Saskatchewan Mining Association: GeoRobotics

Fly Away Birdy Challenge

Grade Level	**Target Grade 7-12** Adaptable Enviro Sci 20, Earth Sci 30, Comp Sci 20/30, Robotics & Automation and other PAA courses (i.e., Wildlife Management, Energy & Mines, etc.).	**Difficulty**	Intermediate
Subject	Science, Practical and Applied Arts, ELA, Mathematics & Career Ed.		
Description	The purpose of the "GeoRobotics" project is to help learners explore real applications of robotics and innovation in the mining industry with respect to making the workplace safer, environmental protection, and career opportunities. Each project or challenge is divided into several SaskCode activities. By completing these activities, learners will be given the knowledge and skills to design, build, and program their own bird alarm using a combination of light, sound, and motion. For the class challenge, learners create a bird deterrence system for a mock tailing pond by using all of the bird alarms together.		
Outcome(s)	**PAA Robotics and Automation 10,20,30** ROBA7A, ROBA7B, ROBA10, ROBA12A, ROBA13B, ROBA14B, ROBA21, ROBA23A, ROBA28A **Life Science:** **IE7.2** Observe, illustrate, and analyze living organisms within local ecosystems as part of interconnected food webs, populations, and communities. **IE7.4** Analyze how ecosystems change in response to natural and human influences, and propose actions to reduce the impact of human behavior on a specific ecosystem. **Earth and Space Science:** **EC7.2** Identify locations and processes used to extract Earth's geological resources and examine the impacts of those locations and processes on society and the environment. **WS8.1** Analyze the impact of natural and human-induced changes to the characteristics and distribution of water in local, regional, and national ecosystems. **WS8.3** Analyze natural factors and human practices that affect productivity and species distribution in marine and freshwater environments. **Physical Science:** **MS7.2** Investigate methods of separating the components of mechanical mixtures and solutions, and analyze the impact of industrial and agricultural applications of those methods. **OP8.3** Compare the nature and properties of human vision with optical devices and vision in other living organisms. **OP8.4** Evaluate the impact of electromagnetic radiation-based technologies on self and community. **CE9.1** Demonstrate and analyze characteristics of static electric charge and current electricity.		

	CE9.2 Analyze the relationships that exist among voltage, current, and resistance in series and parallel circuits. **Math: Shape & Space** **SS7.1** Demonstrate an understanding of circles (circumference and central angles). **SS7.3** Demonstrate an understanding of 2-D relationships involving lines and angles. **SP7.1** Demonstrate an understanding of the measures of central tendency and range for sets of data. **ELA Comprehend & Respond** **CR7.7 & CR8.7** Read independently and demonstrate comprehension of a variety of specialized information texts… **CC7.6 & CR8.6** Use oral language to interact purposefully and appropriately with others in pairs, small groups, and large group situations… **Career Education** **Connections to Community - CC7.1** Reflect on and express insights about how knowledge and skills learned in school transfer to one's future life and work. **Connections to Community – CC8.1** Examine how a disposition for lifelong learning connects to potential career pathways. **Life and Work Plan - LW7.1** Investigate and demonstrate the personal qualities and abilities needed to seek, obtain, or create work. **Life and Work Plan - LW8.1** Compare skills taxonomies such as Essential Skills and Employability Skills and examine how an individual's skills may influence possible future occupational choices.
SaskCode Required Prior Learning	Downloading Programs for Arduino Projects Activity - Creating Functions with RGB LED's (Goal - Program a RGB LED light using Functions) Activity – Making Music (Goal – Make sound using Piezo Speaker. Do not need a Potentiometer). Activity – Servo Motors (Goal – Create a predator or scarecrow that moves. Do not need a Potentiometer. Instead, use "coding and angles") Activity - Distance Sensor (ultrasonic sensor) - with RGB functions (Goal – wire a distance sensor that will light a LED when it "sees" something.
Time Frame	± 5 hours, depending on experience
Materials	SaskCode Arduino Classroom Kit of 15, a computer for each group, student handouts/journals, supplies to make a mini scarecrow or predator (scissors, paper, tape, paperclips, etc.), a bird stuffed animal and a mock pond made out of tape or cut out of fabric.
Additional Resources	https://www.saskcode.ca/ - SaskCode website http://saskmining.ca/ - Saskatchewan Mining Association website
Assessment	Circulate the room observing and assisting. Encourage learners to record their learning in their "Design Journal." Setup clear expectations surrounding their "Design Journals." You may want to create a rubric, checklist or specific questions that learners should be answering within the journals. Also, at the end of each class have learners share their learning, errors and successes while reinforcing the importance of persistence and patience in programming.

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Fly Away Birdy Challenge

Getting Started

1. Complete the **Basic Training** in order to learn how to use Arduinos and necessary components
2. **Engage:** Review the "Voice for Thought" materials and "Career Cards" with learners according to your own teaching preference. The laminated Career Cards will be used within the groups.
3. **Part 1**: Introduce the design challenge to groups. Groups will design, build and code a motion activated alarm to scare away birds using a combination of light, sound, and motion. Students may focus on one component or challenge themselves with multiple components. (Teacher Answer key:)
4. **Part 2**: After completing the bird alarm, learner groups will collaborate as an entire class. The **Fly Away Birdy Challenge** is for learners to use the creations they have already made (light, sound, motion) to scare away birds from a mock pond.

Basic Arduino Training - Suggested Sequencing (10 hours)

Activity - Name, notes	Time (approx)
Downloading Programs for Arduino ○ Review for information on downloading code, safety, breadboards, etc.	30 minutes
Activity - Creating Functions with RGB LED's ○ Goal - Program a RGB LED light using Functions	1 hour
Activity – Making Music ○ Goal - Make sound using a piezo speaker. No potentiometer needed	1 hour
Activity – Servo Motors ○ Goal - Create a predator or scarecrow that moves. Do not need a potentiometer. Instead use 'coding and angles'	1 hour
Activity - Distance Sensor (ultrasonic sensor) ○ Goal - wire a distance sensor that will light a LED when it 'sees' something.	1.5 hours
Design Challenge - Fly Away Birdie ○ Design, build and program a bird deterrence device that uses sound, light and motion. ○ Teacher Answer key:) ○ Collaborate with other groups to build a bird deterrence system to provide coverage over a mock tailings pond.	1 - 2 hours

Teacher Considerations

Paired Programming: Divide learners into groups of 2 - 4 (**Paired Programming**) depending on comfort level. Paired programming is highly recommended when working with coding and robotics so that students can piggyback off each other's ideas and strengths. Have students collaborate ideas to encourage teamwork, build resilience and enhance problem solving. It is possible to use several Arduino's within each group to allow for more hands-on learning and collaboration.

Design Journal: Have each group communicate what they worked on, the problems that they encounter and how they solve these problems in a journal. Some ideas for the Design Journal are included.

Career Cards: Laminated career cards have been included in the classroom kits. Distribute each type of career amongst groups and discuss their strengths in order to divide up roles. Let students know that they are not stuck within the roles they pick. Students should be helping each other out and have the flexibility to try different roles.

MATERIALS:

Individual Groups (2 to 4): one or more Arduino kits with battery adaptors and batteries, computer, set of Career Cards

Classroom Supplies: mock pond (tape to mark the outline, or paper cutout), meter sticks / rulers, scissors, an object to represent a bird.

PREPARATION: Create a mock pond by either marking out an area with tape, or cutting out paper. You can create a pond in any shape. The simplest shape would likely be a circle with a radius of 200 cm. However, you can create a much larger shape to increase the challenge. The meterstick, ruler, string, and scissors are meant to help you create your shape. Also, consider how you will portray the **bird**. Are you carrying the bird or pretending to be a bird? If so, you will want to make your pond bigger because it is detecting you. Are you tying multiple strings around the stuffed bird animal and having it "fly by"? Lastly, you can use the **battery adapters** so projects can be moved easily without computers.

Design Challenge:

Part 1: Student groups will build a bird deterrent device that uses a combination of sound, light and motion to frighten birds.
Part 2: Collaborate as a class to use all of your alarms to create a bird deterrence system that prevents birds from landing on the mock pond. To increase the challenge … In order to scare the bird away from landing on the pond at least three alarms have to be activated. You have "x" amount of tries to "perfect" the design.

GUIDANCE IF NEEDED

- Learners will need to develop a way to collaborate in their groups and as an entire class. You might need to offer guidance. Perhaps select "leaders" to guide a discussion, have a talking circle, use a "talking stick" or brainstorm ideas on the classroom board with a vote. Let learners use the classroom board to draw out a design or write ideas as they brainstorm.

- Learners can also increase the max range of the ultrasonic sensor up to 400 cm.
- They may use a combination of meter sticks, rulers, protractors, etc. to plan the spacing and to figure out what area of the pond is protected or not protected.
- Learners can put alarms on the pond, around the pond, and even further away around the pond. Learners may try to angle their ultrasonic sensor upwards.
- After each try, have learners discuss and reflect. What are the limitations to the design? What are the real-life consequences?

Questions for Design Journal:

- What was your goal during this class time? Describe the progress you made towards your goal? What did you do or not do?

- What problems did you encounter and how did your team solve these problems? Create a flowchart to represent the problems you encountered and the steps or different approaches on how you solved them.

- Describe & Draw in detail what the code is instructing the Arduino to do.

- Explain why the alarm you created would work best for scaring birds away. What did you take into consideration? What are some limitations?

- What do the different blocks of code do?
  - What happens when you change the number for the frequency? Create a definition for frequency.
  - What does timing block delay do? What would happen if you change the number?

- How far can the ultrasonic sensor reach in distance? What is the max angle the ultrasonic sensor can detect an object at? Try altering the code so the alarm goes off from much farther or closer distances. What do you have to change in the code to do this?

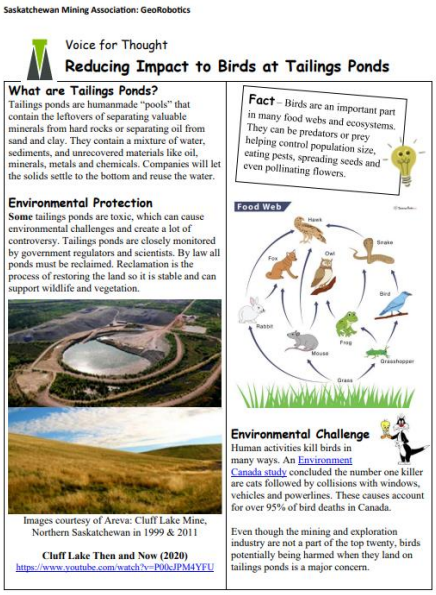
- Give 3 examples of a thing (alive or technology) which uses ultrasonic to detect objects.

- Brainstorm real life applications that coding lights, sounds, or motions have in our everyday lives.

- How might a declining bird population change the ecosystem and food chain? Explain if there would be more of an impact depending on the species of bird.

Review

- ***Voice for Thought* and Career Cards**
  Cluff Lake Then and Now (2020)



Saskatchewan Mining Association: GeoRobotics

Voice for Thought

Reducing Impact to Birds at Tailings Ponds

What are Tailings Ponds?

Tailings ponds are humanmade "pools" that contain the leftovers of separating valuable minerals from hard rocks or separating oil from sand and clay. They contain a mixture of water, sediments, and unrecovered materials like oil, minerals, metals and chemicals. Companies will let the solids settle to the bottom and reuse the water.

Environmental Protection

Some tailings ponds are toxic, which can cause environmental challenges and create a lot of controversy. Tailings ponds are closely monitored by government regulators and scientists. By law all ponds must be reclaimed. Reclamation is the process of restoring the land so it is stable and can support wildlife and vegetation.

Images courtesy of Areva: Cluff Lake Mine, Northern Saskatchewan in 1999 & 2011

Cluff Lake Then and Now (2020)
https://www.youtube.com/watch?v=P00cJPM4YFU

Fact – Birds are an important part in many food webs and ecosystems. They can be predators or prey helping control population size, eating pests, spreading seeds and even pollinating flowers.

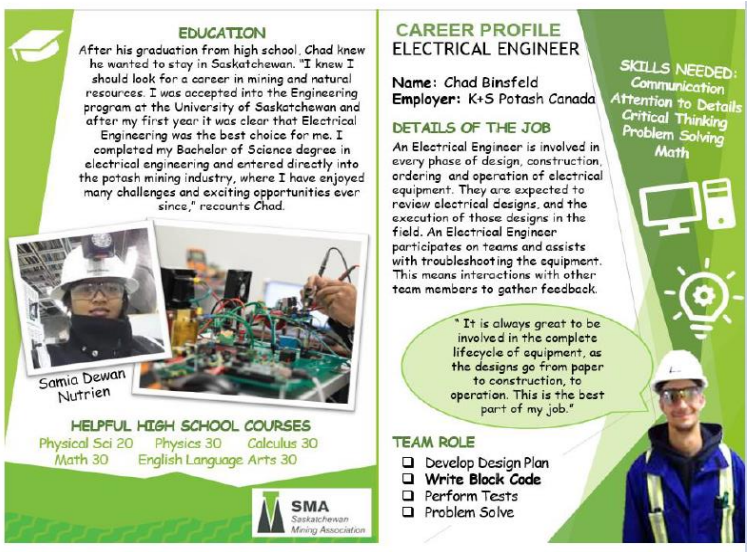
Food Web

Hawk, Snake, Fox, Owl, Bird, Rabbit, Frog, Mouse, Grasshopper, Grass

Environmental Challenge

Human activities kill birds in many ways. An Environment Canada study concluded the number one killer are cats followed by collisions with windows, vehicles and powerlines. These causes account for over 95% of bird deaths in Canada.

Even though the mining and exploration industry are not a part of the top twenty, birds potentially being harmed when they land on tailings ponds is a major concern.



EDUCATION

After his graduation from high school, Chad knew he wanted to stay in Saskatchewan. "I knew I should look for a career in mining and natural resources. I was accepted into the Engineering program at the University of Saskatchewan and after my first year it was clear that Electrical Engineering was the best choice for me. I completed my Bachelor of Science degree in electrical engineering and entered directly into the potash mining industry, where I have enjoyed many challenges and exciting opportunities ever since," recounts Chad.

Samia Dewan
Nutrien

HELPFUL HIGH SCHOOL COURSES

Physical Sci 20 Physics 30 Calculus 30
Math 30 English Language Arts 30

SMA Saskatchewan Mining Association

CAREER PROFILE
ELECTRICAL ENGINEER

Name: Chad Binsfeld
Employer: K+S Potash Canada

DETAILS OF THE JOB

An Electrical Engineer is involved in every phase of design, construction, ordering and operation of electrical equipment. They are expected to review electrical designs, and the execution of those designs in the field. An Electrical Engineer participates on teams and assists with troubleshooting the equipment. This means interactions with other team members to gather feedback.

"It is always great to be involved in the complete lifecycle of equipment, as the designs go from paper to construction, to operation. This is the best part of my job."

TEAM ROLE

- ☐ Develop Design Plan
- ☐ **Write Block Code**
- ☐ Perform Tests
- ☐ Problem Solve

SKILLS NEEDED:
Communication
Attention to Details
Critical Thinking
Problem Solving
Math

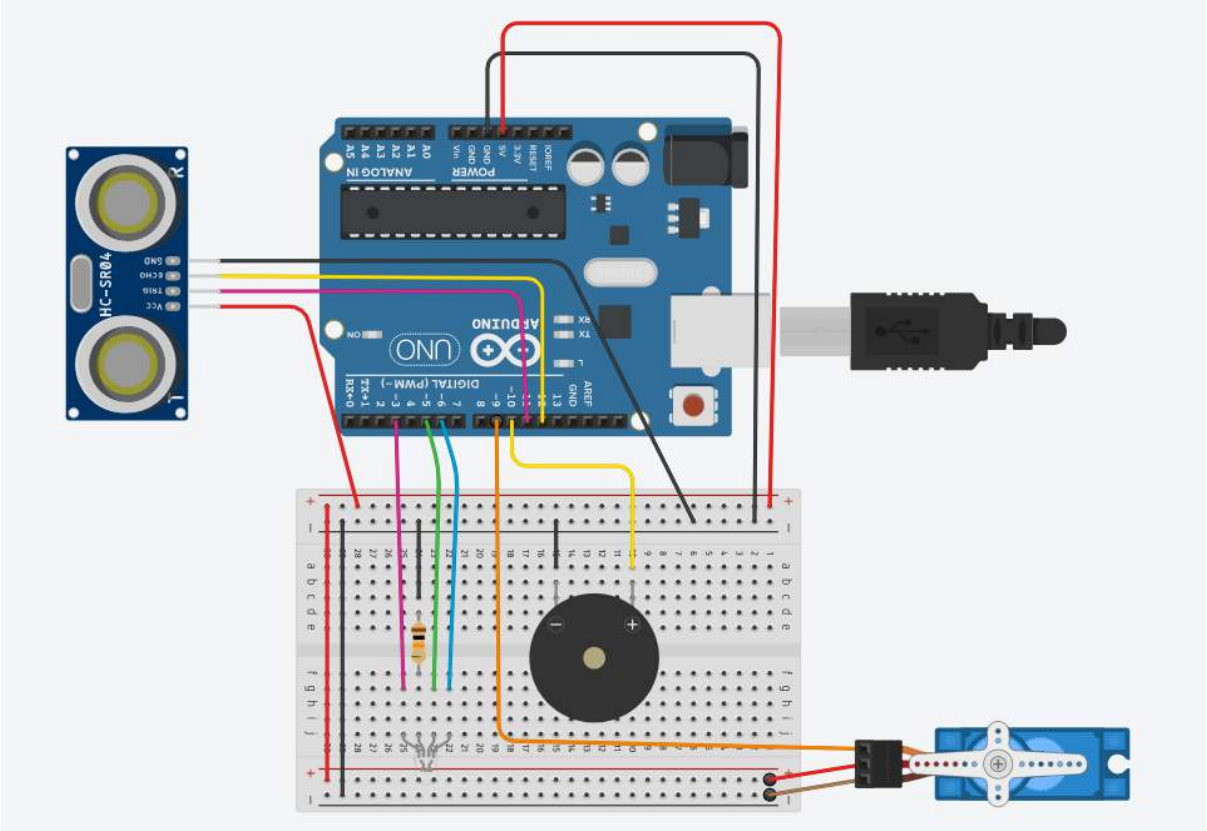
Fly Away Birdy - Student Info

Part 1 - Bird Deterrent Device

The Challenge: With your group; build a bird deterrent device that will frighten away birds from entering a tailings pond. You can use a combination of light, sound and motion to frighten away birds before they land in the tailing pond. Distribute the career cards so that each group member has a job position.

Hints:

- Have a meeting to discuss the work that needs to be completed, and how everyone can contribute to solve the challenge. Call additional meetings if problems arise or people finish tasks.
- Use the following schematic below
- Combine the coding you have done with the light, speaker, servo and ultrasonic to create your design.
- You can customize the sounds, lights and movement of your device as well as build a scarecrow like structure on your servo.



Servo wiring: BROWN is GROUND, RED is POSITIVE, ORANGE is DATA (assigned to a pin 9 on the Arduino)
Ultrasonic Distance Sensor: Trig = Pin 11 on the Arduino, Echo = Pin 12 on the Arduino, VCC = +
Speaker: + = Pin 10 on the Arduino
RGB LED: Long Leg = Ground, Other legs = Pins 3,5,6 on the Arduino

Part 2 - Bird Deterrent System

The Challenge: Your teacher will show you the tailings pond that needs to be protected. You can use your bird deterrent device from Part 1 and combine it with other groups to ensure that you have coverage for the entire pond. An ideal system will have several devices deterring birds from all angles and elevations.

Hints:

- Develop a system for each group to brainstorm ideas on how to cover the pond with detectors. Designate someone to write out ideas.
- Use a combination of meter sticks, rulers, protractors, etc. to plan the spacing and to figure out what area of the pond is protected or not protected.
- Discuss strategies on where to put alarms, their max range, and the angle of the ultrasonic sensors.

Testing:

- Once the pond is protected, it will be visited by a bird. Determine if the pond is adequately protected and make adjustments as needed.

Voice for Thought

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Images courtesy of Areva: Cluff Lake Mine, Northern Saskatchewan in 1999 & 2011

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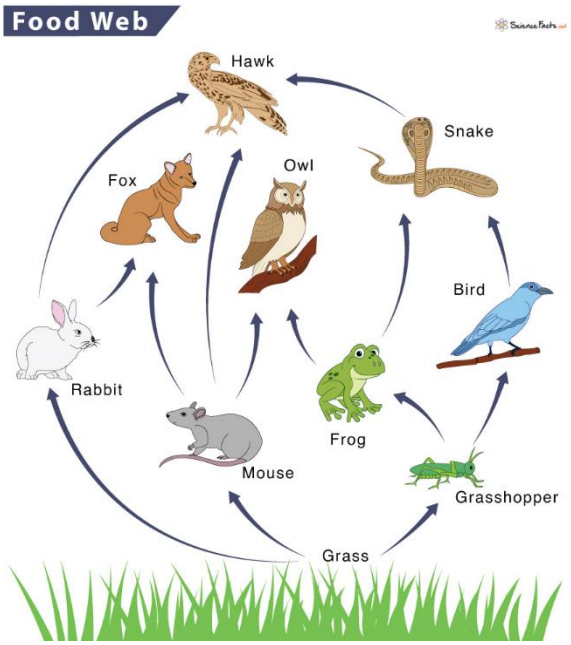

Environmental Challenge

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Even though the mining and exploration industry are not a part of the top twenty, birds potentially being harmed when they land on tailings ponds is a major concern.

For example, birds might ingest the toxic water by drinking or by preening their feathers. If the pond has oil in it, birds can become coated in oil causing them to be unable to fly or swim. Oil removes the waterproofing of bird's feathers causing them to sink. There are bird rescue programs that try to save birds if they become coated in oil. Past studies suggest that out of the birds that land on tailings ponds only about 1% of the landings result in death. Government, industry, academia and other organizations work collaboratively to prevent bird deaths from tailings ponds.

Fly Away Birdy

The mining and exploration industry use robotics and innovation to create **deterrence systems** that scare away birds. These systems can be around the perimeter, on the shore or even floating on top of the tailings ponds. They may use a combo of…

1. **Light:** Different types of lights can be used to startle birds such as lasers, rotating lights, blinking lights and search lights. Sometimes birds are attracted to artificial lights that are always on at the mining sites, especially when it is foggy or cloudy at night. Similar to a deer in headlights. So, some have tried using green-coloured lights which studies show to be the least attracting. Birds showed little response for red and white lights.

2. **Sound:** Noise Cannons that play a variety of programmed sound, wailers, crackers, and screamers frighten birds away. Sounds might include distressed bird calls, predatory bird calls like an owl or hawk, and loud bangs like cannon fire. In some cases, bear horns are used.

3. **Motion:** moving robotic scarecrows and fake predators scare away birds. Also, kites have been used. The newest innovation uses holographic images and drones that look and act like predatory birds to physically chase birds away. These can be deployed on land, water and where applicable in the air.

Limitations

Millions of birds fly over the mining sites each year due to migration pathways. Using radar to track different sized birds, like airplanes, to determine which ones are showing landing behaviour can be tricky. Local birds can become accustomed the scare tactics. Each species of birds behaves differently. For example, some species completely ignore loud sounds while others like songbirds can be harmed by loud sounds. Also, the size and shape of the pond can limit the effectiveness of the deterrence system.

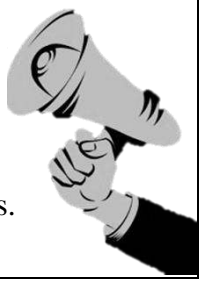
A robotic falcon, used as a bird deterrent, near Fort McMurray.
CODIE MCLACHLAN

Repercussions

Mining and exploration companies are required to have a bird protection plan and monitoring approved before they are allowed to develop. If the bird protection plan fails resulting in bird deaths, then there are consequences. Environmental impact from bird deaths, negative public perception, global attention & criticism and millions of dollars in fines from regulatory bodies are the outcomes. The fines go toward the federal Environmental Damage Fund and provincial projects that support biodiversity, habitat reclamation, and conservation.

Did You Know?

Bird deterrence systems can be used for agriculture, solar farms, wind farms, airports, and landfills.



Voice for Thought

Mosaic On Site Questionnaire

What is the Problem?

"The problem is that we experience migratory birds entering in our oil/separation ponds, typically during migratory bird season in early Spring. However, the risk is there throughout any of the Spring/Summer months, but more so right at the beginning because when the birds migrate North and see what looks to be dark waters to land in, they then become covered in oil if we don't have our deterrents out. 99% of oil pond wildlife incidents are birds – other mammals aren't known to enter these ponds."

How can it be Prevented?

"We've thought and discussed numerous ways we can prevent wildlife incidents with our separation ponds. The best option is to eliminate the ponds entirely by using a different means of separating the oil, but that's a separate story. We can do our best to reduce the amount wildlife incidents by implementing various bird deterrents. We've also discussed the idea of covering the ponds with some sort of modified version of a pool cover or netting. However, operations do need to access the pond for skimming purposes, which isn't ideal for a cover. This idea isn't totally dead, but there are some obstacles."

What Applications are you Currently Using?

"We currently use flagging over the oil ponds and brine ponds at Cluster sites (sometimes oil makes its way over to the brine pond, which is why we use flagging there too), wavy/inflatable men, and propane scare cannons at high volume spots at the beginning of the season. We have also tried to use bird kites. We have had success with these measures, but still get the occasional bird that enters the ponds throughout the Spring/Summer, but a lot less frequent than we once had."

Voice for Thought

Nutrien Questionnaire

How do you Manage your Tailings Ponds?

Potash tailings management systems consist of engineered containment facilities that are designed to store solid tailings and brine. The tailings facilities are licensed and approved by the Saskatchewan Ministry of Environment. At each potash facility there are staff that manage the day-to-day compliance and surveillance requirements, which can include visual inspections, sample collection, and instrumentation data review. Careers that support tailings management areas are engineers, geologists, environmental technicians, heavy equipment operators, and instrumentation technicians.

Nutrien Potash sites are subject to include the Saskatchewan Wildlife Act, Species at Risk Act, and the Migratory Birds Convention Act. Wildlife management around ponds is not an issue for Nutrien Potash sites. Potash brine poses a low risk to wildlife and the tailings management areas can be visited by a variety of wildlife.

What are the Challenges?

Weather related events such as rain, snowmelt/runoff, and wind create challenges that must be factored into their design to ensure that storage is available and that stability factors are maintained. Seasonal effects, including the large temperature swings that Saskatchewan experiences, can also cause challenges when dealing with mobile equipment and materials that undergo thermal expansion and contraction. This requires adequate planning, maintenance, and operation to keep assets functioning as designed.

How do you use Automation?

Automation is used for and around tailings ponds primarily for the purpose of collecting monitoring data and operating pipelines and valves. Some examples include the use of dataloggers, vibrating wire piezometers, cameras, and laser levels. This reduces the need for employees to travel to and from the work area, access and work near higher risk areas, and complete manual/physical tasks, all of which reduces the potential for a safety incident. Drone technology can also be used to complete surveys of elevated areas and large areas with difficult terrain, reducing the need for employees to work at heights and access harder to reach areas.

Orano McClean Lake Questionnaire

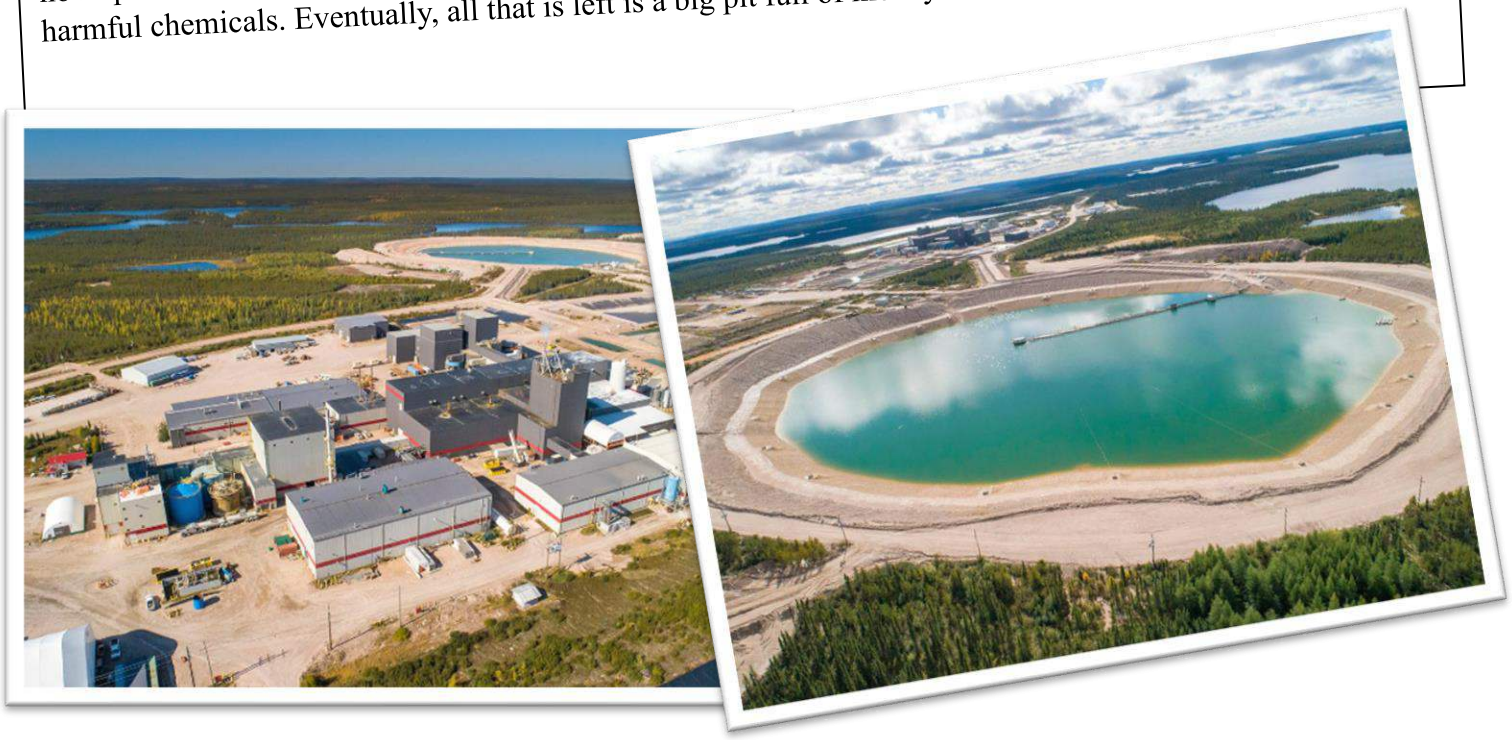
How do you Manage your Tailings Ponds?

“**During Operations** – The tailings are hydraulically contained by pumps. It draws water towards the tailings from the surrounding groundwater. All of the pumped water is treated at the water plant and released back to the environment.

Currently - At McClean Lake the tailings facility is being made bigger, which required 20 years of careful planning and engagement with local people, the Canadian Nuclear Safety Commission, and the Saskatchewan Ministry of the Environment.

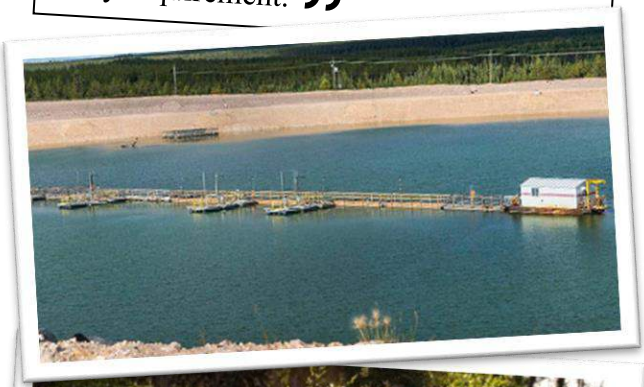
Wildlife Management - As the existing tailings facility is in-pit, wildlife including waterfowl accessing the area is a very rare occurrence. Should waterfowl be observed for more than 2 days, environment technicians will deploy loud noises (typical with the use of bear bangers) to scare away the waterfowl before they can nest.

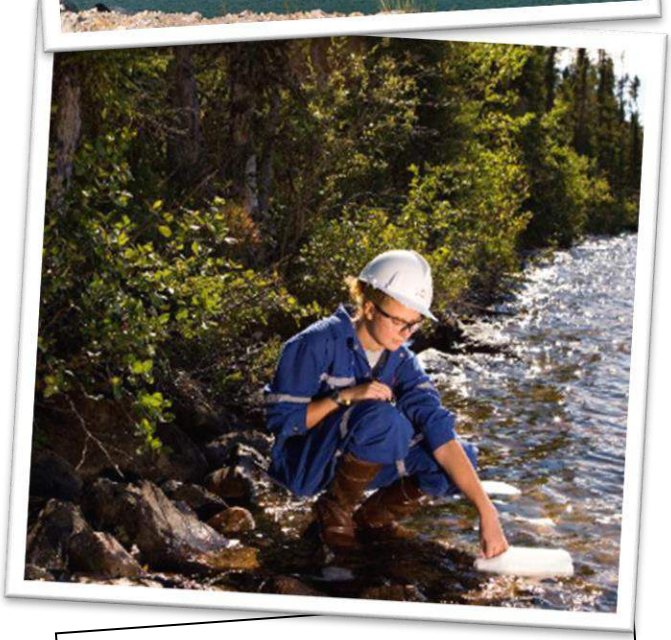
After Operations - The leftover tailings are placed in a mined-out pit and compacted into a solid mass so groundwater cannot flow easily through picking up contaminants from the tailings. The tailings are designed, through the addition of specific chemicals, to evolve to a stable chemical endpoint where the number of constituents of potential concern (COPCs) (e.g., arsenic, molybdenum, uranium selenium, radium-226) released to the environment can be accurately predicted and controlled at very low levels. This approach is sometimes called the “leaky bathtub model”. The release of COPCs is carefully controlled so that there are no impacts to the downstream environment and gradually over time the tailings are depleted of potentially harmful chemicals. Eventually, all that is left is a big pit full of mostly sand and clay. ”



How do you use Automation?

The tailings system is monitored in real-time with flow meters so that any problems can be identified from the mill control room. Currently operators retrieve pond elevations manually. There is an initiative in place to automate this daily requirement.





Careers

Senior Geo-Environmental Scientist

Geochemist

Process Specialist

Civil/Geotech Engineer

Metallurgist

What are the Challenges?

The tailings facility at McLean Lake is designed to be a part of the environmental landscape for thousands of years. After operations, the COPCs are released from the tailings slowly simulating what would happen with an unmined mineral deposit that is naturally present in the ground.

Environmental Risk Assessment

What levels of contaminants are safe for different types of animals that live in/by the lakes and rivers downstream of the tailings? Microscopic creatures such as daphnia all the way up to fish, birds, muskrats and moose are considered.

Human Health Risk Assessment

Information from consultation with locals, primarily First Nations and Métis groups located near McClean Lake, is used to design the tailings facilities to be safe for everyone to use the land just as they always have, now and for generations to come. Information may include:

- What activities they do in the area? (Hunting, fishing and collecting berries)
- How many berries, fish and game they usually harvest?
- How often they travel to the area?
- Which lakes they drink water from or fish in?

Planning for Climate Change

As mentioned, limiting the amount of water that flows through the tailings helps to protect the environment. There is a specially designed cover that channels water from rain and snow melt off the tailings and away downstream. To know how to design this cover the climate of the future must be considered:

- Will there be more or less rain and/or snow?
- If it is likely to be hotter & dryer, could fire and/or erosion affect the cover?

EDUCATION

After his graduation from high school, Chad knew he wanted to stay in Saskatchewan. "I knew I should look for a career in mining and natural resources. I was accepted into the Engineering program at the University of Saskatchewan and after my first year it was clear that Electrical Engineering was the best choice for me. I completed my Bachelor of Science degree in electrical engineering and entered directly into the potash mining industry, where I have enjoyed many challenges and exciting opportunities ever since," recounts Chad.

Samia Dewan
Nutrien

HELPFUL HIGH SCHOOL COURSES

Physical Sci 20 Physics 30 Calculus 30
Math 30 English Language Arts 30

SMA
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CAREER PROFILE
ELECTRICAL ENGINEER

Name: Chad Binsfeld
Employer: K+S Potash Canada

DETAILS OF THE JOB

An Electrical Engineer is involved in every phase of design, construction, ordering and operation of electrical equipment. They are expected to review electrical designs, and the execution of those designs in the field. An Electrical Engineer participates on teams and assists with troubleshooting the equipment. This means interactions with other team members to gather feedback.

" It is always great to be involved in the complete lifecycle of equipment, as the designs go from paper to construction, to operation. This is the best part of my job."

TEAM ROLE

- ❑ Develop Design Plan
- ❑ **Write Block Code**
- ❑ Perform Tests
- ❑ Problem Solve

SKILLS NEEDED:

Communication
Attention to Details
Critical Thinking
Problem Solving
Math

Saskatchewan Mining Association: GeoRobotics

Cluff Lake Mine: A success story in reclamation.

EDUCATION

Emily has always had an interest in the environment and when she first visited a mine site she realized that she was fascinated with the mining industry as well. Shortly after Emily went to university and received a Bachelor of Science in Environmental Engineering. Working as an Environmental Engineer she is able to combine her two interests in a very exciting and rewarding career.

HELPFUL HIGH SCHOOL COURSES

Physical Sci 20 Enviro 20 Earth 30 Calculus 30
Bio 30 Chem 30 Math 30 ELA 30

SMA Saskatchewan Mining Association

CAREER PROFILE

ENVIRONMENTAL ENGINEER

Name: Emily Clauson
Employer: Westmoreland Coal

DETAILS OF THE JOB

Emily is responsible for following current environmental laws and for environmental reporting and permitting at the mine. She also focuses on the reclamation activities. On a typical day she may be in the office organizing information, preparing reports and drafting maps. Or she may be doing fieldwork helping with water samples, collecting data, and checking up on reclaimed areas and special projects.

SKILLS NEEDED:
Science & Math
Passion for Enviro
Critical Thinking
Problem Solving
Decision Making

"One of the best parts of the job is showing people how great mined areas can look once the reclamation process is completed... most people cannot even tell where old mining areas once were located."

TEAM ROLE

- ❑ **Enviro Report**
- ❑ Help Design
- ❑ Make Decisions
- ❑ Problem Solve

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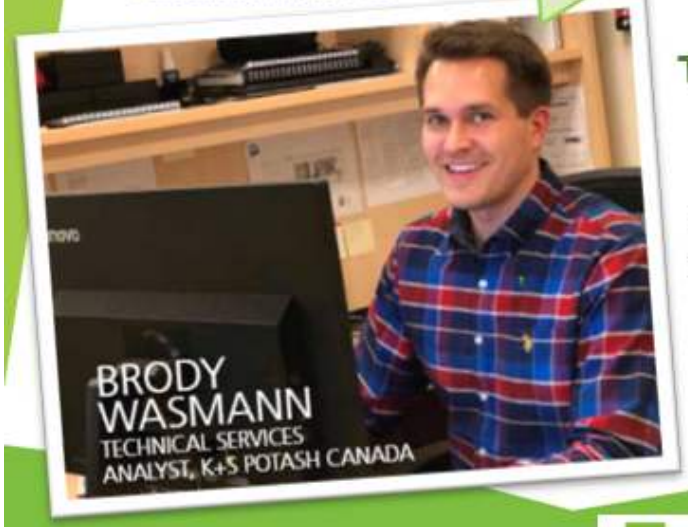
EDUCATION

After taking Computer Science in high school I knew I wanted to be involved with computers in my career. After high school I took the Computer Systems Technology course available at SIAST in Saskatoon. From there I've taken different certifications as part of my continual training in the IT industry.

HELPFUL HIGH SCHOOL COURSES

Computer Science 30
Calculus/Math 30

"One of my first projects was aligning the hardware and software needs of the designer/drafter group."



TEAM ROLE

Download, transfer, save, assist and problem solve with Block Code

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CAREER PROFILE
TECHNICAL SUPPORT ANALYST

Name: Steven Leveque
Home Community: Nipawin
Employer: Cameco Corp.

DETAILS OF THE JOB

My job mainly revolves around helping people fix issues on their computers or helping to maintain computers in the company. This job covers a wide range of things, one day you could be helping someone with their email not working and the next week you may be flying up to one of our mine sites to set people up with new computers. There are usually a dozen calls where I assist people throughout the day and when I'm not taking phone calls I'm reviewing issues emailed to our Helpdesk Inbox. When I'm not helping people with computer issues I'm usually working with many departments in the company to make sure all the computer systems have up to date software.

SKILLS NEEDED:

Communication
Research
Critical Thinking
Problem Solving

"Why is it so great? There's always something new to learn!"

Saskatchewan Mining Association: GeoRobotics

EDUCATION

Instrument school is offered through Trade Schools in Moose Jaw at Sask Polytechnic as well as in Calgary at SAIT & in Edmonton at NAIT. There are two paths into Industrial Instrumentation. **1.** Straight out of high school into a trades school in the Instrumentation Technologist programs. **2.** Apprenticeships out in industry, which combine practical on the job training supplemented with trades school training in the Instrumentation Mechanic programs.

HELPFUL HIGH SCHOOL COURSES

Practical and Applied Arts
Pre-Calculus 30
Physics 30
ELA 30

TEAM ROLE

Safety & Building of the components

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CAREER PROFILE
INSTRUMENTATION TECHNOLOGIST

Name: Derek Worme
Home Community: Young, SK
Employer: Nutrien Ltd.

SKILLS NEEDED:
Communication
Safety First
Observant
Good at Building & Repairing

DETAILS OF THE JOB

I begin my day with a safety discussion with my crew called a toolbox meeting where we discuss safety, work for the day & share any relevant information. Prior to starting each repair, I perform a Job Hazard Assessment (JHA) to identify any potential hazards that may pose a risk to my or other worker's health & safety. Throughout my day, I frequently take a structured pause to check for hazards, get re-focused & stop work when unsure. With the huge variety of instruments contained in a potash refinery, the maintenance I perform every day is not the same day in day out. I come to work daily looking forward to what challenge lies ahead with the plan of going home safe, every day.

"If you are good at computers & working with wrenches, this trade is for you."

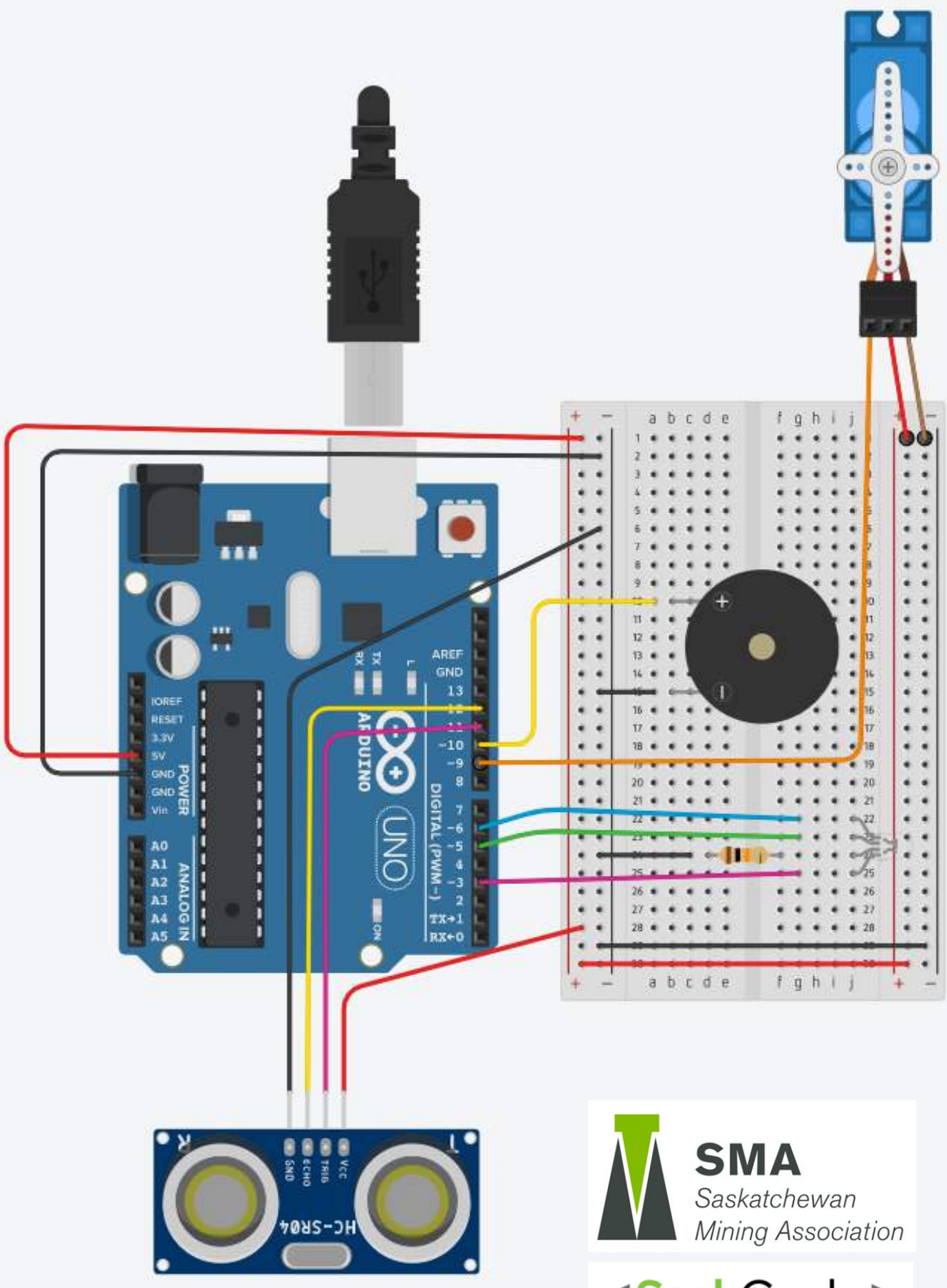
Saskatchewan Mining Association: GeoRobotics

FLY AWAY BIRDY CHALLENGE

Build a bird deterrent device that will frighten away birds from entering a tailings pond. You can use a combination of light, sound and motion to frighten away birds before they land in the tailing pond.

Part 1: Build the Schematic

Servo wiring: BROWN is GROUND, RED is POSITIVE, ORANGE is DATA (assigned to a pin 9 on the Arduino)
Ultrasonic Distance Sensor: Trig = Pin 11 on the Arduino, Echo = Pin 12 on the Arduino, VCC = +
Speaker: + = Pin 10 on the Arduino
RGB LED: Long Leg = Ground, Other legs = Pins 3,5,6 on the Arduino



SMA Saskatchewan Mining Association

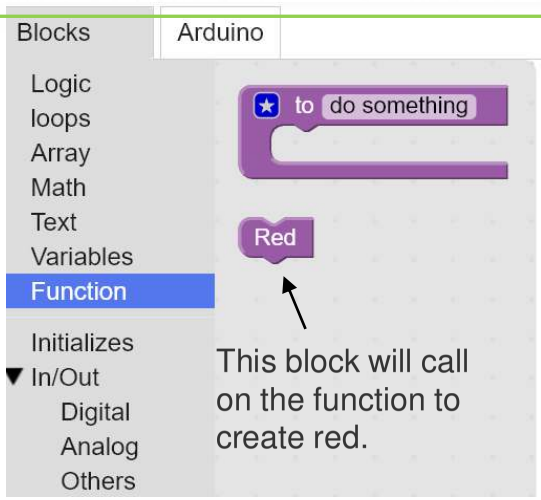
<SaskCode>

Part 2: Code, Test and Customize the sounds, lights and movement of your device as well as build a scarecrow like structure on your servo.

RBG LED

1 - RED Pin 3
2 - GROUND
3 - GREEN Pin 5
4 - BLUE Pin 6

0 is the lowest value and 255 is the max value.



This block will call on the function to create red.

Function

To create other colors, create more functions and change the value numbers.

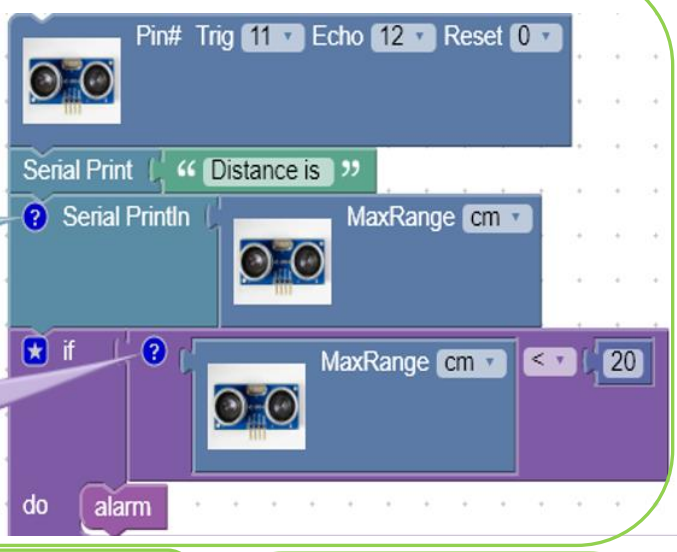
UltraSonic Distance Sensor

Detects motion from 2cm to 400cm away

Click on "**UltraSonic**," to find multiple blocks.
Trig = Pin 11
Echo = Pin 12

Use the serial print monitor to display distances detected by the ultrasonic sensor to help with values for the code

If a bird is detected within 20 cm the alarm will go off

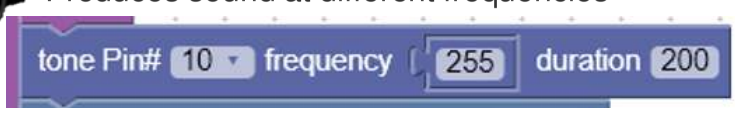


Remove the highlighted text from the Arduino IDE code

```
long duration = pulseIn(12,HIGH,Sonic_Time_out);
if ( duration == 0 ){
```

Piezo Speaker

Produces sound at different frequencies



Click "In/Out" then click "Other." Pin #10 and play with frequency and duration.

Servo Motor

Servo motors move at different angles. They have three wires: one for power, one for ground and one for data (Pin 9). To avoid damaging the motor **use range of 20 – 170**.

Transfer Code

In BlockyDuino Editor click Arduino tab, copy and paste the code into Arduino IDE.

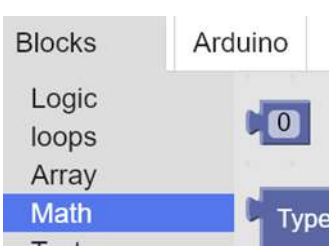
1

2

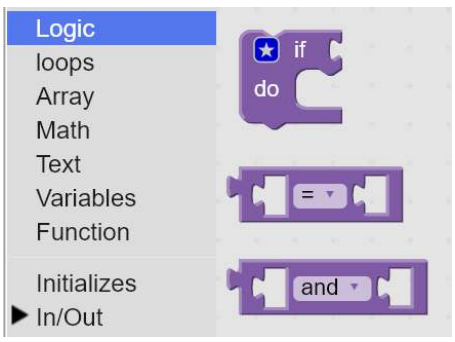
Hook up Arduino to computer using USB cable. Select a board and port by clicking on the drop-down bar. The button on the left "→" will send your code to the Arduino. The checkmark will verify that your program is valid.

Other Coding Blocks

To find the "**delay**" block, click on "**time**." Milliseconds



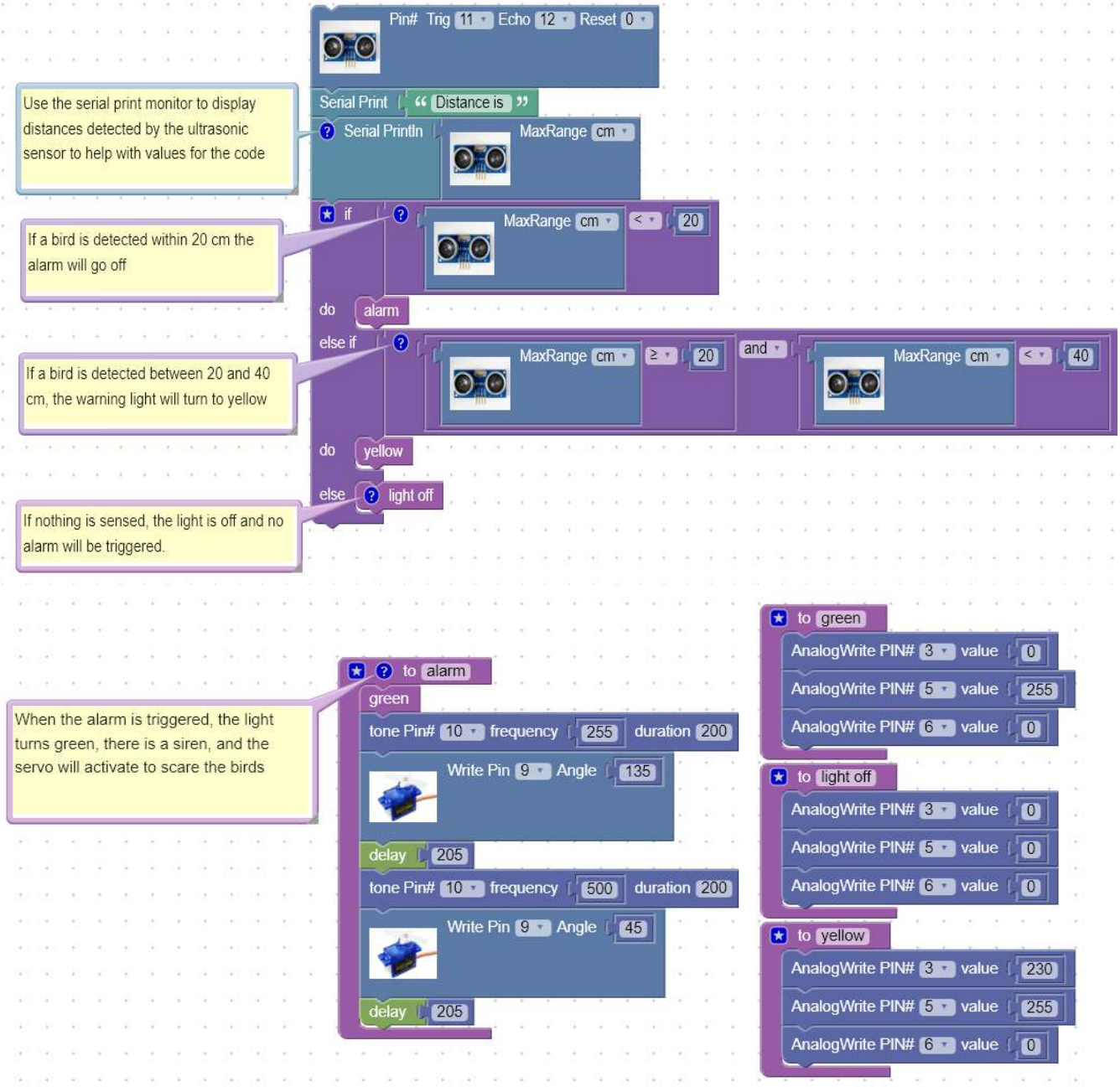
"**Number**" blocks can be found when you click "Math" on the block-bank.



When you click on "Logic," you will find multiple "if do" blocks. To find the "else" block, click on the "star symbol." Connect with the "else" with the "if" block within the panel.

Fly Away Birdie Answer Key

- Students may customize colours, patterns, sounds and motion as well as the sensitivity of the distance sensor. This prototype will give a yellow warning light when the bird approaches and a sound, motion and green light alarm if the bird gets within 20 cm. Please note that the code calls on functions to work.



- Ensure to remove the highlight text from the Arduino IDE code to get the distance sensor to work..

```
long Sonic_Timing(){
  digitalWrite(11, LOW);
  delayMicroseconds(2);
  digitalWrite(11, HIGH);
  delayMicroseconds(10);
  digitalWrite(11, LOW);
  long duration = pulseIn(12,HIGH,Sonic_Time_out);
  if ( duration == 0 ){
    duration = Sonic_Time_out;
```