The local pattern matches the experience of bears in most parts of their North American range; as human developments such as road networks and urban areas expand into wild spaces bears are forced to retreat, adapt or suffer the consequences of increased mortality from functional habitat loss or direct kills arising from defence of life or property and control kills by enforcement officials (Garshelis et al. 2005, COSEWIC 2012). Compared in this way it would seem our local relationship with wildlife tacitly reflects a frontier mentality where the environment must give way to human interests.

The question for managers is how far would they like to go in changing this relationship with wildlife in the adjacent Middle McIntyre Creek area? Yukon's *Wildlife Act,* section 93*,* lays out the minimum requirements that all Yukoners must conform to. For example, garbage must be stored in a way that is inaccessible to bears so we don't contribute to creating "nuisance" bears or "dangerous" wildlife. Our report provides the background and direction to achieve these basic goals. There is certainly room to seek additional improvements that would make Yukon Place more bear safe. We briefly outline three possibilities for future improvements:

> **Improve Trail Signage:** The Yukon Place campus as a whole is connected to an extensive trail network that takes people into the greenspace where they may encounter bears (and other wildlife). It would be beneficial to design and install some interpretative signs to give hikers some information about the wildlife they may encounter and tips on safe travel. The signs could be placed at the trail head behind the Yukon Arts Centre (Trans-Canada Trail) and behind the Seniors' Residence (Boreal Trail).
>
> **Seek Bear Smart certification:** The Bear Smart Community program in British Columbia provides certification for municipalities that have achieved measurable standards in reducing conflicts with bears.[4] While there is no Yukon equivalent, the BC program gives clear pathways towards living sustainably with wildlife, which could be pursued.

[4] The criteria are explained in a short brochure available from the BC Ministry of Environment: http://www.env.gov.bc.ca/wld/documents/bearsmart/bearsmart_brchr.pdf

Serve as a Community Role Model: Bear and wildlife conflicts occur throughout the City of Whitehorse and Yukon Place could act as a leader in demonstrating the effectiveness of instituting practical measures to reduce conflicts.

Bear Safety Audits and Monitoring Progress

Worker safety programs often stress the importance of recognizing "near misses" in the workplace. These events serve as opportunities to reassess existing accident prevention procedures. The intent is to instill a conscious culture of safety, supported by both workers and employers, which aims to reduce the rate of job injuries. By comparison, we have missed many chances over the years to correct some of our garbage practices at Yukon Place and as a result we have had recurring bear problems. A practical solution would be to have staff members carry out periodic bear safety audits, especially at the start of the bear season. The goal would be to identify potential conflict areas with wildlife and remedy them before an actual event occurs. The focus of this brief walking tour of the property would be to look out for poorly secured bear attractants that could be removed or otherwise dealt with. Ideally one or more staff members at each institution could be tasked with this responsibility. The checklist prepared for students living in Campus Housing (Figure 21) gives one example of the commonplace attractants that may be a concern in their living quarters. There are a variety of resources, organizations and people who could help train staff to carry out these routine audits. Both the Conservation Officer Services and WildWise Yukon could assist with training staff members on what to look for so that each institution could develop their own customized checklist.

As part of the research for this report, we sought out records of bear (and other wildlife) sightings that occurred on or adjacent to the greater campus (Figure 4). We were surprised at the number of sightings and suggest it would be much better to track this information in real time rather than use it as an archival source of information. Keeping track of occasional bear sightings around campus and making notes on the behaviour of the bear (e.g*. "investigating a new dumpster*") could provide valuable feedback to anticipate emerging sources of human-bear conflicts. The staff in Yukon College's Safety and Security office are available 24 hours a day and may be in position, if they volunteered to do so, to keep track of bear sightings for both the College and neighbouring institutions at Yukon Place. There would be a clear benefit to all parties if information about a bear that had showed up investigating a dumpster at one corner of Yukon Place was shared widely. If the tracking system we are suggesting was put in place it would be important to clarify the types of bear occurrences which should be reported to Environment Yukon (see Figure 22, left panel, for an example).

Changes Required to Make Yukon Place Safer for Humans and Wildlife

There are several autonomous institutions that share the campus and we have summarized the changes that would be required to make the campus bear safe by differentiating areas of common concern (Table 4) from changes that would need to be implemented by individual institutions (Table 5).

There are three issues that affect the overall campus that need to be dealt with (Table 4). We identified a problem with four small, public garbage containers located on campus and looked after by the grounds keeping staff from Facilities Management and Regional Services. The most critical issue is to remove these plywood garbage containers; ideally the receptacles could be replaced with standard bear-proof garbage containers.

We suggested it would be beneficial to reduce natural attractants as well as improve sightability along the campus perimeter. Students in Yukon College's Renewable Resources Management program are available to help execute this simple habitat treatment along the campus border. The work could be carried out by a combination of student labour during field exercises as well as some paid student labour during August and September 2015.

Finally there is the issue of dealing with the bear attractant posed by ornamental fruit trees on campus. In their capacity as "landlord" the Yukon Government's Facilities Management and Regional Services office would have responsibility to address this issue.

Table 4. Campus-wide bear safety issues that need to be addressed at Yukon Place.

Task	Responsibility	Page
Remove 4 existing plywood garbage containers in public areas and replace with bear-resistant bins	YG Facilities Management and Regional Services	26
Remove natural attractant (soapberry bushes) along campus perimeter	Scott Gilbert, RRM program, Yukon College	13
Firesmart the narrow band of forest along campus perimeter to improve sight lines		13
Remove or mitigate the bear attraction posed by ornamental fruiting trees on campus	YG Facilities Management and Regional Services	32-34

Solid Waste Storage All of the institutions we surveyed at Yukon Place currently store solid waste outside where it is was accessible to bears. We provided a list of six different ways that this storage could be improved to make garbage unavailable to bears and institutions may choose different ways to achieve that end.

Compost Storage Both Yukon College and Yukon Archives store compost outside in polycarts that are not bear-proof. We provide two different options to make this storage bear-resistant.

Vegetable Gardens Both Yukon College and the Seniors' Residence, operated by the Yukon Housing Corporation, have vegetable gardens that could seasonally attract bears. We describe, in broad terms, a solution using the design of an electric bear fence that could deter bears on a seasonal basis when the gardens and associated compost piles (and fruiting shrubs, in the case of the Seniors' Residence) were an attractant.

Table 5. Summary of institution-specific bear safety issues to be addressed at Yukon Place.

Task	Responsibility	Page
Solid waste		
Acquire and install bear-resistant dumpster	Institution specific	14-25
If necessary assign responsibility for unlocking the new dumpsters for weekly garbage pick-up and ensure they are locked after servicing	This step constitutes the weak link in any future bear-resistant storage system and must be addressed	14-25
Compost Storage		
Acquire and install bear-resistant compost cart	Yukon Archives, perhaps Yukon College for the 520 building	27-28
Assign responsibility for unlocking bear-resistant compost cart in time for pick up and then relock	Need support from City of Whitehorse staff to not destroy unit if it is accidently left unlocked for pick-up	27-28
Vegetable Gardens		
Acquire and install electric bear fence for garden complex in front of Seniors' residence, and NRI residence at Yukon College	Seniors' Residence (Yukon Housing Corp.) Yukon College Campus Housing	30-32
Verify fence is operating during the season		
Turn off electric fencing or winterize as needed in late fall		
Prepare fence for operation in spring		
Public Education		
Provide information (brochures, posters, signage) to support changes in garbage handling practices and use of electric bear fencing, support an ethic of making the campus bear safe	Institution specific	
Regular Bear Safety Audits		
Develop an institution-specific checklist of potential bear attractants that can be monitored during routine checks between April and October	Institution specific	38
Record keeping of campus bear sightings		
Share information about bear sightings		38

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Appendix 1 - Review of the Current Literature on Bear Hazard Assessments and Mitigation of Human-Bear Conflicts in Urban-Wilderness Settings

The World Society for the Protection of Animals has published the Principles of Human-Bear Conflict Reduction (WSPA, 2009) which acts as a very broad policy development document covering the world-wide range of eight species of bears. They start by defining human bear conflicts as situations where bears may, "*damage human property; where wild bears harm people; or where people perceive bears to be a direct threat to their property or safety*" (WSPA 2009, p. 2). The authors point out that these conflicts can imperil conservation efforts by causing negative human attitudes towards bears or lead to retaliation against bears. Their report goes into some detail evaluating a variety of methods, focused on the human side of the interaction to reduce conflicts with bears (e.g. public education and awareness, compensation, managing human attractants, etc.) as well as techniques that can be applied to bears (e.g. deterrents, aversive conditioning, habitat management, etc.).

Davis et al. (2002), working in British Columbia, presented a framework for the development of a 'Bear Smart' protocol, including background information and templates for localized risk assessment and bear management plans. We found their document provided the most comprehensive overview of the steps involved in preparing a risk assessment and subsequent management plan. Their report provides a primer on bears' life cycle, habitat, food and reproductive behaviors and explains how humans can influence wildlife and contribute to making 'problem' bears. It suggests resources to look to in planning for wildlife and offers detailed techniques for assessing the local situation.

The differentiation between the risk assessment and the management plan is that the former advises the latter. The risk assessment is 'problem analysis' and identifies the known or undiscovered problems in a local area by obtaining local knowledge and comparing the plants, geography and human behaviour patterns to known risks from other areas that have been studied (Davis et al. 2002). After this data is collected and compiled, the management plan can take shape by offering solutions to the problems that humans are having with the bears, thereby increasing public education and safety. The management plan is not meant to be static, but relies on adaptive management strategies.

We found four studies that described actual management plans that were developed after bear risk assessments were prepared for local areas. The Town of Canmore, Alberta was forced to take action within their municipal boundaries in order to reduce human-bear interactions and bear incidences in the town and surrounding parkland. Heavy recreational pressures in the Bow Valley constantly put bears in contact with humans, the result being an increase in habituated bears and bears that tolerate people. Encounters with domestic dogs also caused much stress to all species involved (Honeyman, 2007). To this end, the Town passed a new Waste Control

Bylaw (Town of Canmore, 2015). This document has well developed do's and don'ts for waste management in the town site, with specific regulations on animal-proof containers and what is to be done with specific types of waste.

In 2011 the Resort Municipality of Whistler was one of the first municipalities in British Columbia to receive accreditation as a *Bear Smart Community*. Whistler had wrestled with bear problems in their community since 1995 and a report by Pacquet (2009) summarizes the evolution of attitudes and numerous steps taken to reduce conflicts. Pacquet's report details the progress made by the community in key areas such as waste management, public education, management of attractants (such as fruit trees used in landscaping) and enforcement (using bylaws that encouraged compliance and disincentives to punish non-compliance - a "carrot and stick" approach). The case history presented by Whistler seems to stand out as a successful model where numerous stakeholders were able to support municipal leadership that was blended public education and the institution bylaws to support bear smart goals.

In 2011, an assessment was produced for the Haines Junction and Kathleen Lake areas of southwest Yukon (Homstol et al. 2011). Most of the Haines Junction part of the assessment is done through GIS methods using pre-existing data from radio-collared grizzly bears. The Kathleen Lake portion utilized more habitat analysis and information from Parks Canada about operations in the area. The report identifies key risks and hazards along with detailed recommendations. The most relevant of the recommendations to our study at Yukon Place have to do with the management of natural and anthropogenic food, public education and thinning of the forests close to human-use zones.

Lee et al. (2011), working on a larger scale, assessed human conflicts with grizzly and black bears in a study area of almost 6,000 km^2 centred around Grande Prairie, Alberta. Their challenge was to identify risks and recommend strategies to reduce conflicts in a landscape shared by residential, agricultural, industrial and recreational users.

Appendix 2 - Raw field data from the October 22nd BIOL 220 surveys of natural bear forage on the campus perimeter

Sample raw data sheet

Observers: _____				**Transect: A (5m) ___ or**							**Plot:** ____		**Waypoint #:** _____											
				B (12 m)___																				
Slope: _____				**Aspect:** _____							**Tree Canopy Spp:** _____													
				Percent Cover																				
	0-25%			26-50%			51-75%			76-100%								**Sightability Code**					
Soapberry											Back along plot 20m _____													
High bush cranberry																								
Rose											Perpendicular towards campus: _____													
Crowberry																								
Low-bush cranberry											Perpendicular away from campus: ____													
Red Bearberry																								
Kinnickinnick											**1. Excellent visibility:** no chance of missing bear; no concern for my safety.													
Horsetails (*E. arvense*)											**2. Moderate visibility:** a bear might be hidden behind one bush or deadfall; some concern for my safety.													
Fireweed											**3. Poor visibility:** a bear would have many hiding spots; I would be worried about my safety if bears were in the area.													
River beauty																								
Oxytropis campestris																								
Lichen																								
Moss																								
Bare ground																								
Other_____																								

Data Listing

Waypoint	Transect	Plot	Observers	Slope	CanopySpp	Soapberry	HiBushCran	Rose	Crowberry	LoBushCran	RedBearberry	Kinnick	Horsetail	Fireweed	RvrButy	Oxytropis	Lichen	Moss	Bare	Grass	Salix	Other	SightRev	SightCamp	SightValley
1	A	1	MH-NH	1								2					1	4		1			1	1	1
2	B	1	KT-HA	2	Pl							3					1	1					1	1	1
3	A	2	DS-CS			1						4					1	1	1			1	1	1	3
4	B	2	JG-RI	1	Sw	1						3					1						1	2	3
5	A	3	MW-MH	1	Sw	1		1				1					2	2	1				2	1	2
6	B	3	DG-AMW	2	Sw			1	4	3							1	4				1	2	1	2
7	A	4	LP-MM	1	Sw			1				4					1	1	1	1			2	1	3
8	B	4	LE-JO	2	Sw					1								1	3				2	2	2
9	A	5	DS-CS	1	Pl							3					1	1	2			1	2	1	3
10	B	5	JG-RI	2	Pl				1								1	1	2		1		1	1	2

Waypoint	Transect	Plot	Observers	Slope	CanopySpp	Soapberry	HiBushCran	Rose	Crowberry	LoBushCran	RedBearberry	Kinnick	Horsetail	Fireweed	RvrButy	Oxytropis	Lichen	Moss	Bare	Grass	Salix	Other	SightRev	SightCamp	SightValley
11	A	6	MH-NH	1															4				2	1	2
12	B	6	KT-HA	1	Pl	1		1		1		1					1	1	2				1	1	3
13	A	7	MW-MH	1															4				2	1	3
14	B	7	DG-AMW	3	Pl	1			3	2		2					3	3					3	2	3
15	A	8	DS-CS	2		1		1	2	1	1	2					1	1	1				3	1	3
16	B	8	LE-JO	2	Pl	1			1	1		1					1	1					2	1	2
17	A	9	MH-NH	2	Sw			1		1								4		1		1	2	1	3
18	B	9	JG-RI	2					1	1		1					2	1	1				2	1	3
19	A	10	MW-MH	2	Sw							1					1	2	2				1	1	3
20	A	11	DS-CS	2	A			1	1	2		2					1	1				1	3	1	3
21	B	10	DG-AMW	2	Pl		1	1		1		1					3	2	1			1	3	1	2
22	A	12	MH-NH	3				1				2					1	4	1			1	1	1	2
23	B	11	LE-JO	2	Pl				1	1		1					1	2				1	2	1	2
24	A	13	MW-MH	3	Pl							1					1	2					2	3	1
25	B	12	JG-RI	3	Pl				1	1		1					1	3				1	2	1	1
26	B	13	KT-HA	3	Sw	1				1		1					1	3					1	1	2
27	A	14	DS-CS	3	Pl	1		1				3		1			1	1	1			1	3	2	3
28	B	14	DG-AMW	3								2					1	4				1	2	3	2
29	A	15	LP-MM	2	Sw		1					4						1		1			2	1	2
30	B	15	LE-JO	3	Pl							2		1				1					2	2	3
31	A	16	DS-CS	3	A	1		1		1		4					1	1		1			2	2	3
32	B	16	JG-RI	3	Sw			1				1					1	4				1	3	1	2
33	A	17	MW-MH	2	Sw							1						4					3	2	3
34	B	17	DG-AMW	2	Sw	1	1	1				1	1				3	4				1	3	3	2
35	A	18	MH-NH	2	Sw			1									1	4		1		1	3	1	3
36	B	18	LE-JO	3	Sw		1			1	1							1	1				2	3	2
37	A	19	DS-CS	3	Sw	1		1		1		2		1			1	2				1	3	2	2
38	B	19	JG-RI	3	Sw			1									1	4					3	2	3
39	A	20	MW-MH	3	Sw							1						4				1	3	3	3
40	B	20	LE-JO	3	Sw	1		1		1				1				3					3	2	3
41	A	21	LP-MM	3	Sw								4	1				1					2	1	2
42	B	21	DG-AMW	3	Sw			1	1	1								4	1			1	3	3	3
43	A	22	MH-NH	3				1									1	4		2		1	2	3	2
44	B	22	JG-RI	2						1								4					3	3	3
45	A	23	MW-MH	3	Sw			1				1						4	1			1	3	3	3
46	B	23	LE-JO	3	Sw			1						1			1	4				1	3	3	3
47	A	24	DS-CS	3	Sw			1		1	1	1		1			1	4		1			3	3	3
48	B	24	MW-MH	3					1									4					3	3	3
49	A	25	LP-MM	1	Sw					1		1						1	1	1			1	1	2
50	B	25	DG-AMW	3	Pl			1	1	3		1					1	4					2	3	3
51	A	26	MH-NH	2	Sw				1	4								3				2	2	1	3
52	B	26	LE-JO	1	Sw			1	1	1	1	1					1	2					3	2	3
53	A	27	DS-CS	1				1		1	1	1					1	2		1		1	2	2	3

Waypoint	Transect	Plot	Observers	Slope	CanopySpp	Soapberry	HiBushCran	Rose	Crowberry	LoBushCran	RedBearberry	Kinnick	Horsetail	Fireweed	RvrButy	Oxytropis	Lichen	Moss	Bare	Grass	Salix	Other	SightRev	SightCamp	SightValley
54	B	27	MW-MH	1	Sw				1	1		1					1	2					3	1	3
55	A	28	LP-MM	1	Sw				2	2		2										1	1	1	1
56	B	28	JG-RI	1				1	1	1		2							2			2	2	2	3
57	A	29	DS-CS	1	Sw			1		2				1			1	3				1	2	2	3
58	B	29	DG-AMW	1	Sw			1		2				1			1	4	1				2	3	3
59	A	30	MH-NH	2	Sw			1		1							1	3	1	1			2	1	3
60	B	30	MW-MH	1	Sw			1	1	1		1						4					3	3	3
61	A	31	DS-CS	1	Sw			1		1		1		1			1	3				1	3	2	3
62	B	31	LE-JO	1	Sw			1	1	1		1		1				2					3	2	3
63	B	32	JG-RI	1				1		1		1		2				1					2	1	1
64	A	32	LP-MM	1	Sw	1				1		1						1				1	1	2	2
65	B	33	MW-MH	1				1				2		1								1	1	1	1
66	A	33	DS-CS	2	Sw	1		1		1				1			1	1	3	1		1	1	2	3
67	B	34	DG-AMW	1	Sw			1		1		3					1		3			3	1	2	3
68	A	34	MH-NH	2				1	1	1		4						1				1	1	1	1
69	B	35	LE-JO	1	A			1				1		1			1		4				2	2	2
70	A	35	DS-CS	2	A							4					1	1		1		1	1	1	2
71	B	36	MW-MH	1	Sw			1				4		1			1						1	1	3
72	A	36	LP-MM	2					1		1	3		1					1				1	1	2
73	B	37	JG-RI	1		1				1		1											2	2	3
74	A	37	MH-NH	1	Pl			1		3		4		1			1	3				1	1	1	1
75	B	38	DG-AMW	1	Sw			1		1		4		1				1				2	2	1	2
76	A	38	DS-CS	1	Pl			1		1		1		1			1	3	1	1	1		1	3	3
77	B	39	LE-JO	1	Sw	3				1		1					1	1	1				1	1	2
78	A	39	DS-CS	1				1		1		3		1			1	1	2	1		1	1	1	2
79	B	40	MW-MH	1								4					1	1					1	1	3
80	A	40	KT-HA	1	Sw			1		1		1						1	2				1	1	1
81	B	41	JG-RI	1								1							4				2	3	3
82	A	41	LP-MM	1		1			1	1							1	2		1			2	1	2
83	A	42	MH-NH	1	Sw				1	1							1	4				1	1	1	1
84	D	1	MW-MH	1						1		1						3					2	2	3
85	D	2	DS-CS	1	Sw					1		1		1			1	3	1	1		1	3	2	3
86	D	3	DG-AMW	1	Sw				2	1		1					1	1	1			1	2	2	1
87	D	4	LE-JO	1	Pl			1		1		1		1			1	1	1				1	1	2
88	D	5	JG-RI	1				1		1		2							1			1	2	1	2
89	D	6	MH-NH	1				1				3							2	1			1	2	1
90	D	7	MW-MH	1	Sw			1				2						1	2			1	1	1	1
91	D	8	DS-CS	1	Pl	1		1		1		4								1			3	1	2
92	D	9	KT-HA	2						1		3					1		1				2	2	1
93	D	10	LP-MM	1								2					2	1	1				2	1	3
94	D	11	DG-AMW	2	Sw	1		1	1	1		1					2	2	1			1	1	2	1
95	D	12	MH-NH	2						3								4		1		1	1	1	1
96	D	13	JG-RI	1				1		2								1				1	2	2	2
97	D	14	LE-JO	1	Sw			1						1			1	2	1				2	2	2
98	D	15	DG-AMW	1	A			1		3								1					1	1	2
99	D	16	MW-MH	1	Sw			1	2			2											1	1	1
100	D	17	DS-CS	1	Sw	2		1		1		2		1				1		1		1	1	1	3
101	D	18	LE-JO	1	Sw			1		1				1				2					2	2	3
102	D	19	MH-NH	1	Sw			1		3							1	4		1			1	1	1
103	C	1	KT-HA	1	Sw			1				4											2	2	2
104	C	2	KT-HA	1	Sw	1		1			1	1						2					2	1	2
105	C	3	KT-HA	1	Sw	1		1		1	1	1						1					1	1	2
106	C	4	KT-HA	1		2		1		1	1						1	1					1	1	3
107	C	5	KT-HA	1	A	1		1		3		1					1	1					1	3	3