Sir Sandford Fleming College

School of Environmental and Natural Resource Sciences

Frost Campus, PO Box 8000

Lindsay, ON K9V 5E6

Attention:

Rob Stavinga, Watershed Resources Technician, Kawartha Conservation Authority

Sara Kelly, Credit for Product Faculty Supervisor

Subject:

Kawartha Conservation Nest Box Implementation Project

Greetings:

The following deliverables were completed in response to your request on September 13th, 2015. Completion of the deliverables was a joint collaboration between the students from the Ecosystem Management Technology program at Sir Sandford Fleming College and the Kawartha Region Conservation Authority. The objective was to construct and install 12 nest boxes, develop a monitoring protocol, create budgeting for school workshops on bird box construction and develop context and layout for interpretive trail signs about nest boxes.

Included in this draft product, is the Ken Reid Nest Box design and budget, TD funding update, installation, school workshop design and budget, the monitoring protocol and the interpretive sign layout. These deliverables may be used by the Kawartha Conservation Authority in whole or in part for current and future purposes.

We look forward to receiving your feedback on these draft products and to using your comments to help us refine our work when creating the final version of these products. If you have any questions or need further clarification, please do not hesitate to contact us.

Sincerely,

P. Moddle S. Peters B. Carmichael J. Boyd

Peter.Moddle@flemingcollege.ca

Sarah.Peters@flemingcollege.ca

Rebecca.Carmichael@flemingcollege.ca

Jarret.Boyd@flemingcollege.ca

Kawartha Conservation Authority Nest Box Implementation Project – Fall 2015

Fall 2015 Credit For Product

November 17, 2015

Created by: Peter Moodle, Sarah Peters, Jarret Boyd and Becca Carmichael

Presented to: Sara Kelly, Faculty; Ecosystems Management Technology, School of Environment and Natural Resource Sciences, Sir Sandford Fleming College

and Rob Stavinga, Kawartha Conservation Authority

Created for Kawartha Conservation Authority

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EXECUTIVE SUMMARY

This report provides steps that were followed by the Fall 2015, Credit for Product (C4P) students from Sir Sandford Fleming College, Ecosystem Management Program for the implementation of Kawartha Region Conservation Authority's Nest Box Project. Four students were chosen by Rob Stavinga to participate in the ongoing nest box project developed in 2014, which aims to implement a series of nest boxes within Ken Reid conservation area.

This team has produced 10 Eastern Bluebird and 2 Wood Duck nesting boxes. They have been installed in appropriate locations throughout Ken Reid conservation area. The team has developed a field note template that volunteers can take into the field while monitoring and can easily be uploaded to Bird Studies Canada online database. The team has developed an interpretive sign template that summarizes the nest box project and parties involved. A budget has been developed for the both the remainder of the first TD Friends of the Environment Grant of $835.00 as well as for the second TD Friends of the Environment grant of $500.00, which was obtained to involve school children in the construction of nest boxes for educational purposes.

The next steps for this project are to use the remaining $554.00 that we did not use from the $835.00 TD Friends of the Environment grant that was provided to implement nest boxes, to gather serious volunteers to follow the monitoring protocol that was developed, and to get schools involved with the project involving children in the construction of nest boxes. Based on the budget we used to construct the 12 nest boxes, the left over money would be sufficient to produce an additional 24 nest boxes that could be installed throughout Ken Reid and Windy Ridge conservation areas. If Windy Ridge is an area that Kawartha Region Conservation Authority is interested in installing the nest boxes at, a habitat analysis should be completed to determine which species and areas should be targeted.

1.0 INTRODUCTION

Kawartha Conservation Authority is a watershed-based, non-profit organization established in 1979 by municipalities under the Ontario Conservation Authorities Act. It is one of 36 conservation authorities operating in Ontario and a member of Conservation Ontario. Its vision is a sustainable watershed with clean and abundant water and natural resources assured for future generations and its mission is to provide leadership in watershed management and conservation. Ken Reid Conservation area is located north of the town of Lindsay and is the flagship conservation area and also houses the administrative centre for Kawartha Conservation Authority. The land was acquired in 1980, from farmer Ken Reid and consists of 110 hectares (272 acres) of forests, meadows, and wetlands including trails, boardwalks, and other recreational facilities.

The implementation of nesting boxes is in line with Kawartha Conservations' mission to restore and sustain a healthy environment for future generations. Due to habitat loss, many cavity nesting species struggle to find suitable nesting habitat. Cavity nesting species are important in maintaining and restoring terrestrial and aquatic ecosystems within the Kawartha watershed.

This project focuses on the construction and installation of nesting boxes at Ken Reid conservation area, which provides these species with suitable habitat. Part of this project includes the development of a nesting box monitoring protocol which will ensure nesting success and improvements for the future. Another part of the project was the creation of an educational trail sign and video. The trail sign will help make the public aware of nesting boxes and their importance. Some bird species this project aims to provide habitat for include: Eastern Screech Owl, Northern Flicker, Tree Swallows, Wood Duck, and Eastern Blue Bird.

1.1 Purpose

The purpose of the Kawartha Conservation Nesting Box Implementation Project – Fall 2015 is to implement bird box construction, installation, and monitoring program within Kawartha Conservation's conservation areas, building on the plan created over the last two years for Ken Reid conservation area. Part of Kawartha Conservation's mission is to provide leadership in conservation, and a focus that includes promoting healthy landscapes through stewardship and science. This project will support these components of Kawartha Conservations strategic plan by providing habitat for bird species that rely on cavities for reproductive success. These bird species are an important part of maintaining and restoring healthy terrestrial and aquatic habitats in watersheds, which continue to be impacted by modern development practices.

1.2 Project Goals

The goals for this project were as follows:

- Construct and install nesting boxes in the Ken Reid conservation area
- To create a monitoring protocol for volunteer use
- To create a budget for school workshop programs to be run in the park using the $500 TD Friends of the Environment grant

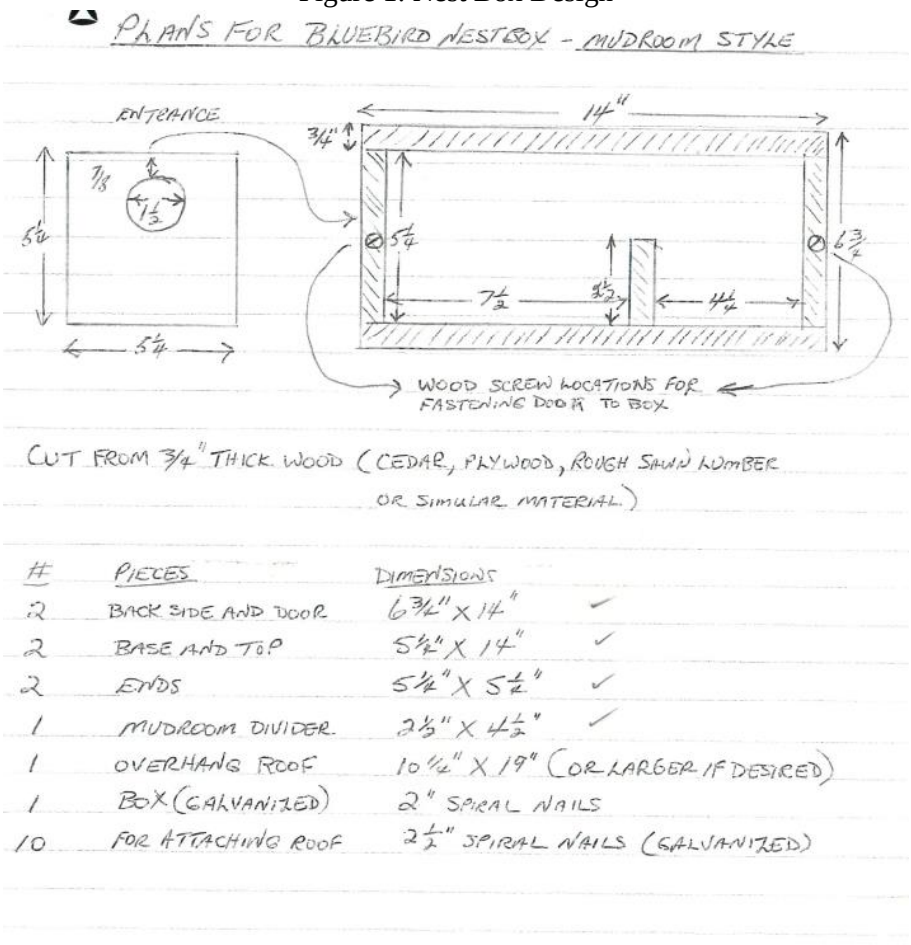
- To create a budget to use the remaining $681 TD Friends of the Environment nest box funding
- Create an educational trail sign on nest boxes and their importance

2.0 NEST BOX PROJECT

2.1 Nest Box Design

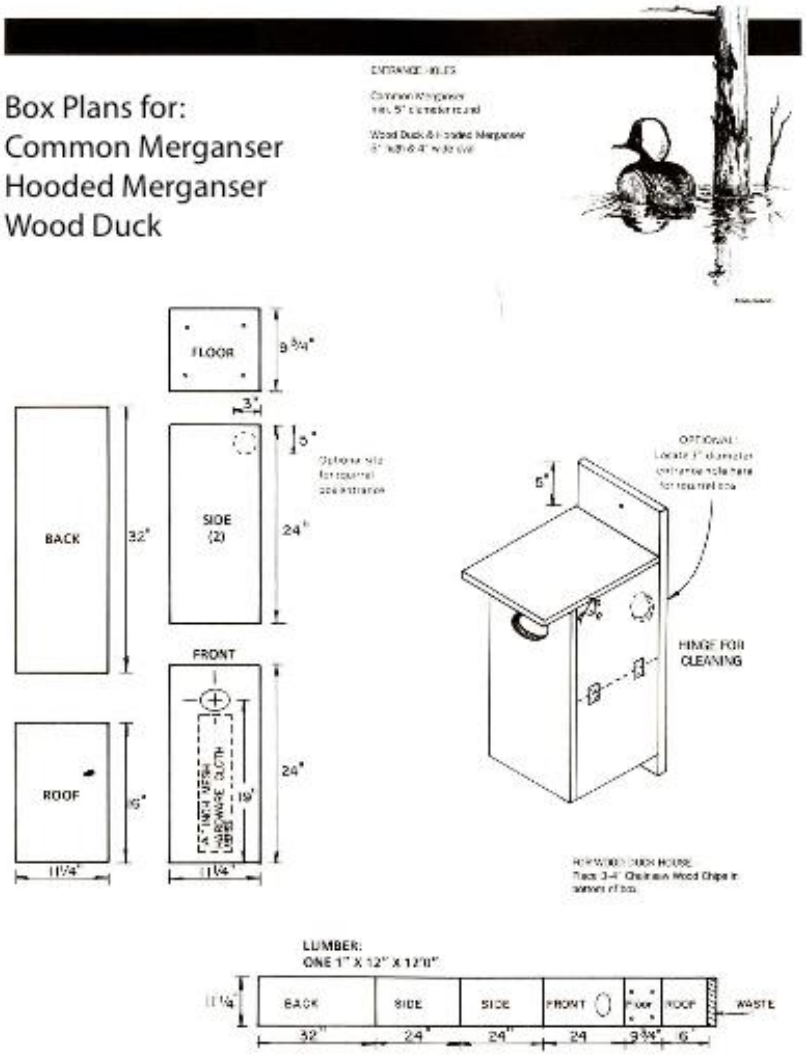
The team used the “Bluebird NestBox design with a mudroom” for construction because of its current use within the Ken Reid conservation area already (See Figure 1). The nesting box features a simple ‘non-traditional’ shape as well as the addition of a ‘half wall’ within the box that has been shown to increase nesting success as it protects young from both predator reach as well as from getting wet when the adult bird enters the box and shakes its feathers. With the installation of these boxes, the team hopes to have increased nesting success of Tree Swallows as well as potentially nesting Eastern Bluebirds next season. Please refer to figure 1 below which shows page 1 of the bluebird nest box instructions. The complete design instructions for this nest box design can be found in 12.1 of the Appendix.

Figure 1: Nest Box Design



The team also installed 2 wood duck nest boxes at Ken Reid conservation area. The team decided to add these new nest boxes to the project, in attempt to introduce a new species (Wood Duck) into the park. The goal of these new boxes is to see if the ducks will nest in the chosen areas and which area is most favored for future box implementation. Below, figure 2 shows the design for the wood duck box that was used in this project.

Figure 2: Wood Duck Box Design



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2.2 Nest Box Budget

A budget was created for the construction cost of the nest boxes, spending a total of $163.00 on the nest boxes of the available $835.00. After other project costs, there is a remaining $554.81, which can be used for future nest box construction as well as for sign fabrication and installation. With this leftover funding it is recommended that 24 more nest boxes be built. This leaves a remaining $228.81 for sign construction and installation and other costs that may arise. Please refer to figure 3 for the nest box budget. Figure 4 shows the budget for the use of remaining funds from the grant.

Figure 3: Nest Box Budget

Nest Box Budget			
Item	Quantity	Cost	Total
Rough Pine	2	$11.50	$23.00
1"x6x8' Cedar	11	$8.88	$97.68
2" Nails	2.61lbs	3.49/lb	$9.11
2" Screws	1.36lbs	5.99/lb	$8.15
Hammer	1	$9.99	$9.99
Metal Piping	1	$8.29	$8.29
Hinges	2 (pack of 2)	$3.39	$6.78
SALES TAX			21.19
		Total	$163.00

Figure 4: Remainder of Funding Budget

TD- Remainder of Funding Budget	
Item	Cost
24 Nest Boxes	$ 326.00
Sign	$ 150.00
Travel/Other	$ 78.81
Total	$ 554.81

3.0 TD FUNDING UPDATE

TD Friends of the Environment provided funding in the form of a grant for the nest box project. The team used only a portion of the funding, preventing the team from submitting a final report to TD, as all of the funding must be spent to do this. However, a testimonial of the teams experience and progression during the project was reported to TD. Please note that it is mandatory that the final report to TD be submitted and the remainder of the in progress requirements be submitted by **April 2016.**

The testimonial to TD:
As a new team taking on this project during our third year of Ecosystem Management Technology at Fleming College we were able to pick up right where the last team left off, thanks to the help of our mentor Rob Stavinga. We were able to learn and expand our knowledge of

birds and the importance of providing nesting locations due to habitat loss. Our team was able to construct and install 12 nest boxes overall, 10 Blue Bird nest boxes as well as 2 wood duck boxes. We also constructed a monitoring plan which volunteers can fill out in the field and then fill out online on Bird Studies Canada's online data collection system. This monitoring plan will help track the nesting success of the project long term. The team also designed a sign that can be used within Ken Reid conservation area and educate the public on the project as well as the importance of nest boxes. Finally the team constructed a budget to use the remainder of the funding to construct as many nest boxes as possible.

The team consisted of:
Becca Carmichael
Peter Moodle
Sarah Peters
Jarret Boyd
Who were all Ecosystem Management Technology students at Fleming College during the fall of 2015.

Under the supervision of:
Sara Kelly - Faculty of Ecosystems Management Technology, Sir Sandford Fleming College
Rob Stavinga - Kawartha Conservation Authority

4.0 INSTALLATION

The team selected sites using an understanding of bird nesting habits and by consulting with existing ecological land classification (ELC) data. Installation was carried out on November 16, 2015. Using pre-selected sites, holes were dug using post-hole diggers. Boxes were mounted on 8-foot cedar posts and placed in the holes, with the box 4-6 feet off the ground. The boxes were oriented so that the entrance hole was facing a Southeastern direction. Each box was numbered and GPS coordinates were taken for monitoring mapping purposes as shown in Figure 10. A map was created to map each new box added in the conservation area as shown in Figure 9. Figures 5 to 8 show photos of the completed nest boxes and the team installing them.

Figure 5: The completed 12 nest boxes

Figure 6: Jarret Boyd digging a hole for nest box installation

Figure 7: Sarah Peters attaching a nest box to a post

Figure 8: A completed Blue Bird Nest Box

Figure 9: A completed Wood Duck Nest Box

Figure 10: Map of Nest boxes at Ken Reid Conservation Area

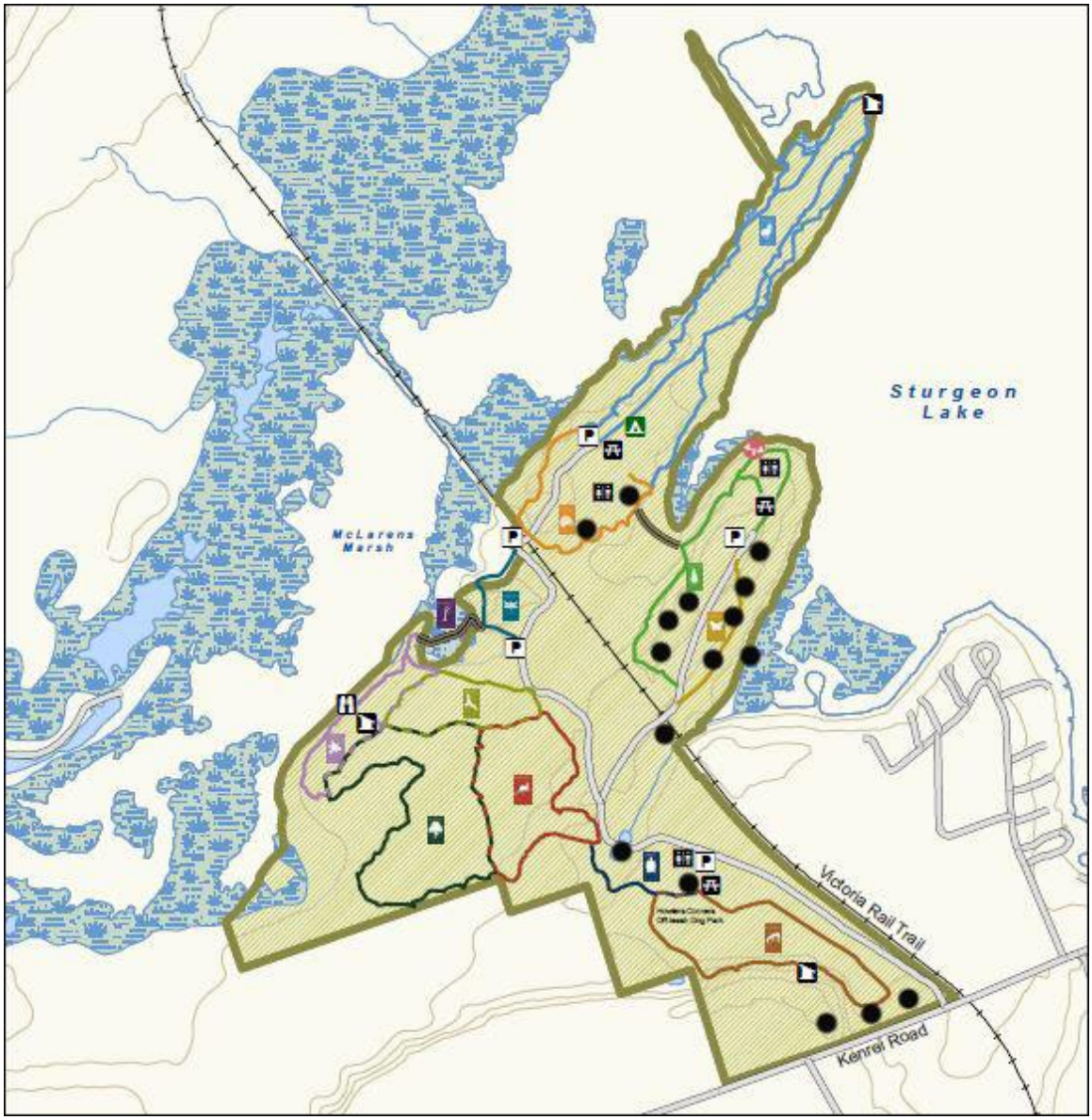


Figure 11: GPS Coordinates of Nest boxes at Ken Reid Conservation Area

Box Number	Latitude	Longitude	Nest Box Type	New or Existing
1	17T 0678063	4918697	Blue Bird	Existing
2	17T0677749	4918842	Duck	New
3	17T0677900	4919191	Blue Bird	Existing
4	17T0677839	4919295	Blue Bird	New
5	17T0677846	4919321	Blue Bird	New
6	17T0677846	4919332	Blue Bird	New
7	17T0678033	4919538	Blue Bird	New
8	17T0678058	4919535	Blue Bird	New
9	17T0678095	4919564	Blue Bird	New
10	17T0678110	4919579	Duck	New
11	17T0678114	4919515	Blue Bird	New
12	17T0677753	4919859	Blue Bird	Existing
13	17T0677725	4919955	Blue Bird	Existing
14	17T0678285	4918739	Blue Bird	New
15	17T0678302	4918766	Blue Bird	New
16	17T0678372	4918776	Blue Bird	New

5.0 SCHOOL WORKSHOPS

Kawartha Region Conservation Authority received additional funding of $500 from TD Friends of the Environment to be spent on education workshops for school children. As one of the deliverables, the team was to come up with a bird box design suitable for school children and a budget for the project.

5.1 Nest Box Design

The nesting box design selected for the school workshop is a simple plan that allows children to learn about nesting box construction but is not as complex as the Bluebird nesting box selected for monitoring around the conservation area. This design is required to be pre-cut for the project so it is ready for the children to assemble it. The children will then need to assemble the box using a hammer and nails. The final side of the nesting box can be either nailed together (the nesting box will not be available for cleaning or monitoring) or screws can be used to fasten this

side (holes can be pre-drilled and screwed in with screwdrivers or adults can fasten the sides with a drill).

Each nesting box requires:
1 - 1”x6”x4’ Piece of common wood
1 - 1”x10”x10-1/2” Piece of common wood
20 – Galvanized nails
3 – Galvanized screws
Please refer to Appendix 12.3 for instructions and design of this nesting box.

5.2 Nest Box Budget

A sum of $500 in funding was available for supplies in order to run the workshops for school children. The current cost of supplies at Home Hardware in Lindsay Ontario, for the project would be around $333.94 (tax excluded). This allows for materials to construct 40 nesting boxes. The cost of the second project would be approximately $123.78 (tax excluded) assuming that 20 new hammers and the hole saw would not need to be re-purchased for the second round.

Figure 12: School Workshop Nest box Budget

Educational Nest Box Budget			
Item	Quantity	Cost	Total
1"x12"x10' Common Wood	2	$16.12	$32.24
1"x6x8' Common Wood	10	$7.84	$78.40
2" Nails	100	$9.29	$4.99
2" Screws	400	$4.29	$8.15
Hammer	20	$9.99	$199.80
Hole Saw	1	$10.36	$10.36
		Total	$333.94

*****Sales Tax Not Included

6.0 MONITORING PROTOCOL

With multiple volunteers working on the nesting box project at Ken Reid Conservation Area, a monitoring protocol is required to keep consistent track of information throughout the project. After consulting many different sources on nesting box studies, the team decided to follow Bird Studies Canada’s method for nest box monitoring. A two-page data form was established for use in the field. This form follows step-by-step order of data collected on Bird Studies Canada,

allowing for the data to be collected on paper. An account was also created on Bird Studies Canada so that the data can be entered into the website allowing for online data files as well. As the field sheets match Bird Studies Canada's layout, online data entry should be straight forward and simple for volunteers. The website also uses the data entered into Ken Reid's account for their data sharing as well. Figure 13 below shows a sample of the monitoring protocol data sheets.

Web link for Bird Studies Canada Nestwatch:
http://www.birdscanada.org/dataentry/nw_login.jsp?ts=1447442999563&lang=EN

Ken Reid account login: kenreidnestwatch Password: kenreidconservation

Figure 13: Sample Monitoring Protocol Data Sheet

Ken Reid Conservation Area Nesting Box Monitoring

Species
Nesting:_____

Province: ONTARIO

Nest Location

Year:_____

Name of Observer(s):_____

Nest Label (ie, box 1, box 2):_____

Location (place name or description): Ken Reid Conservation Area

Postal Code: K9V 4R2

Coordinates (UTM or Latitude and
Longitude):_____

Coordinates Source (circle one): GPS Map Web

Visit Information

Visit Date & Time:

Visit number: _____

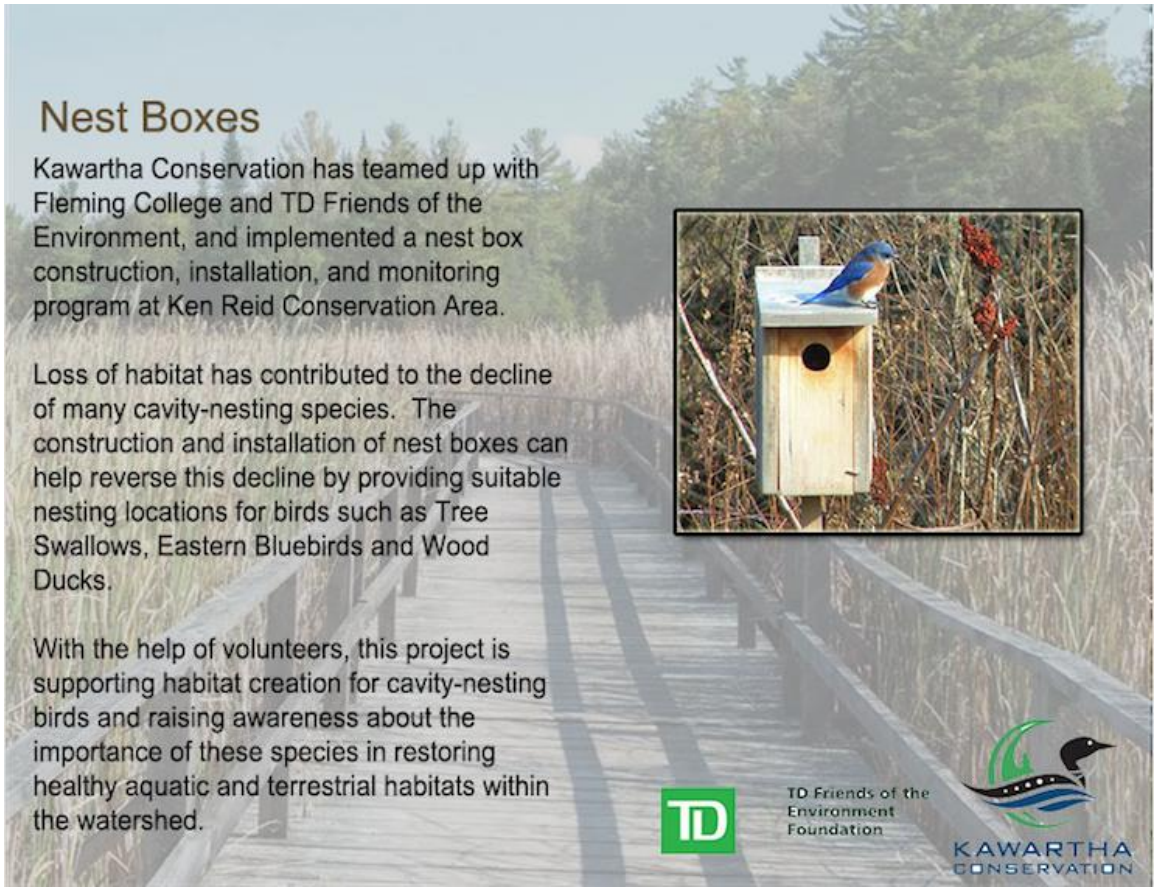
Day:_____ Month:___Time(24h):_____

*Please refer to Appendices for complete monitoring protocol data sheet.

7.0 INTERPRETIVE SIGN

As a way of educating the public about the importance of nest boxes as well as the ongoing nest box project at Ken Reid Conservation Area, a sign was created. The team created a sign with a short description of the project as well as the importance of creating nest boxes in order to provide suitable nesting habitat to birds in the conservation area. The sign acknowledges TD Friends of the Environment and its contribution to the project. Figure 14 below is the finalized sign design that will be used.

Figure 14: Interpretive Sign



7.1 Interpretive Sign Placement

The team selected potential sites for the sign to be installed within Ken Reid, these sites have been selected where it allows easy viewing to the public as well as a safe distance away from nest boxes to minimize disturbance. Below, figure 15 shows the suggested sign placement locations.

Figure 15: Suggested Sign Placement

8.0 TEAM BUDGET

The total team budget for all expenses during the project, including building materials, travel costs and printing is as follows in figure 16 below:

Figure 16: Project Team Budget

C4P Team Budget				
Building Material				
Lumber				$136.37
Hardware 1				$38.45
Hardware 2				$9.37
Travel Costs				
Rebecca				
Place	Distance	Visits	Mileage Rate	Total
Ken Reid	8.1 km	4	0.5	$16.20
Home Hardware	2.8 km	2	0.5	$2.80
Sarah				
Place	Distance	Visits	Mileage Rate	Total
Ken Reid	8.1 km	1	0.5	$4.05
Mutual Life Insurance	4.6 km	1	0.5	$2.30
Peter				
Place	Distance	Visits	Mileage Rate	Total
Home Depot	77.6 km	1	0.5	$38.80
Home Hardware	2.8 km	2	0.5	$2.80
Ken Reid	8.1 km	1	0.5	$4.05
Printing				
250 Pages				$25.00
			Total	$280.19
			Budget	$835.00
			Difference	554.81

9.0 RECOMMENDATIONS

It is recommended that in order to utilise the remainder of the funding money for Ken Reid's nest box project, a total of 24 more bird boxes can be constructed and installed throughout Ken Reid and Windy Ridge Conservation areas. Eligible locations for nesting boxes also need to be selected at Windy Ridge. Part of the funding can also be used for construction and installation of the interpretive sign. It is also recommended that volunteers follow the monitoring protocol and that the data is entered into Ken Reid's account on Bird Studies Canada's Nest watch site. It is recommended that the school workshops use the provided nesting box blue print, in order to complete the project twice using the $500 of funding money efficiently.

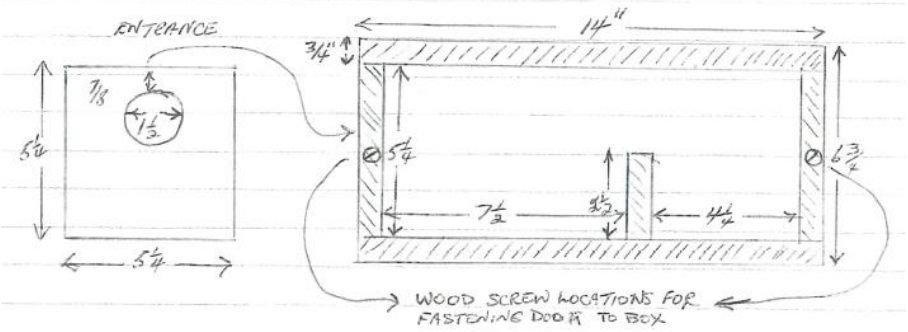
10.0 CONCLUSION

In conclusion, a total of 12 nesting boxes were installed at Ken Reid Conservation Area in the fall of 2015. The team was able to build and install 10 boxes following the Bluebird Nesting Box – Mudroom style as well as 2 nesting boxes following the Wood Duck Construction style. The team hopes that there will be successful nesting in all the installed boxes come spring. The team was also able to establish a monitoring protocol following Bird Studies Canada's Nest Watch program layout. An online account on Bird Studies Canada was created for Ken Reid conservation area, giving the option to have an online database of recorded monitoring records. Lastly, a budget was established for school workshops and the construction of nesting boxes, deciding that the project can be run twice with the current $500 funding.

11.0 APPENDIX

11.1 Mud Room Style Bird Box Design and Instructions

PLANS FOR BLUEBIRD NESTBOX - MUDROOM STYLE



CUT FROM 3/4" THICK WOOD (CEDAR, PLYWOOD, ROUGH SAWN LUMBER OR SIMULAR MATERIAL)

#	PIECES	DIMENSIONS	
2	BACK SIDE AND DOOR	6 3/4" X 14"	✓
2	BASE AND TOP	5 1/2" X 14"	✓
2	ENDS	5 1/4" X 5 1/2"	✓
1	MUDROOM DIVIDER	3 1/2" X 4 1/2"	✓
1	OVERHANG ROOF	10 1/2" X 19" (OR LARGER IF DESIRED)	
1	BOX (GALVANIZED)	2" SPIRAL NAILS	
10	FOR ATTACHING ROOF	2 1/2" SPIRAL NAILS (GALVANIZED)	

ASSEMBLY STEPS FOR MUDROOM NESTBOX

1. CUT A 1½" ENTRANCE HOLE IN ONE OF THE END PIECES. POSITION IT 7/8" FROM THE TOP EDGE AND CENTRED SIDE TO SIDE.

2. THE "BACK SIDE" PIECE IS THE OUTSIDE BOX LENGTH AND HEIGHT. ATTACH THE BASE PIECE TO ONE 14" EDGE AND THE TOP PIECE TO THE OTHER 14" EDGE. INSERT THE END PIECES SO THEY ARE FLUSH AND ATTACH THEM TO THE BACK, TOP AND BOTTOM. POSITION THE MUDROOM DIVIDER ON THE BASE PIECE SO THAT IT TOUCHES THE BACK SIDE AND ATTACH IT TO THE BASE (FROM THE UNDERSIDE) AND THE BACK SIDE (FROM THE OUTSIDE). WHEN YOU ARE FINISHED THIS STEP YOU HAVE THE BOX COMPLETED TO THE STAGE SHOWN IN THE DIAGRAM. REPLACE ANY NAILS THAT HAVE ENDS PENETRATING INTO THE NESTBOX INTERIOR.

3. FIT THE DOOR TO THE OPEN SIDE WITH SCREWS SO IT CAN SWING DOWN TO OPEN FROM EITHER END. FILE THE END OF THE MUDROOM DIVIDER IF NECESSARY TO IMPROVE THE DOOR FIT.

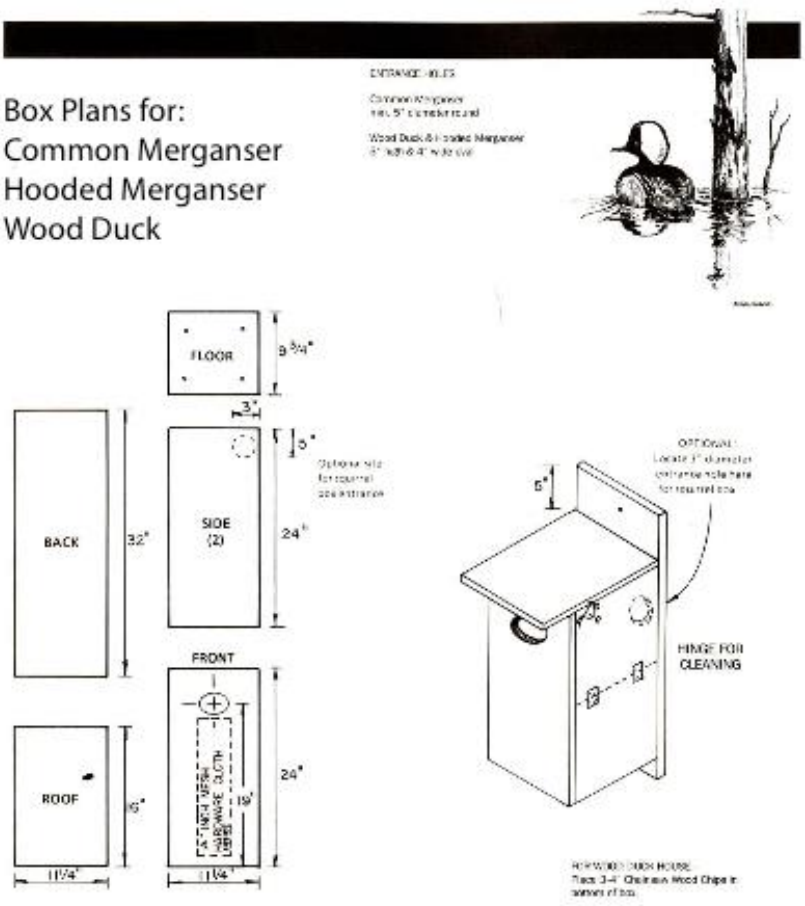
   NOTE

   THE SCREWS MUST BE EXACTLY OPPOSITE AND CENTRED AT EACH END FOR THE DOOR TO SWIVEL PROPERLY.

4. ATTACH THE OVERHANG ROOF SO THAT IT EXTENDS AT LEAST 3" OVER THE HOLE OF THE BOX AND THE DOOR (LESS ON THE OPPOSITE SIDE AND END). REPLACE ANY NAILS OR SCREWS THAT HAVE ENDS PENETRATING INTO THE NESTBOX INTERIOR.

5. STAIN THE OUTSIDE OF THE BOX TO PROTECT THE WOOD FROM THE WEATHER (OPTIONAL). DO NOT STAIN ANY WOOD INSIDE THE BOX.

11.2 Wood Duck Box Design and Instructions



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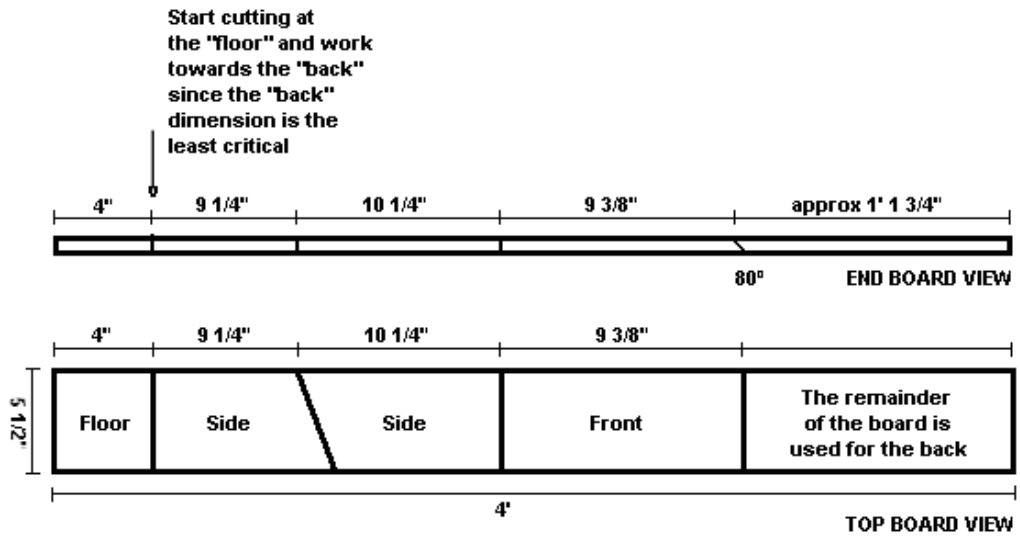
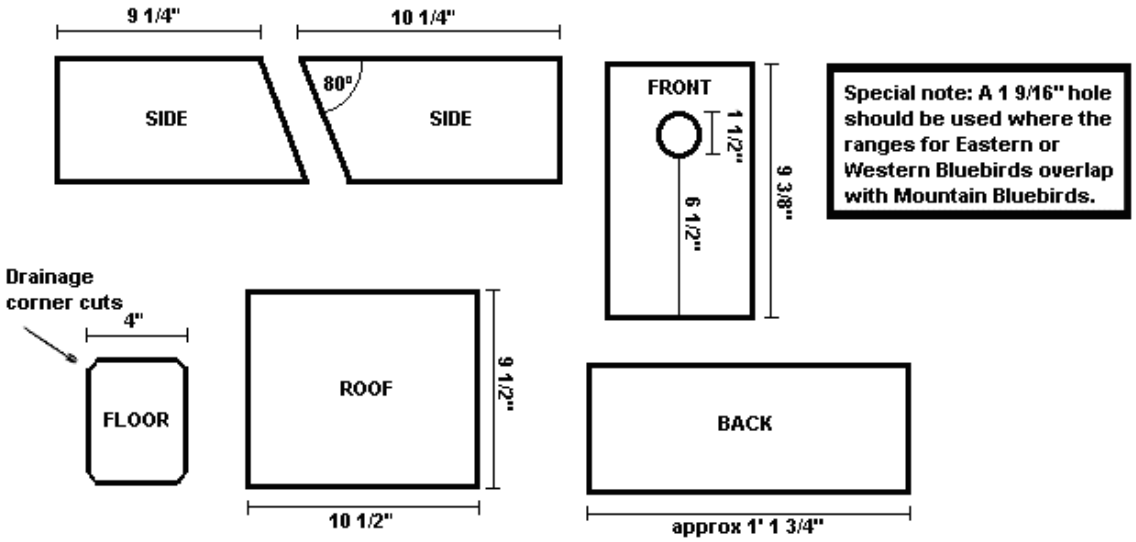
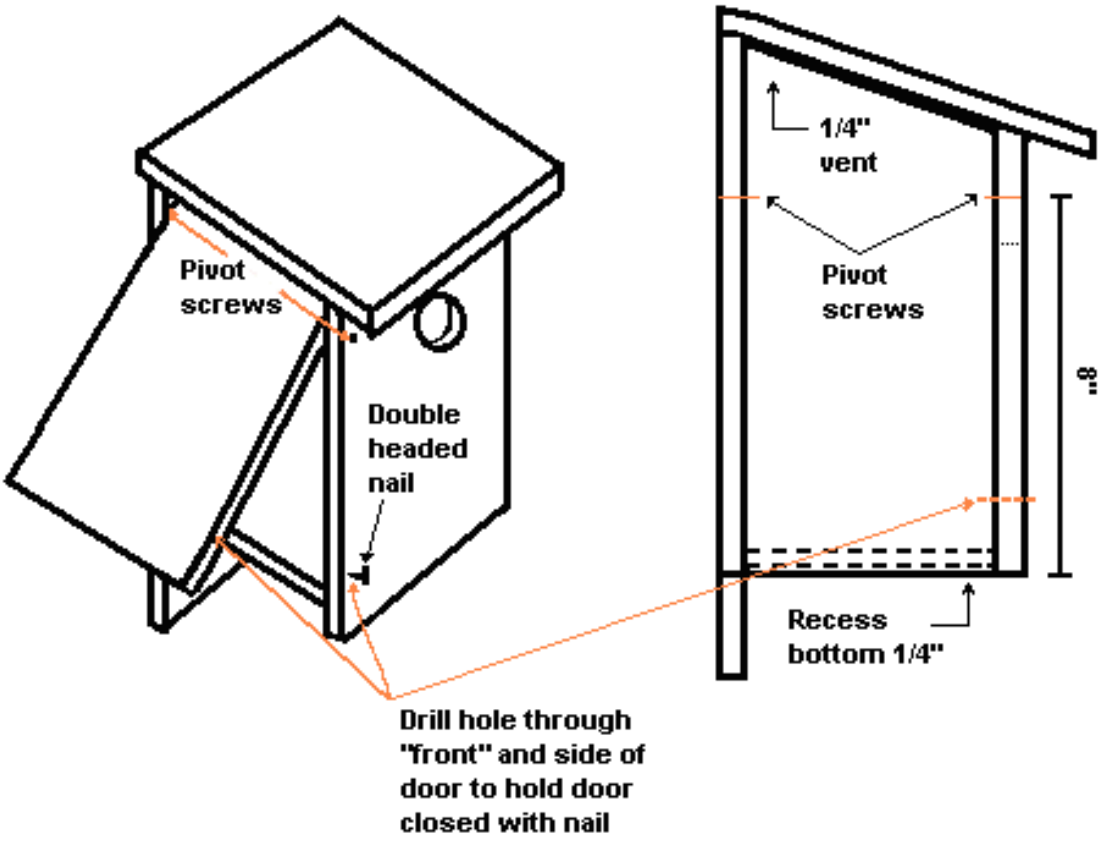
11.3 School Workshop Bird Box Design and Instructions



CONSTRUCTION PLAN




Pivot
screws
Double
headed
nail
1/4"
vent
Pivot
screws
8"
Recess
bottom 1/4"
Drill hole through
"front" and side of
door to hold door
closed with nail

11.4 Monitoring Protocol Data Sheets

Ken Reid Conservation Area Bird Nest Monitoring

Enter Data Online At: Birds Studies Canada Nestwatch
Web Site: http://www.birdscanada.org/dataentry/nw_login.jsp?ts=1447442999563&lang=EN
Login: kenreidnestwatch Password: kenreidconservation

Species Nesting:_____
Province: ONTARIO

Nest Location
Year:_____
Name of
Observer(s):_____
Nest Label (ie, box 1, box 2):_____
Location (place name or description): Ken Reid Conservation Area
Postal Code: K9V 4R2
Coordinates (UTM or Latitude and Longitude):_____
Coordinates Source (circle one): GPS Map Web

Visit Information
Visit Date & Time:
Visit number: _____
Day:_____ Month:___Time(24h):_____
Host:
Number of eggs:_____
Live young: _____
Dead young:_____
Cowbird (or other parasites)
Number of eggs:_____
Live young: _____
Dead young:_____
Comments:_____
_____
_____
_____
_____
_____
_____
_____
_____
Nest Outcome:_____
Parasite Species (ie. Cowbird):
1. No parasite/ species unknown
2. Brow-headed Cowbird
3. Other Species

Nest Site and Habitat Description

Nest site:

In (ie. grass, ditch, earth):_____

On (ie. grass, ditch, earth):_____

Under (ie. grass, ditch, earth):_____

Describe the nest location: _____

_____

_____

Nest site type:

A. Unenclosed
B. Hole or crevice
C. Ledge or platform
d) Nest box
e) Other bird/ mammal nest

Exposure:

0. Well hidden 1. Partially hidden 2. Exposed

Slope:

Flat Gentle Steep Vertical

Direction of Slope (ie. North, West): _____

Direction of nest hole (ie. North, West): _____

Nest height above ground/water: _____m

Habitat

Habitat class:

A. Woodland
B. Grassland, Shrubland and Agriculture
C. Tundra, Alpine
D. Human Sites
E. Wetlands dominated by vegetation
F. Wetlands with mainly open water
G. Saltwater costal sites
H. Rock

Habitat subclass:

0. Unidentified
1. Cliff
2. Scree/ bolder slope
3. Rock outcrop
4. Quarry
5. Mine/ spoil/ slag heap
6. Badland
7. Cave

11.5 Team Charter

1.0 MISSION STATEMENT

Team 4 aims to work as a team in all aspects of the project in order to have equal input from all team members as well as to ensure equal contribution throughout project. Team 4 strives to meet all deadlines and follow project timelines in order to complete the project in a timely fashion and develop the highest quality of work they can.

2.0 GOALS

Our team goals will be developed once we have obtained our permanent credit for product placement.

3.0 TEAM ROLES

Our team roles will be assigned once we have obtained our permanent credit for product placement.

4.0 TEAM GROUND RULES

4.1 All members of this team will respect one another in all aspects of working together

4.2 All members will follow the team schedule unless in extreme circumstances such as an emergency occurs

4.3 All members of this team will give 100% effort in all work integrity and complete each task to their highest standards

4.4 Team will be flexible upon planning meetings to accommodate all team members to the best of their abilities

4.5 Meetings will start promptly on time and all members are expected to be on time

4.6 One person talks at a time; everyone must respectfully listen

4.7 Members will be non-judgemental of each other and always have an open mind on issues

4.8 We will all emphasize collaboration and use of consensus for important decisions

4.9 We will accept the responsibility and accountability of each of our roles on the team

4.10 We will develop all work with proper documentation and professionalism

4.11 Each team member is responsible for keeping copies of his/her work

4.12 This Charter can be amended/ edited as needed by the members of the team

5.0 CONSEQUENCES OF UNACCEPTABLE BEHAVIOUR

5.1 Any concerns that arise will be addressed to the individual directly

5.2 If a situation occurs where a member is unable to participate in a an aspect of project, additional responsibilities will be assigned to accommodate

5.3 In extreme circumstances of a team member not carrying their share of responsibilities a percentage of their final grade will be reduced by up to 25%

6.0 TEAM MEMBER PROFILES

6.1 Team #4 photo. (Peter, Becca, Sarah, Jarret)

6.2 Our group has a variety of educational backgrounds including: B.A Honours on indigenous studies from Trent University, B.A of Environmental Geography from Nipissing University, and two graduates of Ecosystem Management Technician program from Sir Sandford Fleming College.

6.3 Within our team, members have assumed multiple leadership roles throughout their careers. These roles have included:

-Leading co-workers to be successful within company

-Lead Canoe Guide and assistant with primitive skills workshops with Earth Tracks which

- Director of Farm Camp in St. Marys Ontario

- Campaign manager with various humanitarian aid projects for third world countries

- Manager and planning responsibilities for the 10,000 trees project within the rouge watershed

6.4 **Sarah Peters**

- Wildlife and Environmental Technician- Aquatic System Specialist
South Lake Simcoe Naturalists, Georgina Ontario
- Ecologist in Training
‘ Moonlight Crofters, Douglas Ontario
- Habitat Restoration
10,000 Trees for The Rouge, Markham

Rebecca Carmichael

Junior Account Representative
Quinn Marketing, London Ontario
Environmental Resource Technician
Nipisssing University, North Bay Ontario

Jarret Boyd

- Museum Technician
Friends of Algonquin Park, Algonquin Provincial Park Ontario
- Canoe Guide
Earth Tracks, Southern Ontario

- Campground Maintenance
Ministry of Natural Resources, Algonquin Park

Peter Moddle

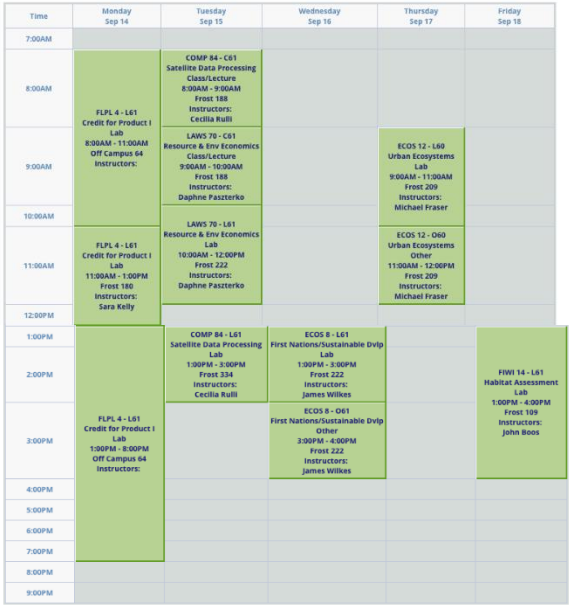
- Trails Maintenance Technician
Upper Thames River Conservation Authority, London Ontario
- Archaeology Field Technician
Golder Associates, London Ontario
- Wilderness Resource Conservation Technician
Pidwa Wilderness Reserve, South Africa

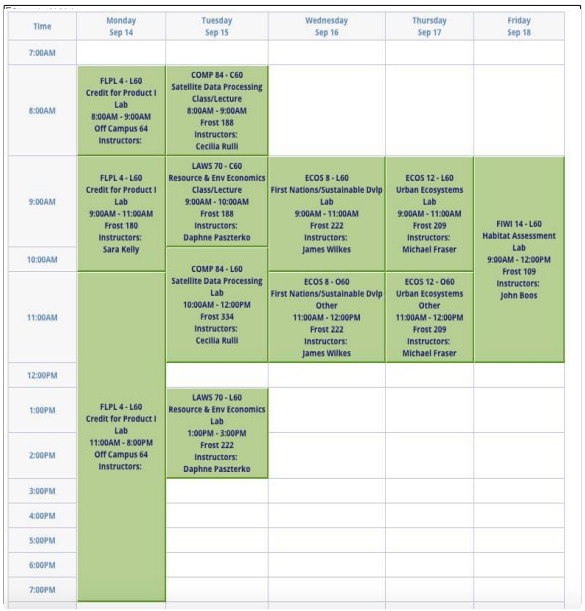
6.5 Our group has a strong dedication to environmental awareness and sustainability. We are comfortable being put into new and challenging tasks, working well under pressure and being in problem solving situations. We have strong identification skills in flora and fauna native to Ontario, and significant experience working outdoors in inclement weather conditions, collecting and recording data. We are a tightknit group who enjoys bonding over fieldwork.

6.6 Our personal goal is to exceed our credit for product placement host's expectations by demonstrating top quality work and outstanding commitment and dedication to the assigned project.

7.0 APPENDICES

7.1 Section 60, and 61 timetables for the 2015-2016 fall semester.





11.6 Project Plan

Project Title	Kawartha Conservation Nest Box Implementation Project
Project Management Team	Rebecca Carmichael, Ecosystem Management Technology, Sir Sandford Fleming College Sarah Peters, Ecosystem Management Technology, Sir Sandford Fleming College Jarret Boyd, Ecosystem Management Technology, Sir Sandford Fleming College Peter Moddle, Ecosystem Management Technology, Sir Sandford Fleming College
Faculty	Sara Kelly, Credit For Product I Faculty, Sir Sandford Fleming College
Project Sponsor(s)	Robert Stavinga, Watershed Resources Technician, Kawartha Region Conservation Authority
Purpose	The purpose of the project is to implement a bird box construction, installation, and monitoring program within Kawartha Conservation's conservation areas, building on the plan created over the last two years for Ken Reid conservation area. Part of Kawartha Conservation's mission is to provide leadership in conservation, and a focus that includes promoting healthy landscapes through stewardship and science. This project will support these components of Kawartha Conservations strategic plan by providing habitat for bird species that rely on cavities for reproductive success. These bird species are an important part of maintaining and restoring healthy terrestrial and aquatic habitats in our watersheds, which continue to be impacted by modern development practices.
Issue	The issue being addressed is the limited habitat available for secondary cavity nesting birds in Ken Reid Conservation Area. This project will address this issue by providing habitat for these birds in the form of bird nesting boxes. This project is happening now because Kawartha Region Conservation Authority has received grant funding from TD Friends of The Environment to help support the implementation of this project.
Deliverables	Implementing the nest box network in Ken Reid Conservation Area: 1) Complete the construction and installation of nest

	boxes in Ken Reid conservation area with the goal of building and installation of minimum 12 nest boxes by the end of the term. 2) Work with volunteer(s) to develop/complete the monitoring protocol and create a database that is in line with Bird Studies Canada (MS Excel/ Access on Jump Drive) 3) Establish a budget for spending the remainder of the TD grant (@$835.00), report to TD Friends of the Environment (MS Excel Sheet on Jump Drive) 4) Create budget and plans for school workshops on bird box construction (MS Word on Jump Drive) 5) Develop content and layout of nest box interpretative signs for the Conservation Area 6) Final Product (MS Word and PDF on Jump Drive) 7) Design and produce final video for promotion of bird boxes for promotional purposes (Video File on Jump Drive)
Exclusions	Team 4 will not be responsible for: 1) Internal communications within the conservation authority. 2) Providing additional funding for the project. 3) Printing, travel, and project related costs.
Stakeholders	Stakeholders include: Kawartha Region Conservation Authority Sir Sandford Fleming College TD Canada Trust Friends of The Environment General Public

	Who needs to be consulted: Robert Stavinga- Kawartha Conservation Authority: Mentor and project lead Jesse James- Kawartha Conservation Authority: Conservation Area coordinator Kawartha Field Naturalists: Assist with monitoring protocol and box design Sara Kelly: Assists with progression of project Monitoring Volunteers: Availability and implementation Political Sensitivity: When completed successfully, project could aid in the public awareness of the Conservation Authorities roles and gain future funding from municipal for projects.
Scope State what you have (eg. $500.00, 11 Mondays 8 hrs/day etc.) not what you don't have	Boundaries and resources include: 1) 11 eight hour days allocated to this project 2) $800 grant fund from TD Canada Trust Friends of The Environment 3) Primary support form watershed resources technician 4) Access to Kawartha Conservation data/mapping 5) Expertise and support in Ecological Land Classification, Ornithology, nest box design 6) Safety training for any tasks undertaken on behalf of Kawartha Conservation 7) Financial support for printing costs associated with project, travel expenses Success will be measured by the following: 8) Completion of expected deliverables mentioned

	above 9) Attending all scheduled meetings 10) Providing quality work to host organization 11) Completing all assignments on time We will ensure these qualities by: 12) Thorough research 13) Attending all meetings 14) Following the team charter 15) Accepting guidance from peers and mentors 16) Providing weekly updates to team mentor of progress of final product
Project Tasks and Timelines	Please view Team 4 Gantt Chart in the appendices.
Health and Safety Plan	Please view Team 4 Health and Safety Plan in the appendices.

Project Plan Sign-Off

_____ _____

(Mentor Signature) **(dd/mm/yr)**

_____ _____

(Student Signature) **(dd/mm/yr)**

_____ _____

(Student Signature) **(dd/mm/yr)**

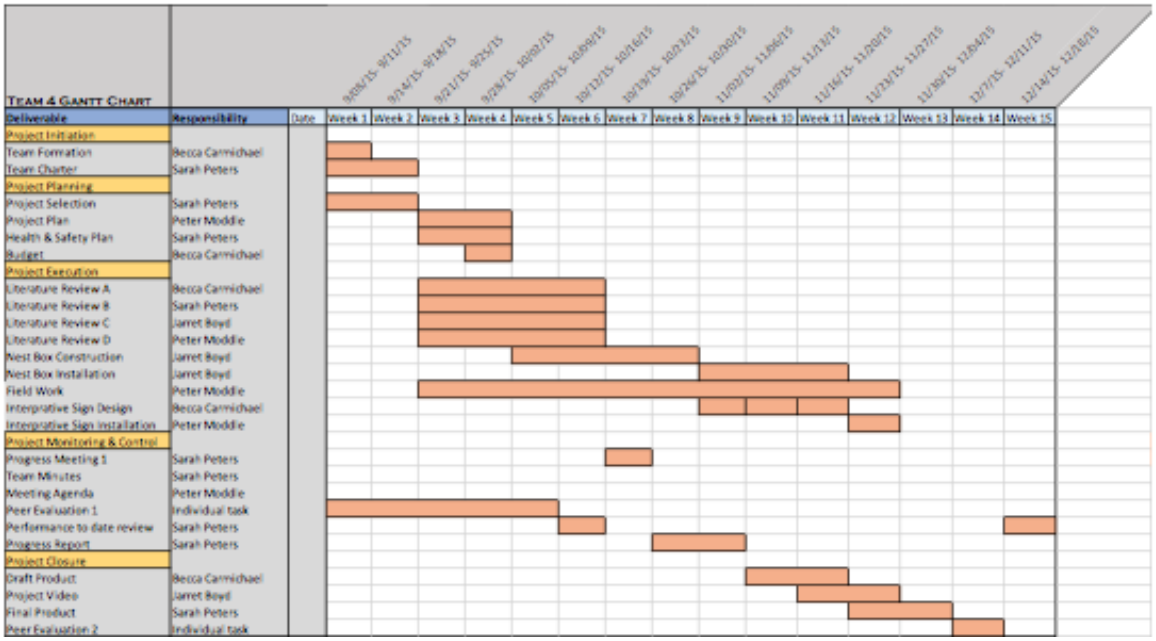
_____ _____

(Student Signature) **(dd/mm/yr)**

(Student Signature) **(dd/mm/yr)**

(Faculty Signature) **(dd/mm/yr)**

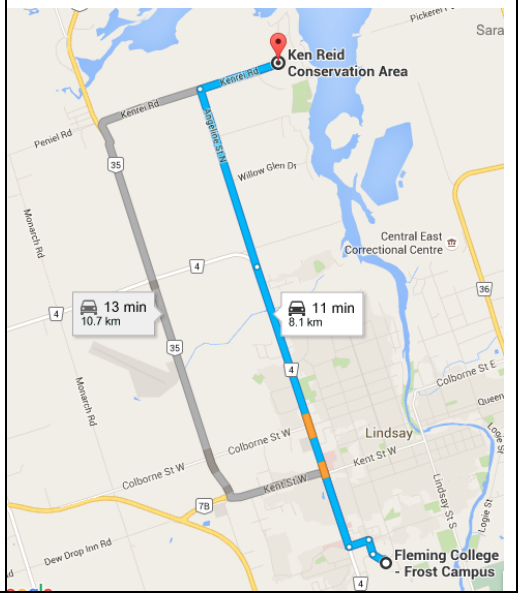
11.7 Gantt Chart

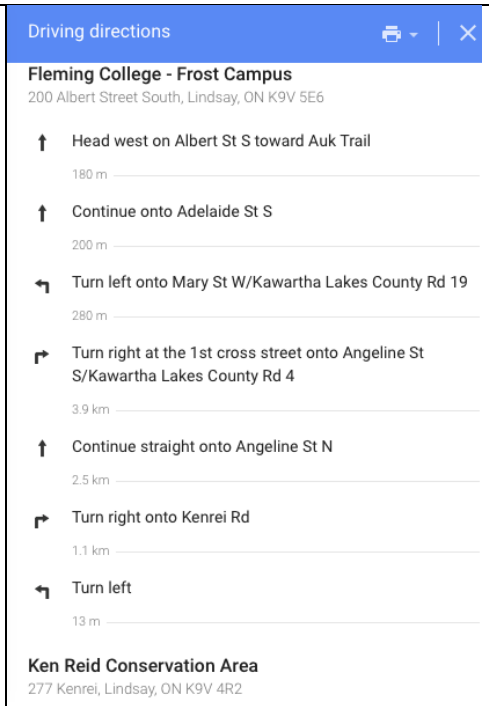


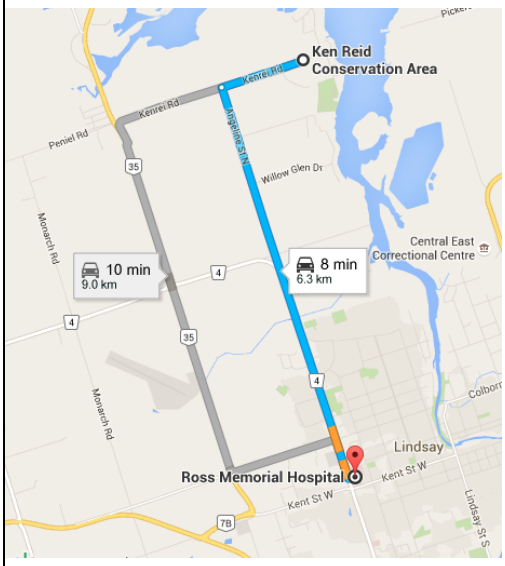
11.8 Health and Safety Plan

Health and Safety Plan for Kawartha Conservation Nest Box Implementation Project, September-December 2015

Project Name	Kawartha Conservation Nest Box Implementation Project
Project Management Team	Sarah Peters, Becca Carmichael, Peter Moddle, Jarret Boyd
Cell Number + Area Code	289-683-2589 - Sarah Peters

	519-719-6291 – Peter Moddle
Date H&S Plan Completed	21/09/2015
Project Location(s)	Kawartha Region Conservation Authority Ken Reid Conservation Area 277 Kenrei Road Lindsay, ON, K9V 4R1 Phone- 705-328-2271 (ext.229) 

	
Permission to be on Property/Project Location(s)	Rob Stavinga, Watershed Resource Technician , KRCA, 13/09/2015
Description of all fieldwork involved in project	-Target areas and species to assist with nest box project needs -Investigate options for nest box construction designs -Complete the construction of 12 nest boxes -Install the nest boxes in our targeted areas -Develop or build on existing monitoring protocol -Establish budget for spending available TD grant ($835.00) -Develop nest box interpretive signs for Ken Reid
Nearest Hospital to Project Location	Ross Memorial Hospital, 10 Angeline Street North,

	Lindsay, ON K9V 5B7  **Ken Reid Conservation Area** 277 Kenrei, Lindsay, ON K9V 4R2 Head south toward Kenrei Rd 13 m Turn right onto Kenrei Rd 1.1 km Turn left onto Angeline St N Destination will be on the left 5.2 km **Ross Memorial Hospital** 10 Angeline Street North, Lindsay, ON K9V 5B7
To report a life threatening emergency situation dial (to be confirmed by student team, before going into field, as may not apply in all locations)	**911**
The course faculty member and host organization mentor must be informed by email within 24hrs of all incidents requiring first aid, and/or emergency care.	
Potential Hazard Identification	1. Slipping, Tripping, Falling

	2. Wildlife encounters 3. Poisonous vegetation (poison ivy, hog weed, etc.) 4. Potential injury while construction nest boxes (cuts, bruises, etc.) 5. Ticks
Hazard Mitigation Plan	1. Always wear proper closed toed footwear with ankle support while in the field 2. At least one team member must carry a whistle 3. Each team member should be able to identify poisonous vegetation 4. While constructing nest boxes team members are required to have hair tied back, safety goggles on, long sleeves, and closed toed shoes. (trained on all equipment) 5. Long Pants tucked into boots & end of the day check
Personal Protective Equipment (PPE) Required	1) Appropriate footwear 2) Cell Phone 3) Whistle 4) Safety Goggles (during nest box construction) 5) High Visibility Vests
Sign-off	_____ _____ _____ (Signature) (Print name) (date) _____ _____ _____ (Signature) (Print name) (date)

	_____ _____ _____ (Signature) (Print name) (date) _____ _____ _____ (Signature) (Print name) (date) _____ _____ _____ (Signature) (Print name) (date) _____ _____ _____ (Signature) (Print name) (date)

11.9 Meeting Agendas

Credit for Product #1
Monday September 21st, 2015
11:00-12...
Kawartha Conservation Office, Ken Reid Conservation Area
277 Kenrei Road, Lindsay, ON K9V4R1

AGENDA-Bird Box Project

1) Welcome/Introductions

2) Assign chair/secretary/(minutes)

3) Agenda discussion (Rob)

4) Maps/materials related to Ken Reid Conservation Area that you might be able to provide (eg. Kawartha Region C.A publications or anything relevant) (All)

5) Potential options for type of interpretive signage (eg. Posted numbers corresponding to a pamphlet vs. actual signs) (All)

6) Nest box design (our group can research different designs but will be good when we visit the site to see the design of the current nest boxes which were successful) (All)

7) Other business

8) Adjourn

To be followed by a short hike in the Conservation Area.

The team will provide input and direction for the project and determine action items:

1.0 Providing ongoing direction for the project.

2.0 Providing recommendations to the Watershed Resources Technician

Credit for Product #2
Monday October 5th, 2015
12:00 – 1:00…
Kawartha Conservation Office, Ken Reid Conservation Area
277 Kenrei Road, Lindsay, ON K9V4R1

AGENDA-Bird Box Project

1) Welcome

2) Assign chair/secretary (minutes)

3) Agenda discussion (C4P team)

4) Discuss new funding and project details. What are exaptation's for these new additions? (All)

5) Monitoring protocol. What are the expected result and any suggestions? (All)

6) Placement of bird boxes. Where should we be looking? (All)

7) Other business

8) Adjourn

1.0 Gain a clear understanding of where to go with all project details.

2.0 Get suggestions of what to do.

The team will provide input and direction for the project and determine action items:

Credit for Product #3
Monday October 19th, 2015
12:00-1:00
Sir Sandford Fleming College, RM 252
200 Albert St S, Lindsay, ON K9V 5E6

AGENDA- Progress Meeting

1) Welcome/Introductions	Time: 2 Mins
2) Expected Deliverables	Time: 10 Min
3) Progress of deliverable to date	Time: 10 Min
4) Budget update and approval	Time: 10 Min
5) Gantt Chart Approval	Time: 2 Min
6) Final Product Printing	Time: 2 Min
7) Project Plan Sign-off and distribution	Time: 5 Min
8) Other Business	Time: 5 Min
9) Adjournment	Time: 2 Min

3. Be courteous and respectful. Do no talk while others are speaking; if you would like to speak, ask the chair.
4. Give reasons to support your position rather than denigrating the opinions of others.
5. Do not carry on side conversations – you can only attend one meeting at a time.
6. Focus disagreements on ideas, not on individuals.
7. Use of electronic media (cell phones, laptops, and BlackBerrys) should be relevant to the current meeting (i.e. note taking, presentations, checking availability for future meetings, etc.)

Chair: Peter Moddle
Minute Taker: Sarah Peters
Presentors: Rebecca Carmichael, Jarret Boyd, Sarah Peters

Meeting Etiquette:
1. Arrive on time and return promptly at breaks.
2. Formally send regrets if unable to attend.

11.10 Meeting Minutes

Meeting #1

Date: September 21st, 2015

Start Time: 11:00am

Location: Ken Reid Office

Purpose: Start-up Meetin

Attendance:

Group Member	Attendance
Sarah Peters	Present
Becca Carmichael	Present
Peter Moddle	Present
Jarret Boyd	Present
Rob Stavinga	Present

Jesse James also attended the meeting

Agenda:

Agenda Items	Decisions Made, Assigned Tasks, etc…
1) Welcome/Introductions	
2) Assign Chair/ Secretary	-Sarah will take Meeting Minutes, Peter will be the Meeting Chair.
3) Agenda Discussion	
4) Maps/ Materials	-Rob agreed to provide us with GIS maps for the Ken Reid Area
5) Interpretive Signage	-Peter will investigate QR codes as well as other types of signage. -The team will need to develop a few interpretive sign designs.
6) Nest Box designs	- Rob agreed to provide the team with nest box designs that have been used in the past. - Rob will connect us with Bill Hoyle (Chair of Kawartha Field Naturalists)
7) Other Business	-The team needs to decide on which species we wish to target. -Sarah will lock down a progress meeting time with Sara Kelly -Sarah will get a binder to track progress of project. -Becca will report to the TD Grant

Notes:

ROB – Provide team with KRCA GIS department Maps of Ken Reid & Windy Ridge

- Provide Team with Nest Box Designs
- Connect Team with Bill Hoyle

- Assist Becca with TD Grant information
- Provide Sarah with information of availability for Progress Meeting

Peter- Investigate QR code option as well as other types of possible signage

Becca- Begin reporting on TD Grant once information from Rob is available

Jarret- Explore literature review options

Sarah – Lock down progress meeting with Sara Kelly

- Consider other possible bird box ideas
- Get a binder to track progress of project

Team- Look into where materials can be bought OR donated

- Look into/Consider who will be making the Nest Boxes

Next Scheduled Meeting: TBA

Time Meeting Adjourned: 11:40am

Meeting #2

Date: October 5th 2015
Start Time: 12:00pm
Location: Ken Reid Conservation Office
Purpose: To discuss project details and strategies to get things completed on time.
Attendance:

Group Member	Attendance
Sarah Peters	Present
Becca Carmichael	Present
Peter Moddle	Present
Jarret Boyd	Absent (sick)
Rob Stavinga	Present

Agenda:

Agenda Items	Decisions Made, Assigned Tasks, etc…
1) Welcome	
2) Assign Chair/Secretary (minutes)	Chair- Peter Moddle Secretary- Sarah Peters
3) Agenda Discussions	
4) Discuss new funding and project details. What are exaptation's for these new additions?	-Additional $500 grant from TD towards educating kids on bird boxes -Expectations are to budget the $500 towards a building as many bird boxes of a design kids can put together. (target 40-60)

5) Monitoring Protocol. What are the expected results and any suggestions?	-Develop Field Sheet that can be relayed into data base (Bird Studies Canada) -How to upload to Bird Studies Canada -Discuss options with Bill Hoydle
6) Placement of bird boxes	-Possible locations discussed; Field off of Ken Rei Road, Field South of Beach, Windy Ridge -Rob ELC maps
7) Other Business	-Discussed possible carpenter for bird boxes -Discussed project video outcomes (Who? What? Why? When? Where? How? About bird boxes)
8) Meeting Adjourned	

Notes:
Rob - Send ELC maps if available

- Contact Bill Hoydle

Team – Consider designs that can be used for kids building bird boxes

- Make decisions on bird box locations and if we need to purchase posts
- Brainstorm ideas for Video project
- Get a quote for how much the carpenter will cost.

Next Scheduled Meeting: Monday October 19th. (Progress Meeting)

Time Meeting Adjourned: 12:45pm

Meeting #3

Date: October 19th 2015
Start Time: 12:13pm
Location: Fleming College, Frost Campus. Board Room 252.
Purpose: To discuss in detail the progress that has been made on the Nest Box project.
Attendance:

Group Member	Attendance
Sarah Peters	Present
Becca Carmichael	Present
Peter Moddle	Present
Jarret Boyd	Present
Rob Stavinga	Present
Sara Kelly	Present

Agenda:

Agenda Items	Decisions Made, Assigned Tasks, etc…
1) Welcome/Introduction	
2) Assign Chair/Secretary (minutes)	Chair- Peter Moddle Secretary- Sarah Peters
3) Expected Deliverables	-To construct 10 Blue Bird nest boxes and 2 wood duck boxes that will be installed in Ken Reid & Windy Ridge Conservation Area -To develop a monitoring protocol for said nest boxes -Develop a signage template for the nest box project -Budget for the $500 TD grant towards educating kids on bird boxes
4) Progress of deliverable to date	-Bird box design have been finalized -Set back due to the TD grant requiring a volunteer to construct bird boxes -Areas where bird boxes will be installed have been chosen -Budget has been created for materials -Monitoring Protocol has been developed that is linked with Bird Studies Canada
5) Budget Update & Approval	-Budget was discussed and using White Cedar and galvanized screws, was suggested by Rob. -Discussed that we must use volunteers rather than contracted carpenter due to funding guidelines
6) Placement of bird boxes	-No issues were found with our Gantt Chart. -Final Product will be printed at Staples and a receipt will be required for reimbursement
7) Gantt Chart Approval	-Project Plan was signed by Team, Rob Stavinga, and Sara Kelly with minor adjustments to the deliverables which now include budgeting for the new grant of $500
8) Final Product Printing	-Signage Requirements include a template that has content about the nest box project, has measurements of how large and where things will be placed on the sign, as well as a credit of Fleming College/KRCA
9) Project Plan Sign-Off and Distribution	-Option to construct bird boxes with the help of Sara on a weekend, OR to contact Dave

	Sanders who is a wood shop teacher at a local high school
10) Other Business	

Notes:

Rob – Give money to Team so we can purchase materials for project over reading break

Sara – Provide team with the nest box designs you have previously used in projects like this
Becca – Look into what data out puts look like from the Bird Studies Canada web site
Peter - Review nest box design so that I can be opened easily and with minimal disturbance
Sarah – Work on gathering information for signage as well as project video
Jarret – Budget for wooden posts for bird boxes to be fastened to
Next Scheduled Meeting: Monday, November 1st, 12:00noon
Time Meeting Adjourned: 1:07pm

11.11 Literature Reviews

11.11.01

Bird Box Placement Factors

There is a growing issue with many different avian species that are considered cavity nesters due to their nesting resource limitations. Many of these species depend on other animal species to create these hollows in dead standing trees, however due to loss of these habitats, conservation efforts, such as the Nest Box Project at Kawartha Regional Conservation Authority, are now being implemented to create man-made nest boxes. This literature review will consider some of the factors that will influence the overall adoption and success of these nest boxes, as well as their over all influence on breeding bird success.

Thesis: There is a Relationship Between Bird Nest Box Breeding Success and the Entrance Hole, Measurements, and overall Designs and Materials Used To Construct Them

Browne, S.J. (2006). Effects of nestbox construction and colour on the occupancy and breeding success of nesting tits Parus spp.: Capsule Breeding performance was not affected, although variation in nestbox occupancy may result from perceived differences in protection from predators and insulation properties. Journal of Bird Study, 53:2, 187-192.

Nestboxes help to increase and enhance nesting opportunities for a range of bird species in areas where cavities are not as readily available for nesting and are also one of the most obvious contributions that anybody can make to the protection and conservation of birds. A recent development has been the use of woodcrete, a mixture of concrete and sawdust which is easily moulded to produce long lasting, insulated nesting sites for birds. This study investigates if from a bird's point of view the woodcrete nestboxes were any better than wooden boxes. The experiment included 192 boxes, which included two types of wooden box designs (which were shallow but had a larger internal volume) and two

types of woodcrete box designs (which were deeper but had a smaller internal volume) were used during research. They concluded that larger, deeper boxes offer better protection from predation and as they require larger nests to fill them, better thermal insulation. It was proven that the improved thermal qualities and perceived greater protection from predation in the woodcrete boxes resulted in their increased use.

Jackson, J.E. (2015). Alternative Material Nest Boxes and Impacts on Nestling Physiology and Adult Behaviour in the Eastern Bluebird (Sialia sialis). Honors Theses. Paper 307. Retrieved on September 9th, 2015 from, http://aquila.usm.edu/cgi/viewcontent.cgi?article=1298&context=honors_theses

In this study, recycled metal ammunition can was used to determine if this was a viable resource for bluebird nesting boxes. This study investigates the effects of this alternate material on nestling physiology and adult behaviour with special emphasis on the impact of temperature (metal boxes are assumed to be warmer). There were no statistically significant differences between the wooden and ammunition can nest box temperatures, incubation, feeding rates, nestling growth or stress. These results show that one nest box was not significantly better than the other, validating the idea that an ammunition can nest box is a safe, alternative habitat for secondary cavity nesters. This may serve as a beneficial resource not only for the species using them but also for the workload and finances of deploying nest boxes of this type.

Jacot, A., Valcu, M., Oers, K., and Kempenaers, B. (2009) Experimental nest site limitation affects reproductive strategies and parental investment in a hole-nesting passerine. Journal of Animal Behaviour, 77:5, 1075-1083?

This study investigates a theory that mating systems are based on resource defence, meaning that there is a relationship between resource availability and reproduction success. This study looked at secondary cavity nesters and tested this theory using experimental plots. One of these was an experimental plot which limited nesting site availability and the other was a control plot that did not. It was proven that birds breeding in the experimental plot did not differ phenotypically from birds in the control plot. However, they found that females nesting in the nest limited plot fed their offspring at a higher rate than control plot females. This result indicated that an increased competition for resources led to more investment in current reproduction and therefore a better overall reproductive success.

Lambrechts, M. M., Wiebe, K. L., Sunde, P., Solonen, T., Sergio, F., Roulin, A., … & Korpimaki, E. (2012). Nest box design for the study of diurnal raptors and owls is still an overlooked point in the ecological, evolutionary and conservation studies: a review. Journal of Ornithology. 153, 23-34.

In this study the importance of nest box design is reviewed to determine how variation in nest box characteristics can affect nest box success. The way nest boxes are designed,

positioned, monitored and maintained may influence a cocktail of abiotic and biotic factors, however, external environmental factors such as food abundance, weather, nest-site availability, presence of other organisms will influence the success as well. Experimenting was done with different variations of nest box design such as; size of whole box, internal size of nest cavity, size of entrance hole, nest box material, presence or absence of drainage holes, wall thickness, location, nest box height, orientation of entrance hole, and substrate which the box is attached. All these factors were proven to influence both the probability that the box will become occupied and the expression of avian life history, such as clutch size, egg hatching success, breeding success, and chick phenotype.

Maicas, R., Muriel, J., Bonillo, J.C., Fernandez-Haeger, J. (2011) Nest-site selection, territory quality and breeding performance in a Blue Tit Cyanistes caeruleus population. Acta Oecologica, 39, 43-50.

This study was conducted in a nest-box plot, which contained 218 nest boxes that were made up of two different types of nest boxes: 50% were large-holed nest boxes (hole-entrance size of 32mm) and 50% were small-holed ones (hole-entrance size of 26mm). The breeding traits studied were laying date, clutch size, hatching success, fledging success and breeding success. It was found that egg lying was earlier in small-holed nest boxes and therefore larger clutch sizes because clutch size declines in late clutches. Hatching success was higher in the small-holed nest boxes as well as fledging. However, breeding success in successful pairs had a tendency to be higher in pairs with late clutches and in those nesting in large-holed nest boxes.

McGilvrey, F.B., Uhler, F.M. (1971) A Starling-Deterrent Wood Duck Nest Box. The Journal of Wildlife Management. 35:4; 793-797

The Starling (Sturnus vulgaris) has been identified as a major competitor for nest boxes that are intended for wood ducks. Nesting structures are becoming increasingly popular among conservation authorities as well as private organizations and individuals because of their attempts to encourage an increase in wood duck populations locally. These special waterfowl enhance public enjoyment so as the issue of starlings occupying the wood duck nest boxes increases, the demand of finding a solution grew as well. The objective of this study was to find a nest box that would be used by the wood ducks but not by the starling. An observation was made that wood ducks would tolerate more light than starling, so the research was determined to test that hypothesis, however it was found that the starling were not in fact discouraged by the light entering the boxes. The study then changed the typical vertical design, to a horizontal nest box design. It was found that the starlings were discouraged to adapt to the horizontal nest boxes. It was also found that the best size of entrance hole to use in order to deter starlings was 3 x 4 inches, likely due to it being too large. Wood ducks had no distinct preferences for any shape of nest box or for any size of entrance hole, which made this horizontal design ideal.

Michigan Blue Bird Society. (2015) What You Need To Know About Bluebird Nest Boxes. Michigan Bluebird Society. Retrieved on 2015-10-17 from; http://michiganbluebirds.org/nestbox-basics

Blue Birds are classified as cavity-nesting birds, which means that their natural choice in nesting is some type of hollowed out cavity in a tree. The issue with this nesting preference is the lack of available nesting cavities in the wild due to removal of dead standing trees, and competing species such as house wren and starling populations. This is where the importance of nesting boxes comes in. If its designed to the proper dimensions and placed in a good location, blue birds will respond. Dimensions of the bluebird nesting box should have an entrance hole of 1 ½"in diameter, which is large enough for Eastern Bluebirds, but too small for larger birds like starling. There are no exact preferred dimensions however, as a guideline the floor area should be between 4" by 4" up to 5" by 5". The best types of wood to use for these nest boxes are inset and rot-resistant species like red cedar, and white cedar and should be at least ¾" thick to allow for better insulation. Other features that are important on the design of the nesting box are openings in the bottom of the box to allow for ventilation and water to drain out, as well as a removable panel that allows for cleaning of the bird box after fledglings leave.

Stephens, S. (2014) Wood Duck Boxes: These wooden structures help boost local wood duck populations. Ducks Unlimited. Retrieved on 2015-11-10, from; http://www.ducks.org/conservation/waterfowl-biology/wood-duck-boxes

In Eastern North America, the wood duck was likely the most abundant waterfowl species in pre-colonial times. Unfortunately, due to overharvesting and destruction of bottomland habitats these birds reached the brink of extinction by the early 20th century. The wood duck recovery is largely attributed to the protection provided by the Migratory Bird Treaty Act of 1918, but also by artificial nesting structures, or wood duck nesting boxes. In many areas where wood ducks have difficulty finding suitable natural nesting sites, wood duck boxes provide a man-made alternative, which helps to increase populations in areas where natural cavities are limited. There are several important factors that must also be considered when selecting sites for the nesting boxes such as; suitable brood habitat within a couple hundred yards, shallow, fertile wetlands with an abundance of invertebrates to provide sufficient food, and boxes should be attached to wooden posts with predator guards. Rough-cut, unfinished lumber is the preferred material to construct wood duck nest boxes because they allow ducklings to climb inside of the box with their claws to reach the exit hole. Wood duck boxes provide an excellent opportunity for anyone to become involved in wildlife management, while helping to boost local populations.

The North American Bluebird Society. (2012) Getting Started with Bluebirds. North American Bluebird Society. Retrieved on 2015-11-10, from;http://www.nabluebirdsociety.org/PDF/FAQ/NABS%20factsheet%20-%20Getting%20Started%20-%2024May12%20DRAFT.pdf

Habitat loss for the Eastern Bluebird was compounded with the introduction to North America of two imported species—the European Starling and the House Sparrow. These two non-native species will outcompete bluebirds for natural nesting cavities, as well as chase away or kill them. However, starlings can be excluded from entering nest boxes by using the correct size of entrance hole. This study suggests using a bluebird trail (a series of bluebird boxes placed along a prescribed route) in areas where nesting boxes have been successfully occupied by bluebirds. The design of the bluebird should; be easy to open for monitoring but well ventilated, watertight, and have drainage holes, it should not have a perch because House Sparrows are attracted to them, and should have a entrance hole of 1½ by 1 9/16 , to prevent starling use. A suitable habitat for a bluebird trail will include a fence line, wires, tree branches, and other areas where bluebirds can perch to search for food. Open pastureland, parks away from human traffic, and moved areas such as cemeteries and golf courses are all great locations to implement a bluebird trail. Each nest box should be installed at least 50-200ft away from brushy and heavily wooded areas as this is House Wren habitat, which may destroy bluebird eggs or compete with nest box occupation. Bluebirds generally return to the same areas each year, which make bluebird trails an extremely effective method of re-establishing the bluebird populations across North America

In conclusion, there is plenty of literature available surrounding this topic of breeding bird success in relation to the nest box design and materials used to construct them. Through out the literature there are some very significant ideas that are discussed and proven time and time again such as; wood, woodcrete and sometimes aluminum are the most preferred material to use when constructing a nest boxes, and the entrance hole on the nesting box should be a specific size depending on the species you are aiming to attract. Literature also indicates that the exact design of the bird box is not tremendously important but that research has proven that nesting boxes, which are deep and have a larger interior area tend to be more successful in delivering larger clutch size, higher rate of hatching, a higher rate of fledging and overall more successful breeding. All of this indicates that there is in fact a relationship between bird nest box breeding success and the design and materials used to construct them.

11.11.02 Factors Effecting Eastern Bluebird (*Sialia sialis)* Next Box Efficiency

Bluebirds, like all cavity-nesting species, are limited by availability of suitable nest sites. Eastern Bluebirds have made a significant comeback since the mid-1900s when populations dropped due habitat loss and pesticide use. Their comeback is partly due to the rising number of bird boxes that have been constructed and placed in North America. Many studies have shown that bluebird populations can be increased by placement of nest boxes in suitable habitat. To ensure the continued progress of Eastern Bluebird populations, nest box placement and design needs to be taken into consideration in order to achieve maximum success rates.

Thesis: Eastern Bluebird *(Sialia sialis)* nesting frequency and nesting success rates are affected by factors such as box orientation, contents of box, box material and surrounding habitat.

Davis, W.H., Kalisz, P. J., Wells, R.J. (1994). Eastern Bluebirds Prefer Boxes

Containing Old Nests. *Journal of Field Ornithology,* 65(2), 250-253.

This article examines whether old nests should be removed from nesting boxes at the end of the nesting season. Conducted in Madison County, Kentucky, 50 power poles with boxes on them where bluebirds had nested in 1992 were removed and all boxes were replaced with pairs of boxes. In each pair, one box had nest in it from the previous season and the other one was cleaned out. Boxes with old nests were brought in from another area; therefore bluebirds could not be returning to the box and site where they had nested previously. Boxes were placed in October 1992, and then monitored weekly March through June of 1993. Boxes were checked for eggs and be considered used it had to have a nest and one or more eggs laid. Bluebirds showed a strong preference for boxes containing old nests: eggs were laid in boxes with old nests at 38 locations, and in empty boxes only at three locations.

Herlugson, C.J. (1981). Nest Site Selection in Mountain Bluebirds. *Condor,* 83, 252-255.

This study, conducted in Washington, United states, reviews the nest site selection of Mountain Bluebirds. It was theorized that the natal type of nest site would be important for secondary cavity-nesting species because of the scarcity of natural cavities and that species-specific differences could influence nest site selection. To test this theory, two types of boxes were used: old and new. Old boxes were nesting boxes first erected in 1966 and new boxes were added in each subsequent years. There was 50 old boxes and 30 new boxes available, both type of box was constructed of wood and of the same design. Bluebirds seems to depend primarily on previous successful breeding experience. Bluebirds tended to choose the same box type from year to year even though some successful birds changed breeding territories. Age would seem to influence nest site selection only in relation to previous nesting experience.

Jackson, A., Froneberger, J., & Cristol, D. (2013). Habitat near nest boxes correlated with fate of eastern bluebird fledglings in an urban landscape. *Urban Ecosystems*, 16(2), 367-376.

Eastern bluebirds are often considered an urban conservation success story because their populations have rebounded since the 1970's, largely in part due to rising number of bird boxes in urban environments. This study was conducted to test if the habitat surrounding the bird box impacted Eastern Bluebird fledgling survival. Taking place in Virginia, United States, three habitat types were selected: along wooded recreational trails, at ecotones between forest and field, and in open fields such as cemeteries, pastures and athletic facilities. Monitoring was taken every six days throughout 2008-2009. Fledglings were banded and tracked until battery failure. A death was only concluded if there was evidence of mortality with the recovered band. Surviving fledglings tended to come from nests surrounded by dense forest, little grass, and close trees. These results suggest that bluebirds often nest in artificial cavities far from trees or in sparse stands of mature trees (urban ecosystems), these locations are less favourable for survival of young fledglings because they are prone to increased hawk predation.

Pitts, D.T. (1988). Effects of Nest Box Size on Eastern Bluebird Nests. *Journal of Field Ornithology,* 59 (4), 309-313.

Numerous designs have been published for Eastern Bluebird nest boxes. One aspect of the designs that remains controversial is floor size of nest box. This article investigates the effects of next box size. Conducted in Tennessee, United States, forty boxes were mounted and monitored. In pairs, one box had a floor size of 143cm^2 and the other box 71.5cm^2 (twice the size). Other than size, design and material were identical. Boxes were monitored weekly and adults and fledglings were banded with U.S. Fish and Wildlife service bands. It was found that neither nest box size was preferred. It was found that nests in the larger boxes significantly bigger and taller than in the small nest box.

Navara, K. J., & Anderson, E. M. (2011). Eastern Bluebirds Choose Nest Boxes Based on Box Orientation. *Southeastern Naturalist*, 10(4), 713-720.

For decades researchers have been trying to find the right nest box design, materials, and placement to maximize nesting results. This study looks at the orientation of the nest box to find if this affects Eastern Bluebird box selection. This study was conducted in the state of Georgia, United States. Two sites were selected using the parameters of the ideal habitat of Eastern Bluebirds. The boxes were placed in April 2010 and were monitored daily for nest building and egg laying for 8 weeks until June 2010. A total of 83 boxes were placed, all in random directions ensuring non-biased results. Along with direction, boxes were also classified into non-vegetated areas (plant height <15cm) and vegetated areas (plant height >15cm). It was found that Eastern Bluebirds population occupied nest boxes facing northwest more than any other direction. It was also found that absence or presence of vegetation impacted nest box occupancy (no vegetation: 65% occupancy, vegetation: 21% occupancy). Boxes that were both facing northwest and in the no vegetation class had 100% success rate whereas all other possible combinations only had 51% success rate. It was found that both nest box orientation and the presence of vegetation immediately surrounding the next box are significant predictors of nest box occupancy.

Stanback, M.T., Dervan, A.A. (2001). Within-season Nest-site Fidelity in Eastern Bluebirds: Disentangling Effects of Nest Success and Parasite Avoidance. *The Auk*, 118 (3), 743-745.

In recent studies of Eastern Bluebird nesting habitats there has been two opposing assumptions about nest-site reuse: that birds either prefer or avoid used cavities. It was tested to see if nest box choices in Eastern Bluebirds depends on whether the presence of a previously used (probable parasite-ridden) nest cavity increases or decreases the likelihood of within-season nest box reuse and whether birds prefer previously successful cavities. Taking place in North Carolina, United States, 100 clean woodcrete boxes were erected in pairs in suitable habitat. After breeding season, half of the used boxes were cleaned out and the remounted so that there was clean box and used box in each pair of boxes. This study found that when confronted with the decision of a clean box or a used box, 71% of the birds chose the clean box.

Stanback, M.T., Mercadante, A.N., Cline, E.L., Burke, T.H., & Roth, J.E. (2013). Cavity depth, not experience, determines nest height in eastern bluebirds. *Wilson Journal of Ornithology*, 125(2), 301-306.

This research article examines the factors that are part of Eastern Bluebirds nest size variation and architecture. It was unknown whether recent nest-building experience influences following nest

architecture. By providing Eastern Bluebirds with either deep or shallow nest boxes for their initial nest of the breeding season, it was tested whether the height of their subsequent nest in the same breeding season reflected the height of their initial nest or whether they built nests to match their current nest cavity regardless of their previous nest height. Field work was conducted North Carolina, United States, with over one hundred monitoring boxes. The sample consisted of 40 boxes that were shallow in spring and deep in summer and 84 boxes that were deep in both spring and summer. It was concluded that cavity depth, not nest building experience determines the nest height.

Stanback, M.T., Rockwell, E.K. (2003). Nest-Site Fidelity in Eastern Bluebirds (Sialia sialis) Depends on the Quality of Alternative Cavities. *The Auk*, 120 (4), 1029-1032.

Secondary cavity nesting birds such as the Eastern Bluebird have been known to switch nesting location when the quality of the site has deteriorated from factors such as: soiled nest materials and parasites. In this study, it was hypothesized that nest-site switching not only depends on quality of original nest but as well on alternative nesting cavities. Taking place in North Carolina, United States, one hundred boxes were mounted. Monitoring was first done on the type of preferred box. Boxes made out of woodcrete (sawdust and concrete) and plain wood boxes. It was found that the woodcrete boxes were greatly favoured. Boxes were mounted in pairs, a soiled box and a cleaned out box; facing the same direction and 1 metre apart. It was found that 32 out of the 45 pairs switched to the clean, unused box. When faced with option of a soiled woodcrete box or the option of a clean less preferred box, the soiled box was chosen. This coincides with the notion that a successful nest box depends on not only cleanliness but quality of box as well.

Svatora, S., Shamnir, L. (2012). Improving Eastern Bluebird nest box performance using computer analysis of satellite images. *Computational Ecology and Software*, 2(2), 96-102.

This study focused on finding the characteristics that effect nesting box preference among Eastern Bluebirds in the United States using satellite images. Understanding how and why a bluebird selects its nesting location is important for increasing box usage and population. The study was based on nesting boxes placed and maintained by Cornell Lab of Ornithology NestWatch project by Oakland County Parks and Recreation in Michigan. Geographical data and nesting season monitoring data for 2010 from the 124 boxes was provided by the NestWatch project and was used as factors in the study. Using satellites from Google Maps, tests were carried out using code that was written to detect and measure edge directionality of the boxes. In the study it was found that the edge directionality measured in satellite images can be used to predict the effectiveness of bluebird nest box placement. The results suggest that bluebirds use a certain visual pattern found in the landscape around the boxes to determine whether to use the sites for nesting or not. In addition to this, placing boxes the appropriate distance apart to avoid territorial disturbances as well as grouping them into pairs, and analyzing the directional representation of the surrounding landscape could lead to increased occupancy.

Eastern Bluebird nest box site preference is decided on various factors. Through the literature consulted, it was found that Eastern Bluebirds favour nest boxes placed in low, open vegetation habitats; such as fields or meadows. It is known that ectoparasites, including fleas, lice, mites, and

blowfly larvae, are known to reside in the nests of Eastern Bluebirds. Bluebirds do not remove old nest material from cavities, but simply build over an existing nest. Birds may prefer to reuse successful cavities either because construction of a new nest may constitute a significant time and energy cost, because successful cavities are more valuable than untested sites or simply because suitable nest cavities are rare. When given the opportunity, Bluebirds will opt for a clean nest box versus a soiled one. To achieve maximum success rates among nest boxes it is best to place in open vegetation habitat, clean after breeding season and use a preferred building material (woodcrete).

11.11.03 Optimizing Bird Nesting Box Success While Balancing Human Interaction

Cavity-nesting birds such as eastern bluebirds, tree swallows, and wood ducks have experienced declines in their populations due to the loss of habitat, specifically the loss of standing dead trees (snags) which they use for nesting. The construction and installation of nest boxes is a way to help reverse this decline.

Thesis: This literature review explores some of the factors to be considered related to the placement of nest-boxes so that reproductive success of cavity-nesting birds can be optimized.

Ardia, D.R., Perez, J.H., and Clotfelter, E.D. (2006). Nest box orientation affects internal temperature and nest site selection by Tree Swallows. *Journal of Field Ornithology* 77(3), 339-344.

Ardia et al. measured the temperatures of tree swallow nest boxes oriented in different directions to determine what effects orientation might have on both nest box temperature during incubation and selection of nest boxes. The breeding season was divided in half between early-nesting birds (before June 1) and late-nesting birds (after June 1). During the first half of the breeding season tree swallows preferred nest boxes that were oriented towards the east and south, which were warmer in the morning hours than those oriented north and west. Nest box selection during the second half of the breeding season was based solely on availability. The authors suggest that warmer nest-box temperatures during the first half of the breeding season are beneficial for Tree Swallows.

Hussell, David J.T. (2012). The influence of food abundance on nest-box **occupancy and territory size in the** tree swallow**, a species that does not defend a feeding territory. *The Condor* 114(3), 595-606.**

Territory size and food abundance are often inversely related for bird species. Food abundance is not a determinant of territory size for tree swallows though, since they only defend their nest sites, not their food supply. The author of this paper studied tree swallow occupancy rates at nest boxes spaced 24 metres apart and occupancy rates at nest boxes spaced 3 metres apart, and measured insect abundance at both site types. The nest boxes spaced 24 metres apart (beyond the normal range of territorial defense) had high occupancy rates of 75-100% while the nest boxes spaced 3 metres apart had occupancy

rates of 25-100%. Because occupancy at both site types showed a positive correlation with insect abundance, and because tree swallows do not defend food resources, it was concluded that "food abundance acts indirectly on occupancy and territory size by influencing the level of competitive pressure for nest boxes".

Jackson, A., Froneberger, J., and Cristol, D. (2013). Habitat near nest boxes correlated with fate of eastern bluebird fledglings in an urban landscape. *Urban Ecosystems* 16(2), 367-376.

Jackson et al. studied how the habitat surrounding nest boxes may influence post-fledgling survival of eastern bluebirds. The vegetation surrounding nest boxes was compared between sites which produced successful fledglings and sites at which fledglings were preyed upon by hawks. The sites that were close to trees, had high forest density and canopy cover, and little grass proved to result in a significantly higher survival rate of fledglings. This is because fledglings are weak flyers and rely on dense vegetation to hide from predators such as hawks. 156 fledglings from 473 nesting attempts were tracked. 21 instances of predation from both accipter (eg. coopers hawk) and buteo (eg. red-tailed hawk) hawks were recorded within 10 days of fledging. Although hawk predation was the leading cause of death of fledglings, there were also instances of snake predation and window strikes.

Male, S.K., Jones, J., and Robertson, R.J. (2006). Effects of nest-box density on the behaviour of tree swallows during nest building. *Journal of Field Ornithology* 77(1), 61-66.

In this study the authors compared areas of high-density nest boxes with those of low-density nest boxes to determine the impact nesting density has on conspecific interactions and nest-building effort among populations of Tree Swallows, and whether any differences in behaviour would affect nest quality and reproductive success. They found that although there was an increase in the frequency of behavioural interactions in areas of high density nesting, there was no difference in either reproductive success or nest quality between high and low-density nesting areas. In this study, the higher density area was double the density of the other area. The authors noted that other studies have shown reproductive success to be negatively affected by higher density when the density was 3 to 8 times greater. Limited food resources during fledgling was the cause for such effect at higher densities.

Navarra, K.J., and Anderson, E.M. (2011). Eastern bluebirds choose nest boxes based on box orientation. *Southeastern Naturalist* 10(4), 713-720.

The authors of this study tested the effects of vegetation height and nest box orientation (facing southeast, southwest, northwest, or northeast) on nest box occupancy of eastern bluebirds. Northwest facing nest boxes were preferred (68% occupancy versus 34%

occupancy for all other directions). The authors note that a previous study in Michigan indicated preference for nest boxes that faced southeast, and the different findings may be due to latitude since this study was conducted in Georgia. A southeast facing box may be advantageous for egg incubation temperature in northern climates, while a northwest facing box may be advantageous in southern climates. The bluebirds also preferred nest boxes surrounded by little or no vegetation (65% occupancy) compared to nest boxes surrounded by high vegetation (21% occupancy). This is likely due to increased ease of spotting food from a perch and then obtaining that food with minimal exposure to predators such as snakes.

Remach, Carolina., and Delgado, Juan Antonio. (2009). Spatial nest box selection of cavity-nesting bird species in response to proximity of recreational infrastructure. *Landscape and Urban Planning* 93(1), 46-53.

The authors studied the spatial influence on cavity-nesting birds (primarily tree swallows, great tits, and house sparrows) resulting from proximity to buildings and recreational trails. It was found that nest boxes closer to buildings were more likely to be used by house sparrows than by great tits or tree swallows, and that proximity to buildings was more significant of a variable than was proximity to trails. It was believed that this is due to the different tolerance levels to human disturbance between species. Habitat structure and edge effects on bird distribution were statistically controlled for through the use of Generalized Linear Models.

Rendell, W.B., and Robertson, R.J. (1990). Influence of forest edge on nest-site selection by tree swallows. *The Wilson Bulletin* 102(4), 634-644.

Rendell and Robertson examined how close to forest edges cavity-nesting tree swallows, eastern bluebirds and house wrens preferred to nest. House wrens and most bluebirds used nest boxes within 30 metres of the forest edge but tree swallows nested anywhere from 3 metres to 100 metres away from the forest edge. The median distance away from the edge was greater for tree swallows than for both bluebirds and house wrens. Tree swallows also selected nest boxes further away from the edge when they were given a choice between one closer and one further away. It is believed that tree swallows choose nest boxes further away in order to avoid nest box competition with both house wrens and bluebirds. House wrens were also observed to destroy tree swallow eggs and usurp their nest boxes within 20 metres of the forest edge. The paper also mentions the influence which the height of the box has on reproductive success; lower boxes increase the chance of predation.

Semel, Brad., and Sherman, P.W. (1995). Alternative placement strategies for wood duck nest boxes. *Wildlife Society Bulletin* 23(3), 463-472.

This study, conducted over a period of three years, demonstrated a connection between wood duck nest box placement and brood parasitism. One group of nest boxes were

placed in a visible area over open water while another group of nest boxes were placed in a less conspicuous area hidden by trees. Reproductive success was greatest for the less visible nest boxes where there was a lower degree of nest parasitism. The hatching of eggs is reduced when nest parasitism occurs.

Svatora, Sarah., and Shamir, Lior. (2012). Improving eastern bluebird nest box performance using computer analysis of satellite images. *Computational Ecology and Software* 2(2), 96-103.

Svatora and Shamir analyzed Google Earth satellite images to see if they could find a correlation between bluebird nest site preferences and the edge directionality measured in the satellite images. A strong correlation was found and they were able to predict, with an accuracy of 74% (a 48% improvement over prediction without the use of satellite images) whether a given nest box would be nested in. The authors contend that the correlation between bluebird nesting and the visual content of the satellite imagery is due to the fact that birds are visually sensitive, and that the bluebirds use the same visual information for nest-site selection that is contained in the satellite images.

Conclusion: Various factors related to the placement of nest-boxes can affect the reproductive success of cavity-nesting birds. These factors include proximity to buildings, proximity to forest edge, surrounding vegetation type, nest box density, nest box orientation, and visibility (for Wood Duck nest boxes). These factors, and certainly others, are important considerations when deciding the placement of nest boxes for cavity-nesting birds.

11.11.04 The Relationship Between Rice Fields and Bird Species

Rice fields, both wild and cultivated, exist in numerous locations worldwide and have been known to provide habitats for many different bird species. As a habitat rice fields provide important resources for bird species including food, plant cover as well as areas for nesting. The use by diverse landbird and waterbird species makes rice fields an area of great interest when considering conservation and monitoring areas of importance. Cultivated rice fields offer both human benefit (food) and natural benefit by providing habitat for many bird species. Wild rice fields offer a natural habitat for bird species and provide a vast amount of habitat for successful nesting of bird species, including endangered and species at risk thus these are very important areas to study.

Thesis: Wild rice fields are a key habitat and food source for bird species and require conservation and monitoring to insure they remain viable and healthy for usage.

Acosta, M., Mugica, L., Blanco, D., López-Lanús, B., Dias, R., Doodnath, L., & Hurtado, J. (2010). Birds of Rice Fields in the Americas. *Waterbirds, 33*(1), 105-122. doi:10.1675/063.033.s108

This article examines bird species use and frequency within rice fields throughout the Americas. The study found rice fields were used by a large amount of diverse bird species within the study

area. Rice fields are an important area of habitat for both waterbird and landbird species. There were 54 different landbird species and 44 waterbird species recorded in rice fields in the in the United State alone. Waterbirds were found to use rice fields for foraging and resting during migration and use was greatest during the first and last stages of rice growth. There is an association between migratory birds and rice fields; this is because of the constant supply of resources by rice fields in both summer and winter to bird species. Several threatened and endangered bird species were found to use rice fields frequently, making them an important area for monitoring and conservation.

Durham, R., & Afton, A. (2006). Breeding Biology of Mottled Ducks on Agricultural Lands in Southwestern Louisiana. *Southeastern Naturalist, 5*(2), 311-316. Retrieved October 10, 2015, from http://www.rnr.lsu.edu/people/afton/PubPDFs/SE Nat 5_311-316.pdf

This article discusses the nesting location success for Mottled Duck in North America and specifically the success of nesting in rice fields. It was found that eggs were not laid until rice fields had been flooded in spring, most likely due to the lack of loaf and feed in the area before flooding. Yearly clutch sizes (eggs laid in a single nest) were average numbers for the species, however there were fewer 'high clutch numbers' (less clutches with a higher than average number of eggs) reported. The reasoning for a lower number of eggs produced per clutch could be due to the fact of a later laying time because ducks waited until the rice fields were flooded or because there was less food available to ducks due to human harvest instead of an natural amount in wild rice fields. It was concluded that there is a correlation between rice cultivation and duck nesting in these areas, where as ducks use these areas for nesting however they are often slightly more successful at nesting in natural rice fields thus increasing the importance of natural rice fields and the protection of theses areas.

Elphick, C. (2000). Functional Equivalency between Rice Fields and Seminatural Wetland Habitats. *Cinservation Biology, 14*(1), 181-191. Retrieved October 9, 2015, from BioOne.

This article compares bird species behavior in wild rice fields (and other natural wetlands) with cultivated rice fields. It was hypothesized that food abundance, perceived predation threat and feeding performance would not be different in the two habitats. Food abundance was found to be no different in the two habitats. Predators were found to be slightly less abundant in natural rice fields as there was more cover available to pray bird species. There was also no difference found in feeding performance within natural rice fields and cultivated rice fields. Cultivated fields were found to have a lower habitat quality because there is not as much varying water depth; there is less surrounding vegetation and a lower nutrient input. This study concluded that there is only a slight difference between bird species behavior in wild rice field and cultivated rice fields, meaning that so long as cultivated rice fields are harvested correctly (as to follow rules and regulations of the areas ie. Proper flooding of rice fields) bird species can co-exist in cultivated areas.

Elphick, C., Baicich, P., Parsons, K., Fasola, M., & Mugica, L. (2010). The

Future for Research on Waterbirds in Rice Fields. ***Waterbirds,*** **(33), 231-243. http://dx.doi.org/10.1675/063.033.s117**

This article examines the connection between rice production and the conservation of birds. It was found that there have been a high number of birds in a wide diversity of species using and benefiting from rice fields worldwide. In some of these areas rice fields have been found to be an important resource to birds and the area has become protected and monitored. Many of the birds utilizing rice fields have been found to be endangered species and the production of rice has been found to help sustain remaining populations of bird species. Research has also found however, that natural habitat being used for rice cultivation can negatively impacted bird populations depending on species and habitat. It was found that rice fields main use to birds was for forging habitat however water depth within fields has a large impact on a species uses of such habitat. Though more research is needed it was found that rice fields were also used for breeding. Success of breeding it is believed to vary depended on the species usage within the rice fields. Harvest methods by humans have been found to have both negative and positive impacts on bird populations, as it is dependent on the method used and the adaptability of the species to such routines. In some pest deterring methods such as random shot firing (firing a gun to make a loud noise) has been known to cause stress on bird health within the area. Some species have been able to adapt to seeding and harvest schedules and adapt their cycles into those. Birds have also been found to offer important benefits to rice fields including aiding nutrient cycles and acting as pest control.

Gertzbein, J. (2000). Ecological Relationships and the Impacts of Wild Rice

on Fish and Wildlife Species. ***Community Opportunities Fund & Canada Wild Rice Council,*** **1-49. Retrieved September 25, 2015, from http://www.manitobamodelforest.net**

In summary this article investigates the relationship of wildlife (including birds and waterfowl) and wild rice as well as legislation and regulations governing wild rice cultivation in wild rice growing portions of central North America. It was found that many different types of waterfowl including many different duck and geese species use wild rice as a food source. Wild rice is consumed by waterfowl species during all stages of the rice growth, and certain parts of the rice like the kernel are available to ducks all year round. In some species of waterfowl it was found that wild rice was the preferred type of food so much so that when its fruit is ripe it will be eaten and other food types will be excluded from waterfowl diet. It was found that wild rice harvest by humans can have a positive impact on waterfowl because canoe movement can open up more channels for birds to get into allowing more access for non-diving birds. It was also found that wild rice allows the cultivation of other food sources for waterfowl including crustaceans and insects. Wild rice also provides resting places during migration, breeding grounds as well as protection and cover for young waterfowl. Waterfowl may be able to have an impact on the success of wild rice crop and the spread of seeds elsewhere during seeding though more research is needed. It was also found that waterfowl populations are abundant in areas where there is a high amount of wild rice. Shorebirds and wading birds have also been found to inhabit wild rice fields using them as forging and nesting areas in the summer. Sparrows and bobolinks are among species which can be found in wild rice fields and they eat ripening and matured seeds off the plant. Blackbirds are also noted as common birds found in wild rice fields, they tend to arrive in August and September and consume ripening grain. Due to blackbirds consuming wild rice in

high quantities they can tend to make the establishment of new wild rice fields difficult as well as causing crop loss to humans, blackbirds however are not yet viewed as a threat on wild rice populations.

Kreitinger, K. (2013). Wisconsin All-Bird Conservation Plan – Wild Rice.

Retrieved October 10, 2015, from

http://www.wisconsinbirds.org/plan/habitats/WildRice.htm

This webpage discusses wild rice habitat and its importance to bird species. Wild rice is a valuable resource to birds as it provides food, cover and lofting sites for various species, thus making wild rice habitat one of the most important food sources for waterfowl in North America. Wild rice seeding in the fall coincides with fall migrations, and can provided stopover habitat during migration. Many different parts of the wild rice plats are consumed by varying bird species; geese and swans consume the young shoots of wild rice and wood duck eat the flowers, steams, leaves and germinating seeds. Wild Rice fields also provide habitat for prey to predatory bird species (ie. small fish, frogs) thus making it a favorable habitat for predatory bird species as well. The webpage also includes plans for conservation of important wild rice fields in the local area which can be used in many other wild rice habitats to preserve and protect the habitat and thus provide am important habitat to the many bird species. Some of these plans include; implementation of a monitoring program, evaluate the impacts of climate change on wild rice fields and the study of seed dispersal of wild rice.

Miller, M., & Reinecke, D. (2009). Wildlife Values of North American Ricelands.

***US Geological Survey*. Retrieved October 9, 2015, from**

http://www.werc.usgs.gov/oldsitedata1/pubbriefs/millerpbfeb2009.pdf

This article discusses why birds are found in rice fields and why is so important to sustain bird populations. Birds use rice fields as a source of food during all seasons. Wild rice lands provide important waterbird habitat in many areas in the US during all seasons as well as a large value to breeding birds in terms of food and cover. Wild rice land management was examined and stated to be an important factor to bird conservation as well as the two went hand and hand, a healthy wild rice habitat will provide and sustain many diverse bird populations. Wild rice lands are facing increasing threats from urbanization, over harvesting by humans, and eradication of wild rice lands by humans because rice is a nuisance to residents. This destruction of natural wild rice lands is thus having a large impact on local bird populations and increases the need for wild rice land conservation, monitoring and protection. In conclusion the wild rice lands are an important habitat to many different bird species and the health and success of the habitat greatly impacts the health and success of the bird species found within the habitat.

Mincey, H. (n.d.). Foraging Behavior and Success of Herons and Egrets in

Natural and Artifical Wetlands. *Eletronic Theses & Dissertations*.

Retrieved October 10, 2015, from

http://digitalcommons.georgiasouthern.edu/cgi/viewcontent.cgi?article=17

03&context=etd

This article discusses whether or not man-made (restored) wetlands are used successfully by herons and egrets when compared to natural wetlands in the US. Cultivated rice plantations have been impounded and have been restored to 'wild rice fields', however these areas still experience controlled flooding like cultivated rice fields thus impacting the bird species in the area. It was noted that with restoration there has been an increase of food and cover plants available to waterfowl allowing for more success in waterfowl reclamation of the area. The article found that nesting success for herons and egrets was detrimental on having very little disturbances during nesting, which is less successful in cultivated rice fields thus there was an increase of nesting success in reclaimed wild rice lands. There was also more success in food availability for herons and egrets in the reclaimed wild rice fields than that in cultivated areas thus making the reclaimed areas favorable for the bird species. In conclusion herons and egrets used the restored rice fields successfully because of the increase of cover plants and food available.

Pierluissi, S. (2009). Breeding Waterbirds in Rice Fields: A Global Review.

***Waterbirds,* (33), 123-132. http://dx.doi.org/10.1675/063.033.s109**

This article discusses the relationship between rice fields and bird populations worldwide mainly focusing on nesting success in these areas. It was found that areas with rice cultivation often share similarities with wetland habitats which are in depletion worldwide, thus rice fields have become much more suitable for breeding sites. Conditions for breeding require vegetation, water and a crop that is tall enough for young to hatch and fledge. There are many different uses breeding water birds have for rice fields which have been divided into 5 categories to aid in studying the importance of rice fields to birds. These categories are; 1) nesting in the standing rice crop, 2) nesting on levees within fields or at field's perimeter, 3) nesting in associated irrigation channels and ditches, 4) nesting in other wet areas that exist because of rice cultivation, and 5) foraging in rice fields while nesting in adjacent habitats. Within the study it was found that the outcomes ranged greatly. It was also found that when conditions were favorable some species breed later than they would in other wetland habitats due to the time in which rice is tall enough to build nests. Birds in the family Rallidae appeared to commonly nest and be successful in rice, these birds also have a relatively impactful relationship on rice, as they do not damage the rice in their presence. Cranes and herons tend to use rice fields differently than other birds depending on how much wetland is remaining in surrounding habitats. It was also found that the more interaction humans had with rice fields the less nest success there was.

In conclusion rice fields are important areas to monitor and protect because they offer valuable habitat for many different bird species. Though cultivated rice fields offer many resource for bird species wild rice fields are much more effective areas for bird species. In wild rice habitats nesting success, food availability and plant coverage are all more abundant and offer more chances for successful bird populations. Healthy rice habitat and healthy bird populations go hand in hand. By implementing monitoring protocol and conservation within wild rice areas bird habitat and populations will also be protected and able to thrive.

11.12 Invoice

Invoice				
Quantity	Item	Unit Price	Total	Paid
2	Rough Pine Board	$11.50	$23.00	Y
11	1x6x8 Cedar Board	$8.88	$97.68	Y
2.61lb	2” Galvanized Nails	$3.49/lb	$9.11	Y
1.3lb	2” Wood Screws	$5.99/lb	$8.15	Y
1	Hammer	$9.99	$9.99	Y
2	Hinges	$3.39/2	$6.78	Y
1	Metal Piping	$9.37	$9.37	N
250 Pages	Printing	$.10/page	$25.00	N
38 km	Travel-Rebecca	$.50/km	$19.00	N
12.7 km	Travel-Sarah	$.50/km	$6.35	N
91.3 km	Travel-Peter	$.50/km	$45.65	N
		Subtotal	$260.08	
		Total Outstanding	$105.37	

11.13 Video Consent Forms

Fleming College

LEARN | BELONG | BECOME

CONSENT FORM

NAME: _____

ADDRESS: _____

TELEPHONE: _____ **E-MAIL ADDRESS:** _____

PROGRAM/YEAR: _____

Pursuant to section 39(2) of the Freedom of Information and Protection of Privacy Act,

I, _____ hereby consent to:

1) the use of personal information obtained during this interview, and

2) the use of any supplemental personal information pertaining to the initial interview which may be needed by the College at a later date; and

3) the use of any photographs or videotape taken by College personnel or by individuals contracted by the College for such purpose.

I understand that my personal information will be used for promotional purposes which includes College publications, broadcasts, website and / or use by the public media when that media requires my information in connection with the printing / broadcasting / web posting of College-related publicity.

The legal authority for the collection of this information is the Ministry of Colleges and Universities Act. R.S.O. 1980, C.272

Date: _____ **Signed:** _____

Questions about this collection should be directed to:

Lori Humphrey

Fleming College

Marketing Consultant

599 Brealey Drive, Peterborough, ON K9J 7B1

(705) 749-5530 – Fax (705) 749-5514

E-mail: lhumphre@flemingc.on.ca

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