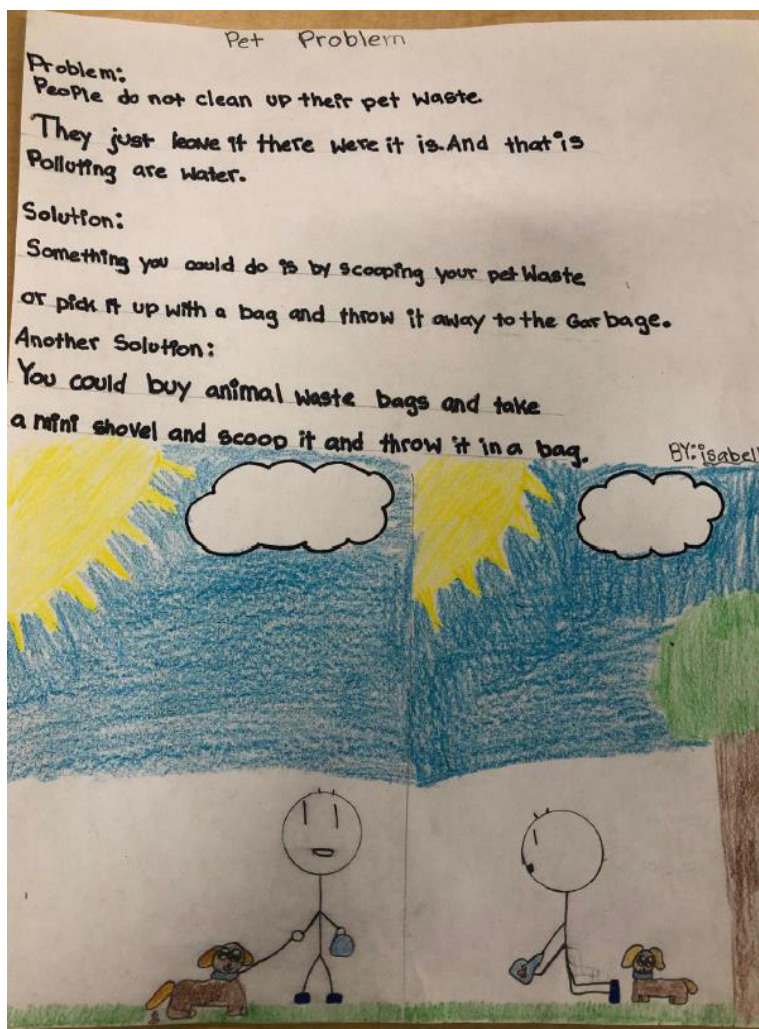


EASTERN WASHINGTON STORMWATER EFFECTIVENESS STUDIES

ELEMENTARY SCHOOL STORMWATER EDUCATION EFFECTIVENESS STUDY: DRAIN RANGERS PROGRAM





ACKNOWLEDGEMENTS

Prepared in partnership by the following organizations and team members:

Kara Kaelber, Education Director	Franklin Conservation District	1724 Superior Street, Pasco, WA 99301 Phone: 509-416-0440, ext. 107 Email: kara-kaelber@conservewa.net
Martin Nelson, Development Review Supervisor	City of Kennewick	1010 E Chemical Drive, Kennewick, WA 99336 Phone: 509-585-4306 Email: martin.nelson@ci.kennewick.wa.us
Brian Pope Civil Engineer I	City of Richland	625 Swift Blvd. MS#26, Richland, WA 99352 Phone: 509-942-7508 Email: bpope@ci.richland.wa.us
Drew Woodruff, PE City Engineer	City of West Richland	3100 Belmont Blvd., Ste. 102, West Richland, WA 99353 Phone: 509-967-5434 Email: drew@westrichland.org
Michael Henao Environmental Compliance Coordinator	City of Pasco	PO Box 293, 525 N. Third Ave., Pasco, WA 99301 Phone: 509-544-3080 ext. 3454 Email: henaom@pasco-wa.gov
Shilo Sprouse, CSI Stormwater Services Program Manager	City of Pullman	325 SE Paradise St, Pullman, WA 99163 Phone: 509-338-3140 Email: shilo.sprouse@pullman-wa.gov
Jeff Wiemer Regional Stormwater Coordinator	Asotin County	PO Box 160, Asotin, WA 99402 Phone: 509-243-2074 Email: jwiemer@co.asotin.wa.us
Jack Wells Natural Resource Specialist, Stormwater Lead	Yakima County	WRD, 4th Floor, 128 N. 2nd Street, Yakima, WA 98901 Phone: 509-574-2350 Email: jack.wells@co.yakima.wa.us
Chad Phillips Assistant Engineer	City of Spokane Valley	10210 E Sprague, Spokane Valley, WA 99206 Phone: 509-720-5013 Email: cphillips@spokanevalley.org
Randy Meloy, PE Surface Water Engineer	City of Yakima	2220 East Viola Ave., Yakima, WA 98901 Phone: 509-576-6606 Email: Randy.Meloy@yakima.gov
Andrea Jedel, PWS Municipal Stormwater Permit Manager	WA State Department of Ecology	1250 W. Alder St, Union Gap, WA 98903-0009 Phone: 509-575-2807 Email: andrea.jedel@ecy.wa.gov
Brandi Lubliner	WA State Department of Ecology	Phone: 360-407-7140 Email: brandi.lubliner@ecy.wa.gov
Abbey Stockwell	WA State Department of Ecology	PO Box 47600, Olympia, WA 98504-7600 Phone: 360-407-7221 Email: abst@ecy.wa.gov



CONTENTS

ACKNOWLEDGEMENTS 2

EXECUTIVE SUMMARY 4

1.0 Background..... 5

1.1 The Stormwater Education and Outreach (E&O) Program..... 5

1.2 Problem Description..... 6

1.3 Results of Prior Studies 8

1.4 Regulatory Requirements 8

2.0 Project Overview..... 9

2.1 Study Goal 9

2.2 Study Description, Objectives and Tasks 9

2.3 Study Location and/or Target Population 10

3.0 Organization and Execution 11

3.1 Key Project Team Members: Roles and Responsibilities..... 11

3.2 Training and Participating Schools..... 12

3.3 Challenges..... 12

4.0 Test Results 13

4.1 Pre/Post Surveys..... 13

4.2 Additional Tasks (Student Essays, Posters and Other Miscellaneous Items)..... 13

5.0 Conclusions..... 14

6.0 Recommendations 15

7.0 Appendices 16

Appendix A – Drain Rangers Curriculum: Overview and Objectives..... 16

Appendix B - EWA Drain Rangers Stormwater Student Pre/Post Survey Form 18

Appendix C – Tabulation of Surveys..... 19

Appendix D – Student Essays and Miscellaneous..... 25

Appendix E – Student Posters..... 30



EXECUTIVE SUMMARY

Under the National Pollutant Discharge Elimination System permits for municipal stormwater discharges, stormwater pollution prevention education and outreach programs are important elements of an effective stormwater management program. It is never too early to teach principles of stormwater pollution prevention and to this end the Drain Rangers program was developed in 2015 by the Pacific Education Institute, working together with formal educators, cities, and nonprofits throughout Washington to create an excellent stormwater curriculum that meets next generation standards.

In 2016, the Franklin Conservation District adapted the Drain Rangers program to Eastern Washington needs, and in 2018 they are implementing the program through several elementary schools (Grades 3-5) in the Quad-Cities (Kennewick, Pasco, Richland, West Richland) area of Eastern Washington.

This study performed before and after testing on students in several elementary school classes to measure the effectiveness of the Drain Rangers program, in areas of Action, Knowledge and Attitude. Due to the effects of the worldwide pandemic, the study was performed from 2019-2021. Ten 4th and 5th grade elementary school classes and 209 students were taught the Drain Rangers program curriculum and given pre/post survey tests, with the results contained in this document.

The study results indicate that the Drain Rangers program has a very positive effect on educating students about stormwater effects and solutions. This included a 22% increase in expressed actions to address stormwater issues, a 67% increase in scoring for stormwater knowledge and solutions, and a 17% increase in expressed attitude that personal actions can make a positive difference to keep waterways clean and healthy.

Based on those scores, this report enthusiastically recommends the continuation and further implementation of the Drain Rangers program to educate elementary school students in the stormwater world. The study includes recommendations for future implementation of the program.



1.0 BACKGROUND

1.1 The Stormwater Education and Outreach (E&O) Program

The Eastern Washington (EWA) NPDES Phase II Municipal Stormwater (MS4) permit specifies that the cities and counties covered under the permit (permittees) implement public education and outreach (E&O) programs. The target audience for these programs is the general public, including school-aged children, living in the permitted jurisdictions or region. The goal of these programs is to inform the public about “...the importance of improving water quality and protecting beneficial uses of waters of the state; potential impacts from stormwater discharges; methods for avoiding, minimizing, reducing and/or eliminating the adverse impacts of stormwater discharges; and actions individuals can take to improve water quality...”.

Some permittees meet this requirement by partnering with K-12 schools in their jurisdiction and providing educational workshops and presentations focused on stormwater as part of the regular school day for students. Other permittees partner with organizations, which specialize in educational training, to provide formal classroom instruction on their behalf. For example, several EWA permittees have an interlocal agreement (ILA) with the Franklin Conservation District (FCD) to provide this service. These jurisdictions include:

- City of Ellensburg
- City of Yakima
- Yakima County Stormwater Group (Selah, Union Gap, Sunnyside, Grandview)
- Quad Cities (Kennewick, Pasco, Richland, West Richland)
- Asotin County
- City of Clarkston
- City of Asotin

The FCD has two stormwater education programs: Water on Wheels and Drain Rangers. Water on Wheels is for students in grades K-6th. The goal of this program is to increase the students’ awareness of water and soil conservation issues. The Drain Rangers program is for students in grades 3rd-5th. The goal of Drain Rangers is to increase the student’s awareness and understanding of stormwater pollution issues facing their community including the specific actions students can take to improve the quality of the waterways in their community.

This study measured the effectiveness of the Drain Rangers educational program. Drain Rangers was developed with funds from an Ecology Grants of Regional or Statewide Significance (GROSS) Grant by educators, western Washington (WWA) permittees, and nonprofit organizations. Drain Rangers is a stormwater curricular unit with 10 lesson plans that are intended to be taught in classrooms and outdoors on the school site over a three to four-week period. The lesson plans focus on teaching students what stormwater is, how pollutants can get into waterways, and the actions students can take to keep waterways clean (i.e. prevent stormwater pollutants from entering waterways). Students also apply the engineering design process to develop solutions to stormwater runoff problems and then develop an educational campaign to share what they learned with others in their community. The curriculum was specifically developed to align with



the MS4s NPDES goals for the E&O programs as well as elementary school learning standards including the Washington State common core for English Language Arts (ELA) and the Next Generation Science Standards (NGSS).

Drain Rangers was pilot tested during the 2016-2017 academic year at schools in WWA. The results from the pilot study were released on June 30, 2017, and can be found at: http://pugetsoundstorm.weebly.com/uploads/1/1/2/3/11234420/drain_rangers-final_report.pdf

The FCD is one of the organizations involved in the Drain Rangers curriculum development. Their role was to adapt the curriculum to EWA and provide teacher training workshops in Spokane, Ellensburg and the Quad-Cities. An overview of the EWA lesson plans is in Appendix A and a copy of the Drain Rangers curriculum is available on the FCD website: <https://drive.google.com/file/d/0B5-jJRFUir7OXVDWFV0Zng4LTQ/view>

The focus of this study was to measure the effectiveness of the Drain Rangers curriculum in up to three EWA elementary schools in the Quad-Cities. In the end, the study involved ten classrooms and ___ students, exceeding expectations.

1.2 Problem Description

Drain Rangers is a new educational program that has been implemented in a limited number of WWA schools. As such, there are many questions about this educational program including:

- What is the short-term impact of the Drain Rangers educational program for increasing student's awareness and understanding of stormwater pollution immediately following their participating in the program?
- Will the Drain Rangers educational program have a lasting impact on student's awareness and understanding of stormwater pollution one or more years after students participate in the program?
- What aspects (if any) of the Drain Rangers educational program will motivate students to take actions that will prevent stormwater pollution in their neighborhoods and communities?
- Will teachers incorporate the Drain Rangers educational program into their standard curriculum and make a long-term commitment to teach the program? survey them.

This study focused on the first question and sought to measure the short-term effectiveness of the Drain Rangers stormwater educational program. Answering the questions in the other bullets was beyond the scope and timeline of this Effectiveness Study. However, since the ultimate goal of stormwater education programs is to make a sustainable, positive impact on students, it is important to understand the variables that are more likely to yield this impact. This section provides a summary of findings from related research that have attempted to answer similar questions. These findings were all reported in a 2001 synthesis of literature written by Rickinson titled *Learners and Learning in Environmental Education: A critical review of the evidence* (Rickinson, 2001).

It is evident from research reported on K-12 environmental educational programs, similar to Drain Rangers, that these programs can have a positive effect on student's attitude and knowledge



of the environment. Many studies have reported a significant positive impact in students immediately after the program. However, the long-term impact of these programs on students is not as evident. Some researchers have reported a measurable increase in student's awareness of the relationship between their actions and the environment years after the educational experience while other researchers have reported no measurable change in students just weeks after they participated in the educational program.

The differences in the effectiveness of educational programs may relate to specific aspects of the educational program which have been reported by researchers to have the most significant influence on student's educational experience. These aspects include:

- **Duration** – longer duration educational programs appear to have more of an impact on students compared to shorter duration programs. A study that evaluated two versions of an outdoor ecology education program (1-day and 5-day) found that only students from the longer 5-day program reported a significant shift in their attitudes and behaviors toward the environment.
- **Location** - outdoor classroom experiences have been identified as the most significant aspects of an environmental program for motivating students. One justification is that students are more likely to relate environmental issues to their own community when they learn the information outdoors in their community.
- **Community involvement** – K-12 environmental education programs that include community involvement appear to enhance the students learning experience, specifically when students are able to share their new knowledge and experiences with their families and friends
- **Preparatory and follow-up work** - environmental educational programs that include teacher training workshops before the program is implemented and teachers that follow up with the students on the environmental program concepts (after the program has been implemented) appear to improve both the short-term and long-term impact on students.

Some of the key aspects reported are already part of the Drain Rangers curriculum. For example, the lesson plans are intended to be taught over a long duration (3/4-week period) with several lessons taught outdoors, and teacher training workshops are provided to teachers to support them in implementing the program in their own classroom. In addition, the final project includes students developing an educational campaign focused on stormwater awareness. This aspect of the program provides students with an opportunity to engage and share with the community what they have learned.

In summary, while this study focuses on evaluating the short-term effectiveness of Drain Rangers, the educational program includes aspects that have been identified by researchers as key for supporting the long-term impact of the program on students.



1.3 Results of Prior Studies

The WWA Drain Rangers educational program pilot testing included evaluating the effectiveness of the curriculum by comparing students before and after survey responses. In the report that was released by the City of Bothell on June 30, 2017, it stated that, “The partners on this grant effort were able to meet and exceed our expectations for our task deliverables.” It goes on to list accomplishments, that included 15 teacher training meetings for 183 educators, participation of nine schools, development of four videos, and adaptation of the curriculum for Eastern WA elementary schools.

1.4 Regulatory Requirements

The EWA Phase II MS4 Permit S5.B.1 requires permittees to implement a public education and outreach program, either locally or regionally. This study will focus on evaluating the effectiveness of a stormwater education program for elementary school aged children.



2.0 PROJECT OVERVIEW

2.1 Study Goal

The goal of the study was to evaluate the short-term effectiveness of the Drain Rangers education program in EWA. Effectiveness was measured based on changes in the students understanding of selected learning objectives immediately before and after participating in this program. The Drain Rangers curriculum includes 10 lesson plans each of which has different learning objectives as shown in Appendix A. This study only evaluated those learning objectives that align with the EWA NPDES MS4 Phase II permit requirements for E&O. Specifically, increased student understanding and awareness of the following:

- Students will understand what stormwater is
- Students will describe problems that can be caused by stormwater runoff
- Students will describe solutions and actions they can take to prevent polluted stormwater from entering waterways and to keep waterways clean

2.2 Study Description, Objectives and Tasks

This study pilot tested the Drain Rangers Stormwater Education program in elementary schools in EWA, using the Drain Rangers curriculum that was developed for EWA as part of a 2015-2017 GROSS Grant. Teacher training workshops were offered to the teachers who participated in the study. The purpose of the workshops was to provide teachers with background on the curriculum concepts as well as guidance for consistently implementing the curriculum in their classrooms. The curriculum was implemented by the student's teachers during the regular school hours. Students were given surveys designed to assess the students' knowledge of the learning objectives immediately before and after they participated in the educational program. The effectiveness of the Drain Rangers programs is evaluated by comparing the differences in student's responses to the pre and post surveys.

The study goals were achieved by meeting the following objectives and tasks:

1. Prepare the EWA Drain Rangers curriculum and teacher training materials
2. Recruit schools and teachers to participate in the study
3. Design a Pre/Post survey to test the students' growth as a result of taking the curriculum. The sample survey is found in Appendix B - EWA Drain Rangers Stormwater Student Pre/Post Survey Form.
4. Train the teachers through workshops to perform the program.
5. Implement the curriculum in several elementary school classes.
6. Collect, evaluate and interpret the effectiveness of the curriculum through comparing the differences in the student's response on the pre- and post-surveys.



2.3 Study Location and/or Target Population

The study was pilot tested at ten elementary schools within the Quad cities (Kennewick, Pasco, Richland and West Richland) area. The target population for this study was students in grades 3-5. This population was pre-determined because it is the target age for the Drain Rangers curriculum.



3.0 ORGANIZATION AND EXECUTION

3.1 Key Project Team Members: Roles and Responsibilities

City of Kennewick stormwater staff acted as the primary lead for this study, working closely with the Franklin Conservation District. Primary roles and responsibilities for each of the team members is summarized in the following table.

Kara Kaelber, Education Director	Franklin Conservation District	Implement Drain Rangers Program; recruit participating teachers; hold workshops to train teachers
Martin Nelson, Development Review Supervisor	City of Kennewick	Responsible for study execution; participate in teacher workshops; tabulate survey results; write final report
Brian Pope Civil Engineer I	City of Richland	Advisory Board Lead/Member
Drew Woodruff, PE City Engineer	City of West Richland	Reviewer
Michael Henao Environmental Compliance Coordinator	City of Pasco	Reviewer
Shilo Sprouse, CSI Stormwater Services Program Manager	City of Pullman	Reviewer
Jeff Wiemer Regional Stormwater Coordinator	Asotin County	Advisory Board Lead/Member
Jack Wells Natural Resource Specialist, Stormwater Lead	Yakima County	Reviewer
Chad Phillips Assistant Engineer	City of Spokane Valley	Reviewer
Randy Meloy, PE Surface Water Engineer	City of Yakima	Reviewer
Andrea Jedel, PWS Municipal Stormwater Permit Manager	WA State Department of Ecology	Permit Manager
Brandi Lubliner	WA State Department of Ecology	QA Coordinator
Abbey Stockwell	WA State Department of Ecology	Permit Administrator



3.2 Training and Participating Schools

The study exceeded the goal of three elementary school classes and 75 students, as ten classes with 209 students participated in the study, of which 142 completed both a pre and post test. The following table lists the participating teachers, grades, schools and associated school demographics.

Teacher	Grade	Elementary School	School District
Baumgartner	4th	Ruth Livingston	Pasco
Cooper	5th	Tapteal	West Richland
Cortinas	5th	Marcus Whitman	Richland
Dutcher	4th	James McGee	Pasco
Fouad	5th	Lewis and Clark	Richland
Hampton	5th	Tapteal	West Richland
Martinez	5th	Emerson	Pasco
Rogers	5th	Tapteal	West Richland
Rucker	5th	Lewis and Clark	Richland
Staley	4th	Edison	Kennewick

Demographic Information							
	Caucasian	Hispanic	Native American	Asian	African American	Pacific Islander	Multiracial
Tapteal	64.1%	25.1%	0.9%	1.2%	1.6%	0.2%	6.9%
Marcus Whitman	62.7%	27.7%	1.5%	1.0%	0.6%	0.2%	6.3%
Lewis and Clark	58.5%	26.2%	0.4%	6.0%	1.7%	0.0%	7.2%
Edison	40.7%	51.7%	0.0%	0.9%	2.0%	0.6%	4.1%
Ruth Livingston	53.5%	37.1%	0.4%	2.2%	0.7%	0.2%	5.9%
James McGee	33.6%	60.1%	0.0%	1.7%	1.2%	0.0%	3.4%
Emerson	5.2%	91.8%	0.2%	0.5%	0.2%	0.5%	1.5%

3.3 Challenges

It was anticipated that this study would be completed in early 2020; however, initial recruitment of teachers went slowly in 2019. Franklin Conservation District and the City of Kennewick incentivized teacher participation with ice cream parties and gift cards, which increased participation in early 2020, when the worldwide COVID-19 pandemic swept the country and cancelled in-person classes and disrupted teacher curriculums. As students returned to in-person classes, we were fortunate to receive participation exceeding our original study goal.



4.0 TEST RESULTS

4.1 Pre/Post Surveys

Results of the testing were compiled and analyzed by City of Kennewick stormwater staff, with review and input from members of the project team. Summary tabulations for each of the ten participating school classes are included in Appendix C.

A comparison summary of the pre/post survey results for each sub-category (Actions, Knowledge, Attitude) are included in the following table.

The study results indicate that the Drain Rangers program has a very positive effect on educating students about stormwater effects and solutions. This included a 22% increase in expressed actions to address stormwater issues, a 67% increase in scoring for stormwater knowledge and solutions, and a 17% increase in expressed attitude that personal actions can make a positive difference to keep waterways clean and healthy.

4.2 Additional Tasks (Student Essays, Posters and Other Miscellaneous Items)

As part of the implementation of the Drain Rangers Program Curriculum, Franklin Conservation District asked all teachers to not only complete the pre/post survey, but also to complete one portion of the curriculum with their students. This included either a Performance Task (student essay) or the Science and Engineering Task (student posters/surveys). These additional tasks are included in Appendix D and Appendix E of this study.

Some of the highlights from the additional tasks include:



5.0 CONCLUSIONS

The pre/post survey scores were extremely encouraging, concluding that the Drain Rangers Program curriculum for elementary school students is very effective at teaching key concepts of what stormwater is, what solutions can improve conditions and impacts from stormwater, and how individuals' actions can make a significant difference in keeping our rivers and environment cleaner, healthier and safer both now and into the future.



6.0 RECOMMENDATIONS

Based on the extremely encouraging pre/post survey comparison scores, this study enthusiastically recommends the continuation and further implementation of the Drain Rangers Program to educate elementary school students in the stormwater world.

Some minor observations noted that students did not seem to grasp what soil erosion and its impacts were.

Regardless of minor suggestions for improvements, the Drain Rangers Program teaches and encourages these impressionable elementary school students to make a positive difference in protecting our environment through wise stormwater solutions.

The project team thanks the Franklin Conservation District and the Washington State Department of Ecology for their participation in making this study meaningful and successful.

“Teach your children well.” – Crosby, Stills & Nash



7.0 APPENDICES

Appendix A – Drain Rangers Curriculum: Overview and Objectives

Lesson	Overview	Student Learning Objectives
Lesson 1: ELA Performance Task: Part 1	This lesson is designed to build background knowledge about stormwater pollution: what it is, why it is a problem, and what we can do to help keep the water clean. Students are introduced to the problem of stormwater runoff pollution by doing research using 3 different sources.	<ul style="list-style-type: none"> • Complete Part 1: Performance Task “Stormwater Pollution.” • Compile research from 3 sources in “My Notes” (page 11) and answer 3 questions about stormwater pollution (pages 12-14).
Lesson 2: ELA Performance Task: Part 2	Students will work individually to compose an informative/explanatory essay on addressing polluted stormwater runoff, referring to their notes and answers from the 3 research questions.	<ul style="list-style-type: none"> • Organize their essay using the “Organizing My Essay: Stormwater Pollution” graphic organizer (page 26) using their notes and answers to the 3 research questions. • Write a 5 paragraph essay, citing sources as outlined in the graphic organizer.
Lesson 3: Watershed Model	Students develop a watershed model that shows the basic shape (geography) of a watershed, how water flows through it, and the impact people can have on both water quality and water quantity. Then students compare the similarities and difference between their physical watershed and the model they built.	<ul style="list-style-type: none"> • Define a watershed as the entire land area from which water drains into a particular water body. • Use their model to demonstrate that pollutants can cause water quality problems within a watershed. • Compare their model to the watershed they live in.
Lesson 4: Four Rain Drops	Students simulate the movement of water droplets in a forested (undeveloped) and an urbanized (developed) watershed and graph the results.	<ul style="list-style-type: none"> • Compare how water moves through a forested watershed (undeveloped) and an urbanized watershed (developed). • Learn that an equal amount of rainfall creates very different amounts of stormwater runoff depending on the amount of forest trees vs. urban development. • Explore impacts to land and aquatic habitat caused by increased amounts of runoff. • Think of ways to control or reduce the amount of stormwater runoff in urban watersheds.
Lesson 5: Research the Problem: Schoolyard System	In this lesson students develop a model of the schoolyard system by drawing and labeling the parts of the schoolyard. Then students investigate (find evidence) of how water flows through their schoolyard including identifying pervious and impervious surfaces and possible quality and quantity stormwater runoff problems.	<ul style="list-style-type: none"> • Use drawings as a model of a system. • Identify the parts of the system and water inputs and outputs. • Identify features in their schoolyard system that impact water flow and the collection of pollution in that system. • Identify pervious and impervious surfaces in the schoolyard.



<p>Lesson 6: Engineering Design and Defining the Problem</p>	<p>Students will use all the information from the Performance Task: Part 1 reading, diagram, videos, and watershed model to define the stormwater runoff problem in their community.</p>	<ul style="list-style-type: none"> • Be introduced to Engineering Design as described in the Next Generation Science Standards. • Come up with a statement about the stormwater pollution problem in their community. • Determine things they need to know and research to explore solutions to the stormwater pollution problem.
<p>Lesson 7: Understanding Stakeholders</p>	<p>Students identify various people and groups (stakeholders) that are interested in stormwater. They will interview a stakeholder or analyze information from the web to understand this group's priorities and advice on what type of project they should do.</p>	<ul style="list-style-type: none"> • Identify stakeholders. • Obtain information from a stakeholder (interview or website) to help plan and implement a stormwater project in their community.
<p>Lesson 8: Explore and Compare Possible Solutions</p>	<p>Students explore and compare multiple possible solutions to the stormwater runoff problem in their community that will reduce pollution in stormwater runoff.</p>	<ul style="list-style-type: none"> • Explore multiple solutions to the stormwater pollution problem in their community. • Evaluate multiple stormwater solutions in their community that will reduce pollution in stormwater.
<p>Lesson 9: Develop, Implement and Test</p>	<p>Students develop the steps to their outreach plan including who to contact, people who can help, how this helps solve the problem, and materials they will need. Before implementing their plan, students develop a method to measure if their solution was successful. Students implement their plan following the steps they outlined, and then test the effect of their outreach.</p>	<ul style="list-style-type: none"> • Plan steps for their solution project. • Create outreach materials sharing a message of stormwater pollution prevention. • Plan how they will test their outreach solution using surveys or other feedback. • Implement the test of their solutions.
<p>Lesson 10: Evaluate Solutions and Communicate</p>	<p>Students will evaluate their solutions by analyzing the data from surveys, personal action plans, or other tests they used. Students will then discuss improvements to their project (optimize), reflect on their accomplishments, and communicate their accomplishments in some way to the school or the community.</p>	<ul style="list-style-type: none"> • Analyze data from surveys, personal action plans, or other tests to evaluate their solution. • Discuss ways to improve their stormwater pollution project. • Reflect on their accomplishment. • Communicate their project in some way; for example, put their project on a website.



Appendix B - EWA Drain Rangers Stormwater Student Pre/Post Survey Form

Name (First and last): _____ Teacher: _____ Grade (3-5): _____ School: _____

Part A: Actions		5. Describe three problems that can be caused by stormwater runoff. (Listing is okay, or paragraph style – your choice!)					
1. Rank how true these statements are for you: 1 is not at all true, 5 is very true.							
I never litter. <i>Circle one.</i>							
1	2			3	4	5	
My family picks up our pet's waste. <i>Circle one.</i>							
1	2			3	4	5	I don't have a pet.
I talk to my family about the actions we can take at home to reduce stormwater runoff pollution. <i>Circle one.</i>							
1	2	3	4	5			
Part B: Knowledge		6. Describe three possible solutions to prevent polluted stormwater runoff. (Listing is okay, or paragraph style – your choice!)					
2. What is stormwater? (select best answer)							
a) The rain that falls from the sky into local waterways							
b) The rain that soaks into the ground and goes to local waterways							
c) The rain that runs off hard surfaces and goes to local waterways							
d) I don't know		7. Connect each of the items on the left by drawing a line to the statement it best matches on the right.					
3. Which of the following are usually hard or impervious surfaces? <i>Check all that are correct.</i>							
<input type="checkbox"/> Roof	<input type="checkbox"/> Forest			<input type="checkbox"/> Sidewalk			
<input type="checkbox"/> Garden	<input type="checkbox"/> Parking Lot	<input type="checkbox"/> Soccer Field					
4. Which of the following can be affected by pollution entering the Columbia River? <i>Circle one.</i>		1. Car leaks		It can IMPROVE water quality.			
a) Fish		2. Picking up dog poop		It can make water quality WORSE .			
b) Birds		3. Littering					
c) Food webs		4. Planting trees		It has NO DIFFERENCE on water quality.			
d) All of the above		5. Washing cars at home on the driveway					
e) None of the above		6. Soil erosion					
		8. What impact do impervious surfaces have on the watershed? <i>Check the correct response.</i>					
		<input type="checkbox"/> They allow water to be absorbed by the soil resulting in decreased surface water runoff and increased infiltration.					
		<input type="checkbox"/> They prevent water from absorbing into the soil resulting in increased surface water runoff.					
		<input type="checkbox"/> None of the above.					
		Part C: Attitude					
		9. My actions can make a positive difference to keep waterways clean and healthy. <i>Check one:</i>					
		<input type="checkbox"/> Strongly Agree	<input type="checkbox"/> Agree	<input type="checkbox"/> Disagree	<input type="checkbox"/> Strongly Disagree		

DRAIN RANGERS | FINAL REPORT 2022



Appendix C – Tabulation of Surveys

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)														
Class Information			Teacher and Student Information			Study Areas								
Class Level	School	District	Teacher	Number of Students w/ Pre and Post Tests	Total Students	Actions			Knowledge			Attitude		
						Pre	Post	Improve	Pre	Post	Improve	Pre	Post	Improve
4	Ruth Livingston	Pasco	1	24	27	54%	63%	9%	46%	77%	31%	74%	88%	14%
5	Tapteal	West Richland	2	12	22	65%	69%	4%	57%	79%	22%	79%	88%	9%
5	Marcus Whitman	Richland	3	13	19	58%	64%	6%	37%	72%	35%	71%	81%	10%
4	James McGee	Pasco	4	3	13	73%	87%	14%	10%	19%	9%	92%	100%	8%
5	Lewis and Clark	Richland	5	14	24	71%	69%	-2%	40%	60%	20%	72%	89%	17%
5	Tapteal	West Richland	6	17	21	63%	76%	13%	45%	75%	30%	68%	78%	10%
5	Emerson	Pasco	7	14	15	47%	65%	18%	30%	56%	26%	79%	88%	9%
5	Tapteal	West Richland	8	13	18	59%	71%	12%	45%	76%	31%	73%	81%	8%
5	Lewis and Clark	Richland	9	15	23	61%	72%	11%	56%	77%	21%	77%	87%	10%
4	Edison	Kennewick	10	17	27	64%	60%	-4%	26%	59%	33%	59%	87%	28%
Total				142	209			8%			26%			12%

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																										
Tabulation of Pre/Post Surveys																										
Class 1, 4th Grade, Livingston Elementary, Pasco	Survey Questions & Maximum Points, Pre/Post Scores																									
	Actions					Knowledge								Attitud												
	Q1 A	Q1 B*	Q1 C	Total		Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total		Q9											
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post											
Student No.	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	6	6	1	1	20	20	4	4			
1	1	5	3	5	1	5	11	1	0	1	2	1	2	2	3	1	3	3	5	0	1	1	8	16	4	4
2	4	4	4	5	2	1	10	10	0	1	3	3	1	3	3	3	0	3	3	4	1	1	11	18	3	3
3	4	2			1	2	5	4	1	1	3	3	1	2	1	3	0	2	3	4	0	1	9	16	3	3
4	1	4	1	5	1	1	3	10	0	1	3	3	1	1	0	3	0	0	4	3	0	1	8	12	3	4
5	5	4			1	1	6	5	0	0	3	3	3	2	3	0	3	4	4	1	0	13	16	4	4	
6	3	3	3	4	1	1	7	8	0	0	3	1	1	1	0	2	0	3	2	3	0	0	6	10	3	3
7	5	5	5	5	1	1	11	11	0	1	3	3	3	3	0	3	0	3	2	5	1	0	9	18	4	4
8	4	3			1	1	5	4	0	0	1	3	1	3	0	2	1	2	0	4	0	1	3	15	3	4
9	5	4			2	4	7	8	0	1	3	3	1	3	2	3	1	3	4	4	1	1	12	18	3	4
10																										
11	3	5	2	2	1	5	6	12	0	1	3	3	1	3	0	2	1	1	3	5	1	1	9	16	1	3
12	4	5			1	5	5	10	0	1	3	3	1	2	0	0	0	1	1	5	1	1	6	13	3	4
13	3	3	2	1	1	1	6	5	0	1	3	3	1	3	1	2	1	3	3	4	0	1	9	17	2	3
14	4	2			1	1	5	3	0	0	3	3	1	3	1	3	1	3	4	6	0	1	10	19	4	4
15	4	5	4	4	1	3	9	12	0	1	3	3	1	2	1	2	0	2	4	5	0	1	11	16	3	3
16	3	2	4	2	1	2	8	6	0	1	3	2	1	1	2	2	1	2	3	3	0	1	10	12	3	3
17	4	3			1	2	5	5	0	1	3	3	0	3	0	2	0	3	4	3	1	0	8	15	3	4
18	4	4	3	5	1	1	8	10	0	1	3	2	1	3	1	1	1	2	2	4	0	1	8	14	3	4
19	4	4	5	5	1	1	10	10	0	0	3	3	3	3	3	3	1	3	2	5	0	0	12	17	3	1
20	5	5	5	5	1	1	11	11	0	0	3	3	1	3	1	3	0	3	2	4	0	0	7	16	4	3
21																										
22	3	3	3	5	1	2	7	10	0	1	3	3	1	3	3	3	2	3	4	5	1	1	14	19	3	3
23	3	5			1	3	4	8	0	0	3	3	3	2	1	1	0	2	4	5	0	1	11	14	3	4
24	4	4			1	1	5	5	0	0	3	3	3	2	1	1	0	2	4	5	0	1	11	14	3	4
25	4	4	4	4	3	3	11	11	1	0	3	3	3	3	1	3	0	3	2	5	1	0	10	17	3	4
26	4	4	5	5	1	1	10	10	0	0	3	3	1	1	2	2	2	2	0	3	0	1	8	12	0	4
Class Average	Actions					Knowledge						Attitude														
	Pre	Pos	Improve		Pre	Post	Improv		Pre	Post	Improv															
	54%	63%	10%		46%	77%	31%		74%	88%	14%															

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 2, 5th Grade, Tapteal Elementary, West Richland		Survey Questions & Maximum Points, Pre/Post Scores																									
		Actions										Knowledge														Attitude	
		Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4
1																											
2	4	4	4	3	1	4	9	11	0	1	3	3	1	1	0	0	0	3	2	1	0	1	6	10	1	4	
3	5	5	3	5	1	3	9	13	0	0	3	3	3	3	0	3	0	3	5	6	1	1	12	19	3	3	
4	5	3	5	5	1	1	11	9	1	1	2	3	1	3	0	0	1	3	4	5	0	1	9	15	4	3	
5																											
6	5	5	5	5	1	4	11	14	0	1	3	3	3	3	0	0	0	3	6	6	0	1	12	17	4	4	
7																											
8																											
9	2	2	1	1	1	1	4	4	0	0	3	3	3	3	0	3	0	3	4	6	0	0	10	18	3	3	
10																											
11	5	5	5	5	1	1	11	11	3	0	3	3	1	1	3	0	3	3	6	6	1	1	20	14	4	4	
12	4	3	3	4	1	1	8	8	0	0	3	3	1	1	0	3	0	3	1	5	1	1	6	15	2	3	
13	4	4	4	4	1	1	9	9	0	0	3	3	3	3	0	3	0	3	2	5	0	1	8	18	4	3	
14	5	4	5	5	5	5	15	14	0	1	1	3	1	1	1	0	2	3	4	4	1	1	10	13	4	4	
15	5	4			1	4	6	8	1	0	3	3	3	3	1	3	2	3	5	5	0	1	15	18	2	4	
16	5	5	4	3	2	2	11	10	1	1	3	3	3	3	3	0	3	3	4	4	1	1	18	15	4	4	
17																											
18	5	5	3	2	1	2	9	9	0	0	3	3	3	3	0	0	0	3	4	5	1	1	11	15	3	3	

Class Average	Actions			Knowledge			Attitude		
	Pre	Post	Improve	Pre	Post	Improve	Pre	Pos	Improve
	65%	69%	4%	57%	79%	22%	79%	88%	8%

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																										
Tabulation of Pre/Post Surveys																										
Survey Questions & Maximum Points, Pre/Post Scores																										
Class 3, 5th Grade, Marcus Whitman Elementary, Richland	Actions										Knowledge										Attitud					
	Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4
1	5	5	5	5	1	5	11	15	0	0	2	3	1	3	0	1	0	1	3	4	0	0	6	12	3	4
2	3	3	2	5	1	1	6	9	0	0	3	3	3	3	0	3	0	2	4	4	1	1	11	16	3	3
3	5	5	4	5	1	5	10	15	0	1	1	3	3	1	0	3	0	3	3	3	0	1	7	15	3	3
4	5	4			1	1	6	5	0	0	2	3	0	1	0	2	0	2	2	3	0	0	4	11	2	3
5	4	3	5	5	1	1	10	9	0	1	3	3	1	1	0	3	0	3	4	5	0	0	8	16	3	3
6	4	2	2	1	1	1	7	4	0	0	3	3	3	3	0	3	0	3	1	4	1	1	8	17	2	4
7	5	5	5	4	1	3	11	12	0	1	3	3	1	2	0	1	0	1	1	2	1	0	6	10	4	4
8	1	2	5	5	1	1	7	8	1	0	3	3	2	2	0	2	0	3	3	4	1	1	10	15	3	3
9	2	3	3	4	1	1	6	8	0	0	3	2	3	1	0	3	0	2	2	4	0	0	8	12	3	3
10	3	2	3	3	1	2	7	7	0	1	2	3	1	3	0	3	0	2	2	4	1	1	6	17	3	3
11	5	5	5	5	1	1	11	11	0	1	3	3	3	1	0	1	0	1	2	5	0	0	8	12	2	3
12	4	4	4	5	1	3	9	12	0	1	3	3	1	1	0	3	0	3	3	4	0	1	7	16	3	3
13	5	1			1	3	6	4	0	1	3	3	1	3	0	2	0	3	3	5	0	1	7	18	3	3

Class Average	Actions			Knowledge			Attitude		
	Pre	Post	Improve	Pre	Post	Improve	Pre	Post	Improv
	58%	64%	6%	37%	72%	35%	71%	81%	10%

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																										
Tabulation of Pre/Post Surveys																										
Survey Questions & Maximum Points, Pre/Post Scores																										
Class 4, 4th Grade, James McGee Elementary, Pasco	Actions										Knowledge										Attitud					
	Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4
1	4	4	5	5	1	3	10	12	0	1	3	3	3	3	1	3	1	3	5	5	0	1	13	19	3	4
2	5	5	5	5	3	4	13	14	0	1	2	2	1	1	0	2	0	3	3	5	1	1	7	15	4	4
3	4	4	5	4	1	5	10	13	0	1	2	3	1	1	0	2	0	3	3	4	1	1	7	15	4	4
4							0	0															0	0		
5							0	0															0	0		
6							0	0															0	0		
7							0	0															0	0		
8							0	0															0	0		
9							0	0															0	0		
10							0	0															0	0		
11							0	0															0	0		
12							0	0															0	0		
13							0	0															0	0		

Class Average	Actions			Knowledge			Attitude		
	Pre	Post	Improve	Pre	Post	Improve	Pre	Post	Improv
	73%	87%	13%	10%	19%	8%	92%	100%	8%

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 5, 5th Grade, Lewis & Clark Elementary, Richland		Survey Questions & Maximum Points, Pre/Post Scores																									
		Actions								Knowledge																Attitude	
		Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4
1	3	4	5	5	1	3	9	12	0	0	3	3	1	2	2	3	1	3	5	5	1	1	13	17	4	4	
2	5	5	4	3	3	1	12	9	0	0	1	3	1	1	1	1	1	2	0	4	0	0	4	11	0	3	
3	5	1	5	5	1	5	11	11	1	0	3	3	1	3	0	1	1	2	2	3	1	1	9	13	3	4	
4	4	2	3	4	1	5	8	11	0	0	3	3	3	3	0	1	1	3	4	3	1	1	12	14	3	3	
5	5	5	5	5	1	1	11	11	0	1	3	3	3	3	2	3	3	3	4	5	1	1	16	19	3	4	
6	2	2			3	1	5	3	0	0	3	3	1	3	0	3	0	3	5	4	0	1	9	17	4	4	
7	5	5			2	3	7	8	0	0	3	3	1	1	2	2	2	2	3	3	1	0	12	11	3	3	
8	5	1	5	5	3	5	13	11	1	0	3	3	3	3	2	3	2	3	4	4	0	1	15	17	4	4	
9	4	4	5	5	5	3	14	12	0	0	3	3	1	1	1	3	0	3	2	5	1	1	8	16	3	4	
10	3	3	1	1	1	1	5	5	0	0	2	3	1	3	1	3	0	2	2	4	1	1	7	16	3	3	
11	5	5	5	5	2	1	12	11	0	1	3	0	3	3	0	3	0	3	4	4	0	0	10	14	4	3	
12	5	5	5	5	4	5	14	15	0	0	3	0	0	3	0	1	0	3	0	5	0	0	3	12	0	4	
13	3	5	5	4	4	1	12	10	1	0	3	3	3	3	1	2	0	1	1	4	0	0	9	13	4	3	
14	3	2	5	5	1	1	9	8	0	0	3	3	1	1	0	2	0	3	6	5	0	0	10	14	4	4	
15							0	0															0	0			
16							0	0															0	0			
17							0	0															0	0			
Class Average	Actions								Knowledge								Attitude										
	Pre		Post		Improve				Pre		Post		Improve				Pre		Post		Improve						
	71%		69%		-2%				40%		60%		20%				75%		89%		14%						

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 6, 5th Grade, Tapteal Elementary, West Richland		Survey Questions & Maximum Points, Pre/Post Scores																									
		Actions								Knowledge																Attitude	
		Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4	
1	3	4	5	5	1	4	9	13	0	0	1	2	1	3	0	0	0	3	4	5	0	1	6	14	3	3	
2	4	4	5	5	1	4	10	13	0	1	0	2	1	1	0	0	0	3	2	5	0	1	3	13	3	4	
3	4	4	3	4	1	4	8	12	0	1	2	3	3	3	1	3	2	3	5	5	0	1	13	19	3	4	
4	4	4	5	4	1	3	10	11	0	1	3	3	3	1	0	0	2	3	4	4	0	0	12	12	4	3	
5	4	4	5	4	3	3	12	11	0	0	3	3	3	3	2	3	3	3	5	5	1	0	17	17	3	3	
6	5	5			4	4	9	9	1	1	3	3	1	1	0	0	1	3	4	4	1	0	11	12	3	3	
7	4	4	2	4		3	6	11	0	0	0	3	0	1	0	0	0	0	3	4	1	0	4	8	3	2	
8	4	4	3	5	1	2	8	11	0	1	3	3	2	2	0	3	0	3	2	5	1	1	8	18	2	3	
9	4	5	5	4	4	1	13	10	0	0	2	3	2	3	0	3	0	2	3	4	0	0	7	15	4	3	
10	4	4	2	2	1	4	7	10	0	0	3	3	0	3	1	0	1	3	2	6	0	1	7	16	3	3	
11	4	4	5	3	1	4	10	11	1	1	3	3	1	3	0	3	0	3	4	5	1	1	10	19	3	3	
12	3	5	5	5	1	3	9	13	0	1	3	3	3	3	2	0	2	3	5	6	1	1	16	17	4	3	
13	4	4	1	5	1	1	6	10	0	1	2	3	0	3	0	0	0	2	0	4	0	0	2	13	0	3	
14																											
15	5	4	5	5	1	4	11	13	0	1	3	3	3	3	3	3	1	3	2	5	1	1	13	19	3	3	
16	4	4	5	5	1	5	10	14	0	0	2	2	0	1	0	0	0	3	0	4	0	1	2	11	0	4	
17	4	4	4	3	1	2	9	9	0	1	3	3	3	3	1	3	1	3	3	4	0	1	11	18	2	3	
18	4	4	3	4	1	2	8	10	0	0	3	3	2	3	0	0	0	3	4	5	1	1	10	15	3	3	
Class Average	Actions								Knowledge								Attitude										
	Pre		Post		Improve				Pre		Post		Improve				Pre		Post		Improve						
	63%		76%		13%				45%		75%		31%				68%		78%		10%						

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 7, 5th Grade, Emerson Elementary, Pasco		Survey Questions & Maximum Points, Pre/Post Scores																									
		Actions										Knowledge														Attitude	
		Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4	
1	3	3	3	5	0	4	6	12	1	1	0	3	0	1	0	1	0	2	0	4	1	0	2	12	4	4	
2	4	5			1	1	5	6	0	1	3	2	3	1	0	2	0	2	3	4	0	0	9	12	4	4	
3	5	3	1	3	0	5	6	11	0	0	0	1	0	1	0	2	0	2	1	4	0	0	1	10	3	3	
4	2	2	4	4	3	2	9	8	0	0	1	3	3	3	0		0		3		0		7	6	3	4	
5	4	5	5	5	1	5	10	15	0	0	1	3	3	3	0	3	0	3	5	4	1	1	10	17	4	3	
6	3	5			1	1	4	6	0	0	1	1	1	0	0	1	0	2	4	4	0	0	6	8	3	3	
7	3	4	5	5	0	2	8	11	0	1	3	3	3	3	0	2	0	2	3	4	0	0	9	15	3	4	
8	3	3	5	5	1	1	9	9	0	0	2	3	1	1	0	1	0	1	2	5	0	0	5	11	3	4	
9	5	5	5	4	3	3	13	12	0	1	3	0	1	3	0	0	0	1	2	2	0	1	6	8	4	4	
10	1	1	1	5	1	4	3	10	0	0	3	3	1	1	0	2	0	3	4	4	0	1	8	14	3	3	
11	4	3			0	1	4	4	0	0	1	3	3	3	0	3	0	3	4	4	0	0	8	16	3	3	
12	3	2			0	3	3	5	1	1	0	1	0	1	1	2	0	2	3	4	0	0	5	11	4	4	
13	3	2	3	5	0	1	6	8	0	0	1	1	1	3	0	2	0	0	3	3	0	0	5	9	3	3	
14	3	5	1	1	0	1	4	7	1	0	0	1	1	1	0	1	0	2	0	2	0	0	2	7	0	3	

Class Average	Actions			Knowledge			Attitude		
	Pre	Post	Improve	Pre	Post	Improve	Pre	Post	Improve
	47%	65%	18%	30%	56%	26%	79%	88%	9%

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 8, 5th Grade, Tapteal Elementary, West Richland		Survey Questions & Maximum Points, Pre/Post Scores																									
		Actions										Knowledge														Attitude	
		Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	6	6	1	1	20	20	4	4		
1																											
2																											
3	3	5			1	4	4	9	1	1	2	3	1	1	0	3	0	3	4	5	0	0	8	16	3	4	
4																											
5	4	4	5	5	1	2	10	11	1	0	3	3	2	1	0	0	0	3	2	5	1	0	9	12	3	3	
6	1	4			3	5	4	9	0	1	1	2	2	1	0	0	0	1	2	4	0	1	5	10	3	3	
7	4	3	5	5	1	1	10	9	0	1	1	3	1	1	0	0	0	3	1	4	0	1	3	13	1	3	
8	4	4	5	5	1	5	10	14	0	1	3	3	3	3	2	3	2	3	4	4	1	1	15	18	4	4	
9																											
10																											
11	5	5	5	5	1	1	11	11	0	1	3	3	3	3	0	3	0	3	5	6	0	1	11	20	3	3	
12	1	5	2	3	4	2	7	10	0	1	2	3	0	1	0	0	0	3	3	4	0	0	5	12	4	4	
13	3	2	2	2	1	3	6	7	0	1	3	3	3	3	2	0	0	3	3	5	1	1	12	16	1	3	
14	2	4	5	5	4	4	11	13	0	0	3	3	3	3	3	3	3	3	5	4	1	1	18	17	3	3	
15	3	4	5	5	1	1	9	10	0	1	3	3	3	3	0	3	0	2	4	3	0	1	10	16	3	2	
16	2	5	5	5	1	1	8	11	0	0	3	3	2	3	0	3	0	3	4	5	1	1	10	18	3	3	
17																											
18	5	1	5	5	1	1	11	7	0	0	0	2	1	2	0	0	0	3	2	6	0	1	3	14	4	4	

Class Average	Actions			Knowledge			Attitude		
	Pre	Post	Improve	Pre	Post	Improve	Pre	Post	Improve
	59%	71%	12%	45%	76%	30%	73%	81%	8%

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 9, 5th Grade, Lewis & Clark Elementary, Richland	Survey Questions & Maximum Points, Pre/Post Scores																										
	Actions								Knowledge																Attitude		
	Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
1	4	4	1	1	1	1	6	6	1	0	3	3	3	3	0	3	1	2	3	5	1	1	12	17	4	4	
2	4	4			3	4	7	8	0	1	3	3	3	3	2	2	3	3	6	3	1	1	18	16	3	4	
3	4	5	3	3	1	1	8	9	1	1	3	3	3	3	2	3	3	3	4	4	1	1	17	18	4	4	
4	3	5	5	5	2	3	10	13	1	1	3	1	3	3	0	2	1	2	5	4	0	0	13	13	3	4	
5	4	4	5	5	2	2	11	11	1	1	3	2	3	3	2	2	1	3	4	5	1	1	15	17	4	4	
6	3	5	5	5	2	2	10	12	0	0	3	3	1	3	0	2	2	2	4	4	0	1	10	15	4	4	
7	5	5	5	5	3	3	13	13	0	0	3	3	1	3	2	3	3	3	4	5	1	0	14	17	3	3	
8	2	4	2	3	1	5	5	12	0	0	3	3	0	1	0	3	0	3	4	4	0	1	7	15	0	4	
9	4	4	5	5	2	3	11	12	0	1	3	3	1	1	1	2	0	3	4	5	1	1	10	16	4	4	
10	5	4			1	1	6	5	1	0	3	3	3	3	0	2	0	2	2	4	0	1	9	15	4	4	
11	4	5	4	5	1	3	9	13	0	1	1	1	1	1	3	0	2	0	2	3	4	1	0	6	13	3	4
12	4	5	5	4	2	2	11	11	1	1	3	3	2	3	1	1	1	3	3	4	1	1	12	16	3	3	
13	5	5			1	1	6	6	0	1	3	3	1	3	0	2	0	1	3	2	1	1	8	13	2	1	
14	1	5	5	5	1	1	7	11	0	1	3	3	1	3	0	3	0	3	3	3	1	1	8	17	2	1	
15	4	4			2	1	6	5	0	0	3	3	3	3	0	1	0	1	3	3	1	1	10	12	3	4	

Class Average	Actions						Knowledge						Attitude					
	Pre		Post		Improve		Pre		Post		Improve		Pre		Post		Improve	
	61%	72%	10%	56%	77%	20%	77%	87%	10%									

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank

Elementary School Stormwater Education Effectiveness Study (Drain Rangers)																											
Tabulation of Pre/Post Surveys																											
Class 10, 4th Grade, Edison Elementary, Kennewick	Survey Questions & Maximum Points, Pre/Post Scores																										
	Actions								Knowledge																Attitude		
	Q1 A		Q1 B*		Q1 C		Total		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Total		Q9		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Student No.	5	5	5	5	5	5	15	15	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
1	1	1	5	1	1	1	7	3	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	1
2	5	5	5	4	3	4	13	13	1	1	0	1	1	0	0	0	0	0	4	2	1	1	7	5	2	3	
3	5	5	5	5	3	3	13	13	0	0	3	3	1	3	0	3	0	2	0	3	0	0	4	14	2	4	
4	5	5	5	5	1	1	11	11	0	0	1	3	1	1	0	2	0	2	0	6	0	0	2	14	4	4	
5	3	1	5	5	1	2	9	8	0	0	2	2	1	1	0	2	0	2	3	4	0	1	6	12	0	4	
6	5	1			1	1	6	2	0	0	1	1	0	1	0	1	0	0	0	4	0	1	1	8	3	4	
7	5	5			1	1	6	6	1	1	1	3	1	1	0	2	0	3	2	5	0	1	5	16	3	4	
8	5	2	4	4	2	2	11	8	0	0	3	3	1	1	0	1	0	3	4	5	0	0	8	13	3	4	
9	2	2	1	2	1	1	4	5	0	0	1	3	0	1	1	2	0	3	1	4	1	0	4	13	3	3	
10	5	5	5	5	1	1	11	11	0	0	3	3	3	1	2	3	0	3	4	5	1	1	13	16	3	3	
11	5	5	5	4	2	3	12	12	0	0	0	3	1	1	0	2	0	3	0	0	1	0	2	9	4	4	
12	4	5			1	1	5	6	0	0	2	3	3	1	0	0	0	0	0	0	0	0	5	4	0	3	
13	3	3			2	4	5	7	1	1	3	3	1	1	0	3	0	2	2	5	0	0	7	15	4	4	
14	4	5			1	4	5	9	0	0	1	3	0	3	1	2	0	3	0	5	0	1	2	17	0	4	
15	4	3	4	4	1	2	9	9	0	1	2	3	3	3	2	3	0	2	3	5	0	0	10	17	3	3	
16	5	5			2	1	7	6	1	0	0	3	0	3	1	2	1	3	3	2	0	1	6	14	3	3	
17	4	2	5	1	1	2	10	5	0	0	1	3	3	0	1	1	0	1	0	5	0	1	5	11	3	4	

Class Average	Actions						Knowledge						Attitude					
	Pre		Post		Improve		Pre		Post		Improve		Pre		Post		Improve	
	64%	60%	-4%	26%	59%	34%	59%	87%	28%									

* If the answer to Q1 B is "in don't have a pet", then leave the field blank
 ** When a pretest or post test is not available, then leave the student data row completely blank



Appendix D – Student Essays and Miscellaneous

April 27, 2021
Stormwater Runoff

Did you know that everything you
pour down the drain goes to the
river? Stormwater is water that
comes from the sky when it rains.
Stormwater gets polluted by trash,
oil and dirt, and other stuff too.

Here's what you can do, instead of
washing your car on your driveway
go to your local car wash nearby ^{your city.}

Another thing you can do is pick
up dog waste because, it carries
harmful bacteria. And can get
people very sick.



April 27, 2024
Stofmayer runoff

A last thing you can do is, limit your use of fertilizers and pesticides. it harms animals and people too. so read the labels on your yard chemicals bottle or container. Also, use natural yard chemicals to keep your yard looking fresh and clean.

On the culverts paper you can see a young girl pouring oil, paint or yard chemicals down the drain. She ^{yes} doesn't know that only rain down the storm drain.



April 26, 2021
Stormwater Runoff

Did you know that some of your car oil and bacteria off your pets waste goes into your local waterways without getting cleaned? While I was looking into this I the reason for this is Stormwater Runoff. After finding I decided to do some more research. When I found more things that were going down our waterways I was devastated. But I also found ways we could help. So come with me and help stop Stormwater Runoff!

Stormwater Runoff is rain that has runoff hard surfaces and collected dirt, oil, bacteria, lawn chemicals, ect. Another reason Stormwater Runoff is important is that after it gets polluted it goes down storm drain without getting cleaned, then it goes into the strait down to the river. In case you didn't know fish live in the river. So if you put polluted water in the river then the fish that live in the river and polluted water then the fish die.

*One way you can help to stop Stormwater pollution is to not use too much lawn chemicals. Lawn chemicals are bad for Stormwater because they have chemicals in them that make them toxic to fish. The reason not to use too much helps is that when you use less lawn chemicals less fish die. Another way you can help is to clean up your yard clippings. By doing this you are helping the water so it is not as dirty, and we know if the waters dirty then the fish die. The last way you can help is to **NOT DUMP THINGS DOWN THE STORM DRAIN**. If you dump things down the drain that is just as bad as not cleaning up your pets waste. If you dump things like car oil or herbicides and pesticides into the storm drain then the water gets polluted just as easily.*

Now that you know what Stormwater runoff is and how it gets polluted and some things you can do to stop Stormwater pollution. We can now help stop Stormwater pollution!



April 26, 2021
Stormwater runoff.

Have you ever wondered where most of the pollution in Lakes and Rivers comes from? Well most of it comes from stormwater runoff. Stormwater runoff is any water that doesn't soak into the ground and ends up in storm drains. Stormwater runoff gets carried to storm drains which carry the stormwater to dry wells, aquifers or into lakes and rivers.

Storm water gets polluted by a lot of things. One of the main things that pollute the storm water is people washing their cars on pavement or hard surfaces. This is bad and pollutes the storm water because the water that comes off of the hard surface flows down the street picking up trash, oils, salts, and all kinds of litter. After the water flows down the street with all the liters it goes directly into the nearest storm drain. The water that goes down into the drain is polluted because it is not filtered and has all the litter going into the storm drain with it so all of the litter that came down with the water goes into the nearest body of water. Another thing that pollutes the water is car leaks. If you have a car leak the Oil or whatever is leaking out of your car will do the same thing that the water did. It will flow off of where your car leak is and will flow down the street and go straight to a storm drain. The oil will go through the pipes and into a river or lake which pollutes that water and will not be safe for the animals swimming in the water.

One way we can help stop this is if you need to wash your car go to a carwash if possible. If you somehow can't get to a carwash do it on your lawn or anywhere that is not a hard surface. This will prevent the water from flowing down the street, picking up litter and going to a storm drain. If you can possibly get to a car wash instead of your lawn that would be much better than doing it on any sort of flat surface. At car washes that have a special drain that also collects any extra water. Doing this will help stop polluting stormwater.

Another way we can help stop polluting stormwater is if your car is leaking you can go get it fixed. If you can't get your car fixed another way you can help stop the leak is by putting some sort of bowl, pot, or pan under where the leak is. This will help not pollute the water because if you have your leak on a hard surface it will wash off into the road and go into another storm drain which will go to a river or lake and also won't be safe for the animals living in the water. If you get it fixed that would be better than putting something under the leak to collect it because if the pot, pan or bowl gets knocked over by something it will go into the road and do the same thing that the water did. It will flow to the nearest storm drain which then goes through pipes and straight to a lake or river. If you do this when your car is leaking it will help stop polluting stormwater.

Now you know where most pollution in lakes and rivers come from. Along with some ways to try and keep the storm water clean. This is healthier for the animals living in lakes and rivers. And remember only rain down the storm drain.



April 26, 2021

Have you ever wondered where all of the pollution from river water comes from? Well believe it or not a big chunk of river pollution comes from rain water. During the storm water unit I did in class I learned that river pollution can come from your pets waste or even grass clippings.

Storm water is rainwater that falls from the sky and hits a hard surface like a street or a sidewalk. When the storm water hits the hard surface it collects all of the pesticides and chemicals and bacteria on the ground or hard surface. After it collects all of that it goes to the nearest storm drain. Once it's at the nearest storm drain all of the chemicals and bacteria goes down the storm drain into the nearest body of water. After it's in the nearest body of water it contaminates all of the things in the water like the fish, the plants, the water and all of the things that drink the water.

That's how the river water gets so dirty but here are some ways that you can keep the river water from getting more polluted. One way to keep the river water clean is to wash your car on the lawn because if you wash your car on the street or on your driveway all of the chemicals in the car cleaner goes into the water and then the water goes into the storm drain. If you wash your car on your lawn or go to a car wash the water actually gets cleaned when you wash your car on your lawn because the water goes into the ground and gets purified by the ground because the ground is taking all of the chemicals out of the water. Also if you take your car to a car wash they have a drain that sends the water to a water purifier factory.

Another way to help keep the river water clean is to not blow your grass clippings into the street because if you do that the grass clippings will get into the storm drain and clog it so that more gross chemicals will get into the water in other storm drains. When the grass clippings get through the storm drain the grass clippings sit there on top of the river water then they die. One way to not do that is to put them into a garbage bin or use them for something useful.

That's where a big chunk of river pollution comes from. I also listed some reasons to help stop river pollution. Remember you doing a small thing like cleaning your car on your lawn or even putting your grass clippings in a garbage can can help save something as big as a river or lake and the ocean. Oh I forgot only rain down the storm drain.



Appendix E – Student Posters

