

DRAFT

Teacher Manual



Dear Teachers;

Welcome to the Blue Schools program!

Your involvement in Blue Schools, and the work completed by your students, colleagues and yourself through the program, represents an important shift in the way we relate to aquatic ecosystems. By taking steps to reduce your school's water footprint, achieving Blue Schools certification demonstrates a commitment to protecting our precious water resources - it will have a positive, lasting effect on the aquatic ecosystem and everyone involved in the program.

Blue Schools certification requires the engagement and dedication of you, your students, fellow teachers, school administration and support staff. Each group will be involved in different capacities at different times and it is essential that everyone is aware of the Blue Schools program process from the beginning in order to ensure successful certification.

The Blue Schools program is structured as a series of activities that are completed in sequence throughout the school year to: introduce the water audit process, complete a water audit in the school, analyze the data collected, prepare an action plan for water conservation in the school and finally, implement the action plan and measure success. Multiple connections to the Science and Technology, Mathematics and Social Studies & Geography curriculum documents are highlighted for each activity. Additionally, each activity is related to a relevant category of the achievement chart (Knowledge and Understanding, Thinking and Investigation, Communication, Application) to allow for flexible assessment based on the dynamic classroom environment.

We are excited to have you on board as a partner in water conservation through the Blue Schools program. Program staff at Toronto Zoo are available to assist you and your school throughout the certification process – frequent communication is the key to success! We look forward to working closely with you to protect our aquatic ecosystems and foster school communities that are actively engaged in ongoing conservation efforts.

Sincerely,

Blue Schools Program Staff

DRAFT

Table of Contents

DRAFT

Preface

The Toronto Zoo is Canada's national leader in saving wildlife to ensure the rich diversity of nature for future generations. The Zoo also has a strong mandate to improve public awareness with the goal of species conservation, which involves the local delivery of curriculum-based education programs. For over 15 years Toronto Zoo's highly successful, bilingual Great Lakes Program (GLP) has supported this mandate through bilingual in-class and public outreach, student and teacher resource development, community events and freshwater research.

As an extension of the GLP, Blue Schools fosters a deeper appreciation for water resource use, management and protection through direct, hands-on learning. Taking learning out of the classroom, this STEM-based program involves the entire school from students and educators to support staff, administration and board-level representatives. After completing a water audit in their schools, students work as part of a team including all levels of school operation to develop and implement an action plan to improve sustainable water use practices in the school and raise awareness of local water issues.

PLEASE NOTE: No personal student or staff information is collected through the Blue Schools Program. Water-use data identifying specific schools will not be published or distributed.

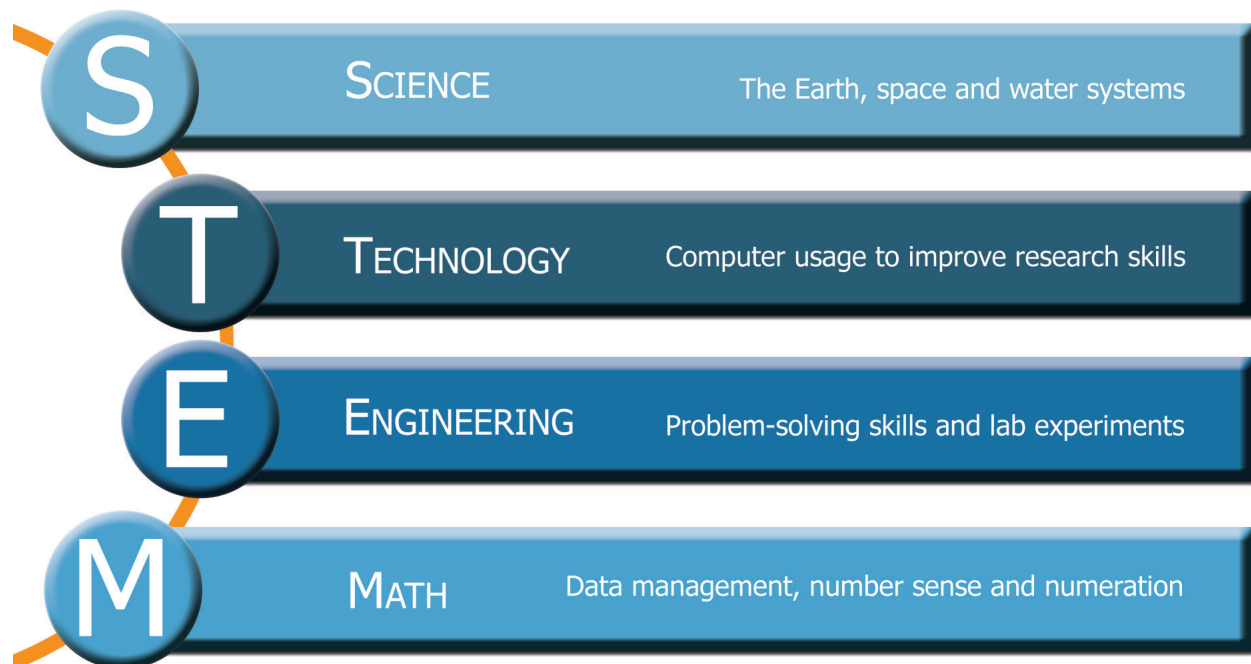
Curriculum Connections

Blue Schools is directly linked to multiple grades and subjects of the Ontario Curriculum. Specific links to curriculum expectations in the following subjects and grades are listed at the start of each activity.

- Science & Technology, Grade 6-8
- Mathematics, Grade 6-8
- Social Studies & Geography, Grade 6-8
- Language, Grade 6-8

Blue Schools implementation is not limited to the subjects or grades listed here. Teachers of all grades and subjects are encouraged to participate in addition to extra-curricular clubs such as environmental or social action clubs.

Blue Schools is based on STEM (Science, Technology, Engineering and Math) pedagogy. Additional integration of the Blue Schools program into classroom learning is strongly encouraged.



Additional application of this resource to classroom learning is encouraged.

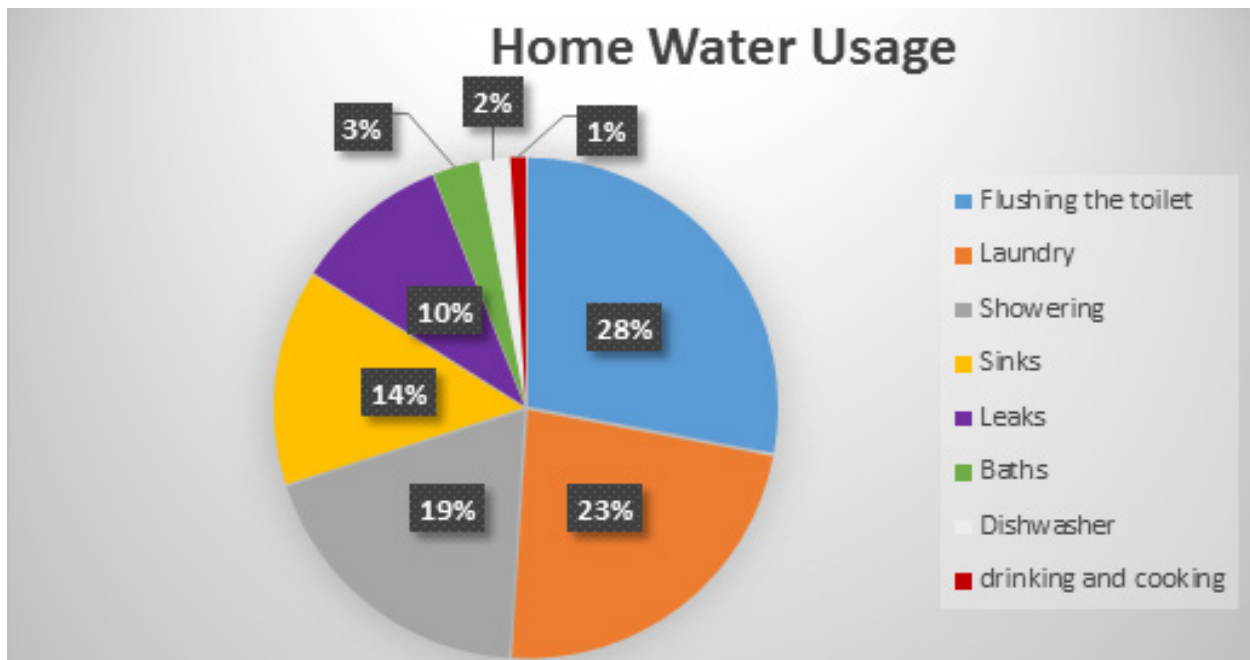
Introduction

Fresh water is one of the most important resources in Canada. The North American Great Lakes represent the largest source of surface freshwater in the world however, they face a number of threats including invasive species, pollution and overconsumption.

Residential water use in Canada is the second highest in the world, second only to the United States. Canadians use approximately 300 L of water in the home each day, not including water used for the production of goods and services. Figure 1 illustrates the breakdown of residential water use highlighting that the most water used in a day is used in the washroom.

By completing a water audit and investigating water use in the school, students and staff will have the information necessary to develop an action plan to reduce water consumption in the school. Blue Schools provides the framework and resources to support the water conservation initiatives and strategies in participating schools.

Figure 1: Daily residential water use breakdown.
Modified from Environment and Climate Change Canada.



How to Become a Blue School

The Blue Schools program is divided into 5 consecutive activities that culminate with the implementation of water conservation strategies in the school.

Activities

1. Home Water Audit
2. School Water Audit
3. Calculating School Water Use
4. Action Plan Development
5. Action Plan Implementation & Certification

A Blue School is a school committed to protecting our aquatic ecosystems. It is a school that has completed all 5 program activities, is actively implementing water conservation strategies and can demonstrate a reduction in school water use as a result.

View page xx for more information about Blue Schools Certification

Certification

Schools are encouraged to participate in the Blue Schools program annually to progress through the four levels of certification. Recognizing that water conservation initiatives will vary from school to school, certification is based on types of actions implemented.

Level 1

School Level Actions

1. Complete Activities 1-5
2. Implement actions within the school property

Examples may include:

- Awareness campaign
- Install and use rain barrels at the school
- Build or plant a rain garden on school property

Level 2

Community Level Actions

1. Complete Activities 2-3 to measure success of actions implemented in Level 1
2. Identify new actions to add to the action plan developed in Level 1
3. Implement actions at the community level

Examples may include:

- Shoreline garbage clean-up
- Attend a tree planting event
- Communicate Level 1 success at a community event

Level 3

Community to Community Actions

1. Complete Activities 2-3 to measure success of actions implemented in Level 1 & 2
2. Identify new actions to add to the action plan developed in Level 1 & 2
3. Implement actions at the community to community level
4. Maintain actions implemented in Levels 1 & 2

Examples may include:

- Host a fundraiser for a water local conservation group
- Initiate a social media campaign for water conservation
- Host a water-audit workshop for another school

Level 4

National Level Actions

1. Complete Activities 2-3 to measure success of actions implemented in Level 1, 2 & 3
2. Identify new actions to add to the action plan developed in Level 1, 2 & 3
3. Implement actions at the national level
4. Maintain actions implemented in Levels 1, 2 & 3

Examples may include:

- Host a fundraiser for a national water conservation group
- Get involved with an international water charity group

Communicate with Blue Schools program staff for assistance with Action Plan implementation at any level.

Timeline

Blue Schools is a long-term, 8-month program. Suggested timing is October to May.

October



- ☐ Establish support (Admin., support staff)
- ☐ Make a plan
- ☐ Determine scope

Nov. - Dec.



- ☐ Students collect baseline data
- ☐ Students collate data
- ☐ Students analyse and present results

January



- ☐ List actions and targets
- ☐ List persons responsible
- ☐ Timeline for each action

Feb. - Mar.



- ☐ Implement action plan

Apr. - May



- ☐ Follow-up data collection - same as baseline parameters
- ☐ Compare results
- ☐ Summarize results & identify future needs

Following Year



- ☐ Repeat process the following year

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Materials

Participating schools will receive a Blue Schools water auditing kit including: a graduated bucket, stopwatch and clipboard.

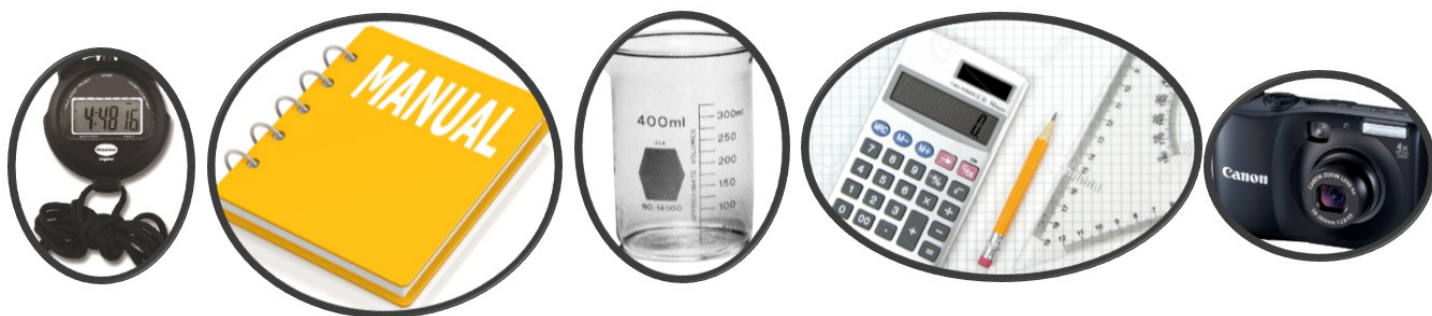


Table 1: Materials needed for water audit

Item	Quantity	Purpose
Stop watch	1 per 4 students	To measure flow rates in sinks and faucets, and/or flush timing in washrooms
Graduated beaker or measuring cup	1 per 4 students	To measure flow rates in sinks and faucets
Graph paper	For each student	To graph results
Ruler	For each student	To graph results
Camera	1-3 total	To record progress; use photos in results presentation
Empty 2L container of milk	Optional	For student volume reference
Student Manual	1 per 4 students	To reference for data collection and action plan steps and procedures
Data collection template	1 per 4 students	To record data

Sample calculations, templates and standard water-use values are provided for the following parameters:

- Toilets
- Urinals
- Washroom faucets
- Science and other faucets
- Drinking fountains
- Showers
- Dishwashers
- Washing machines



Activity 1

To kick-off the Blue Schools program, this two-day lesson begins with an in-person introduction to the program by Toronto Zoo program staff. This introduction provides context for the Blue Schools program by emphasizing the importance of the Great Lakes ecosystem and our role within it. Students will complete a basic home water audit to begin to understand their personal water use and become familiar with the water audit process. An optional exercise on day three provides an opportunity to practice math skills such as charting and graphing.

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Activity 1: Home Water Audit

Learning Goals

- Discover the source of the water you use at home and at school.
- Understand how (and how much) water is used in your home.
- Recognize that your daily water-use practices can affect our Great Lakes ecosystem in different ways.

Success Criteria

- Determine the source of water used in your home and at school through research.
- Complete the 'Snapshot! Home Water Use' questionnaire and calculate the average volume of water used in your home in a typical week.
- Identify 3 ways your daily water-use practices affect our Great Lakes.



Time Required

2 class periods over 2 days and take home questionnaire

Plus

Optional day 3 extension activity

Curriculum Connections

Subject	Grade 6	Grade 7	Grade 8
	Strand		
Science and Technology	Biodiversity	Interactions in the Environment	Water Systems
Mathematics	Number Sense and Numeration Measurement	Measurement	Measurement

See Appendix X, page XX for specific expectations related to Lesson 1.

Day One: Introduction and Take-Home Activity

Time

1 class period.

Materials

Appendix 1 'Snapshot! Home Water Use' questionnaire - 1 per student.

Lesson

1 Inform students of class and/or school involvement in Toronto Zoo's Blue Schools program. Explain the Blue Schools program main stages and end goal of becoming a certified Blue School.



2 Schedule a visit from Toronto Zoo's Great Lakes/Blue Schools program staff to introduce the Great Lakes ecosystem and kick-off the Blue Schools program.

Blue Schools stages

- Introduction and personal water-use
- Conduct a school-wide water audit
- Develop an action plan to reduce water consumption in the school
- Implement the action plan
- Certification

3 Take Home Activity
Following the introduction by Toronto Zoo program staff, distribute take-home questionnaire, 'Snapshot! Home Water Use' (Appendix X) for students to complete.

To schedule a visit from Great Lakes/Blue Schools program staff:

E-mail : greatlakes@torontozoo.ca

Tel: 416.392.6022

Optional

4 Digital/online water calculators
There are different types of online water-calculators for determining water-use in the home. Students may wish to explore the following examples for comparison:
<https://water.usgs.gov/edu/activity-percapita.html>
<http://www.home-water-works.org/calculator>

DRAFT

Day Two: Calculate Weekly Water-Use in Your Home



Time

1 class period.

Materials

1 per student of the following materials:

- Completed 'Snapshot! Home Water Use' student questionnaires
- Appendix 2 'Home Water Use Calculation' worksheet
- Scrap or slips of paper

Lesson

1 Instruct students to calculate their weekly home water-use using the values from the completed 'Snapshot! Home Water Use' questionnaires and following the steps outlined in Appendix X – 'Home Water Use Calculation'. This may be a group/class activity for younger students, or independent work for older students.

2 Ask each student to write their total weekly water use on a slip of paper (for anonymity).

3 Select one or two students to collect the slips and write each value on the board.

4. Calculate!

Ask students to calculate the total and class average weekly water use:

Sum of all weekly total values
(entire class)

Number of weekly total values

= _____ Class average
water use/week

Day Three – *Optional* Extension Activity

Time

1 class period.

Materials

1 per student of the following materials:

- Completed 'Snapshot! Home Water Use' student questionnaires
- Graph paper
- Scrap paper
- And 4 Slips of paper per student

Lesson

- 1 Distribute 4 slips of paper to each student
- 2 Instruct each student to label each slip of paper, 1 per category - Toilet, Shower/Bath, Dishwasher, Laundry
- 3 Ask students to write their value for volume of water used per week on the slips of paper for each corresponding category.
- 4 Ask one student to make a chart on the board with 4 columns, one for each category. At the same time, ask another student to collect the slips of paper
- 6 Ask 4 different students to fill in the chart on the board using the values on the slips of paper
- 7 Instruct the class to add each column and write the totals at the bottom of each column
- 9 Add a row below the total and instruct the class to calculate the average volume of water used per category and write it in the row below the total
- 10 Using the average weekly volume of water used per category, instruct students to create a chart or bar graph to illustrate the results
- 11 In groups, students could brainstorm why some categories are higher than others and develop ideas to reduce weekly water use in the home in these categories



Name: _____

Home Water Use

Fill in this questionnaire to explore how much water is used in your home each day. This is a quick exercise to estimate home water-use so approximate numbers are ok.

TIP:

Find the volume of water your toilet uses per flush by checking...

Occupancy

Number of people in your home



Toilets

Volume of water used per flush (if available)

Shower/Bath

L/flush or Ga/flush

How many showers happen in your home on a typical day?



How many baths happen in your home on a typical day?



Is your shower head low-flow?

Yes/ No

Kitchen/Laundry

Is there a dishwasher in your home?

Yes/ No

If Yes, how many loads of dishes are washed each day?



If No, how many times are dishes washed each day?



Is there a washing machine in your home?

Yes/ No

If Yes, how many loads of laundry are washed each week?



Name: _____

Weekly Home Water Use Calculation

Using the values from your 'Snapshot! Home Water Use' questionnaire and the values from Table 1, follow the steps below to calculate the approximate volume of water used in your home each week.

Table 1: Average Volume of Water Used in the Home

NOTE: Averages are highly variable!

Appliance/Item	Average Volume of Water per Use	Average Number of Uses
Toilet – standard	13.6 L/flush	5 times/day/person
Toilet – low flush	6 L/flush	5 times/day/person
Shower – standard	15 L/minute	8 minutes/shower/person
Shower – low flow	7.6 L/minute	8 minutes/shower/person
Bath - standard	130 L/bath	-
Dishwasher - standard	45 L/load	2 loads/week
Washing Machine - standard	150 L/load	2 loads/week

Assumptions

This exercise assumes that all occupants are home each day of the week and that the Average Number of Uses listed in Table 1 are accurate.

Toilets

Calculate the weekly volume of water used by flushing the toilet in your home.

*To convert gallons to litres, multiply by 3.79

$$1. \frac{\text{Volume of water used per flush} \times \text{Average number of flushes/day}}{\text{Volume of water used/person/day}} \quad \times \frac{\text{L}}{\text{Person/Day}}$$

$$2. \frac{\text{Volume of water used/person/day} \times \text{Number of people in your home}}{\text{Volume of water used per day.}} \quad \times \frac{\text{L}}{\text{Day}}$$

$$3. \frac{\text{Volume of water used per day} \times \text{Number of days in a week.}}{\text{Volume of water used per week}} \quad \times \frac{\text{L}}{\text{Week}}$$

Weekly Home Water Use Calculation

Shower/Bath

Select either shower OR bath

$$1. \frac{\text{Average volume of water per use (standard OR low flow)} \times \text{Average number of uses per person (table 1)}}{\text{Volume of water used per person per shower or bath}} \times \frac{\text{L}}{\text{Person/Shower}}$$

$$2. \frac{\text{Volume of water per person per shower} \times \text{Number of people in your home}}{\text{Volume of water used per day}} \times \frac{\text{L}}{\text{Day}}$$

$$3. \frac{\text{Volume of water used per day} \times \text{Number of days in a week.}}{\text{Volume of water used per week}} \times \frac{\text{L}}{\text{Week}}$$

Kitchen/Laundry

If you answered No on questionnaire, use standards from Table 1

$$1. \frac{\text{Average volume of water per use} \times \text{Average number of uses per day}}{\text{Volume of water used per day}} \times \frac{\text{L}}{\text{Day}}$$

$$2. \frac{\text{Volume of water used per day} \times \text{Number of days in a week.}}{\text{Volume of water used per week}} \times \frac{\text{L}}{\text{Week}}$$

$$1. \frac{\text{Average volume of water per use} \times \text{Average number of uses per day}}{\text{Volume of water used per day}} \times \frac{\text{L}}{\text{Day}}$$

$$2. \frac{\text{Volume of water used per day} \times \text{Number of days in a week.}}{\text{Volume of water used per week}} \times \frac{\text{L}}{\text{Week}}$$

Weekly Water Use (Approximate)

Add volume of water used per week (L/week) for Toilets, Shower/Bath, Dishwasher & Laundry:

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \frac{\text{L}}{\text{Week}}$$



Activity 2

The first step in conducting a water audit is to collect baseline data. This establishes the water-use **benchmark** which will be used to demonstrate improvements in water-use practices later on. In this lesson students make their way through the school speaking with custodians, administration and other teachers collecting basic school information integral to the water auditing process. Data collected in this lesson will be used to calculate the approximate volume of water used by the school each day in Lesson 3.

Activity 2: School Water Audit

Learning Goals

- Plan and conduct an investigation into water-use in the school.
- Understand how (and how much) water is used in your school.

Success Criteria

- Investigate water-use in the school building and on school grounds by speaking with school staff and visiting different areas of the school
- Collect and record baseline school water-use data
- Determine volume of water used in different areas of the school



Time Required

Approximate

2 class periods over 2 days

Curriculum Connections

Subject	Grade 6	Grade 7	Grade 8
	Strand		
Science and Technology	Biodiversity	Interactions in the Environment	Systems in Action Water Systems
Mathematics	Data Management and Probability	Measurement Data Management and Probability	Measurement

See Appendix X, page XX for specific expectations related to Lesson 2.

Day One: Brainstorming Water Use in School

Time

1 class period.

Before you begin:

Notify school administration, other teachers and support staff that students will be in the halls during class time and approaching staff to ask questions about water-use in the school as part of the Blue Schools certification process.

Lesson

- 1** Inform students that this is the first step in the water audit process. The information/data collected in this lesson/activity determines the rest of the process and will be used to develop the water conservation action plan.
- 2** Brainstorm as a class all the ways water is used in the school – write all the ideas on the board or chart paper.
- 3** Brainstorm with the class how to find out how much water is used for each of the ideas. Post answers from 2 and 3 for reference during day 2.

Day Two: Baseline Data Collection

Time

1 class period.

Lesson

Materials

Baseline Data Collection Sheets

1-10 - 1 per group

Clipboard - 1 per group

Pencils - 1 per student

Stopwatches - 5-6

Measuring cup (500mL min) - 2

Bucket(graduated) - 1

- 1** Divide students into groups of 2-4 students depending on class size.
- 2** Assign a different area of water use to each group. (May need to assign more than one water-use area to some groups depending on class size.)
- 3** Ensure that students know where/how to find the information they need to complete their data collection sheet. Refer to brainstorm list from day 1.
- 4** Release students to collect data and complete their area-specific data sheets.
- 5** Once all the data sheets have been completed, re-group as a class to complete the Master Data Sheet.
- 6** Ask a representative from each group to write the name of their water-use area and their final volume or flow rate (from the blue box on the data collection sheet) on the board.
- 7** Enter these final volumes and flow rates into the Master Data Sheet. Keep this sheet for use in Lesson 3.
- 8** Debrief with students to discuss the data collection process as a class, including any challenges or difficulties encountered while searching for water-use information in the school.

Day Three: *Optional* Water Bill/Water Meter Comparison

Time

1 class period.

Materials

- School water bill or water meter data
- Pencils
- Rulers
- Graph paper

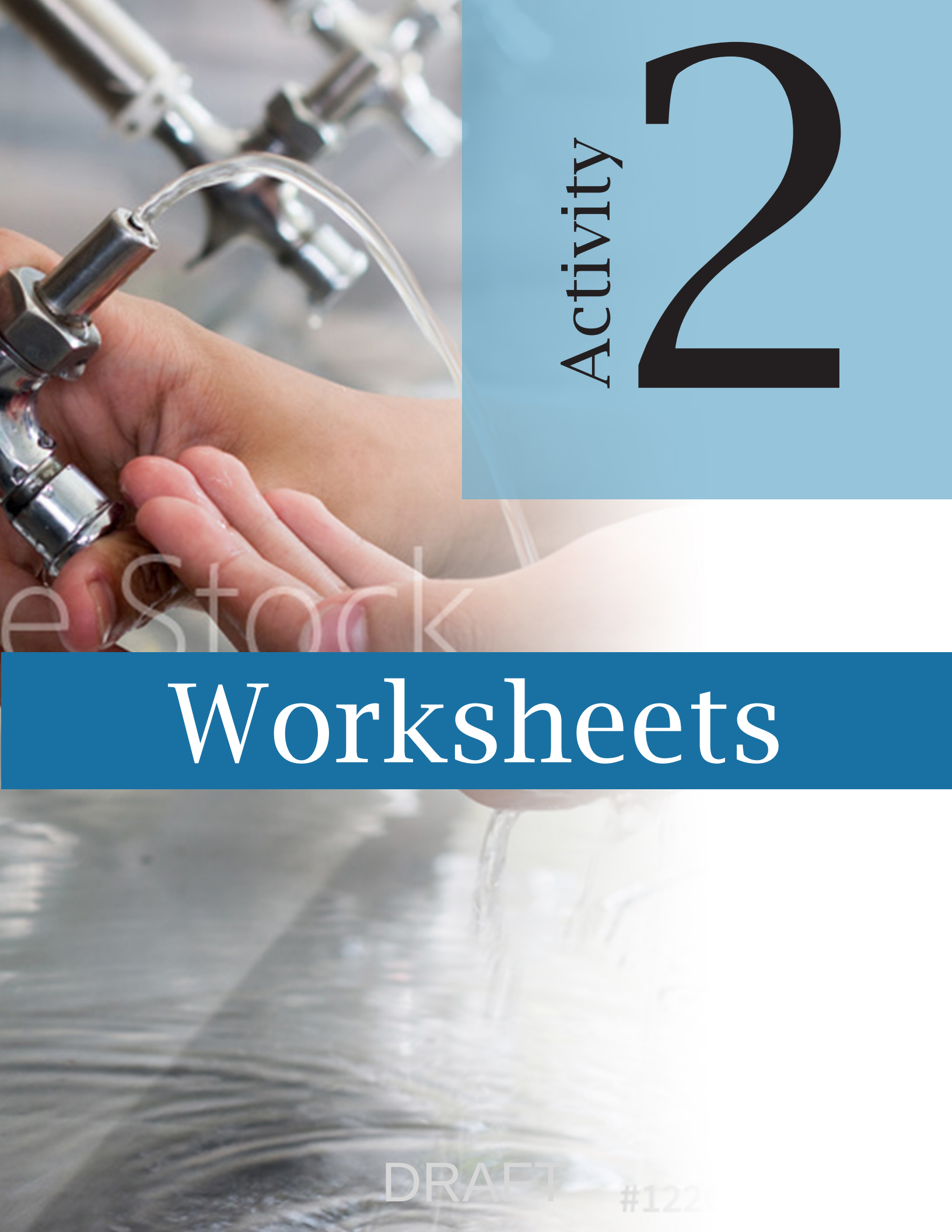
Lesson

1 Obtain water bill or water meter readings from school Administration or Custodians – may have to inquire with school board.

2 Using this data students prepare graphs to illustrate school water use throughout the school year.



3 Using this data students calculate the average monthly water use in the school and compare with the baseline data they collected on Day One.



Activity 2

Worksheets

DRAFT

#122

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

School basics

Number of students in the school	
Number of teachers in the school	
Number of staff in the school (administration and support staff)	
Total number of people in the school	
Number of females in the school (students + teachers + staff)	
Number of males in the school (students + teachers + staff)	
Number of days the school is used each year	

Name: _____

Baseline Data Collection

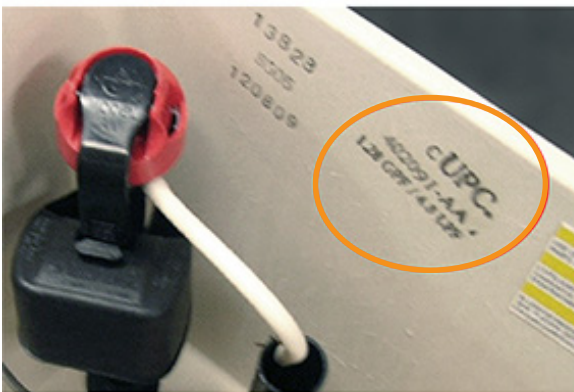
BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Toilets

Volume of water used by toilets per flush Toilet type 1	L/flush
Volume of water used by toilets per flush Toilet type 2	L/flush
Volume of water used by toilets per flush Toilet type 3	L/flush
Volume of water used by toilets per flush Toilet type 4	L/flush
Volume of water used by toilets per flush Toilet type 5	L/flush
Average volume of water used by toilets per flush	L/flush

TIP: Volume of Water Used Per Flush can be found inside the toilet tank (remove lid) or printed on the toilet bowl behind the toilet seat.

Tank



Bowl



See reverse for more instructions.

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Baseline Data Collection

Toilets - continued

If the volume of water per flush is not printed anywhere on the toilet,

follow these steps to calculate volume of water used per flush.

1. Get a stopwatch
2. In pairs, one person hold the stopwatch, the other will flush the toilet
3. Press START on the stopwatch when the flush handle is down
4. Press STOP on the stopwatch when the water in the toilet is at its lowest point
5. Record time in seconds in the table below. In general: 1 second of flush = 1 litre of water
6. REPEAT steps 1-5 two more times and record the results in the table below
7. Add the total for the Time and Volume columns
8. Calculate the average of your three tests to find the average volume of water (litres) used per flush

Flush number	Time (seconds)	Volume (litres)
Flush #1	s	L
Flush #2	s	L
Flush #3	s	L
Total		

Average volume of water used per toilet per flush:

$$\begin{array}{c}
 \underline{\hspace{10em}} \\
 \text{Total volume (L)}
 \end{array}
 \div
 \begin{array}{c}
 3 \\
 \underline{\hspace{10em}} \\
 \text{Number of flushes}
 \end{array}
 =
 \begin{array}{c}
 \boxed{\hspace{10em}} \\
 \underline{\hspace{10em}} \\
 \text{L/flush}
 \end{array}$$

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Urinals

Volume of water used by urinals per flush Urinal type 1	L/flush
Volume of water used by urinals per flush Urinal type 2	L/flush
Volume of water used by urinals per flush Urinal type 3	L/flush
Average volume of water used per flush	L/flush
Are urinals sensor or timer activated?	L/flush
If timer activated, how often do they flush?	L/flush

TIP: Volume of Water Used Per Flush may be found near the flush handle.



See reverse for more instructions.

DRAFT

Baseline Data Collection

Urinals - continued

If the volume of water per flush is not printed anywhere on the urinal,

follow these steps to calculate volume of water used per flush.

1. Get a stopwatch
2. In pairs, one person hold the stopwatch, the other will flush the urinal.
3. Press START on the stopwatch when the flush handle is down
4. Press STOP on the stopwatch when the water stops flowing from the top.
5. Record time in seconds in the table below. In general: 1 second of flush = 1 litre of water
6. REPEAT steps 1-5 two more times and record the results in the table below
7. Add the total for the Time and Volume columns
8. Calculate the average of your three tests to find the average volume of water (litres) used per flush

Flush number	Time (seconds)	Volume (litres)
Flush #1	s	L
Flush #2	s	L
Flush #3	s	L
Total		

Average volume of water used per urinal per flush:

$$\begin{array}{c}
 \underline{\hspace{10em}} \\
 \text{Total volume (L)}
 \end{array}
 \div
 \begin{array}{c}
 \underline{\hspace{10em}} \\
 \text{Number of flushes}
 \end{array}
 =
 \begin{array}{c}
 \boxed{\hspace{10em}} \\
 \text{L/flush}
 \end{array}$$

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Faucets

Flow rate of the student washroom faucets	L/sec
Flow rate of the staff washroom faucets	L/sec
Flow rate the science room faucets	L/sec
Flow rate of other faucets 1	L/sec
Flow rate of other faucets 2	L/sec
Flow rate of other faucets 3	L/sec
Total flow rate of other faucets (1+2+3)	L/sec

Supplies

To calculate volume of water used by faucets you will need:

- Measuring cup (minimum 500 mL)
- Stopwatch
- Extra paper
- Pencil

Procedure

1. Select a faucet type from the table above, and turn faucet 90o (or ¼ turn)
2. **At the same time**, place measuring cup under the water and press START on the stopwatch.
3. Press 'STOP' on timer when water reaches top fill line (ex: 500 mL)
4. Record time in the table on the next page next to 'Trial #1'.
5. Repeat steps 1-4 twice more for a total of **three** time values to complete the table
6. Calculate the average of your three trials to find the average time it takes to fill the measuring cup.

See reverse for more instructions.

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Baseline Data Collection

Faucets - continued

Trial Number	Time student WR faucet	Time staff WR faucet	Time science rm faucet	Time other faucet 1	Time other faucet 2
Trial #1	s				
Trial #2	s				
Trial #3	s				
Total					

Calculate average time to fill measuring cup:

$$\frac{\text{Total time (s)}}{3} = \text{sec}$$

Total time (s) Number of trials

7. Calculate the faucet flow rate by dividing the volume of the measuring cup by the **average time** recorded in step 6.

EXAMPLE using a 500mL measuring cup:

$$\frac{\text{Volume of measuring cup}}{\text{Average time to fill measuring cup}} = \frac{500 \text{ mL}}{7.3 \text{ seconds}} = 68 \text{ mL/sec}$$

Faucet flow rate

Calculate faucet flow rate

$$\frac{\text{Volume of measuring cup}}{\text{Avg. time to fill measuring cup}} \text{ sec} = \text{mL/sec}$$

Convert to L/sec

$$\frac{\text{flow rate mL/sec}}{1000} = \text{L/sec}$$

flow rate mL/sec mL

8. Record faucet flow rate in L/sec in the table on the previous page next to the corresponding faucet type.

9. Repeat steps 1-8 for each different faucet type in the school

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Drinking fountains

Flow rate of drinking fountains	mL/sec
Volume of water used by water bottle refill stations each day	L/day

Supplies

To calculate volume of water used by faucets you will need:

- Measuring cup (minimum 500 mL)
- Stopwatch
- Pencil

Procedure

1. Turn the fountain knob all the way open.
2. **At the same time**, place measuring cup under the water AND press START on the stopwatch.
3. Press 'STOP' on timer when water reaches top fill line (ex: 500 mL)
4. Record time on the table below.
5. Repeat steps 1-4 two more times for a total of three time values to complete the table.

Trial Number	Time (seconds)	Volume (litres)
Trial #1	s	mL
Trial #2	s	mL
Trial #3	s	mL
Total	s	mL

See reverse for further instructions.

DRAFT

Baseline Data Collection

Drinking fountains - continued

Procedure - continued

6. Calculate the average time to fill the measuring cup

Average time

$$\frac{\text{Total time (s)}}{\text{Number of trials}} = \frac{\quad}{3} = \text{sec}$$

7. Calculate the flow rate by dividing the volume of the measuring cup by the **average time** recorded in step 6.

EXAMPLE using a 500mL measuring cup:

$$\begin{array}{rcl} \text{Volume of measuring cup} & & 500 \text{ mL} \\ \text{Average time to fill measuring cup} & \div & 7.3 \text{ seconds} \\ \hline \text{Faucet flow rate} & = & 68 \text{ mL/sec} \end{array}$$

Calculate faucet flow rate

$$\frac{\text{Volume of measuring cup}}{\text{Avg. time to fill measuring cup}} = \frac{\quad}{\quad} \frac{\text{sec}}{\quad} = \text{mL/sec}$$

Convert to L/sec

$$\frac{\text{flow rate mL/sec}}{\quad} = \frac{\quad}{1000} = \text{L/sec}$$

8. Record drinking fountain flow rate in L/sec in the table on the previous page.

Baseline Data Collection

Water bottle refill stations

Procedure

1. Record volume of water or 'number of water bottles saved' from station display (if available) first thing in the morning
2. Record the value again at the end of the day
3. Repeat this process for 5 days.
4. Calculate the difference between the morning and afternoon values for each day, then calculate the average to find the average volume of water used by refill stations daily.

$$\begin{array}{ccccccc}
 \underline{\hspace{2cm}} & + & \underline{\hspace{2cm}} & + & \underline{\hspace{2cm}} & + & \underline{\hspace{2cm}} & = & \underline{\hspace{2cm}} \\
 \text{Day 1} & & \text{Day 2} & & \text{Day 3} & & \text{Day 4} & & \text{Day 5} & & \text{Total}
 \end{array}$$

$$\begin{array}{ccc}
 \underline{\hspace{4cm}} & / & \underline{\hspace{2cm}} \quad 5 \\
 \text{Volume used in week 1} & & \text{Days}
 \end{array}
 = \boxed{\hspace{2cm}} \text{ L/day}$$

Avg. volume used each day

If refill station display shows 'water bottles saved', multiply difference between #1 and #2 for each days by 500mL (average water bottle volume). The result is volume of water used by refill stations.

Name: _____

Baseline Data Collection

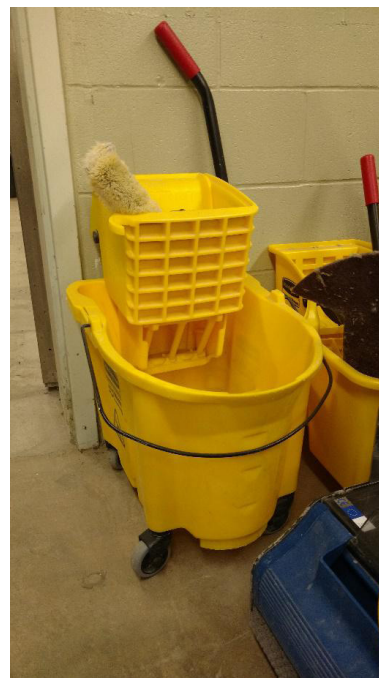
BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Floor cleaning

Are the floors cleaned with a mop and bucket or with a floor cleaner?	
Volume of water used each time floors are cleaned	L/use
How often are the floors cleaned each day?	

Procedure

1. Speak to the custodian to find out how the floors are cleaned (floor cleaning machine or mop and bucket) and how often
2. Find out how much water is used in the floor cleaning machine and/or the bucket each time



Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Dishwashers

Number of Dishwashers in the school	
Volume of water used by dishwashers per cycle	
How often are the dishwashers used each day?	

Procedure

1. Open dishwasher door and locate product sticker (Image 1).
2. Record the Model Number
3. Look up the Model Number on the internet
4. Find the user manual for your dishwasher model
5. Look in the manual for water use information

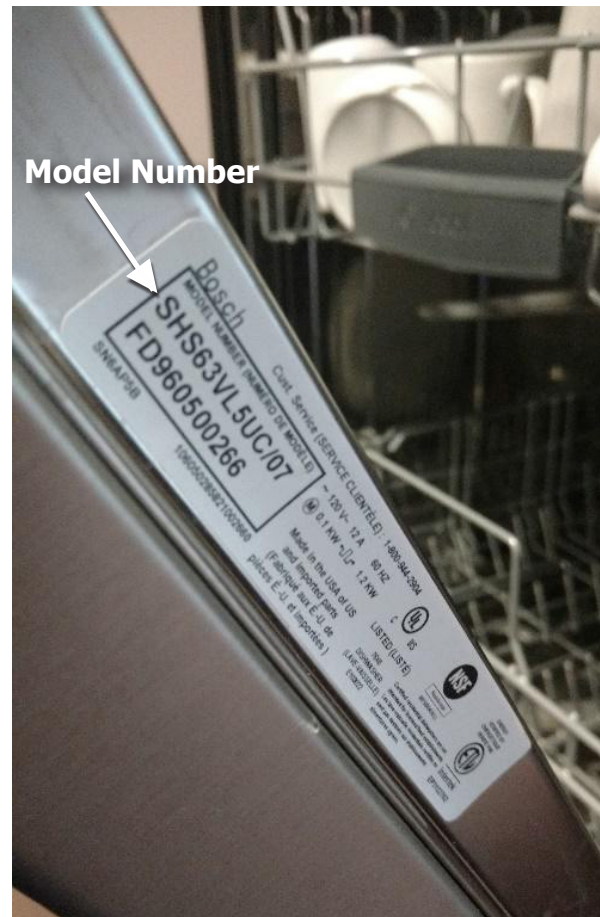


Image 1

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Washing Machines

Number of washing machines in the school	
Volume of water used by washing machines per use	
How often are the washing machines used each day?	

Procedure

1. Open washing machine door and locate product sticker (Image 1)
2. Record the Model Number (Image 2)
3. Look up the Model Number on the internet
4. Find the user manual for your washing machine model
5. Look in the manual for water use information

NOTE: If you are unable to locate water-use information, use the standard 60 L/use



Image 2

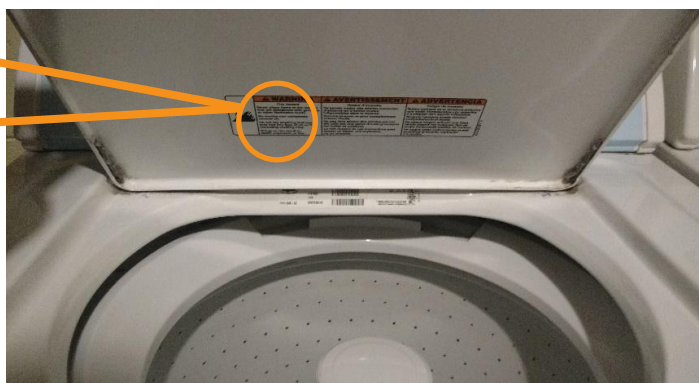


Image 1

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Showers

Are there showers in the school?	
Flow rate of showers	L/sec
How often are showers used each day?	

Supplies

To calculate volume of water used by showers you will need:

- Graduated bucket
- Stopwatch
- Baseline Data Collection - Showers sheet

Procedure

1. One person turn shower faucet 90o (or ¼ turn) to start water, while holding the bucket.
2. Place bucket under the water AND another person press 'START' on the stopwatch at the same time.
3. Press 'STOP' on timer after 15 seconds AND turn water off at the same time.
4. Record volume in table on the next page.
5. Repeat steps 1-4 two more times for a total of three volume values.
6. Calculate the average volume using the table and equation on the next page.

See reverse for further instructions.

Baseline Data Collection

Showers - continued

Procedure - continued

Trial Number	Time (seconds)	Volume (litres)
Trial #1	15s	L
Trial #2	15s	L
Trial #3	15s	L
Total	45s	L

6. Calculate the average volume

Average time

$$\frac{\text{Total volume}}{\text{Number of trials}} = \frac{\quad}{3} = \quad \text{L}$$

7. Calculate the flow rate by dividing the volume of the measuring cup by the average time recorded in step 6.

EXAMPLE using a 500mL measuring cup:

$$\frac{\text{Volume of measuring cup}}{\text{Average time to fill measuring cup}} = \frac{500 \text{ mL}}{7.3 \text{ seconds}} = 68 \text{ mL/sec}$$

Calculate faucet flow rate

$$\frac{\text{Avg. volume collected (L)}}{\text{Time per trial}} = \frac{\quad}{15 \text{ sec}} = \quad \text{L/sec}$$

8. Record faucet flow rate in the table on page 1

9. Repeat steps 1-8 for each different shower faucet type in the school

Name: _____

Baseline Data Collection

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Irrigation and School Grounds

Is there an irrigation or sprinkler system used on the school grounds?	
If yes, what is the volume of water used each time?	
How often is the irrigation system used per day?	



Activity 3

In Activity 3 students use the results from their data collection in Activity 2 to calculate the approximate volume of water used in the school each day and each year. This two-part activity offers flexibility for schools with less access to water-use information. Alternatively, both parts of the activity may be completed as an extension activity to compare between water-use results based on standardized water-use data and water-use results based on student calculations in Activity 2. The results of Activity 3 will be used to identify water conservation opportunities in the school and the development of the Action Plan in Activity 4.

DRAFT

Activity 3: Data Entry and Other Water-Uses

Learning Goals

- Consolidate and organize data.
- Investigate other water-uses in the school.

Success Criteria

- Investigate water-use in the school building and on school grounds by speaking with school staff and visiting different areas of the school.
- Collect and record data on stormwater runoff from school property and other areas of water use in the school.
- Calculate volume of water used in the school on a daily and annual basis.



Time Required

Approximate

2 class periods over 2 days

Curriculum Connections

Subject	Grade 6	Grade 7	Grade 8
	Strand		
Science and Technology	Biodiversity (1.1)	Pure Substances and Mixtures	Systems in Action Water Systems
Mathematics	Data Management and Probability	Measurement Data Management and Probability	Data Management and Probability

See Appendix X, page XX for specific expectations related to Activity 3.

Day One: Calculate Daily and Annual School Water Use

Time

1 class period.

Materials

- Baseline Data Master Data Sheet - completed (Activity 2)
- Daily and Annual Water Use Calculation - Excel spreadsheet

Lesson

1 Set-up a computer/projector so the entire class can see and participate in the data entry process.

2 Open the 'Daily and Annual Water-Use Calculation' Excel spreadsheet.

3 Begin filling in the 'Value' column, highlighted yellow, of the 'Master Data Table'. Start with 'School Basics'.

4 Start filling in the 'Value' column, highlighted yellow, for each Area of Water-Use in the School. These values were calculated in Lesson 2 and compiled into the 'Baseline Data Master Data Sheet'.

5 As you fill in the 'Value' column, water-use per area in the school will be automatically calculated in the 'Water-Use Breakdown' table below.

6 Once the Master Data Table has been filled in, total daily and annual school water use will appear at the bottom of the 'Water-Use Breakdown' table, highlighted blue and green respectively.



NOTE:

Values in the 'Frequency (Daily)' column, highlighted orange, have been included based on standard values for each water use area. Modify these frequency values where possible to match water use patterns at your school for a more accurate calculation of daily and annual water use.

NOTE for 'Showers':

The formula to estimate water-use of showers assumes that $\frac{1}{4}$ of the student population uses the showers once per day. This is noted in the formula bar as '(B7/4)' where 'B7' is the total student population at the school. Modify this formula as necessary.

NOTE for Standard Water-Use Values

table: Values in this table may be substituted for values in the 'Master Data Table' where data is missing or unavailable.

Day Two: Calculate Volume of Other Water-Use Areas

Time

1 class period.

Materials

- Clipboards
- Data Collection sheets (1 per group) - 'Impervious Surfaces'
- Pencils
- Calculator
- Measuring tape and/or measuring wheel
- Computer Access



Activity

So far students have investigated the common ways water is used in the school, but what are other areas in the school that use water and should be included in the investigation?

1 Ask students to brainstorm as a class other areas of water-use in the school that have not yet been examined. Write their ideas on the board.

3 Ask students to brainstorm the impacts (positive and negative) of water-use in their assigned area.

2 Once a list is compiled, break students into groups and assign an area from the list to each group.

4 Take up the brainstorming results as a group

Heating and cooling systems, swimming **pools** and **stormwater runoff** are just a few of the other ways schools use and interact with water on a regular basis. These three areas will be investigated in this lesson and if possible, include any additional areas of water used identified in step 1.

Enter data collected in this lesson into the Master Data Sheet in the 'Other Water Uses' tab.

Day Two Continued: Stormwater Runoff

1. Measure Area of Impervious Surfaces

Divide students into groups to measure area of:

- School building footprint (to determine roof area)
 - Parking lot footprint
 - Outdoor running track footprint
 - Outdoor basketball court footprint
 - Footprint of any additional permanent structures or paved areas on school property
- Distribute corresponding data collection sheets to each group.

Note: Assign one group to collect data on swimming pool water-use during this section if applicable to your school. See 'Swimming Pool' section for details.

2. Data Collection

Students may wish to use any one of the following methods to measure area for items 1a-e, or use a combination of methods and then compare the accuracy of the results between methods used. Students record surface details and area on data collection sheets provided.

a. Google Maps (or other mapping software)

Using 'Create a Map' in the 'My Maps' section of Google Maps, students can zoom in on the school property using the Satellite map view. Then using the 'Draw a line' or 'Measure distances and areas' tools students can trace buildings and surfaces to determine the area.

b. School Schematics

Students may speak to school custodians to obtain area values from school schematics.

c. Manual Measurement

Students physically measure the perimeter of school buildings and surfaces using measuring tapes or measuring wheels.

Add the values from each group to get the total area of impervious surface on school property.

NOTE: The area values can also be entered into the corresponding lines in the Other Water Uses tab of the Master Data Sheet. The Total Impervious Surface Area will be automatically calculated.

Day Two Continued: Stormwater Runoff

3. Calculate Runoff

- Conduct an online search to determine the average annual rainfall for your area.
Possible websites include:
 - Weather Network
 - Environment Canada
- Enter the value from a into the Average Annual Rainfall line in the Other Water Uses tab of the Master Data Sheet
- Annual runoff from impervious surfaces will be automatically calculated (gallons and litres).

4. Calculate Total Annual School Water Use

- Add volume of runoff from school property calculated in 3c. to 'Total Annual School Water Usage' calculated in Activity 2.

Swimming Pools (If applicable to your school)

Note: During the Stormwater Runoff data collection process, one group should be assigned to collect swimming pool data if applicable to your school.

Ontario Regulation 565, Health Protection and Promotion Act R.R.O. 1990 outlines guidelines for water turnover in public pools as necessary to maintain health and safety standards and good water quality for swimmers.

Some important regulations include:

- Water must be topped up with make-up water by a minimum of 20L per bather per operating day.
- 15% of the total pool water-volume must be capable of being withdrawn from the gutter or skimmer lines daily and discharged to waste

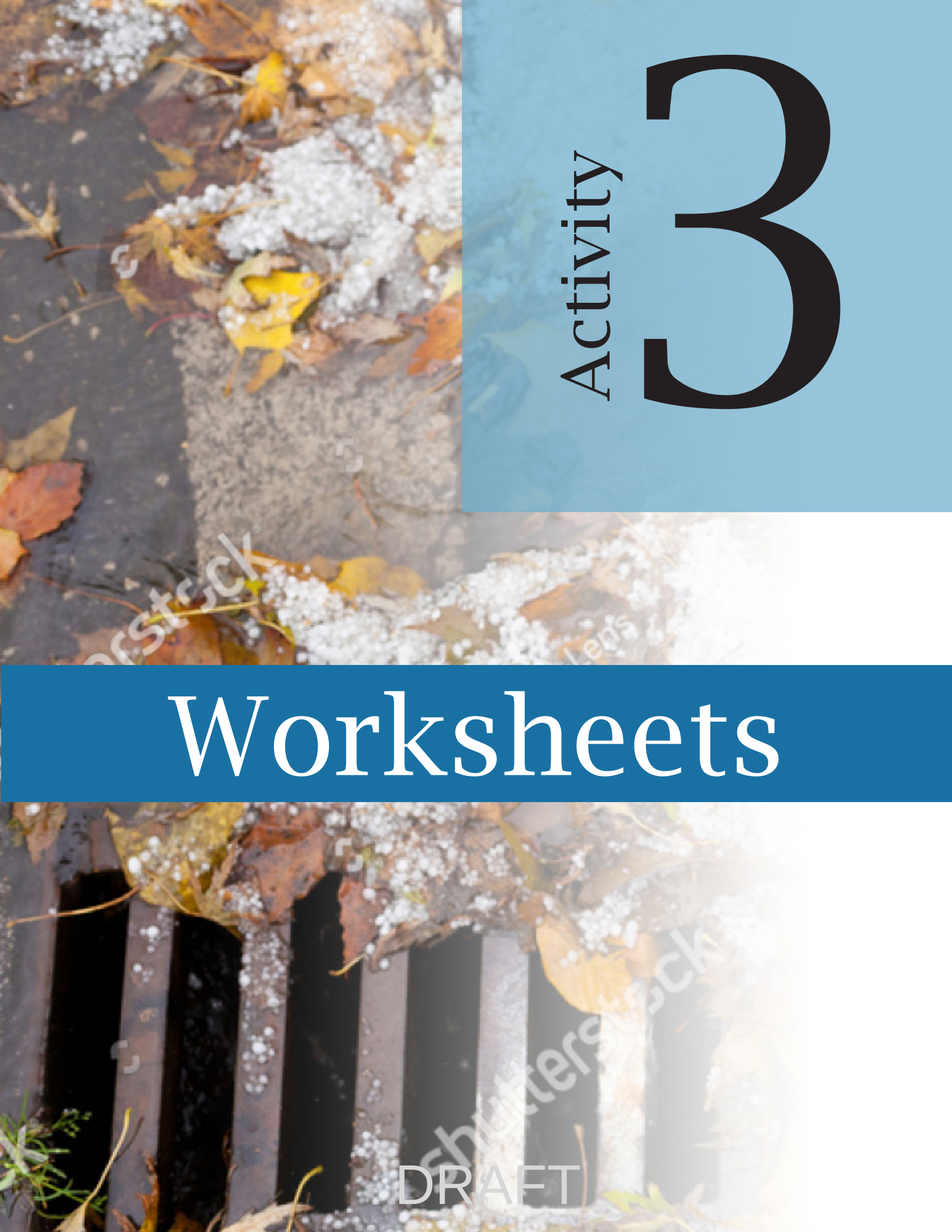
To determine how much water your pool uses on average each day and annually to meet these criteria, students will need to collect data on:

- Number of days the pool is in operation each year
- Average number of bathers per day of operation
- Total pool volume
- Volume of waste discharged from the pool each day*

*If it is not possible to determine the exact daily volume of water discharged as waste from the pool, assume the minimum 15% of total pool volume is discharged each day.

Instructions

Using the "Data Collection – Swimming Pools" data sheet, one group of students can collect data on swimming pool water use as part of the Stormwater Runoff data collection process, or complete swimming pool data as a class.

The background of the page is a photograph of a path covered with fallen autumn leaves in shades of yellow, orange, and brown. Patches of white snow are scattered across the path, particularly in the upper right and lower right areas. The path itself appears to be made of dark material, possibly asphalt or wet pavement.

Activity

3

Worksheets

DRAFT

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

School Building (Roof)

Measurement method (circle one)

- ☐ Online or map software
- ☐ School schematics
- ☐ Manual measurement



Area (m²) School Building: _____

Area = Length x Width

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Parking Lot

Measurement method (circle one)

-  Online or map software
-  School schematics
-  Manual measurement



Area (m²) Parking Lot: _____

Area = Length x Width

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Outdoor Running Track

Measurement method (circle one)

- ☐ Online or map software
- ☐ School schematics
- ☐ Manual measurement



Area (m²) Outdoor Running Track: _____

Area = Length x Width

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Outdoor Basketball Court

Measurement method (circle one)

- ☐ Online or map software
- ☐ School schematics
- ☐ Manual measurement



Area (m²) Outdoor Basketball Court: _____

Area = Length x Width

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Outdoor Tennis Court

Measurement method (circle one)

-  Online or map software
-  School schematics
-  Manual measurement



Area (m²) Outdoor Tennis Court: _____

Area = Length x Width

Names: _____

Data Collection: Impervious Surfaces

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Other Surface/Structure

Measurement method (circle one)

-  Online or map software
-  School schematics
-  Manual measurement



Area (m²) Other Surface/Structure: _____

Area = Length x Width

Names: _____

Data Collection: Swimming Pool If applicable to your school

BEFORE COLLECTING DATA: Get permission from your teacher before exploring the school to collect data and always knock before entering a classroom, office or washroom.

Total swimming pool volume Multiply gallons by 3.79 to find volume in litres	L
Volume discharged daily to waste	L/day

If unable to obtain volume of water discharged use equation below:

$$\frac{\text{L}}{\text{Volume of measuring cup}} \times \frac{0.15}{\text{Avg. time to fill measuring cup}} = \text{L/day}$$

Number of days the pool is in operation (annually)	days
---	------

Number of swimmers per day of operation (average)

$$\frac{\text{Sum of daily swimmers}}{\text{Number of days in operation}} = \text{ppl/day}$$

Volume of make-up water used per day of operation

$$\frac{\text{Avg. number of swimmers/day}}{\text{Litres of make-up water/person}} = \text{L/day}$$

Total volume of water used daily

$$\text{Vol. of discharge water} + \text{Volume of make-up water (daily)} = \text{L/day}$$

Total volume of water used annually

$$\text{Total volume of water used daily} \times \text{Number of days of operation} = \text{L/year}$$